

1993 ENGINES

EuroVan - 2.5L 5-Cylinder

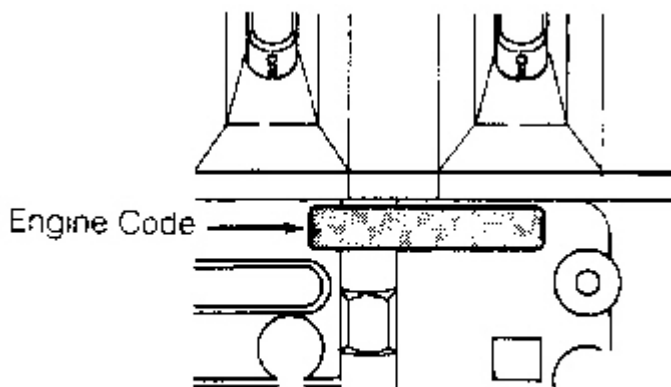
ENGINE IDENTIFICATION

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

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

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



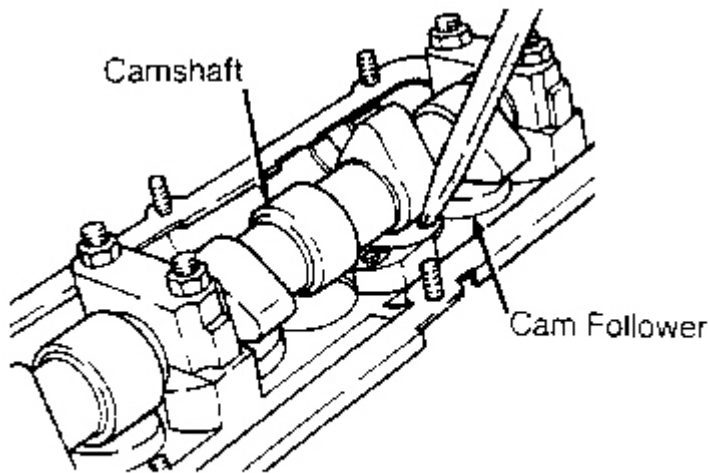
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Fig. 1: Locating Engine Identification Number
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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 **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.



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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.

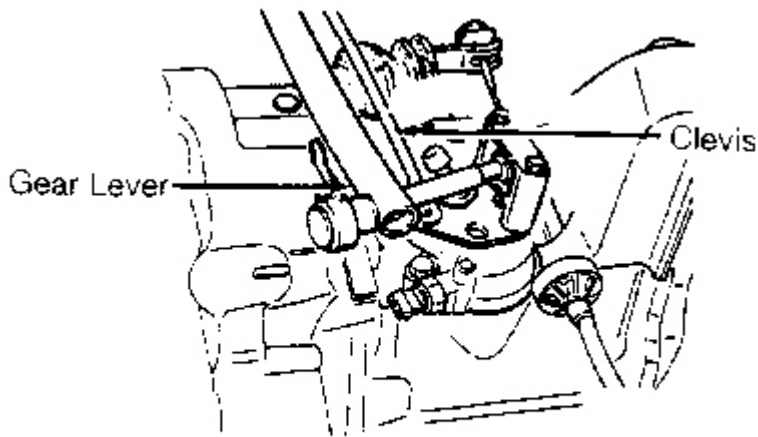
ENGINE

Removal

1. Obtain radio code. Disconnect negative battery cable. Support upper control arms with Wedge (3250). Drain cooling system. Disconnect cooling fan and thermoswitch.
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.

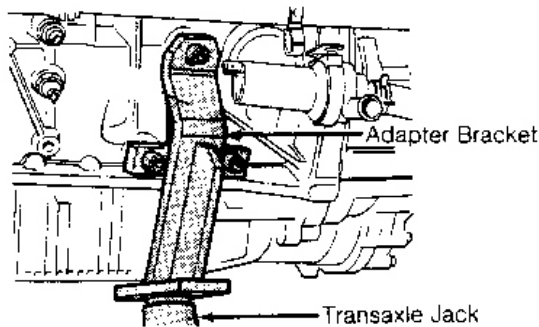
Installation

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.



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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.

EXHAUST MANIFOLD

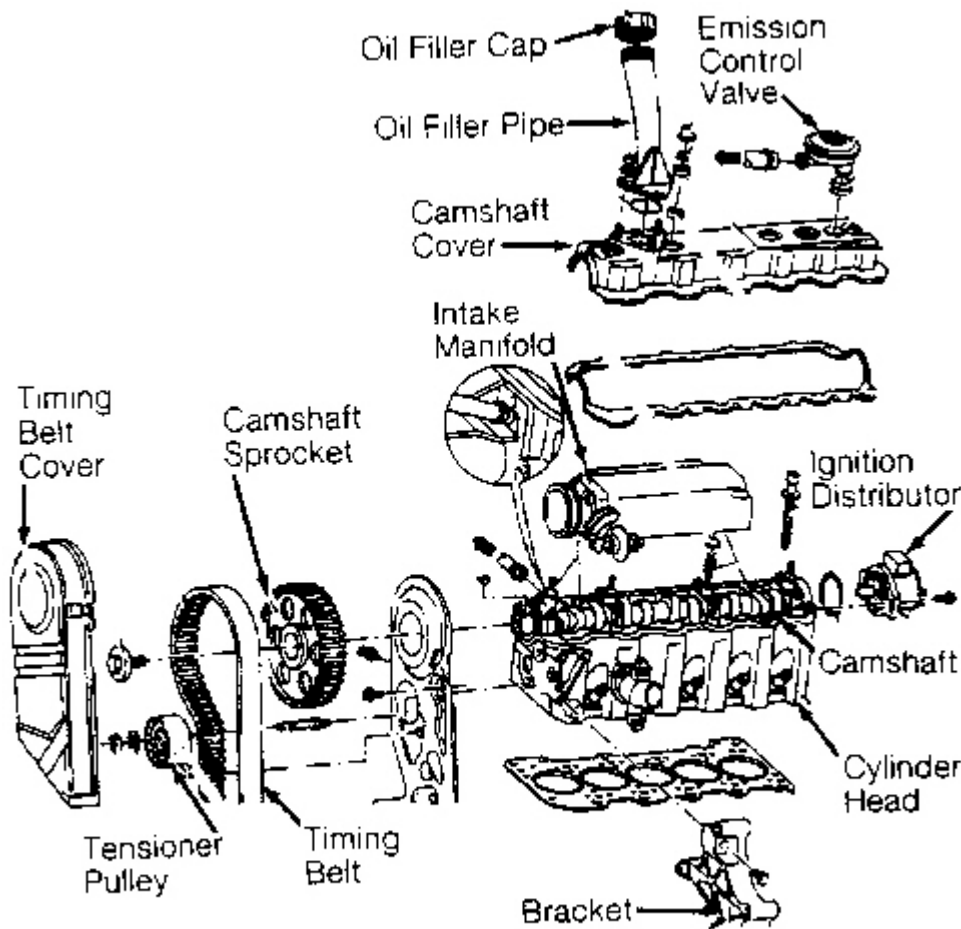
Removal and installation procedure is not available from manufacturer. See **TORQUE SPECIFICATIONS** table.

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.



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

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Inspection

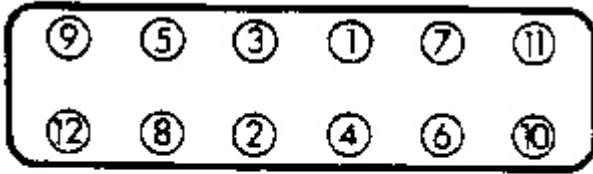
Thoroughly clean all gasket mating surfaces. Check cylinder head for warpage. Maximum warpage is .004" (.10 mm). Check minimum cylinder head height and replace cylinder head (if necessary).

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

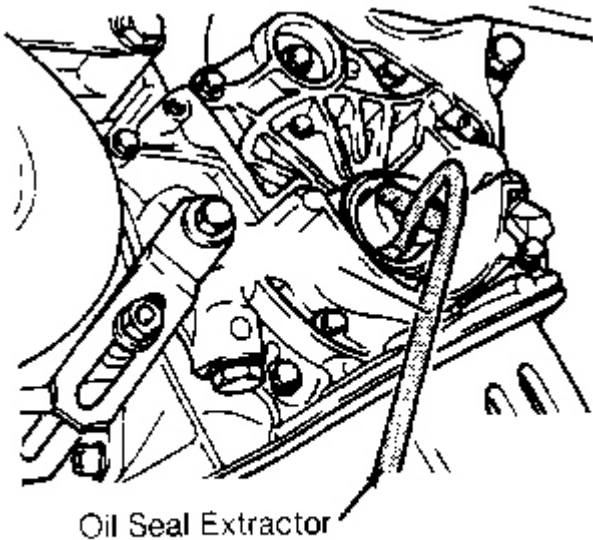
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Fig. 6: Cylinder Head Bolts Tightening Sequence
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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.



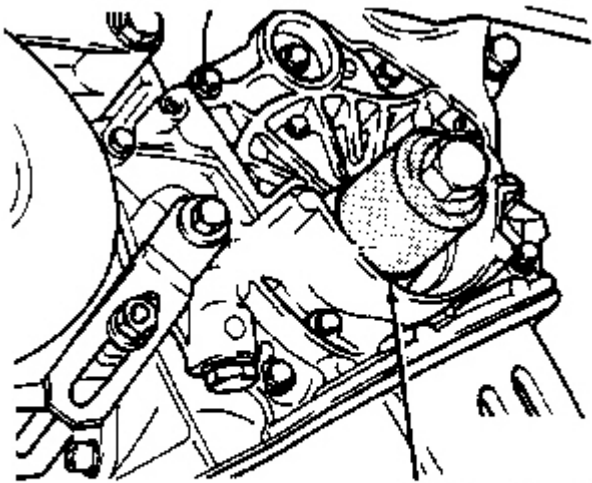
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Fig. 7: Removing Front Cover Oil Seal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

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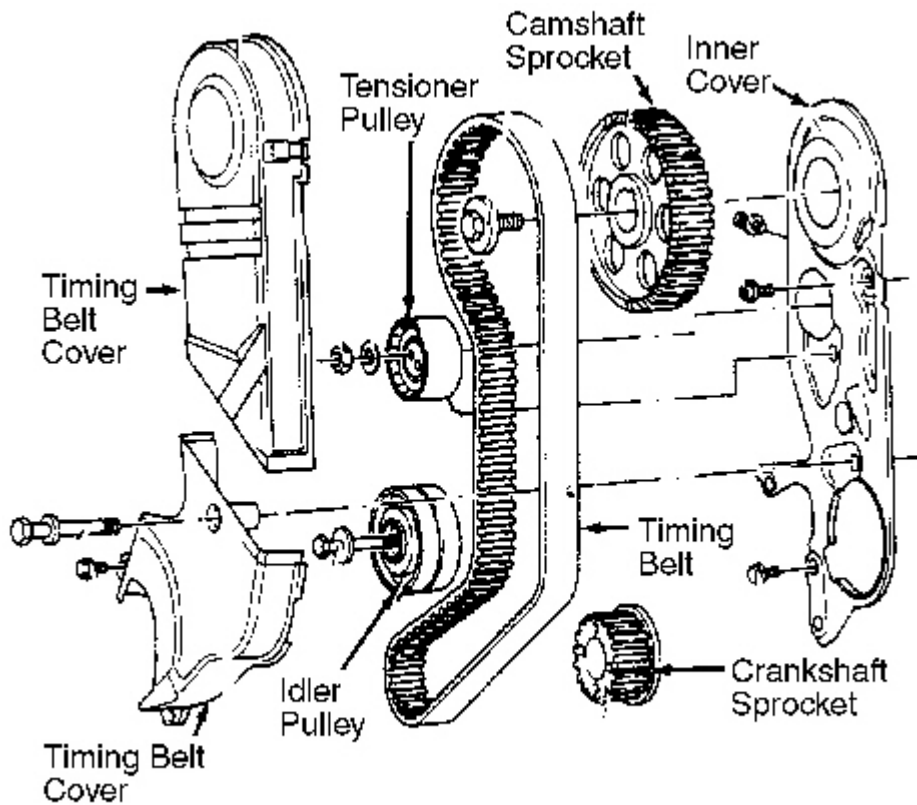
Fig. 8: Installing Front Cover Oil Seal

Courtesy of VOLKSWAGEN UNITED STATES, INC.

TIMING BELT

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** .

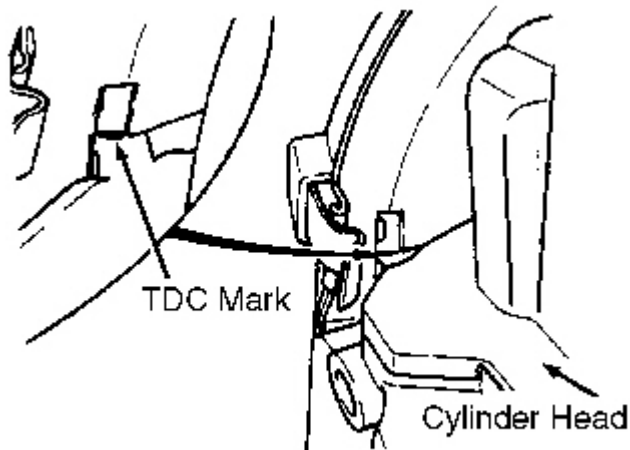


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Fig. 9: Exploded View Of Timing Belt & Related Components
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

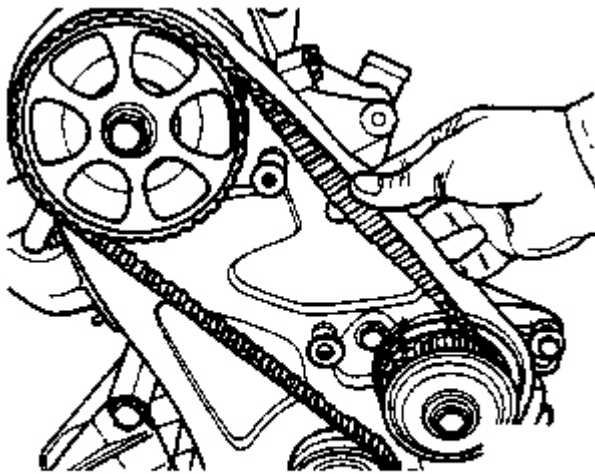
Installation

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.



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Fig. 10: Aligning Camshaft Timing Marks
 Courtesy of VOLKSWAGEN UNITED STATES, INC.



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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.

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.

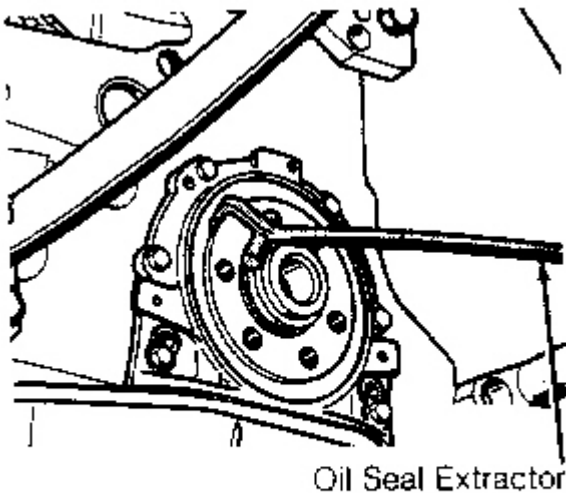
Installation

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

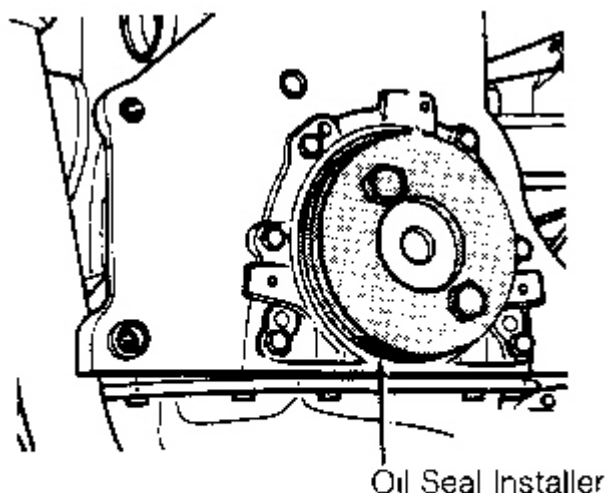
Remove flywheel/flexplate, and discard bolts. Remove retaining flange. Using Oil Seal Extractor (10-221), remove oil seal. See **Fig. 12**. Use Seal Installer (2003/1) to install seal. See **Fig. 13**. To complete installation, reverse removal procedure. Install new flywheel/flex plate bolts.



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Fig. 12: Removing Rear Crankshaft Oil Seal

Courtesy of VOLKSWAGEN UNITED STATES, INC.



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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

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.

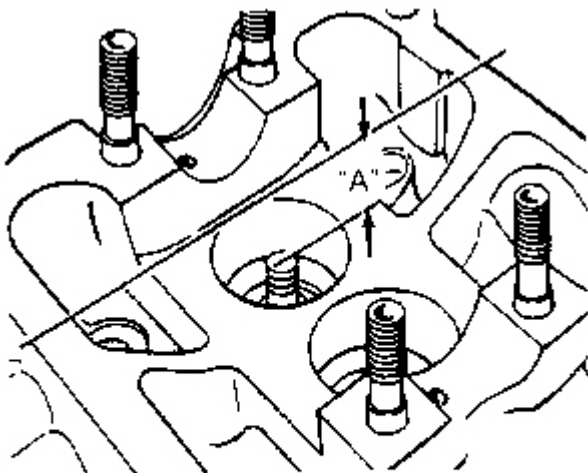
MINIMUM VALVE INSTALLED HEIGHT SPECIFICATIONS

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

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Fig. 14: Measuring Valve Installed Height
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

CYLINDER BLOCK ASSEMBLY

1993 Volkswagen EuroVan CV

2.5L 5-CYL

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

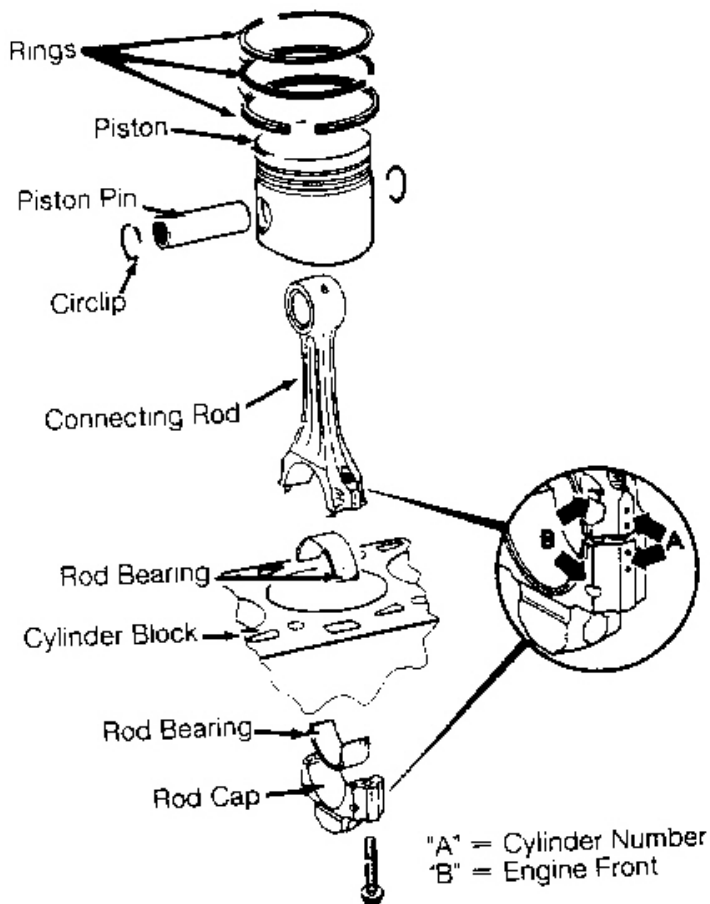
Measure clearances with cylinder block supported on work bench. Check clearance of piston-to-cylinder bore. Piston diameter is stamped on top of piston in millimeters.

PISTON-TO-CYLINDER BORE DIMENSIONS

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

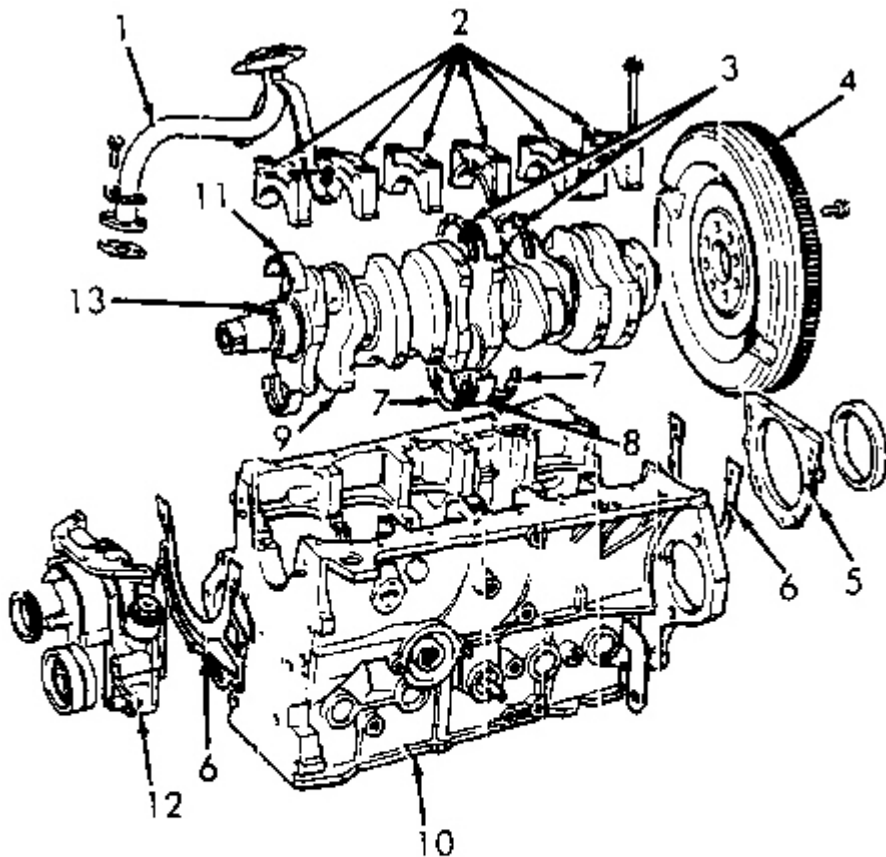
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Rod Bearings

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 | |

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Fig. 16: Exploded View Of Crankshaft Assembly
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

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

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.

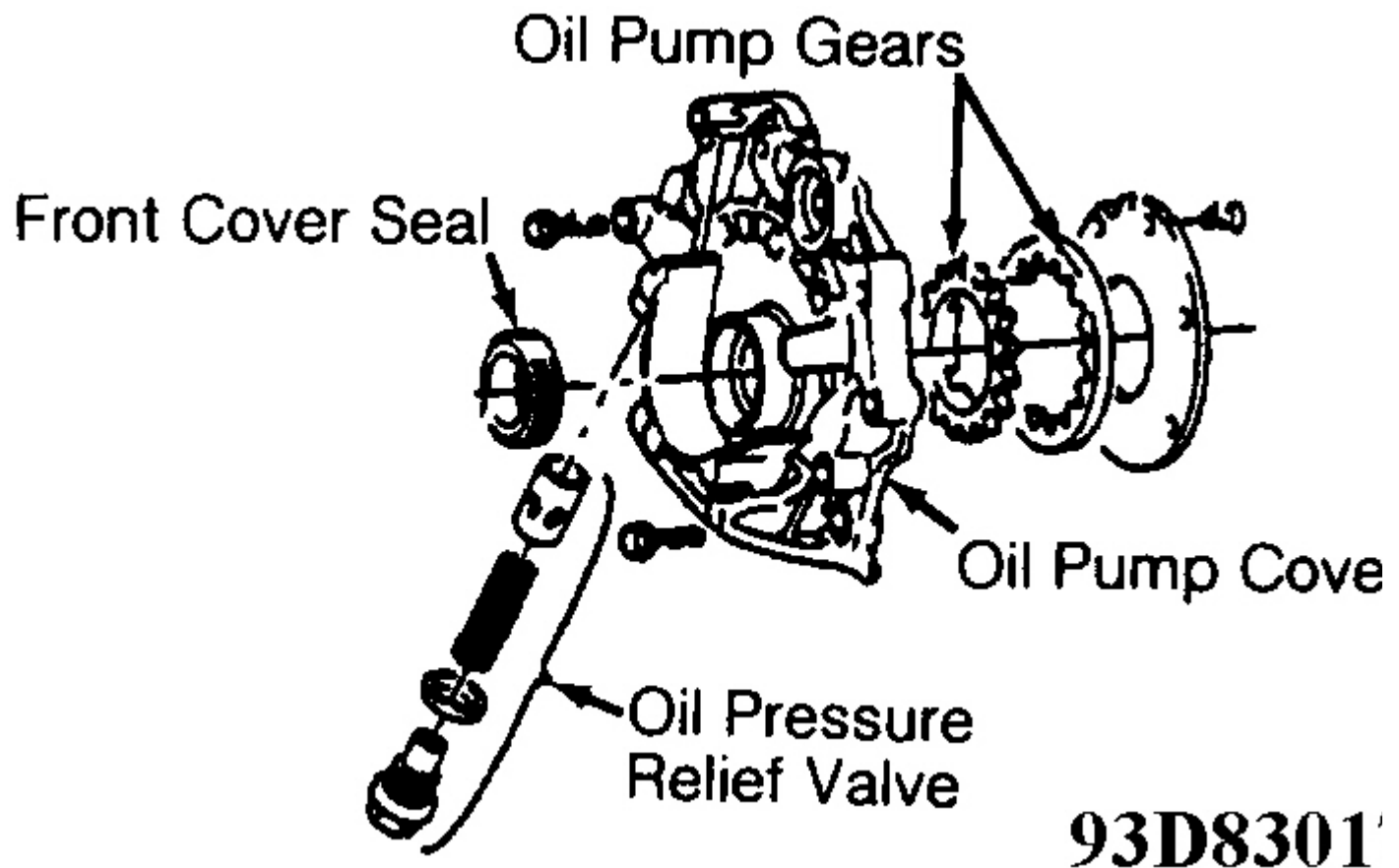


Fig. 17: Oil Pump Assembly

Courtesy of VOLKSWAGEN UNITED STATES, INC.

1993 Volkswagen EuroVan CV

2.5L 5-CYL

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

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

1993 Volkswagen EuroVan CV

2.5L 5-CYL

Transaxle/Engine Cover Plate Bolt	89 (11)
Valve Cover Retaining Nut	89 (11)
Water Pump-To-Housing	89 (11)

ENGINE SPECIFICATIONS**GENERAL ENGINE SPECIFICATIONS****GENERAL ENGINE SPECIFICATIONS**

Application	Specification
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

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS**CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS**

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)

PISTONS, PINS & RINGS SPECIFICATIONS**PISTONS, PINS & RINGS SPECIFICATIONS**

Application	In. (mm)
Pistons	

1993 Volkswagen EuroVan CV

2.5L 5-CYL

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)
Service Limit	.039 (1.0)
Side Clearance	
Standard	.001-.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 Clearance	.001-.002 (.02-.05)
(1) Information not available from manufacturer.	

CYLINDER BLOCK SPECIFICATIONS

CYLINDER BLOCK SPECIFICATIONS

Application	In. (mm)
Cylinder Bore	
Standard Diameter	3.189 (81.01)
Maximum Taper	.0032 (.08)
Maximum Out-of-Round	.001 (.03)

VALVES SPECIFICATIONS

VALVES SPECIFICATIONS

Application	Specification
Intake Valves	
Face Angle	45°
Head Diameter	1.574" (40.00 mm)
Length	3.583" (91.00 mm)

1993 Volkswagen EuroVan CV

2.5L 5-CYL

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.	

CYLINDER HEAD SPECIFICATIONS**CYLINDER HEAD SPECIFICATIONS**

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.	

CAMSHAFT SPECIFICATIONS**CAMSHAFT SPECIFICATIONS**

1993 Volkswagen EuroVan CV

2.5L 5-CYL

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