

2.22L 5-CYL

Article Text

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Sunday, March 19, 2000 12:48AM

ARTICLE BEGINNING

1987 VOLKSWAGEN ENGINES
2.22L 5-Cylinder

Quantum, Quantum Syncro

* 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 CODING

ENGINE IDENTIFICATION

Engine number is stamped on machined pad just below cylinder
head on left side of block. Letter prefix indicates engine type.

ENGINE IDENTIFICATION CODES TABLE

AA

Application Engine Code

2.22L 5-Cylinder

Quantum, Quantum Syncro KX

AA

ENGINE, MANIFOLDS & CYLINDER HEAD

ENGINE R & I

REMOVAL

1) Disconnect battery ground cable. Open heater control valve
fully. Open cap on coolant expansion tank. Remove engine mounting bolt
holding coolant pipe at bellhousing. Remove all coolant hoses. Remove
ground strap from left engine mount. Remove upper radiator cover.
Remove power steering pump with hoses attached. Tie pump aside.

2) Disconnect wiring from engine mounted components. Remove
fuel injectors, cold start valve and control pressure regulator,
leaving fuel lines attached. Plug injector sockets and cap injectors
and cold start valve. Remove throttle rod. Remove front engine stop.

3) On Quantum (with A/T) belt pulley on crankshaft must be
removed. Hold pulley in place with Locking Spanner (2084). Using
Extension (2079), remove crankshaft bolt through grille opening.
Remove 2 and loosen other 2 pulley bolts. Loosen pulley with light
taps. Remove 2 remaining bolts and belt pulley, leaving drive sprocket
in place on crankshaft.

4) Remove alternator adjusting and mounting bolts. Tie

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alternator aside with wires attached. Remove alternator bracket from engine block. Loosen clamps and remove air duct. Disconnect all vacuum hoses leading to engine. Disconnect fuel feed and return lines. Disconnect breather hose from valve cover. Remove air filter cover.

5) If equipped with automatic transmission, remove coolant hoses at ATF cooler. Remove coolant hose flange from engine block. Remove cover for right engine mount. Loosen left and right engine mounts at frame. Detach ground strap from mounting bracket.

6) Remove all but one bolt holding engine to transmission. If A/C equipped, remove compressor drive belt. Disconnect wire from compressor clutch. Remove compressor mount bolts from engine. Hang compressor aside with hoses connected. Disconnect starter wires. Remove both front subframe bolts.

7) On all models, disconnect exhaust pipe from manifold and exhaust pipe support at transmission. Remove starter. Working through starter mounting hole, remove 3 bolts holding torque converter to flex plate (if equipped). Remove lower bolts which hold engine to transmission. Detach shift rod (or clutch cable) from transmission. Attach Support Bar (VW 785/1) under transmission.

8) Ensure all wiring, hoses, lines, cables and linkages are disconnected from engine. Attach lifting device to engine and lift engine slightly. On all models, adjust support bar to contact transmission. Remove last bolt holding engine to transmission.

9) Separate engine from transmission. On Quantum models, lift engine without allowing it to turn. On models with A/T, secure torque converter in transmission.

INSTALLATION

1) Reverse removal procedure to install engine. On all models, ensure starter wires will not touch engine block or exhaust system. When installing belt pulley on crankshaft, align dimple on pulley with nub on sprocket. Use Loctite 573 on both threads and contact surface of crankshaft bolt.

2) Adjust tension of power steering pump, alternator and A/C compressor belts. Refill cooling system. Adjust accelerator cable or throttle linkage rods. Tighten engine mounting bolts with engine running at idle speed. Ensure cooling fan cycles properly.

CYLINDER HEAD & MANIFOLDS R & I

REMOVAL

1) Disconnect battery ground strap. Drain cooling system. Disconnect coolant hoses from head. Disconnect all vacuum hoses from intake manifold. Disconnect all electrical and ignition wires at cylinder head and intake manifold.

2) Remove fuel injectors and cold start valve, leaving fuel lines attached. Cap injectors and cold start valve and plug injector sockets. Remove air duct from throttle housing. Remove throttle rods or cables from throttle valve housing.

3) Disconnect fuel supply and return lines at fuel

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distributor. Remove airflow sensor and fuel distributor. Disconnect exhaust pipe from manifold. Remove upper radiator cover. Remove drive belts.

4) Remove power steering pump and position aside with hoses connected. Remove camshaft cover and timing belt cover. See Fig. 1. Loosen water pump bolts to relieve tension on timing belt. Remove timing belt. Remove water pump to replace "O" ring.

NOTE: Sealing "O" ring between water pump and cylinder block should be replaced whenever water pump bolts are loosened as leak may occur if old "O" ring is reused.

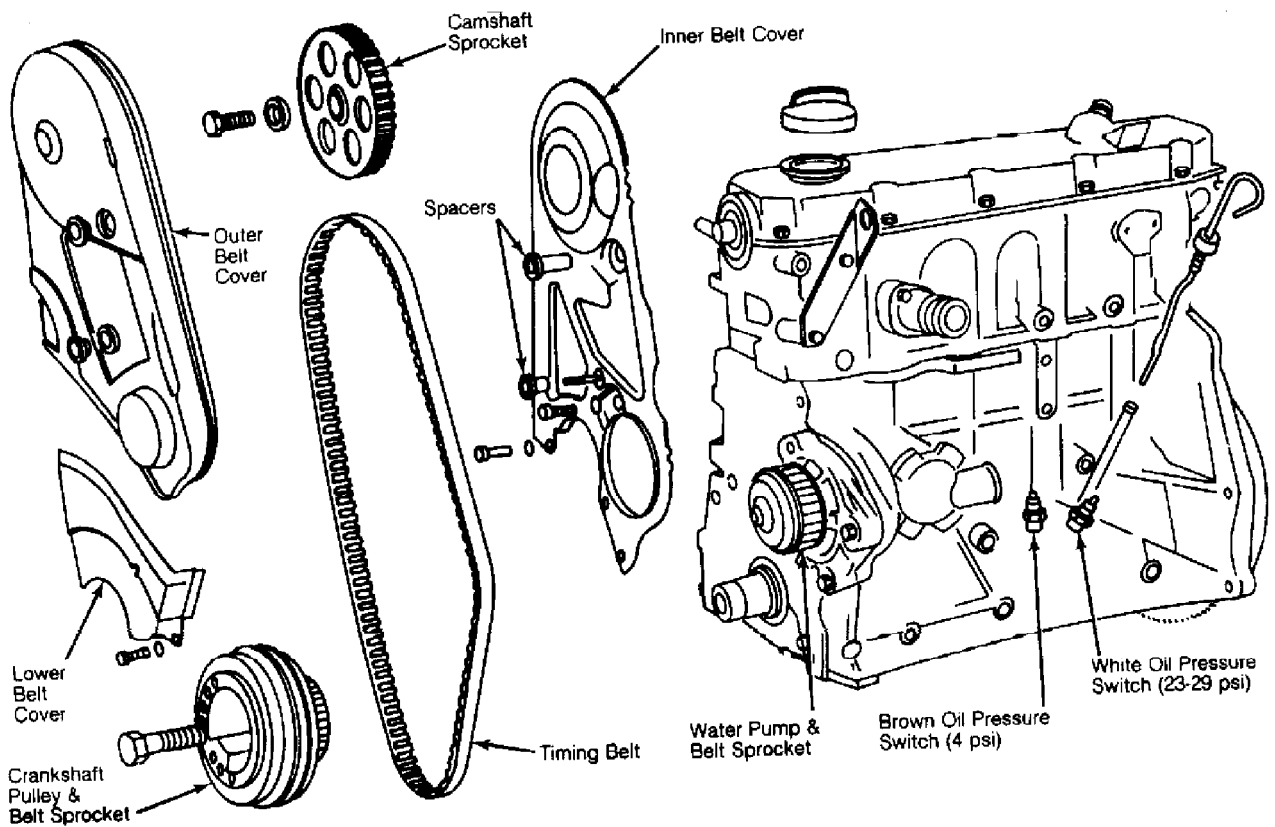


Fig. 1: Timing Belt, Sprockets & Covers

Always check sealing "O" ring when water pump is moved or loosened.

5) Loosen head bolts in reverse order of tightening sequence. See Fig. 2. Ensure all wiring, hoses and lines have been disconnected from cylinder head and intake manifold before lifting head from block. Remove cylinder head with intake manifold attached.

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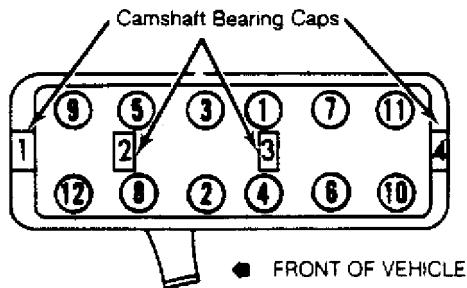


Fig. 2: Cylinder Head Tightening Sequence

CAUTION: If head bolt(s) require replacement, install new polygon bolts in complete sets only. Polygon head bolts do not require retorque procedure at 1000 mile service following repair.

INSTALLATION

1) Check cylinder head for warping with straightedge. Maximum warp allowable is .004" (.10 mm). Minimum thickness of head after machining, measured from head gasket surface to camshaft cover gasket surface, is 5.226" (132.75 mm).

2) Install head gasket dry with part number facing upward. Use locating pins to hold gasket in place. Before installing cylinder head, turn crankshaft until all pistons are about equal distance from TDC to prevent any open valves from hitting pistons. Position head correctly and install bolts No. 9 and 11 to align head. Remove locating pins and install remaining bolts.

3) Tighten cylinder head bolts in 3 stages. See Fig. 2. First step of head bolt tightening procedure is to 29 ft. lbs. (40 N.m). Second step is to 43 ft. lbs. (60 N.m). Third step is an additional 180 degrees in one movement (two 90 degree movements are acceptable).

4) Set engine to TDC of compression stroke on No. 1 cylinder. Turn camshaft until timing mark on sprocket is aligned with upper edge of camshaft cover gasket (or rear timing belt cover). See Fig. 3. Install water pump with NEW sealing "O" ring, leaving bolts loose enough to move pump body.

5) Install timing belt. Turn water pump body counterclockwise to increase belt tension. Tension is correct when belt can be twisted 90 degrees using finger pressure at point midway between camshaft sprocket and water pump sprocket. Recheck valve timing. Complete installation in reverse order of removal.

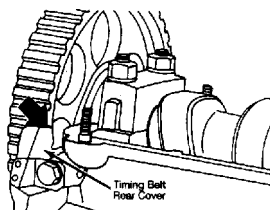


Fig. 3: Aligning Camshaft Sprocket

CAMSHAFT

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TIMING BELT COVER R & I

REMOVAL & INSTALLATION

Remove upper radiator cover. Remove all drive belts from pulleys. Remove power steering pump with pressure hoses connected. Position pump aside. Remove timing belt cover. To install, reverse removal procedure.

TIMING BELT R & I

REMOVAL

1) Remove upper radiator cover. Remove drive belts. Remove power steering pump with pressure hoses connected. Position pump aside. Remove camshaft cover and outer timing belt covers. See Fig. 1.

2) Using crankshaft bolt, turn crankshaft clockwise to TDC of compression stroke on No. 1 cylinder. Align timing mark on back of camshaft sprocket with upper edge of gasket. See Fig. 3.

3) Loosen water pump adjusting bolts to relieve tension on timing belt. Remove timing belt. Remove water pump to check sealing "O" ring. Do not allow crankshaft or camshaft to move.

INSTALLATION & VALVE TIMING

1) Both camshaft lobes on No. 1 cylinder must point upward. Mark (notch or dot) on back of camshaft sprocket must be aligned with top of valve cover gasket or rear timing belt cover. Crankshaft must be at TDC for No. 1 cylinder. Flywheel TDC mark must be aligned with index point on transmission housing.

2) Install water pump with new sealing "O" ring. Install timing belt. Turn water pump body counterclockwise to increase belt tension. Tension is correct when belt can be twisted 90 degrees using finger pressure at point midway between camshaft sprocket and water pump sprocket. Recheck valve timing. Complete installation in reverse order of removal.

VALVE TIMING

See TIMING BELT INSTALLATION & VALVE TIMING.

CAMSHAFT R & I

REMOVAL

Remove timing belt. If necessary, mark camshaft bearing caps No. 1 to No. 4 (front to rear). Loosen nuts holding No. 2 and No. 4 caps in diagonal pattern. Remove No. 2 and No. 4 caps. Loosen nuts holding No. 1 and No. 3 caps in diagonal pattern. Remove No. 1 and No. 3 caps. Remove camshaft from head.

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INSTALLATION

1) Lubricate bearing surfaces in caps and camshaft journals. Install camshaft. Ensure oil spray jet is situated so that spray direction is at 90 degrees to camshaft. Install all bearing caps in original positions and correctly aligned.

2) Ensure caps are aligned correctly. See Fig. 4. Lightly tighten No. 2 and No. 4 caps in diagonal pattern. Tighten nuts on all 4 caps in diagonal pattern. Install remaining components. Set valve timing.

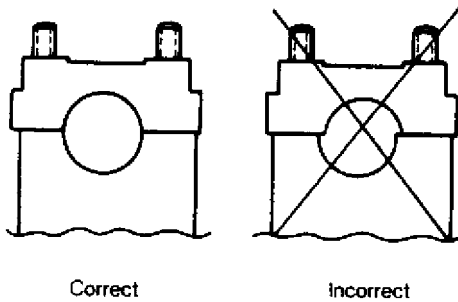


Fig. 4: Alignment of Camshaft Bearing Cap

CAMSHAFT OIL SEAL R & I

REMOVAL

1) Remove timing belt cover and camshaft cover. Position No. 1 piston on TDC. Loosen camshaft sprocket bolt while keeping camshaft from moving. Loosen water pump adjusting bolts to relieve tension on timing belt.

2) Remove timing belt. Remove water pump to check sealing ring. Remove camshaft sprocket and Woodruff key. Install sprocket bolt 3 turns into end of camshaft and secure with lock nut. Use Seal Extractor (2085) to remove camshaft oil seal.

3) Back inner portion of extractor 3 or 4 turns out from outer portion. Lock inner part with set screw on outer part. Lubricate threaded head of seal extractor and thread it into seal while pushing against end of extractor. Loosen set screw and turn inner part of extractor until seal comes out.

INSTALLATION

1) Lubricate seal lips and seal recess with oil. Use Seal Installer (10-203) to press seal into place until flush with chamfered edge of head.

2) Install water pump and timing belt. Adjust valve timing and belt tension. Install remaining parts in reverse of removal procedure.

CAMSHAFT INSPECTION

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END PLAY

Remove valve lifters. Check camshaft end play. If end play exceeds limit, check camshaft thrust flange and bearing cap for wear. Replace worn components.

CAUTION: Hydraulic valve lifters are always stored with contact face down. This applies to new lifters or to lifters removed for engine repairs. Lifters will take about 30 minutes to leak down after installation. DO NOT start engine during leak-down period as internal engine damage will occur.

OIL CLEARANCE

1) Remove camshaft and valve lifters. Keep lifters in order for reassembly. Place hydraulic lifters on clean surface with contact faces down. Remove sprocket and oil seal from camshaft. Clean bearing caps, bearing seats and camshaft journals.

2) Place camshaft on cylinder head. Ensure lobes do not touch valves or valve spring retainers. Place Plastigage on camshaft journals parallel to length of camshaft. Install bearing caps in correct position and tighten cap nuts. DO NOT rotate camshaft with Plastigage installed.

3) Remove bearing caps and read clearance. If wear limit is exceeded, repeat measurement with new camshaft installed. If wear limit is still exceeded with new camshaft, cylinder head must be replaced.

VALVES

VALVE ARRANGEMENT

E-I-E-I-I-E-I-E-I-E (Front-to-rear).

VALVE GUIDES R & I

INSPECTION

1) Clean valve guides. Attach dial indicator and Adapter (VW 387) to mounting surface of cylinder head. Insert new valve into valve guide. End of valve stem must be flush with end of valve guide.

2) Rock valve head back and forth against tip of dial indicator to measure clearance between stem and guide. If reading exceeds limits, replace guides and/or valves. See VALVES specifications at end of article.

REMOVAL

Use press and Valve Guide Drift (10-206) to remove and install guides. Press guides out from combustion chamber side of head.

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INSTALLATION

Coat new guides with oil. Press guides into head from camshaft side. Press guides in as far as possible. Do not use more than one ton of pressure after guide shoulder is seated as guide shoulder may break. Ream guide by hand to proper size.

VALVES & SEATS

CAUTION: NEVER rework exhaust valves on machine. Lap exhaust valves by hand only.

1) If intake valves are to be refaced, they must exceed minimum standards. Measure intake valve stem diameter. Measure exhaust valve stem diameter. Measure overall length of valves. See VALVES specifications at end of article.

2) One of 2 limits for cutting valve seats (dimension "y") is determined by measured distance "X" between stem end of closed stem and upper face of cylinder head (where camshaft cover gasket rests). See Fig. 5. Insert valve into guide and hold tightly against seat.

3) Measure distance "X". Subtract minimum dimension "X" from measured distance "X". Result is maximum cut allowed (dimension "y") for refacing valve seats. Minimum dimension "X" is 1.33" (33.8 mm) for intake valves and 1.34" (34.1 mm) for exhaust valves.

NOTE: If minimum dimension "X" is greater than measured distance "X", cylinder head must be replaced. If minimum dimension is not observed, hydraulic valve lifters may not function properly.

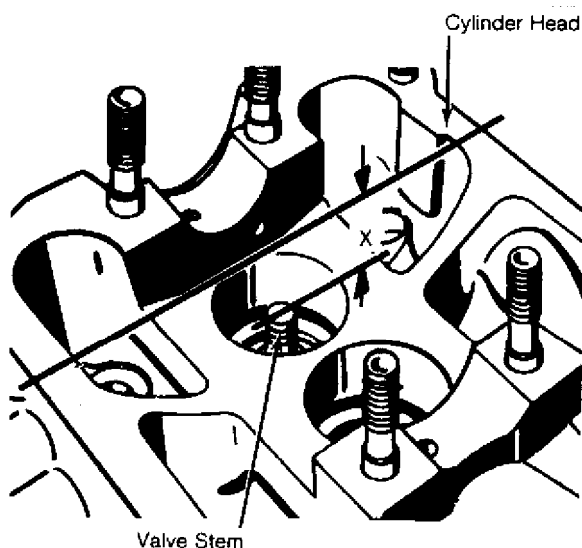


Fig. 5: Measuring Refacing Limit Of Valve Seats

4) On all models, second limit for maximum amount of material that may be removed from seat is determined by distance "D" from lower

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face of cylinder head to edge of 45 degrees valve seat angle. See Fig. 6. Maximum distance "D" for intake seats is .36" (9.2 mm). Maximum distance "D" for exhaust seats is .35" (9.0 mm).

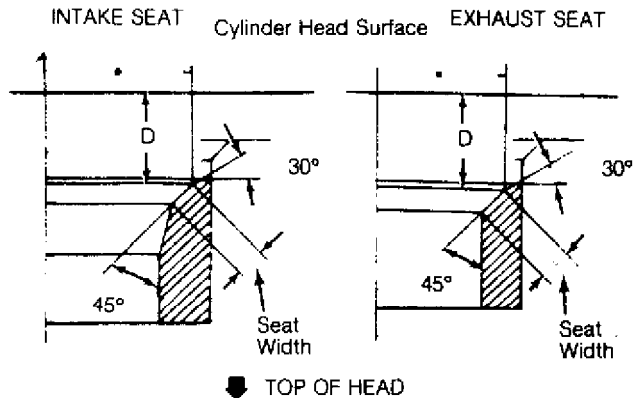


Fig. 6: Measuring Refacing Limits of Valve Seats

5) Do not reface exhaust valves on machine. Lap exhaust valves only by hand. Be sure to remove all traces of grinding compound from valves and guides after valves have been lapped into seats.

VALVE STEM OIL SEALS R & I

NOTE: Valve stem seals may be replaced with cylinder head installed on vehicle.

CAUTION: Hydraulic valve lifters are always stored with contact face down. This applies to new lifters or to lifters removed for engine repairs. Lifters will take about 30 minutes to leak down after installation. DO NOT start engine during leak-down period as internal engine damage will occur.

REMOVAL

1) Remove camshaft. Remove hydraulic lifters. Keep in order for reassembly. Remove spark plug of cylinder to be serviced. Turn crankshaft until piston is at BDC.

2) Install air hose and Adapter (VW 653/3) in spark plug hole and apply line pressure of at least 87 psi. Do not remove line pressure until valve spring components are reassembled.

CAUTION: Be aware that engine can rotate due to air pressure if piston is not at true BDC. Keep hands clear of belts and pulleys.

3) Use Spring Compressor (VW 541/1 or 2036). Compress valve spring and remove keepers, retainers and springs. Take out seals with Seal Remover Pliers (10-218).

INSTALLATION

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Slide protective plastic sleeve onto valve stem. Lubricate new seal and push into place with Seal Installer (10-204). Install remaining components in reverse order of removal. Ensure valve timing is correct.

HYDRAULIC VALVE LIFTERS

NOTE: Hydraulic valve lifters are not repairable or adjustable. Any worn, damaged or noisy lifter must be replaced as complete assembly. Some occasional valve/lifter noise is normal immediately after starting engine.

CHECKING

1) Run engine until radiator cooling fan has cycled at least once. Hold engine at steady 2500 RPM for 2 minutes. Allow engine speed to return to idle. If lifter is still noisy, replace it.

2) Remove camshaft cover. Turn engine by crankshaft bolt until both camshaft lobes of cylinder to be checked point upward. Push down on lifters with wooden stick. If lifter compresses more than .004" (.10 mm), it must be replaced.

3) If hydraulic valve lifters are removed for engine repairs, keep them in correct order for reassembly. Store lifters on clean surface with contact surface facing down. This is upside down compared to installed position.

CAUTION: Hydraulic valve lifters are always stored with contact face down. This applies to new lifters as well as to lifters removed for engine repairs. Lifters will take about 30 minutes to leak down after installation. DO NOT start engine during leak-down period as internal engine damage will occur.

PISTONS, PINS & RINGS

OIL PAN R & I

REMOVAL

Remove 2 front bolts of subframe. Drain engine oil. Remove dipstick. Remove flywheel dust cover. Remove rear pan bolts. Remove remaining pan bolts and lower pan from engine.

INSTALLATION

Clean all gasket mating surfaces. Make sure flange of oil pan is not distorted. Install oil pan with new gasket. Tighten pan bolts in criss-cross pattern. Replace dipstick and flywheel dust cover. Tighten subframe bolts.

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PISTON & ROD ASSEMBLY R & I

REMOVAL

1) Drain oil and coolant. Remove cylinder head and oil pan. Place piston to be removed at bottom of cylinder and cover with cloth to collect metal cuttings. Use ridge reamer to remove ridge or deposit from upper end of cylinder bore.

2) Before removing piston and rod from engine, mark rod and rod cap for cylinder identification. Remove rod cap and carefully push piston and rod out top of cylinder. Loosely install rod cap to rod for reassembly.

PISTON IDENTIFICATION

Piston recess is measured from face of piston, to bottom of dish in top of piston. The compression height of these pistons, is measured from face of piston to top of wrist pin opening. See PISTON IDENTIFICATION table.

INSTALLATION

1) Coat cylinder bore, piston and rings with engine oil. Ensure ring end gaps are spaced 120 degrees apart. Install ring compressor on piston, making sure position of rings does not change.

2) Install piston and rod in original bore. Arrow on piston head faces toward front of engine. Forged marks (lumps) on rod and cap must also face toward front of engine. Make sure connecting rod bolts do not damage bearing journals on crankshaft.

PISTON IDENTIFICATION TABLE

AA

Engine	Recess	Compression Height
--------	--------	--------------------

KX, JT	8.1 mm	22.2 mm
--------	--------	---------

AA

FITTING

1) Measure cylinder out-of-round. Limit for cylinder out-of-round is .0016" (.040 mm). Determine piston-to-cylinder clearance. Block must be bored and oversize pistons installed if clearance is excessive. See PISTONS, PINS, RINGS specifications at end of article.

NOTE: Cylinder bore dimensions should not be measured with engine mounted on stand as readings may be incorrect due to distortion of block.

2) Different oversizes of pistons are available, depending upon engine application. See PISTON & CYLINDER DIMENSIONS table for available pistons and correct bore dimensions.

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PISTON & CYLINDER DIMENSIONS TABLE

AA

Size	Piston Diameter	Cylinder Bore
------	-----------------	---------------

2.22L

Standard	80.98 mm	81.01 mm
----------	-------	----------	-------	----------

1st O/S	81.23 mm	81.26 mm
---------	-------	----------	-------	----------

2nd O/S	81.48 mm	81.51 mm
---------	-------	----------	-------	----------

AA

FITTING RINGS

Measure piston ring end gap. Measure ring side clearance. Install compression rings on piston with "TOP" mark facing upward. Recessed edge on outside of center ring must face down toward piston pin. Oil scraper ring can be installed either way. Space ring end gaps 120 degrees apart.

PISTON PIN REPLACEMENT R & I

REMOVAL

Remove circlip from pin bore groove. Use Piston Pin Drift (VW 207C) to remove and install piston pin. If pin is too tight, warm pistons to about 140°F (60°C) and then install pin.

INSTALLATION

Assemble connecting rod to piston. Arrow on piston head and forged marks on connecting rod must face toward front of engine when assembly is installed. Use pin drift to install piston pin. Install circlip into pin bore groove.

CRANKSHAFT & ROD BEARINGS

MAIN BEARINGS

1) Main bearing caps are numbered one through 6 (front to rear). Never interchange bearing caps. Use Plastigage method for measuring bearing clearances. See CRANKSHAFT MAIN & CONNECTING ROD BEARINGS specifications at end of article.

2) When replacing bearings, install grooved bearing halves into cylinder block. Plain bearing halves are installed in main caps. Lubricate crankshaft journals and bearings prior to installation.

CONNECTING ROD BEARINGS

Use Plastigage method for measuring bearing clearances. Use feeler gauge to check connecting rod side clearance. See CRANKSHAFT MAIN & CONNECTING ROD BEARINGS specifications at end of article.

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CRANKSHAFT END PLAY

Use feeler gauge to check crankshaft end play. Insert feeler gauge between No. 4 main bearing (thrust bearing) and crankshaft journal thrust face. See CRANKSHAFT MAIN & CONNECTING ROD BEARINGS specifications at end of article.

FRONT CRANKSHAFT OIL SEAL R & I

REMOVAL

1) Remove lower grille. Remove timing belt cover. Loosen water pump to remove timing belt. Remove water pump to replace sealing "O" ring. Use Crankshaft Lock (2084) to hold crankshaft.

2) Remove crankshaft damper/pulley bolt with Spanner (2079). Remove pulley with belt drive sprocket. Using Seal Remover (2086), carefully pry seal from oil pump housing.

INSTALLATION

1) Lightly coat new seal lip and outer edge with oil. Using Seal Installer (2080) and Guide Sleeve (2080A), press in seal until seated. Install crankshaft damper with timing belt. Install water pump with new sealing ring. Mount crankshaft lock on crankshaft pulley.

2) Use Loctite 573 on crankshaft damper bolt and install. Use spanner and torque wrench to tighten crankshaft pulley bolt. Torque specification only applies if torque wrench handle and spanner are in a straight line.

3) Remove tools and adjust timing belt tension. Make sure valve timing is correct. Install remaining parts in reverse order of disassembly.

REAR CRANKSHAFT OIL SEAL R & I

REMOVAL

Index mark flywheel/drive plate to crankshaft before removal. Remove flywheel/drive plate. Note position of any shims used. Using Seal Remover (2086), carefully pry oil seal from seal flange.

INSTALLATION

1) Coat lips of new seal with oil. Position seal in place and start by hand. Using Seal Installer (2003/1), press seal in until seated. There must be sufficient clearance between drive plate (A/T models) and back of engine block. Bolt torque converter tightly to crankshaft without shim.

2) Measure inside of drive plate from top edge of lip to face of plate where torque converter attaches. Measure from top edge of lip to engine block on both sides of block. Subtract inside measurement

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from outside measurement. If result is in range of .68-.74" (17.2-18.8 mm), no shim is required between drive plate and end of crankshaft. If result is smaller than range, shim is required.

3) Remove bolts and coat with locking compound. Install flywheel/flex plate with correct shim (if required) and tighten bolts. Note that notch on outer washer of flex plate faces toward torque converter on models with A/T. Replace shoulder bolts with new bolts. Install remaining components.

ENGINE OILING

ENGINE OILING SYSTEM

Slipper gear-type pump is used. Oil pump is mounted at front of engine and driven by crankshaft. See Fig. 7. Oil is lifted from pan by oil suction tube, which extends from oil pump. Oil is then fed to internal engine moving parts. Lubrication is either by pressure feed or drainage method.

CRANKCASE CAPACITY

Crankcase capacity is either 3.7 qts. (3.5L) with filter replacement or 3.2 qts. (3.0L) if filter is not replaced.

OIL PRESSURE

Oil pressure is 29 psi (2.0 kg/cm²) at 2000 RPM. Measurement is to be made with fresh oil at temperature of 176°F (80°C).

OIL PRESSURE RELIEF VALVE

Oil pressure relief valve opens at 77-91 psi (5.3-6.3 kg/cm²).

OIL PRESSURE WARNING SYSTEM

1) Dynamic oil pressure warning system is used on this motor. Control unit with buzzer is mounted on relay panel adapter. Dual oil pressure switches are on side of block. See Fig. 1.

2) Contacts of both switches are open with engine off. If oil pressure drops below 4.0 psi (.3 kg/cm²) while engine is running, contacts of Brown oil pressure switch will open. Buzzer will sound and oil pressure symbol will appear on instrument panel.

3) If oil pressure drops below 23-29 psi (1.6-2.0 kg/cm²) with engine running at 2500 RPM, contacts of White oil pressure switch will open. Buzzer will sound and oil pressure symbol will appear on instrument panel.

OIL PUMP R & I

REMOVAL & DISASSEMBLY

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1) Remove all drive belts from crankshaft pulley. Remove power steering pump (with hoses connected) and position aside. Remove timing belt covers. Loosen crankshaft damper/pulley bolt.

2) Turn crankshaft to position No. 1 piston at TDC after compression stroke. Loosen water pump adjusting bolts. Turn water pump to relieve tension on timing belt.

3) Remove lower timing belt cover. Ensure crankshaft position has not changed. Remove damper/pulley from crankshaft with drive sprocket attached. Remove dipstick.

4) Drain engine oil and remove oil pan. Remove oil suction tube from oil pump. Remove oil pump. Remove end cover from pump housing. Lift out outer and inner pump gears. See Fig. 7.

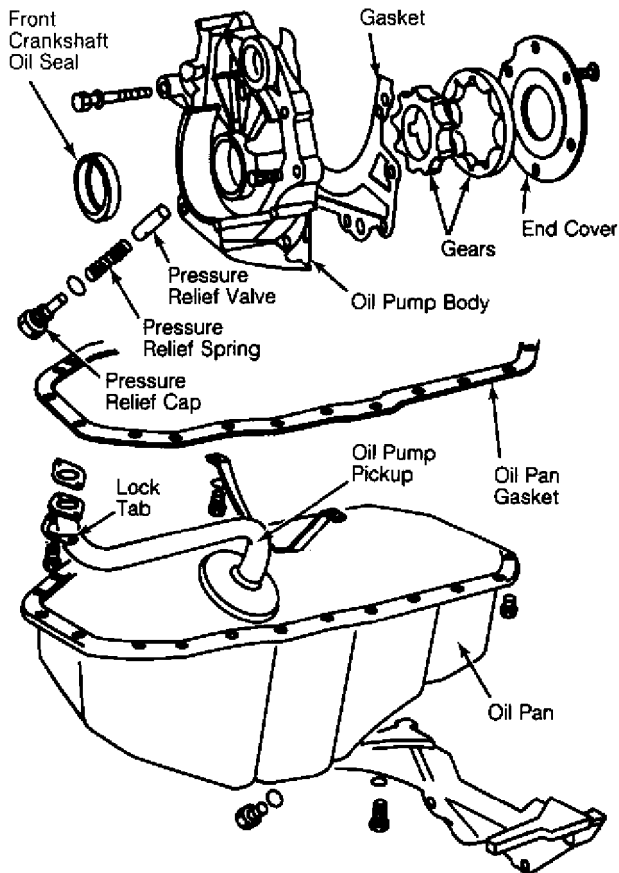


Fig. 7: Oil Pump, Pick-Up & Pan

INSPECTION & REASSEMBLY

Inspect end cover, housing and gears for wear or scoring. Replace end cover if scored. If pump gears require replacement, replace only in pairs. Install gears in pump housing with triangular mark facing end cover. Install end cover.

INSTALLATION

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Prime oil pump prior to installing. Install oil pump in reverse of removal procedure. Coat threads of crankshaft damper/pulley bolt with Loctite prior to installing. Adjust timing belt tension. Ensure valve timing is correct.

ENGINE COOLING

WATER PUMP R & I

REMOVAL

1) Drain cooling system. Remove timing belt covers. Turn crankshaft to TDC for No. 1 cylinder. Align timing marks on flywheel and camshaft gear with reference marks.

2) Loosen water pump to relieve tension on timing belt. Remove timing belt. Do not allow crankshaft or camshaft to move. Remove water pump.

NOTE: If remanufactured water pump is being used, check "O" ring size. Some pumps are resurfaced and require a 5 mm "O" ring. These pumps will have numeral "5" stamped in mounting flange.

INSTALLATION

Install water pump in reverse of removal procedure, using new "O" ring. Ensure valve timing is correct prior to installing remaining components.

NOTE: For further information on cooling systems, see ENGINE COOLING SYSTEMS article in this section.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

AA

Application	Ft. Lbs. (N.m)
Camshaft Bearing Cap Nuts	14 (20)
Camshaft Sprocket Bolt	58 (80)
Connecting Rod Cap Nuts	37 (50)
Crankshaft Damper/Pulley Bolt (1)	(2) 258 (350)
Cylinder Head Bolts	
Step 1	29 (40)
Step 2	43 (60)
Step 3	Plus 180 Degree (1/2 Turn)
Exhaust Manifold-to-Head Nuts	18 (25)
Flywheel-to-Crankshaft Bolts (1)	
Without Shoulder	55 (75)
With Shoulder (3)	74 (100)
Intake Manifold Bolts	18 (25)
Main Bearing Cap Bolts	47 (65)

2.22L 5-CYL

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Torque Converter-to-Drive Plate Bolts 22 (30)

- (1) - Use locking compound.
- (2) - Applies only when using Spanner (2079) and torque wrench. Torque wrench must be in-line with spanner handle.
- (3) - Always use new bolts.

AA

ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS TABLE

AA

Application In. (mm)

2.22L

Displacement	
Cu. In.	135.8
Liters	2.22
Fuel System	KE-Jetronic
HP @ RPM	110 @ 5500
Torque Ft. @ RPM	122 @ 2500
Compr. Ratio	8.5:1
Bore	3.19 (81.0)
Stroke	3.40 (86.4)

AA

VALVE SPECIFICATIONS

VALVE SPECIFICATIONS TABLE

AA

Application In. (mm)

2.22L

Intake (1)	
Head Diameter	1.496 (38.00)
Face Angle	45°
Seat Angle	(3) 45°
Seat Width	(4) .079 (2.00)
Stem Diameter314 (7.98)
Stem Clearance039 (1.0)
Valve Lift
Exhaust (2)	
Head Diameter	1.300 (33.00)
Face Angle	45°
Seat Angle	(3) 45°
Seat Width	(5) .094 (2.40)
Stem Diameter313 (7.95)
Stem Clearance051 (1.3)
Valve Lift

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- (1) - Overall length is 3.58" (90.9 mm).
- (2) - Overall length is 3.57" (90.8 mm).
- (3) - Correction angle is 30 degrees.
- (4) - Diameter limit is 1.47" (37.2 mm).
- (5) - Diameter limit is 1.28" (32.4 mm).

AA

PISTONS, PINS & RINGS SPECIFICATIONS

PISTONS, PINS & RINGS SPECIFICATIONS TABLE

AA

Application	In. (mm)
-------------	----------

2.22L

Pistons

Clearance	(1) .001-.003 (.03-.08)
-----------	-------------------------

Pins

Piston Fit	(2)
------------	-----

Rod Fit	Interference
---------	--------------

Rings

Ring No.	All
----------	-----

End Gap	(3) .010-.020 (.25-.50)
---------	-------------------------

Side Clearance	(4) .0008-.003 (.020-.080)
----------------	----------------------------

(1) - Wear limit is .003" (.08 mm)

(2) - Push fit at 140°F (60°C).

(3) - Wear limit is .04" (1.0 mm).

(4) - Wear limit is .004" (.10 mm).

AA

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS SPECS

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS SPECS TABLE

AA

Application	In. (mm)
-------------	----------

2.22L

Standard Size

Main Bearings

Journal Diameter.	(1) 2.2818-2.2826 (57.958-57.978)
-------------------	-----------------------------------

Clearance	(2) .0005-.0030 (.015-.076)
-----------	-----------------------------

Thrust Bearing	No. 4
----------------	-------

Crankshaft End Play	(3) .003-.007 (.07-.18)
---------------------	-------------------------

Connecting Rod Bearings

Journal Diameter.	(1) 1.880-1.880 (47.76-47.78)
-------------------	-------------------------------

Clearance	(4) .0006-.0024 (.015-.062)
-----------	-----------------------------

Side Play	.016 Max. (.41)
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1st U/Size

Main Bearings

Journal Diameter	2.2720-2.2728 (57.708-57.728)
------------------	-------------------------------

Connecting Rod Bearings

2.22L 5-CYL

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Journal Diameter 1.870-1.871 (47.51-47.53)
2nd U/Size
Main Bearings
Journal Diameter 2.2621-2.2629 (57.458-57.478)
Connecting Rod Bearings
Journal Diameter 1.860-1.861 (47.26-47.28)
3rd U/Size
Main Bearings
Journal Diameter 2.2523-2.2531 (57.208-57.228)
Connecting Rod Bearings
Journal Diameter 1.850-1.852 (47.01-47.03)

(1) - Out-of-round limit is .001" (.03 mm).

(2) - Wear limit is .006" (.16 mm).

(3) - Wear limit is .010" (.25 mm).

(4) - Wear limit is .005" (.12 mm).

AA

CAMSHAFT SPECIFICATIONS

CAMSHAFT SPECIFICATIONS TABLE

AA

Application (1) In. (mm)

Journal Diameter
Clearance004 (.10) Max.
Lobe Lift

(1) - Maximum end play is .001" (.03 mm).

AA

END OF ARTICLE