4000, 5000, COUPE & QUATTRO 5-CYLINDER

ENGINE CODING

ENGINE IDENTIFICATION

Engine number is stamped on a machined pad. On 4000, Coupe and Quattro models, it is located on left side of cylinder block near the distributor. On 5000 models, it is located on left side of block near control pressure regulator. Letter prefix indicates engine type.

ENGINE IDENTIFICATION CODES

Engine	Code
2144 cc	
4000, 5000 & Coupe	
Non-turbo	WE
Turbo	WK
Quattro Turbo	WX

ENGINE, MANIFOLDS & CYLINDER HEAD

ENGINE

Removal (4000 & Coupe)

1) Disconnect battery ground cable. Open heater control valve fully. Open cap on coolant expansion tank. Drain coolant by disconnecting lower radiator hoses. Remove engine-to-transmission bolt holding coolant pipe. Remove upper coolant hose from pipe (left side of engine).

2) Remove upper radiator cover. Remove upper radiator hose from engine. Remove vacuum hose at brake booster and at cruise control unit. Remove power steering pump and position aside.

3) Disconnect coolant hose at thermostat housing. Disconnect wires from oil pressure switch and control pressure regulator. Remove control pressure regulator, leaving fuel lines attached. Remove throttle push rod.

4) Remove remaining coolant hose. Remove alternator adjusting bolt and mounting bolt and position alternator aside. Remove alternator bracket from engine block. Remove front engine stop.

5) Loosen clamps and remove air duct. Disconnect electrical plugs from frequency valve and grounding point. Remove distributor vacuum unit hoses. Disconnect electrical plugs at cold start valve, auxiliary air regulator and throttle switch. Remove coil high tension wire at ignition coil.

6) Pull out fuel injectors, and remove cold start valve, leaving fuel lines connected. Protect injectors and cold start valve with caps or plugs. Disconnect fuel feed and return lines. Remove fuel distributor with air flow sensor plate. Pull PCV valve hose from valve cover.

7) Remove air filter assembly. Disconnect oxygen sensor, thermo switch, thermo-time switch, temperature sending unit, and ignition distributor connectors.

8) If equipped with automatic transmission, remove hoses at oil cooler. Remove oil cooler hose flange from engine block. Remove heater hoses. Remove cover for right engine mount. Loosen left and right engine mounts.

9) Detach ground strap from mounting bracket. Remove upper engine-to-transmission bolts, leaving one easy-to-reach bolt installed. Disconnect wire from oil temperature switch.

10) If A/C equipped, remove compressor drive belt. Disconnect wire from compressor clutch. Remove compressor mount bolts from engine and remove compressor. Position compressor aside, leaving hoses connected.

11) Disconnect starter wires. Remove both front subframe bolts. Remove exhaust pipe attaching nuts from manifold. Remove bolt from exhaust pipe support. Remove starter.

12) Working through starter mounting hole, remove 3 torque converter mounting bolts from drive plate. Remove lower engine-to-transmission bolts. Detach shift rod (or clutch cable) from transmission. Support transmission with transmission support bar.

13) Make sure that all wiring, hoses, lines, cables and linkages are are disconnected from engine. Attach lifting device to engine. Adjust support bar to contact transmission. Remove remaining upper engine-to-transmission bolt.

14) Lift engine slightly and pry engine away from transmission. Continue to lift engine, while turning it toward the left. Use care when guiding engine out of engine compartment. Secure torque converter so it does not fall out.

Installation

To install engine, reverse removal procedure while noting the following: Install and tighten starter cable so it does not touch engine. Align exhaust system and refill coolant tank. Tighten engine mounting bolts while engine is running at idle speed.

Removal (5000)

1) Disconnect battery ground cable. Remove coolant expansion tank cap. Disconnect bottom hose from expansion tank and drain. Set temperature lever in "COLD" position if vehicle is equipped with air conditioning.

2) Disconnect lower radiator hoses to drain coolant from engine. Remove remaining coolant hoses from engine. Remove control pressure regulator. Remove cold start valve and fuel injectors. Plug or cap injectors and cold start valve.

3) Disconnect air duct and vacuum hoses from throttle valve assembly. Remove air cleaner assembly with fuel distributor and air flow sensor attached, and position aside. If necessary, remove fuel supply and return hoses from fuel distributor.

4) Remove hood latch cable guide from bracket. Remove radiator cowl, shroud, electric fan and radiator. On air conditioned vehicles, remove grilie and tilt condenser outward.

5) Remove power steering pump and position aside, leaving hoses connected. Remove vacuum amplifier, ignition coil and EGR control valve. Remove windshield washer and power steering reservoirs from holders. Remove distributor cap, rotor and ignition wires.

6) Disconnect throttle cable (or throttle rod) from engine. Disconnect primary wiring from distributor. Disconnect wiring to oil pressure sender, water temperature sender and oxygen sensor.

7) Remove air conditioning compressor, leaving hoses connected. Secure compressor away from engine. Disconnect exhaust pipe from transmission bracket and from exhaust manifold. If equipped, disconnect

4000, 5000, COUPE & QUATTRO 5-CYLINDER (Cont.)

turbocharger from exhaust pipe. Remove front engine mount. Remove starter and alternator.

8) Remove torque converter mounting bolts (automatic transmission) from drive plate, doing so through starter mounting hole. Remove lower engine-to-transmission bolts. Install transmission support bar (VW 785/1). Remove upper engine-to-transmission bolts.

9) Remove left engine bracket and loosen right engine bracket from engine mount. With engine lifting device securely attached, lift engine until drive belt pulley is behind grille opening. Support transmission with support bar. Separate engine from transmission.

10) Make sure that all wiring, hoses, lines, cables and linkages are disconnected from engine. While lifting engine upward, turn front of engine toward right side of vehicle. Carefully remove engine.

Installation

1) To install engine, reverse removal procedure while noting the following: Install and tighten starter cable so it does not touch engine. Metal lip of gasket between exhaust manifold and exhaust pipe must face exhaust pipe.

2) Adjust power steering pump, alternator, and air conditioning compressor belt tension. Attach vacuum hoses to EGR control valve with straight adapter installed to EGR valve and angled adapter to vacuum amplifier.

3) Refill coolant expansion tank. Adjust accelerator cable. Tighten engine mounting bolts with engine running at idle speed.

NOTE: Engine and transmission assembly must be removed by lowering from bottom of vehicle. Place vehicle on a lift prior to proceeding.

Removal (Quattro)

1) Disconnect battery ground strap (battery located under rear seat). Open heater control valve fully. Remove cap from coolant expansion tank. Disconnect coolant hose from bottom of radiator and drain coolant from engine.

2) Remove air intake hose from injector blower cooling motor. Remove upper radiator cover. Remove upper radiator hose from engine. Remove electrical plug from coolant fan. Remove coolant hose between radiator and expansion tank.

3) Remove bleeder hose to auxiliary radiator. Remove wire plug from thermoswitch. Remove right side and bottom radiator covers. Remove radiator mounts. Discharge refrigerant in A/C system.

4) Remove refrigerant lines at A/C condneser and position aside. Remove radiator with A/C condensor attached. Remove windshield washer reservoir. Remove A/C compressor and power steering pump drive belts.

5) Remove A/C compressor and bracket. Remove power steering pump with hoses connected, and position aside. Label and disconnect wires from oil pressure switch and sender for temperature gauge.

6) Label and disconnect wire plugs from control pressure regulator. Remove air distributor duct, hose and injector blower cooling motor. Remove control pressure regulator with fuel lines connected.

7) Remove throttle cable and position aside. Remove holder for injector fuel lines. Pull out injectors with fuel lines connected. Remove cold start valve with fuel lines connected. Cap or plug fuel injector nozzles and cold start valve nozzle.

8) Label and disconnect wires from switches at throttle valve housing (throttle valve and intake temperature switches). Place wiring out of way. Disconnect air intake hose from throttle valve housing.

9) Label and disconnect electrical plug and vacuum hoses from auxiliary air regulator. Disconnect engine breather hose. Remove injector cooling fan connector. Label and remove vacuum hoses from two-way valve.

10) Remove thermo-pneumatic valve with vacuum hoses connected. Remove RPM sensor. Disconnect speedometer cable at transmission. Disconnect high tension lead from distributor cap and spark plug wires from spark plugs.

11) Remove primary ignition wiring from distributor, then remove distributor. Disconnect wires from thermo-time switch and overheating warning lamp switch. Disconnect heater hoses from engine.

12) Disconnect brake booster and reservoir from motor mount with lines connected. Disconnect electrical connector for differential lock control lights. Disconnect wires to back-up light switch at transmission.

13) Disconnect tie rod bracket on steering rack. Disconnect shift linkage from transmission. Remove clutch slafe cylinder (with line connected), bracket and pin. Pin is located under bracket in transmission. Disconnect ground strap from left engine mount.

14) Remove oil cooler air duct. Remove intercooler (intake air cooler). Label and disconnect electrical cables to alternator. Remove oil cooler with lines connected. Remove starter cables. Disconnect exhaust pipe at flange.

15) Remove transmission cover plates. Remove right side transmission mount. Disconnect left and right axle shafts at transmission. Disconnect drive shaft at rear of engine. Disconnect differential lock cable from transmission.

16) Remove both transmission mounts. Remove mounting bolts for left and right ball joints. Disconnect rear (left and right) subframe mounts. Remove subframe and press ball joint out of strut.

17) Attach lifting chain and hoist to engine, and lift engine slightly. Remove left and right engine mounts. Carefully lower engine and transmission from vehicle. Raise vehicle and remove engine and transmission.

Installation

1) Install engine and transmission assembly in reverse order of removal, while noting the following:

2) To install subframe, raise vehicle on lift. Position subframe in place. Position boom of an engine hoist under subframe, and lift subframe into place by raising boom.

3) Install and tighten subframe bolts in following sequence: Left rear, right rear, left front and right front. When installing starter cables, do not allow cables to ground on engine or mounts. Be sure engine is aligned.

CYLINDER HEAD

Removal

1) Disconnect battery ground strap. Drain cooling system. Disconnect coolant hoses from head. Lable and disconnect all vacuum and air hoses from intake manifold.

2) Label and disconnect all electrical and ignition wires at cylinder head and intake manifold, that might interfere with cylinder head removal.

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3) Remove fuel injectors from head and cold start valve from intake manifold, leaving fuel lines attached. Cap or plug injectors and cold start valve. Remove air duct from throttle housing. Remove all throttle linkage or cables from throttle valve housing.

4) Label and disconnect fuel supply and return lines to fuel distributor. Remove air flow sensor, fuel distributor, injectors and cold start valve (with fuel lines attached), and position aside.

5) Disconnect exhaust pipe from manifold. If equipped, disconnect exhaust pipe from turbocharger. Remove exhaust manifold from cylinder head. If necessary, remove turbocharger unit.

6) Remove upper radiator cover. Remove drive belts. Remove power steering pump with pressure hose connected, and position pump aside. Remove cam cover and timing belt cover.

7) Loosen water pump adjusting bolts to relieve tension on timing belt. Remove timing belt. Loosen head bolts in reverse order of tightening sequence. *See Fig. 1.*

8) Ensure all wires, hoses and lines have been removed from cylinder head and intake manifold prior to removing head. Remove cylinder with intake manifold attached.

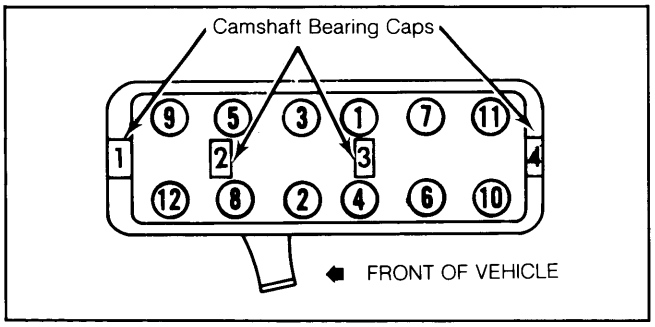
CAUTION: If head bolt(s) require replacement, install new polygon head bolts in complete sets only. Retightening of polygon head bolts at 1000 mile service following repair is NOT recommended by manufacturer.

Installation

1) Clean all gasket mating surfaces. Install head gasket DRY (no adhesive) with part number facing upward. Before installing cylinder head, turn crankshaft so that pistons are about equal distance from TDC. This will prevent an open valve from hitting a piston.

2) Install head using polygon head bolts only. Install bolts 9 and 11 to align head. Install remaining bolts. Tighten cylinder head bolts in 3 steps. *See Fig. 1.*

Fig. 1: Cylinder Head Tightening Sequence



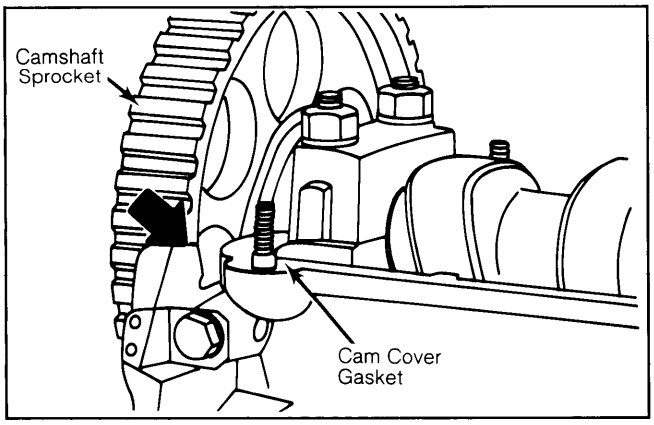
Install bolts 9 and 11 to align head, then install remaining bolts.

3) Turn camshaft until timing mark on sprocket is aligned with upper edge of cam cover gasket (or rear timing belt cover). *See Fig. 2.* Turn crankshaft to align TDC mark on flywheel with reference mark on clutch housing.

4) Install timing belt. To adjust timing belt tension, turn water pump until pump sprocket provides tension against timing belt.

5) Belt has correct tension when it can be twisted 90° with thumb and finger pressure, at a point midway between camshaft sprocket and water pump sprocket. Recheck valve timing. Complete installation in reverse order of removal.

Fig. 2: Aligning Camshaft Sprocket



Align mark on camshaft sprocket (arrow) with upper edge of cam cover gasket (or rear timing belt cover).

CAMSHAFT

TIMING BELT COVER

Removal & Installation

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

FRONT MAIN BEARING OIL SEAL

Removal

Remove front cover. Using crankshaft support tool (2084) to keep crankshaft from moving, remove crankshaft damper/pulley. Using seal remover tool (2086), carefully pry seal from oil pump housing.

Installation

Lightly coat new seal lip and outer edge with oil. Using seal installer and guide sleeve (2080A), press in seal until seated. Install crankshaft damper and front cover. Use Loctite on crankshaft damper bolt.

TIMING BELT & SPROCKET

Removal

1) Remove upper radiator cover. Remove drive belts. Remove power steering pump with pressure hose connected, and position pump aside. Remove cam cover and timing belt cover.

2) Turn crankshaft clockwise (by crankshaft pulley bolt), until timing mark on camshaft sprocket is aligned with upper edge of cam cover gasket (or rear timing belt cover). *See Fig. 2.*

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

Installation

1) Install new belt. To adjust timing belt tension, turn water pump until pump sprocket provides tension against timing belt.

2) Belt has correct tension when it can be twisted 90° with thumb and finger pressure, at a point

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midway between camshaft sprocket and water pump sprocket. Recheck valve timing. Complete installation in reverse order of removal.

VALVE TIMING

See procedures in Timing Belt & Sprocket.

CAMSHAFT

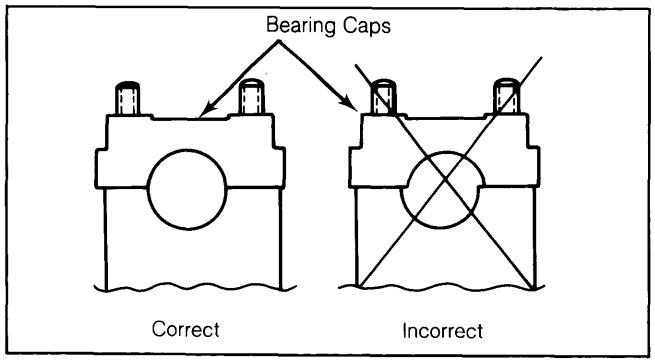
Removal

Remove timing belt. If necessary, mark cam bearing caps 1 to 4 (front to rear). Diagonally loosen bearing caps 2 and 4, then remove caps. Diagonally loosen bearing caps 1 and 3, then remove caps. Remove camshaft from head.

Installation

1) Lubricate bearing surfaces in cam bearing caps. Lubricate camshaft journals. Install camshaft. Install cam bearing caps in original locations from which removed. Ensure caps are not misaligned. *See Fig. 3.*

Fig. 3: Proper Cam Bearing Cap Alignment



Tighten cam bearing nuts to 14 ft. lbs. (20 N.m).

2) Lightly tighten bearing caps 2 and 4 in a diagonal pattern, then tighten all bearing caps. Install remaining components.

CAMSHAFT OIL SEAL

Removal

1) Remove timing belt cover and cam 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 camshaft sprocket and Woodruff key. Using seal removing tool (2085), remove camshaft oil seal.

Installation

Lubricate seal lips with oil. Lubricate seal recess in front cam bearing with oil. Using seal installing tool (10-203), press seal into place until flush with chamfered edge. Do not press seal in any farther, otherwise oil return hole in bearing cap will be blocked.

CAMSHAFT END THRUST

1) Check camshaft end thrust with cam followers removed. Attach dial indicator to cylinder head. Position indicator point on end of camshaft (or sprocket). Push camshaft rearward and zero dial indicator.

2) Push camshaft forward to record maximum movement. If end thrust exceeds .006" (.15 mm), check camshaft thrust flange and bearing cap for wear. Replace worn components.

VALVES

CAUTION: Never rework exhaust valves on a valve grinding machine. Lap exhaust valves by hand only.

NOTE: New design intake and exhaust valves with 3 keeper grooves and chamfered spring retainers have been introduced by manufacturer. Old and new design valves may be installed in same engine, but keepers and spring retainers are not interchangeable.

VALVE ARRANGEMENT

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

VALVE GUIDE SERVICING

Inspection

1) Clean valve guides. Attach dial indicator and adapting fixture (VW 387) to mounting surface of cylinder head. Insert a new valve into valve guide. Valve tip must be flush with bottom of valve guide.

2) Rock valve back and forth against dial indicator point to measure amount of stem-to-guide clearance. If wear exceeds .039" (1.0 mm) for intake valves, or .051" (1.3 mm) for exhaust valves, replace guides.

Removal

Use arbor press and valve guide remover/installer tool (10-206) to remove and install guides. Press guides out from combustion chamber side of head.

Installation

Coat new guides with oil. Press into cold head from camshaft side. Press guides in as far as they will go. Do not use more than 1 ton pressure once guide shoulder is seated, or guide shoulder may break. Ream guide by hand to proper size.

VALVE STEM OIL SEALS

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

CAUTION: Installing valve stem oil seal without using plastic protective sleeve of seal installing tool (10-204), may result in seal damage.

Removal

1) Remove camshaft, followers and valve adjusting discs. Remove spark plug of cylinder to be serviced. Turn crankshaft until piston of cylinder concerned is at bottom of its stroke.

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

3) Using spring compressor tool (VW 541/1 or 2036), compress valve spring and remove keepers, retainers and springs. Use seal removing pliers (10-218) to remove seal.

Installation

Place seal protector over valve stem. Lubricate new seal and push seal into place with seal installing tool (10-204). Install remaining valve components.

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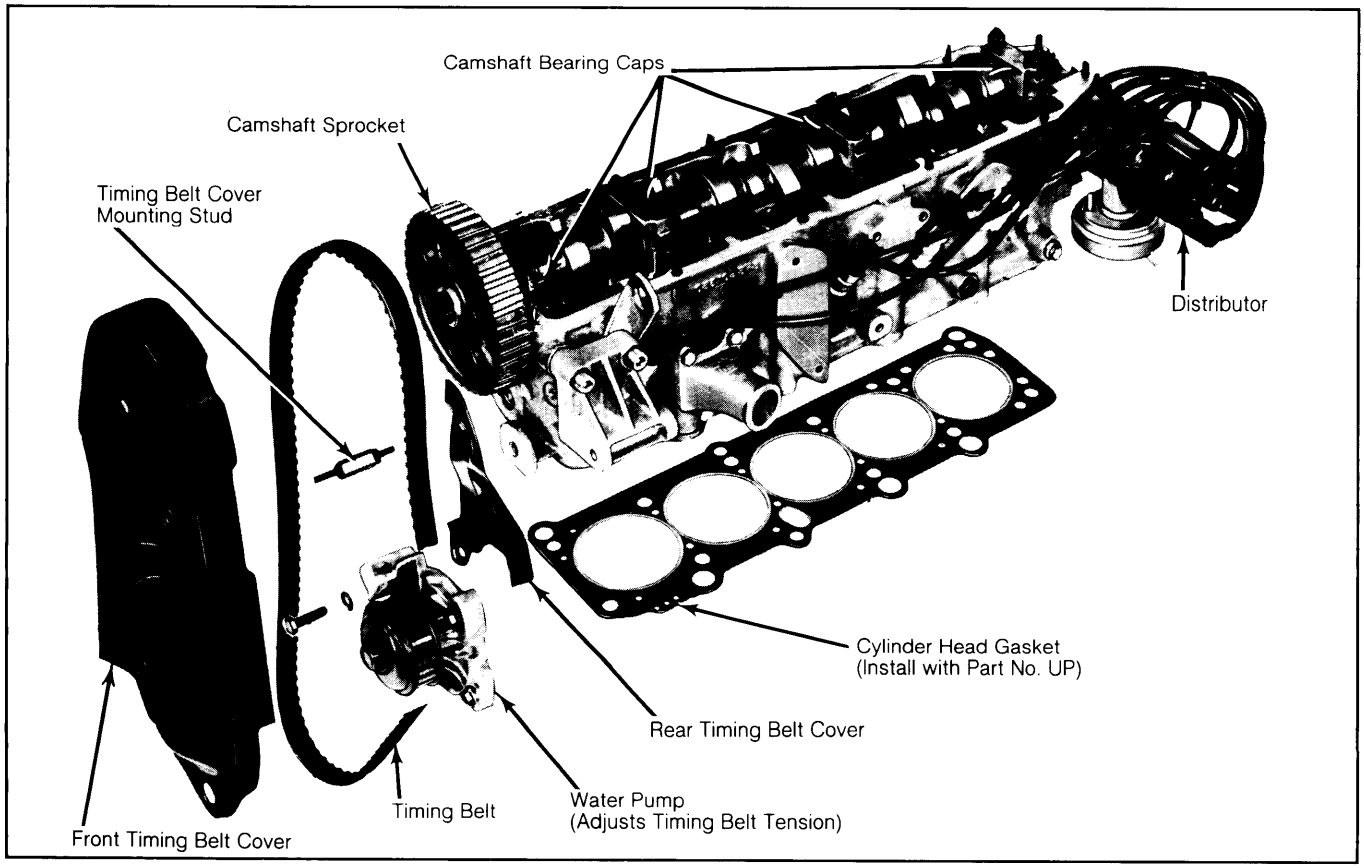
Fig. 4: Cylinder Head and Camshaft Assembly with Timing Belt and Cover



VALVE SPRINGS

Valve springs may be replaced with cylinder head installed on vehicle. To replace valve springs, use removal and installation procedure explained in "Valve Stem Oil Seals" above.

CAM FOLLOWERS

When removing cam followers, keep them in order for later installation in their original locations. With camshaft and adjusting discs removed, lift out cam followers. Inspect for wear or damage and replace as necessary. Coat with oil when installing.

VALVE CLEARANCE ADJUSTMENT

NOTE: Cold valve clearances are given for initial settings, after engine work has been performed. Recheck valve clearance and make final adjustment with engine warm (coolant temperature about 95°F, 35°C).

Measuring Valve Clearance

1) Disconnect accelerator linkage and remove cam cover. Turn crankshaft clockwise until both cam lobes of cylinder to be adjusted point upward.

CAUTION: Never use camshaft sprocket attaching bolt to turn camshaft, as this may stretch timing belt. Never turn crankshaft counterclockwise.

2) Using feeler gauge, measure valve clearances between cam and follower in firing order sequence of 1-2-4-5-3. If clearance is not as specified in Valve Clearance Specifications, adjust valves.

VALVE CLEARANCE SPECIFICATIONS

Application	In. (mm)
Intake	
Hot	.008-.012 (.20-.30)
Cold	.006-.010 (.15-.25)
Exhaust	
Hot	.016-.020 (.40-.51)
Cold	.014-.018 (.36-.46)

NOTE: When cylinder head service has been performed, valve clearance must be checked and adjusted after 1000 miles.

Adjusting Valve Clearance

1) To remove adjusting disc, cam follower must be depressed using compressing tool (VW 546). Turn cam followers so that grooves are accessible for compressing tool. *See Fig. 5.* Using compressing tool, depress cam follower. Use disc remover tool (US 4476) to remove adjusting disc. *See Fig. 6.*

2) Thickness of adjusting disc is stamped on bottom of disc. If measured valve clearance is larger than specifications, use a thicker disc. If clearance is less than specification, use a thinner disc. Adjust clearance to middle of tolerance range.

3) Adjusting discs are available in .002" (.05 mm) increments from .118" (3.0 mm) to .167" (4.25 mm).

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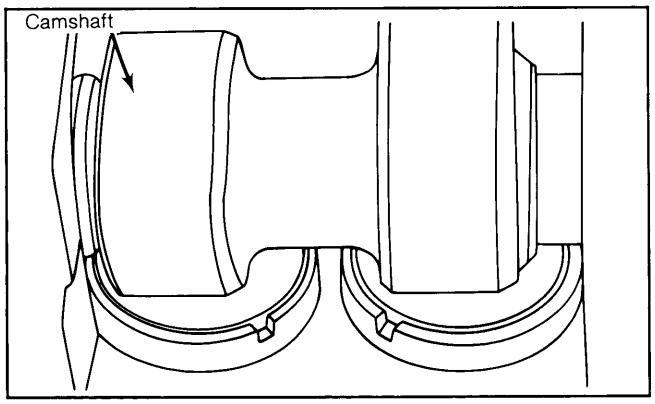
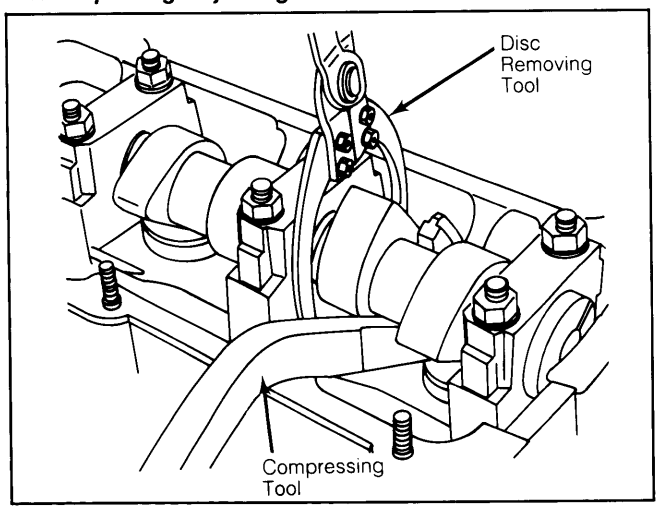
Fig. 5: Positioning Cam Followers After Replacing Adjusting Disc



4) To install discs, depress cam followers and slip discs into place. Ensure side of disc with thickness marking is installed down, facing cam follower. Repeat procedure until all valves are properly adjusted.

Fig. 6: Compressing Cam Follower After Replacing Adjusting Disc



PISTONS, PINS AND RINGS

OIL PAN

Removal

Remove 2 front bolts in subframe. Drain engine oil. Turn flywheel so recesses point downward, then remove both rear pan bolts. Remove remaining pan bolts and lower pan from engine.

Installation

Clean all gasket mating surfaces. Using new pan gasket, install oil pan. Tighten pan bolts in a criss-cross pattern.

PISTON & ROD ASSEMBLY

Removal

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

2) Before removing piston and rod from engine, ensure rod and rod cap are marked for cylinder identification. Remove rod cap and carefully push piston and rod out top of cylinder. Install rod cap on rod from which removed.

Installation

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

2) Install piston and rod in its respective bore, with arrow on piston head facing toward front of engine. Forged casting beads on rod and cap must also face toward front of engine.

FITTING PISTONS

1) Take cylinder measurements 90° to crankshaft centerline and in line with crankshaft centerline as follows: 3/8" from top of bore, at middle of bore and 3/8" from bottom of bore. Difference between the corresponding measurements is out-of-round, and must not exceed .0016" (.040 mm).

2) Measure piston diameter 90° to piston pin bore, approximately 9/16" from bottom of piston skirt. Compare this measurement with measurement of corresponding cylinder bore. Maximum allowable piston-to-cylinder clearance is .0010" (.025 mm) for a new piston, and .0030" (.076 mm) for a used piston.

3) Install oversize pistons if piston-to-cylinder clearance is excessive. Three sizes of oversize replacement pistons are available.

FITTING RINGS

1) Place piston rings squarely into cylinder bore about 5/8" from bottom of bore. Use a feeler gauge to measure ring end gap.

2) With rings installed on piston, use a feeler gauge to measure ring side clearance. Take measurement around entire circumference of piston, between top of ring and ring land.

3) Install rings on piston with "TOP" mark facing upward. Recessed edge on outside of center ring must face piston pin. Space ring end gaps 120° apart.

PISTON PIN REPLACEMENT

Removal

Remove circlip from pin bore groove. Use piston pin tool (VW 207c) to remove and install piston pins. If pins are too tight it may be necessary to warm pistons to about 140° F (60° C).

Installation

Assemble connecting rod to piston. Arrow on piston head and forged casting beads on connecting rod must face toward front of engine when assembly is installed. Use piston pin tool (VW 207c) to install piston pin. Install circlip into pin bore groove.

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

CRANKSHAFT MAIN BEARINGS

1) Main bearing caps are numbered 1 through 6 (front to rear). Never interchange bearing caps. Always measure main bearing clearances 1 at a time.

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2) Use Plastigage method for measuring bearing clearances. Ensure oil film is removed from bearing halves and crankshaft journal prior to measuring clearance.

3) With Plastigage in place, install bearing cap and tighten to specification. Do not allow crankshaft to turn. Remove bearing cap. Measure flattened width of Plastigage with scale furnished to determine clearance.

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

CONNECTING ROD BEARINGS

1) Always measure connecting rod bearing clearances 1 at a time. Use Plastigage method for measuring bearing clearances. Ensure oil film is removed from bearing halves and crankshaft journal prior to measuring clearance.

2) With Plastigage in place, install bearing cap and tighten to specification. Do not allow crankshaft to turn. Remove bearing cap. Measure flattened width of Plastigage with scale furnished to determine clearance.

3) Use a feeler gauge to check connecting rod side clearance. Insert feeler gauge between connecting rod and crankshaft thrust face.

CRANKSHAFT END THRUST

1) Check rings for gap and end clearance. Replace if not within specifications. Lubricate piston pins and connecting rod bushings. Push in piston pin (do not heat piston), and insert snap rings.

2) Stagger ring gaps on piston and fit ring compressor. Install piston and rod assembly with arrow on piston facing toward front of engine.

3) Install rod caps, matching code numbers to and facing rod numbers. Tighten rod cap nuts and check all clearances.

Use a feeler gauge to check crankshaft end play. Insert feeler gauge between No. 4 main bearing (thrust bearing) and crankshaft thrust face.

REAR MAIN BEARING OIL SEAL

Removal

Remove transmission and flywheel. Using seal remover tool (2086), carefully pry oil seal from seal flange.

Installation

Coat new seal lips with oil. Position seal in place. Start seal into place by hand. Using seal installing tool (2003/1), press in seal until seated. Install remaining components. Use Loctite on flywheel bolts.

ENGINE OILING

CRANKCASE CAPACITY

Capacity is 4.2 quarts (4.0L) without filter replacement; 4.8 quarts (4.5L) with filter replacement.

NORMAL OIL PRESSURE

Oil pressures should be 14 psi (.98 kg/cm²) at idle speed, and 77 psi (5.4 kg/cm²) at 5500 RPM. Measurements are with oil temperature at 176° F (80° C).

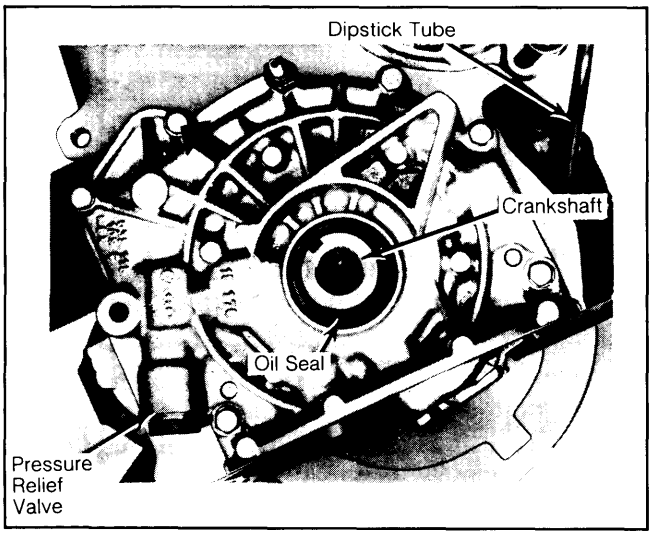
OIL PRESSURE RELIEF VALVE

Oil pressure relief valve opens at 77-91 psi (5.4-6.4 kg/cm²).

ENGINE OILING SYSTEM

A gear type pump is used. Oil pump is mounted at front of engine, and is driven by the crankshaft. *See Fig. 7.*

Fig. 7: Engine Oil Pump



An oil suction tube, extending from oil pump, lifts oil from the oil pan. Oil is then fed to internal engine moving parts. Lubrication is either by pressure feed or drainage method.

To aid in piston cooling, turbo engines use oil nozzles. Oil nozzles are installed at the bottom of each cylinder. Oil is sprayed into underside of piston to cool piston skirt and head. If oil nozzles are removed, coat retaining bolt threads with thread adhesive.

OIL PUMP

Removal & Disassembly

1) Remove all drive belts from crankshaft pulley. Remove power steering pump (with hoses connected) and position aside. Remove timing belt cover. 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) If equipped, remove lower timing belt cover. Ensure crankshaft position has not changed. Remove damper/pulley from crankshaft with timing belt attached. Remove oil dip stick.

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.

Inspection & Reassembly

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

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Installation

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

ENGINE COOLING

THERMOSTAT

Thermostat begins opening at 189°F (87°C), and is fully open at 216°F (102°C). When installing, position so arrow on housing points downward.

COOLANT CAPACITY

Capacity is 8.6 quarts (8.1L) for non-turbo models, and 10 quarts (9.4L) for turbo models.

EXPANSION TANK CAP

Relief valve opens at 17-19 psi (1.20-1.33 kg/cm²) to relieve pressure.

WATER PUMP

Removal

1) Drain cooling system. Remove timing belt cover. Turn crankshaft to align TDC timing mark with reference mark on clutch housing.

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

Installation

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

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Camshaft Bearing Cap	15 (20)
Camshaft Sprocket	58 (80)
Cold Start Valve	7 (10)
Connecting Rod Cap	36 (50)
Crankshaft Damper/Pulley (Loctite)	258 (350)
Cylinder Head Bolts	
Step 1	29 (40)
Step 2	43 (60)
Step 3	[1] 54 (75)
Exhaust Manifold	18 (25)
Exhaust Manifold-to-Turbocharger	43 (60)
Exhaust Pipe-to-Turbocharger	22 (30)
Flywheel (Loctite)	54 (75)
Intake Manifold	18 (25)
Main Bearing Cap	47 (65)
Oil Return Line	
Bracket-to-Turbocharger	18 (25)

[1] — After 3rd step, tighten head bolts an additional 1/4 turn. DO NOT retighten after 1,000 miles.

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Year	DISPLACEMENT		Fuel System	HP@RPM	Torque Ft. Lbs.@RPM	Compr. Ratio	BORE		STROKE	
	Cu. In.	cc					In.	mm	In.	mm
1982										
Non-Turbo	130.8	2144	Fuel Inj.	100@5100	118@4000	8.0:1	3.13	79.5	3.40	86.4
Turbo	130.8	2144	Fuel Inj.	130@5400 [1]	142@3000 [2]	7.0:1	3.13	79.5	3.40	86.4

[1] — Quattro is 160@5500
[2] — Quattro is 170@3000

VALVES

Engine Size & Valve	Head Diam. In. (mm)	Face Angle	Seat Angle	Seat Width In. (mm)	Stem Diameter In. (mm)	Stem Clearance In. (mm)	Valve Lift In. (mm)
2144 cc							
Intake	1.496 (38.00)	45°	45°	.079 (2.00)	.314 (7.98)	.039 Max. (1.00)	.....
Exhaust	1.220 (31.00)	45°	45°	.094 (2.40)	.313 (7.95)	.051 Max. (1.30)	.....

4000, 5000, COUPE & QUATTRO 5-CYLINDER (Cont.)

ENGINE SPECIFICATIONS (Cont.)

PISTONS, PINS, RINGS

Engine	PISTONS	PINS		RINGS		
	Clearance In. (mm)	Piston Fit In. (mm)	Rod Fit In. (mm)	Ring No.	End Gap In. (mm)	Side Clearance In. (mm)
2144 cc	.001-.003 (.025-.080)	[1]	.....	All	.010-.020 [2] (.25-.51)	.0008-.0030 [3] (.020-.080)

[1] — Push fit at 140°F (60°C).
[2] — Wear limit is .04" (1.0 mm).
[3] — Wear limit is .004" (.10 mm)

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	Journal Diam. In. (mm)	Clearance In. (mm)	Thrust Bearing	Crankshaft End Play In. (mm)	Journal Diam. In. (mm)	Clearance In. (mm)	Side Play In. (mm)
2144 cc							
Std. Size	2.282 [1] (57.97)	.0006-.0030 [2] (.015-.076)	No. 4	.0030-.0070 [3] (.076-.178)	1.810 [1] (45.97)	.0006-.0020 [4] (.015-.051)	.016 (.41)
1st U/Size	2.272 (57.71)				1.800 (45.72)		
2nd U/Size	2.262 (57.45)				1.790 (45.47)		
3rd U/Size	2.252 (57.20)				1.780 (45.22)		

[1] — Maximum out-of-round for standard or undersize crankshaft journals 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).