

5000 5 CYLINDER

ENGINE CODING

ENGINE IDENTIFICATION

Engine number is stamped on left side of block just ahead of distributor. 2.2 liter, 5 cylinder engine is coded WD and includes North American imports except for California. California models are coded with a WE prefix.

ENGINE & CYLINDER HEAD

ENGINE

NOTE — Leave all fuel injection lines connected unless otherwise specified.

Removal — 1) Disconnect battery ground cable. Remove coolant expansion tank cap, place A/C control in "COLD" position and drain coolant. Disconnect coolant hoses, remove radiator cowl, shroud, electric fan and radiator.

2) Remove control pressure regulator, cold start valve, fuel supply line, fuel injectors, and air cleaner cover with filter. Detach air duct and vacuum hoses from throttle valve assembly. Pull hood latch cable guide off of bracket at right front alignment hole.

3) Remove and suspend power steering pump, leaving hose connected. On air conditioned models, remove grill and tip condenser outwards. Dismount A/C compressor and tie back with wire, but do not disconnect refrigerant hoses. On all models, remove windshield washer and power steering reservoirs from holders. Remove distributor cap, wires and rotor.

4) Take off circlip and remove throttle cable (manual transmission) or throttle push rod (automatic transmission). Disconnect electrical leads from distributor, oil pressure and water temperature senders. Detach exhaust pipe from manifold and from transmission bracket. Remove front engine mount, starter and alternator.

5) On automatic transmission models, work through starter hole and remove torque converter mounting bolts. On all models, remove lower engine/transmission bolts and install transmission supporting tool. Remove upper engine/transmission bolts.

6) Attach suitable sling to engine and lift engine/transmission enough to remove left and right engine bracket. Lift engine so that front pulley is behind grill opening and support transmission. Detach engine from transmission and lift from car while turning slightly to right.

Installation — To install engine, reverse removal procedure noting that metal lip on gasket between exhaust manifold and pipe faces exhaust pipe. Straight adaptor on EGR temperature control valve goes to EGR valve while angled adaptor goes to vacuum amplifier. It is recommended that engine mounting bolts be tightened with the engine running at idle speed.

CYLINDER HEAD

Removal — 1) Disconnect battery ground strap and drain cooling system. Disconnect coolant hoses from head and exhaust pipe from manifold. Remove electrical and vacuum leads

from distributor. Disconnect accelerator linkage, fuel and vacuum lines and air filter from manifold.

2) Remove valve cover and timing belt cover. Rotate crankshaft so that number 1 cylinder is at TDC on firing stroke. Remove drive belt sprocket from camshaft, but do NOT separate from timing belt. Loosen head bolts in reverse order of tightening sequence and lift off head.

Installation — Install head gasket with part number facing UP. (Guide pins may be used at opposite corners of head to ease alignment.) Install head using bolts 9 and 11 (See illustration) to center head, then tighten bolts in sequence illustrated. Complete assembly in reverse order of removal and assure that timing marks are properly positioned.

NOTE — Early models may be equipped with hexagonal socket bolts which require re-torquing when warm. Polygon socket head bolts are tightened to 55 ft. lbs. (7.5 mkg) with engine cold, and then tightened 1/4 more. No further tightening is required.

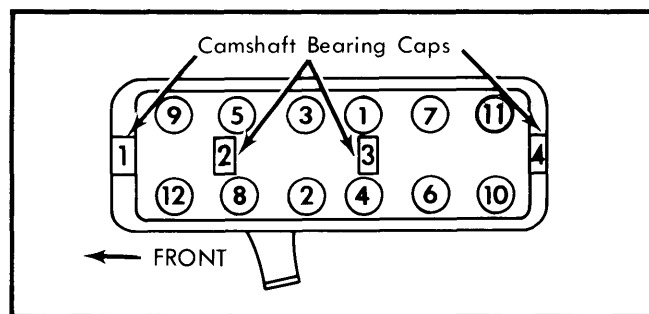


Fig. 1 Tighten Cylinder Head in Sequence Shown (Loosen in Reverse Order)

VALVES

VALVE ARRANGEMENT

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

VALVE GUIDE SERVICING

1) With head disassembled, insert new valve and check for wear with dial indicator. See Fig. 2. If wear exceeds .039" (1.0 mm) for intake, or .051" (1.3 mm) for exhaust valve, guides should be replaced.

2) Press worn guides out of head from combustion chamber side with suitable tool (10-206). Coat new guides with oil and press into cold head from camshaft side. Press guides in as far as they will go, but DO NOT use more than 1 ton pressure once shoulder is seated. Ream guide by hand to proper size.

VALVE STEM OIL SEALS

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

With camshaft and followers removed, remove spark plug and turn crankshaft until piston of cylinder concerned is at BDC position. Install pressure hose (VW 653/3) in spark plug hole and apply low pressure air to keep valve seated. Remove valve

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springs with compressor (VW 541/1 or 2036) and lift off seal with pliers (1-218). Place seal protector over valve stem, lubricate seal and push in place with installing tool (10-204).

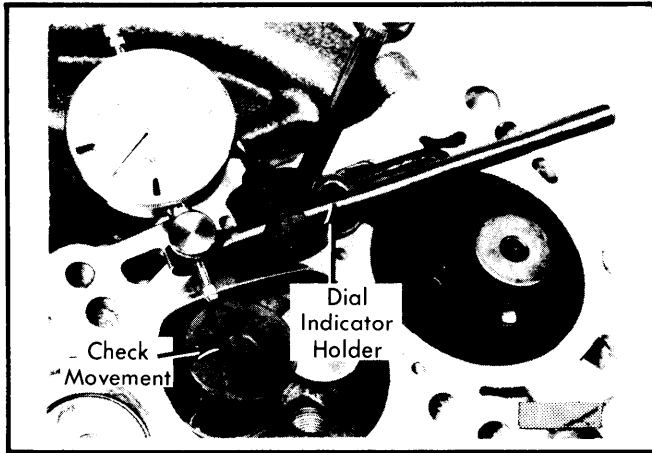


Fig. 2 Checking Valve Guide for Wear

VALVE SPRINGS

With camshaft and followers removed, compress spring with suitable tool (US 1020 and 1020/1 or 2037) and remove valve locks (keepers). Lift off valve springs. If required, valve spring seats may be removed using pliers (10-218). To install, reverse removal procedure.

CAM FOLLOWERS (TAPPETS)

With camshaft removed, lift off followers and adjusting discs. Inspect for wear or damage and replace as necessary.

NOTE — Cam followers and valve system components must be kept in order and installed in original positions. Coat with oil when installing.

VALVE CLEARANCE ADJUSTMENT

1) Disconnect accelerator linkage and remove valve cover. Turn crankshaft so that both cam lobes of cylinder to be adjusted point upward. Check valve clearances between cam and follower in firing order (1-2-4-5-3). If clearance is greater than .002" (.05 mm) from specifications, select thicker or thinner disc.

2) To replace valve adjusting discs, use follower depressor tool (2078) to press follower down, then remove adjusting disc with tool (10-208 or US4476). Insert appropriate disc and recheck clearance. Discs are available in .0019" (.05 mm) increments from .1181" (3.0 mm) to .1673" (4.25 mm). Thickness is etched on bottom of disc and should be assembled with etched mark toward follower.

Valve Clearances

Application	Hot In. (mm)	Cold In. (mm)
Intake008-.012 (.20-.30)...	.006-.010 (.15-.25)
Exhaust016-.020 (.40-.50)...	.014-.018 (.35-.45)

NOTE — Cold settings are given for reference as initial setting after engine rework. Final adjustments are to be made after engine is warm (at least 95°F or 35°C), and checked again after 1000 miles.

PISTONS, PINS & RINGS

OIL PAN

Drain engine oil and remove both bolts on front sub frame. Remove pan bolts and take pan from engine. Install new pan gasket and tighten pan bolts in a criss-cross pattern.

PISTON & ROD ASSEMBLY

Note that rod cap and rod are marked for proper installation and remove cap nuts. Push piston and rod assembly out of cylinder from bottom. When assembling, note that arrow on piston top points toward timing gear. Raised forge marks on connecting rod bosses also must point to front of engine.

FITTING PISTONS

1) Measure cylinder at 3 points: .39" (10 mm) from top and bottom, and at center of cylinder bore. Take measurements in line with thrust face and at 90° to thrust face.

2) Measure pistons at .63" (16 mm) from bottom of piston skirt (measuring 90° to pin bore). Compare this measurement with corresponding cylinder bore. If clearance exceeds .003" (.08 mm), oversize pistons must be installed.

3) To check ring gap, push ring into bottom of cylinder about .65" (16 mm) and check gap with feeler gauge. Measure ring side clearance in piston with feeler gauge. If clearance is greater than .004" (.1 mm) with new rings, piston replacement is required. Install rings with gaps 120° apart and "TOP" mark toward piston crown.

PISTON PINS

Use pin-drift to remove circlip from pin boss in piston and press out pin. If pin is too tight, heat piston to approximately 140°F (60°C) and use tool (VW 207c) for both removal and installation. Assemble piston on connecting rod so that arrow on piston top faces forward when assembly is correctly installed.

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

MAIN & CONNECTING ROD BEARINGS

Check crankshaft end play at number 4 main bearing with feeler gauge. Check main bearing clearance using Plastigage method. Bearings are numbered 1 through 6 with 1 at front and 6 at flywheel end, and must be installed in original positions. Install bearing shells with lubrication grooves in block and shells with grooves in bearing caps. Check connecting rod bearing clearance with Plastigage and replace as required.

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Crankshaft Journal Diameters

Size	Main Bearing In. (mm)	Connecting Rod In. (mm)
Std.	2.260 (57.96)	1.790 (45.96)
1st US	2.250 (57.71)	1.780 (45.71)
2nd US	2.240 (57.46)	1.770 (45.46)
3rd US	2.230 (57.21)	1.760 (45.21)

REAR MAIN BEARING OIL SEAL

With flywheel removed, pry old seal out with tool (2086). Coat lips of new seal with oil and press into position by hand, then use installing tool (2003/1) to press in until properly seated.

FRONT CRANKSHAFT OIL SEAL

1) Hold crankshaft front pulley with tool (2084) and remove crankshaft bolt. Loosen water pump and take tension off drive belt. Remove "V" belt pulley and drive belt sprocket from crankshaft. Pry out oil seal with tool (2086).

2) Coat lips of new seal with oil and place in position on crankshaft. Use pulley bolt and tool (2080) to press seal in housing until flush. If crankshaft shows signs of scoring, drive seal all the way in until it bottoms. Align pulley and sprocket with Woodruff key and replace components in reverse order of removal.

CAMSHAFT

TIMING BELT

Remove "V" drive belts and take off drive belt cover. Engine should be in number 1 firing position (TDC). Loosen water pump bolts and turn pump counterclockwise to loosen belt. Install new belt and adjust by turning water pump clockwise to tighten. Belt is properly adjusted when it can just be twisted 90° with thumb and index finger between camshaft and water pump sprockets. Ensure that valve timing is correct.

CAMSHAFT

Remove bearing caps 2 and 4, then diagonally loosen bearing caps 1 and 3. Remove camshaft from head. When installing, caps must go in original position. Lubricate bearings and journals and install caps with off-center position properly aligned.

CAUTION — Front oil seal must not be installed beyond flush position or oil return will be blocked.

VALVE TIMING

Rotate crankshaft until notch on "V" belt pulley aligns with mark on oil pump housing (engine out of vehicle) or TDC "0" mark on flywheel aligns with lug cast on clutch housing (engine installed). Fully loosen belt tension by loosening and turning water pump counterclockwise. Turn camshaft sprocket so that punch mark on rear aligns with rocker cover gasket on left side of engine. Install and adjust belt.

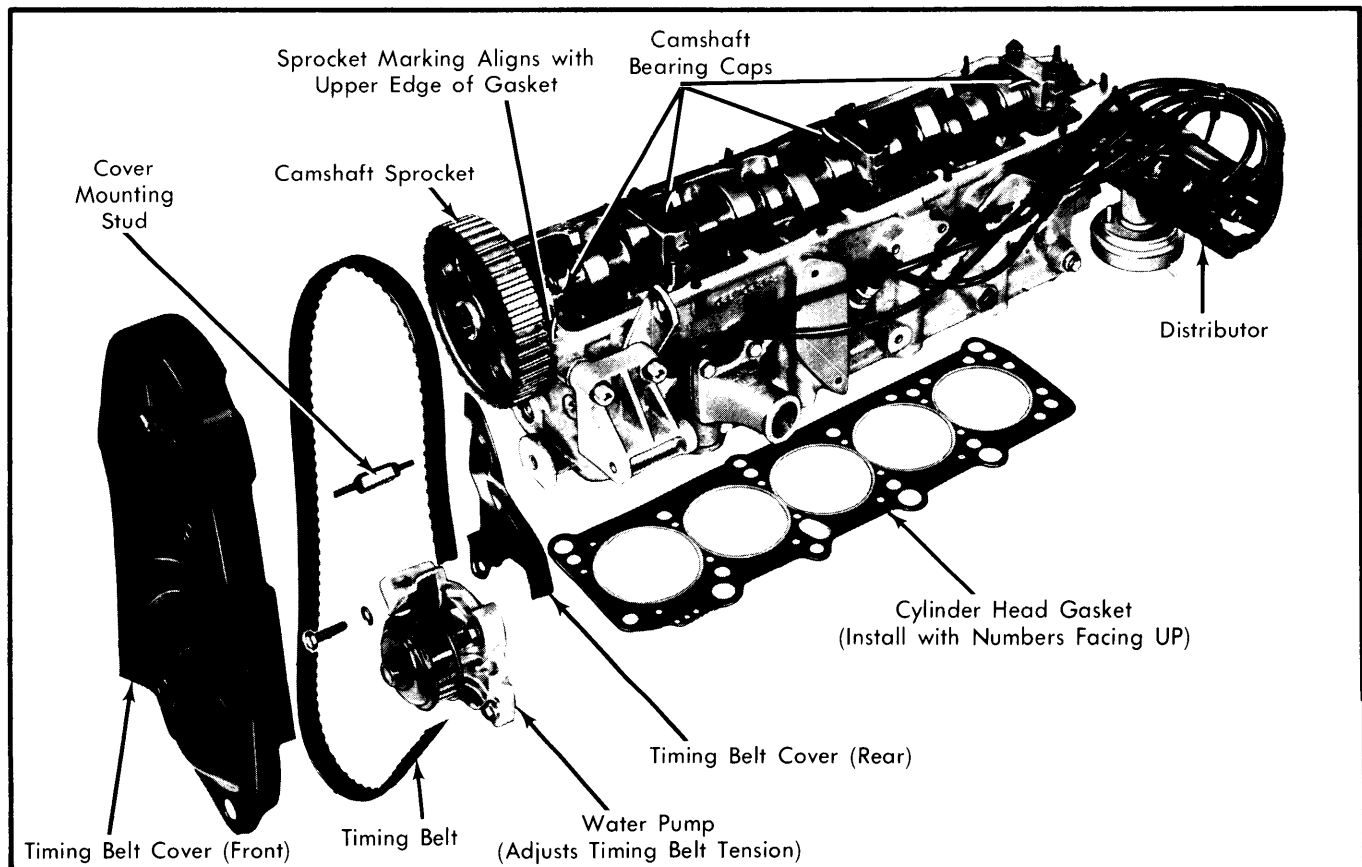


Fig. 3 Cylinder Head and Camshaft Assembly with Timing Belt and Cover

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ENGINE OILING

Crankcase Capacity — 5.3 quarts (includes filter change).

Oil Filter — Replaceable spin-on type.

Normal Oil Pressure — 14 psi at idle, 85 psi at 5500 RPM with oil temperature 176°F (80°C).

OIL PUMP

Gear type pump is mounted at front of engine, driven by crankshaft with oil suction pipe extending to oil pan. To

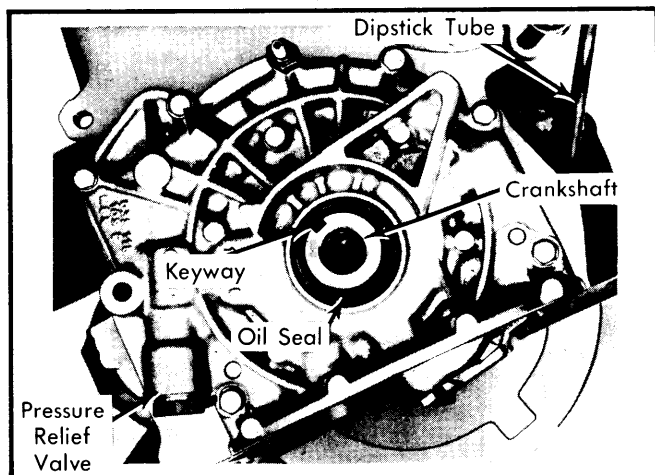


Fig. 4 Engine Oil Pump with Crankshaft Oil Seal

remove, take off timing belt cover and front "V" belt pulley/drive belt sprocket. Drain engine oil and remove oil pan and oil suction pipe. Unbolt pump and remove from front of engine. Inspect endcover, housing and gears for wear or scoring. Replace pump gears in pairs only, with triangle marking toward endcover (rear). To install, reverse removal procedure.

ENGINE COOLING

Cooling System Capacity — 8.6 quarts.

Thermostat — Opens at 194°F (90°C).

Expansion Tank Cap — Relief valve opens at 17-19 psi.

Radiator — Cross flow type with electric cooling fan and coolant expansion tank. Fan cuts in at 194-203°F (90-95°C) and cuts off at 185-194°F (85-90°C).

WATER PUMP

Water pump is driven by timing belt and is mounted at lower left front of engine block. To remove, drain cooling system and remove timing belt cover. Loosen and remove water pump mounting bolts. Remove pump and check for wear. To install, use new "O" ring and reverse removal procedure. Add coolant mixture until tank is full and replace cap. Run engine until cooling fan turns on. Check coolant level and top off if necessary.

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS										
Year	Displ.		Carburetor	HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore		Stroke	
	cu. ins.	cc					in.	mm	in.	mm
1978	130.8	2144	Fuel Inj.	103@5300	112.4@4000	8.0:1	3.13	79.5	3.40	86.4

VALVES							
Engine & Valve	Head Diam. In. (mm)	Face Angle	Seat Angle	Seat Width In. (mm)	Stem Diameter In. (mm)	Stem Clearance In. (mm)①	Valve Lift In. (mm)
2144 cc Intake	1.496 (38.0)	45°	45°	.079 (2.0)	.314 (7.97)	.039 (1.0)
Exhaust	1.220 (31.0)	45°	45°	.094 (2.4)	.313 (7.95)	.051 (1.3)

① — Maximum allowable clearance.

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ENGINE SPECIFICATIONS (Cont.)

PISTONS, PINS, RINGS						
Engine	PISTONS Clearance In. (mm)	PINS		RINGS		
		Piston Fit In. (mm)	Rod Fit In. (mm)	Rings	End Gap In. (mm)②	Side Clearance In. (mm)③
2144 cc	.001-.003 (.025-.080)	①	All	.010-.020 (.25-.50)	.0008-.003 (.02-.08)

① — Push fit at 140°F (160°C). ② — Wear limit .040" (1.0 mm). ③ — Wear limit .004" (.1 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	2.26 (57.96)	.0006-.006 (.016-.160)	No. 4	.003-.010 (.07-.25)	1.790 (45.96)	.0006-.005 (.016-.120)	.016 (.40)

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Head Bolts	
Cold①	55 (7.5)
Warm (Hex Socket Head Only)	61 (8.5)
Main Bearing Caps	47 (6.5)
Connecting Rod Caps	36 (5.0)
Flywheel/Drive Plate (Use Loctite)	54 (7.5)
Crankshaft Pulley/Sprocket	235 (35)
Oil Pan Bolts	7 (1.0)
Exhaust Manifold	18 (2.5)
Intake Manifold	18 (2.5)
Camshaft Bearing Caps	14 (2.0)
Camshaft Sprocket	58 (8.0)
Oil Pump Mounting Bolts	7 (1.0)
Timing Belt Cover	7 (1.0)
Cylinder Head Cover	7 (1.0)
Water Pump Mounting Bolts	14 (2.0)
Engine Mount Bolts	33 (4.5)

① — Tighten polygon socket head bolts ¼ turn past specified torque and DO NOT retighten.