

# Audi Engines

## 5000 5-CYLINDER DIESEL & TURBO DIESEL

### ENGINE CODING

#### ENGINE IDENTIFICATION

Engine number is stamped on a raised pad. Pad is located at left top side of block, between No. 2 and 3 cylinders. Letter prefix indicates engine type.

#### ENGINE IDENTIFICATION CODES

Engine	Code
1986 cc	
Std. Diesel .....	CN
Turbo Diesel .....	DE

### ENGINE & CYLINDER HEAD

#### ENGINE

##### Removal

1) Disconnect battery ground strap. Remove air cleaner. Remove front grille. Remove cover plates under engine and transmission. Detach windshield washer reservoir and hydraulic fluid reservoir. Lay reservoirs aside.

2) Pull hood latch cable guide out of bracket. Drain cooling system and disconnect coolant and heater hoses attached to engine. Remove power steering pump with hoses connected and lay aside.

3) If equipped with A/C, loosen condenser and tilt outward. Remove auxiliary radiator. Disconnect wiring harness, overheating fuse connector, temperature sender wire, and wires connected to starter.

4) Remove upper part of fuel filter. Loosen fuel return pipe on injection pump. Detach accelerator cable and disconnect idle speed control cable from injection pump lever.

5) Remove right engine mount cover plate and remove front engine mount from crossmember. If equipped with A/C, remove compressor from engine leaving hoses attached.

6) Remove alternator mounting bracket. Disconnect exhaust pipe from manifold and transmission bracket. If equipped, disconnect exhaust pipe from turbocharger. Remove body ground strap. Remove lower engine-to-transmission bolts.

7) Remove flywheel cover plate from transmission and install transmission supporting tool (VW 785/1) with slight preload. Attach lifting device to engine.

8) Remove left engine bracket. Loosen right engine bracket from engine mount. Lift engine and transmission until transmission housing contacts steering housing. Adjust transmission support tool until it contacts transmission housing.

9) Remove upper engine-to-transmission bolts. Separate engine from transmission. Turn engine to right (90° from installed position) while lifting from vehicle. Use caution not to damage transmission or clutch parts.

##### Installation

1) To install engine, reverse removal procedures. Note that metal lip on exhaust manifold flange gasket must face exhaust pipe.

2) After installing upper transmission-to-engine bolts, remove transmission support tool. Tighten engine mounts while engine is running at idle speed.

#### CYLINDER HEAD

##### Removal

1) Disconnect battery ground strap. Drain cooling system. Label and disconnect coolant hoses and electrical wiring from head. Disconnect exhaust pipe from manifold (or turbocharger). Disconnect exhaust manifold from cylinder head.

2) Remove fuel lines connected to cylinder head. 5 cylinder. Remove cam cover and front timing belt covers.

3) Remove vacuum pump drive belt from pulley at rear of engine. Remove injection pump belt cover. Set crankshaft to TDC on number 1 cylinder. Timing marks on flywheel and clutch housing must be aligned.

4) Ensure timing marks on injection pump sprocket and injection pump mounting plate are aligned. Lock injection pump sprocket in place with pin tool (2064).

5) Hold vacuum pump pulley and injection pump drive sprocket (camshaft rear sprocket) in place with tool (3036). Remove injection pump drive sprocket retaining bolt. Camshaft must not move. Remove pulley, noting number and position of spacer washers.

6) Remove injection pump drive sprocket and drive belt from rear of camshaft. Install camshaft holding tool (2065A) at rear of camshaft. With camshaft locked in place, remove front camshaft sprocket with timing belt attached. DO NOT separate sprocket from belt.

7) Loosen and remove head bolts in reverse order of tightening sequence. See Fig. 1. Lift off cylinder head and intake manifold.

**CAUTION: Never interchange old style 6-point Allen head bolts with new style multi-point Allen head bolts. Always replace head bolts when cylinder head has been removed.**

**CAUTION: Turbo-diesel and standard diesel head gaskets do not use the same material. Head gaskets are not interchangeable.**

**CAUTION: Cylinder head gaskets have identification notches next to part number. Notches indicate thickness of head gasket. If new pistons or short block is installed, measure the height pistons project above cylinder block deck when piston is at TDC. Select new head gasket according to maximum measured piston height.**

##### Installation

1) Ensure that mating surfaces of engine block and cylinder head are clean. Use gasket with same identification notches as old gasket if installing on original piston and block assembly.

2) Install guide pins in cylinder block at right front and left rear cylinder head bolt holes. Install head gasket DRY (no adhesive) with part number facing upward.

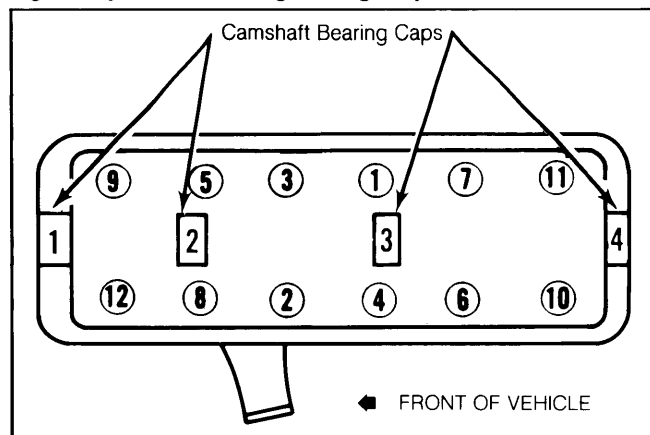
3) Install and tighten head bolts in 3 steps. See Fig. 1. After 3rd step, turn bolts in sequence an additional 1/2 turn. Install remaining components. Ensure valve timing is correct.

4) Run engine and warm to operating temperature. Tighten head bolts an additional 1/4 turn further. At 1000 mile service after repairs, tighten cylinder head bolts

## 5000 5-CYLINDER DIESEL & TURBO DIESEL (Cont.)

in sequence an additional 1/4 turn. Engine may be cold or warm.

**Fig. 1: Cylinder Head Tightening Sequence**



Loosen cylinder head bolts in reverse order of tightening.

### CAMSHAFT

#### TIMING BELT COVERS

##### Removal & Installation

Remove drive belts from crankshaft pulley. Remove power steering pump with hoses connected, and position aside. Remove attaching bolts and remove upper and lower timing belt covers. To install, reverse removal procedure.

#### TIMING BELTS & SPROCKETS

##### Removal

**1)** Remove drive belts from crankshaft pulley. Remove outer half of vacuum pump pulley and drive belt at rear of engine. Note position and number of spacer washers on pulley.

**2)** Remove timing belt covers and injection pump belt cover. Remove cam cover. Rotate crankshaft to position No. 1 cylinder at TDC. Timing marks on flywheel and clutch housing must be aligned. Also, timing marks on fuel injection pump sprocket and pump mounting plate must be aligned.

**3)** Lock injection pump sprocket with pin tool (2064). Hold inner half of vacuum pump pulley and injection pump drive sprocket with tool (3036). Remove sprocket center retaining bolt. Remove inner pulley half, pump sprocket and injection pump drive belt.

**4)** Secure crankshaft from moving with support tool (2084). Loosen crankshaft damper/pulley center bolt. Install camshaft holding tool (2065A) at rear of camshaft.

**5)** With camshaft locked in place, loosen water pump bolts to relieve tension on timing belt. Remove crankshaft pulley with timing belt sprocket and timing belt.

##### Installation

**1)** Ensure crankshaft and injection pump timing marks are aligned. Install crankshaft damper/pulley with sprocket and timing belt. Using tool (2084) to hold crankshaft, install and tighten center bolt.

**2)** With camshaft still locked in place loosen camshaft sprocket bolt 1 full turn. Using a brass drift inserted through hole in rear timing belt cover, tap camshaft sprocket loose from camshaft taper.

**3)** Attach timing belt to camshaft sprocket. To adjust timing belt tension, turn water pump until pump sprocket provides tension against timing belt.

**4)** Using tension tester (VW 210), check timing belt tension midway between camshaft and water pump sprockets. Tension is correct when tester reads 12-13.

**5)** Check that crankshaft and injection pump timing marks are still aligned. Tighten camshaft sprocket bolt and remove camshaft holding tool.

**6)** Install injection pump sprocket, drive belt and inner pulley half. Tighten injection pump drive sprocket retaining bolt until it is just possible to turn sprocket on camshaft by hand.

**7)** Adjust fuel injection pump drive belt tension by loosening mounting bolts and repositioning mounting plate and support on engine. Using tension tester (VW 210), check belt tension midway between fuel injection pump and drive sprockets.

**8)** Tighten fuel injection pump drive sprocket bolt and remove pin tool (2064) from injection pump sprocket. Install remaining components in reverse order of removal. Ensure valve timing and injection pump timing are correct.

### INJECTION PUMP & VALVE TIMING

To check injection pump and valve timing, use procedures explained in Timing Belts & Sprockets.

### CAMSHAFT

#### Removal

Remove timing belt and fuel injection pump belt. If necessary, mark cam bearing caps 1 to 4 (front to rear). Loosen bearing caps 1 and 4, then remove caps. Diagonally loosen bearing caps 2 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.

**2)** Lightly tighten bearing caps 2 and 3 in a diagonal pattern, then tighten all bearing caps. Install remaining components. Make sure valve timing and injection pump timing are correct.

### CAMSHAFT FRONT OIL SEAL

#### Removal

**1)** Remove timing belt covers and fuel injection pump drive belt cover. Remove cam cover. Position No. 1 piston on TDC. Timing marks on flywheel and clutch housing. Timing marks on fuel injection pump sprocket and mounting plate must be aligned.

**2)** Lock injection pump sprocket in place with pin tool (2064). Lock vacuum pump pulley and injection pump drive sprocket (rear camshaft sprocket) in place with tool (3036). Remove belt pulley, injection pump drive sprocket and drive belt from rear of camshaft.

**3)** Install camshaft holding tool (2065A) to rear of camshaft to secure in place. Loosen water pump bolts to relieve tension on timing belt. Loosen camshaft sprocket bolt 1 full turn.

**4)** Using a brass drift inserted through hole in rear timing belt cover, tap camshaft sprocket loose from camshaft taper. Remove camshaft sprocket with timing belt attached. Using seal removing tool (2002), remove camshaft oil seal.

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## 5000 5-CYLINDER DIESEL & TURBO DIESEL (Cont.)

### 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 seated. Install remaining components in reverse order of removal procedures. Ensure valve timing and injection pump timing are correct.

### CAMSHAFT REAR OIL SEAL

#### Removal

1) Remove vacuum pump belt and pulley. Remove injection pump belt cover. Set No. 1 cylinder on TDC. Timing marks on flywheel and clutch housing, and injection pump sprocket and mounting plate must be aligned.

2) Lock injection pump sprocket in place with pin tool (2064). Secure injection pump drive sprocket in place with tool (3036), and remove injection pump drive sprocket and drive belt from rear of camshaft. Using oil seal removing tool (2002), remove 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 seated. Install remaining components in reverse order of removal procedures. Ensure valve timing and injection pump timing are correct.

### CAMSHAFT END THRUST

1) Check camshaft end thrust with cam followers and timing belts 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 .051" (1.3 mm) for intake or 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. Remove followers and valve adjusting discs of cylinder to be serviced. Turn crankshaft until piston of cylinder concerned is at TDC, so valve will rest on piston head when valve springs are removed.

2) 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. Reverse removal procedures to complete installation.

### 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) 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.

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If clearance is not as specified in Valve Clearance Specifications table, 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)

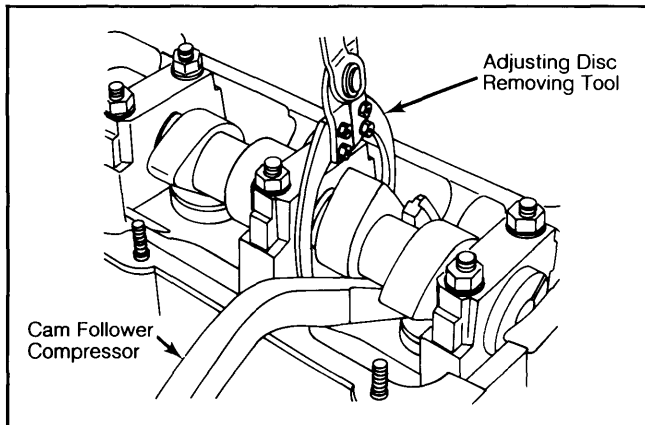
**NOTE:** When cylinder head service has been performed, valve clearance must be checked and adjusted after 1000 miles.

#### Adjusting Valve Clearance

1) When adjusting valves, piston of cylinder being serviced must not be at TDC. Turn crankshaft about 1/4 turn past piston TDC position. This will keep valves from contacting pistons when cam followers are depressed.

2) To remove adjusting disc, cam follower must be depressed using compressing tool (VW 546). See Fig. 2.

**Fig. 2: Removing and Installing Adjusting Discs**



Ensure piston of cylinder being serviced is not at TDC.

3) Using tool (2078), depress cam follower. Use disc remover tool (US 4476) to remove adjusting disc.

4) 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.

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

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

## 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 will be on oil filter side 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 .0012" (.030 mm) for a new piston, and .0027" (.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. Space ring end gaps 120° apart.

## PISTON PIN REPLACEMENT

### Removal

Remove circlip from pin bore groove. Use piston pin tool (10-508) 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

1) Assemble connecting rod to piston. Arrow on piston head must face toward front of engine. Forged

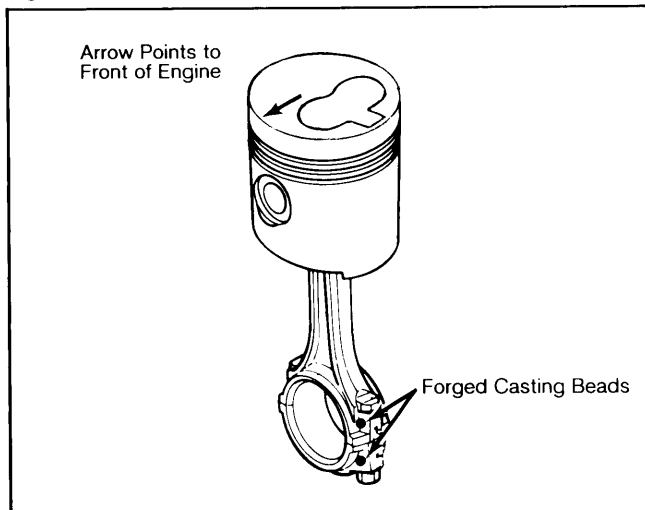
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casting beads on connecting rod must be on oil filter side of engine when assembly is installed. See Fig. 3.

2) Use piston pin tool (VW 207c) to install piston pin. Install circlip into pin bore groove.

**Fig. 3: Piston-to-Rod Relationship**



Forged casting beads on connecting rod must be on oil filter side of engine when assembly is installed.

### 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.

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

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.

#### FRONT MAIN BEARING OIL SEAL

##### Removal

Remove front cover. Remove timing belt. Using crankshaft support tool (2084) to keep crankshaft from moving, remove crankshaft damper/pulley and sprocket. 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 remaining components in reverse order of removal. Ensure valve timing is correct. Use Loctite on crankshaft damper bolt.

### ENGINE OILING

**NOTE:** Crankcase capacity, oil pressure and relief valve information for turbo diesel not available at time of printing.

#### CRANKCASE CAPACITY

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

#### NORMAL OIL PRESSURE

Minimum oil pressure for standard diesel should be 28 psi (1.97 kg/cm<sup>2</sup>) at 2000 RPM. Measurement is with oil temperature at 176° F (80° C).

#### OIL PRESSURE RELIEF VALVE

Relief valve opens at 75-90 psi (5.3-6.3 kg/cm<sup>2</sup>)

#### ENGINE OILING SYSTEM

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

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 diesel 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.

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### OIL PUMP

#### Removal & Disassembly

1) Remove timing belt covers. Remove timing belt. Using crankshaft support tool (2084) to keep crankshaft from moving, remove crankshaft damper/pulley and sprocket.

2) 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.

#### 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.

3) Lock injection pump sprocket in place with pin tool (2064). Lock vacuum pump pulley and injection pump drive sprocket (rear camshaft sprocket) in place with tool (3036). Remove belt pulley, injection pump drive sprocket and drive belt from rear of camshaft.

4) Install camshaft holding tool (2065A) to rear of camshaft to secure in place. Loosen water pump bolts to relieve tension on timing belt. Loosen camshaft sprocket bolt 1 full turn.

5) Using a brass drift inserted through hole in rear timing belt cover, tap camshaft sprocket loose from camshaft taper. Remove camshaft sprocket with timing belt attached. Remove water pump.

#### Installation

Installation is the reverse of removal procedures. Use a new seal when installing water pump. Be sure valve timing and injection pump timing is correct. Also, ensure timing belts are properly tensioned.

### ENGINE COOLING

**NOTE:** Thermostat, coolant capacity and expansion tank cap information for turbo diesel not available from manufacturer at time of printing.

#### THERMOSTAT

Standard diesel thermostat begins opening at 188°F (87°C), and is fully open at 202°F (94°C).

#### COOLANT CAPACITY

Standard diesel capacity is 10 quarts (9.4L).

#### EXPANSION TANK CAP

Standard diesel relief valve opens at 17-19 psi (1.20-1.33 kg/cm<sup>2</sup>) to relieve pressure.

#### WATER PUMP

##### Removal

1) Drain coolant. Remove power steering pump with hoses connected and lay pump aside. Remove timing belt covers and fuel injection pump drive belt cover.

2) Remove cam cover. Position No. 1 piston on TDC. Timing marks on flywheel and clutch housing must be aligned. Timing marks on fuel injection pump sprocket and mounting plate must be aligned.

### TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Camshaft Bearing Cap .....	15 (20)
Camshaft Sprockets	
Front .....	33 (45)
Rear .....	72 (100)
Connecting Rod Cap .....	33 (45)
Crankshaft Damper/Pulley (Loctite) .....	258 (350)
Cylinder Head Bolts	
Step 1 .....	29 (40)
Step 2 .....	43 (60)
Step 3 .....	54 (75)
Exhaust Manifold .....	18 (25)
Exhaust Manifold-to-Turbocharger .....	43 (60)
Exhaust Pipe-to-Turbocharger .....	29 (40)
Flywheel (Loctite) .....	54 (75)
Glow Plugs .....	29 (40)
Injectors .....	51 (70)
Injector Pipes .....	18 (25)
Intake Manifold .....	18 (25)
Main Bearing Cap .....	47 (65)
Oil Return Line	
Bracket-to-Turbocharger .....	18 (25)

<sup>1</sup> — After 3rd step, tighten head bolts an additional 1/2 turn. Warm engine and tighten bolts an additional 1/4 turn. At 1000 miles, retighten bolts an additional 1/4 turn.

### 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 Turbo	121	1986	Fuel Inj. Fuel Inj.	67@4800 84@4500	90@3000 127@2800	23:1 23:1	3.01 3.01	76.5 76.5	3.40 3.40	86.4 86.4
	121	1986								

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## 5000 5-CYLINDER DIESEL & TURBO DIESEL (Cont.)

### ENGINE SPECIFICATIONS (Cont.)

#### 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)
1986 cc Intake	1.417 (36.00)	45°	45°	.078 (2.00)	.314 (7.98)	.051 Max. (1.30)	.....
Exhaust	1.220 (31.00)	45°	45°	.096 (2.40)	.313 (7.95)	.051 Max. (1.30)	.....

#### 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)
1986 cc	.0012-.0028 (.030-.070)	1	.....	Upper	.012-.020 <sup>2</sup> (.30-.51)	.002-.004 <sup>3</sup> (.05-.10)
				Center	.012-.020 <sup>2</sup> (.30-.51)	.002-.003 <sup>3</sup> (.05-.08)
				Oil	.010-.016 <sup>2</sup> (.25-.40)	.001-.002 <sup>4</sup> (.03-.05)

<sup>1</sup> — Push fit at 140°F (60°C).

<sup>2</sup> — Wear limit is .04" (1.0 mm).

<sup>3</sup> — Wear limit is .008" (.20 mm).

<sup>4</sup> — Wear limit is .006" (.15 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)
1986 cc Std. Size	2.282 <sup>1</sup> (57.97)	.0006-.0030 <sup>2</sup> (.015-.076)	No. 4	.0030-.0070 <sup>3</sup> (.076-.178)	1.881 <sup>1</sup> (47.77)	.0006-.0020 <sup>4</sup> (.015-.051)	.016 (.41)
1st U/Size	2.272 (57.71)				1.871 (47.52)		
2nd U/Size	2.262 (57.45)				1.861 (47.27)		
3rd U/Size	2.252 (57.20)				1.851 (47.02)		

<sup>1</sup> — Maximum out-of-round for standard or undersize crankshaft journals is .001" (.03 mm).

<sup>2</sup> — Wear limit is .006" (.16 mm).

<sup>3</sup> — Wear limit is .010" (.25 mm).

<sup>4</sup> — Wear limit is .005" (.12 mm).