

1.6L 4-CYL DIESEL/TURBO DIESEL

1984 Volkswagen Jetta
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ARTICLE BEGINNING

1984 ENGINES

Volkswagen 1.6L 4-Cylinder Diesel & Turbo Diesel

Jetta, Quantum, Rabbit

*** 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 identification is stamped on left side of cylinder block on machined pad near No. 3 cylinder.

ENGINE IDENTIFICATION CODES TABLE

Application	Engine Code
1.6L 4-Cylinder Diesel Jetta & Rabbit	JK
1.6L 4-Cylinder Turbo-Diesel Jetta & Quantum	CY

ENGINE, MANIFOLDS & CYLINDER HEAD

ENGINE

NOTE: Engine and transmission assembly is lowered out of Jetta and Rabbit models as complete unit. Engine is separated from transmission and lifted out on Quantum models.

Removal (Jetta & Rabbit)

1) Disconnect battery ground. Open coolant expansion tank. Open heater valve and drain coolant from system at thermostat flange. Remove radiator with fan. Drain engine oil. Remove alternator and detach fuel filter from body. Disconnect wires for fuel shut-off solenoid, glow plugs, oil pressure switch and coolant temperature sensor.

2) Disconnect hoses for heater and expansion tank. Remove fuel supply and return lines and disconnect accelerator cable with bracket from injection pump. Disconnect cold start cable. On models with A/C, remove A/C compressor with mounting brackets and set out of way without disconnecting hoses.

3) On M/T models, detach clutch cable and remove relay shaft lever. On all models, disconnect wires from starter and back-up light switch and ground from transmission mount. Remove exhaust flex pipe nuts. On Turbo models, disconnect exhaust pipe from turbocharger.

4) On all models, disconnect drive axles from drive flanges. Remove starter, horn, oil filter and front engine mount. Loosen axle nuts and disconnect lower ball joints from bearing housings. Remove drive shaft while holding strut assembly away from vehicle.

CAUTION: Do not allow weight of vehicle to rest on wheels unless outer CV joint axle stub is installed with nut tightened. (Bolt, nut, and large washers may also be used to hold hub bearing together.) Damage to hub bearings will occur if

stub axle and nut are not in place.

5) Reconnect ball joints so vehicle may be lowered onto wheels. Remove complete rear mount. Remove right front wheel. Attach Lifting Sling (US 1105) to engine and lift slightly. On M/T models, remove relay shaft and gearshift lever rods.

6) On all models, remove bolts holding side mounts to body. Lower engine and transmission assembly to dolly. Raise vehicle to clear and remove assembly.

Installation

To install, reverse removal procedure noting that fuel supply and return union screws are not interchanged. Fuel return pipe union screw is marked "OUT" on hexagonal head.

Removal (Quantum)

1) Disconnect battery ground cable. Remove engine and transmission cover plate. Remove horn and coolant tank cap. Open heater control valve. Disconnect hose at thermostat flange and drain cooling system. Disconnect wiring from fan, thermo time switch and series resistance.

2) Remove remaining coolant hoses at tank, radiator and engine. Remove radiator support bolts. Lift radiator assembly out of vehicle. Disconnect fuel supply and return lines at pump. Detach accelerator cable from pump. On models with A/T, remove cable bracket as well.

3) On all models, detach cable from support. Disconnect cold start cable. Disconnect fuel shutoff solenoid wiring. Remove gear shift indicator switch with wiring. Remove hose between air filter and turbocharger. Disconnect wiring at oil pressure switch, coolant temperature switches and glow plugs.

4) Disconnect any remaining coolant or heater hoses. Remove power steering pump with bracket and hoses attached. Hang pump aside. Disconnect hose at vacuum pump. Disconnect clutch cable, if equipped. Remove nuts from left and right engine mounts. Remove alternator and engine stop bracket.

5) On models with A/C, take off pulley nuts and remove compressor belt. Leaving hoses attached, remove A/C compressor with bracket and tie to side without any tension on hoses. On all models, remove exhaust pipe at turbocharger and bracket at transmission. Disconnect starter.

6) Remove starter and lay on subframe. Remove 2 lower bolts holding transmission and engine together. Remove flywheel or transmission cover. On A/T models, remove 3 bolts which hold torque converter to drive plate. Attach Transmission Support Bar (VW 785/1B). Attach Lifting Sling (US 1105) and lift engine and transmission assembly until engine mounts are clear.

7) Adjust support bar so that it contacts transmission. Remove 3 upper bolts holding engine and transmission together. Separate engine and transmission. Lift engine and guide it carefully out of engine compartment.

Installation

1) Check clutch release bearing for wear. Lightly lubricate release bearing and mainshaft splines with molybdenum disulfide grease. Do NOT lubricate release bearing guide sleeve. Always use new self-locking nuts on engine mounts. Put starter on subframe before lowering engine into compartment.

2) Connect fuel supply and return lines properly. Return pipe union screw has "OUT" written on head for identification. Install starter motor cable so it cannot touch engine. Hang alternator "V" belt over engine stop bracket before installing stop.

3) Locate engine mounts so that there is no strain upon them. Mounts can be aligned by shaking engine. Adjust tension of A/C

compressor belt by moving shims to inside or outside of crankshaft pulley. Complete installation in reverse of removal procedure.

CYLINDER HEAD & MANIFOLDS

Removal

1) Remove air cleaner and ducting, then drain cooling system. Remove camshaft drive belt. Unbolt thermostat housing from water pump. Disconnect battery ground strap. Disconnect accelerator cable from injection pump. Detach fuel lines at injectors and pump. Disconnect glow plug wiring, temperature sending wire and any other wires which could interfere with removal of cylinder head.

2) Unbolt exhaust pipe support (if equipped). Disconnect exhaust pipe from manifold. Disconnect coolant hoses from head and remove any other hoses which may interfere with head removal. Remove valve cover. Loosen head bolts in reverse order of tightening sequence. See Fig. 2. Lift off head.

3) Combustion chamber inserts are NOT supplied as spare parts. If inserts are damaged it will be necessary to replace cylinder head. Remove injectors and glow plugs to prevent damage while working on head.

Installation

1) Clean gasket surface and ensure that cylinder head is not warped. Maximum distortion of .004" (.01 mm) is allowed. If installing on original piston and block assembly select new head gasket that has same number of identification notches as original.

2) To determine proper head gasket, measure projection of piston above block at TDC. See Fig. 1. Select proper gasket from CYLINDER HEAD GASKET IDENTIFICATION table. Gasket must be installed with word "OBEN" facing up.

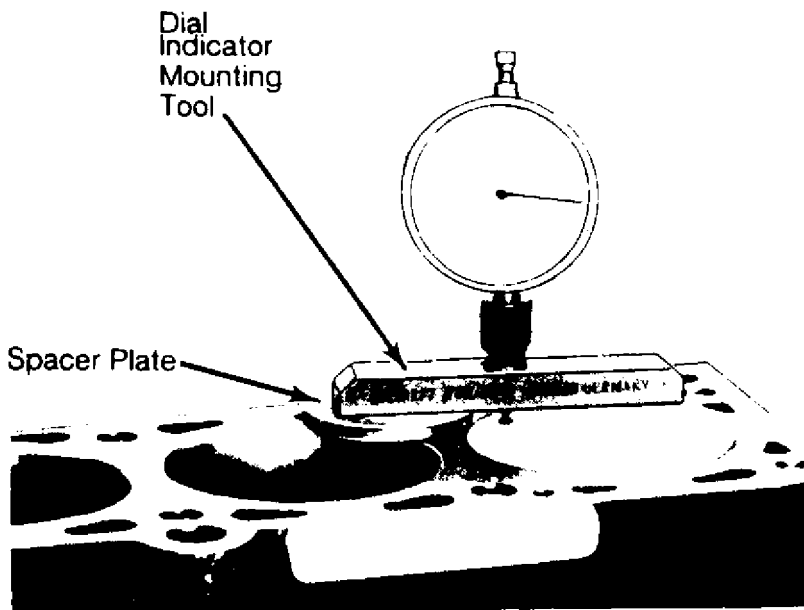


Fig. 1: Measuring Piston Projection
Select head gasket by piston height.

CYLINDER HEAD GASKET IDENTIFICATION TABLE

Piston Projection In. (mm)	Ident. Notches
.026-.031 (.67-.80)	1
.032-.036 (.81-.90)	2
.036-.040 (.91-1.02)	3

NOTE: Make sure that cylinder bores and head bolt holes are absolutely free of any debris or fluid prior to installation of head or bolts.

3) Lower head carefully onto gasket. Use Guide Pins (3070) to keep gasket and head aligned with block. Tighten cylinder head bolts in sequence in 3 stages. See Fig. 2. Tighten 12-point bolts to 29 ft. lbs. (40 N.m) in first step. Tighten to 43 ft. lbs. (60 N.m) in second step. On third step, turn bolt 180° (1/2 turn) in 1 movement (two 90° movements are acceptable).

4) Start engine and run until oil temperature is 122°F (50°C). Tighten bolts another 90° (1/4 turn) without loosening first. Tighten bolts another 90° (1/4 turn) without loosening after 1000 miles of use. Engine may be warm or cold for 1000 mile service.

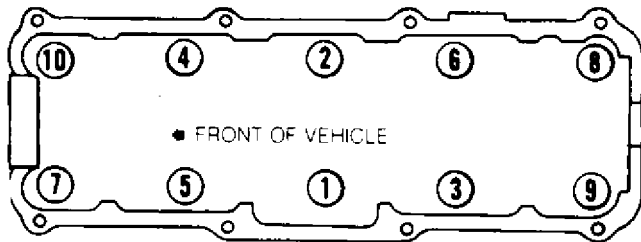


Fig. 2: Cylinder Head Tightening Sequence
Loosen in reverse order.

5) When installing injectors, new heat shields must be installed between each injector and cylinder head. Place new shield in position with recess upward, toward injector. Tighten injector. To complete cylinder head installation, reverse removal procedure.

CAMSHAFT

TIMING BELT

CAUTION: Do NOT turn camshaft or crankshaft with drive belt removed.

Removal

1) Loosen alternator and remove "V" belt. Remove crankshaft "V" belt pulley. Remove air cleaner and ducting. Remove drive belt and cylinder head cover. Remove timing plug on top of bell housing. Rotate engine to bring No. 1 piston to TDC. Check that TDC mark on flywheel is aligned with reference.

2) Use Locking Bar (2065A) to lock camshaft in position. Align bar by turning camshaft until one end of bar touches cylinder head. Measure gap at other end with feeler gauge. Insert feeler gauges of 1/2 thickness measured between bar and cylinder head at each end of bar. See Fig. 3.

3) Secure injection pump sprocket at TDC with Lock Pin (2064). See Fig. 6. Make sure that timing marks on pump sprocket, bracket and body are aligned with engine at TDC. Loosen belt tensioner and remove timing belt.

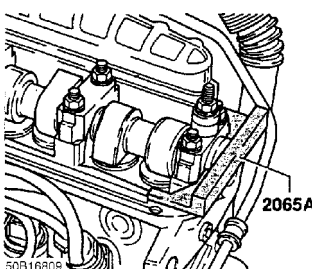
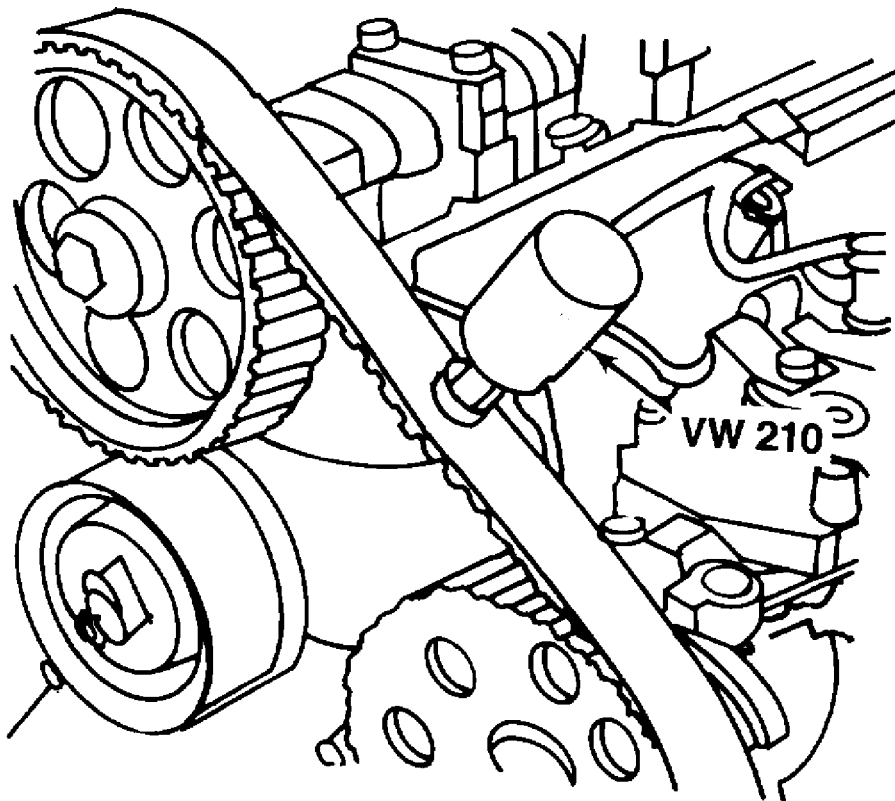


Fig. 3: Aligning Camshaft Locking Bar (2065A)
Do not turn camshaft or crankshaft with drive belt removed.



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Fig. 4: Adjusting Timing Belt Tension
 Courtesy of Volkswagen United States, Inc.

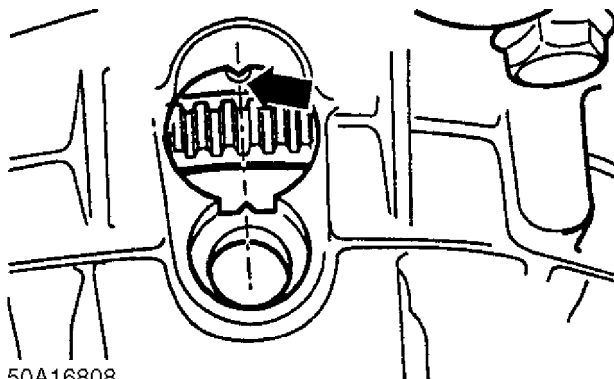


Fig. 5: Timing Mark (View Through Transmission)
 Courtesy of Volkswagen United States, Inc.

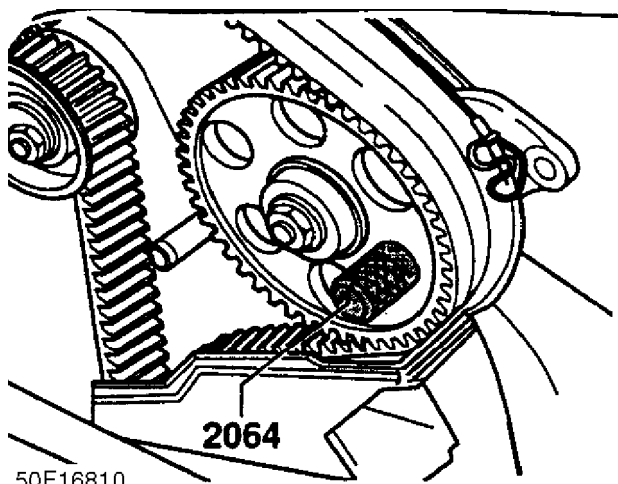


Fig. 6: Locking Injection Pump Sprocket (Lock Pin 2064)
 Courtesy of Volkswagen United States, Inc.

Installation

1) Ensure that TDC mark on flywheel is still aligned with pointer. With camshaft and injection pump locked in place, loosen

camshaft sprocket bolt 1/2 turn. Lightly tap camshaft gear loose from camshaft. Install drive belt. Remove lock pin from pump sprocket.

2) Tighten belt by turning tensioner to right. Adjust belt tension until scale reads 12-13 on Tension Gauge (VW 210). Measure tension between camshaft and injection pump sprockets. Tighten camshaft sprocket bolt and tensioner adjuster lock nut. Remove lock bar from camshaft.

3) Turn crankshaft 2 revolutions in direction of engine rotation. Using rubber hammer, strike belt once between camshaft sprocket and injection pump sprocket. Recheck belt tension. Check injection pump timing. Install remaining components in reverse order of removal.

CAMSHAFT

Removal

Remove timing belt. Remove bearing caps Nos. 1, 3 and 5. Loosen caps 2 and 4 diagonally. Bearing caps are numbered front (sprocket end) to rear. Note proper alignment position for off-center bore of bearing caps.

Inspection

1) Remove camshaft followers and keep in order for reassembly. Reinstall camshaft using Nos. 1 and 5 bearing caps. Check end play of camshaft with dial indicator. If play exceeds .006" (.15 mm), either head or camshaft is worn and must be replaced.

2) To measure camshaft radial play, install bearing caps and check with Plastigage method. Wear limit for radial play is .004" (.11 mm). If wear limit is exceeded, measure again with new camshaft. If radial play still excessive, replace cylinder head.

3) Check camshaft runout by installing shaft between centers and applying dial indicator at center bearing journal. Runout must not exceed .0004" (.010 mm) when camshaft is rotated. Inspect cam lobes, followers and all bearing surfaces. Ensure that all oil passages are clean. Replace any components that are worn or damaged.

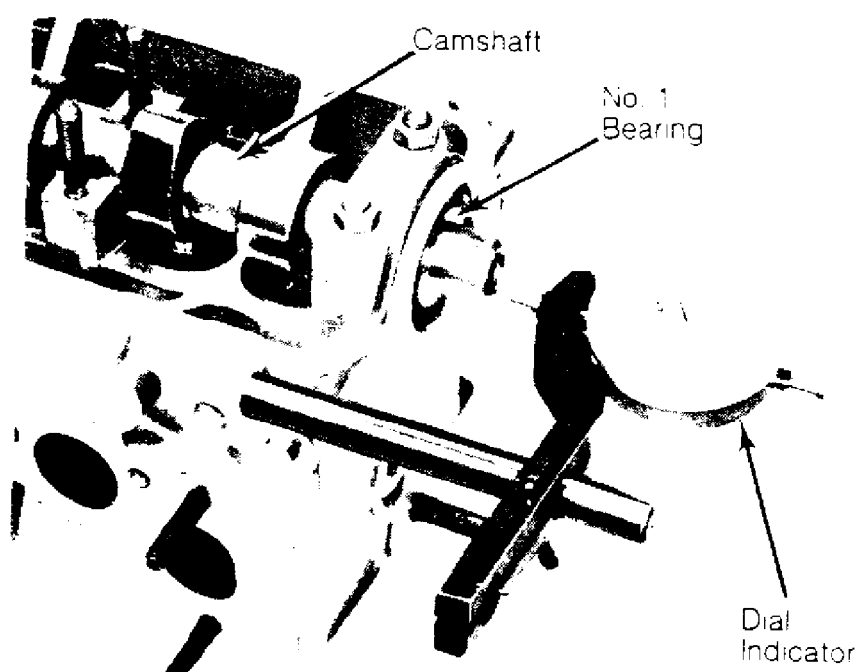


Fig. 7: Measuring Camshaft End Play
End play must not exceed .006" (.15 mm).

Installation

1) Lightly lubricate all components for assembly. Install cam followers in original bores with matching adjusting discs. Place camshaft and Nos. 2 and 4 bearing caps in position with cam lobes of No. 1 cylinder pointing upward.

2) Gradually tighten all 4 bearing cap nuts in diagonal pattern until camshaft is fully seated. Install caps 5, 3, and 1. Use Seal Installer (10-203) to install front oil seal. Complete installation in reverse order of removal. Set valve timing and check pump timing.

VALVE TIMING

See TIMING BELT INSTALLATION.

INJECTION PUMP TIMING

1) To check injection pump timing, set crankshaft to TDC on No. 1 cylinder and align marks on flywheel and clutch housing. Check that marks on injection pump sprocket, mounting plate and pump body are aligned. Make sure that cold start device is completely pushed in (off).

2) Remove plug from injection pump cover. Install Adapter (2066) and dial indicator (0-3 mm range) in place of plug. Preload dial indicator to .097" (2.5 mm). Turn engine slowly counterclockwise until dial indicator needle stops moving. Zero indicator.

3) Turn engine clockwise until TDC mark on flywheel is lined up with reference mark. Check dial indicator reading against specifications. See INJECTION PUMP TIMING SPECIFICATIONS. If outside of checking range, loosen mounting plate bolts and support bolt. Rotate pump slightly to set timing within adjustment range. Tighten bolts and recheck pump timing.

INJECTION PUMP TIMING SPECIFICATIONS TABLE

Application	Range In. (mm)
Quantum	(1) .037-.042 (.93-1.07)
Jetta & Rabbit	
With no paint dot	(2) .033-.037 (.83-.93)
With Yellow paint dot	(3) .043-.047 (1.10-1.20)
(1) - Adjust to .039-.040" (.98-1.02 mm).	
(2) - Adjust to .033-.035" (.84-.88 mm).	
(3) - Adjust to .044-.046" (1.13-1.17 mm).	

VALVES

VALVE ARRANGEMENT

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

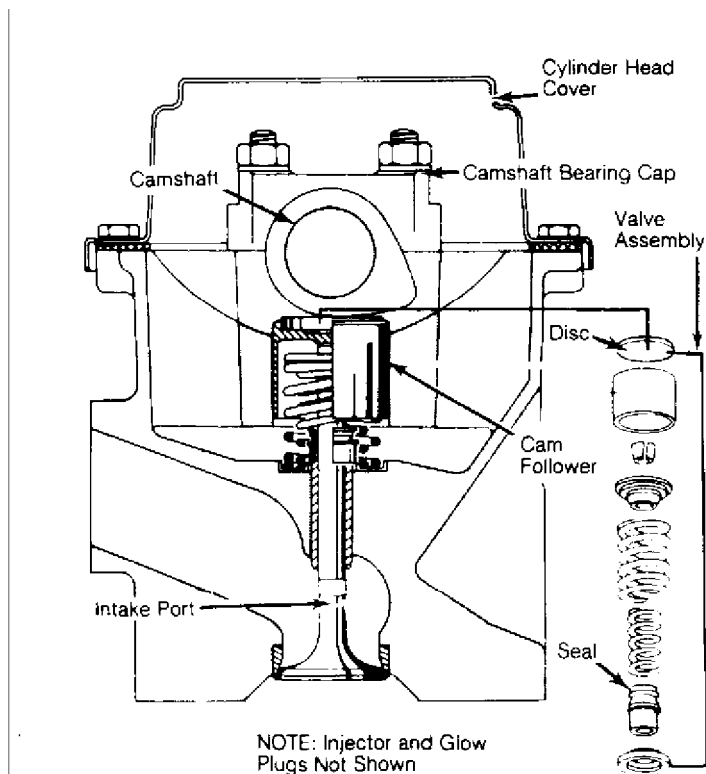


Fig. 8: End View of Camshaft and Valve Assembly

VALVE GUIDE SERVICING

1) To check for wear, insert NEW valve in clean valve guide until stem end is flush with spring end of guide. Use dial indicator to check that lateral (rocking) movement is not more than .051" (1.3 mm) when moved back and forth against indicator.

2) Prior to replacing worn guides, check that head is not cracked and that valve seats can be refaced. Press out old guides and coat new guides with oil. Press new guides in up to shoulder but do not use more than 1 ton of pressure once shoulder is seated. Hand ream guides to size.

VALVE STEM SEALS AND SPRINGS

NOTE: It is possible to replace valve springs and seals with head installed provided camshaft and tappets are removed. Piston of cylinder concerned must be at top dead center position

Use Valve Spring Compressor (VW 541/1) to depress spring and retainer. Remove keepers, retainer and springs. Remove stem seal. Use protective sleeve over valve stem. Install new seal with Seal Installer (10-204). Complete assembly in reverse order of disassembly.

VALVE CLEARANCE ADJUSTMENT

1) Engine should be at operating temperature. Rotate crankshaft so that both cam lobes for No. 1 cylinder point upward. Check intake and exhaust clearance between heel of cam lobe and follower.

2) Use crankshaft pulley to rotate crankshaft 180° at time and check No. 3, No. 4, and No. 2 valve clearances. If clearances are not within specifications, use thinner or thicker adjusting discs to increase or decrease clearance.

NOTE: Do not turn engine by camshaft pulley as this will stretch drive belt. Turn engine by crankshaft bolt to move crankshaft and valve train.

3) Twenty-six different thicknesses of discs are available in increments of .0019" (.05 mm) from .1181" (3.0 mm) to .1673" (4.25

mm). To install, turn crankshaft about 90° (1/4 turn) past TDC and press cam follower down with Follower Hook (VW 546). Remove old disc with Disc Removing Pliers (VW 10-208) and insert new disc with thickness marking toward cam follower.

VALVE CLEARANCE SPECIFICATIONS TABLE

Application In. (mm)

Intake	
Hot008-.012 (.20-.30)
Cold006-.010 (.15-.25)
Exhaust	
Hot016-.020 (.40-.50)
Cold014-.018 (.35-.45)

NOTE: Cold settings are given for reference as initial settings to be used during cylinder head rework. Final adjustments are made at normal operating temperatures and should be checked after 1000 miles of operation.

PISTONS, PINS & RINGS

PISTON & ROD ASSEMBLY

Removal

1) Mark cylinder number on crown of each piston. If necessary, mark arrows pointing toward front of block on piston crowns. Remove rod cap bolts and push piston out top of cylinder using wooden hammer handle.

2) If ridge at top of cylinder prevents piston removal, use ridge reamer prior to further disassembly. Do NOT force piston out of cylinder. Mark rods and bearing caps for correct reassembly.

Installation

1) Turn crankshaft so No. 1 journal is at BDC. Install piston and rod assembly until ring compressor contacts block. Guide rod over journal and use wooden handle of hammer to push piston into cylinder.

2) Repeat with No. 4 piston and rod assembly ensuring that tabs on bearing halves engage notches in respective rod and cap. Tighten caps on rod Nos. 1 and 4, then rotate crankshaft 180° and install No. 2 and No. 3 piston and rod assemblies.

PISTON PINS

Removal

Remove circlips. Press out pin and remove piston, noting direction piston is fitted to rod. If pin is too tight, heat piston to approximately 140°F (60°C) and then press out.

Installation

Check piston and pin fit for thumb push fit. Connecting rod may be rebushed and honed to proper size if required. If pin is too loose in piston, replace both pin and piston.

FITTING PISTONS

Measure cylinder at 3 points: 3/8" (10 mm) from top and bottom, and at center of bore. Measure in line with and at 90° to thrust face. Cylinder wear limit is .0016" (.040 mm) out of round. If limit is exceeded, cylinders must be honed and new pistons fitted.

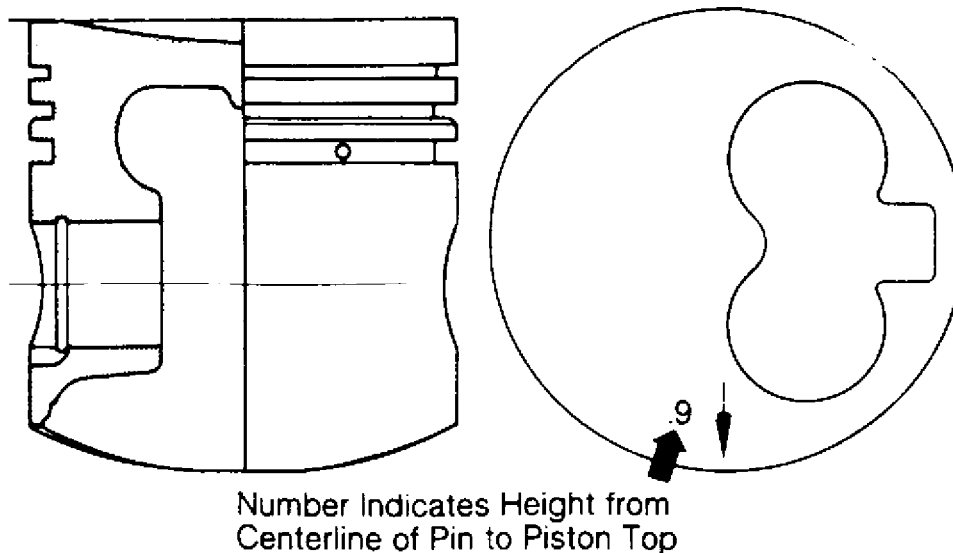


Fig. 9: Side and Top View of Diesel Piston
Quantum pistons have notch in skirt for oil jet.

CRANKSHAFT & ROD BEARINGS

MAIN & CONNECTING ROD BEARINGS

1) Push crankshaft toward one end and measure end play at No. 3 (thrust) bearing. Main bearing caps are numbered "1" through "5" with "1" at drive belt end and "5" at flywheel end. Measure connecting rod side play. Check all bearing clearances with Plastigage.

NOTE: On Turbo models with stretch bolts, only tighten rod nuts to 26 ft. lbs. (35 N.m) when checking clearances.

2) Measure crankshaft journals to check out-of-round. Maximum allowable out-of-round is .0012" (.030 mm). Install main inserts with bearing half having oil groove in block. Bearing tangs must be above one another. Lubricate bearings and install caps in original positions.

REAR MAIN BEARING OIL SEAL

NOTE: Rear main bearing oil seal may be replaced with engine in vehicle. Transmission and flywheel must be removed.

Removal

Insert screwdriver between crankshaft and flywheel flange and inside lip of seal. Carefully pry seal out.

Installation

Install Guide Sleeve (2003/2A) over crankshaft flange. Start new seal into recess in carrier. Remove guide sleeve. Fit Seal Driver (2003/1) and seat seal by tightening bolts.

FRONT MAIN BEARING OIL SEAL & INTERMEDIATE SHAFT OIL SEAL

NOTE: Diesel engine intermediate shaft rotates counterclockwise and utilizes different seal than gas engine. Arrow pointing counterclockwise on seal indicates correct application for Diesel model.

Removal (Quantum)

Remove crankshaft sprocket. Insert hex head bolt of Seal Remover/Installer (3083) into Seal Extractor Guide (2085) and remove oil seal.

Installation

To install, slide sleeve of seal remover/installer on crankshaft journal. Dip seal into engine oil and slide over sleeve. Slide thrust sleeve over guide sleeve. Press seal in with thrust sleeve and bolt until fully seated.

Removal (All Others)

Remove camshaft belt and crankshaft sprocket. On all others, pry seal from carrier using care not to damage carrier. Use Seal Extractor (10-219) to remove seal.

Installation

Coat seal lips with oil and press into carrier until flush. Use Seal Driver (10-203). Remove steel sleeve from carrier and use aluminum part of driver to drive seal in to depth of .08" (2 mm) from front of carrier.

NOTE: Same procedures are used for intermediate shaft seal except that intermediate shaft sprocket is removed. Seal is pressed in only until flush with carrier.

ENGINE OILING

ENGINE OILING SYSTEM

Gear-type oil pump provides oil for pressure feed to crankshaft journals, camshaft bearings, and intermediate shaft. Heavy-duty oil filter and revised oil pump drive are used in Diesel. Other lubrication characteristics are similar to spark ignition engines.

CAUTION: On Turbo-Diesel models, use only oil that is rated "CD" by API-System.

CRANKCASE CAPACITY

OIL CAPACITY TABLE

Application	Qts. (L)
Quantum	
With Filter Change	3.7 (3.5)
Without Filter Change	3.2 (3.0)
Jetta & Rabbit	
With Filter Change	4.7 (4.5)
Without Filter Change	4.2 (4.0)

OIL FILTER

Oil filter is replaceable, spin-on type.

NORMAL OIL PRESSURE

On Quantum models, oil pressure should be minimum of 23 psi (1.6 kg/cm²) @ 2000 RPM. Quantum oil pressure should be measured using 20W/20 oil at oil temperature of 176°F (80°C). On Jetta and Rabbit models, oil pressure should be minimum of 28 psi (2.0

ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS TABLE

Application In. (mm)

1984

Displacement

Cu. In. 97.0

Liters 1.6

Fuel System Diesel Fuel Inj.

HP @ RPM

Diesel 52 @ 4800

Turbo-Diesel 68 @ 4500

Torque Ft. @ RPM

Diesel 70 @ 2500

Turbo-Diesel 98 @ 2800

Compr. Ratio 23:1

Bore 3.012 (76.5)

Stroke 3.40 (86.4)

VALVE SPECIFICATIONS

VALVE SPECIFICATIONS TABLE

Application In. (mm)

1.6L

Intake

Head Diam. 1.338 (40.00)

Face Angle 45°

Seat Angle 45°

Seat Width079 (2.00)

Stem Diameter314 (7.97)

Stem Clearance

Valve Lift

Exhaust

Head Diam. 1.220 (31.00)

Face Angle 45°

Seat Angle 45°

Seat Width095 (2.40)

Stem Diameter313 (7.95)

Stem Clearance

Valve Lift

PISTON/PIN/RING SPECIFICATIONS

PISTONS, PINS, & RINGS SPECIFICATIONS TABLE

Application In. (mm)

1.6L

Pistons

Clearance (1) .001 (.03)

Pins

Piston Fit (2) Push Fit

Rod Fit Push Fit

Rings

Ring No. 1

End Gap (3) .0120-.0200 (.30-.50)
 Side Clearance (4) .0020-.0040 (.06-.09)
 Ring No. 2
 End Gap (3) .0120-.0200 (.30-.50)
 Side Clearance (4) .0020-.0030 (.06-.08)
 Ring No. 3
 End Gap (3) .0100-.0160 (.25-.40)
 Side Clearance (4) .0010-.0020 (.03-.06)

- (1) - Wear limit .031" (.08 mm).
- (2) - If too tight, heat to 140°F (60°C).
- (3) - Wear limit .039" (1.0 mm).
- (4) - Wear limit .008" (.20 mm).

AA

BEARING SPECIFICATIONS

CRANKSHAFT MAIN & CONNECTING
 ROD BEARINGS SPECIFICATIONS TABLE

AA

Application In. (mm)

1.6L

Main Bearings

Journal Diam.

Std. Size (1) 2.124-2.125 (53.96-53.98)
 1st U/Size 2.114-2.115 (53.71-53.73)
 2nd U/Size 2.104-2.105 (53.46-53.48)
 3rd U/Size 2.095-2.096 (53.21-53.23)

Clearance (2) .001-.003 (.025-.076)

Thrust Bearing No. 3

Crankshaft End Play (3) .003-.007 (.07-.17)

Connecting Rod Bearings

Journal Diam.

Std. Size (1) 1.880-1.881 (47.76-47.78)
 1st U/Size (1) 1.871-1.872 (47.51-47.53)
 2nd U/Size (1) 1.860-1.861 (47.26-47.28)
 3rd U/Size (1) 1.851-1.852 (47.01-47.03)

Clearance (4) .0011-.0033 (.028-.088)

Side Play014 Max. (.37)

- (1) - Maximum out-of-round from standard or undersize crankshaft journals is .001" (.03 mm).
- (2) - Wear limit .007" (.17 mm).
- (3) - Wear limit .010" (.25 mm).
- (4) - Wear limit .005" (.12 mm).

AA

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