2000 ENGINES

1.8L 4-Cylinder Turbo, AUG & AWM Engines

ENGINE IDENTIFICATION

NOTE: For engine repair procedures not covered in this article, see ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION article in the GENERAL INFORMATION section.

Engine identification number is stamped on a machined pad on left rear side of engine block, below cylinder head. Engine code may also be found, stamped on the ear of cylinder head. A sticker with this information may also be placed at the timing belt cover or the cylinder head cover. See Fig. 1 and Fig. 2.

ENGINE CODES

<table>
<thead>
<tr>
<th>Application</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audi A4</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>AWM</td>
</tr>
<tr>
<td>Volkswagen Passat</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>(1) AUG</td>
</tr>
<tr>
<td>2002</td>
<td>AWM</td>
</tr>
</tbody>
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(1) Some late 2001 models may be equipped with AWM engine.
Engine Code

G98F07914

Fig. 1: Locating Engine Identification Code & Serial Number
Courtesy of VOLKSWAGEN UNITED STATES, INC.
PROGRAMMING

NOTE: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle.

After any repair which required that the battery be disconnected, the following should be performed. Refer to owners manual for additional information.

1. Ensure ignition switch is in OFF position. Reconnect battery positive cable first then connect the negative ground strap.
2. After connecting battery, enter anti-theft code for radio (if equipped).
3. Fully close all power windows, operate each window door switch in up position for at least one
second (windows closed) to activate "one touch" opening/closing function (if equipped).

4. Set clock to correct time.

ADJUSTMENTS

ACCELERATOR PEDAL

NOTE: A drive by wire throttle system is used on this model vehicle. No throttle cable adjustment required.

For testing and matching engine electronics control module to throttle valve control module. See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

VALVE CLEARANCE

Engine is equipped with non-adjustable, non-serviceable hydraulic valve adjusters. Irregular valve adjuster noise during cranking is normal. If valve adjuster(s) are noisy under any other condition inspect valve adjusters. See HYDRAULIC VALVE ADJUSTERS.

HYDRAULIC VALVE ADJUSTERS

WARNING: ALWAYS release fuel pressure before disconnecting fuel injection related component. DO NOT allow fuel to contact engine or electrical components. See FUEL PRESSURE RELEASE.

CAUTION: DO NOT start engine for about 30 minutes after installing camshafts. Hydraulic valve lifters must bleed down or valves may strike pistons. Rotate crankshaft by hand 2 full revolutions before starting engine to ensure valves do not strike pistons.

NOTE: Valve lifters are not repairable or adjustable. Replace faulty lifters. Irregular valve train noise is normal when starting engine.

Checking

1. Start engine and run until cooling fan cycles at least once. Increase engine speed to 2500 RPM for 2 minutes or test drive vehicle and observe valve train noise. If valve train noise is still considered noisy, go to next step.

2. Turn engine off. Remove cylinder head cover. Rotate crankshaft until camshaft lobes point upward on lifter being checked. Using a wooden or plastic wedge, push down on top of lifter. See Fig. 3. Try inserting a .20 mm (0.008") feeler gauge between top of lifter and camshaft. If feeler gauge fits between top of lifter and camshaft, replace faulty lifter.
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Fig. 3: Placement Of Wedge On Lifter (Push Down)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

TROUBLESHOOTING

To trouble shoot mechanical engine components, see appropriate table in TROUBLE SHOOTING article in GENERAL INFORMATION.

REMOVAL & INSTALLATION

CAUTION: Radio/cassette or radio/CD player is equipped with an anti-theft protection circuit. Whenever battery is disconnected, radio will go into anti-theft mode. When battery is reconnected, radio will display CODE, and will be inoperative until proper code number is entered. Obtain security code before
disconnecting battery.

**NOTE:** When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle.

**NOTE:** For reassembly reference, label all electrical connectors, vacuum hoses and fuel lines before removal. Place mating marks on other major assemblies before removal.

**FUEL PRESSURE RELEASE**

Remove fuel pump relay from fuse/relay block under left side of instrument panel. Start engine. Allow engine to run until it stops. Turn ignition off. Disconnect negative battery cable. Install fuel pump relay. Slight pressure may remain in system. Before disconnecting any fuel system line, cover connector with a clean shop towel.

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**MICRO CENTRAL ELECTRIC**

1. Dual Horn Relay
2. Load Reduction Relay
4. Fuel Pump Relay
5. Wiper/Washer Intermittent Relay
6. Wiper/Washer Intermittent Relay

**Fig. 4: Locating Fuel Pump Relay (A4 - Micro Central Electric, Behind Left Side Of Dash)**

Courtesy of AUDI OF AMERICA, INC.
RELAY PANEL

1. Dual Horn Relay
2. Load Reduction Relay
3. Not Used
4. Fuel Pump (FP) Relay
V. Wiper/Washer Intermittent Relay
VI. Wiper/Washer Intermittent Relay

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Fig. 5: Locating Fuel Pump Relay (Passat - Relay Panel, Under Left Side Of Dash)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

COOLING SYSTEM BLEEDING

1. Ensure coolant all hoses are secure.
2. Remove seal from plenum chamber cover in direction of arrow. See Fig. 6. Remove plenum chamber cover (1) from front.
3. Install fill adaptor to coolant expansion tank. See Fig. 7 and Fig. 8. If special tools are not used, loosen expansion tank and raise about 4 INCHES. Keep in this position while filling.
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Fig. 7: Installing Fill Adaptor To Coolant Expansion Tank With Large Cap
Courtesy of AUDI OF AMERICA INC.
4. Expose vent hole on heater pipe at firewall connection by pulling back heater hose. See Fig. 9. Fill cooling system through expansion tank until coolant comes out of vent hole. Tighten heater hose and bleed screw.

6. With engine at normal operating temperature, coolant should be at the Max mark indicated on expansion tank. Once engine has completely cooled, coolant should be at the low mark. Add coolant as necessary.

DRAINING COOLING SYSTEM
Removal & Installation (A4)

**WARNING:** The cooling system is pressurized when the engine is warm. When opening the expansion tank, wear gloves and other appropriate protection, cover the cap with a cloth and open carefully to relieve system pressure slowly.

**NOTE:** For help in identifying components and component locations, refer to illustration. See Fig. 10 and Fig. 11.

1. Open cap on engine coolant expansion tank. Remove lower engine shield (noise insulator). Remove lower radiator hose (1). Drain coolant from radiator and hose. See Fig. 11.
2. With bumper and air duct in front of charge air cooler removed, the coolant can also be drained from the radiator via the drain screw. See Fig. 12. If necessary attach an auxiliary hose when draining coolant. Drain coolant into clean container if coolant is in good condition and is going to be reused.
3. Disconnect lower coolant hose on oil cooler, and drain off remaining coolant from cylinder block. See Fig. 13.
4. To fill cooling system, see **COOLING SYSTEM BLEEDING**.

© 2004 Mitchell Repair Information Company, LLC.
1. Heater Unit Heat Exchanger
2. Radiator Hose, Lower
3. Expansion Tank
4. Oil Cooler
5. Intake Manifold
6. Lower Coolant Hose
7. Upper Coolant Hose
8. Radiator
9. Thermostat Housing
10. Coolant Pump
11. Turbocharger
12. Cylinder Head/Cylinder Block
13. Connection
1. Lower Radiator Coolant Hose
2. Retaining Clip
Fig. 12: Identifying Location Of Coolant Drain Plug At Front Of Radiator With Bumper Removed (A4)
Courtesy of AUDI OF AMERICA, INC.
Removal & Installation (Passat)

**WARNING:** The cooling system is pressurized when the engine is warm. When opening the expansion tank, wear gloves and other appropriate protection, cover the cap with a cloth and open carefully to relieve system pressure slowly.

**NOTE:** For help in identifying components and component locations, refer to illustrations. See Fig. 14 and Fig. 15.

1. Open cap on engine coolant expansion tank. Remove lower engine shield (noise insulator). Remove lower radiator hose (1). Drain coolant from radiator and hose. See Fig. 15 and Fig. 16.
1 - Heater core
2 - Lower coolant pipe
3 - Expansion tank
8 - Radiator
9 - Upper coolant line
10 - Coolant pump/coolant reg
Fig. 14: Coolant Hose Connection & Routing Diagram (Passat)
Courtesy of VOLKSWAGEN UNITED STATES, INC.
1 - Heater unit heat exchanger
2 - Radiator hose, lower
3 - Expansion tank
4 - Oil cooler
5 - Intake manifold
6 - Lower coolant hose
7 - Upper coolant hose
8 - Radiator
9 - Radiator hose, upper
2. Drain coolant into clean container if coolant is in good condition and is going to be reused. Disconnect coolant hose from thermostat housing.
3. Remove housing and thermostat, and drain off remaining coolant from cylinder block. See Fig. 17.
4. To fill cooling system, see COOLING SYSTEM BLEEDING.
1. Lower Radiator Coolant Hose
2. Retaining Clip

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Fig. 16: Identifying Lower Radiator Coolant Hose & Retaining Clip (Passat)
Courtesy of VOLKSWAGEN UNITED STATES, INC.
1. Bolt 10 Nm (7 ft. lbs.)
2. Thermostat Housing
3. O-Ring Seal
4. Thermostat

**WARNING:** The cooling system is pressurized when the engine is warm. When opening the expansion tank, wear gloves and other appropriate protection, cover the cap with a cloth and open carefully to relieve system pressure slowly.
NOTE: Obtain radio code before disconnecting battery. Remove engine, without transmission, through front of engine compartment.

1. Raise vehicle. Remove lower engine shield (noise insulator). See Fig. 18. Drain coolant. See DRAINING COOLING SYSTEM.

2. Thermostat is located at front side of engine behind generator. See Fig. 19. Disconnect battery ground cable. Remove the generator drive belt. Remove viscous fan, see VISCOUS FAN.
1. Bolt 10 Nm (7 ft. lbs.)
2. Thermostat Housing
3. Gasket (O-Ring)
4. Thermostat
3. Remove generator. Remove intake manifold support bracket (2). See Fig. 19 and Fig. 88.
4. Remove bolts from thermostat housing cover, note positioning of thermostat (reinforcement vertical). Remove thermostat.
5. Clean mating surfaces. Lube new O-ring gasket with coolant. Install thermostat (if equipped, bleed hole at top). Tighten thermostat housing bolts to specification. See TORQUE SPECIFICATIONS.
6. To complete installation, reverse removal procedure. Fill and bleed cooling system. See COOLING SYSTEM BLEEDING.

WARNING: The cooling system is pressurized when the engine is warm. When opening the expansion tank, wear gloves and other appropriate protection, cover the cap with a cloth and open carefully to relieve system pressure slowly.

1. Raise vehicle. Remove lower engine shield (noise insulator). See Fig. 18. Drain coolant. See DRAINING COOLING SYSTEM.
2. Thermostat is located at front side of engine behind generator. See Fig. 19. Disconnect battery ground cable. Remove the generator drive belt. Remove viscous fan, see VISCOUS FAN. Remove generator. Remove intake manifold support bracket (2). See Fig. 19 and Fig. 88.
3. Remove bolts from thermostat housing cover, note positioning of thermostat (reinforcement vertical). Remove thermostat.
4. Clean mating surfaces. Lube new O-ring gasket with coolant. Install thermostat (if equipped, bleed hole at top). Tighten thermostat housing bolts to specification. See TORQUE SPECIFICATIONS.
5. To complete installation, reverse removal procedure. Fill and bleed cooling system. See COOLING SYSTEM BLEEDING.

NOTE: For help in identifying components and component locations, refer to illustration. See Fig. 20.
1. Drain coolant. See DRAINING COOLING SYSTEM.

2. Remove front bumper. See FRONT BUMPER and LOCK CARRIER.

3. Pull radiator hoses from radiator. Disconnect harness connectors from fan(s) and thermoswitch. Remove cowl from intercoolers. Unbolt the fasteners for the power steering line cooler from the radiator and body frame. See Fig. 43.

4. Remove ATF lines from radiator, if equipped. To prevent fluid lose, plug lines or point lines upward and secure. Remove radiator fasteners (retaining pins) and take out radiator. See Fig. 21.
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Fig. 21: Releasing Retaining Pins At Top Of Radiator (One On Each Side)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

5. To install, reverse removal procedure, tighten bolts to specification. See TORQUE SPECIFICATIONS. Fill and bleed cooling system. See COOLING SYSTEM BLEEDING.

CORE PLUG (CYLINDER HEAD)

CAUTION: Ensure core plug (sealing cap) is installed in cylinder head.

Removal

Removal procedure of core plug not provided by manufacturer.
Installation

Coat outside circumference of core plug (sealing cap) with sealant (AMV 188 001 02). Using needle bearing drift (VW295), drive in core plug until outside rim is flush with end of chamfer in cylinder head. See Fig. 22.

Fig. 22: Identifying Installed Depth Of Core Plug (Sealing Cap)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

LOCK CARRIER

Placing In Service Position (A4)

NOTE: Lock carrier is slid forward onto alignment tools. This will allow servicing of front engine components. Lock carrier can be removed at technicians discretion.

1. Remove lower engine shield (noise insulation). See Fig. 18.
2. Drain coolant. See DRAINING COOLING SYSTEM.
3. Disconnect intake air ducting located near radiator support. Disconnect headlight and turn signal electrical connectors. Disconnect harness connectors at horns. See Fig. 41.
4. Disconnect coolant fan thermal switch. Remove fasteners from power steering cooling coil.
5. Remove front bumper. See FRONT BUMPER.
6. Unscrew bolt (No. 3) and replace with Support Tool (Part No. 3369) onto right and left-hand longitudinal member (chassis). Remove bolts securing front of body (lock carrier) to vehicle. See Fig. 23 and Fig. 24.
1 - Lock Carrier
2 - Torx® bolts
   ♦ 10 Nm (7 ft lb)
3 - Bolt w/washer assembly
   ♦ 50 Nm (37 ft lb)
4 - Bolt w/washer assembly
   ♦ 50 Nm (37 ft lb)
5 - Bolt w/washer assembly
   ♦ 50 Nm (37 ft lb)
   ♦ For service position: remove bolt and install 3369 support tool
6 - Alignment Tool (3369)

Note: After installing the lock carrier, check the headlight settings and adjust if necessary.

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Fig. 23: Identifying Lock Carrier (Front Of Body)
Courtesy of AUDI OF AMERICA, INC.
7. Slide lock carrier forward, moving it into service position. After lock carrier is slid forward, secure by installing bolts at front of fender. See Fig. 25. To return, reverse procedure.
1. Lock Carrier
2. Securing Fastener

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Fig. 25: Securing Lock Carrier In Service Position
Courtesy of AUDI OF AMERICA, INC.

Placing In Service Position (Passat)

NOTE: Lock carrier is slid forward onto alignment tools. This will allow servicing of front engine components. Lock carrier can be removed at technicians discretion.

1. To move lock carrier (First design) into service position. See Fig. 26. If vehicle is equipped with Second design, go to step 11. See Fig. 27.
1. Lock Carrier
2. Bolts (6) 37 Ft. Lbs. (50 N.m)
3. Bolt (6) 37 Ft. Lbs. (50 N.m)
4. Bolts (2) 6 Ft. Lbs. (8 N.m)
5. Seal
6. Bowden Cable
7. Hole In Side Panel
8. Bolts (2)
9. Hole For Special Tool
2. Remove lower engine shield (noise insulation). See Fig. 18.
3. Unbolt air guide between lock carrier and air cleaner on lock carrier. Remove bolt (No. 3) from left and right longitudinal frame member. Screw Support Tool (3369) into frame member. See Fig. 24 and Fig. 26.
4. Remove remaining fasteners, pull and slide lock carrier forward on Support Tool (3396).
5. To remove lock carrier (First design) perform these additional steps. Drain coolant. See DRAINING COOLING SYSTEM. Disconnect headlight and turn signal electrical connectors.
6. Disconnect harness connectors at horns. See Fig. 42. Disconnect coolant fan thermal switch.
7. Disconnect power steering cooling coil. Remove front bumper.
8. Remove side mounted guide from fenders. Disconnect intake air and charge air cooling ducting located near radiator support (components may vary).
9. Remove hood latch and cable. Remove condenser from lock carrier (DO NOT open A/C system).
10. Disconnect coolant hoses. Remaining coolant will drain at this time.
11. To move lock carrier (Second design) into service position. See Fig. 27.
1. Remove lower engine shield (noise insulation). See Fig. 18. Remove front bumper cover.
2. Unbolt air guide between lock carrier and air cleaner on lock carrier. Unscrew and replace with Remove bolt (No. 5) from left and right longitudinal frame member.
4. Remove remaining fasteners, pull and slide lock carrier forward on Guide Rods (3411). Lock carrier
can be pulled forward about 4". See Fig. 28 -Fig. 29.

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Fig. 28: Identifying Guide Rods (Part No. 3411)
Courtesy of VOLKSWAGEN UNITED STATES, INC.
16. To remove lock carrier perform these additional steps. Remove lower engine shield (noise insulation). See Fig. 18.
17. Remove hood latch and cable. Disconnect headlight and turn signal electrical connectors. Disconnect harness connectors at horns. See Fig. 41. Remove the front bumper cover.
18. Disconnect coolant fan thermal switch. Disconnect power steering cooling coil.
20. Disconnect intake air and charge air cooling ducting located near radiator support (components may vary). Drain coolant and disconnect coolant hoses. See DRAINING COOLING SYSTEM.
21. Remove condenser from lock carrier. It is NOT necessary to open the A/C system.

FRONT BUMPER

Removal & Installation

1. Raise vehicle. Remove lower front engine shield (noise insulator). Loosen appropriate front bumper fasteners at this time. See Fig. 30 - Fig. 34. Lower vehicle.

2. Separate hood release lever from hood lock. Disconnect any wiring harness that attach to the front bumper, remove front bumper cover. See Fig. 30 - Fig. 34. Remove bumper cover carrier from impact absorbers.

3. To install, reverse removal procedure. To move lock carrier into service position. See LOCK CARRIER.

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Fig. 30: Exploded View Of Front Bumper Assembly (Passat Up To Sept. 2000)
2000 Volkswagen Passat GLX
1.8L 4-CYLINDER TURBO 5-VALVE

Courtesy of VAG. OF AMERICA
1 - Cover
- Material -PP/EPDM
- Removing:
  - Remove radiator grille
  - Remove screws -2-, -5- and -10-.
  - Pull cover off guide pieces -3- (left and right).

2 - Bolt
- Qty: 6
- 6 Nm

3 - Guide piece

5 - Screw
- Qty: 8
- 2 Nm

6 - Speed nut
- Qty: 6

7 - Bumper strip
- Clipped into cover

8 - Ventilation grill
- Consists of three parts and is clipped into cover
Fig. 31: Exploded View Of Front Bumper Assembly (Passat From Oct. 2000)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Combination Bolt
Hex Bolt
Impact Absorber
Bracket

Combination Bolt
Bumper

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Fig. 32: Identifying Front Bumper (Up To VIN 8DXA20000; Late Models Similar)
Courtesy of AUDI OF AMERICA, INC.
Fig. 33: Removing Inner End Of Air Inlet Grill (To Gain Access To Bumper Fasteners)
Courtesy of AUDI OF AMERICA, INC.
1. Raise vehicle, remove lower engine shield (noise insulator), if equipped. Move lock carrier to service position. See LOCK CARRIER. Loosen 2 mounting bolts at A/C belt tensioner. Release tension from belt. Remove belt. See Fig. 35.
2. To install, reverse removal procedure. Ensure pulleys are free of debris. Attach a torque wrench to the

1. Generator
2. Viscous Fan Clutch Pulley
3. Power Steering
4. Tensioner Pulley
5. A/C Compressor
6. Crank Pulley
hex on the A/C belt tensioner. Place torque wrench at 7 o'clock position. Apply 22 ft. lbs. (30 N.m) torque to tensioner in clockwise direction. While holding tensioner in this position, tighten tensioner mounting bolts to 15 ft. lbs. (20 N.m).

3. Start engine and check belt running condition.
4. Secure lock carrier to body. See LOCK CARRIER.

Removal & Installation (Serpentine Belt)

CAUTION: If reusing old serpentine or other accessory drive belt(s), mark the running direction of belt with crayon or marker. Reinstalling a used belt in reversed direction could damage the belt, and cause component(s) or engine damage.

1. For models with A/C, remove A/C belt. See REMOVAL & INSTALLATION (A/C BELT - Passat).
2. Place an open end wrench on the machined tab on the top of the serpentine belt tensioner. Move tensioner in a clockwise direction to relieve belt tension. Remove serpentine drive belt. See Fig. 35.
3. To install serpentine drive belt, reverse removal procedure. Start engine. Ensure drive belt is properly seated in pulleys.

VISCOUS FAN (ENGINE COOLING)

Removal & Installation

1. Raise vehicle. Remove lower engine shield (noise insulator). See Fig. 18.
2. Move lock carrier to service position. See LOCK CARRIER. Remove accessory drive belts. See ACCESSORY DRIVE BELTS.
3. Use a drift punch to lock up the viscous fan pulley (1). See Fig. 36. Using an 8 mm hex wrench (2), remove viscous fan coupling-to-bearing bolt. Remove viscous fan. The belt pulley can now be removed from the viscous fan clutch.
4. To remove viscous fan bearing. See VISCOUS FAN BUSHING (BEARING), or go to next step.
5. To install viscous fan, reverse removal procedure. Ensure pulleys are free of debris. Tighten viscous fan coupling-to-bearing bolt to specification. See TORQUE SPECIFICATIONS.

VISCOUS FAN BUSHING (BEARING)

Removal & Installation

1. Raise vehicle, remove lower engine shield (noise insulator). See Fig. 18. Move lock carrier to service position. See LOCK CARRIER.
2. Release tension off serpentine belt. See ACCESSORY DRIVE BELTS. Remove viscous fan and pulley. See VISCOUS FAN (ENGINE COOLING).
3. With fan and pulley removed, remove circlip (1) from bracket. See Fig. 37. Pull bearing out of bracket using (VAG 3367/3, 3350, and 3301). See Fig. 38.
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Fig. 37: Identifying Location of Viscous Fan Bearing & Circlip In Bracket
Courtesy of AUDI OF AMERICA, INC.
4. Press bearing back into bracket using (VAG 3367/1, 3367/2, 3367/3, and 3301). See Fig. 39.
5. To complete install, reverse removal procedure. Ensure pulleys are free of debris. Install viscous fan. Tighten viscous fan coupling-to-bearing bolt to specification. See TORQUE SPECIFICATIONS.

6. Using a torque wrench tighten fan (blade) to viscous coupling to 10 N.m (89 INCH lbs.).

7. Start engine and check viscous fan and belt running condition.

ENGINE

WARNING: The cooling system is pressurized when the engine is warm. When opening the expansion tank, wear gloves and other appropriate protection, cover the cap with a cloth and open carefully to relieve system pressure slowly.

NOTE: Obtain radio code before disconnecting battery. Remove engine, without transmission, through front of engine compartment.

NOTE: To gain access to rear fastener on Motronic Engine Control Module (E-Box)
carrier cover. Turn ignition on, operate windshield wipers till wiper arms are in the vertical position (pointing up), turn off ignition. See Fig. 51. Other option is to remove wiper arm.

Removal

1. Release fuel pressure. ALWAYS release fuel pressure before disconnecting fuel injection related component. DO NOT allow fuel to contact engine or electrical components. See FUEL PRESSURE RELEASE.
2. Remove battery. Remove lower engine shield (noise insulator). See Fig. 18. Drain engine oil. Drain coolant, see DRAINING COOLING SYSTEM.
3. Remove seal from plenum chamber cover, pull forward. See Fig. 6. Remove plenum chamber cover.
4. Remove cover for fuel injectors. Disconnect fuel supply (1) and return lines (2) at fuel rail. See Fig. 40. Remove fasteners from air duct at radiator support. Disconnect intake air ducting located near radiator support. Remove air box cover.

5. Disconnect headlight and turn signal electrical connectors. Disconnect harness connectors at horns. See Fig. 41 and Fig. 42.
Fig. 41: Identifying Horn & Turn Signal Harness Connectors (A4)

Courtesy of AUDI OF AMERICA, INC.
6. Remove front bumper. See FRONT BUMPER. Unbolt bracket for sound insulation. Remove air cowl in front of charge air cooler (intercooler). Disconnect harness connector to Charge Pressure sensor at charge air cooler (intercooler).

7. With front bumper removed, unclip temperature sensor for ambient temperature display from bracket, at lower left of radiator. Unbolt power steering hydraulic oil cooling line, ensure cooling coil is free (DO NOT open hydraulic oil circuit). See Fig. 43. Place drip tray below engine. Turn drain screw on radiator counterclockwise. If necessary, install a drain hose on connection. Drain residual coolant.
8. Remove air duct hose to bottom left charge air cooler from lock carrier. Remove air duct hose to bottom right charge air cooler from lock carrier. Place drip tray underneath to collect oil. Detach ATF lines. Remove bracket for ATF lines from left side of engine.

9. Remove hood latch and cable. Remove cover of power steering reservoir and disconnect connectors (1) to (5). See Fig. 44. Secure wiring harness aside. Remove upper coolant hose from radiator.
10. **NOTE:** DO NOT open the air conditioning refrigerant lines.

Disconnect green electrical connector to A/C compressor. See Fig. 45. Disconnect A/C refrigerant line brackets at support points only. After A/C compressor is removed from bracket, support with heavy wire and set A/C compressor carefully aside, avoid damage from bending or kinking refrigerant lines.
11. Remove left and right side air ducts (4). Remove condenser mounting bolts (1) and (2). Disconnect harness connector (3) for A/C pressure switch. See Fig. 46. Pull condenser up out of its bracket, rotate it to side and use heavy wire to secure it on or near right front wheel.
12. On A4, unbolt lock carrier, secure in service position. On Passat, remove lock carrier. See LOCK CARRIER.

13. On A4, proceed with this step. For Passat, go to next step. At air filter box, disconnect harness connectors from ACF valve, Air Mass Meter, and Wastegate Bypass Regulator Valve. Disconnect turbocharger air intake and throttle valve control module ducts and hoses. Remove ACF valve from air filter box. Disconnect harness connectors from Secondary Air Injection Pump, disconnect secondary air inlet hose, both located under the air box. Disconnect cables and hoses that would interfere with engine removal. See Fig. 47 and Fig. 48.
14. Disconnect vacuum hoses to brake booster, ACF valve and vacuum reservoir. See Fig. 40.
15. On Passat, disconnect pressure hose for Secondary Air Injection (AIR) pump at connecting tube. Remove tube for crankcase housing ventilation (1). Disconnect pressure tube (2) at combination valve.
and unbolt from cylinder head cover. Unbolt combination valve with mount (3) and move to side. Remove T-piece (5) of crankcase housing ventilation. See Fig. 49. Disconnect required connecting and vacuum hoses from engine.

![Crankcase Housing Ventilation](image)

1. Crankcase Housing Ventilation Tube  
2. Pressure Tube  
3. Combination Valve Mounting Fasteners  
4. Harness Connector  
5. "T" Piece Connector

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Fig. 49: Identifying Secondary Air Injection Connection Components (Passat)  
Courtesy of VOLKSWAGEN UNITED STATES, INC.

16. On all A4 and Passat, disconnect all coolant and heater hoses. Remove coolant system expansion reservoir and set aside. See Fig. 50. Remove heater hoses at cylinder head connection.
17. Remove Motronic Engine Control Module (E-Box) carrier cover and disconnect harness connectors.
   See Fig. 51 and Fig. 52.
Fig. 51: Identifying Motronic Engine Control Module (E-Box) Cover Fasteners

Courtesy of AUDI OF AMERICA, INC.
18. Release locks on additional relay carrier, located at the rear of the ECM/Relay protective box. Disconnect harness connectors on rear of console. See Fig. 53. Kickdown switch harness connector. See Fig. 54.
19. Disconnect oxygen sensors harness connectors, remove fasteners to harness connector bracket also remove ground wires at firewall. Set harness bracket aside. See **Fig. 55** and **Fig. 56**.
1. Oxygen Sensor Connector

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Fig. 55: Identifying Oxygen Sensor Harness Connector
Courtesy of AUDI OF AMERICA, INC.
20. Disconnect front exhaust pipe from catalytic converter. Remove front catalytic converter from turbocharger. See Fig. 57 and Fig. 58.
1. Bolt With Spring Fastener

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Fig. 57: Identifying Front Exhaust Pipe Front Exhaust Hanger
Courtesy of AUDI OF AMERICA, INC.
1. Catalyst Flange Fasteners

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Fig. 58: Identifying Catalytic Converter & Turbocharger Junction
Courtesy of AUDI OF AMERICA, INC.

21. Disconnect Leak Detection Pump (LDP) vacuum lines. See Fig. 59.
22. Disconnect Vehicle Speed Sensor (VSS). On Manual Transmission (M/T) disconnect harness connector from transmission (backup lights). Disconnect Anti-Lock Brake System (ABS) harness connectors. See Fig. 60.
23. Remove serpentine (ribbed) accessory drive belt. See ACCESSORY DRIVE BELTS. Remove viscous fan. See VISCOUS FAN. Remove power steering pump and position to the side and secure (DO NOT open power steering lines).

24. Remove support bracket between starter and cylinder block, disconnect wiring harness from starter. Remove starter from transmission. See Fig. 61.
25.

**NOTE:** Different mounting holes are provided for the different engine versions.

Remove upper engine-to-transmission bolts. Mark positions of left and right engine mount locating sleeves from bottom. See **Fig. 62**. Remove lower left and right engine mount nuts. If equipped with automatic transmission, raise vehicle, remove 3 torque converter bolts accessed through starter pinion hole at bell housing. See **Fig. 63**.
Fig. 62: Identifying Location Of Locating Sleeves (Mark Sleeves For Reinstallation)
Courtesy of AUDI OF AMERICA, INC.
Fig. 63: Identifying Access To Torque Converter Bolts
Courtesy of AUDI OF AMERICA, INC.

G00107799
CAUTION: When lifting engine, ensure crankcase housing ventilation tube does not contact the firewall (bulkhead) and that no lines get pinched.

For A4 A4, proceed with this step. For Passat, go to next step. Lift engine and transmission slightly using Workshop Crane (VAG 1202 A) to allow lower engine/transmission connecting bolts to be removed. See Fig. 64. Remove lower engine/transmission connecting bolts.

On Passat, raise vehicle, remove stop from front of engine at oil pan. See Fig. 66. Position Pole jack (VAG 1383A) under engine and fasten Adaptor Mount (T10062) to oil pan. USE one of the bolts from the stop bracket with 3 washers (each 4 mm thick), and put bolt and washers through Adaptor Mount (T10062) to bolt hole in oil pan. Tighten bolts to 30 N.m (22 ft. lbs.). See Fig. 67. Lift engine and transmission slightly to allow lower engine/transmission connecting bolts to be removed. Lift
engine only high enough to remove bolts.

Fig. 65: Modifying Adaptor Mount (T10062) For Passat Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.
1. Stop Bracket

G00135143

Fig. 66: Identifying Engine Stop Bracket At front of Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.
1. Original Bolt With 3 Washer (4 mm)

G00135141

Fig. 67: Using Pole Jack (VAG 1383 A) & Adaptor Mount (T10062) To Raise Engine
Courtesy of VOLKSWAGEN UNITED STATES, INC.

28. **CAUTION:** When lifting engine, ensure crankcase housing ventilation tube does not contact the firewall (bulkhead) and that no lines get pinched. DO NOT allow torque converter to fall out of bell housing.

On A4 and Passat, install Engine Support Bracket (10-222A) and Hooks (10-222A/2) to engine. Install Transmission Support (3147) to transmission bellhousing bolt hole. See Fig. 68 -Fig. 70.
Fig. 68: Installing Support Bridge (10-222A) & Trans Support Adaptor (3147) (A4)
Courtesy of AUDI OF AMERICA, INC.

Fig. 69: Installing Support Bridge (10-222A) & Trans Support Adaptor (3147) (Passat)
Courtesy of AUDI OF AMERICA, INC.
29. Carefully raise engine out of vehicle. Install engine to Support Clamp (VW 313) using engine/transmission Bracket (VW 540). See Fig. 71.
Installation

1. To install, reverse removal procedure. Always replace self-locking nuts. Ensure engine-to-transmission locating sleeves are properly installed in cylinder block. For manual transmission, go to next step. For automatic transmission, go to step 3.

2. **NOTE:** Manufacturer recommends using NEW pressure plate-to-flywheel bolts on installation.

For manual transmission, ensure dowel sleeves and intermediate plate are installed on block before installing transmission. Clean and lubricate transmission input shaft splines with lubricant (G 000100)
or equivalent. Make sure clutch disc and pressure plate are properly installed. See TORQUE SPECIFICATIONS. Make sure pilot needle bearing is installed. For more information on transmission servicing, see appropriate article in CLUTCHES. Go to step 5.

3. **NOTE:** Always replace seals and O-rings.

For automatic transmission, when mounting torque converter to drive plate, use only bolts specified for this use. Before installing engine, align torque converter and drive plate so that one hole in torque converter and one hole in drive plate are level with opening for starter. See Fig. 63.

4. **CAUTION:** If the torque converter is not installed correctly the torque converter, drive plate or the ATF pump will be seriously damaged when the transmission is attached to the engine.

Check installation position of torque converter. If the torque converter is installed correctly, the distance between contact surfaces at the mounting holes on the torque converter and contact surface of the bell housing flange (transmission 01V) will be approximately 23 mm (7/8”). If the torque converter was not completely installed, this distance will be approximately 11 mm (7/16 in.). See Fig. 72.
5. On all models, align engine to transmission bellhousing and install proper length bolts. Torque to specifications. See Fig. 73 and Fig. 74.
<table>
<thead>
<tr>
<th>Item</th>
<th>Bolt</th>
<th>Nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 8, 9, 10</td>
<td>M10 x 45</td>
<td>45</td>
</tr>
<tr>
<td>2, 3, 4, 11</td>
<td>M12 x 67</td>
<td>65</td>
</tr>
<tr>
<td>5</td>
<td>M12 x 110</td>
<td>65</td>
</tr>
<tr>
<td>6</td>
<td>M12 x 90</td>
<td>65</td>
</tr>
<tr>
<td>7</td>
<td>M10 x 60</td>
<td>45</td>
</tr>
</tbody>
</table>
Fig. 73: Identifying Transmission To Engine Bolt Length Reference (Automatic Transmission) 
Courtesy of AUDI OF AMERICA, INC.
### Items and Bolts Table

<table>
<thead>
<tr>
<th>Item</th>
<th>Bolt</th>
<th>Nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 3, 4</td>
<td>M12 x 67</td>
<td>65</td>
</tr>
<tr>
<td>2, 6</td>
<td>M12 x 90</td>
<td>65</td>
</tr>
<tr>
<td>5, 11</td>
<td>M12 x 110</td>
<td>65</td>
</tr>
<tr>
<td>7...10</td>
<td>M10 x 45</td>
<td>45</td>
</tr>
</tbody>
</table>

A: Centering sleeves
6. Engine alignment adjustment is necessary whenever engine is removed or mounts are loosened. To adjust, loosen through-bolt on engine mounts. Lightly rock engine and transaxle to shift as necessary. Tighten mount bolts. Align exhaust so components are free of stress. Tighten all bolts and nuts to specification. See TORQUE SPECIFICATIONS.

7. With the engine settled, adjust the front engine mount. Loosen front engine mount stop bracket, adjust so "stop" comes to rest on "stop buffer" under its own weight. Tighten fastener bolts to 30 N.m (22 ft. lbs.). See Fig. 75.
1 - Transverse line
2 - Stop buffer
3 - Stop
4 - Fastener Bolt 30 Nm (22 ft. lbs.)

G00135146
8. Verify engine fluid levels are filled to proper levels. Adjust clutch pedal (if equipped). For more information on transmission servicing, see appropriate article in CLUTCHES for manual transmission.

9. Refill and bleed air from cooling system. See COOLING SYSTEM BLEEDING .

10. Perform a test drive and check memory for Diagnostic Trouble Codes (DTC). See appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

11. Match engine electronics control module to throttle valve control module.
   - For 2001 Passat, see THROTTLE VALVE CONTROL MODULE (J338) in SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.
   - For 2002 Passat, see THROTTLE VALVE CONTROL MODULE (J338) in SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.
   - For 2001 A4, see FUNCTION 04 -- BASIC SETTING article in SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

12. Read Readiness Codes.
   - For 2001 Passat, see SELF-DIAGNOSTICS -- 1.8L TURBO article in ENGINE PERFORMANCE.
   - For 2002 Passat, see SELF-DIAGNOSTICS -- 1.8L TURBO article in ENGINE PERFORMANCE.
   - For 2001 A4, see SELF-DIAGNOSTICS -- A4 1.8L TURBO article in ENGINE PERFORMANCE.

13. If DTC memory has been erased or engine control module separated from permanent positive, readiness code must be generated again.

DRIVE PLATE (A/T)

Removal

NOTE: The following procedure is given assuming the transmission has been removed or the engine has been removed for servicing.

1. Mark the position of the drive plate relative to the engine. Also mark positions of the washer (1) and the shim (2) between the drive plate and the crankshaft flange. See Fig. 76.
2. Using appropriate counter hold tool, loosen the bolts in a cross pattern. Remove drive plate. See Fig. 77 and Fig. 78.
Fig. 77: Locking Drive Plate In Position Using Counter Hold Tool (VW 558)
Courtesy of AUDI OF AMERICA, INC.
Fig. 78: Identifying Location Of Bearing Bushing For Torque Converter
Courtesy of VOLKSWAGEN UNITED STATES, INC.
Installation

**NOTE:** Manufacturer recommends using NEW bolts on installation.

1. Install driveplate with shim. See Fig. 76. Using 3 of the old bolts inserted into flange, evenly spaced torque to 30 N.m (22 ft. lbs.).

2. Check dimension "A" at 3 points to milled surface of cylinder block. See Fig. 79. Dimension should be:

   - **A4**
     18.9-20.5 mm (0.744-0.807”)

   - **Passat**
     26-28 mm (1.023-1.102”)
3.

**NOTE:** Only one shim of the proper size may be used. Tighten flange bolts in a cross pattern.

If specification is incorrect, replace shim to obtain proper dimension. Once specification is attained, install NEW bolts and tighten in 3-step process. See **TORQUE SPECIFICATIONS**.

**DUAL-MASS FLYWHEEL (M/T)**

**Removal**
NOTE: The following procedure is given assuming the transmission has been removed or the engine has been removed for servicing.

NOTE: For flywheel (M/T) pilot needle bearing inspection. See PILOT NEEDLE BEARING (M/T).

1. Mark the position of the flywheel relative to the engine.
2. Using appropriate counter hold tool, loosen the bolts in a cross pattern. See Fig. 80. Remove flywheel.

Fig. 80: Locking Flywheel In Position Using Counter Hold Tool (VAG 10 201)
Courtesy of AUDI OF AMERICA, INC.
NOTE: Manufacturer recommends using NEW bolts on installation.

Install flywheel in reverse order of removal using NEW bolts. Tighten bolts to specification in a crisscross pattern. See TORQUE SPECIFICATIONS.

PILOT NEEDLE BEARING (M/T)

Removal & Installation

1. Remove transmission. See appropriate article in CLUTCHES. Remove flywheel.
2. Using Puller (Kukko 22/1) and Bearing Extractor (Kukko 21/1), remove pilot needle bearing. See Fig. 81.

G00107841

Fig. 81: Removing Pilot Needle Bearing
Courtesy of VOLKSWAGEN UNITED STATES, INC.
3. Use Bearing Driver (VW 207C) to install pilot needle bearing. See Fig. 82 and Fig. 83. For flywheel installation. See DRIVE PLATE (A/T) & FLYWHEEL (M/T).

G00115557

Fig. 82: Installing Pilot Needle Bearing Using (VW 207C)
Courtesy of VOLKSWAGEN UNITED STATES, INC.
INTAKE MANIFOLD

NOTE: Obtain radio code before disconnecting battery. Remove engine, without transmission, through front of engine compartment.

WARNING: The cooling system is pressurized when the engine is warm. When opening the expansion tank, wear gloves and other appropriate protection, cover the cap with a cloth and open carefully to relieve system pressure slowly.

1. Remove battery. Remove lower engine shield (noise insulator). See Fig. 18. Drain coolant, see DRAINING COOLING SYSTEM.
2. Remove cover for fuel injectors. Remove bolts securing fuel rail to intake manifold. Remove fuel injectors and rail together and rest aside on a clean shop towel. See Fig. 84.
3. Disconnect vacuum lines (1) through (4) from around intake manifold. Disconnect harness connector (5) from throttle body. Remove air intake tube (6) from throttle body. See Fig. 85.
4. At rear of manifold on bottom side, unbolt the 3 fasteners and move solenoid retainer plate aside
(vacuum lines and harness connectors can remain connected). See Fig. 86. Disconnect vacuum lines from brake booster. Disconnect Cam Position (CMP) Sensor. See Fig. 135.

5. Disconnect coolant hoses at upper coolant line. See Fig. 84. Disconnect upper coolant line at intake line and rear coolant flange at rear of cylinder head. See Fig. 87.
6. Disconnect crank case ventilation hose (1) at manifold. Remove brace (2). See Fig. 88. Remove oil dipstick and remove dipstick guide line bracket.
7. Unbolt intake manifold at flange and remove manifold. Block intake ports in cylinder head with clean shop towels. To install, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

8. Refill and bleed air from cooling system. See **COOLING SYSTEM BLEEDING**.

**Exhaust Manifold**

Removal and installation procedures are not available from manufacturer. See **TURBOCHARGER**. On installation, tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

**Turbocharger**

**WARNING:** The cooling system is pressurized when the engine is warm. When opening the expansion tank, wear gloves and other appropriate protection, cover the cap with a cloth and open carefully to relieve system pressure slowly.

**NOTE:** Obtain radio code before disconnecting battery. Remove engine, without transmission, through front of engine compartment. Always replace gaskets and self locking nuts.

**NOTE:** For help in identifying components and component locations, refer to illustrations. See **Fig. 91 - Fig. 97**.

**Removal & Installation**

1. Remove battery. Remove engine cover(s). Raise vehicle, remove lower engine shield (noise insulator). See **Fig. 18**. Drain coolant, see **DRAINING COOLING SYSTEM**.

2. **NOTE:** DO NOT let A/C compressor hang by hoses, do not open the A/C system.

   Unbolt A/C compressor. Move compressor aside and support with wire.

3. Unbolt turbo support bracket (2), disconnect oil return line (1) from turbo and move aside. Remove ducting from turbo (4 and 5). Remove pressure line banjo fitting (3). See **Fig. 89**.
4. Disconnect hose from support for charge air pressure regulator valve. Unbolt bracket for coolant supply line at charge air pressure regulator valve. Remove air intake duct between cowl and air cleaner housing.

5. Disconnect harness connectors from around air cleaner box. Remove air cleaner box. See Fig. 47.

6. Unbolt crankcase ventilation hose (1). Unbolt oil supply line bolts (3) at heat shield. Remove heat shield (4). Remove sleeve (2) from coolant return hose. Remove turbo return hose at line to turbo. The line remains bolted to turbocharger. Unbolt the oil supply line (7) from turbo. See Fig. 90.
7. Unbolt catalytic converter from turbocharger. Remove bolts from exhaust manifold. Position turbocharger to gain access to coolant supply line banjo fitting. Remove banjo fitting. Remove turbocharger.

8. **NOTE:** Before tightening turbocharger, loosely bolt coolant supply line to vacuum diaphragm for air pressure regulator valve. Tighten banjo fitting, then tighten mounting bolts for bracket to proper torque.

To complete installation, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**. For help in identifying intake ducting components, vacuum line routing and component locations, refer to **Fig. 93 -Fig. 97**.

9. Refill and bleed air from cooling system. See **COOLING SYSTEM BLEEDING**.
1. Only use original bolt

2. Gasket
   - Always replace

3. Catalytic converter
   - Always replace

5. 30 Nm (22 ft. lbs.)

7. Oil supply line
   - Tighten union nut to 23 Nm (17 ft. lbs.)
   - From oil filter bracket

8. 3.5 Nm (28 ft. lbs.)

11. Exhaust manifold
    - Always replace
    - Apply G052112A3 high temp.

12. 35 Nm (25 ft. lbs.)
    - Always replace

13. 10 Nm (7 ft. lbs.)

14. Banjo bolt - 30 Nm (22 ft. lbs.)

15. Gasket
    - Always replace
    - Note installation position

16. Coolant return line
    - Tighten union nut to 30 Nm (22 ft. lbs.)

17. 30 Nm (22 ft. lbs.)
    - Always replace

    - Apply D 000 600 Seal

20. Coolant supply hose/line
    - Apply D 000 600 Seal

21. Banjo bolt - 35 Nm (25 ft. lbs.)
    - Apply D 000 600 Seal

22. 10 Nm (7 ft. lbs.)

23. Gasket
    - Always replace

24. Oil return line
    - To oil pan

25. Gasket
    - Always replace

26. 10 Nm (7 ft. lbs.)

27. 10 Nm (7 ft. lbs.)

28. Turbocharger
Fig. 91: Identifying Exhaust Manifold & Turbocharger Components (A4)
Courtesy of AUDI OF AMERICA, INC.
Fig. 92: Identifying Exhaust Manifold & Turbocharger Components (Passat)
Courtesy of VOLKSWAGEN UNITED STATES, INC.
1 - Vacuum hose
   ♦ To Recirculating valve for turbocharger - N249-

2 - Recirculating valve

3 - Hose
   ♦ To recirculating valve

4 - Air duct hose
   ♦ To connection on turbocharger

5 - Hose
   ♦ To A/C valve

8 - Hose
   ♦ To crankcase breather line

9 - Pressure regulating valve
   ♦ For crankcase breather

10 - Hose
    ♦ To turbocharger

11 - Hose
    ♦ To vacuum unit for charge pressure regulating valve

12 - Wastegate Pressure Regulator valve
Fig. 93: Identifying Intake Ducting & Components (A4 & Passat)
Courtesy of AUDI OF AMERICA, INC.
1 - Air duct
2 - Rubber grommet
3 - Hose
4 - Air duct hose
    Between intake manifold and charge air cooler (intercooler)
5 - O-ring
    Replace, if damaged
6 - Charge Air Pressure sensor -G31-
7 - 3 Nm (26 ft. lbs.)
8 - Rubber grommet
Fig. 94: Identifying Intake Ducting & Components With Charge Air Cooler (A4)
Courtesy of AUDI OF AMERICA, INC.
1 - Activated charcoal filter (ACF)
2 - EVAP Canister Purge Regulator valve -N80-
3 - Non return valve for ACF
   - Between ACF container and intake line in front of exhaust turbocharger
   - Note position (light side/dark side) as shown in Fig; arrow faces in direction of flow
4 - Air cleaner
   - With Mass Air Flow (MAF) sensor -G70-
5 - Turbocharger
6 - Combination valve for secondary air inlet
7 - Fuel pressure regulator
8 - To brake servo
9 - Non-return valve
   - Between brake servo and intake line
   - Note position (light side/dark side) as shown in Fig; arrow faces in direction of flow
13 - Secondary Air Injection (AIR) Solenoid valve -N112-
   - Location: Below intake line
14 - Crankcase breather
15 - Non-return valve
   - Between ACF container and intake line
   - Note position (light side/dark side) as shown in Fig; arrow faces in direction of flow
16 - From Leak Detection Pump (LDP) -V144-
17 - Charge air cooler
   - With Charge Air Pressure sensor -G31-
18 - Throttle Valve Control Module -J338-
19 - Recirculating valve for turbocharger -N248-
   - Location: below intake line
20 - Intake manifold
   - With Intake Air Temperature (IAT) sensor -G42-
21 - Vacuum unit for charge pressure control
Fig. 95: Identifying Intake Ducting & Components With Charge Air Cooler (Passat)
Courtesy of VOLKSWAGEN UNITED STATES, INC.
1 - Activated charcoal filter (ACF)
2 - EVAP Canister Purge Regulator valve - N80-
3 - Non return valve for ACF
   - Between ACF container and intake line in front of exhaust turbocharger
   - Note position (light side/ dark side) as shown in Fig; arrow faces in direction of flow
4 - Air cleaner
   - With Mass Air Flow (MAF) sensor -G70-
5 - Turbocharger
6 - Combination valve for secondary air inlet
7 - Fuel pressure regulator
8 - To brake servo
9 - Non-return valve
   - Between brake servo and intake line
   - Note position (light side/ dark side) as shown in Fig; arrow faces in direction of flow
10 - Secondary Air Injection (AIR) Solenoid valve -N112-
    - Location: Below intake line
14 - Crankcase breather
15 - Non-return valve
   - Between ACF container and intake line
   - Note position (light side/ dark side) as shown in Fig; arrow faces in direction of flow
16 - From Leak Detection Pump (LDP) -V144-
17 - Charge air cooler
   - With Charge Air Pressure sensor -G31-
18 - Throttle Valve Control Module -J338-
19 - Recirculating valve for turbocharger -N249-
    - Location: below intake line
20 - Intake manifold
   - With intake Air Temperature (IAT) sensor -G42-
21 - Vacuum unit for charge pressure control
1 - EVAP canister
2 - Vent line
  ◆ From change-over valve at fuel tank
3 - Check-valve
  ◆ For EVAP canister system
4 - Turbocharger
5 - Combination valve
  ◆ For Secondary Air Injection (AIR) system
6 - Fuel pressure regulator
7 - To cylinder head cover
  ◆ Crankcase breather valve
8 - To brake booster
9 - Vacuum booster
10 - Vacuum reservoir
  ◆ To separate chambers
11 - To diagnostic pump
12 - Check-valve
  ◆ Bypass to vacuum booster
13 - Check-valve
  ◆ For engine vacuum control
14 - Crankcase ventilation
15 - Secondary Air Injection (AIR) solenoid valve -N112-
16 - Check-valve
  ◆ For EVAP canister system
17 - Check-valve
  ◆ For diagnostic pump
18 - Charge air pressure sensor -G31-
19 - Charge air pressure cooler
20 - Throttle valve control module
21 - Intake manifold
22 - Recirculating valve for turbocharger -N249-
23 - Pressure unit
  ◆ For charge air pressure regulation
  ◆ Part of turbocharger, cannot be replaced
24 - Wastegate bypass regulator valve
  ◆ Valve is activated (pulsed) by the Engine Control Module (ECM)
  ◆ Closed when no voltage present, lim Charges air pressure
  ◆ Checking activation:
25 - Deceleration shut-off valve
26 - Pressure regulation valve
  ◆ For crankcase ventilation
27 - Secondary Air Injection (AIR) pump -V101-
28 - Evaporative Emission (EVAP) canister purge regulator valve -N85-
CYLINDER HEAD COVER

Removal & Installation

1. Remove fasteners securing air duct. See Fig. 98. Remove air ducts to air filter box.
1. Air Duct
2. Air Duct
3. Air Duct Fasteners
2. Disconnect crankcase vent lines (1) and (2) from combination valve and cylinder head cover. Remove fasteners from head shield (if equipped). See Fig. 99. Carefully move secondary air inlet line to the side.

3. Disconnect ground wire, remove ignition coils and remove fasteners securing upper timing belt cover to the cylinder head cover. See Fig. 100. Remove cover fasteners (nuts) in small amounts, in several steps. See Fig. 101.
1. Ignition Coils
2. Ground
3. Ignition Coil Harness Connectors

Fig. 100: Identifying Ground Wire & Ignition Coils
Courtesy of AUDI OF AMERICA, INC.
4. Clean sealing surfaces on cylinder head. To install, reverse removal procedure. Before installation of cylinder head cover apply a thin layer of sealer (D 454 300 A2) at the points of cylinder head cover where leakage may occur. See Fig. 102. To prevent oil leaks, replace old gaskets.
5. Tighten cylinder head cover nuts in several steps. First tighten inner nuts, then tighten the outer nuts diagonally to specification. See **TORQUE SPECIFICATIONS**.

**CYLINDER HEAD**

**CAUTION:** DO NOT start engine for about 30 minutes after installing camshafts. Hydraulic valve lifters must settle or valves may strike pistons. Rotate crankshaft by hand 2 revolutions before starting engine to ensure valves do not strike pistons.

**NOTE:** When installing an exchange cylinder head with the camshafts installed, the contact surfaces between bucket tappet and cam running surface must be oiled after installation of the cylinder head.

**NOTE:** When installing a new cylinder head or cylinder head gasket, drain off all the old coolant and refill with new coolant.

**CAUTION:** ALWAYS REPLACE the cylinder head bolts. When performing repairs, replace seals, gaskets, self-locking nuts and bolts which have a specified tightening angle. DO NOT reuse torque to yield bolts.

**NOTE:** Cylinder heads which have cracks between the valve seats or the valve seat inserts and the spark plug thread can be used further without reducing service life, provided the cracks do not exceed a maximum of 0.3 mm in width, or when no more than the first 4 turns of the spark plug threads are cracked.

**Removal**

1. Release fuel pressure. See **FUEL PRESSURE RELEASE**. Disconnect negative battery cable.
2. Label and disconnect electrical connectors and vacuum hoses. Drain coolant. See **DRAINING COOLING SYSTEM**.
3. Remove cover for fuel injectors, wrap a rag around fuel supply and fuel return lines. Disconnect fuel lines at fuel rail connector. See **Fig. 40**. Seal fuel line to prevent dirt entry.
4. Disconnect power steering cooling coil located at lower left of radiator. Drain coolant from radiator (by disconnecting lower radiator hose). See **Fig. 11**.
5. Disconnect intake air ducting located near radiator support. See **Fig. 93**, **Fig. 94** and **Fig. 95**.
6. Disconnect headlight and turn signal electrical connectors. Disconnect coolant fan thermal switch located near lower coolant hose on left side of radiator.
7. Disconnect both horn connectors. See **Fig. 42**.
8. Remove bolts securing front of body (lock carrier) to vehicle. See **LOCK CARRIER**. Slide front of body (lock carrier) forward onto alignment tool. This will allow servicing of front engine components and facilitate removal of cylinder head.
9. Disconnect Mass Airflow (MAF) sensor electrical connector. Disconnect ignition coil power output stages harness connectors. Remove intake air duct between air cleaner and turbocharger. Disconnect
10. Disconnect engine coolant temperature sensor and the valve timing adjuster electrical connectors at back of cylinder head. See Fig. 103.

11. Remove upper timing belt cover. Place crankshaft at Top Dead Center (TDC) with No. 1 cylinder on compression stroke. See Fig. 116.

12. Remove tension from timing belt. See TIMING BELT. With tension removed, lift belt off of camshaft sprocket. Take pistons off Top Dead Center (TDC) by turning crankshaft back slightly.

13. Disconnect Camshaft Position (CMP) sensor on front of cylinder head. See Fig. 135. Disconnect ignition coils and ground wire from cylinder head cylinder head cover and set aside. Cut cable tie on cylinder head cylinder head cover and set wiring aside.

14. Disconnect coolant expansion tank. Disconnect hoses from left coolant line over intake manifold. Release retainers and remove coolant lines at back of cylinder head. Also at the back of cylinder head,
disconnect vacuum line from combination valve. Remove bolt (1) and remove bracket for oil feed line. Remove bolts (2) and (3), remove coolant flange. See Fig. 104.
1. Fastener For Oil Feed Line Bracket
2. Fastener For Coolnat Flange
3. Fastener For Coolnat Flange
4. Coolant Flange
5. Combination Valve

Fig. 104: Identifying Components At Back Of Cylinder Head
Courtesy of AUDI OF AMERICA, INC.
15. Remove intake manifold support. Disconnect heated oxygen sensor connector at left side of plenum and set aside.

16. Remove bolts of oil feed line. Remove the exhaust manifold to turbocharger bolts. See Fig. 105.

1. Oil Feed Line Fastener
2. Oil Feed Line Fastener
3. Exhaust Manifold To Turbocharger Bolts

Fig. 105: Identifying Oil Feed Line & Turbocharger Bolts For Removal
17. Remove cylinder head cover. See CYLINDER HEAD COVER.

18. **NOTE:** When cylinder head cover has been removed, take note of oil deflector positioning. On Polydrive cylinder head bolts, use tool (3452).

Loosen head bolts in sequence, in small amounts, until all bolts are loose. See Fig. 106. Remove cylinder head from vehicle.

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**Fig. 106: Cylinder Head Bolt Loosening Sequence**

Courtesy of AUDI OF AMERICA, INC.

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**Inspection**

Thoroughly clean all gasket mating surfaces. Check cylinder head for warpage. Maximum warpage is 0.100 mm. (004”). Check minimum cylinder head height and replace cylinder head (if necessary). See
**CYLINDER HEAD** under OVERHAUL. See **CYLINDER HEAD** under ENGINE SPECIFICATIONS.

**Installation**

**CAUTION:** If cam followers or camshaft have been removed and followers are charged with oil, allow 30 minutes for followers to bleed down before starting engine. Pistons may strike valves, resulting in bent valves.

**NOTE:** DO NOT reuse antifreeze after replacing cylinder block, cylinder head, head gasket, radiator and/or heater core.

**CAUTION:** ALWAYS REPLACE the cylinder head bolts. When performing repairs, replace seals, gaskets, self-locking nuts and bolts which have a specified tightening angle. DO NOT reuse torque to yield bolts.

**NOTE:** Remove all coolant or oil from cylinder head bolt threaded holes in cylinder block.

1. If using original equipment cylinder head gasket, ensure part number on cylinder head gasket faces up and is readable from the intake side of cylinder block. Install gasket on cylinder block. DO NOT use any type of sealant.
2. Align camshaft timing marks and position crankshaft at Top Dead Center (TDC). See Fig. 116. Ensure pistons are not at TDC. If necessary turn crankshaft backwards slightly.
3. Loosen the bolts on turbocharger support bracket. This will allow slight movement at the turbocharger, which should aid in installing cylinder head.
4. **NOTE:** When torquing down head bolts, DO NOT use torque wrench on the final 1/4 turn on the head bolts.

Carefully position cylinder head on cylinder block. Install NEW head bolts finger tight. Tighten cylinder head bolts (in several steps) in sequence to specification. See Fig. 107. See **TORQUE SPECIFICATIONS**.
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Fig. 107: Cylinder Head Bolt Tightening Sequence
Courtesy of AUDI OF AMERICA, INC.

5. Before installation of cylinder head cover apply a thin layer of sealer (D 454 300 A2) at the points of cylinder head cover where leakage may occur. See Fig. 102.

6. Install timing belt. See TIMING BELT.

7. Install new seal between turbocharger and exhaust manifold. To complete installation, reverse removal procedure.

8. Refill and bleed air from cooling system. See COOLING SYSTEM BLEEDING.

9. Secure lock carrier to body. See LOCK CARRIER.

CRANKSHAFT FRONT OIL SEAL

NOTE: For help in identifying components and component locations, refer to illustration. See Fig. 108.
1. Remove timing belt. See TIMING BELT.

2. Remove crankshaft timing belt sprocket, by counter-holding sprocket with Holding Tool (3415) tool.

Fig. 108: Identifying Crankshaft Oil Seals & Front & Rear Sealing Flanges
Courtesy of VOLKSWAGEN UNITED STATES, INC.
See Fig. 109. To guide oil seal extractor, screw center bolt as far into crankshaft as possible, by hand. See Fig. 110.

Fig. 109: Removing Crankshaft Timing Belt Sprocket Using Holding Tool (3415)
Courtesy of VOLKSWAGEN UNITED STATES, INC.
3. Unscrew inner part of oil seal extractor 9 turns (about 20 mm) out of the outer section, and lock with knurled screw. Lubricate threaded head of Oil Seal Extractor (3203), place in position and while exerting firm pressure, screw as far as possible into oil seal. See Fig. 111.
4. Loosen knurled screw and turn inner part against crankshaft until oil seal is pulled out.

Installation

NOTE: Replace crankshaft center bolt with a NEW bolt (DO NOT reuse torque to yield bolt).

NOTE: DO NOT lube threads or shoulder of NEW bolt, install dry.

NOTE: If using a new PTFE oil seal, DO NOT lubricate sealing lip or outer circumference of new oil seal. PTFE oil seal can be identified by a sealing lip with a wider design and there is no annular spring. PTFE sealing surface has a thread-like design. PTFE seals MUST be aligned to rotation direction of shaft. There is an arrow marking direction of rotation on face of PTFE sealing ring. Installing in wrong rotation direction will cause oil leakage.

1. Place Guide Sleeve (T10053/1) onto crankshaft journal. Push oil seal over guide sleeve. Using center bolt (T10053/2, M16 x 1.4 x 60), press seal completely into position with Press Sleeve (T10053). See Fig. 112 and Fig. 113.
Fig. 112: Installing Guide Sleeve (T10053/1) Over Crank Journal
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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2. Reinstall crankshaft timing belt sprocket, by holding sprocket with Holding Tool (3415). Install NEW bolt and tighten to specification. See **TORQUE SPECIFICATIONS**. See **Fig. 109**. To complete installation, reverse removal procedure.

**CRANKSHAFT FRONT OIL SEAL FLANGE**

**Removal & Installation**

1. Remove timing belt. See **TIMING BELT**.
2. Drain engine oil. Remove oil pan. See **OIL PAN**.
3. Remove flange from block, to loosen tap lightly with a rubber hammer. Remove old sealant from block using a flat scraper. Using a plastic wheel remove old sealant from flange mating surface. See **Fig. 114**. Ensure mating surface is not damaged during cleaning.
4. **NOTE:** If using a new PTFE oil seal, DO NOT lubricate sealing lip or outer circumference of new oil seal. PTFE oil seal can be identified by a sealing lip with a wider design and there is no annular spring. PTFE sealing surface has a thread-like design. PTFE seals MUST be aligned to rotation direction of shaft. There is an arrow marking direction of rotation on face of PTFE sealing ring. Installing in wrong rotation direction will cause oil leakage.

Apply silicone sealant in a 3 mm (0.1") bead along flange mating surface. See Fig. 115. With seal already installed in flange, DO NOT lubricate lip of NEW seal. Place Guide Sleeve (T10053/1) onto crankshaft journal. See Fig. 112.
5. Push oil seal over guide sleeve. Slide flange over crank journal, lightly tighten all flange bolts by hand. In a crisscross pattern, tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

6. If oil seal is not installed, install flange and in a crisscross pattern tighten bolts to specification. See **TORQUE SPECIFICATIONS**. Install crankshaft oil seal. See **CRANKSHAFT FRONT OIL SEAL**. Allow 30 minutes for sealant on flange to dry before adding oil to engine.

7. Continue installation in reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

**TIMING BELT**

**CAUTION:** DO NOT turn crankshaft or camshaft with timing belt removed. Valve damage may result.

**NOTE:** Hydraulic plunger type timing belt tensioners are oil filled, when compressing the plunger it must be pressed back in slowly and with even pressure. With plunger completely extended this procedure can take up to 5 minutes. Excessive force during compression can damage the tensioner. Testing of hydraulic tensioner not provided by manufacturer. Replace
Removal (A4)

1. Disconnect negative battery cable. Remove lower engine shield (noise insulator). See Fig. 18.
2. Move lock carrier to service position. See LOCK CARRIER. Attach Alignment Tools to chassis. Slide front of body forward onto alignment tool. This will allow servicing of front engine components.
3. Remove accessory drive belts. See ACCESSORY DRIVE BELTS. Remove serpentine belt tensioner.
4. Remove viscous fan from mounting. See VISCOUS FAN (ENGINE COOLING). Remove upper timing belt cover.
5. Rotate crankshaft by hand in normal direction of rotation to Top Dead Center (TDC). See Fig. 116. Remove crankshaft vibration damper pulley from crankshaft sprocket. Remove lower timing belt cover.

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**Removal (A4)**

1. Disconnect negative battery cable. Remove lower engine shield (noise insulator). See Fig. 18.
2. Move lock carrier to service position. See LOCK CARRIER. Attach Alignment Tools to chassis. Slide front of body forward onto alignment tool. This will allow servicing of front engine components.
3. Remove accessory drive belts. See ACCESSORY DRIVE BELTS. Remove serpentine belt tensioner.
4. Remove viscous fan from mounting. See VISCOUS FAN (ENGINE COOLING). Remove upper timing belt cover.
5. Rotate crankshaft by hand in normal direction of rotation to Top Dead Center (TDC). See Fig. 116. Remove crankshaft vibration damper pulley from crankshaft sprocket. Remove lower timing belt cover.

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**Removal (A4)**

1. Disconnect negative battery cable. Remove lower engine shield (noise insulator). See Fig. 18.
2. Move lock carrier to service position. See LOCK CARRIER. Attach Alignment Tools to chassis. Slide front of body forward onto alignment tool. This will allow servicing of front engine components.
3. Remove accessory drive belts. See ACCESSORY DRIVE BELTS. Remove serpentine belt tensioner.
4. Remove viscous fan from mounting. See VISCOUS FAN (ENGINE COOLING). Remove upper timing belt cover.
5. Rotate crankshaft by hand in normal direction of rotation to Top Dead Center (TDC). See Fig. 116. Remove crankshaft vibration damper pulley from crankshaft sprocket. Remove lower timing belt cover.

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**Removal (A4)**

1. Disconnect negative battery cable. Remove lower engine shield (noise insulator). See Fig. 18.
2. Move lock carrier to service position. See LOCK CARRIER. Attach Alignment Tools to chassis. Slide front of body forward onto alignment tool. This will allow servicing of front engine components.
3. Remove accessory drive belts. See ACCESSORY DRIVE BELTS. Remove serpentine belt tensioner.
4. Remove viscous fan from mounting. See VISCOUS FAN (ENGINE COOLING). Remove upper timing belt cover.
5. Rotate crankshaft by hand in normal direction of rotation to Top Dead Center (TDC). See Fig. 116. Remove crankshaft vibration damper pulley from crankshaft sprocket. Remove lower timing belt cover.

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**Removal (A4)**

1. Disconnect negative battery cable. Remove lower engine shield (noise insulator). See Fig. 18.
2. Move lock carrier to service position. See LOCK CARRIER. Attach Alignment Tools to chassis. Slide front of body forward onto alignment tool. This will allow servicing of front engine components.
3. Remove accessory drive belts. See ACCESSORY DRIVE BELTS. Remove serpentine belt tensioner.
4. Remove viscous fan from mounting. See VISCOUS FAN (ENGINE COOLING). Remove upper timing belt cover.
5. Rotate crankshaft by hand in normal direction of rotation to Top Dead Center (TDC). See Fig. 116. Remove crankshaft vibration damper pulley from crankshaft sprocket. Remove lower timing belt cover.
Fig. 117: Exploded View Of Timing Belt Components (A4)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

6. If timing belt is to be reused, mark direction of rotation on belt. Socket Head Fastener (T10092) or a threaded stud onto timing belt tensioner. Screw (T10092) or threaded stud M5 x 55 (1) into timing belt tensioner.
belt tensioner. See Fig. 118. If using threaded stud M5 x 55, fit a hexagon nut with large washer onto threaded stud. Align tensioner pressure piston so holes in the piston line up with hole in housing. Install Locking Pin (T40011) or a suitable pin through hole to lock piston in place. See Fig. 118.

7. Remove timing belt.

Installation (A4)

CAUTION: When turning camshaft, crankshaft must NOT be at TDC of any cylinder. This is an interference engine, damage to valves and pistons may occur.

1. Align mark on camshaft sprocket with mark on cylinder head cover and/or timing belt guard. See Fig. 116. Install timing belt on crankshaft timing belt sprocket. Install lower timing belt cover.
2. Install vibration damper pulley in original location with one old bolt.
3. Put crankshaft at Top Dead Center (TDC) mark. See Fig. 116. Install timing belt in the order of coolant pump, tightening roller, and camshaft sprocket (taking up slack in belt). DO NOT let crankshaft rotate as belt is installed.
4. With timing marks aligned, and very little slack on the water pump side of the belt, unscrew Socket Head Fastener (T10092) or threaded stud on timing belt tensioner. Remove locking pin from automatic tensioner. See Fig. 118.
5. Allow tensioner to stabilize wait 1 minute. Turn crankshaft 2 full revolutions in normal direction of rotation using crankshaft sprocket center bolt. Ensure camshaft and crankshaft sprockets align with their reference marks. Repeat timing belt procedure if marks are out of alignment. Once again, rotate crankshaft 2 revolutions in running direction and stop on TDC and recheck.
6. Install vibration damper pulley to crankshaft timing sprocket using NEW bolts. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Install timing belt covers.
7. Install viscous fan. See VISCOUS FAN (ENGINE COOLING).
8. Install accessory drive belt. See ACCESSORY DRIVE BELTS. Install lock carrier to original position. See LOCK CARRIER. To complete installation, reverse removal procedure.

Removal (Passat Up To 7/2000)

1. Disconnect negative battery cable. Remove lower engine shield (noise insulator). See Fig. 18.
2. Move lock carrier to service position. See LOCK CARRIER. Attach Alignment Tools to chassis. Slide front of body forward onto alignment tool. This will allow servicing of front engine components.
3. Rotate serpentine belt tensioner clockwise and remove serpentine belt. See ACCESSORY DRIVE BELTS. Remove serpentine belt tensioner.
4. Remove upper timing belt cover. Rotate crankshaft by hand to Top Dead Center (TDC). See Fig. 116. Remove crankshaft vibration damper pulley. Remove lower timing belt cover.
5. If timing belt is to be reused, mark direction of rotation on belt. Socket Head Fastener (T10092) or a threaded stud onto timing belt tensioner. Screw (T10092) or threaded stud M5 x 55 (1) into timing belt tensioner. See Fig. 118. If using threaded stud M5 x 55, fit a hexagon nut with large washer onto threaded stud. Align tensioner pressure piston so holes in the piston line up with hole in housing. Install locking pin (T40011) or a suitable pin through hole to lock piston in place. See Fig. 118.
6. CAUTION: When turning camshaft, crankshaft must NOT be at TDC of any cylinder. This is an interference engine, damage to valves and pistons may occur.

Remove timing belt from engine. Turn crankshaft back slightly.
Fig. 119: Exploded View Of Timing Belt Components (Passat)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Installation (Passat Up To 7/2000)
CAUTION: When turning camshaft, crankshaft must NOT be at TDC of any cylinder. This is an interference engine, damage to valves and pistons may occur.

1. Align mark on camshaft sprocket with mark on cylinder head cover and/or timing belt guard. Install timing belt on crankshaft timing belt sprocket. Install lower timing belt cover.

2. Install vibration damper pulley using NEW bolts. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Put crankshaft at Top Dead Center (TDC) mark. See Fig. 116.

3. Install timing belt in the order of water pump, tensioner pulley and camshaft sprocket (taking up slack in belt). DO NOT let crankshaft rotate as belt is installed.

4. With timing marks aligned, and very little slack on the water pump side of the belt, unscrew Socket Head Fastener (T10092) or threaded stud on timing belt tensioner. Remove locking pin from auto-tensioner. See Fig. 118.

5. Allow tensioner to stabilize wait 1 minute. Turn crankshaft 2 full revolutions in normal direction of rotation. Ensure camshaft and crankshaft sprockets align with their timing marks. Repeat timing belt procedure if marks are out of alignment. Once again, rotate crankshaft 2 revolutions in running direction and stop on Top Dead Center (TDC) and recheck.

6. Install timing belt covers. Install serpentine drive belt tensioner and tighten to specification. See TORQUE SPECIFICATIONS.

7. Install accessory drive belt. See ACCESSORY DRIVE BELTS. Install lock carrier to body. See LOCK CARRIER. To complete installation, reverse removal procedure. See TORQUE SPECIFICATIONS.

Removal (Passat After 8/00)

1. Disconnect negative battery cable. Remove lower engine shield (noise insulator). See Fig. 18.

2. Move lock carrier to service position. See LOCK CARRIER. Attach alignment tools to chassis. Slide front of body forward onto alignment tool. This will allow servicing of front engine components.

3. Remove accessory (serpentine) drive belts. See ACCESSORY DRIVE BELTS. Remove serpentine drive belt tensioner from engine block.

4. Rotate crankshaft by hand to Top Dead Center (TDC). See Fig. 116. Remove upper timing belt covers.

5. Remove crankshaft vibration damper pulley. Remove lower timing belt cover.

6. **CAUTION:** Timing belt tensioner is an oil damper device and can only be compressed slowly and with equal force. Excessive force during compression can damage tensioner.

Insert an hex wrench into hex socket up to stop. Press tensioner pulley in counterclockwise direction with uniform (non-excessive) force until timing belt tensioner can be aligned using Locking Plate (T10008). See Fig. 120.
7. **NOTE:** Impact tab "A" of pin wrench must not be bent. See Fig. 121.

To loosen toothed belt, loosen nut (1) of tightening roller and turn Pin Wrench (3387) clockwise. See Fig. 121. Remove timing belt. Rotate crankshaft back slightly.
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Fig. 121: Removing Timing Belt (With Adjustable Type Roller)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Installation (Passat After 8/00)

CAUTION: When turning camshaft, crankshaft must NOT be at TDC of any cylinder. This is an interference engine, damage to valves and pistons may occur.

NOTE: If the timing belt tensioner is completely extended, it must be pressed back in installed position. This procedure can take up to 5 minutes. Excessive force during compression can damage tensioner.

1. Align mark on camshaft sprocket with mark on timing belt guard. See Fig. 116.
2. Install timing belt on crankshaft timing belt sprocket. Install lower timing belt cover.
3. Install vibration damper pulley using NEW bolts. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

4. Put crankshaft at Top Dead Center (TDC) mark. See **Fig. 116**. Install timing belt in the order of water pump, tightening roller and camshaft sprocket (taking up slack in belt). DO NOT let crankshaft rotate as belt is installed.

5. To correctly tension timing belt, turn pin wrench counterclockwise (tab of pin wrench must not be bent) using pin wrench (3387) pin wrench until Locking Plate (T10008) can be removed without tension. See **Fig. 122**.

6. Turn pin wrench to the right in clockwise direction (direction of arrow) until an 8 mm drill bit can be pulled through tightening lever and tensioner housing. See **Fig. 123**. Hold tensioner pulley in this position, and tighten securing nut to 20 ft. lbs. (27 N.m).
7. Turn crankshaft 2 full revolutions in normal direction of rotation and check that camshaft and crankshaft sprockets align with their reference marks. Repeat timing belt procedure if marks are out of alignment. Once again, rotate crankshaft 2 revolutions in running direction. Stop at TDC and recheck all timing marks.

8. Recheck clearance between tightening lever and tensioner housing. See Fig. 123. Clearance should be 6-10 mm (.24-.40"). If clearance is not correct, readjusting timing belt tension.

9. Install timing belt covers. Install serpentine drive belt tensioner and tighten bolt to specification. See TORQUE SPECIFICATIONS. Install serpentine drive belt. See ACCESSORY DRIVE BELTS.

10. Install lock carrier to body. See LOCK CARRIER. To complete installation, reverse removal procedure.

CAMSHAFTS

**CAUTION:** If camshaft needs to be turned, crankshaft must NOT be at TDC of any cylinder. This is an interference engine, damage to valves and pistons may occur.

**NOTE:** For help in identifying components and component locations, refer to Fig. 124.
Removal (A4)

1. Gain access to camshaft sprocket. Remove upper timing belt cover. Remove cylinder head cover. See CYLINDER HEAD COVER. Place crankshaft at Top Dead Center (TDC) with No. 1 cylinder on compression stroke. See Fig. 116.

2. Remove tension from timing belt. See TIMING BELT. With tension removed, lift belt off of camshaft sprocket. Using Camshaft Holder (3036), remove camshaft sprocket bolt. Remove camshaft sprocket. Remove Camshaft Position (CMP) sensor housing and its components.

3. Mark installation position on bearing caps with a colored marker. See Fig. 125.
4. Secure chain tensioner by installing Chain Tensioner (3366). Tighten to keep slight pressure on chain between camshafts. DO NOT overtighten chain tensioner. See Fig. 126. Mark on camshafts must be in line with arrows on bearing caps. See "A" and "B" in Fig. 127.
Fig. 126: Identifying Camshaft Chain Adjuster Retainer Tool
Courtesy of VOLKSWAGEN UNITED STATES, INC.
5. Clean camshaft drive chain and chain sprockets. Align the marks on the cam sprocket with arrows on the bearing caps. Using paint, mark chain and sprockets opposite arrows on bearing caps. Distance between both arrows (and between paint markings) is 16 rollers on the chain. See Fig. 128.

6. Remove camshaft intake and exhaust bearing caps No. 3 and No. 5. Loosen bolts in small amounts evenly in a crisscross manner. See Fig. 125.

7. Remove double bearing cap. Remove both bearing caps at chain sprockets on intake and exhaust camshafts.

8. Remove chain tensioner securing bolts.

9. Remove intake and exhaust camshaft 2nd and 4th bearing caps using alternate and cross-over sequence.

10. Remove intake and exhaust camshafts with chain tensioner and retainer for Chain Tensioner (3366) from cylinder head.
Inspection

Check camshaft bearing oil clearance. See CAMSHAFT table under ENGINE SPECIFICATIONS. If oil clearance is not within specification, install new camshaft and recheck clearance. If clearance still exceeds specification, replace cylinder head. Check camshaft end play. See VALVE TRAIN under OVERHAUL.

CAUTION: If cam followers are charged with oil, allow 30 minutes for followers to bleed down before starting engine. Pistons may strike valves, resulting in bent valves.

Installation (A4)

1. Replace chain tensioner rubber/metal gasket and coat shaded area lightly with sealant (AMV 188 001 02). See Fig. 129. Slide chain tensioner between drive chain.

2. Place camshafts in cylinder head. Ensure lobes for No. 1 cylinder are pointed upward. See Fig. 124. Fit drive chain onto both camshafts relative to the marks.

3. Install drive chain on camshaft sprockets. When old chain is being reused, check position of marks made on camshafts sprockets relative to one another (positioning should be close to prior to removal).
See **Fig. 128**. If a new chain is being installed, distance between Notch "A" and "B" must equal 16 drive chain rollers. Notch "A" is slightly off set inward toward drive chain roller (1). See **Fig. 127**.

4. Push camshaft adjuster between drive chain (2 technicians required).

5. **NOTE:** When installing the bearing caps, ensure that the cap markings can be read from the intake side of the cylinder head. Take note of dowel sleeves for bearing caps and camshaft adjuster. Ensure dowels are in cylinder head.

Oil running surfaces of camshafts. Place camshafts with drive chain in cylinder head. Tighten chain tensioner to 10 N.m (89 INCH lbs.). Tighten camshaft bearing caps No. 2 and No. 4 evenly to 10 N.m (89 INCH lbs.). Install both bearing caps at chain sprockets for intake and exhaust camshafts. Tighten bearing caps to 10 N.m (89 INCH lbs.). Ensure camshafts are positioned correctly. Remove retainer for chain tensioner (3366).

6. Lightly coat hatched area of double bearing cap with sealant (AMV 188 001 02). See **Fig. 130**. Ensure dowel sleeves are installed. Install double bearing cap. Tighten bolts to 10 N.m (89 INCH lbs.).

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**Fig. 130: Applying Sealant (AMV 188 001 02 Or D 454 300 A2) To Double Bearing Cap**
Courtesy of VOLKSWAGEN UNITED STATES, INC.

7. Install remaining bearing caps and tighten to 10 N.m (89 INCH lbs.). Ensure dowel sleeves are installed.

8. Install timing belt cam sprocket, ensure timing mark for No. 1 is facing outward and visible from the front. Install securing bolt for cam sprocket, torque to 88 N.m (65 ft. lbs). Install Camshaft Position Sensor (CMP).

9. To complete installation, reverse removal procedure. If cam followers are charged with oil, allow 30 minutes for followers to bleed down before starting engine. Before starting engine, manually turn crankshaft 2 complete turns. Ensure valves do not make contact pistons.

**Removal (Passat)**

1. Gain access to camshaft sprocket. Remove upper timing belt cover. Remove cylinder head cover. See **CYLINDER HEAD COVER**. Place crankshaft at Top Dead Center (TDC) with No. 1 cylinder on compression stroke. See **Fig. 116**.

2. Remove tension from timing belt. See **TIMING BELT**. With tension removed, lift belt off of camshaft sprocket. Turn crankshaft back slightly. Using Camshaft Holder (3036), remove camshaft sprocket bolt. Remove camshaft sprocket. Remove Camshaft Position (CMP) sensor housing and its components.
3. Clean camshaft drive chain and chain sprockets. Moving only the cams, align the marks on the cam sprocket with arrows on the bearing caps. Using paint, mark chain and sprockets opposite arrows on bearing caps. Distance between both arrows (and between paint markings) is 16 rollers on the chain. See Fig. 128. If a new chain is being installed, distance between Notch "A" and "B" must equal 16 drive chain rollers. Notch "A" is slightly off set inward toward drive chain roller (1). See Fig. 127.

4. Mark installation position on bearing caps with a colored marker. Secure chain tensioner, install Chain Tensioner (3366). Tighten tensioner to keep slight pressure on chain between camshafts. DO NOT overtighten chain tensioner. See Fig. 126.

5. Remove intake and exhaust camshafts with chain tensioner and retainer for chain tensioner (3366) from cylinder head.

6. Remove camshaft intake and exhaust bearing caps No. 3 and 5. Loosen bolts in small amounts evenly in a crisscross manner. See Fig. 125.

7. Remove double bearing cap. Remove both bearing caps at chain sprockets on intake and exhaust camshafts. Remove chain tensioner securing bolts. Remove intake and exhaust camshaft 2nd and 4th bearing caps using alternate and cross-over sequence.

**Inspection**

Check camshaft bearing oil clearance. See CAMSHAFT table under ENGINE SPECIFICATIONS. If oil clearance is not within specification, install new camshaft and recheck clearance. If clearance still exceeds specification, replace cylinder head. Check camshaft end play. See VALVE TRAIN under OVERHAUL.

**CAUTION:** If cam followers are charged with oil, allow 30 minutes for followers to bleed down before starting engine. Pistons may strike valves, resulting in bent valves.

**Installation (Passat)**

**NOTE:** When installing the bearing caps, ensure that the cap markings can be read from the intake side of the cylinder head.

1. Place camshafts in cylinder head. Ensure lobes for No. 1 cylinder are pointed upward. See Fig. 124. Fit drive chain onto both camshafts relative to the marks. Replace chain tensioner rubber/metal gasket and coat shaded area lightly with sealant (D 454 300 A2). See Fig. 129. Slide chain tensioner between drive chain.

2. **NOTE:** Take note of dowel sleeves installed position.

   Oil running surfaces of camshafts. Place camshafts with drive chain in cylinder head. Tighten chain tensioner to 10 N.m (89 INCH lbs.). Tighten camshaft bearing caps No. 2 and No. 4 evenly to 10 N.m (89 INCH lbs.). Install both bearing caps at chain sprockets for intake and exhaust camshafts. Ensure camshafts are positioned correctly. Tighten bearing caps to 10 N.m (89 INCH lbs.). Remove retainer for Chain Tensioner (3366).

3. Lightly coat hatched area of double bearing cap with sealant (D 454 300 A2). See Fig. 130. Install and tighten double bearing cap bolts to 10 N.m (89 INCH lbs.). Ensure dowel sleeves are installed correctly.

4. Install remaining bearing caps and tighten to 10 N.m (89 INCH lbs.). Ensure dowel sleeves are installed correctly. When old chain is being reused, check position of marks made on camshafts sprockets relative to one another (positioning should be close to prior to removal). See Fig. 128. If a
new chain is being installed, distance between notch "A" and "B" must equal 16 drive chain rollers. Notch "A" is slightly off set inward toward drive chain roller. See Fig. 127.

5. Install timing belt camshaft sprocket. Ensure timing mark for No. 1 is facing outward and visible from the front. Install securing bolt for camshaft sprocket and tighten to specification. See TORQUE SPECIFICATIONS. Install Camshaft Position Sensor (CMP).

6. To complete installation, reverse removal procedure. If cam followers are charged with oil, allow 30 minutes for followers to bleed down before starting engine. Before starting engine, manual turn crankshaft 2 complete turns. Ensure valves do not make contact pistons.

CAMSHAFT DRIVE CHAIN

For camshaft drive chain removal and installation procedures, see CAMSHAFTS.

CAMSHAFT OIL SEALS

CAUTION: DO NOT turn crankshaft or camshaft with timing belt removed. Valve damage may result.

CAUTION: DO NOT allow camshaft to turn when removing camshaft sprocket bolt.

Removal (Exhaust Camshaft)

1. Place lock carrier in service position. See LOCK CARRIER. On A4, remove engine cover.
2. On all models, remove upper timing belt cover. Place crankshaft at Top Dead Center (TDC) with No. 1 cylinder on compression stroke. Ensure crankshaft and camshaft timing marks are aligned. See Fig. 116.
3. Turn crankshaft back slightly. Remove tension from timing belt. See TIMING BELT.
4. Using Camshaft Holder (3036) to hold camshaft sprocket stationary, remove camshaft sprocket bolt. Remove camshaft sprocket. Install camshaft sprocket bolt and washer until bolt comes to a stop (hand tight) against camshaft. See Fig. 131.
5. Unscrew inner part of (2085) oil seal extractor 2 turns (about 3 mm) out of the outer section and lock with knurled screw. See Fig. 132. Lubricate threaded head of oil seal extractor, place in position and while exerting firm pressure, screw as far as possible into oil seal.
6. Loosen knurled screw and turn inner part against crankshaft until oil seal is pulled out.

Installation (Exhaust Camshaft)

NOTE: If using a new PTFE oil seal, DO NOT lubricate sealing lip or outer circumference of new oil seal. PTFE oil seal can be identified by a sealing lip with a wider design and there is no annular spring. PTFE sealing surface has a thread-like design. PTFE seals MUST be aligned to rotation direction of shaft. There is an arrow marking direction of rotation on face of PTFE sealing ring. Installing in wrong rotation direction will cause oil leakage.

1. Using Guide Sleeve (T 10071/1), slide seal until flush with head. See Fig. 133.
2. Using seal installer with Press Sleeve (T 10071/3) and Bolt (T 10071/4). Install new camshaft oil seal flush into cylinder head. See Fig. 134.
3. Install camshaft sprocket. Camshaft sprocket is correctly installed when narrow web of sprocket faces outward (toward front of car). Camshaft timing mark should be visible. Install and tighten camshaft sprocket bolt. See **TORQUE SPECIFICATIONS**.

4. Install timing belt. See **TIMING BELT**.

5. Install lock carrier to body. See **LOCK CARRIER**.

To complete installation, reverse removal procedure. Tighten all bolts and nuts to specification. See **TORQUE SPECIFICATIONS**.

**Removal (Intake Camshaft)**

1. Place lock carrier in service position. See **LOCK CARRIER**.
2. Remove upper timing belt cover.
3. Disconnect electrical connector from Camshaft Position (CMP) sensor. See **Fig. 135**.
4. Unbolt Camshaft Position (CMP) sensor. See Fig. 124. Remove CMP sensor hood (shutter wheel) bolt and lift off shutter wheel.

5. Screw Oil Seal Extractor (2058/1 bolt) into camshaft. See Fig. 136. Unscrew inner part of Oil Seal Extractor (2085/1) 2 turns (about 3 mm or 0.118") out of outer part, and lock with knurled screw. See Fig. 137.
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Fig. 136: Installing Oil Seal Extractor (2085/1) Into Intake Camshaft
Courtesy of AUDI OF AMERICA, INC.
6. Lubricate thread head of oil seal extractor, place it in position while applying firm pressure screw it as far as into oil seal. Loosen knurled screw and turn inner part of extractor against camshaft until oil seal has been extracted.

Installation (Intake Camshaft)

NOTE: If using a new PTFE oil seal, DO NOT lubricate sealing lip or outer circumference of new oil seal. PTFE oil seal can be identified by a sealing lip with a wider design, and there is no annular spring. PTFE sealing surface has a thread-like design. PTFE seals MUST be aligned to rotation direction of shaft. There is an arrow marking direction of rotation on face of PTFE sealing ring. Installing in wrong rotation direction will cause oil leakage.

1. Check edge chamfer end of camshaft for burrs or sharp edges. If necessary, smooth edge with an oil stone.
2. Place new oil seal carefully onto end of camshaft by hand. Using Guide Sleeve (3241/2), slide seal until flush with head. See Fig. 138.
3. Using seal installer with Press Sleeve (3241/1) and Bolt (3241/3), install new camshaft oil seal flush into cylinder head. See Fig. 139.
4. Install CMP sensor hood (shutter wheel) and bolt. Insert tab in notch in end of camshaft. Tighten hood (shutter wheel) bolt to 25 N.m (18 ft. lbs.). Install Camshaft Position (CMP) sensor housing bolts to 10 N.m (89 INCH lbs.).

5. To complete installation, reverse removal procedure. Tighten all bolts and nuts to specification. See TORQUE SPECIFICATIONS.

CAMSHAFT SOLENOID VALVE

Some models of this are equipped with variable valve timing. For testing of the camshaft solenoid and camshaft adjustment circuit, see:

A4(2001) SELF-DIAGNOSTICS - 1.8L TURBO article in ENGINE PERFORMANCE.
Passat
VARIABLE VALVE TIMING SYSTEM in SYSTEM & COMPONENT TESTING article in ENGINE PERFORMANCE.

CRANKSHAFT REAR OIL SEAL

NOTE: Crankshaft rear oil seal and carrier are serviced as an assembly.

NOTE: For help in identifying components and component locations, refer to Fig. 108.

Removal & Installation

1. Remove transmission. For M/T, see appropriate article in CLUTCHES. For A/T, see TRANSMISSION REMOVAL & INSTALLATION article in TRANSMISSION SERVICING. Remove drive plate (A/T) or dual-mass flywheel (M/T). See DRIVE PLATE (A/T) or DUAL-MASS FLYWHEEL (M/T).

2. Remove crankshaft oil seal carrier bolts and remove carrier (flange) with oil seal. DO NOT add any additional oil or grease to seal lip.

3. Install NEW oil seal with carrier using supplied sleeve. Tighten crankshaft oil seal carrier bolts to specification. See TORQUE SPECIFICATIONS. Remove supplied sleeve after the flange and seal assembly has been slid onto the crankshaft.

WATER PUMP

CAUTION: Coolant and water mixture should be used at all times. Use only ethylene glycol based (phosphate-free) coolant.

NOTE: Water pump is driven by timing belt.

Removal & Installation

1. Raise vehicle, remove lower engine shield (noise insulator), if equipped. See Fig. 18.

2. Place front lock carrier assembly into service position. See LOCK CARRIER. Disconnect all necessary electrical connectors from front of vehicle.

3. Drain engine coolant. See DRAINING COOLING SYSTEM.

4. Remove engine cover if equipped. Remove accessory drive belts. See ACCESSORY DRIVE BELTS.

5. Remove viscous fan and fan pulley. See VISCOS FAN.

6. Remove timing belt upper and center cover, ensure all bolts are removed. Turn crankshaft and align timing marks. See Fig. 116.

7. NOTE: Timing belt does not have to be completely removed from engine. Lower portion of belt will stay installed to crankshaft sprocket.

Release tensioner, using Screw (T10092) or a threaded stud. Turn Screw (T10092) or threaded stud M5 x 55 (1) into timing belt tensioner. See Fig. 118. If using threaded stud M5 x 55, fit a hexagon nut (2) with large washer (3) onto threaded stud (1). Align pressure piston using pointed pliers or wire...
before tensioning (turning piston to match hole in tensioner housing). Tension the lever so holes in the piston line up with hole in housing. Install Locking Pin (T40011) or a suitable pin through hole to lock piston in place. Slide timing belt off camshaft and water pump sprockets. Timing belt should remain in contact with crankshaft timing sprocket.

8. **NOTE:** Place clean shop towels under water pump, to protect timing belt from residual coolant that may come from block. Keep timing belt free of coolant and grease. Change shop towels for dry ones when necessary. Remove shop towel after water pump is installed.

With timing belt removed from water pump, remove fasteners and pull water pump away from block. See **Fig. 140**. Clean sealing surface, lube NEW seal (O-ring) with coolant.
1. Bolts 15 Nm (11 ft. lbs.)
2. Water Pump (Sealing Plug In Housing Points Down)
3. O-Ring (Seal)
9. Install O-ring and water pump. Tighten water pump bolts to specification. See **TORQUE SPECIFICATIONS**.

10. To complete installation, reverse removal procedure. For timing belt installation, see **TIMING BELT**. Install front lock carrier assembly to body. See **LOCK CARRIER**.

11. Fill and bleed cooling system. See **COOLING SYSTEM BLEEDING**.

**OIL PAN (A4)**

**NOTE:** For help in identifying components and component locations, refer to Fig. 141.
1 - 28 Nm (20 ft. lbs.)
2 - Limit stop for torque reaction support
3 - Oil pan
   - Apply silicone sealant D 176 404 A2 before installing
4 - Oil Pump
   - Replace pump if there is scoring on moving surfaces and gear teeth
   - Tightening torque for oil pump cover to oil pump housing: 10 Nm (7 ft. lbs.)
5 - Chain sprocket for oil pump
   - Sprocket can only be installed on oil pump shaft in one position
6 - 22 Nm (6 ft. lbs.)
7 - Drive chain for oil pump
   - Mark direction of rotation before removing
   - Check for wear
8 - 15 Nm (11 ft. lbs.)
9 - Sealing flange - front
10 - Chain tensioner
    - Tighten to 15 Nm (12 ft. lbs.)
    - Do not disassemble
    - Note installation position
    - Pre tension spring and engage before installing
    - If spring is broken replace chain tension complete
11 - Chain sprocket for oil pump
12 - Dowel sleeves
    - 2 pieces
13 - O-ring
    - Always replace
14 - 16 Nm (12 ft. lbs.)
15 - Suction pipe
    - Clean strainer if soiled
16 - Baffle plate
17 - 16 Nm (12 ft. lbs.)
18 - 15 Nm (11 ft. lbs.)
   - Tighten in stages and in sequence
19 - 40 Nm (30 ft. lbs.)
20 - Sealing ring
    - Always replace
21 - Oil drain plug, 30 Nm (22 ft)
22 - Gasket
    - Always replace
23 - 10 Nm (7 ft. lbs.)
24 - Oil return pipe
    - From exhaust turbocharger
Fig. 141: Identifying Engine Oiling System Components
Courtesy of AUDI OF AMERICA, INC.

Removal

1. Move lock carrier into service position. See LOCK CARRIER.
2. Raise vehicle. Remove bracket for sound insulation. Remove air ducts from front engine area at air charge cooler (intercooler). Raise vehicle. Remove center engine shield (noise insulators). See Fig. 18. Drain engine oil.
3. Lower vehicle. Remove engine cover from top of engine.
4. Remove seal from plenum chamber cover, pull forward. See Fig. 6. Remove plenum chamber cover from front.
5. Remove nut from top of left engine mount. See Fig. 142.
1. Nut Top Of Left Engine Mount

G00135151
Fig. 142: Identifying Left Side Engine Mount
Courtesy of AUDI OF AMERICA, INC.

6. Setup Support Bar (10-222 A) on fender panel flanges. See Fig. 143.
7. Remove lifting eye from Lifting Tackle (2024 A). Replace pin (1) in center hole on lifting tackle and secure with locking pin. Engage pin on Lifting Tackle (2024 A) on spindle of Support Bar (10-222 A). See Fig. 144.
8. **CAUTION:** The hooks and locating pins of the lifting tackle must be secured with locking pins.

Engage lifting tackle (2024 A) in front and rear lifting eyes on engine. Pretension engine with spindle of support bar, do not lift.

9. Remove oil return line of exhaust turbocharger from oil pan. Disconnect electrical connector from oil level sender located at the bottom of oil pan.

10. On vehicles with automatic transmission, remove bolt and disconnect ATF cooler lines from transmission. See **Fig. 145**. Remove bracket for ATF lines from engine. Move ATF lines aside.
11. On all models, remove stop for torque reaction support from oil pan. See Fig. 66.

12. If equipped, unclip operating rod of vehicle level sender from lower transverse link. See Fig. 146. Cut through cable ties. Open retainer for starter cable and take out electrical wiring. See Fig. 147.
Fig. 146: Remove Clip From Vehicle Level Sender Transverse Link
Courtesy of AUDI OF AMERICA, INC.
13. **NOTE:** Different mounting holes are provided for the different engine versions.

Mark positions of mountings (1) and locating sleeves (2) on left and right engine mountings (lower). Remove nut (1) from lower right of engine mounting. Completely remove left engine mounting. See Fig. 62.

14. Support subframe with Workshop Crane (VAG 1202 A). See Fig. 148.
CAUTION: Support subframe, and DO NOT let hang by remaining bolts.

NOTE: The subframe should be disconnected and lowered at the front only, otherwise it will be necessary to check the wheel alignment.

Remove front subframe bolts (2) and (3) left and right side and loosen bolts (1). See Fig. 149.
16. On vehicles with Automatic Transmission (A/T), go to 17. On vehicles with Manual Transmission (M/T), loosen nut (1) on left transmission mounting until it is flush with end of bolt (about four turns on the thread). See Fig. 150.
17. On vehicles with automatic transmission, loosen rear bolt (2) on left transmission mounting a few turns. Remove front bolt (1) on left transmission mounting. See Fig. 151.
18. For both A/T and M/T, loosen rear bolt (2) on right transmission mounting a few turns. Remove front bolt (1) on right transmission mounting. See Fig. 152. Lower subframe slowly using Workshop Crane (VAG 1202 A). Take out workshop crane.
Remove the M10 bolts from oil pan/transmission. See Fig. 153. Loosen bolts No. 1 to No. 18 in a diagonal pattern.

Additional steps are required, to remove bolts No. 17 and No. 18 from oil pan with manual transmission. See step 20.
20. On vehicles with manual transmission, turn flywheel (3) until the notch in flywheel is aligned with the bolt at the rear of oil pan. Unscrew both rear oil pan bolts (1) and (2) with extension attachment tool.
(3249). See Fig. 154 and Fig. 155.

1. Bolts Rear Of Oil Pan
2. Notch In Flywheel
3. Clutch Mounted On Flywheel

G00135156

Fig. 154: Identifying Location Of Bolts At Rear Of Oil Pan & Notched Flywheel

Courtesy of VAG OF AMERICA
21. On all models, remove oil pan bolts. Remove oil pan. If necessary loosen it by striking lightly with a rubber hammer. Carefully remove sealant residues from cylinder block (remove baffle plate). Remove remaining sealant from oil pan with a rotating plastic brush. Clean sealing surfaces, ensure they are free of oil and grease. See Fig. 156.
Installation

**NOTE:** Always replace seals and gaskets.

1. Apply silicone sealant (D 176 404 A2) in a 3 mm (0.1") bead along flange mating surface. See Fig. 157 and Fig. 158.
G00135063

Fig. 157: Apply Sealant (D 176 404 A2) To Oil Pan
Courtesy of VOLKSWAGEN UNITED STATES, INC.
2. **NOTE:** When installing the oil pan with the engine removed from the vehicle, ensure that the oil pan (3) is positioned flush with the intermediate plate (1) at the flywheel end (oil pan should protrude dimension "a"). Dimension "a" equals 0.8 mm from cylinder block with respect to the cylinder block (2). See Fig. 159.

Place oil pan against block, ensuring pan is flush with block. Install and tighten fasteners in sequence. See Fig. 153. Tighten bolts as follows:

- Insert vertical M10 bolts into oil pan before installing the oil pan.
- Tighten pan-to-block bolts 1 to 18 diagonally to 5 N.m (44 INCH lbs.).
- Tighten bolts securing oil pan to transmission at this time to 45 N.m (33 ft. lbs.).
- Tighten M10 bolts to 40 N.m (29 ft. lbs.)
- Tighten pan-to-block bolts 1 to 18 diagonally to 15 N.m (11 ft. lbs.).
1. Intermediate
2. Cylinder Block
3. Oil Pan

Fig. 159: Identifying Oil Pan Installation Engine Out Of Vehicle
3. Install subframe using Workshop Crane (VAG 1202 A).

4. Tighten subframe bolts No. 1 and No. 2 to 75 N.m (55 ft. lbs.). See Fig. 149. Tighten subframe bolt No. 3 to 110 N.m (81 ft. lbs.), then turn bolt an additional 1/4 turn (90 degrees).

5. On vehicles with automatic transmission, secure ATF lines.

6. On all models, secure lock carrier to body. See LOCK CARRIER.

7. Allow 30 minutes for sealant on oil pan to dry before adding oil to engine. Fill engine with oil. To complete installation, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS.
OIL PAN (PASSAT)

Removal

1. Move lock carrier into service position. See LOCK CARRIER.
2. Raise and support vehicle. Drain engine oil.
3. Unbolt stop for torque reaction support from oil pan. See Fig. 66.
4. Cut through cable ties. Open retainer for starter cable and take out electrical wiring. See Fig. 147.
5. Remove bolt from turbocharger oil return line at oil pan.
6. For vehicles with automatic transmission, remove bracket securing ATF cooler lines.
7. On all vehicles. Unplug connector from oil level thermal sensor in oil pan.
8. Mark positions of mountings (1) and locating sleeves (2) on left and right engine mountings (lower). Remove nut (1) from lower right of engine mounting. Completely remove left engine mounting. See Fig. 62.
9. Setup support bar (10-222 A) on fender panel flanges. See Fig. 143.
10. Remove lifting eye from Lifting Tackle (2024 A). Replace pin (1) in center hole on lifting tackle and secure with locking pin. Engage pin on Lifting Tackle (2024 A) on spindle of Support Bar (10-222 A). See Fig. 144.
11. CAUTION: The hooks and locating pins of the lifting tackle must be secured with locking pins.

Engage Lifting Tackle (2024 A) in front and rear lifting eyes on engine. Pretension engine with spindle of support bar, do not lift.
12. Support subframe with workshop crane (VAG 1202 A). See Fig. 148.
13. CAUTION: Support subframe, and DO NOT let hang by remaining bolts.

NOTE: The subframe should be disconnected and lowered at the front only, otherwise it will be necessary to check the wheel alignment.

Remove front subframe bolts (2) and (3) left and right side and loosen bolts (1). See Fig. 149.
14. On vehicles with Automatic Transmission (A/T), go to step 15. On vehicles with Manual Transmission (M/T), loosen nut (1) on left transmission mounting until it is flush with end of bolt (about four turns on the thread). See Fig. 150.
15. On vehicles with automatic transmission, loosen rear bolt (2) on left transmission mounting a few turns. Remove front bolt (1) on left transmission mounting. See Fig. 151.
16. For both A/T and M/T, loosen rear bolt (2) on right transmission mounting a few turns. Remove front bolt (1) on right transmission mounting. See Fig. 152. Lower subframe slowly using Workshop Crane (VAG 1202 A). Take out Workshop Crane (VAG 1202 A).
17. NOTE: Additional steps are required, to remove bolts No. 17 and No. 18 from oil pan with manual transmission. See step 18.

Remove the M10 bolts from oil pan/transmission. See Fig. 153. Loosen bolts 1 to 18 in a diagonal pattern.
18. On vehicles with manual transmission, turn flywheel (3) until the notch in flywheel is aligned with the bolt at the rear of oil pan. Unscrew both rear oil pan bolts (1) and (2) with extension attachment tool (3249). See Fig. 154 and Fig. 155.

19. On all models, remove oil pan bolts. Remove oil pan. If necessary loosen it by striking lightly with a rubber hammer. Carefully remove sealant residues from cylinder block (remove baffle plate). Remove remaining sealant from oil pan with a rotating plastic brush. Clean sealing surfaces, ensure they are free of oil and grease. See Fig. 156.

Installation

1. Apply silicone sealant (D 176 404 A2) in a 3 mm (0.1") bead along flange mating surface. See Fig. 157 and Fig. 158.

2. **NOTE:** When installing the oil pan with the engine removed from the vehicle, ensure that the oil pan (3) is positioned flush with the intermediate plate (1) at the flywheel end (oil pan should protrude dimension "a"). Dimension "a" equals 0.8 mm from cylinder block with respect to the cylinder block (2). See Fig. 159.

Place oil pan against block, ensuring pan is flush with block. Install and tighten fasteners in sequence. See Fig. 153. Tighten bolts as follows:

- Insert vertical M10 bolts into oil pan before installing the oil pan.
- Tighten pan-to-block bolts 1 to 18 diagonally to 5 N.m (44 INCH lbs.).
- Tighten bolts securing oil pan to transmission at this time to 45 N.m (33 ft. lbs.).
- Tighten M10 bolts to 40 N.m (29 ft. lbs.)
- Tighten pan-to-block bolts 1 to 18 diagonally to 15 N.m (11 ft. lbs.).

3. Install subframe using Workshop Crane (VAG 1202 A).

4. Tighten subframe bolts No. 1 and No. 2 to 75 N.m (55 ft. lbs.). See Fig. 149. Tighten subframe bolt No. 3 to 110 N.m (81 ft. lbs.), then turn bolt an additional 1/4 turn (90 degrees).

5. On all models, secure lock carrier to body. See LOCK CARRIER.

6. Allow 30 minutes for sealant on oil pan to dry before adding oil to engine. Fill engine with oil. To complete installation, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

CHAIN SPROCKET (CRANKSHAFT)

Removal

1. Remove oil pan. See OIL PAN.

2. Remove front oil seal flange. See CRANKSHAFT FRONT OIL SEAL FLANGE.

3. Remove the bolt from the oil pump drive sprocket. Remove chain tensioner and the chain.

4. **NOTE:** Place a suitable washer at end of crankshaft to protect the snout from damage.

With suitable washer in place (1), use a 2 jaw puller (2) to pull chain sprocket off crankshaft. See Fig. 161.
Installation

1. To install reverse removal procedure. Heat chain sprocket in heating appliance for approximately 15 minutes to 428° F (220° C).

2. **WARNING:** Chain sprocket will be hot, wear protective gloves.

Position on crankshaft with wide collar on sprocket facing the engine block. Use Drift Sleeve (30-100) to drive sprocket onto seat at end of snout. See Fig. 162.
Fig. 162: Installing Chain Sprocket Onto Crankshaft Using Drift Sleeve (30-100)
Courtesy of AUDI OF AMERICA, INC.

OVERHAUL

CAUTION: DO NOT start engine for about 30 minutes after installing camshafts. Hydraulic valve lifters must bleed down or valves may strike pistons. Rotate crankshaft by hand 2 full revolutions before starting engine to ensure valves do not strike pistons.

CYLINDER HEAD
Cylinder Head Resurfacing

1. Measure cylinder head warpage, measure at several points along gasket surface using straight edge and feeler gauge. See Fig. 163. If warpage exceeds specification, machine cylinder head. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

2. If machining causes cylinder head height to be less than specification, replace cylinder head. When checking dimensions for cylinder head height, measure at (A) through the holes for the head bolts. See Fig. 164. Cylinder head height is measured from head gasket sealing surface to cylinder head cover surface.

NOTE: For view of cylinder head components, see Fig. 124.
Valve Guides Checking

NOTE: Intake valve stem diameter differs from exhaust valve stem diameter. Use appropriate valve when measuring valve guide wear.

1. To measure valve guide wear, attach dial indicator to cylinder head. Insert valve into guide until valve stem tip is even with top end of guide.
2. Lightly push edge of valve head against dial indicator tip. Zero dial indicator. Push valve away from dial indicator, in direction opposite of camshaft axis.
3. Maximum allowable deflection is 0.8 mm (.032") on intake or exhaust valve. If deflection does not exceed specification, guide is okay. If deflection exceeds specification, recheck using new valve. If deflection still exceeds specification, replace worn guides. See Fig. 165.

NOTE: Manufacturer does not give specific procedure for replacing valve guides.
1. Remove camshafts. See CAMSHAFTS under REMOVAL & INSTALLATION.
2. Remove valve lifters and place them with contact surface downward. During removal note installed position of lifters, and make sure lifters are not interchanged.
3. Remove spark plugs.
4. Set piston of relevant cylinder to Bottom Dead Center (BDC).
5. Screw Pressure Hose (653/3) into spark plug thread. See Fig. 166.
Fig. 166: Installing Air Pressure Hose (653/3) Into Spark plug Hole & Valve Spring Compressor (3362) Onto Cylinder Head.
Courtesy of VOLKSWAGEN UNITED STATES, INC.

6. **NOTE:** DO NOT remove valve springs at this time.

Secure (3362) valve spring compressor to cylinder head with tool securing bolt. Position installing tool for compressing valve springs to following positions.

- Outer intake valves: lower position
- Center intake valve: upper position
• Exhaust valve: lower position

See Fig. 166.

7. Connect pressure hose to compressed air system supplying at least 6 bar (87 psi) and remove valve springs.

8. Remove valve stem seals with Valve Stem Seal Puller (3364) for valve shaft seal. See Fig. 167.
Installing Valves Stem Seals

1. Slide plastic sleeve (A) supplied over valve stem. This will prevent the new valve stem seal (B) from being damaged. See Fig. 168.

2. Place new valve stem seal into Installation Tool (3365).
3. Oil valve stem seal sealing lip and press carefully onto the valve guide. See Fig. 168.
Valve Seats

When repairing engines with leaking valves, it is not sufficient to replace or renew valve seats and valves. It is also necessary to check the valve guides for wear. This is particularly important on high mileage engines. The valve seats should only be refaced just enough to produce a perfect seating pattern.

The maximum permissible refacing dimension must be calculated before beginning refacing. If the refacing dimension is exceeded, the function of the hydraulic valve lifters can no longer be guaranteed and the cylinder head should be replaced. If the valve is to be replaced as part of a repair, use a new valve for the calculation.

1. Insert valve into guide. Press valve tightly against valve seat. Lay a straightedge across top of cylinder head. Measure distance between valve stem tip and bottom of straightedge. See Fig. 169. This is valve installed height. If a new valve is going to be installed, use new valve to make this measurement.

**CAUTION:** DO NOT start engine for about 30 minutes after installing camshafts. Hydraulic valve lifters must bleed down or valves may strike pistons. Rotate crankshaft by hand 2 full revolutions before starting engine to ensure valves do not strike pistons.

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G96A19117

*Fig. 169: Measuring Valve Installed Height*

Courtesy of VOLKSWAGEN UNITED STATES, INC.
2. Determine maximum allowable refacing dimension by subtracting minimum valve installed height from distance measured in previous step. See **MINIMUM VALVE INSTALLED HEIGHT** table. For example: if measured distance is 31.4 mm and minimum dimension is 31.0 mm, maximum allowable refacing dimension will be 0.4 mm. See **Fig. 170**.

**MINIMUM VALVE INSTALLED HEIGHT**

<table>
<thead>
<tr>
<th>Application</th>
<th>In. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake Valve</td>
<td></td>
</tr>
<tr>
<td>Outer</td>
<td>1.220 (31.0)</td>
</tr>
<tr>
<td>Center</td>
<td>1.268 (32.2)</td>
</tr>
<tr>
<td>Exhaust Valve</td>
<td>1.256 (31.9)</td>
</tr>
</tbody>
</table>
Measured distance minus minimum dimension = max. permissible refacing dimension.

Example:

<table>
<thead>
<tr>
<th>Measured distance</th>
<th>mm (in.)</th>
<th>34.4 (1.354)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum dimension</td>
<td>mm (in.)</td>
<td>34.0 (1.339)</td>
</tr>
<tr>
<td></td>
<td>mm (in.)</td>
<td>0.4 (0.016)</td>
</tr>
</tbody>
</table>

*) The max. permissible refacing dimension is shown on illustrations for reworking valve seats as dimension “b”.

Refacing inlet valve seat

- \( a = 26.2 \text{ mm (1.031 in.) diameter} \)
- \( b = \text{Max. permissible refacing dimension} \)
- \( c = 1.5 \text{–} 1.8 \text{ mm (0.0394–0.1063 in.)} \)
- \( Z = \text{Cylinder head lower edge} \)
- \( \alpha = 45^\circ \text{ valve seat angle} \)
- \( \beta = 30^\circ \text{ upper correction angle} \)
- \( \gamma = 60^\circ \text{ lower correction angle} \)

Refacing exhaust valve seat

- \( a = 29.0 \text{ mm (1.142 in.) diameter} \)
- \( b = \text{Max. permissible refacing dimension} \)
- \( c = \text{Approx. 1.8 mm (0.1063 in.)} \)
- \( Z = \text{Cylinder head lower edge} \)
- \( \alpha = 45^\circ \text{ valve seat angle} \)
- \( \beta = 30^\circ \text{ upper correction angle} \)
- \( \gamma = 60^\circ \text{ lower correction angle} \)

*) Calculating max. permissible refacing \( \alpha \)

See Example:
3. If valve stem height measurement is still less than specification, replace cylinder head. If valve stem height exceeds specification, seat can be machined; however, DO NOT machine enough material away from seat to cause valve stem height to be less than minimum specification.

VALVE TRAIN

Lifters (Cam Followers)

**CAUTION:** If lifters are charged with oil, allow 30 minutes to bleed down before starting engine. Pistons may strike valves, resulting in bent valves.

**CAUTION:** DO NOT start engine for about 30 minutes after installing camshafts. Hydraulic valve lifters must bleed down or valves may strike pistons. Rotate crankshaft by hand 2 full revolutions before starting engine to ensure valves do not strike pistons.

Test lifters for correct operation. See **VALVE LIFTERS** under REMOVAL & INSTALLATION. If lifter(s) can be pushed down more than .007" (.20 mm), replace lifters.

Camshaft Axial Play (A4)

Measure camshaft axial play (intake and exhaust) with lifter and camshaft chain removed. Measure with chain side camshaft bearing caps and cam sprocket side double bearing cap installed. See **Fig. 171**. Remove all other caps, note their locations for reassembly. See **Fig. 172**. Maximum wear limit .20 mm (.008").
INTAKE CAM
Camshaft Axial Play (Passat)

Measure camshaft axial play (intake and exhaust) with lifter and camshaft chain removed. Camshaft bearing caps No. 2. and No. 4. installed. Remove all other caps, note their locations for reassemble. See Fig. 172. Maximum wear limit .20 mm (.008”). See Fig. 173.
Valves

**CAUTION:** Sodium-filled exhaust valves must not be disposed of until they have been properly treated as follows: By HAND (no air tools), saw the valves into two sections using a metal saw at a point between the center of the valve stem and the valve head. The valves must not come into contact with water when this is done. Throw the valves into a bucket of water (not more than ten at a time) and step back. A sudden chemical reaction will occur during which the sodium filling burns. After this treatment the valves can be disposed of as normal scrap.

Measure valve stem diameter and valve margin. If not within specification, replace valves. Replace as necessary. See [VALVES & VALVE SPRINGS](#) table under ENGINE SPECIFICATIONS.

Valves must not be refaced by grinding. Hand lap only. If lapping does not produce proper sealing, check...
valve seat. See VALVE SEATS.

Valve Springs

Information is not available from manufacturer.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

1. Ensure piston, connecting rod and rod caps are marked with matching cylinder number prior to removal. Ensure engine front arrow is marked on top of piston and front mark "A" exists on rod and cap. See Fig. 174. Pistons and rods are to be replaced in sets of 4. Connecting rod cap bolts MUST be replaced after removing or loosening.
2. Mark piston in relation to pin. Remove circlips from ends of pin bore. Use Piston Pin Replacer/Installer (VW 222A) to remove and install piston pin. If pin is too tight, heat piston to 60°C (140°F). Ensure rod is properly positioned with piston. See Fig. 174.

3. When installing pistons, ensure "A" marks on connecting rods face front (crankshaft pulley end) of engine. Ensure arrow on piston crown points to front (crankshaft pulley end) of engine.

4. If reinstalling old bearing shells, Do NOT interchange used bearing shells.

**Fitting Pistons**

1. Measure piston diameter about 10 mm from lower edge of skirt, at 90 degrees to piston pin axis.
2. Check clearance of piston-to-cylinder bore. Piston diameter is stamped on top of piston in millimeters. See CYLINDER BLOCK under ENGINE SPECIFICATIONS.

**Piston Rings**

1. To measure ring end gap, place ring squarely in bore about 15 mm (.591") from bottom. Use a piston without rings to seat ring in bore. See Fig. 175.
2. Clean piston ring grooves before checking side clearance. Measure ring side clearance to piston ring groove. See Fig. 176.
3. If not within specification, replace parts as necessary. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

4. Install rings on piston with TOP mark facing upward toward crown. Position ring gaps on piston at 120 degree intervals. See Fig. 174.

Rod Bearings

1. Mark rod caps for reinstallation in original position. Use Plastigage to measure bearing oil clearance. Do NOT interchange used bearing shells, if reusing old bearings. When installing bearing shells, ensure they are centered in connecting rod or bearing cap.

2. When measuring connecting rod oil clearance or side play, install old bolts. Tighten old bolts to 30 N.m (22 ft. lbs.), but do not tighten any further. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

3. Lubricate bolt threads when installing NEW connecting rod cap bolts. Do not reuse old bolts. Tighten evenly to specification in several steps. See TORQUE SPECIFICATIONS.

Crankshaft & Main Bearings

Manufacturer recommends replacing sender wheel (RPM sensor) and mounting bolts, if they are removed from crankshaft. The mounting holes for the sensor wheel are asymmetrically spaced, so it is only possible to install the sensor wheel in one position. If the mounting bolts are installed a second time, the countersunk seats for the bolts in the sensor wheel will be distorted so that the bolt heads will come in contact with the
crankshaft. The result will be the sensor wheel will fit loosely on the crankshaft and not be properly positioned. See **SENSOR WHEEL (ENGINE RPM)**.

1. Main bearing caps are marked with matching journal for installation in original position. See **Fig. 177**. Use Plastigage(R) to measure oil clearance. Measure crankshaft end play. See **Thrust Washer**.
Fig. 177: Exploded View Of Crankshaft Assembly
Courtesy of VOLKSWAGEN UNITED STATES, INC.
2.

**CAUTION:** Do NOT interchanged used bearings. Keep in original position, if reusing.

The upper bearing shell (engine block side) are color coded at the factory. Color dots are used to mark the thickness of the bearing shells. The position of each bearing thickness is marked with letters on the oil pan sealing area of the engine block. See Fig. 178.
3. The letter codes relate to the color of the bearing shell installed. See MAIN BEARING COLOR CODING. The lower main bearing shells (main bearing cap side) are always supplied with a Yellow color coding.

<table>
<thead>
<tr>
<th>Letter On Engine Block</th>
<th>Bearing Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Black</td>
</tr>
<tr>
<td>R</td>
<td>Red</td>
</tr>
<tr>
<td>G</td>
<td>Yellow</td>
</tr>
</tbody>
</table>

**Thrust Washer**

Insert feeler gauge between No. 3 main bearing and crankshaft thrust face to measure end play. Replace thrust washer as necessary. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

**Cylinder Block**

**CAUTION:** Cylinder bore must not be measured with engine block secured to engine stand or readings will not be accurate.

1. Measure cylinder bore diameter in 3 places: at center of bore and 10 mm (.39") from top and bottom of bore. See Fig. 179.
2. If cylinder bore diameter is not within specification, hone cylinder bore until diameter meets first oversize specification. See CYLINDER BLOCK under ENGINE SPECIFICATIONS.

SENSOR WHEEL (ENGINE RPM)

NOTE: For help in identifying components and component locations, refer to Fig. 108.

Sensor Wheel Precautions

Manufacturer recommends replacing sender wheel (RPM sensor) and mounting bolts, if they are removed from crankshaft. The mounting holes for the sensor wheel are asymmetrically spaced, so it is only possible to install the sensor wheel in one position. If the mounting bolts are installed a second time, the countersunk seats for the bolts in the sensor wheel will be distorted so that the bolt heads will come in contact with the crankshaft. The result will be the sensor wheel will fit loosely on the crankshaft and not be properly positioned.

Removal & Installation

1. Remove transmission. For M/T, see appropriate article in CLUTCHES. For A/T, see TRANSMISSION REMOVAL & INSTALLATION article in TRANSMISSION SERVICING.

2. Remove drive plate (A/T) or dual-mass flywheel (M/T). See DRIVE PLATE (A/T) or DUAL-MASS FLYWHEEL (M/T).

3. NOTE: Sensor wheel can only be installed once, installation distorts the plate. Once sensor wheel is removed, the sensor wheel and its fasteners must be replaced. See Fig. 180.

Remove sensor wheel. Discard mounting bolts.
4. To complete installation, reverse removal procedure. Tighten NEW bolts to 10 N.m (89 INCH lbs.) plus an additional 1/4 turn (90°). See TORQUE SPECIFICATIONS.

5. For drive plate or flywheel installation. See DRIVE PLATE (A/T) or DUAL-MASS FLYWHEEL (M/T).
ENGINE OILING

ENGINE LUBRICATION SYSTEM

Crankcase Capacity

See CRANKCASE CAPACITY table.

<table>
<thead>
<tr>
<th>Application</th>
<th>Qts. (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without Filter Replacement</td>
<td>3.7 (3.4)</td>
</tr>
<tr>
<td>With Filter Replacement</td>
<td>4.3 (3.9)</td>
</tr>
</tbody>
</table>

Oil Pressure

Check oil pressure with engine at normal operating temperature. Oil pressure at idle should be not less than 1.3 bar (18.9 psi). Oil pressure at 2000 RPM should be 3.5-4.5 bar (50.8-65.3 psi).

Oil Spray Jet (For Piston Cooling)

Oil spray jet bolt contains a pressure relief valve. See Fig. 181. The opening pressure for the pressure relief valve is 1.6-1.8 bar (23-26 psi). Do not substitute standard bolt for pressure relief valve.
1 - Oil spray jet (for piston cooling)

2 - Bolt with pressure relief valve - 27 Nm (20 ft. lbs)

OIL PRESSURE SWITCH

Oil pressure switch is on oil filter housing. See Fig. 182. The switch contacts should open at 1.2-1.6 bar (19-23 psi).
2000 Volkswagen Passat GLX
1.8L 4-CYLINDER TURBO 5-VALVE

Fig. 182: Identifying Oil Filter Bracket & Components
Courtesy of AUDI OF AMERICA, INC.

1 - Screw plug - 40 Nm (30 ft. lbs.)
2 - Sealing ring
   ♦ Always replace
3 - Spring
   ♦ For pressure relief valve, approx. 4 bar
4 - Piston
   ♦ For pressure relief valve, approx. 4 bar
5 - Gasket
   ♦ Always replace
6 - Oil retention valve
   ♦ Tighten to 8 Nm (6 ft. lbs.)
   ♦ Built into oil filter bracket
7 - O-ring
   ♦ Always replace
8 - Locking clip
9 - Pipe
   ♦ For crankcase breather
10 - 20 Nm (15 ft. lbs.)
   ♦ Install with locking fluid D 000 600 A2
11 - Bottom coolant pipe
12 - Screw plug - 15 Nm
13 - Sealing ring
   ♦ If seal is leaking, cut open and replace
14 - Oil supply pipe
   ♦ To turbocharger
15 - Banjo bolt - 30 Nm (11 ft. lbs.)
16 - Seals
   ♦ Always replace
17 - Oil pressure switch
   ♦ 1.4 bar - 25 Nm (18 ft. lbs.)
   ♦ Black insulation
18 - Sealing ring
   ♦ If seal is leaking, cut open and replace
19 - 15 Nm + 1/4 turn (90°) further (11 l)
   ♦ Always replace
20 - Gasket
   ♦ Always replace
   ♦ Engage in projections on oil cooler
21 - Oil filter
   ♦ Observe change intervals
22 - 25 Nm (18 ft. lbs.)
23 - Oil cooler
   ♦ Ensure clearance to adjacent comp;
24 - Oil filter bracket
   ♦ With pressure relief valve, approx.
OIL PUMP

**NOTE:** For help in identifying components and component locations, refer to Fig. 141.

Removal & Installation

Remove oil pan. See OIL PAN. Remove oil pump sprocket bolt (1). Remove oil pump to cylinder block attaching bolts (2) and remove oil pump assembly. See Fig. 183. To install, reverse removal procedure.

Inspection

Check chain, tensioner, drive gear and oil pump sprocket for wear or damage (chips or nicks). Inspect oil pump, if running surfaces or gears are scored, replace oil pump assembly. Ensure oil pickup (suction pipe) is clean and unrestricted. Ensure oil cooler is not contaminated. Ensure oil pressure relief is not scored. Replace faulty component(s).
1. Oil Pump Sprocket Center Bolt 22 Nm (16 ft. lbs)
2. Oil Pump To Block Fastener 16 Nm (11 ft. lbs)

G00135150

Fig. 183: Removing Oil Pump From Cylinder Block
Courtesy of AUDI OF AMERICA, INC.

TORQUE SPECIFICATIONS

<table>
<thead>
<tr>
<th>Application</th>
<th>Ft. Lbs. (N.m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/C Belt Tensioner (1)</td>
<td>15 (20)</td>
</tr>
<tr>
<td>A/C Compressor-To-Bracket</td>
<td>18 (24)</td>
</tr>
<tr>
<td>A/C Condenser-To-Radiator</td>
<td>7 (10)</td>
</tr>
<tr>
<td>Component</td>
<td>Step 1</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Belt Pulley-To-Viscous Fan Clutch Bolt</td>
<td>22 (30)</td>
</tr>
<tr>
<td>Camshaft Adjuster-To- Cylinder Head</td>
<td>7 (10)</td>
</tr>
<tr>
<td>Camshaft Bearing Caps-To- Cylinder Head</td>
<td>7 (10)</td>
</tr>
<tr>
<td>Camshaft Timing Belt Sprocket Bolt</td>
<td>65 (88)</td>
</tr>
<tr>
<td>Camshaft Position Sensor Rotor-To-Camshaft Bolt</td>
<td>18 (25)</td>
</tr>
<tr>
<td>Catalytic Converter-To-Turbocharger</td>
<td>22 (30)</td>
</tr>
<tr>
<td>Crosspiece For Underbody-To-Body</td>
<td>15 (20)</td>
</tr>
<tr>
<td>Connecting Rod Bearing Cap Bolt (2)</td>
<td>22 (30)</td>
</tr>
<tr>
<td>Crankshaft Front Oil Seal Flange -To-Cylinder Block</td>
<td>11 (15)</td>
</tr>
<tr>
<td>Crankshaft Main Bearing Cap Bolt (2)</td>
<td>48 (65)</td>
</tr>
<tr>
<td>Crankshaft Rear Sealing Flange -To-Cylinder Block</td>
<td>11 (15)</td>
</tr>
<tr>
<td>Crankshaft Timing Sprocket Bolt (2)</td>
<td>66 (90)</td>
</tr>
<tr>
<td>Cylinder Head Bolt (2)</td>
<td>30 (40)</td>
</tr>
<tr>
<td>Audi</td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td>30 (40)</td>
</tr>
<tr>
<td>Step 2</td>
<td>44 (60)</td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
</tr>
<tr>
<td>Step 4</td>
<td></td>
</tr>
<tr>
<td>Passat</td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td>30 (40)</td>
</tr>
<tr>
<td>Step 2</td>
<td>44 (60)</td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
</tr>
<tr>
<td>Step 4</td>
<td></td>
</tr>
<tr>
<td>Driveplate-To-Crankshaft Bolt (Auto. Trans.) (2)</td>
<td>44 (60)</td>
</tr>
<tr>
<td>Driveplate-To-Torque Converter (2)</td>
<td>63 (85)</td>
</tr>
<tr>
<td>Dual-Mass Flywheel-To-Crankshaft Bolt (Man. Trans.) (2)</td>
<td></td>
</tr>
<tr>
<td>43 mm Bolt Length</td>
<td>44 (60)</td>
</tr>
<tr>
<td>25.5 mm Bolt Length</td>
<td>44 (60)</td>
</tr>
<tr>
<td>Engine Mount-To-Subframe Bolt</td>
<td>18 (25)</td>
</tr>
<tr>
<td>Bolt Description</td>
<td>Torque Value</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Engine Mount-To-Engine Support Bolt</td>
<td>18 (25)</td>
</tr>
<tr>
<td>Exhaust Manifold-To-Cylinder Head</td>
<td>22 (30)</td>
</tr>
<tr>
<td>Front Exhaust Pipe -To-Catalytic Converter</td>
<td>30 (40)</td>
</tr>
<tr>
<td>Generator-To-Bracket Bolts</td>
<td></td>
</tr>
<tr>
<td>M8 Bolt</td>
<td>17 (23)</td>
</tr>
<tr>
<td>M10 Bolt</td>
<td>34 (46)</td>
</tr>
<tr>
<td>Heated Oxygen Sensor</td>
<td>36 (50)</td>
</tr>
<tr>
<td>Heat Shield-To-Transmission</td>
<td>17 (23)</td>
</tr>
<tr>
<td>Intake Manifold Bracket Bolt</td>
<td>15-18 (20-25)</td>
</tr>
<tr>
<td>Oil Jet Bolt (Piston Cooling)</td>
<td>20 (27)</td>
</tr>
<tr>
<td>Oil Feed Line-To-Cylinder Head</td>
<td>17 (23)</td>
</tr>
<tr>
<td>Oil Pan Bolt</td>
<td></td>
</tr>
<tr>
<td>Oil Pump-To-Cylinder Block Bolt</td>
<td>11 (15)</td>
</tr>
<tr>
<td>Oil Pump Drive Sprocket Bolt</td>
<td>(5) 15 (20)</td>
</tr>
<tr>
<td>Oil Pan Drain Plug</td>
<td>22 (30)</td>
</tr>
<tr>
<td>Oil Return Line Turbo (Both Ends)</td>
<td>7 (10)</td>
</tr>
<tr>
<td>Piston Oil Pressure Relief Valve</td>
<td>20 (27)</td>
</tr>
<tr>
<td>Power Steering Pump-To-Bracket</td>
<td>17 (23)</td>
</tr>
<tr>
<td>Power Steering Pump Pulley-To-Power Steering Pump</td>
<td>17 (23)</td>
</tr>
<tr>
<td>Pressure Plate-To-Flywheel Bolt (2)</td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td>22 (30)</td>
</tr>
<tr>
<td>Step 2</td>
<td>44 (60)</td>
</tr>
<tr>
<td>Step 3</td>
<td>Additional 90 Degrees</td>
</tr>
<tr>
<td>Sender Wheel-To-Crankshaft Bolts (Sensor Trigger) (2)(4)</td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td>7 (10 Nm)</td>
</tr>
<tr>
<td>Step 2</td>
<td>Additional 90 Degrees</td>
</tr>
<tr>
<td>Serpentine Belt Tensioner-To-Engine Bolt</td>
<td>18 (25)</td>
</tr>
<tr>
<td>Starter Mount Bolt</td>
<td>48 (65)</td>
</tr>
<tr>
<td>Stop/Torque Reaction Bracket-To-Oil Pan</td>
<td>22 (30)</td>
</tr>
<tr>
<td>Tensioner/Accessory Drive Belt-To-Bracket</td>
<td>17 (23)</td>
</tr>
<tr>
<td>Thermostat Housing Bolt</td>
<td>11 (15)</td>
</tr>
<tr>
<td>Timing Belt Tensioner Nut</td>
<td>20 (27)</td>
</tr>
<tr>
<td>Torque Converter-To-Driveplate</td>
<td>63 (85)</td>
</tr>
<tr>
<td>Transmission Mount-To-Frame Bolt</td>
<td>18 (25)</td>
</tr>
<tr>
<td>Transmission Bell Housing-To-Engine Block</td>
<td></td>
</tr>
<tr>
<td>Transmission Support-To-Subframe</td>
<td>18 (25)</td>
</tr>
<tr>
<td>Transmission Support-To-Transmission Mount</td>
<td>30 (40)</td>
</tr>
<tr>
<td>Turbocharger-to-Exhaust Manifold (2)</td>
<td>26 (35)</td>
</tr>
<tr>
<td>Turbocharger Support Bracket-to-Cylinder Block</td>
<td>18 (25)</td>
</tr>
<tr>
<td>Turbocharger Support Bracket-to-Turbocharger</td>
<td>22 (30)</td>
</tr>
</tbody>
</table>
### ENGINE SPECIFICATIONS

#### GENERAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Application</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>110 Cu. In. (1.8L)</td>
</tr>
<tr>
<td>Bore</td>
<td>3.189 (81.01)</td>
</tr>
<tr>
<td>Stroke</td>
<td>3.40&quot; (86.4 mm)</td>
</tr>
<tr>
<td>Compression Ratio</td>
<td>9.5:1</td>
</tr>
<tr>
<td>Fuel System</td>
<td>Motronic SFI</td>
</tr>
</tbody>
</table>

#### CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

<table>
<thead>
<tr>
<th>Water Pump Bolt</th>
<th>11 (15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration Dampener Pulley-To-Crankshaft (2)</td>
<td>7 (10)</td>
</tr>
<tr>
<td>Additional 90 Degrees</td>
<td>33 (45)</td>
</tr>
</tbody>
</table>

### Step-by-Step Instructions

1. Tighten A/C belt tensioner bolt with 22 ft. lbs. (30 N.m) clockwise torque applied to tensioner (with belt in place).
2. Use NEW bolts.
3. Several steps are required to install oil pan. See OIL PAN under REMOVAL & INSTALLATION.
4. Sender wheel must be replaced. One time usage distorts the mounting points. See SENDER WHEEL under OVERHAUL.
5. Install with thread locking fluid (D000 600 A2).
6. Several bolts lengths are used. For bolt installation and torque specification. See Fig. 73 and Fig. 74.
### Main Bearings

<table>
<thead>
<tr>
<th>Application</th>
<th>In. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crankshaft End Play</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>.003-.009 (.07-.23)</td>
</tr>
<tr>
<td>Service Limit</td>
<td>.011 (.30)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Journal Diameter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td></td>
</tr>
<tr>
<td>Nominal</td>
<td>2.1260 (54.000)</td>
</tr>
<tr>
<td>1st Undersize</td>
<td>2.1161 (53.750)</td>
</tr>
<tr>
<td>2nd Undersize</td>
<td>2.1063 (53.500)</td>
</tr>
<tr>
<td>3rd Undersize</td>
<td>2.0965 (53.250)</td>
</tr>
<tr>
<td>Journal Out-Of-Round</td>
<td>(1)</td>
</tr>
<tr>
<td>Journal Taper</td>
<td>(1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Oil Clearance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>.0008-.0024 (.020-.060)</td>
</tr>
<tr>
<td>Service Limit</td>
<td>.005 (.12)</td>
</tr>
</tbody>
</table>

### Connecting Rod Bearings

<table>
<thead>
<tr>
<th>Journal Diameter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td></td>
</tr>
<tr>
<td>Nominal</td>
<td>1.8819 (47.800)</td>
</tr>
<tr>
<td>1st Undersize</td>
<td>1.8720 (47.550)</td>
</tr>
<tr>
<td>2nd Undersize</td>
<td>1.8622 (47.300)</td>
</tr>
<tr>
<td>3rd Undersize</td>
<td>1.8524 (47.050)</td>
</tr>
<tr>
<td>Journal Out-Of-Round</td>
<td>(1)</td>
</tr>
<tr>
<td>Journal Taper</td>
<td>(1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Oil Clearance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>.0004-.00236 (.01-.06)</td>
</tr>
<tr>
<td>Service Limit</td>
<td>.005 (.12)</td>
</tr>
</tbody>
</table>

(1) Information is not available from manufacturer.

### CONNECTING RODS

### CONNECTING RODS

<table>
<thead>
<tr>
<th>Application</th>
<th>In. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bore Diameter</td>
<td></td>
</tr>
<tr>
<td>Pin Bore</td>
<td>(1)</td>
</tr>
<tr>
<td>Crankpin Bore</td>
<td>(1)</td>
</tr>
<tr>
<td>Center-To-Center Length</td>
<td>(1)</td>
</tr>
<tr>
<td>Side Play</td>
<td></td>
</tr>
</tbody>
</table>

| Standard | .002-.012 (.05-.31) |
| Service Limit | .015 (.37) |

(1) Information is not available from manufacturer.

PISTONS, PINS & RINGS

PISTONS, PINS & RINGS

<table>
<thead>
<tr>
<th>Application</th>
<th>In. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pistons</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standard Diameter (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4</td>
</tr>
<tr>
<td>Passat</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1st Oversize (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4</td>
</tr>
<tr>
<td>Passat</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pins</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>(2)</td>
</tr>
<tr>
<td>Piston Fit</td>
<td>(2)</td>
</tr>
<tr>
<td>Rod Fit</td>
<td>(2)</td>
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</table>

<table>
<thead>
<tr>
<th>Rings</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1 &amp; 2</td>
<td></td>
</tr>
<tr>
<td>End Gap</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>.007-.016 (.20-.40)</td>
</tr>
<tr>
<td>Service Limit</td>
<td>.031 (.80)</td>
</tr>
<tr>
<td>Side Clearance</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>(3) .002-.003 (.06-.09)</td>
</tr>
<tr>
<td>Service Limit</td>
<td>.007 (.20)</td>
</tr>
</tbody>
</table>

| No. 3 (Oil)   |        |
| End Gap       |        |
| Standard      | .010-.020 (.25-.50) |
| Service Limit | .031 (.80) |
| Side Clearance|        |
| Standard      | .001-.002 (.03-.06) |
| Service Limit | .006 (.15) |

(1) Measurement does not include graphite coating, thickness of .02 mm (.0008”). Graphite coating wears away.

(2) Information is not available from manufacturer.

Audi specification for the second compression ring, is specified as .002-
(3) .003" (.05-.08 mm). Service Limit stays the same.

CYLINDER BLOCK

<table>
<thead>
<tr>
<th>Application</th>
<th>In. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>3.189 (81.01)</td>
</tr>
<tr>
<td>1st Oversize</td>
<td>3.209 (81.51)</td>
</tr>
<tr>
<td>Maximum Taper</td>
<td>.003 (.08)</td>
</tr>
</tbody>
</table>

VALVES & VALVE SPRINGS

<table>
<thead>
<tr>
<th>Application (1)</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake Valves</td>
<td></td>
</tr>
<tr>
<td>Face Angle</td>
<td>45°</td>
</tr>
<tr>
<td>Head Diameter</td>
<td>1.059&quot; (26.9 mm)</td>
</tr>
<tr>
<td>Length</td>
<td>4.127-4.147&quot; (104.84-105.34 mm)</td>
</tr>
<tr>
<td>Minimum Margin</td>
<td>(2)</td>
</tr>
<tr>
<td>Stem Diameter</td>
<td>.234&quot; (5.96 mm)</td>
</tr>
<tr>
<td>Valve Stem Installed Height (Minimum)</td>
<td></td>
</tr>
<tr>
<td>Center</td>
<td>1.32 (33.7)</td>
</tr>
<tr>
<td>Outer</td>
<td>1.29 (34.0)</td>
</tr>
<tr>
<td>Exhaust Valves</td>
<td></td>
</tr>
<tr>
<td>Face Angle</td>
<td>45°</td>
</tr>
<tr>
<td>Head Diameter</td>
<td>1.177&quot; (29.9 mm)</td>
</tr>
<tr>
<td>Length</td>
<td>4.080-4.100&quot; (103.64-104.14 mm)</td>
</tr>
<tr>
<td>Minimum Margin</td>
<td>(2)</td>
</tr>
<tr>
<td>Stem Diameter</td>
<td>.233&quot; (5.94 mm)</td>
</tr>
<tr>
<td>Valve Stem Installed Height</td>
<td></td>
</tr>
</tbody>
</table>

(1) DO NOT machine valves; hand lap only.
(2) Information not available from manufacturer.
(3) To calculated valve stem installed height or maximum allowable valve seat refacing. See Valve Seats under CYLINDER HEAD.

CYLINDER HEAD

<table>
<thead>
<tr>
<th>Application</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder Head Height (Minimum)</td>
<td>5.480&quot; (139.2 mm)</td>
</tr>
<tr>
<td>Maximum Warpage</td>
<td>.004&quot; (.10 mm)</td>
</tr>
<tr>
<td>Valve Seats</td>
<td></td>
</tr>
<tr>
<td>Intake Valve</td>
<td></td>
</tr>
</tbody>
</table>

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### Seat Angle
<table>
<thead>
<tr>
<th>Seat Angle</th>
<th>45°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seat Width</td>
<td>.059-070&quot; (1.50-1.80 mm)</td>
</tr>
</tbody>
</table>

### Exhaust Valve
<table>
<thead>
<tr>
<th>Seat Angle</th>
<th>45°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seat Width</td>
<td>.070&quot; (1.80 mm)</td>
</tr>
</tbody>
</table>

### Valve Guides

#### Intake Valve
- **Valve Stem-To-Guide Oil Clearance**: (1) .031" (.80 mm)

#### Exhaust Valve
- **Valve Stem-to-Guide Oil Clearance**: (1) .031" (.80 mm)

(1) New valve installed in cylinder head. Dial indicator used to measure valve wobble in guide.

### Camshaft

#### Application

<table>
<thead>
<tr>
<th>Application</th>
<th>In. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Journal Diameter</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>(1)</td>
</tr>
<tr>
<td>Undersize</td>
<td>(1)</td>
</tr>
<tr>
<td>End Play (Maximum)</td>
<td>.007 (.20)</td>
</tr>
<tr>
<td>Runout</td>
<td>.0004 (.010)</td>
</tr>
<tr>
<td>Oil Clearance (Maximum)</td>
<td>.004 (.10)</td>
</tr>
</tbody>
</table>

(1) Information is not available from manufacturer.