

ENGINE

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ENGINE 2.0L SOHC

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ENGINE 2.0L SOHC

DESCRIPTION

The 2.0 Liter (122 cu. in.) in-line four cylinder engine is a single over head camshaft with hydraulic lash adjusters and four valves per cylinder design (Fig. 1). The engine does not have provisions for a free wheeling valve train.

The cylinders are numbered from front of the engine to the rear. The firing order is 1-3-4-2.

The engine identification number is located on the left side of the engine block at the bedplate/engine block parting line near the crankshaft position sensor (Fig. 2).

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE

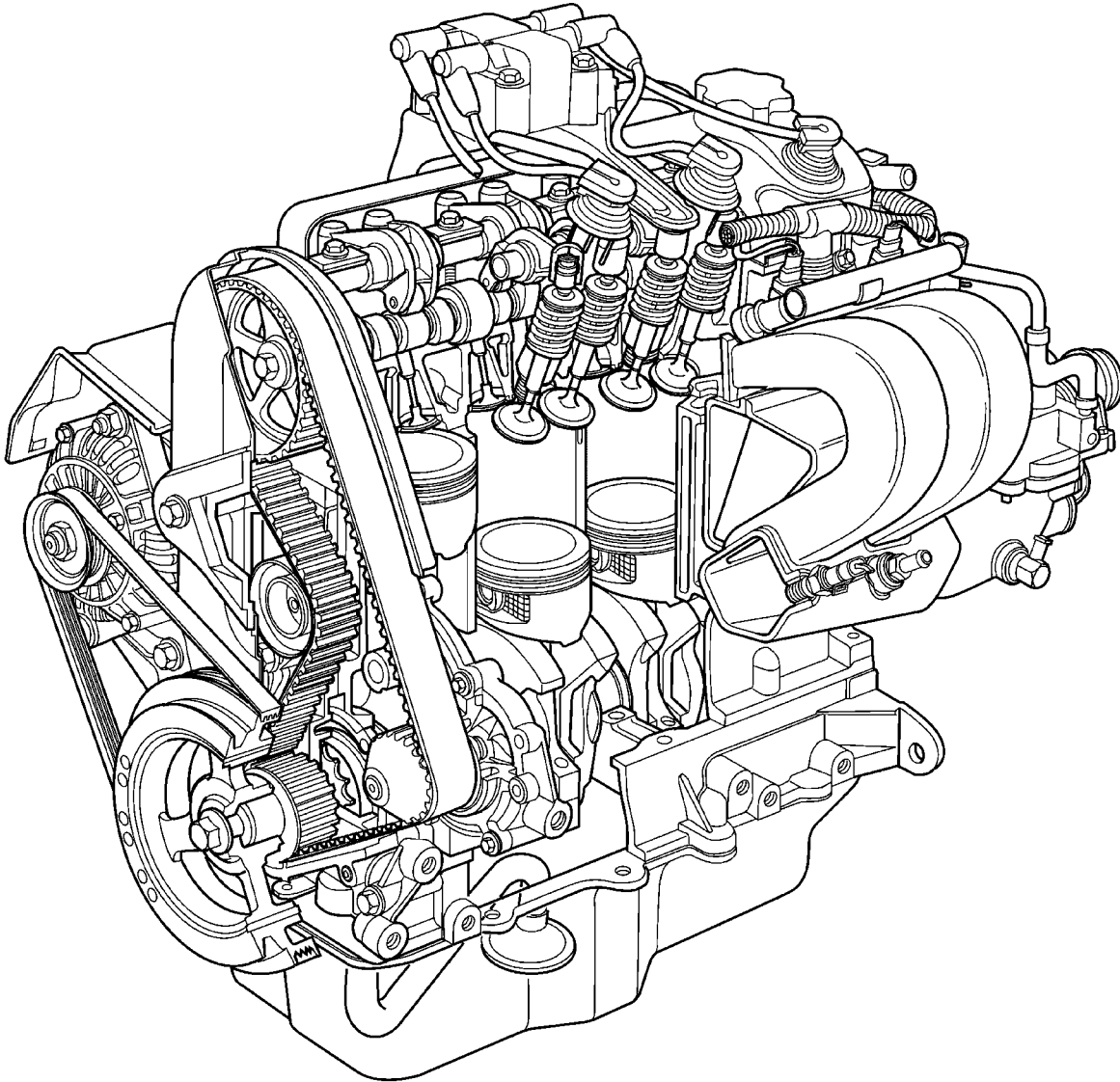
DIAGNOSIS - INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

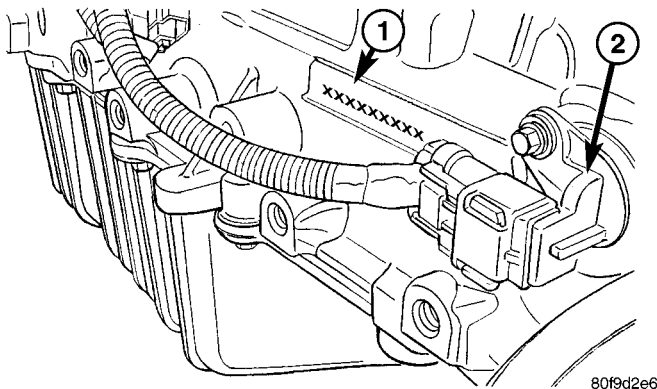
These malfunctions may be classified as either mechanical (e.g., a strange noise), or performance (e.g., engine idles rough and stalls).

Refer to the Engine Mechanical and the Engine Performance diagnostic charts, for possible causes and corrections of malfunctions (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING - MECHANICAL) (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING - PERFORMANCE).

ENGINE 2.0L SOHC (Continued)

**Fig. 1 2.0L SOHC Engine**

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**Fig. 2 Engine Identification**

- 1 - ENGINE IDENTIFICATION LOCATION
- 2 - CRANKSHAFT POSITION SENSOR

For fuel system diagnosis, (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - DIAGNOSIS AND TESTING).

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that cannot be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following:

- Cylinder Compression Pressure Test
- Cylinder Combustion Pressure Leakage Test
- Engine Cylinder Head Gasket Failure Diagnosis
- Intake Manifold Leakage Diagnosis
- Hydraulic Lash Adjuster Noise Diagnosis
- Engine Oil Leak Inspection

ENGINE 2.0L SOHC (Continued)**DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - PERFORMANCE**

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery. 2. Corroded or loose battery connections. 3. Faulty starter. 4. Faulty coil(s) or control unit. 5. Incorrect spark plug gap. 6. Contamination in fuel system. 7. Faulty fuel pump. 8. Incorrect engine timing.	1. Test battery. Charge or replace as necessary. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - DIAGNOSIS AND TESTING) 2. Clean and tighten battery connections. Apply a coat of light mineral grease to terminals. 3. Test starting system. (Refer to 8 - ELECTRICAL/STARTING - DIAGNOSIS AND TESTING) 4. Test and replace as needed. (Refer to Appropriate Diagnostic Information) 5. Set gap. (Refer to 8 - ELECTRICAL/IGNITION CONTROL - SPECIFICATIONS) 6. Clean system and replace fuel filter. 7. Test fuel pump and replace as needed. (Refer to Appropriate Diagnostic Information) 8. Check for a skipped timing belt/chain.
ENGINE STALLS OR IDLES ROUGH	1. Idle speed too low. 2. Incorrect fuel mixture. 3. Intake manifold leakage. 4. Faulty ignition coil(s).	1. Test minimum air flow. (Refer to Appropriate Diagnostic Information) 2. (Refer to Appropriate Diagnostic Information) 3. Inspect intake manifold, manifold gasket, and vacuum hoses. 4. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)

ENGINE 2.0L SOHC (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped plugs. 2. Contamination in fuel system. 3. Faulty fuel pump. 4. Incorrect valve timing. 5. Leaking cylinder head gasket. 6. Low compression. 7. Burned, warped, or pitted valves. 8. Plugged or restricted exhaust system. 9. Faulty ignition coil(s).	1. Clean plugs and set gap. 2. Clean system and replace fuel filter. 3. Test and replace as necessary. (Refer to Appropriate Diagnostic Information) 4. Correct valve timing. 5. Replace cylinder head gasket. 6. Test compression of each cylinder. 7. Replace valves. 8. Perform exhaust restriction test. (Refer to 11 - EXHAUST SYSTEM - DIAGNOSIS AND TESTING) Install new parts, as necessary. 9. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
ENGINE MISSES ON ACCELERATION	1. Dirty or incorrectly gapped spark plugs. 2. Contamination in Fuel System. 3. Burned, warped, or pitted valves. 4. Faulty ignition coil(s).	1. Clean spark plugs and set gap. 2. Clean fuel system and replace fuel filter. 3. Replace valves. 4. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
ENGINE MISSES AT HIGH SPEED	1. Dirty or incorrect spark plug gap. 2. Faulty ignition coil(s). 3. Dirty fuel injector(s). 4. Contamination in fuel system.	1. Clean spark plugs and set gap. 2. Test and replace as necessary. (Refer to Appropriate Diagnostic Information) 3. Test and replace as necessary. (Refer to Appropriate Diagnostic Information) 4. Clean system and replace fuel filter.

ENGINE 2.0L SOHC (Continued)**DIAGNOSIS AND TESTING - ENGINE
DIAGNOSIS - MECHANICAL**

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES	1. High or low oil level in crankcase. 2. Thin or diluted oil. 3. Thick oil 4. Low oil pressure. 5. Dirt in tappets/lash adjusters. 6. Worn rocker arms. 7. Worn tappets/lash adjusters. 8. Worn valve guides. 9. Excessive runout of valve seats on valve faces. 10. Missing adjuster pivot.	1. Check and correct engine oil level. 2. Change oil to correct viscosity. 3. (a) Change engine oil and filter. (b) Run engine to operating temperature. (c) Change engine oil and filter again. 4. Check and correct engine oil level. 5. Replace rocker arm/hydraulic lash adjuster assembly. 6. Inspect oil supply to rocker arms. 7. Install new rocker arm/hydraulic lash adjuster assembly. 8. Ream guides and install new valves with oversize stems. 9. Grind valve seats and valves. 10. Replace rocker arm/hydraulic lash adjuster assembly.
CONNECTING ROD NOISE	1. Insufficient oil supply. 2. Low oil pressure. 3. Thin or diluted oil. 4. Thick oil 5. Excessive bearing clearance. 6. Connecting rod journal out-of-round. 7. Misaligned connecting rods.	1. Check engine oil level. 2. Check engine oil level. Inspect oil pump relief valve and spring. 3. Change oil to correct viscosity. 4. (a) Change engine oil and filter. (b) Run engine to operating temperature. (c) Change engine oil and filter again. 5. Measure bearings for correct clearance. Repair as necessary. 6. Replace crankshaft or grind surface. 7. Replace bent connecting rods.

ENGINE 2.0L SOHC (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
MAIN BEARING NOISE	1. Insufficient oil supply. 2. Low oil pressure. 3. Thin or diluted oil. 4. Thick oil 5. Excessive bearing clearance. 6. Excessive end play. 7. Crankshaft journal out-of-round or worn. 8. Loose flywheel or torque converter.	1. Check engine oil level. 2. Check engine oil level. Inspect oil pump relief valve and spring. 3. Change oil to correct viscosity. 4. (a) Change engine oil and filter. (b) Run engine to operating temperature. (c) Change engine oil and filter again. 5. Measure bearings for correct clearance. Repair as necessary. 6. Check thrust bearing for wear on flanges. 7. Replace crankshaft or grind journals. 8. Tighten to correct torque.
OIL PRESSURE DROP	1. Low oil level. 2. Faulty oil pressure sending unit. 3. Low oil pressure. 4. Clogged oil filter. 5. Worn parts in oil pump. 6. Thin or diluted oil. 7. Oil pump relief valve stuck. 8. Oil pump suction tube loose. 9. Oil pump cover warped or cracked. 10. Excessive bearing clearance.	1. Check engine oil level. 2. Install new sending unit. 3. Check sending unit and main bearing oil clearance. 4. Install new oil filter. 5. Replace worn parts or pump. 6. Change oil to correct viscosity. 7. Remove valve and inspect, clean, or replace. 8. Remove oil pan and install new tube or clean, if necessary. 9. Install new oil pump. 10. Measure bearings for correct clearance.
OIL LEAKS	1. Misaligned or deteriorated gaskets. 2. Loose fastener, broken or porous metal part. 3. Misaligned or deteriorated cup or threaded plug.	1. Replace gasket(s). 2. Tighten, repair or replace the part. 3. Replace as necessary.

ENGINE 2.0L SOHC (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL CONSUMPTION OR SPARK PLUGS FOULED	1. PCV system malfunction. 2. Worn, scuffed or broken rings. 3. Carbon in oil ring slots. 4. Rings fitted too tightly in grooves. 5. Worn valve guide(s). 6. Valve stem seal(s) worn or damaged.	1. Check system and repair as necessary. (Refer to 25 - EMISSIONS CONTROL/ EVAPORATIVE EMISSIONS/PCV VALVE - DIAGNOSIS AND TESTING) 2. Hone cylinder bores. Install new rings. 3. Install new rings. 4. Remove rings and check grooves. If groove is not proper width, replace piston. 5. Ream guide(s) and replace valve(s) with oversize valve(s) and seal(s). 6. Replace seal(s).

DIAGNOSIS AND TESTING - CYLINDER COMBUSTION PRESSURE LEAKAGE TEST

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

WARNING: DO NOT REMOVE THE PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

Check the coolant level and fill as required. DO NOT install the pressure cap.

Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.

Clean spark plug recesses with compressed air.

Remove the spark plugs.

Remove the oil filler cap.

Remove the air cleaner.

Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum, with 552 kPa (80 psi) recommended.

Perform the test procedures on each cylinder according to the tester manufacturer's instructions. While testing, listen for pressurized air escaping

through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the coolant.

All gauge pressure indications should be equal, with no more than 25% leakage per cylinder.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

DIAGNOSIS AND TESTING - CYLINDER COMPRESSION PRESSURE TEST

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

(1) Check engine oil level and add oil if necessary.

(2) Drive the vehicle until engine reaches normal operating temperature. Select a route free from traffic and other forms of congestion, observe all traffic laws, and accelerate through the gears several times briskly.

(3) Remove all spark plugs from engine. As spark plugs are being removed, check electrodes for abnormal firing indicators fouled, hot, oily, etc. Record cylinder number of spark plug for future reference.

(4) Remove the Auto Shutdown (ASD) relay from the PDC.

(5) Be sure throttle blade is fully open during the compression check.

(6) Insert compression gauge adaptor Special Tool 8116 or the equivalent, into the #1 spark plug hole in cylinder head. Connect the 0–500 psi (Blue) pressure

ENGINE 2.0L SOHC (Continued)

transducer (Special Tool CH7059) with cable adaptors to the DRBIII®. For Special Tool identification, (Refer to 9 - ENGINE - SPECIAL TOOLS).

(7) Crank engine until maximum pressure is reached on gauge. Record this pressure as #1 cylinder pressure.

(8) Repeat the previous step for all remaining cylinders.

(9) Compression should not be less than 689 kPa (100 psi) and not vary more than 25 percent from cylinder to cylinder.

(10) If one or more cylinders have abnormally low compression pressures, repeat the compression test.

(11) If the same cylinder or cylinders repeat an abnormally low reading on the second compression test, it could indicate the existence of a problem in the cylinder in question. **The recommended compression pressures are to be used only as a guide to diagnosing engine problems. An engine should not be disassembled to determine the cause of low compression unless some malfunction is present.**

STANDARD PROCEDURE

STANDARD PROCEDURE - REPAIR OF DAMAGED OR WORN THREADS

Damaged or worn threads (excluding spark plug and camshaft bearing cap attaching threads) can be repaired. Essentially, this repair consists of drilling out worn or damaged threads, tapping the hole with a special Heli-Coil Tap, (or equivalent) and installing an insert into the tapped hole. This brings the hole back to its original thread size.

CAUTION: Be sure that the tapped holes maintain the original center line.

Heli-Coil tools and inserts are readily available from automotive parts jobbers.

STANDARD PROCEDURE - HYDROSTATIC LOCKED ENGINE

When an engine is suspected to be hydrostatically locked, regardless of what caused the problem, the following steps should be used.

CAUTION: DO NOT use starter motor to rotate the engine, severe damage may occur.

(1) Inspect air cleaner, induction system and intake manifold to insure system is dry and clear of foreign material.

(2) Remove negative battery cable.

(3) Place a shop towel around the spark plugs when removing them from the engine. This will catch

any fluid that may possibly be in the cylinder under pressure.

(4) With all spark plugs removed, rotate engine crankshaft using a breaker bar and socket.

(5) Identify the fluid in the cylinder(s) (i.e., coolant, fuel, oil or other).

(6) Make sure all fluid has been removed from the cylinders. Inspect engine for damage (i.e., connecting rods, pistons, valves, etc.)

(7) Repair engine or components as necessary to prevent this problem from re-occurring.

CAUTION: Squirt approximately one teaspoon of oil into the cylinders, rotate engine to lubricate the cylinder walls to prevent damage on restart.

(8) Install new spark plugs.

(9) Drain engine oil and remove oil filter.

(10) Install a new oil filter.

(11) Fill engine with specified amount of approved oil.

(12) Connect negative battery cable.

(13) Start engine and check for any leaks.

STANDARD PROCEDURE - FORM-IN-PLACE GASKETS AND SEALERS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket.

There are numerous types of form-in-place gasket materials that are used in the engine area. Mopar® Engine RTV GEN II, Mopar® ATF-RTV, and Mopar® Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

MOPAR® ENGINE RTV GEN II is used to seal components exposed to engine oil. This material is a specially designed black silicone rubber RTV that retains adhesion and sealing properties when exposed to engine oil. Moisture in the air causes the material to cure. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® ATF RTV is a specifically designed black silicone rubber RTV that retains adhesion and sealing properties to seal components exposed to automatic transmission fluid, engine coolants, and moisture. This material is available in three ounce

ENGINE 2.0L SOHC (Continued)

tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER is an anaerobic type gasket material. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR® BED PLATE SEALANT is a unique (green-in-color) anaerobic type gasket material that is specially made to seal the area between the bed plate and cylinder block without disturbing the bearing clearance or alignment of these components. The material cures slowly in the absence of air when torqued between two metallic surfaces, and will rapidly cure when heat is applied.

MOPAR® GASKET SEALANT is a slow drying, permanently soft sealer. This material is recommended for sealing threaded fittings and gaskets against leakage of oil and coolant. Can be used on threaded and machined parts under all temperatures. This material is used on engines with multi-layer steel (MLS) cylinder head gaskets. This material also will prevent corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or 4oz./16 oz. can w/applicator.

SEALER APPLICATION

Mopar® Gasket Maker material should be applied sparingly 1 mm (0.040 in.) diameter or less of sealant to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Engine RTV GEN II or ATF RTV gasket material should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. All mounting holes must be circled. For corner sealing, a 3.17 or 6.35 mm (1/8 or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Gasket Sealant in an aerosol can should be applied using a thin, even coat sprayed completely over both surfaces to be joined, and both sides of a gasket. Then proceed with assembly. Material in a can w/applicator can be brushed on evenly over the sealing surfaces. Material in an aerosol can should be used on engines with multi-layer steel gaskets.

STANDARD PROCEDURE - ENGINE GASKET SURFACE PREPARATION

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.

Never use the following to clean gasket surfaces:

- Metal scraper
- Abrasive pad or paper to clean cylinder block and head
- High speed power tool with an abrasive pad or a wire brush (Fig. 3)

NOTE: Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.

Only use the following for cleaning gasket surfaces:

- Solvent or a commercially available gasket remover
- Plastic or wood scraper (Fig. 3)
- Drill motor with 3M Roloc™ Bristle Disc (white or yellow) (Fig. 3)

CAUTION: Excessive pressure or high RPM (beyond the recommended speed), can damage the sealing surfaces. The mild (white, 120 grit) bristle disc is recommended. If necessary, the medium (yellow, 80 grit) bristle disc may be used on cast iron surfaces with care.

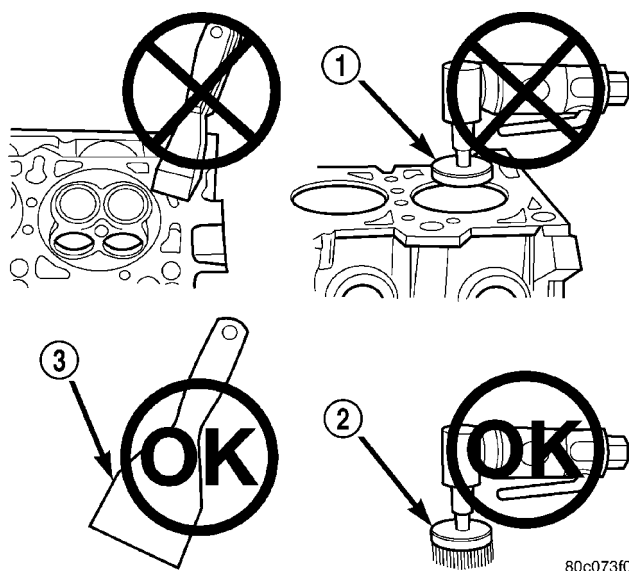


Fig. 3 Proper Tool Usage For Surface Preparation

- 1 - ABRASIVE PAD
- 2 - 3M ROLOC™ BRISTLE DISC
- 3 - PLASTIC/WOOD SCRAPER

ENGINE 2.0L SOHC (Continued)

STANDARD PROCEDURE - MEASURING BEARING CLEARANCE USING PLASTIGAGE

Engine crankshaft bearing clearances can be determined by use of Plastigage or equivalent. The following is the recommended procedure for the use of Plastigage:

- (1) Remove oil film from surface to be checked. Plastigage is soluble in oil.
- (2) Place a piece of Plastigage across the entire width of the bearing shell in the cap approximately 6.35 mm (1/4 in.) off center and away from the oil holes (Fig. 4). (In addition, suspected areas can be checked by placing the Plastigage in the suspected area). Torque the bearing cap/bed plate bolts of the bearing being checked to the proper specifications.

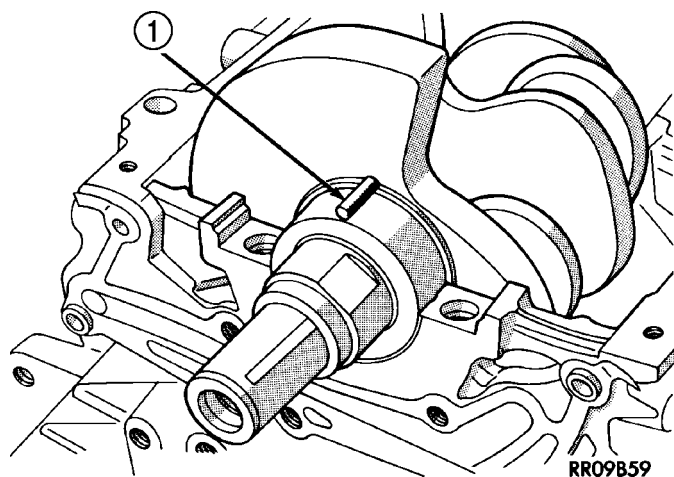


Fig. 4 Plastigage Placed in Lower Shell—Typical

1 - PLASTIGAGE

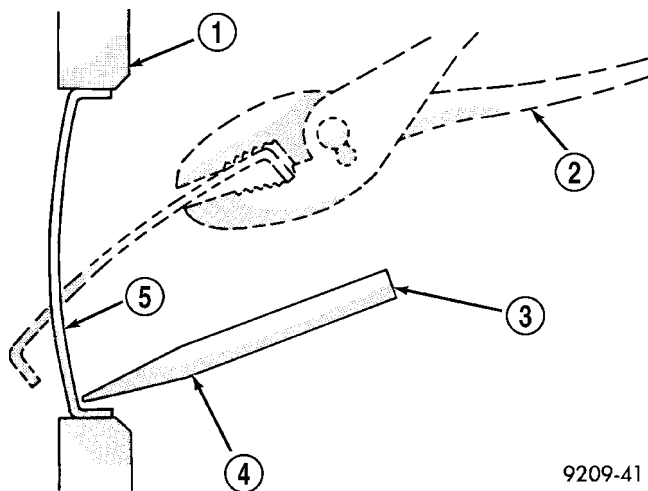
- (3) Remove the bearing cap and compare the width of the flattened Plastigage with the metric scale provided on the package. Locate the band closest to the same width. This band shows the amount of clearance in thousandths of a millimeter. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Compare clearance measurements to specs found in engine specifications (Refer to 9 - ENGINE - SPECIFICATIONS). **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.**

NOTE: Plastigage is available in a variety of clearance ranges. Use the most appropriate range for the specifications you are checking.

- (4) Install the proper crankshaft bearings to achieve the specified bearing clearances.

STANDARD PROCEDURE - ENGINE CORE AND OIL GALLERY PLUGS

Using a blunt tool such as a drift and a hammer, strike the bottom edge of the cup plug. With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 5).



9209-41

Fig. 5 Core Hole Plug Removal

- 1 - CYLINDER BLOCK
- 2 - REMOVE PLUG WITH PLIERS
- 3 - STRIKE HERE WITH HAMMER
- 4 - DRIFT PUNCH
- 5 - CUP PLUG

CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with Mopar® Stud and Bearing Mount. Make certain the new plug is cleaned of all oil or grease. Using proper drive plug, drive plug into hole so that the sharp edge of the plug is at least 0.5 mm (0.020 in.) inside the lead-in chamfer.

It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

REMOVAL - ENGINE ASSEMBLY

- (1) Perform fuel pressure release procedure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE). Remove fuel line to fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).

- (2) Disconnect and remove battery and tray.

- (3) Drain cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).

ENGINE 2.0L SOHC (Continued)

(4) Discharge air conditioning system (if equipped) (Refer to 24 - HEATING & AIR CONDITIONING - STANDARD PROCEDURE).

(5) Disconnect the following:

- (a) Air intake duct at intake manifold
- (b) Throttle cables
- (c) Electrical connectors from throttle body

(6) Remove air cleaner housing assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).

(7) Remove radiator upper hose.

(8) Remove radiator fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).

(9) Remove radiator lower hose.

(10) **Automatic Transmission equipped vehicles:**

(a) Using a blade or suitable hose cutter, cut transaxle oil cooler lines off flush with transmission fittings. Plug lines and fittings to prevent debris from entering transaxle or cooler circuit. A service splice kit will be installed upon reassembly.

(b) Disconnect transmission electrical connectors.

(c) Disconnect transmission shift linkage.

(11) **Manual Transmission equipped vehicles:**

(a) Using Special Tool 6638A, disconnect clutch hydraulic line.

(b) Disconnect transmission shift linkage.

(c) Disconnect transmission electrical connectors.

(12) Disconnect engine wiring harness.

(13) Disconnect and remove powertrain control module (PCM).

(14) Disconnect positive cable from power distribution center (PDC) and ground wire from vehicle body.

(15) Disconnect the body-to-engine ground wire at the right side strut tower.

(16) Disconnect heater hoses.

(17) Disconnect vacuum hose from brake booster.

(18) Disconnect coolant reserve/recovery hose.

(19) Remove power steering pump drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(20) Siphon as much fluid as possible from the power steering fluid reservoir.

(21) Disconnect power steering lines from power steering pump. Remove the power steering pump/reservoir.

(22) Disconnect lines and remove air conditioning compressor (if equipped) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - REMOVAL).

(23) Hoist vehicle.

(24) Remove front wheels.

(25) Remove accessory drive belt splash shield.

(26) Remove generator drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(27) Drain engine oil.

(28) Remove axle shafts (Refer to 3 - DIFFERENTIAL & DRIVELINE/HALF SHAFT - REMOVAL).

(29) Remove screws attaching power steering cooler (if equipped) and relocate cooler to provide engine removal clearance.

(30) Disconnect downstream oxygen sensor connector.

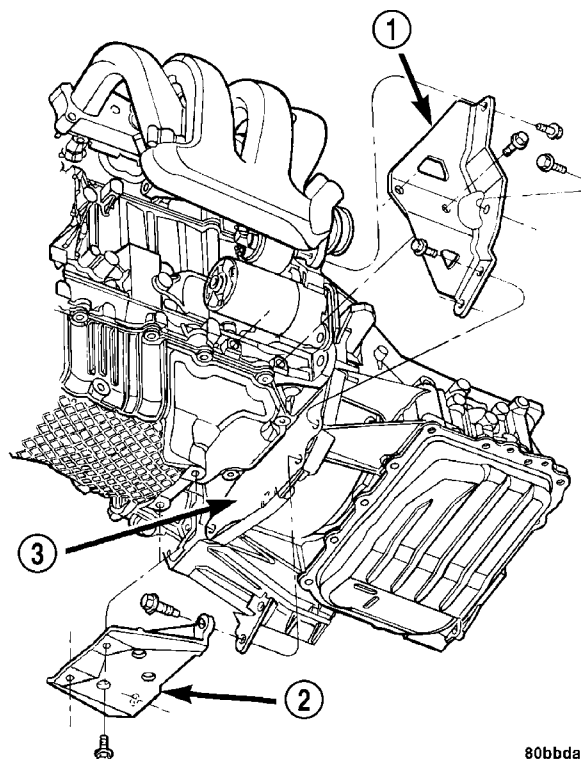
(31) Disconnect exhaust system from exhaust manifold.

(32) Disconnect exhaust system isolators and move exhaust rearward.

(33) Remove lower engine torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - REMOVAL).

(34) Remove generator, lower bracket, and upper mounting bolt.

(35) Remove structural collar, intake support bracket, and dust cover (Fig. 6) (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COVER - REMOVAL).



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Fig. 6 Manifold Support Bracket, Structural Collar, and Dust Cover

- 1 - SUPPORT BRACKET
- 2 - STRUCTURAL COLLAR
- 3 - DUST COVER

(36) **Automatic Transmission equipped vehicles:**

ENGINE 2.0L SOHC (Continued)

(a) Remove torque converter bolts and mark converter to flex plate orientation for reassembly.

(37) Manual Transmission equipped vehicles:

(a) Remove drive plate to clutch module bolts.

(38) Remove bolt securing power steering line to engine block. Reposition power steering line to allow for engine removal.

(39) Lower vehicle.

(40) Raise vehicle enough to allow engine dolly and cradle, Special Tools 6135 and 6710 to be installed under vehicle.

(41) Loosen engine support posts to allow movement for positioning onto engine locating holes and flange on the engine bedplate. Lower vehicle and position cradle until the engine is resting on support posts (Fig. 9). Tighten mounts to cradle frame. This will keep support posts from moving when removing or installing engine and transmission.

(42) Install safety straps around the engine to cradle (Fig. 9). Tighten straps and lock them into position.

WARNING: Safety straps MUST be used to secure engine to the dolly fixture.

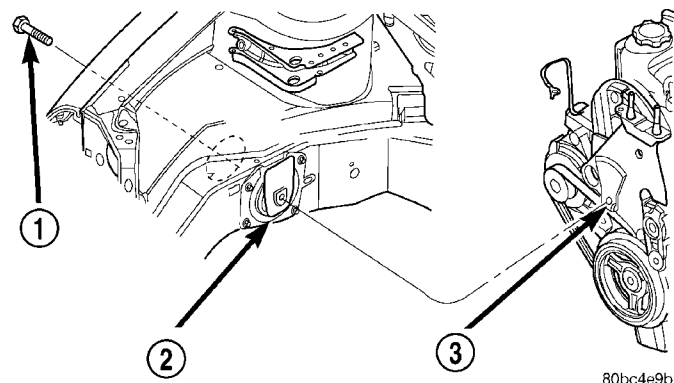
(43) Raise vehicle enough to see if straps are tight enough to hold cradle assembly to engine.

(44) Lower vehicle so weight of the engine and transmission ONLY is on the cradle assembly.

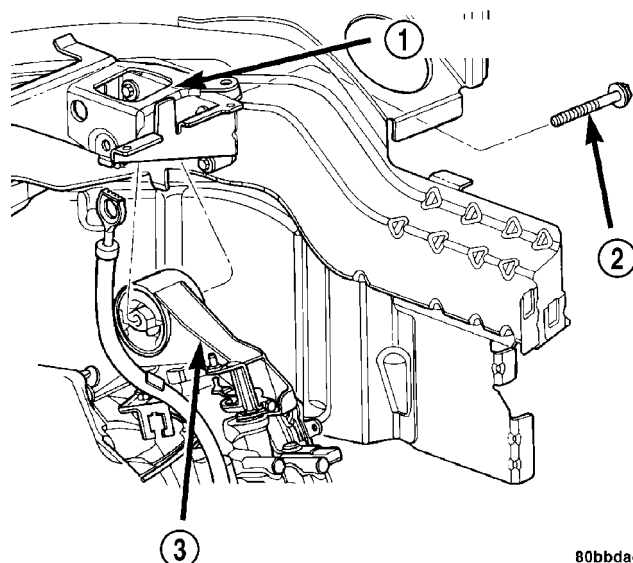
(45) Remove upper engine torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - REMOVAL).

(46) Remove right and left engine and transaxle mount through bolts (Fig. 7) and (Fig. 8).

(47) Continue raising vehicle slowly until engine/transaxle assembly clears engine compartment. It may be necessary to move the engine/transmission assembly with the cradle to allow for removal around body flanges.

**Fig. 7 Right Mount**

- 1 - THROUGH BOLT
- 2 - RIGHT ENGINE MOUNT
- 3 - ENGINE MOUNT BRACKET

**Fig. 8 Left Mount Through Bolt**

- 1 - MOUNT BRACKET
- 2 - BOLT
- 3 - MOUNT

INSTALLATION - ENGINE ASSEMBLY

(1) Position engine and transmission assembly under vehicle and slowly lower the vehicle over the engine/transaxle assembly.

(2) Continue lowering vehicle until engine/transaxle aligns to mounting locations. Install mounting bolts at the right and left engine/transaxle mounts (Fig. 7) and (Fig. 8). Tighten bolts to 118 N·m (87 ft. lbs.).

(3) Install upper engine torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - INSTALLATION).

(4) Remove safety straps from engine/transaxle assembly. Slowly raise vehicle enough to remove the engine dolly and cradle.

(5) Raise vehicle on hoist.

(6) Install generator, lower bracket, and adjusting bolt.

(7) Install axle shafts (Refer to 3 - DIFFERENTIAL & DRIVELINE/HALF SHAFT - INSTALLATION).

(8) Automatic Transmission equipped vehicles:

(a) Install torque converter bolts.

(9) Manual Transmission equipped vehicles:

(a) Install drive plate to clutch module bolts.

(10) Install bolt securing power steering line to engine block.

(11) Install screws for power steering cooler (if equipped).

(12) Install dust shield, intake manifold support bracket, and structural collar (Fig. 6)(Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COVER - INSTALLATION).

ENGINE 2.0L SOHC (Continued)

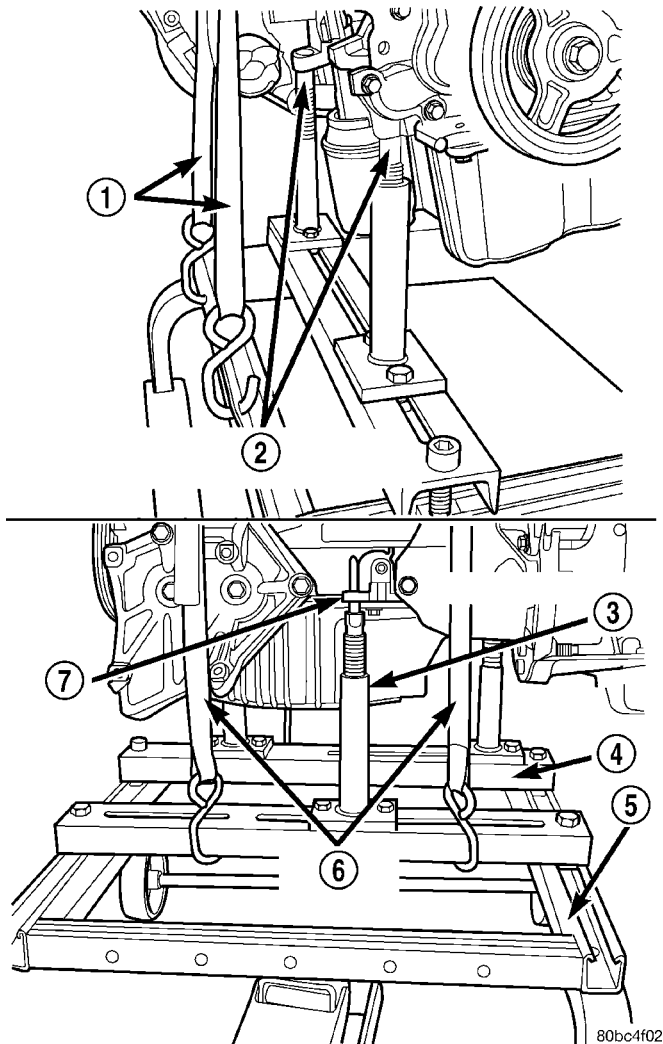


Fig. 9 Positioning Engine Cradle Support Post

- 1 - SAFETY STRAPS
- 2 - PLACE REAR POSTS INTO LOCATING HOLES
- 3 - SPECIAL TOOL 6848
- 4 - SPECIAL TOOL 6710
- 5 - SPECIAL TOOL 6135
- 6 - SAFETY STRAPS
- 7 - PLACE FRONT POST UNDER BLOCK FLANGE

(13) Install lower engine torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - INSTALLATION).

(14) Connect exhaust system isolators and catalytic converter to exhaust manifold. Torque exhaust fasteners to 28 N·m (250 in. lbs.).

(15) Connect downstream oxygen sensor.

(16) Install A/C compressor and lines (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - INSTALLATION).

(17) Install accessory drive belts (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(18) Ensure oil pan drain plug is tight. Install new oil filter.

(19) Install accessory drive belt splash shield.

(20) Install front wheels and lower vehicle.

(21) Install power steering pump and reservoir. Connect power steering lines.

(22) **Manual Transmission equipped vehicles:**

- (a) Connect clutch hydraulic line.
- (b) Connect transmission shift linkage.
- (c) Connect transmission electrical connectors.

NOTE: It is not necessary to bleed the clutch hydraulic system. The quick-connect fittings close immediately after disconnection; allowing no fluid to escape.

(23) **Automatic Transmission equipped vehicles:**

(a) Connect transmission oil cooler lines using service splice kit. Refer to instructions provided with kit.

(b) Connect transmission electrical connectors.

(c) Connect transmission shift linkage.

(24) Connect fuel line (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).

(25) Connect heater hoses.

(26) Connect all ground straps.

(27) Install and connect powertrain control module (PCM).

(28) Connect engine wiring harness.

(29) Connect lower radiator hose.

(30) Install radiator fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

(31) Install upper radiator hose.

(32) Fill cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).

(33) Install battery tray and battery.

(34) Install air cleaner housing assembly and connect intake duct to intake manifold (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(35) Connect all throttle body electrical connectors and linkage.

(36) Fill engine crankcase with proper oil to correct level.

(37) Fill power steering fluid reservoir with proper fluid to correct level.

(38) Evacuate and recharge Air Conditioning system (if equipped)(Refer to 24 - HEATING & AIR CONDITIONING - STANDARD PROCEDURE).

(39) Start engine and run until operating temperature is reached.

(40) Ensure engine is properly positioned by performing torque strut adjustment (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - ADJUSTMENTS).

(41) Adjust transmission linkage, if necessary.

ENGINE 2.0L SOHC (Continued)

SPECIFICATIONS

2.0L DOHC ENGINE

GENERAL SPECIFICATIONS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Type	In-Line OHV, DOHC	
Number of Cylinders	4	
Displacement	2.0 Liters	122 cu. in.
Bore	87.5 mm	3.445 in.
Stroke	83.0 mm	3.268 in.
Compression Ratio	9.4:1	
Firing Order	1-3-4-2	
Compression Pressure	1172-1551 kPa	170-225 psi
Max. Variation Between Cylinders	25%	

CYLINDER BLOCK

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Cylinder Bore Diameter	87.4924-87.5076 mm	3.4446-3.4452 in.
Out-of-Round (Max.)	0.051 mm	0.002 in.
Taper (Max.)	0.051 mm	0.002 in.

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Piston Diameter	87.463-87.481 mm	3.4434-3.4441 in.
Clearance @ 17.5 mm (11/16 in.) from bottom of skirt	0.018-0.050 mm	0.0007-0.0020 in.
Weight	340-350 grams	11.99-12.34 oz.
Land Clearance (Diametrical)	0.740-0.803 mm	0.029-0.031 in.
Piston Length	64.8 mm	2.551 in.

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Piston Ring Groove Depth No. 1	3.983-4.132 mm	0.157-0.163 in.
Piston Ring Groove Depth No. 2	4.456-4.605 mm	0.175-0.181 in.
Piston Ring Groove Depth No. 3	3.841-4.075 mm	0.151-0.160 in.

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance in Piston	0.008-0.020 mm	0.0003-0.0008 in.
Clearance in Connecting Rod	Interference	
Diameter	20.998-21.003 mm	0.8267-0.8269 in.
End Play	None	
Length	74.75-75.25 mm	2.943-2.963 in.

PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Ring Gap-Top Compression Ring	0.23-0.52 mm	0.009-0.020 in.
Wear Limit	0.8 mm	0.031 in.
Ring Gap-2nd Compression Ring	0.49-0.78 mm	0.019-0.031 in.
Wear Limit	0.8 mm	0.031 in.
Ring Gap-Oil Control Steel Rails	0.23-0.66 mm	0.009-0.026 in.
Wear Limit	1.0 mm	0.039 in.
Ring Side Clearance-Compression Rings	0.025-0.065 mm	0.0010-0.0026 in.
Wear Limit	0.10 mm	0.004 in.

ENGINE 2.0L SOHC (Continued)

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Ring Side Clearance-Oil Ring Pack	0.004-0.178 mm	0.0002-0.0070 in.
Ring Width-Compression Rings	1.47-1.50 mm	0.057-0.059 in.
Ring Width-Oil Ring Pack	2.854-3.008 mm	0.1124-0.1184 in.

CONNECTING ROD

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bearing Clearance	0.026-0.059 mm	0.001-0.0023 in.
Wear Limit	0.075 mm	0.003 in.
Bore Diameter-Piston Pin	20.96-20.98 mm	0.8252-0.8260 in.
Bore Diameter-Crankshaft End	50.991-51.005 mm	2.0075-2.0081 in.
Side Clearance	0.13-0.38 mm	0.005-0.015 in.
Wear Limit	0.40 mm	0.016 in.
Weight-Total (Less Bearing)	548.8 grams	19.36 oz.

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Connecting Rod Journal Diameter	47.9924-48.0076 mm	1.8894-1.8900 in.
Main Bearing Journal Diameter	51.9924-52.0076 mm	2.0469-2.0475 in.
Journal Out-of-Round (Max.)	0.0035 mm	0.0001 in.
Journal Taper (Max.)	0.0038 mm	0.0001 in.
End Play	0.09-0.27 mm	0.0035-0.0106 in.
Wear Limit	0.37 mm	0.015 in.
Main Bearing Diametrical Clearance	0.022-0.062 mm	0.0008-0.0024 in.

HYDRAULIC LASH ADJUSTER

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Body Diameter	15.901-15.913 mm	0.626-0.6264 in.
Plunger Travel Minimum (Dry)	3.0 mm	0.118 in.

CYLINDER HEAD CAMSHAFT BEARING BORE DIAMETER

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Journals No.1-6	26.020-26.041 mm	1.024-1.025 in.

CAMSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Journal Diameter No. 1-6	25.951-25.970 mm	1.021-1.022 in.
Bearing Clearance-Diametrical	0.069-0.071 mm	0.0027-0.003 in.
End Play	0.05-0.15 mm	0.002-0.006 in.
Lift (Zero Lash)		
Intake	8.65 mm	0.340 in.
Exhaust	7.95 mm	0.312 in.
Intake Valve Timing*		
Closes (ABDC)	33.6°	
Opens (BTDC)	3.8°	
Duration	212.8°	
Exhaust Valve Timing*		
Closes (BTDC)	1°	
Opens (BBDC)	41.8°	
Duration	220.8°	
Valve Overlap	0°	
*All readings in crankshaft degrees, at 0.5 mm (0.019 in.) of valve lift.		

ENGINE 2.0L SOHC (Continued)

CYLINDER HEAD

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Material	Cast Aluminum	
Gasket Thickness (Compressed)	0.71 mm	0.028 in.

VALVE SEAT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Angle	44.5°- 45°	
Seat Diameter-Intake	34.37- 4.63mm	1.353-1.363in.
Seat Diameter-Exhaust	27.06- 7.32mm	1.065-1.075in.
Runout (Max.)	0.05 mm	0.002 in.
Valve Seat Width-Intake and Exhaust	0.9-1.3 mm	0.035-0.051 in.
Service Limit-Intake	2.0 mm	0.079 in.
Service Limit-Exhaust	2.5 mm	0.098 in.

VALVE GUIDE

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Diameter I.D.	5.975-6.000 mm	0.235-0.236 in.
Guide Bore Diameter	11.0-11.02 mm	0.4330-0.4338 in.
Guide Height (spring seat to guide tip)	13.25-13.75 mm	0.521-0.541 in.

VALVES

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Face Angle-Intake and Exhaust	44.5-45°	
Head Diameter-Intake	34.67-34.93 mm	1.364-1.375 in.
Head Diameter-Exhaust	28.32-28.52 mm	1.114-1.122 in.
Valve Length (Overall)		
-Intake	112.76-113.32 mm	4.439-4.461 in.
-Exhaust	110.89-111.69 mm	4.365-4.397 in.
Valve Stem Diameter		
-Intake	5.934-5.952 mm	0.2337-0.2344 in.
-Exhaust	5.906-5.924 mm	0.2326-0.2333 in.

VALVE MARGIN

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake	1.200-1.700 mm	0.047-0.066
Service Limit	0.95 mm	1/32 in.
Exhaust	0.985-1.315 mm	0.038-0.051 in.
Service Limit	1.05 mm	3/64 in.

VALVE STEM TIP HEIGHT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake	48.04 mm	1.891 in.
Exhaust	47.99 mm	1.889 in.

ENGINE 2.0L SOHC (Continued)

VALVE STEM TO GUIDE CLEARANCE

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake	0.048-0.066 mm	0.0018-0.0025 in.
Max. Allowable	0.076 mm	0.003 in.
Exhaust	0.0736-0.094 mm	0.0029-0.0037 in.
Max. Allowable	0.101 mm	0.004 in.

VALVE SPRINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Free Length (Approx.)	49.2 mm	1.937 in.
Nominal Force (Valve Closed)	334 N @ 38.0 mm	75 lbs. @ 1.496 in.
Nominal Force (Valve Open)	598 N @ 29.75 mm	134 lbs. @ 1.172 in.
Installed Height	38.00 mm	1.496 in.
Number of Coils	6.9	
Wire Diameter	3.61 mm	0.142 in.

OIL PUMP

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance Over Rotors (Max.)	0.10 mm	0.004 in.
Cover Out-of-Flat (Max.)	0.076 mm	0.003 in.
Inner Rotor Thickness (Min.)	7.64 mm	0.301 in.
Outer Rotor Thickness (Min.)	7.64 mm	0.301 in.
Outer Rotor Clearance (Max.)	0.039 mm	0.015 in.
Outer Rotor Diameter (Min.)	79.95 mm	3.148 in.
Tip Clearance Between Rotors (Max.)	0.20 mm	0.008 in.

OIL PRESSURE

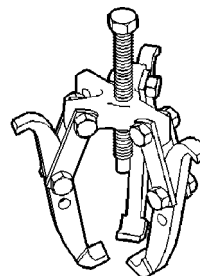
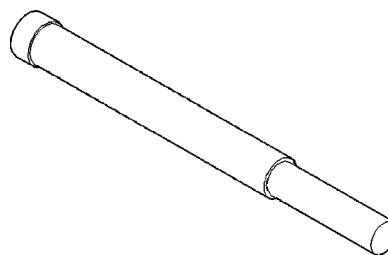
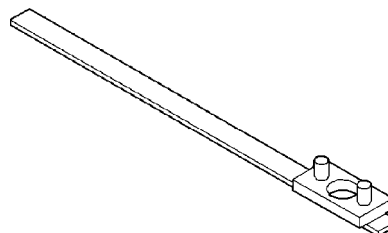
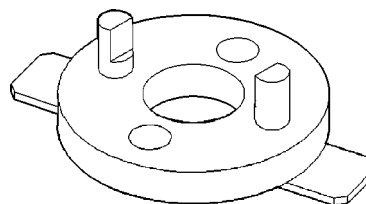
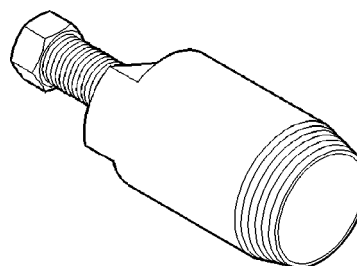
DESCRIPTION	SPECIFICATION	
	Metric	Standard
At Curb Idle Speed*	25 kPa	4 psi
At 3000 rpm	170-550 kPa	25-80 psi
CAUTION: *If pressure is ZERO at curb idle, DO NOT run engine at 3000 rpm.		

TORQUE

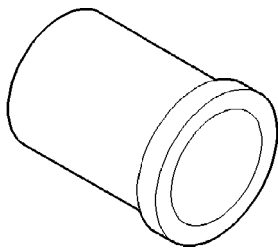
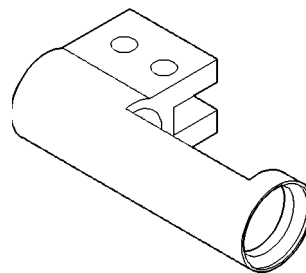
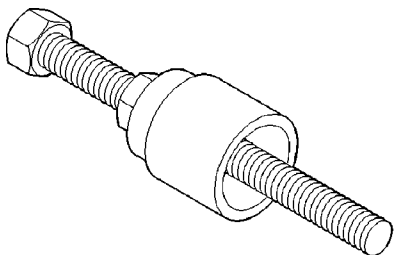
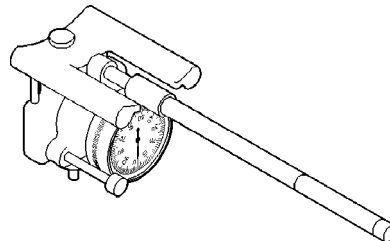
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Camshaft Sensor-Bolts	(Refer to 8 - ELECTRICAL/IGNITION CONTROL - SPECIFICATIONS)		
Camshaft Sprocket-Bolt	115	85	-
Connecting Rod Cap-Bolts	27 + $\frac{1}{4}$ turn	20 + $\frac{1}{4}$ turn	-
Structural Collar-Bolts	(Refer to 9 - ENGINE/ ENGINE BLOCK/ STRUCTURAL COVER - INSTALLATION)		
Crankshaft Main Bearing Cap/Bedplate			
-M8 Bolts	34	25	-
-M11 Bolts	81	60	-
Crankshaft Damper	136	100	-
Crankshaft Target Ring	13	-	110
Cylinder Head-Bolts	(Refer to 9 - ENGINE/ CYLINDER HEAD - INSTALLATION)		
Cylinder Head Cover-Bolts	12	-	105
Engine Mount Bracket Right-Bolts	61	45	-
Engine Mounting	Refer to Procedure		
Exhaust Manifold to Cylinder Head-Bolts	23	-	200
Exhaust Manifold Support Bracket (Federal and LEV)			
-M8 Nut	28	-	250
-M10 Bolt	61	45	-

ENGINE 2.0L SOHC (Continued)

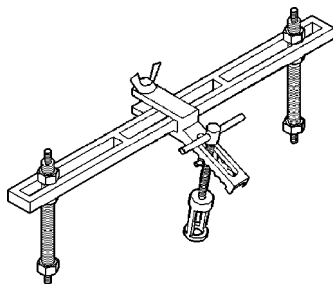
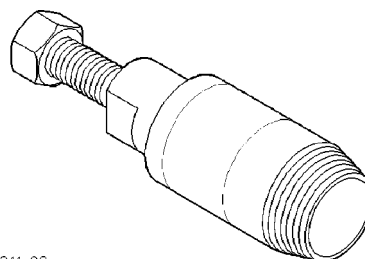
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Exhaust Manifold Support Bracket (ULEV)	54	40	-
Engine Torque Strut Bracket to Engine-Bolts	61	45	-
Flex Plate to Crankshaft	95	70	-
Intake Manifold-Bolts	12	-	105
Powertrain Bending Strut-Front			
-Long Bolts	101	75	-
-Short Bolts	61	45	-
Oil Filter Adaptor	80	60	-
Oil Filter	11	8	-
Oil Pan—Bolts	12	-	105
Oil Pan Drain—Plug	27	20	-
Oil Pump to Block	28	-	250
Oil Pump Cover Plate-Bolts	12	-	105
Oil Pump Pick-up Tube-Bolt	28	-	250
Oil Pump Relief Valve-Cap	41	30	-
PCV Valve	5.6	-	50
Rocker Arm Shaft-Bolts	28	-	250
Spark Plugs	(Refer to 8 - ELECTRICAL/IGNITION CONTROL - SPECIFICATIONS)		
Timing Belt Cover-Bolts	12	-	105
Timing Belt Tensioner Bracket-Mounting Bolts	31	23	-
Timing Belt Tensioner Lock Nut	30	22	-
Water Pump-Bolts	(Refer to 7 - COOLING - SPECIFICATIONS)		

SPECIAL TOOLS**2.0L SOHC ENGINE****Puller 1026****Crankshaft Damper Removal Insert 6827A****Camshaft Sprocket Remover/Installer C-4687****Camshaft Sprocket Remover/Installer Adapter C-4687-1****Camshaft Seal Remover C-4679-A**

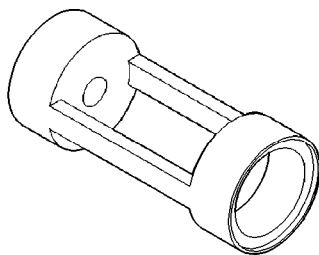
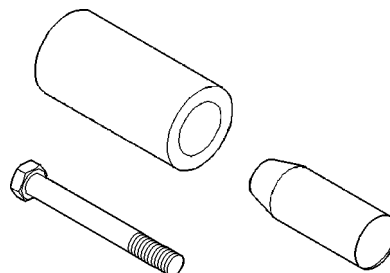
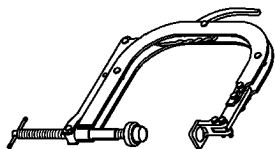
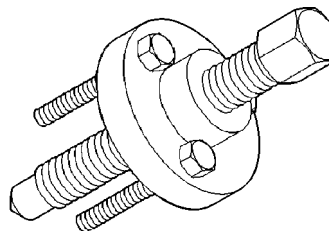
ENGINE 2.0L SOHC (Continued)

**Camshaft Seal Installer MD-998306****Spring Compressor Adapter 6526****Crankshaft Damper/Sprocket Installer 6792**

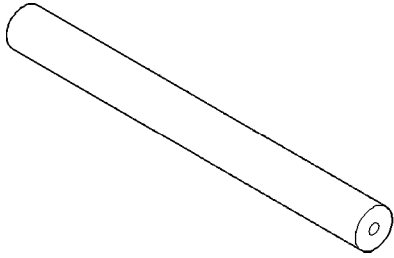
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Cylinder Bore Indicator C-119**Valve Spring Compressor MD-998772-A**

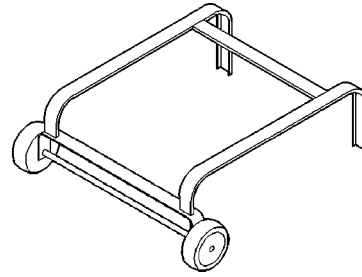
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Front Crankshaft Seal Remover 6771**Spring Compressor Adapter 6779****Front Crankshaft Seal Installer 6780****Valve Spring Compressor C-3422-D****Crankshaft Sprocket Remover 6793**

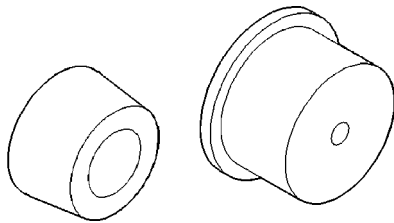
ENGINE 2.0L SOHC (Continued)



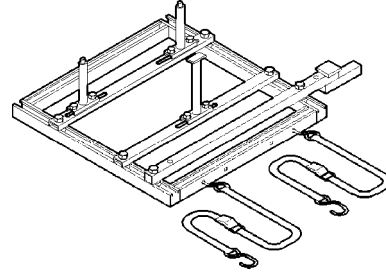
Crankshaft Sprocket Remover Insert C-4685-C2



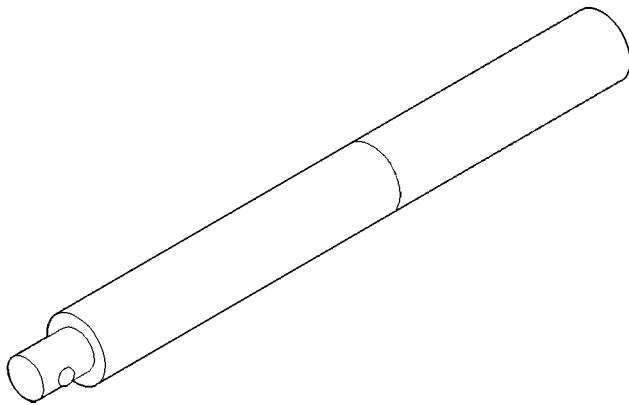
Dolly 6135



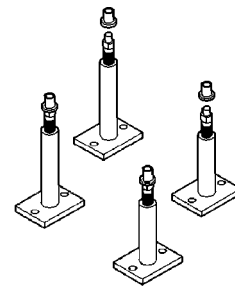
Rear Crankshaft Seal Guide and Installer 6926-1 and 6926-2



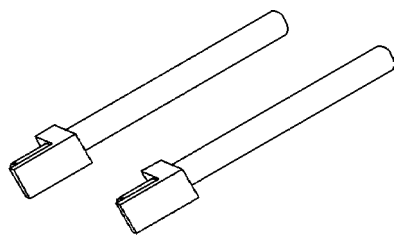
Cradle 6710



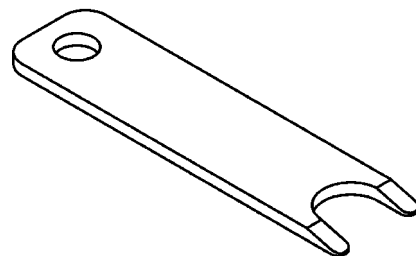
Driver Handle C-4171



Post Kit Engine Cradle 6848

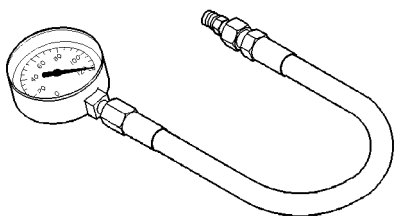
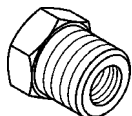
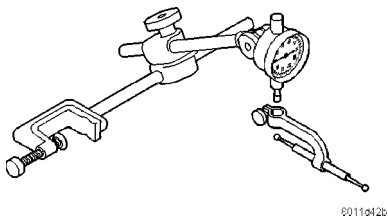
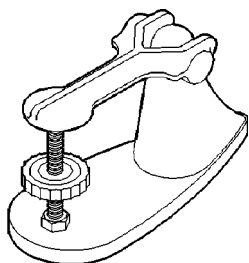
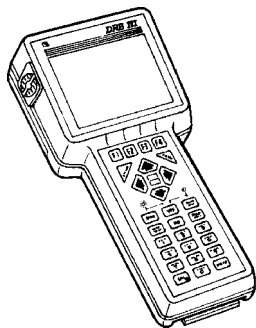
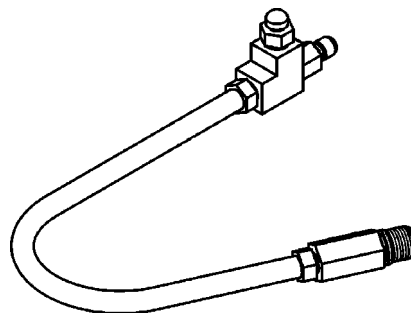
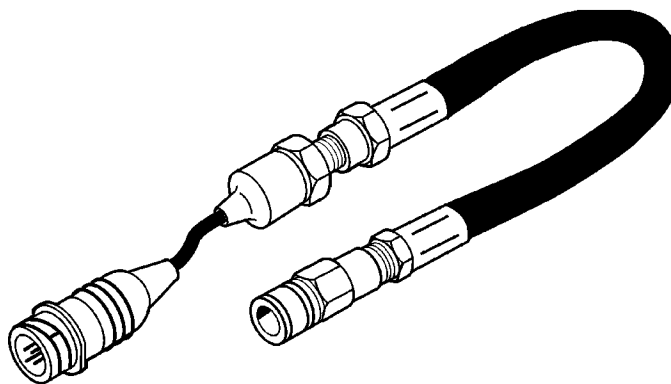


Connecting Rod Guides 8189

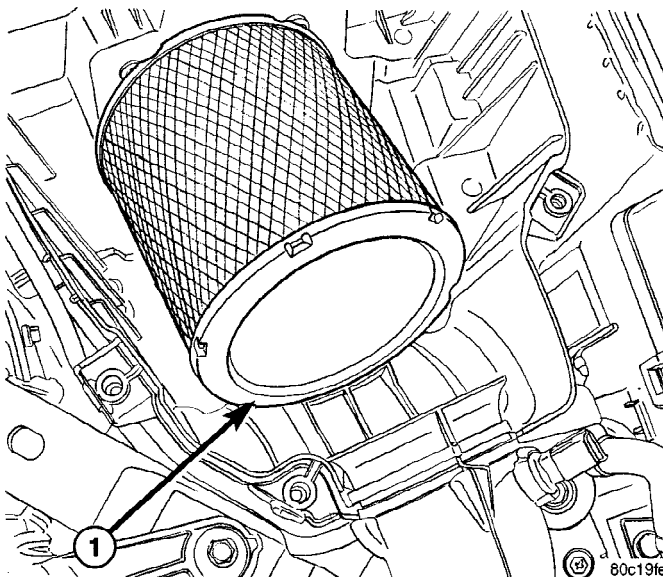


Clutch Line Disconnect 6638A

ENGINE 2.0L SOHC (Continued)

**Pressure Gauge C-3292****Adapter 8406****Dial Indicator C-3339****Valve Spring Tester C-647****DRB III® with PEP Module – OT-CH6010A****Cylinder Compression Pressure Adaptor 8116****Pressure Transducer CH7059****AIR CLEANER ELEMENT****REMOVAL**

- (1) Unlatch 2 clips and rotate the lid upward and off of the air cleaner box (Fig. 10).
- (2) Remove the air filter element (Fig. 10).

**Fig. 10 Air Cleaner Element**

1 - Lip for Element

AIR CLEANER ELEMENT (Continued)**INSTALLATION**

(1) Install the air filter element on locator (Fig. 11) and then make sure that the element is locked in at the lip in the air cleaner box (Fig. 11).

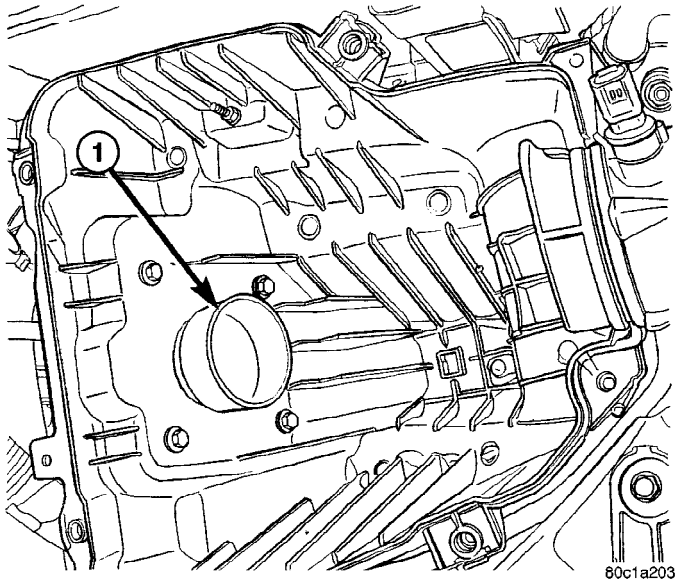


Fig. 11 Element Locator

1 - Element Locator

- (2) Install the air cleaner housing lid.
- (3) Clip the 2 latches for the air cleaner housing lid (Fig. 11).

AIR CLEANER HOUSING**REMOVAL**

- (1) Unlatch 2 clips and rotate the lid upward and off of the air cleaner box.
- (2) Pull air filter up and out of air cleaner box (Fig. 12).
- (3) Remove the 4 bolts from the air cleaner box to throttle body.
- (4) Remove the make-up air hose from the air cleaner box.
- (5) Remove the bolt and nut from the air cleaner box.
- (6) Remove wiring harness from the clips on the side of the air cleaner box.
- (7) Remove the wiring clip from the front of the air cleaner box.
- (8) Disconnect the vacuum harness from the throttle body and body harness.
- (9) Pull air cleaner box up and off of stud and battery tray and remove from vehicle.

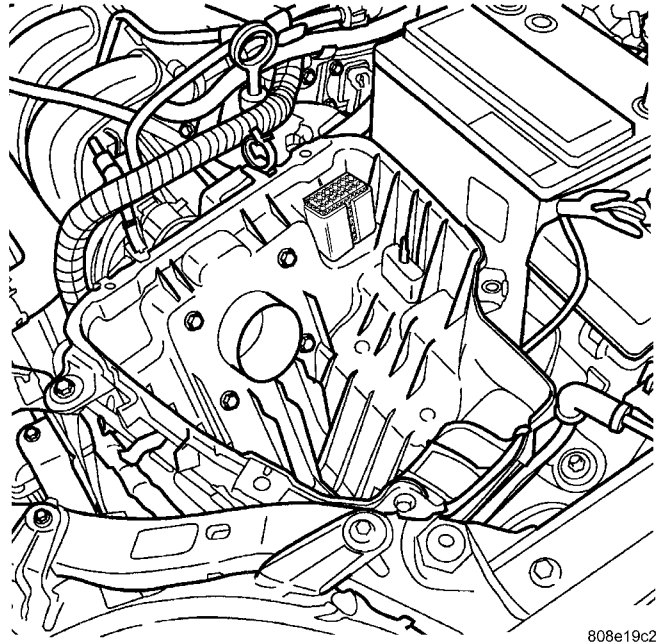
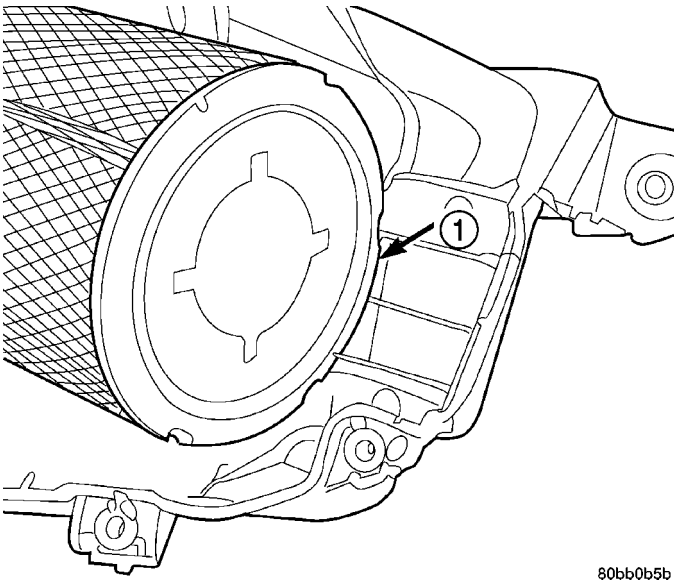


Fig. 12 Air Cleaner Box

INSTALLATION

- (1) Install air cleaner box. Make sure that it is on the battery tray tab in the back and on the stud on the side.
- (2) Install the bolts to the throttle body and tighten.
- (3) Connect the make-up air hose to the air cleaner box.
- (4) Connect the vacuum harness to the throttle body and body harness.
- (5) Install the wiring clip in the front of the air cleaner box.
- (6) Install the wiring harness into the clips on the side of the air cleaner box.
- (7) Install the nut and bolt for air cleaner box and tighten to 7.3 N·m (65 in. lbs.).
- (8) Install inlet elbow to air cleaner box and fender.
- (9) Install air filter element on to throttle body and push towards the throttle body and past lip in air cleaner box bottom (Fig. 13).
- (10) Install lid and latch the 2 clips.

AIR CLEANER HOUSING (Continued)

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Fig. 13 Air Cleaner Box Lip

1 - LIP

CYLINDER HEAD**DESCRIPTION**

The cross flow designed, aluminum cylinder head contains a single over head camshaft with four valves per cylinder (Fig. 14). The valves are arranged in two in-line banks. The intake valves face toward the front of the vehicle. The exhaust valves face the dash panel. The cylinder head incorporates powdered metal valve guides and seats. The cylinder head is sealed to the block using a head gasket and retaining bolts.

The rocker arm shafts mount directly to the cylinder head. The rocker arms shafts are hollow, providing lubrication passages to the hydraulic lash adjusters, camshaft, and valve mechanisms.

DIAGNOSIS AND TESTING—CYLINDER HEAD GASKET

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

Possible indications of the cylinder head gasket leaking between adjacent cylinders are:

- Loss of engine power
- Engine misfiring
- Poor fuel economy

Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:

- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust

- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING). An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50–70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

CHEMICAL TEST METHOD

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

REMOVAL - CYLINDER HEAD

(1) Perform fuel system pressure release procedure **before attempting any repairs** (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).

(2) Disconnect negative battery cable.

(3) Remove power steering/air conditioning drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(4) Raise vehicle on hoist.

CYLINDER HEAD (Continued)

(5) Drain cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).

(6) Disconnect exhaust pipe from exhaust manifold.

(7) Remove right front wheel.

(8) Remove accessory drive belt splash shield.

(9) Remove generator belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(10) Remove crankshaft vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(11) Remove lower torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - REMOVAL).

(12) Lower vehicle and remove upper torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - REMOVAL).

(13) Remove ground strap and power steering hose support clip from engine mount bracket.

(14) Remove power steering pump assembly and set aside.

(15) Support engine from beneath with a suitable jack.

(16) Remove right side engine mount to bracket through bolt.

(17) Remove the lower engine mount bracket bolt. Raise engine slightly and remove the upper engine mount bracket bolts.

(18) Remove the engine mount bracket. This procedure may require additional raising/lowering of engine until bracket will clear engine components (Refer to 9 - ENGINE/ENGINE MOUNTING/ENGINE MOUNT BRACKET - REMOVAL).

(19) Remove front timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - REMOVAL).

(20) Rotate engine until timing marks are aligned.

(21) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - REMOVAL).

(22) Remove timing belt tensioner/bracket assembly (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT TENSIONER & PULLEY - REMOVAL).

(23) Remove camshaft sprocket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - REMOVAL).

(24) Remove rear timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - REMOVAL).

(25) Disconnect fuel line at fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).

(26) Remove coolant recovery container (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - REMOVAL).

(27) Remove ground strap to cylinder head.

(28) Remove upper radiator hose.

(29) Remove intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).

(30) Disconnect ignition coil electrical connector.

(31) Remove ignition coil and spark plug cables from engine.

(32) Remove make-up air hose from cylinder head cover.

(33) Disconnect cam sensor and engine coolant temperature (ECT) sensor electrical connectors.

(34) Remove heater tube to cylinder head attaching fasteners.

(35) Remove heater hose from thermostat housing connector.

(36) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(37) Remove cylinder head bolts.

(38) Remove cylinder head and gasket (Fig. 14).

CLEANING

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.

NOTE: Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.

Remove all gasket material from cylinder head and block (Refer to 9 - ENGINE - STANDARD PROCEDURE). Be careful not to gouge or scratch the aluminum head sealing surface.

Clean all engine oil passages.

INSPECTION

(1) Cylinder head must be flat within 0.1 mm (0.004 in.) (Fig. 15).

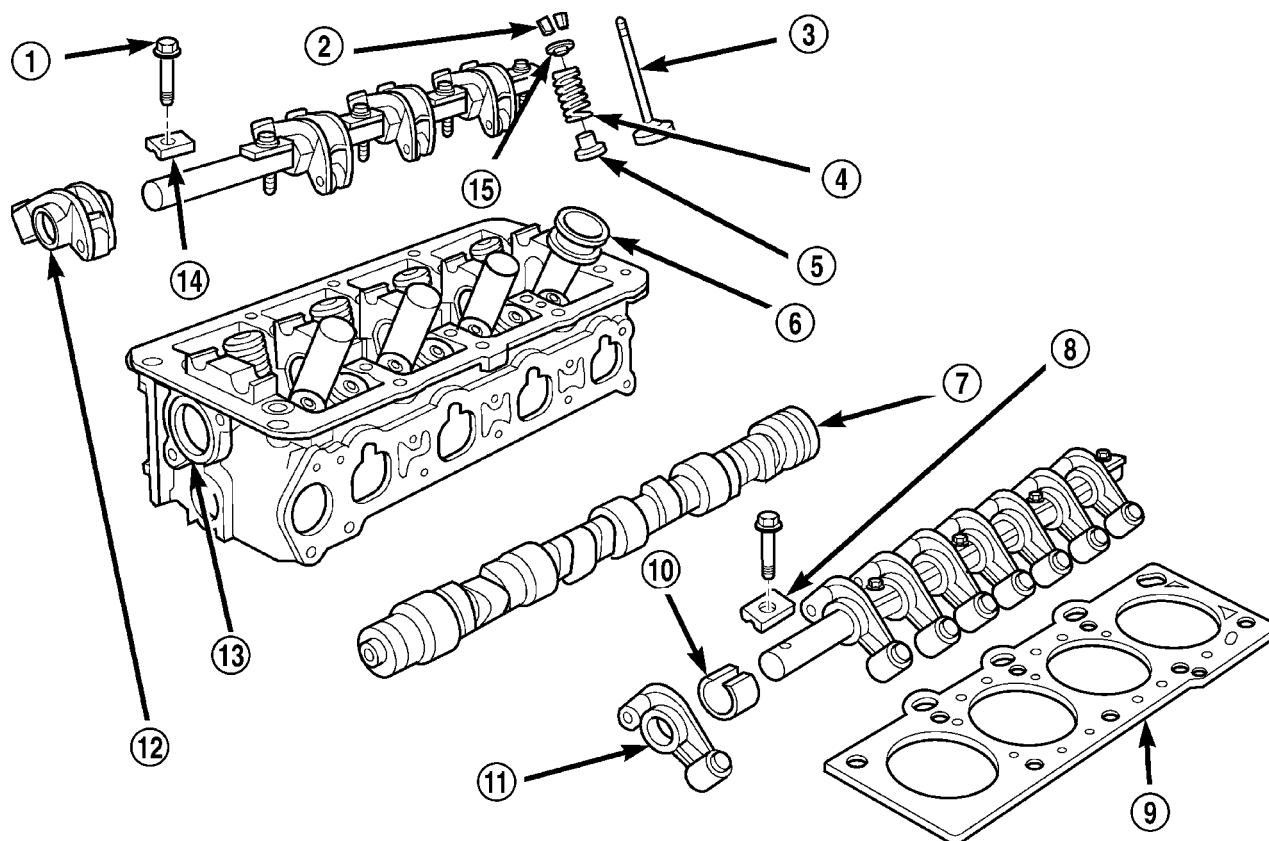
(2) Inspect camshaft bearing journals for scoring.

(3) Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

(4) Using a small hole gauge and a micrometer, measure valve guides in 3 places top, middle and bottom (Fig. 16). (Refer to 9 - ENGINE - SPECIFICATIONS) Replace guides if they are not within specification.

(5) Check valve guide height (Fig. 17).

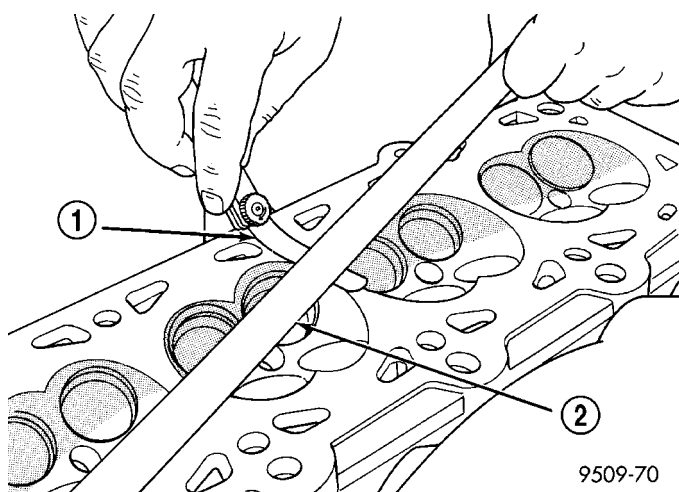
CYLINDER HEAD (Continued)



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Fig. 14 Cylinder Head Assembly

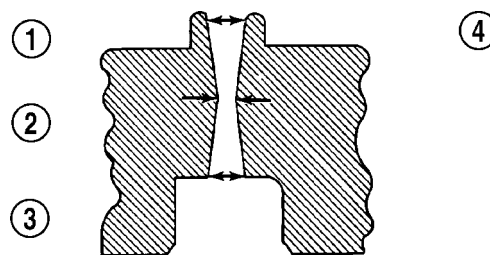
- | | |
|---|--|
| 1 - ROCKER SHAFT RETAINING BOLT | 10 - SPACER |
| 2 - VALVE RETAINING LOCKS | 11 - INTAKE ROCKER ARM/HYDRAULIC LASH ADJUSTER ASSEMBLY |
| 3 - VALVE | 12 - EXHAUST ROCKER ARM/HYDRAULIC LASH ADJUSTER ASSEMBLY |
| 4 - VALVE SPRING | 13 - CAMSHAFT SEAL |
| 5 - VALVE SEAL AND VALVE SPRING SEAT ASSEMBLY | 14 - RETAINER SPACER |
| 6 - SPARK PLUG TUBE SEAL | 15 - VALVE SPRING RETAINER |
| 7 - CAMSHAFT | |
| 8 - ROCKER ARM SHAFT RETAINER SPACER | |
| 9 - GASKET | |



9509-70

Fig. 15 Checking Cylinder Head Flatness

- 1 - FEELER GAUGE
2 - STRAIGHT EDGE



9109-98

Fig. 16 Checking Wear on Valve Guide—Typical

- 1 - TOP
2 - MIDDLE
3 - BOTTOM
4 - CUT AWAY VIEW OF VALVE GUIDE MEASUREMENT LOCATIONS

CYLINDER HEAD (Continued)

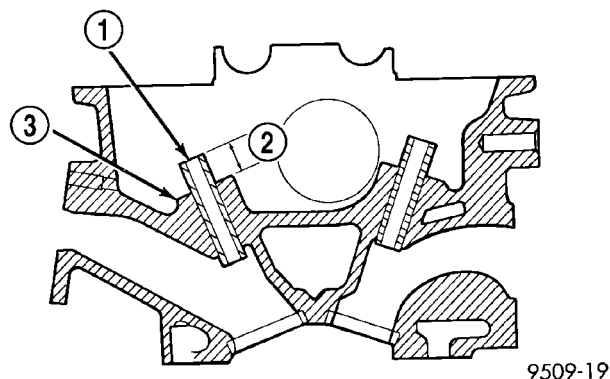


Fig. 17 Valve Guide Height

- 1 - VALVE GUIDE
 2 - 13.25 - 13.75 MM (0.521 - 0.541 IN.)
 3 - SPRING SEAT

INSTALLATION - CYLINDER HEAD

EXAMINING CYLINDER HEAD BOLTS

NOTE: The cylinder head bolts should be examined **BEFORE** reuse. If the threads are necked down, the bolt(s) should be replaced (Fig. 18).

Necking can be checked by holding a scale or straight edge against the threads. If all the threads do not contact the scale, the bolt(s) should be replaced.

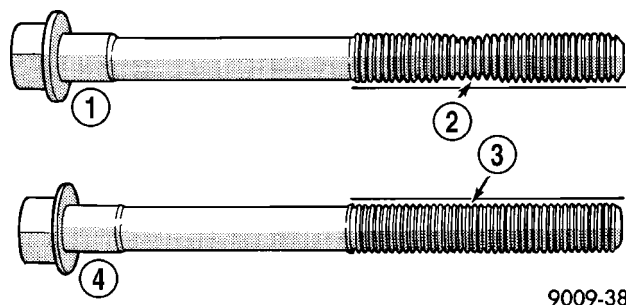


Fig. 18 Checking Bolts for Stretching (Necking)

- 1 - STRETCHED BOLT
 2 - THREADS ARE NOT STRAIGHT ON LINE
 3 - THREADS ARE STRAIGHT ON LINE
 4 - UNSTRETCHED BOLT

(1) Clean the cylinder head and cylinder block sealing surfaces (Refer to 9 - ENGINE/CYLINDER HEAD - CLEANING).

(2) Apply Mopar® Gasket Sealant (aerosol can) to both sides of the new cylinder head gasket.

(3) Position a new cylinder head gasket on the locating dowels.

(4) Position crankshaft sprocket to TDC, then rotate crankshaft until mark is three teeth before TDC (Fig. 19). This will ensure that no piston-to-valve contact occurs upon installation of cylinder head in the event of camshaft rotation.

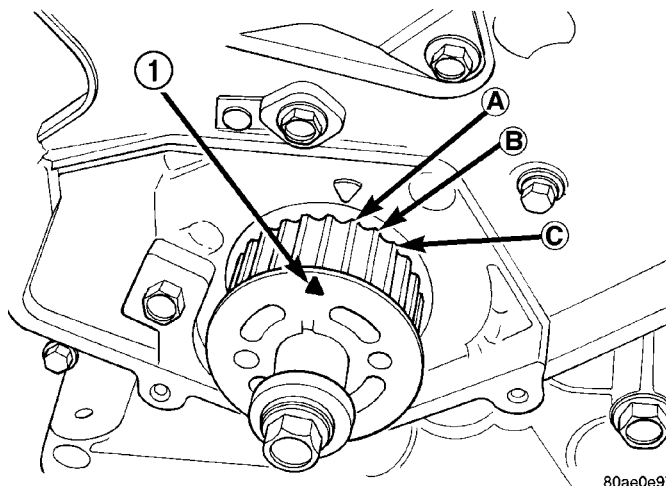


Fig. 19 Crankshaft Sprocket Position

1 - TDC MARK

(5) Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

(6) Before installing cylinder head bolts, the threads should be oiled with engine oil. The 4 shorter bolts 164 mm (6.45 in.), are to be installed in positions 7, 8, 9, and 10 (Fig. 20).

(7) Tighten the cylinder head bolts in the sequence shown in (Fig. 20). Using the 4 step torque turn method, tighten according to the following values:

First:

- All bolts to 34 N·m (25 ft. lbs.)

Second:

- Bolts 1-6 to 68 N·m (50 ft. lbs.)
- Bolts 7-10 to 49 N·m (35 ft. lbs.)

Third:

- Bolts 1-6 to 68 N·m (50 ft. lbs.)
- Bolts 7-10 to 49 N·m (35 ft. lbs.)

CAUTION: Do not use a torque wrench for the Fourth step.

Fourth:

- Tighten all bolts in the specified sequence an additional 90° (1/4 Turn)

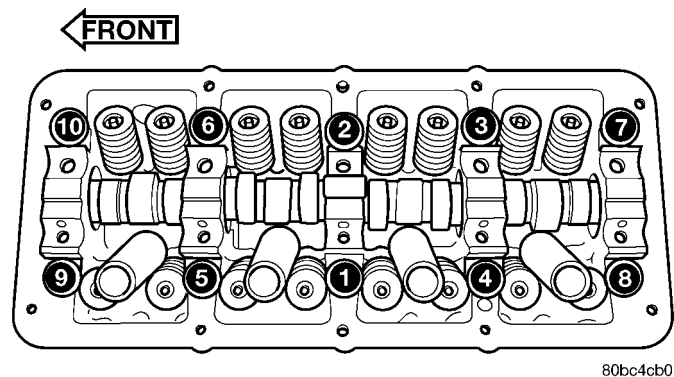
(8) Install cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(9) Install heater hose to thermostat housing connector.

(10) Install heater tube to cylinder head attaching fasteners.

(11) Connect cam sensor and engine coolant temperature (ECT) sensor electrical connectors.

CYLINDER HEAD (Continued)

**Fig. 20 Cylinder Head Tightening Sequence**

(12) Connect make-up air hose to cylinder head cover.

(13) Install ignition coil and spark plug cables. Connect coil electrical connector.

(14) Install intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).

(15) Install upper radiator hose.

(16) Install ground strap to cylinder head.

(17) Install coolant recovery container (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - INSTALLATION).

(18) Connect fuel line to fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).

(19) Install rear timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - INSTALLATION).

(20) Install timing belt tensioner/bracket assembly (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT TENSIONER & PULLEY - INSTALLATION).

(21) Install camshaft sprocket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION).

(22) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION).

(23) Install front timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - INSTALLATION).

(24) Install engine mount bracket (Refer to 9 - ENGINE/ENGINE MOUNTING/ENGINE MOUNT BRACKET - INSTALLATION).

(25) Position engine and install right side engine mount to engine mount bracket through bolt. Tighten bolt to 118 N·m (87 ft. lbs.). Remove jack from beneath engine.

(26) Install power steering pump assembly.

(27) Install power steering hose support clip and ground strap to engine mount bracket.

(28) Install upper torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - INSTALLATION).

(29) Raise vehicle on hoist.

(30) Install lower torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - INSTALLATION).

(31) Install crankshaft vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(32) Install accessory drive belts (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(33) Install accessory drive belt splash shield and front wheel.

(34) Connect exhaust pipe to exhaust manifold. Tighten fasteners to 23 N·m (200 in. lbs.).

(35) Lower vehicle and fill cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).

(36) Connect negative cable to battery.

(37) Perform torque strut adjustment procedure (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - ADJUSTMENTS).

CYLINDER HEAD COVER

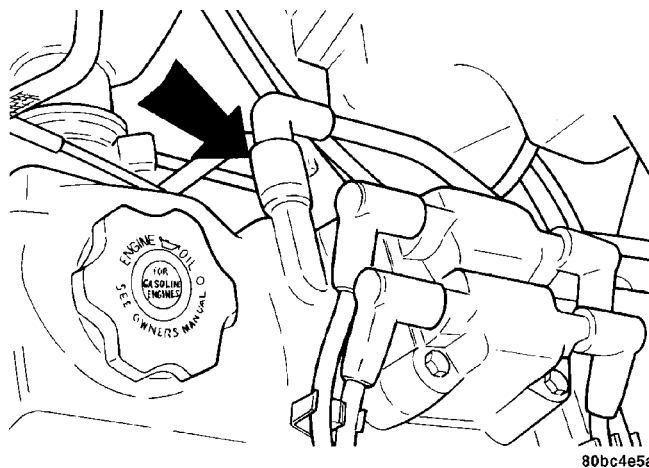
REMOVAL

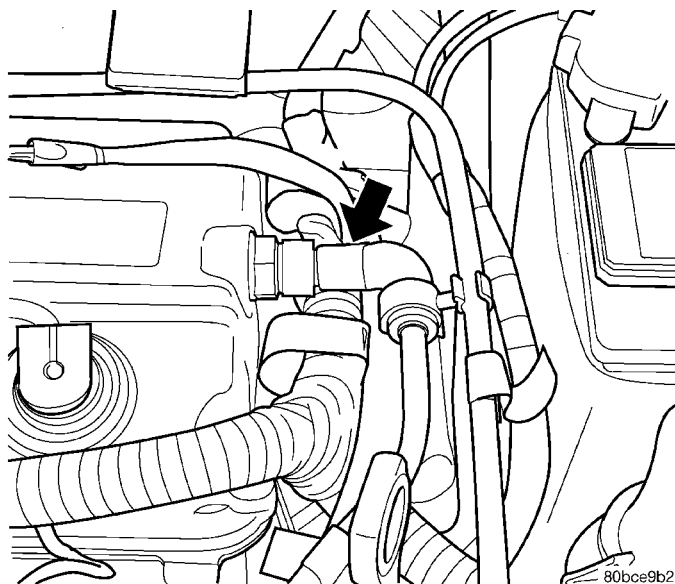
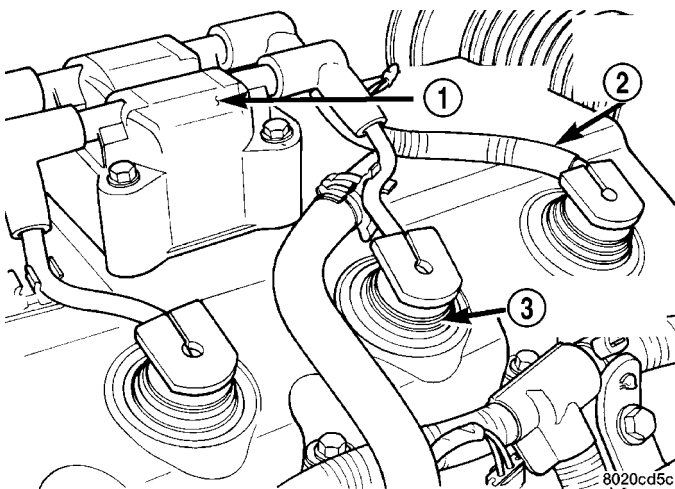
(1) Disconnect make-up air (Fig. 21) and PCV (Fig. 22) hoses from cylinder head cover.

(2) Remove ignition coil and spark plug cables (Fig. 23).

(3) Remove cylinder head cover bolts.

(4) Remove cylinder head cover.

**Fig. 21 Make-up Air Hose**

CYLINDER HEAD COVER (Continued)**Fig. 22 PCV Valve Hose****Fig. 23 Ignition Coil and Spark Plug Cables**

- 1 - IGNITION COILS
- 2 - SPARK PLUG CABLE
- 3 - SPARK PLUG INSULATOR

CLEANING

Clean cylinder head and cover mating surfaces using a suitable solvent.

INSPECTION

Inspect cover rails for flatness.

INSTALLATION

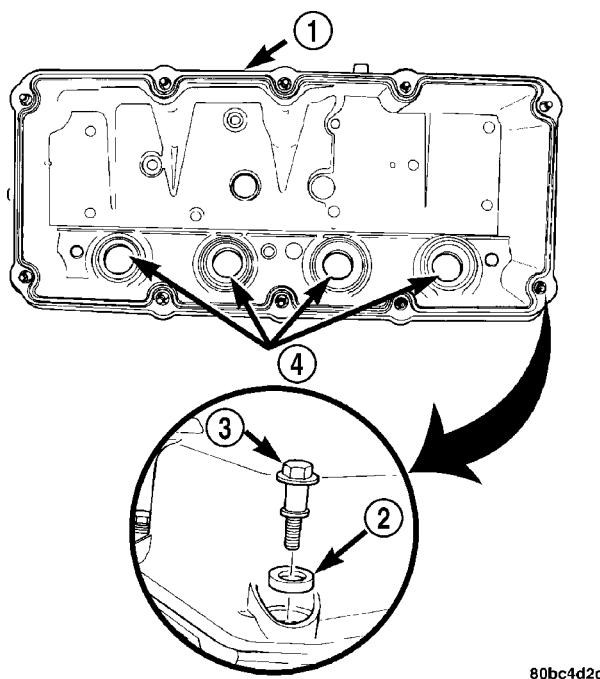
(1) Inspect gasket and seals (Fig. 24). Replace as necessary. For replacement of spark plug tube seals, (Refer to 9 - ENGINE/CYLINDER HEAD/SPARK PLUG TUBE SEAL - INSTALLATION).

CAUTION: Do not attempt to loosen or remove baffle plate attaching screws. The screws are self-tapping, and in the attempt to retighten, thread damage (stripping) will result.

(2) Install cylinder head cover and gasket. Tighten bolts to 12 N·m (105 in. lbs.).

(3) Install ignition coil and spark plug cables (Fig. 23). Tighten ignition coil fasteners to 12 N·m (105 in. lbs.).

(4) Connect make-up air (Fig. 21) and PCV (Fig. 22) hoses.

**Fig. 24 Cylinder Head Cover Gasket and Seals**

- 1 - CYLINDER HEAD COVER GASKET
- 2 - SEAL
- 3 - BOLT
- 4 - SPARK PLUG TUBE SEALS

ROCKER ARM / HYDRAULIC LASH ADJUSTER ASSEMBLY**DIAGNOSIS AND TESTING - HYDRAULIC LASH ADJUSTER NOISE DIAGNOSIS**

A tappet-like noise may be produced from several items. Check the following items.

(1) Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.

(2) Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.

ROCKER ARM / HYDRAULIC LASH ADJUSTER ASSEMBLY (Continued)

(3) During this time, turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.

(4) Low oil pressure.

(5) The oil restrictor (integral to the head gasket) in the vertical oil passage to the cylinder head is plugged with debris.

(6) Air ingested into oil due to broken or cracked oil pump pick up.

(7) Worn valve guides.

(8) Missing swivel foot on lash adjuster.

(9) Incorrect rocker shaft installation.

(10) Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.

(11) Faulty lash adjuster.

- Check lash adjusters for sponginess while installed in cylinder head. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Spongy adjusters can be bottomed out easily.

- Remove suspected lash adjusters, and replace as necessary.

REMOVAL

(1) Remove cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL)

(2) Identify the rocker arm shaft assemblies before removal.

(3) Loosen the attaching fasteners. Remove rocker arm shaft assemblies from cylinder head.

(4) Identify the rocker arms spacers and retainers for reassembly. Disassemble the rocker arm assemblies by removing the attaching bolts from the shaft (Fig. 25).

(5) Slide the rocker arms and spacers off the shaft. Keep the spacers and rocker arms in the same location for reassembly.

INSPECTION

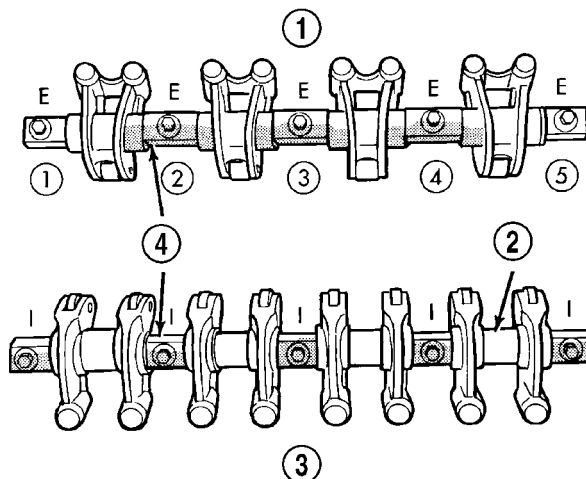
(1) Inspect the rocker arm for scoring, wear on the roller or damage to the rocker arm (Fig. 26). Replace as necessary.

(2) Check the location where the rocker arms mount to the shafts for wear or damage. Replace if damaged or worn.

(3) The rocker arm shaft is hollow and is used as a lubrication oil duct. Check oil holes for clogging with small wire, clean as required.

INSTALLATION

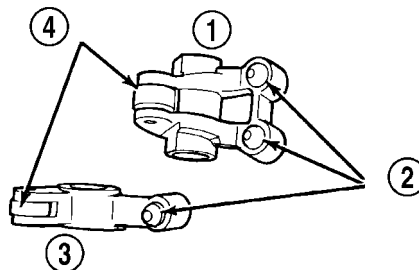
CAUTION: Set crankshaft to 3 notches before TDC before installing rocker arm shafts. Refer to Timing Belt System and Camshaft Seal Service of this section for procedure.



9509-15

Fig. 25 Rocker Arm Shaft Assemblies

- 1 - EXHAUST ROCKER ARM ASSEMBLY
- 2 - PLASTIC SHAFT SPACERS
- 3 - INTAKE ROCKER ARM ASSEMBLY
- 4 - ROCKER ARM SHAFT RETAINERS



9509-22

Fig. 26 Rocker Arm Assemblies

- 1 - EXHAUST ROCKER ARM
- 2 - HYDRAULIC LASH ADJUSTERS
- 3 - INTAKE ROCKER ARM
- 4 - ROLLERS

(1) Lubricate the rocker arms and spacers. Install onto shafts in their original position (Fig. 25).

(2) Install rocker arm/hydraulic lash adjuster assembly making sure that adjusters are at least partially full of oil. This is indicated by little or no plunger travel when the lash adjuster is depressed. If there is excessive plunger travel. Place the rocker arm assembly into clean engine oil and pump the plunger until the lash adjuster travel is taken up. If travel is not reduced, replace the assembly. Hydraulic lash adjuster and rocker arm are serviced as an assembly.

ROCKER ARM / HYDRAULIC LASH ADJUSTER ASSEMBLY (Continued)

(3) Install rocker arm and shaft assemblies with NOTCH in the rocker arm shafts pointing up and toward the timing belt side of the engine (Fig. 27). Install the retainers in their original positions on the exhaust and intake shafts (Fig. 25).

CAUTION: When installing the intake rocker arm shaft assembly be sure that the plastic spacers do not interfere with the spark plug tubes. If the spacers do interfere rotate until they are at the proper angle. To avoid damaging the spark plug tubes, do not attempt rotating the spacers by forcing down the shaft assembly.

(4) Verify that hydraulic lash adjuster swivel feet are still in place.

(5) Tighten bolts to 28 N·m (250 in. lbs.) in sequence shown in (Fig. 28).

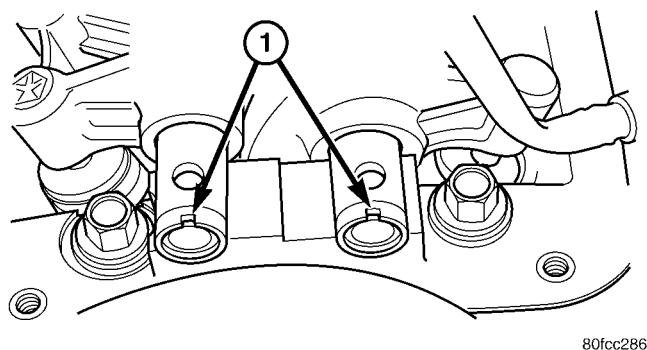


Fig. 27 Rocker Arm Shaft Notches

1 - NOTCHES FACING UP AND TOWARD THE TIMING BELT SIDE OF THE ENGINE

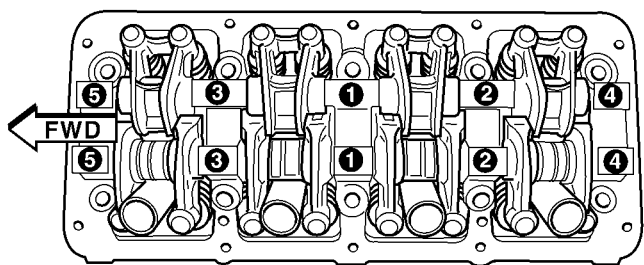


Fig. 28 Rocker Arm Shaft Tightening Sequence

(6) Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

CAMSHAFT**DESCRIPTION**

The camshaft is made of nodular iron with five bearing journal surfaces and three cam lobes per cylinder. Provision for a cam position sensor is provided on the rear of the camshaft. The camshaft position sensor bolts to the rear of the cylinder head and also controls camshaft thrust. A hydrodynamic oil seal is used for oil control at the front of the camshaft.

OPERATION

The camshaft is driven by the crankshaft via drive sprockets and belt. The camshaft has precisely machined lobes to provide accurate valve timing and duration.

STANDARD PROCEDURE - CAMSHAFT END-PLAY

(1) Measure camshaft end play using the following procedure:

- Mount dial indicator C-3339 or equivalent, to a stationary point on cylinder head (Fig. 29).
- Using a suitable tool, move camshaft to rearward limits of travel.
- Zero the dial indicator.
- Move camshaft forward to limits of travel and read dial indicator.
- End play travel: 0.13–0.33 mm (0.005–0.013 in.).

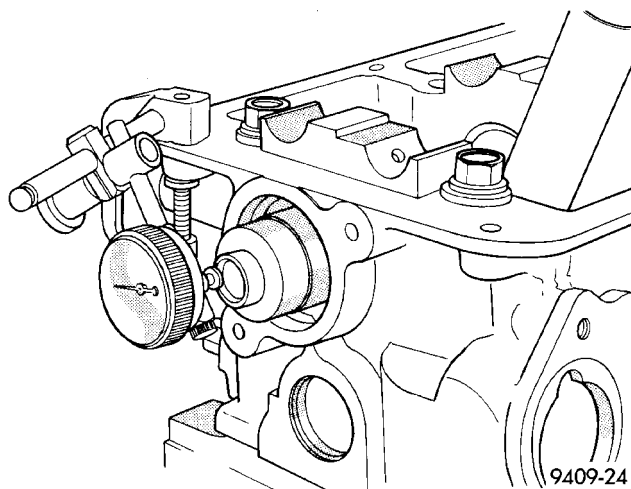


Fig. 29 Camshaft End Play

REMOVAL

- Disconnect and isolate negative battery cable.
- Disconnect positive battery cable. Remove the battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL).

CAMSHAFT (Continued)

(3) Disconnect the IAT sensor electrical connector (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/INLET AIR TEMPERATURE SENSOR - DESCRIPTION) .

(4) Disconnect the following:

- Air intake duct at throttle body
- Throttle cables
- TPS and IAC connectors
- Make-up air hose at air cleaner housing

(5) Remove the air cleaner housing assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).

(6) Remove the battery tray. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - REMOVAL)

(7) Remove the front timing belt cover, timing belt, and tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - REMOVAL).

(8) Remove the camshaft sprocket and rear timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - REMOVAL).

(9) Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(10) Mark rocker arm shaft assemblies so that they are installed in their original positions.

(11) Remove rocker arm and shaft assemblies (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL).

(12) Drain cooling system below heater hose level.

(13) Disconnect the ECT sensor electrical connector.

(14) Disconnect hoses from heater supply and return tubes.

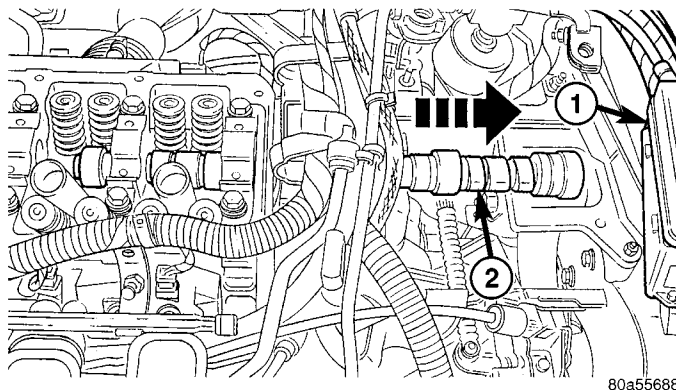
(15) Remove heater tube support bracket bolts at rear of cylinder head.

(16) Remove PDC attaching screws and reposition for camshaft removal clearance.

(17) Remove camshaft sensor and camshaft target magnet (Refer to 8 - ELECTRICAL/IGNITION CONTROL/CAMSHAFT POSITION SENSOR - REMOVAL).

(18) Carefully remove camshaft from the rear of cylinder head. Reposition heater tubes and PDC for camshaft clearance (Fig. 30).

(19) Remove the camshaft seal (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT OIL SEAL(S) - REMOVAL).



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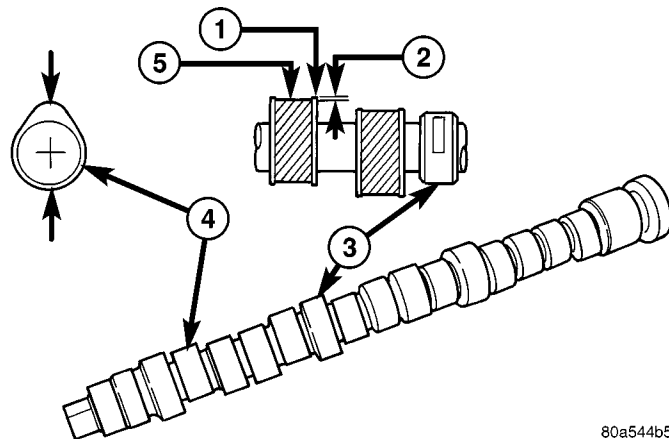
Fig. 30 Camshaft Removal

- 1 - POWER DISTRIBUTION CENTER (PDC)
2 - CAMSHAFT

(2) Check the cam lobe and bearing surfaces for abnormal wear and damage. Replace camshaft if defective.

NOTE: If camshaft is replaced due to lobe wear or damage, always replace the rocker arms.

(3) Measure the lobe actual wear (unworn area - wear zone = actual wear) (Fig. 31) and replace camshaft if out of limit. Standard value is 0.0254 mm (0.001 in.), wear **limit** is 0.254 mm (0.010 in.).



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Fig. 31 Checking Camshaft(s) for Wear

- 1 - UNWORN AREA
2 - ACTUAL WEAR
3 - BEARING JOURNAL
4 - LOBE
5 - WEAR ZONE

CLEANING

Clean camshaft with a suitable solvent.

INSPECTION

(1) Inspect camshaft bearing journals for damage and binding (Fig. 31). If journals are binding, check the cylinder head for damage. Also check cylinder head oil holes for clogging.

INSTALLATION

(1) Lubricate the camshaft journals with oil.

(2) Carefully install the camshaft into the cylinder head. Reposition the PDC and heater tubes for clearance (Fig. 30).

(3) Install camshaft target magnet into the end of the camshaft. Tighten mounting screw to 3.4 N·m (30 in. lbs.).

CAMSHAFT (Continued)

(4) Install camshaft position sensor (Refer to 8 - ELECTRICAL/IGNITION CONTROL/CAMSHAFT POSITION SENSOR - INSTALLATION).

(5) Measure camshaft end-play (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT - STANDARD PROCEDURE).

NOTE: Camshaft must be installed before installation of the camshaft seal.

(6) Install camshaft seal (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT OIL SEAL - INSTALLATION).

(7) Install rear timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - INSTALLATION).

(8) Install the camshaft sprocket on the camshaft.

CAUTION: DO NOT use an impact wrench (or any other air operated tool) for tightening the camshaft sprocket bolt. Damage to the camshaft timing pin can result. ONLY use a hand wrench while holding camshaft sprocket with Special Tool.

(9) Install camshaft sprocket retaining bolt. While holding sprocket with Special Tools C-4687 and modified Adaptor C-4687-1, tighten attaching bolt to 115 N·m (85 ft. lbs.).

(10) Install timing belt and tensioner/bracket assembly (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION).

(11) Install front timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - INSTALLATION).

(12) Install rocker arm and shaft assemblies in correct order as removed (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / HYDRAULIC LASH ADJUSTER ASSEMBLY - INSTALLATION).

(13) Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(14) Install ignition coil and spark plug cables. Tighten ignition coil fasteners to 12 N·m (105 in. lbs.).

(15) Install the heater tube bracket attaching bolt.

(16) Connect the heater hoses to the heater tubes.

(17) Connect the ECT electrical connector.

(18) Install the PDC attaching screws.

(19) Install the battery tray (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - INSTALLATION).

(20) Install the air cleaner housing assembly (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(21) Connect the following:

- Air intake duct at throttle body

- Throttle cables
- TPS and IAC connectors
- Make-up air hose at air cleaner housing

(22) Connect the IAT sensor.

(23) Install battery. Connect positive battery cable (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - INSTALLATION).

(24) Connect negative battery cable.

(25) Refill cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).

CAMSHAFT OIL SEAL**REMOVAL**

(1) Disconnect and isolate negative battery cable.

(2) Remove front timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - REMOVAL).

(3) Remove timing belt and tensioner/bracket assembly (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - REMOVAL).

CAUTION: Do Not Rotate the camshaft or crankshaft when timing belt is removed damage to the engine may occur.

(4) Hold camshaft sprocket with Special Tools C-4687 and modified C-4687-1 as shown in (Fig. 32), while removing attaching bolt.

(5) Remove sprocket from camshaft.

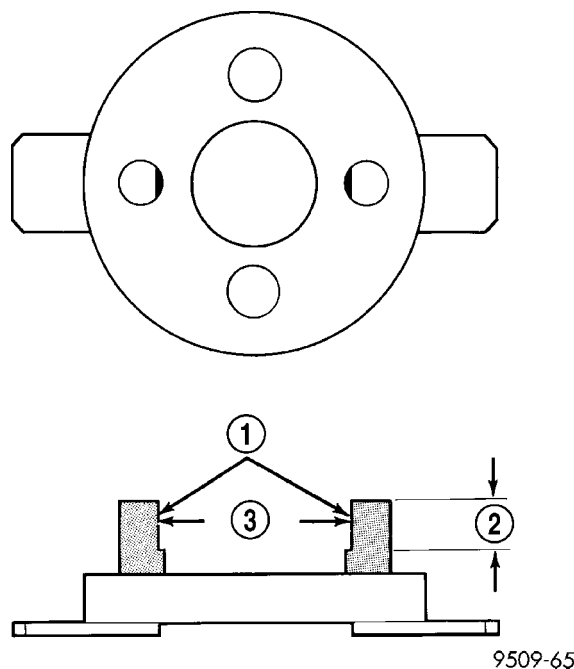


Fig. 32 Modification to Special Tool

- 1 - GRIND LOCATION
- 2 - 12.7 MM (1/2 IN.)
- 3 - 50.8 MM (2 IN.)

CAMSHAFT OIL SEAL (Continued)

(6) Remove rear timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - REMOVAL).

(7) Remove camshaft seal by carefully using a suitable pry tool. Be careful not to nick or damage the camshaft seal surface or cylinder head seal retaining bore.

CAUTION: Do not nick shaft seal surface or seal bore.

(8) Shaft seal lip surface must be free of varnish, dirt or nicks. Polish with 400 grit paper, if necessary.

INSTALLATION

(1) Install camshaft seal flush with cylinder head using Special Tool MD998306 (Fig. 33).

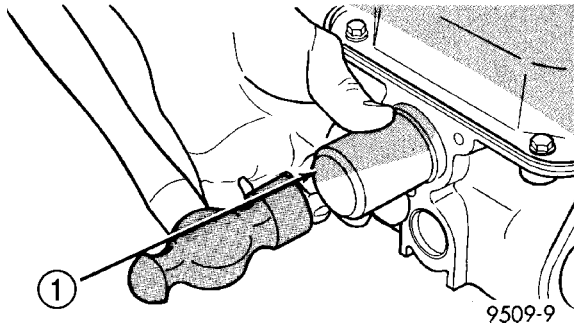


Fig. 33 Camshaft Oil Seal - Installation

1 - SPECIAL TOOL MD 998306

(2) Install rear timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - INSTALLATION).

(3) Install the camshaft sprocket on the camshaft.

CAUTION: DO NOT use an impact wrench (or any other air operated tool) for tightening the camshaft sprocket bolt. Damage to the camshaft timing pin can result. ONLY use a hand wrench while holding camshaft sprocket with Special Tool.

(4) Install camshaft sprocket retaining bolt. Hold camshaft sprocket with Special Tools C-4687 and modified C-4687-1 (Fig. 32) and tighten bolt to 115 N·m (85 ft. lbs.).

(5) Install timing belt and tensioner/bracket assembly (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION).

(6) Install front timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - INSTALLATION).

(7) Connect negative battery cable.

SPARK PLUG TUBE

REMOVAL

(1) Remove the cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL)

(2) Using locking pliers, remove the tube from the cylinder head (Fig. 34). Discard old tube.

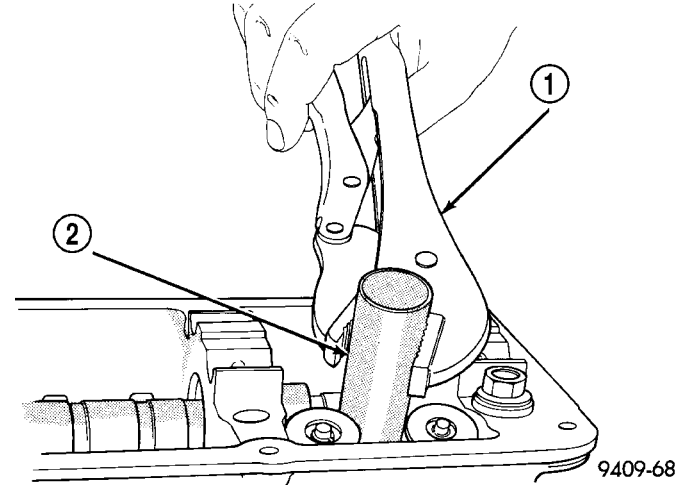


Fig. 34 Spark Plug Tube - Removal

1 - LOCKING PLIERS
2 - SPARK PLUG TUBE

INSTALLATION

(1) Clean area around spark plug with Mopar® parts cleaner or equivalent.

(2) Apply Mopar® Stud and Bearing Mount or equivalent to a new tube approximately 1 mm (0.039 in.) from the end in a 3 mm (0.118 in.) wide area.

(3) Install sealer end of tube into the cylinder head. Then carefully install the tube using a hardwood block and mallet until the tube is seated into the bottom of the bore.

(4) Install the cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION)

SPARK PLUG TUBE - SEAL

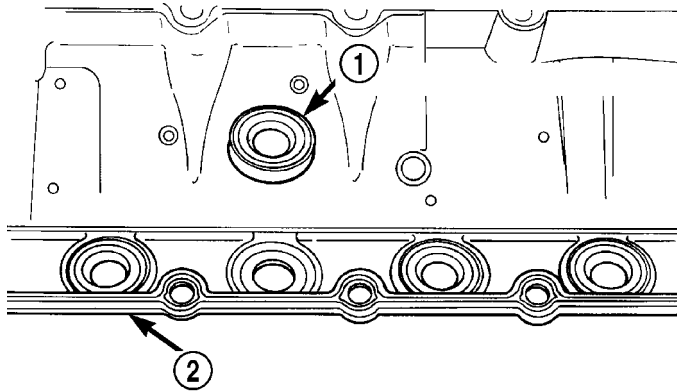
DESCRIPTION

The spark plug tube seals are located in the cylinder head cover (Fig. 35). These seals are pressed into the cylinder head cover to seal the outside perimeter of the spark plug tubes. If these seals show signs of hardness and/or cracking, they should be replaced.

SPARK PLUG TUBE - SEAL (Continued)**REMOVAL**

(1) Remove the cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL)

(2) Using an appropriate tool, carefully remove spark plug tube seals. Care should be taken not to damage cylinder head cover sealing surfaces.



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Fig. 35 Spark Plug Tube Seal

- 1 - SPARK PLUG TUBE SEAL
2 - CYLINDER HEAD COVER

INSTALLATION

(1) Clean all sealing surfaces.

NOTE: Position seal with the concave side facing the installation tool (Fig. 36).

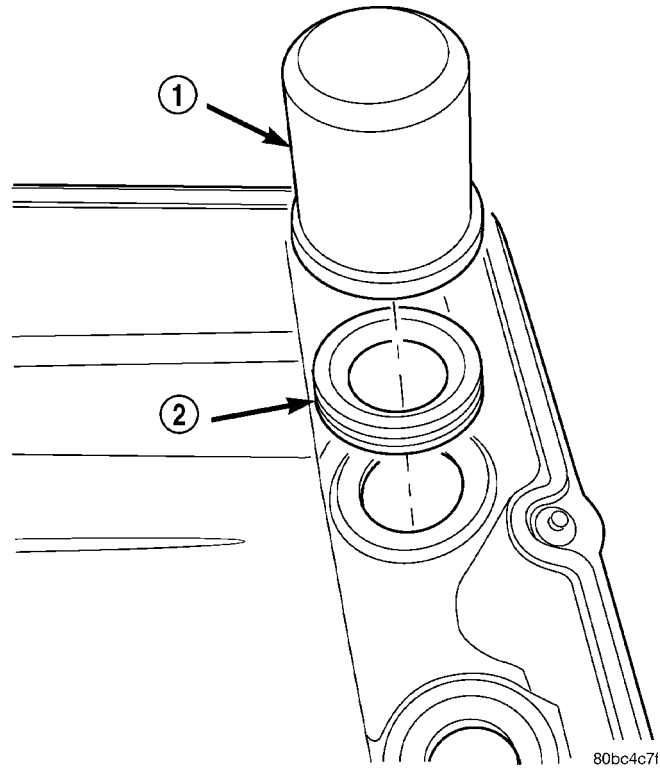
(2) Install seals using Special Tool MB-998306 (Fig. 36). Only hand pressure on tool is needed to install new seals.

(3) Install the cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION)

VALVE SPRINGS**REMOVAL****REMOVAL - CYLINDER HEAD OFF**

(1) Using Special Tool C-3422-D (valve spring compressor) with Adapter 6526 compress valve spring and remove valve retaining locks. For Special Tool identification, (Refer to 9 - ENGINE - SPECIAL TOOLS).

(2) Slowly release valve spring compressor. Remove valve spring retainer and valve spring.



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Fig. 36 Spark Plug Tube Seal Installation

- 1 - SPECIAL TOOL MD-998306
2 - SPARK PLUG TUBE SEAL

(3) Remove valve stem seal assembly (Refer to 9 - ENGINE/CYLINDER HEAD/VALVE STEM SEALS - REMOVAL).

REMOVAL - CYLINDER HEAD ON

(1) Remove the cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL)

(2) Remove rocker arm shafts assemblies. (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL)

(3) Rotate crankshaft until piston is at TDC on compression stroke.

(4) With air hose attached to adapter tool installed in spark plug hole, apply 90-120 psi air pressure.

(5) Using Special Tool MD-998772A with adapter 6779 (Fig. 37) compress valve springs and remove valve locks.

(6) Remove the valve spring.

(7) Remove the valve stem seal. (Refer to 9 - ENGINE/CYLINDER HEAD/VALVE STEM SEALS - REMOVAL)

VALVE SPRINGS (Continued)

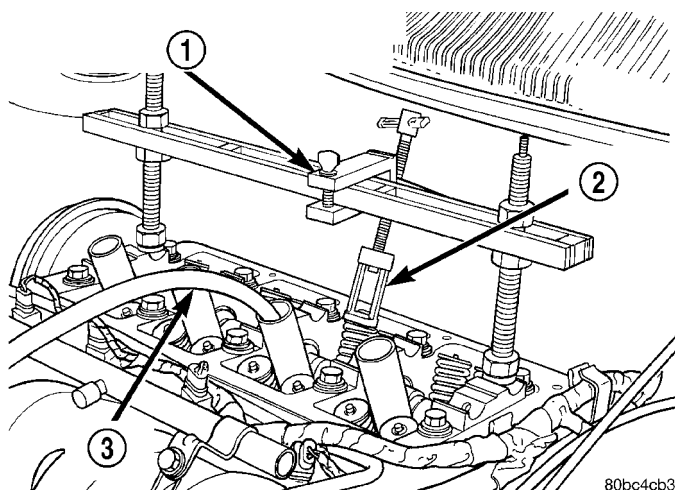


Fig. 37 Valve Spring - Removal/Installation

- 1 - VALVE SPRING COMPRESSOR SPECIAL TOOL MD-998772A
 2 - ADAPTER 6779
 3 - AIR HOSE

INSPECTION

When valves have been removed for inspection, reconditioning or replacement, valve springs should be tested (Fig. 38). **As an example;** the compression length of the spring to be tested is 38.00 mm (1.496 in.). Turn table of Tool C-647 until surface is in line with the 38.00 mm (1.496 inches.) mark on the threaded stud and the zero mark on the front. Place spring over stud on the table and lift compressing lever to set tone device. Pull on torque wrench until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to Engine Specifications to obtain specified height and allowable tensions (Refer to 9 - ENGINE - SPECIFICATIONS). Replace springs that do not meet specifications.

INSTALLATION

INSTALLATION - CYLINDER HEAD OFF

- (1) Coat valve stems with clean engine oil and insert in cylinder head.
- (2) Install new valve stem seals (Refer to 9 - ENGINE/CYLINDER HEAD/VALVE STEM SEALS - INSTALLATION).

CAUTION: If oversize valves are used, there is only one oversize valve available. The same stem seal is used on both the standard and oversize valve.

NOTE: On the high output R/T engine, the valve spring **MUST** be oriented properly when installed.

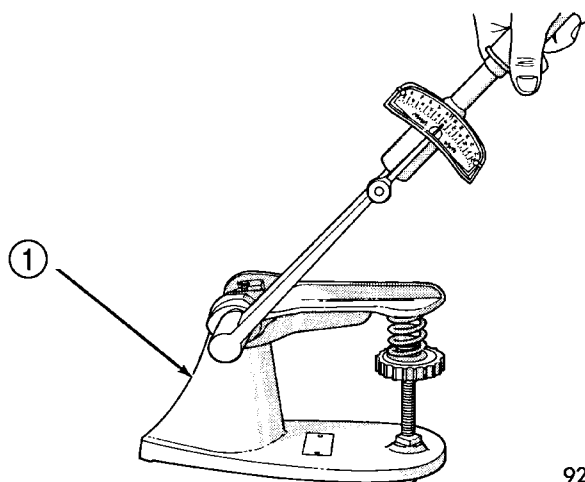


Fig. 38 Testing Valve Spring

- 1 - SPECIAL TOOL C-647

The closely spaced spring coils should be positioned toward the cylinder head (spring seat) (Fig. 41).

(3) Position valve spring and retainer on spring seat (Fig. 40) or (Fig. 41).

(4) Compress valve springs only enough to install locks, taking care not to misalign the direction of compression. Nicked valve stems may result from misalignment of the valve spring compressor.

CAUTION: When depressing the valve spring retainers with valve spring compressor the locks can become dislocated. Check to make sure both locks are in their correct location after removing tool.

(5) Check the valve spring installed height after refacing the valve and seat (measurement B) (Fig. 39). Make sure measurements are taken from top of spring seat to the bottom surface of spring retainer. If height is greater than 40.18 mm (1.58 in.), install a 0.762 mm (0.030 in.) spacer under the valve spring seat to bring spring height back within specification.

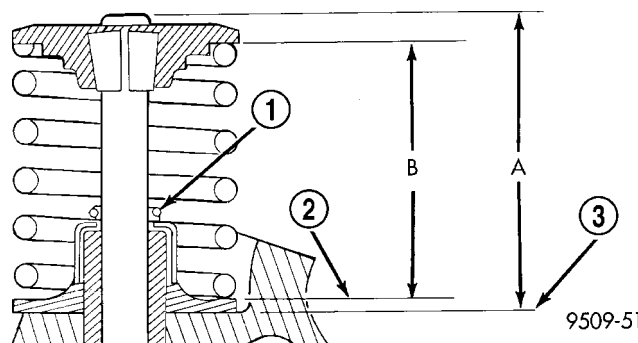


Fig. 39 Spring Installed Height

- 1 - GARTER SPRING
 2 - VALVE SPRING SEAT
 3 - CYLINDER HEAD SURFACE

VALVE SPRINGS (Continued)

(6) Install rocker arms and shafts. (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - INSTALLATION)

(7) Checking dry lash. Dry lash is the amount of clearance that exists between the base circle of an installed cam and the rocker arm roller when the adjuster is drained of oil and completely collapsed. Specified dry lash is 1.00 mm (0.039 in.) for intake and 1.40 mm (0.055 in.) for exhaust. After performing dry lash check, refill adjuster with oil and allow 10 minutes for adjuster(s) to bleed down before rotating cam.

INSTALLATION - CYLINDER HEAD ON

(1) Install valve stem seal assembly. (Refer to 9 - ENGINE/CYLINDER HEAD/VALVE STEM SEALS - INSTALLATION)

NOTE: On the high output R/T engine, the valve spring **MUST** be oriented properly when installed. The closely spaced spring coils should be positioned toward the cylinder head (spring seat) (Fig. 41).

(2) Position valve spring and retainer on spring seat (Fig. 40) or (Fig. 41).

(3) With air pressure applied in cylinder and piston at TDC, use Special Tool MD-998772A to compress valve springs, only enough to install the locks. Correct alignment of tool is necessary to avoid nicking valve stems.

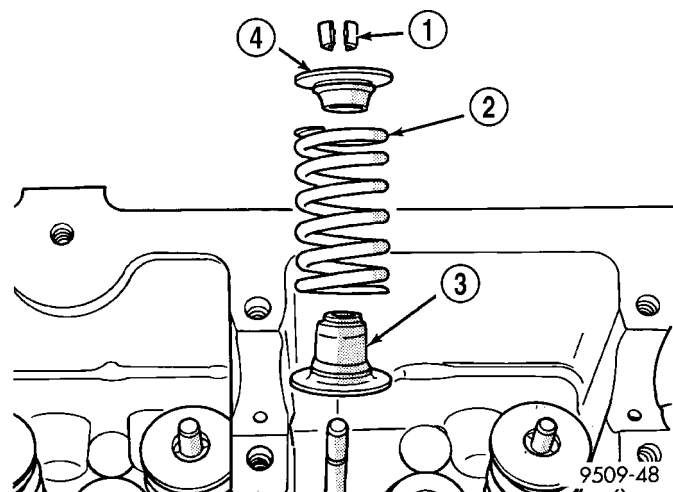
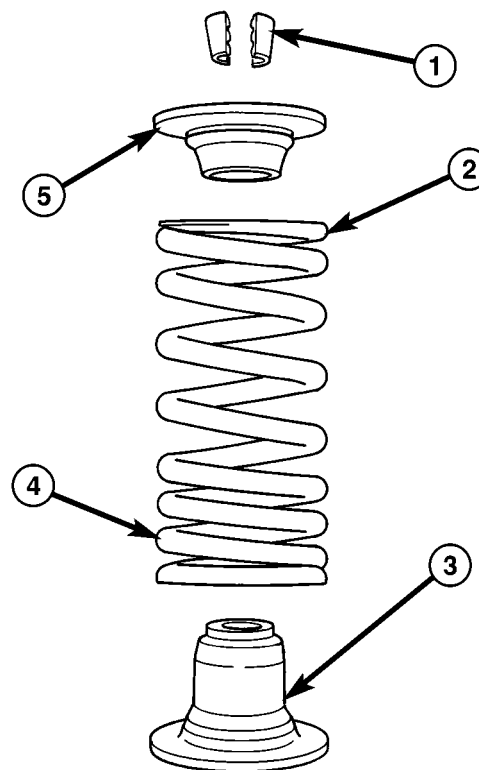


Fig. 40 Valve Spring Assembly

- 1 - VALVE RETAINING LOCKS
- 2 - VALVE SPRING
- 3 - VALVE SEAL AND VALVE SPRING SEAT ASSEMBLY
- 4 - VALVE SPRING RETAINER

(4) Install the rocker arm shaft assemblies. (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - INSTALLATION)



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Fig. 41 VALVE SPRING - R/T ENGINE

- 1 - VALVE LOCKS
- 2 - VALVE SPRING - TOP
- 3 - VALVE SEAL AND SPRING SEAT ASSEMBLY
- 4 - VALVE SPRING - BOTTOM (CLOSER SPACED SPRING COILS)
- 5 - VALVE SPRING RETAINER

(5) Install the cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION)

VALVE STEM SEALS

REMOVAL

(1) Remove valve spring. (Refer to 9 - ENGINE/CYLINDER HEAD/VALVE SPRINGS - REMOVAL)

(2) Remove valve stem seals by using a valve stem seal tool (Fig. 42).

INSTALLATION

(1) The valve stem seal/valve spring seat should be pushed firmly and squarely over the valve guide using the valve stem as guide. **Do Not Force** seal against top of guide. When installing the valve retainer locks, compress the spring **only enough** to install the locks.

CAUTION: Do not remove garter spring around the seal at the top of the valve stem seal (Fig. 43).

VALVE STEM SEALS (Continued)

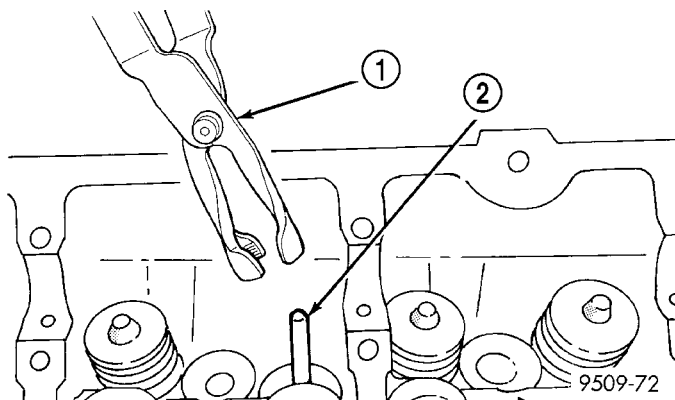


Fig. 42 Valve Stem Seal - Removal

- 1 - VALVE SEAL TOOL
2 - VALVE STEM

(2) Install valve spring. (Refer to 9 - ENGINE/CYLINDER HEAD/VALVE SPRINGS - INSTALLATION)

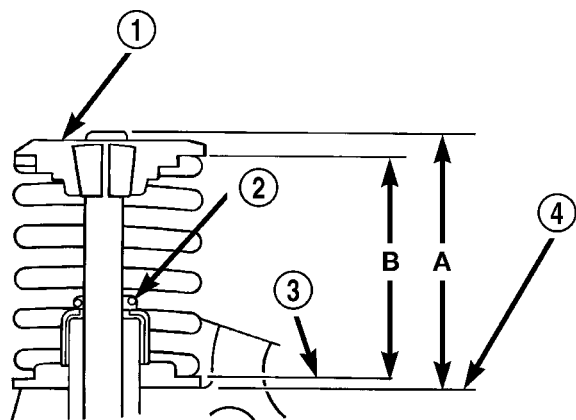


Fig. 43 Checking Valve Tip Height and Valve Spring Installed Height

- 1 - SPRING RETAINER
2 - GARTER SPRING
3 - VALVE SPRING SEAT TOP
4 - CYLINDER HEAD SURFACE

INTAKE/EXHAUST VALVES & SEATS

DESCRIPTION

The four valves per cylinder are opened by using roller rocker arms with hydraulic lash adjusters which pivot on the rocker shafts. The valves have chrome plated valve stems. Viton rubber valve stem seals are integral with the spring seats.

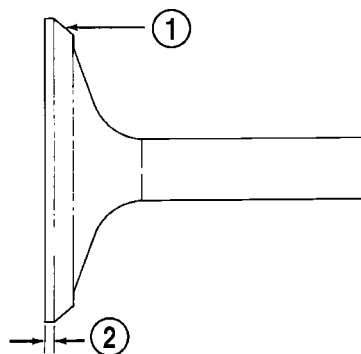
The valve springs, spring retainers, and locks are 3-bead design.

STANDARD PROCEDURE - VALVE AND VALVE SEAT REFACING

For all applicable valve and seat dimensions and angles (Refer to 9 - ENGINE - SPECIFICATIONS).

(1) Reface valves using a suitable valve refacing machine.

(2) Inspect the remaining margin after the valves are refaced (Fig. 44). Intake valves with less than 0.79 mm (0.0312 in.) margin and exhaust valves with less than 1.19 mm (0.0469 in.) margin should be replaced.



9409-78

Fig. 44 Intake and Exhaust Valve Refacing

- 1 - VALVE FACE
2 - VALVE MARGIN

(3) Valve seats which are worn or burned can be reworked, provided that correct angle and seat width are maintained. The intake valve seat must be serviced when the valve seat width is 2.0 mm (0.079 in.) or greater. The exhaust valve seat must be serviced when the valve seat width is 2.5 mm (0.098 in.) or greater. Otherwise the cylinder head must be replaced.

(4) Reface valve seats using a suitable valve seat machine

(5) When refacing valve seats, it is important that the correct size valve guide pilot be used for reseating stones or cutter. A true and complete surface must be obtained.

(6) Measure the concentricity of valve seat and valve guide using a valve seat runout dial indicator. Total runout should not exceed 0.051 mm (0.002 in.) (total indicator reading).

(7) Inspect the valve seat with Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to top edge of the valve face, lower valve seat with a 15 degrees stone/cutter. If the blue is transferred to the bottom edge of valve face raise valve seat with a 65 degrees stone/cutter.

INTAKE/EXHAUST VALVES & SEATS (Continued)

(8) When seat is properly positioned the width of intake and exhaust seats should be 0.75–1.25 mm (0.030–0.049 in.) (Fig. 45).

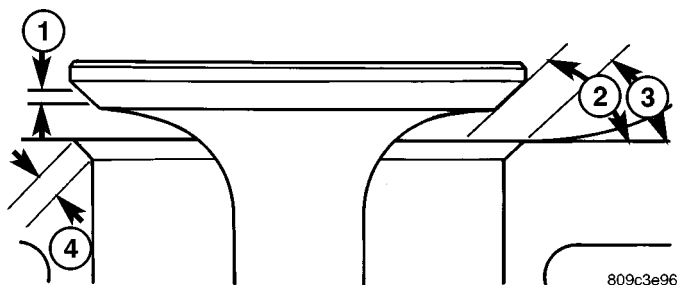


Fig. 45 Valve Face and Seat

- 1 - SEAT WIDTH
- 2 - FACE ANGLE
- 3 - SEAT ANGLE
- 4 - SEAT CONTACT AREA

(9) Check valve tip to spring seat dimensions A after machining the valve seats or faces. Grind valve tip until within specifications. Measure from valve tip to spring seat when installed in the head (measurement A) (Fig. 46). For valve tip specifications, (Refer to 9 - ENGINE - SPECIFICATIONS). The valve tip chamfer is needed to be reground to prevent seal damage when the valve is installed.

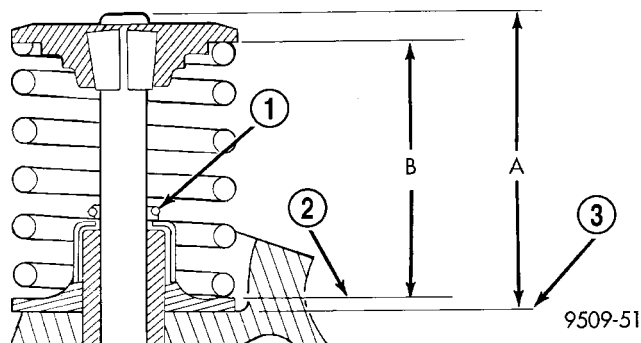


Fig. 46 Spring Installed

- 1 - GARTER SPRING
- 2 - VALVE SPRING SEAT
- 3 - CYLINDER HEAD SURFACE

REMOVAL

(1) Remove valve spring. (Refer to 9 - ENGINE/CYLINDER HEAD/VALVE SPRINGS - REMOVAL)

(2) Before removing valve, **remove any burrs from valve stem lock grooves to prevent damage to the valve guides.** Identify valves to insure installation in original location.

(3) Remove valve(s) from cylinder head.

CLEANING

(1) Clean all valves thoroughly and discard burned, warped and cracked valves.

INSPECTION

VALVES

(1) Measure valve stems for wear (Fig. 47) approximately 60 mm (2.36 in.) below the valve lock grooves. For valve specifications (Refer to 9 - ENGINE - SPECIFICATIONS).

NOTE: Valve stems are chrome plated and should not be polished (Fig. 47).

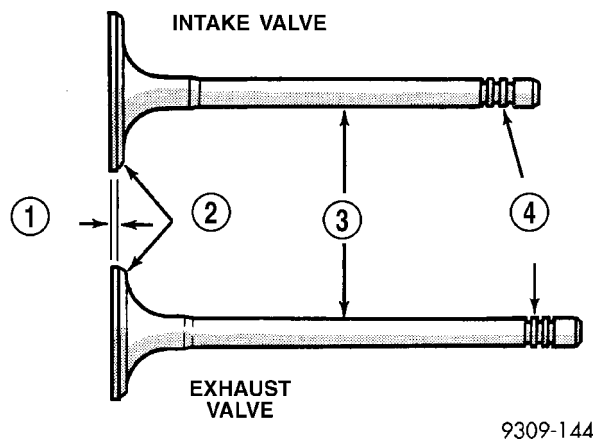


Fig. 47 Intake and Exhaust Valves

- 1 - MARGIN
- 2 - FACE
- 3 - STEM
- 4 - VALVE SPRING RETAINER LOCK GROOVES

VALVE GUIDES

NOTE: Replace cylinder head if stem-to-guide clearance exceeds specifications, or if guide is loose in cylinder head.

(1) Measure valve stem-to-guide clearance as follows:

(2) Install valve into cylinder head so it is 15 mm (0.590 in.) off the valve seat. A small piece of hose may be used to hold valve in place.

(3) Attach dial indicator Tool C-3339 to cylinder head and set it at right angle of valve stem being measured (Fig. 48).

(4) Move valve to and from the indicator. (Refer to 9 - ENGINE - SPECIFICATIONS)

(5) Check valve guide height (Fig. 49).

INSTALLATION

(1) Coat valve stems with clean engine oil.

(2) Install valve in cylinder head.

(3) Install valve seal. (Refer to 9 - ENGINE/CYLINDER HEAD/VALVE STEM SEALS - INSTALLATION)

INTAKE/EXHAUST VALVES & SEATS (Continued)

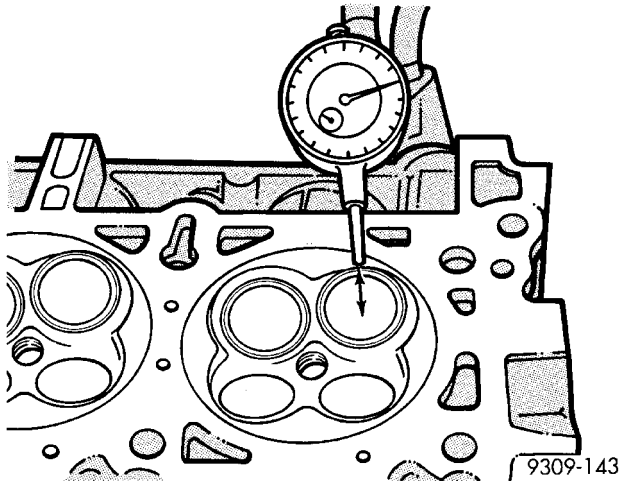


Fig. 48 Measuring Valve Guide

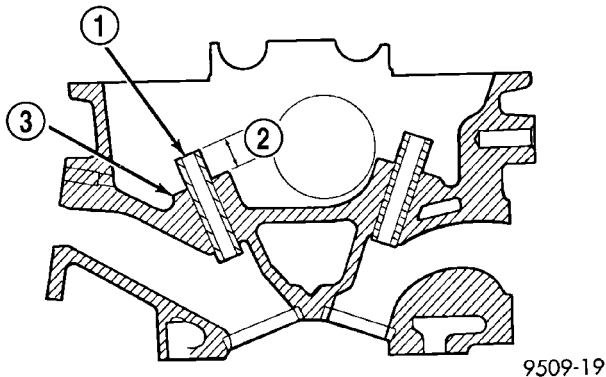


Fig. 49 Valve Guide Height

- 1 - VALVE GUIDE
 2 - 13.25 - 13.75 MM (0.521 - 0.541 IN.)
 3 - SPRING SEAT

(4) Install valve springs. (Refer to 9 - ENGINE/CYLINDER HEAD/VALVE SPRINGS - INSTALLATION)

ENGINE BLOCK

DESCRIPTION

The cast iron cylinder block is a two-piece assembly, consisting of the cylinder block and bed plate (Fig. 50). The bed plate incorporates the main bearing caps and bolts to the cylinder block. This design offers a much stronger lower end and increased cylinder block rigidity. The rear oil seal retainer is integral with the block. The bed plate and block are serviced as an assembly.

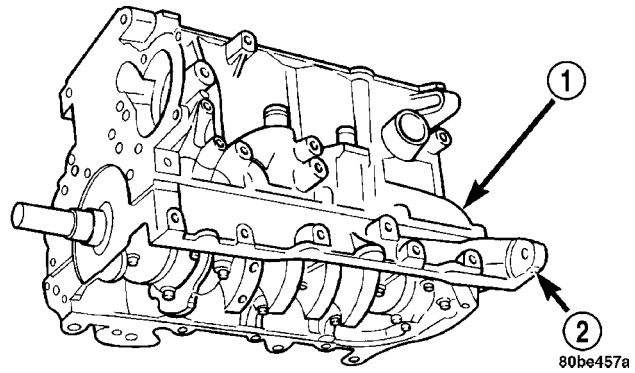


Fig. 50 Cylinder Block and Bed plate

- 1 - CYLINDER BLOCK
 2 - BED PLATE

STANDARD PROCEDURE - CYLINDER BORE HONING

(1) Used carefully, the cylinder bore resizing hone, recommended tool C-823 or equivalent, equipped with 220 grit stones, is the best tool for this honing procedure. In addition to deglazing, it will reduce taper and out-of-round as well as removing light scuffing, scoring or scratches. Usually a few strokes will clean up a bore and maintain the required limits.

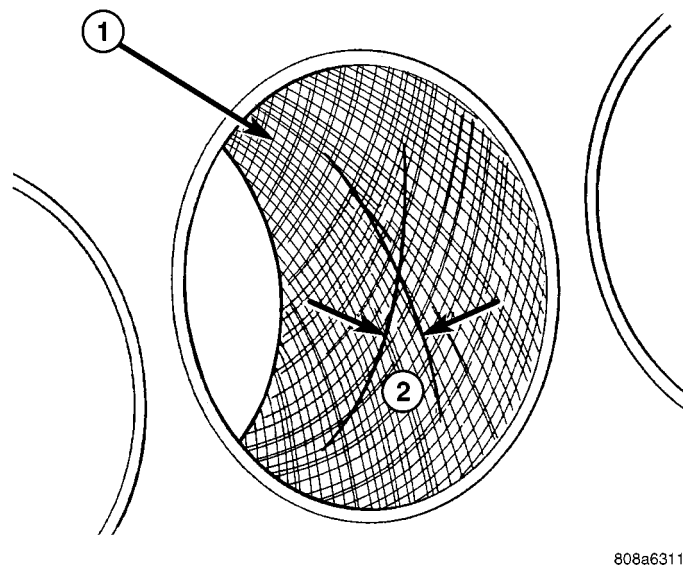
(2) Deglazing of the cylinder walls may be done using a cylinder surfacing hone, recommended tool C-3501 or equivalent, equipped with 280 grit stones, if the cylinder bore is straight and round. 20-60 strokes depending on the bore condition, will be sufficient to provide a satisfactory surface. Use a light honing oil. **Do not use engine or transmission oil, mineral spirits or kerosene.** Inspect cylinder walls after each 20 strokes.

(3) Honing should be done by moving the hone up and down fast enough to get a cross-hatch pattern. When hone marks **intersect** at 40-60 degrees, the cross hatch angle is most satisfactory for proper seating of rings (Fig. 51).

(4) A controlled hone motor speed between 200-300 RPM is necessary to obtain the proper cross-hatch angle. The number of up and down strokes per minute can be regulated to get the desired 40-60 degree angle. Faster up and down strokes increase the cross-hatch angle.

(5) After honing, it is necessary that the block be cleaned again to remove all traces of abrasive.

CAUTION: Ensure all abrasives are removed from engine parts after honing. It is recommended that a solution of soap and hot water be used with a brush and the parts then thoroughly dried. The bore can be considered clean when it can be wiped clean with a white cloth and cloth remains clean. Oil the bores after cleaning to prevent rusting.

ENGINE BLOCK (Continued)**Fig. 51 Cylinder Bore Cross-Hatch Pattern**

- 1 - CROSS-HATCH PATTERN
2 - 40°–60°

CLEANING

Clean cylinder block thoroughly using a suitable cleaning solvent.

INSPECTION**ENGINE BLOCK**

(1) Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.

(2) If new core plugs are to be installed, (Refer to 9 - ENGINE - STANDARD PROCEDURE - ENGINE CORE AND OIL GALLERY PLUGS).

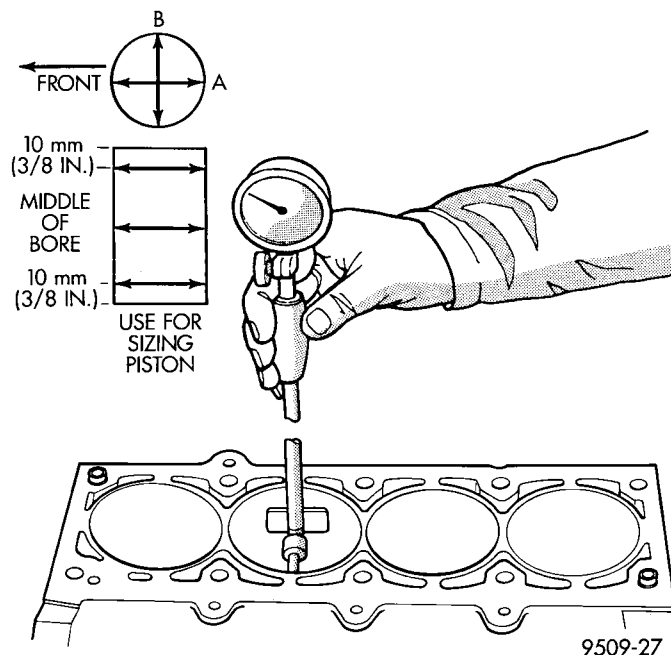
(3) Examine block and cylinder bores for cracks or fractures.

(4) Check block deck surfaces for flatness. Deck surface must be within service limit of 0.1 mm (0.004 in.).

CYLINDER BORE

NOTE: The cylinder bores should be measured at normal room temperature, 21°C (70°F).

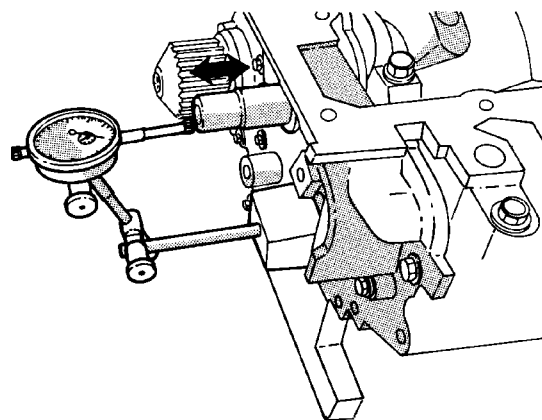
The cylinder walls should be checked for out-of-round and taper with Tool C119 or equivalent (Fig. 52) (Refer to 9 - ENGINE - SPECIFICATIONS). If the cylinder walls are badly scuffed or scored, the cylinder block should be replaced, and new pistons and rings fitted.

**Fig. 52 Checking Cylinder Bore Size**

Measure the cylinder bore at three levels in directions A and B (Fig. 52). Top measurement should be 10 mm (3/8 in.) down and bottom measurement should be 10 mm (3/8 in.) up from bottom of bore. (Refer to 9 - ENGINE - SPECIFICATIONS).

CRANKSHAFT**STANDARD PROCEDURE - CRANKSHAFT END PLAY**

(1) Mount a dial indicator to front of engine, locating probe on nose of the crankshaft (Fig. 53).



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Fig. 53 Checking Crankshaft End Play - Typical

(2) Move crankshaft all the way to the rear of its travel.

(3) Zero the dial indicator.

CRANKSHAFT (Continued)

(4) Move crankshaft all the way to the front of its travel and read the dial indicator. For crankshaft specifications (Refer to 9 - ENGINE - SPECIFICATIONS)

REMOVAL - CRANKSHAFT

- (1) Remove engine assembly from vehicle (Refer to 9 - ENGINE - REMOVAL).
- (2) Separate transaxle from engine.
- (3) Remove drive plate/flexplate.
- (4) Remove crankshaft rear oil seal (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - REMOVAL).
- (5) Mount engine on a suitable repair stand.
- (6) Drain engine oil.
- (7) Remove crankshaft vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
- (8) Remove front timing belt cover, front engine mount bracket, and timing belt (Refer to 9 -

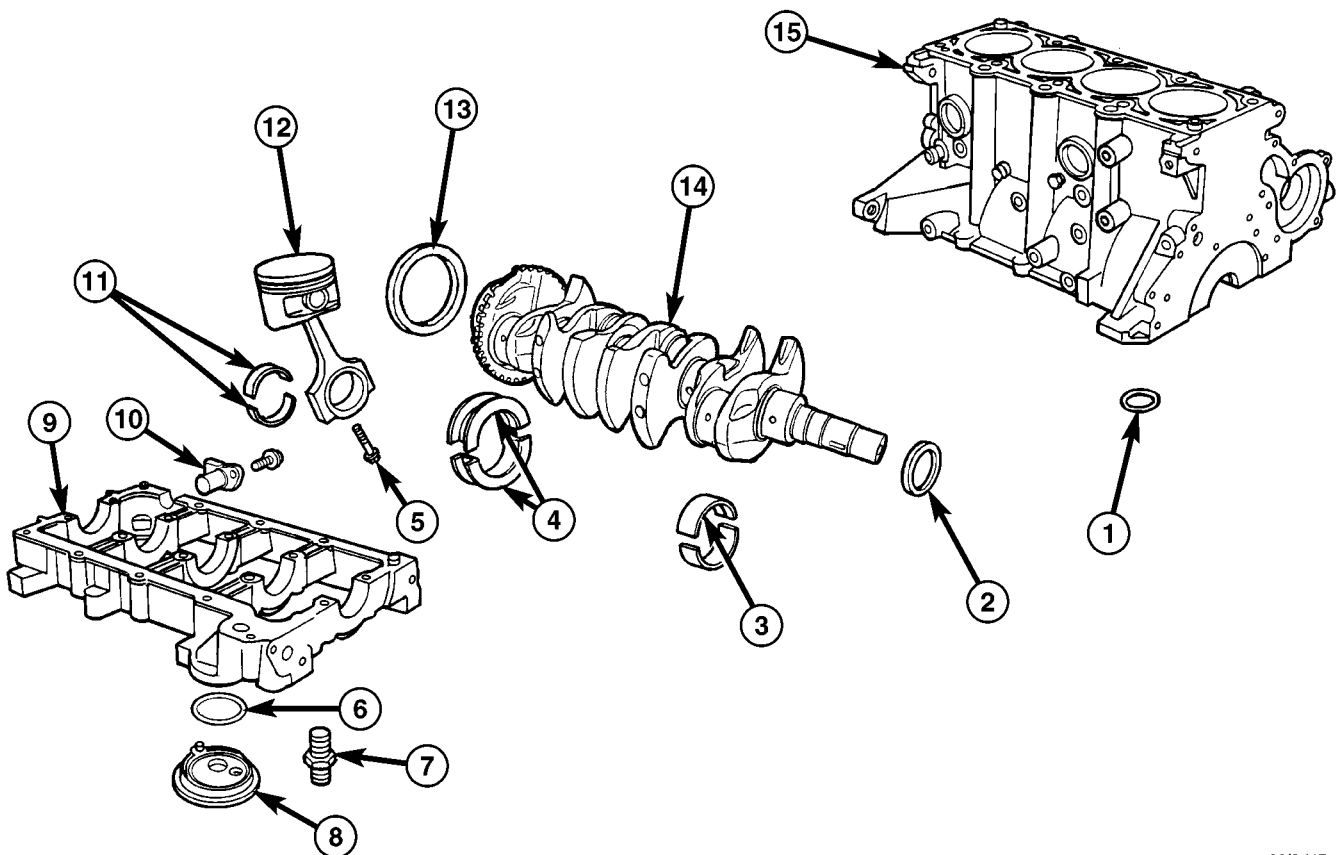


Fig. 54 Engine Block and Components

- | | |
|-----------------------------|---|
| 1 - OIL PASSAGE O-RING | 9 - BEDPLATE |
| 2 - FRONT CRANKSHAFT SEAL | 10 - CRANKSHAFT POSITION SENSOR |
| 3 - UPPER BEARING (GROOVED) | 11 - CONNECTING ROD BEARINGS |
| 4 - THRUST BEARINGS | 12 - PISTON AND CONNECTING ROD ASSEMBLY |
| 5 - BOLT | 13 - REAR CRANKSHAFT SEAL |
| 6 - O-RING | 14 - CRANKSHAFT |
| 7 - NIPPLE | 15 - ENGINE BLOCK |
| 8 - OIL FILTER ADAPTER | |

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CRANKSHAFT (Continued)

(17) Using a permanent ink or paint marker, identify cylinder number on each connecting rod cap (Fig. 55).

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods. Damage to connecting rod could occur.

(18) Remove all connecting rod bolts and caps. Care should be taken not to damage the fracture rod and cap surfaces.

NOTE: Do not reuse connecting rod bolts.

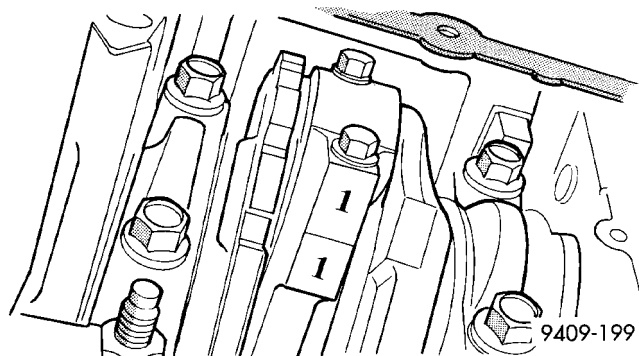


Fig. 55 Identify Connecting Rod to Cylinder - Typical

(19) Remove all bed plate bolts from the engine block (Fig. 56).

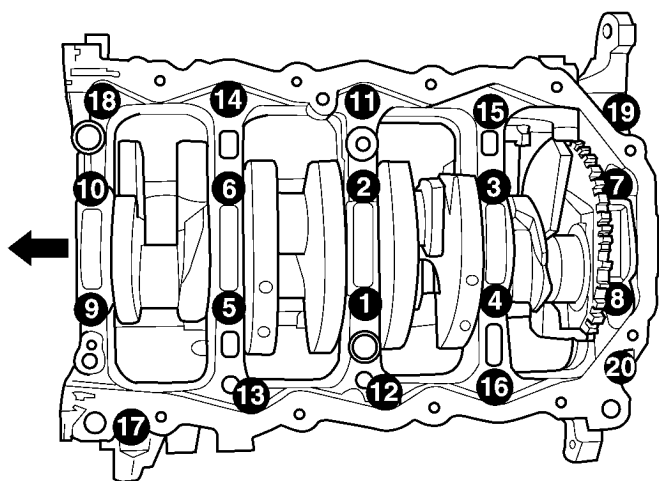


Fig. 56 Main Bearing Caps/Bed Plate Bolt Removal Sequence

(20) Using a mallet tap the bed plate loose from the engine block dowel pins.

CAUTION: Do not pry up on one side of the bed plate. Damage may occur to cylinder block to bed plate alignment and thrust bearing.

(21) Bedplate should be removed evenly from the cylinder block dowel pins to prevent damage to the dowel pins and thrust bearing.

CAUTION: Use extreme care when handling crankshaft. Tone wheel damage can occur if crankshaft is mis-handled.

(22) Lift out crankshaft from cylinder block. Do not damage the main bearings or journals when removing the crankshaft.

(23) Remove the target ring mounting screws and discard.

(24) Remove the target ring from the crankshaft.

INSPECTION

The crankshaft journals should be checked for excessive wear, taper and scoring (Fig. 57). Limits of taper or out of round on any crankshaft journals should be held to 0.025 mm (0.001 in.). Journal grinding should not exceed 0.305 mm (0.012 in.) under the standard journal diameter. **DO NOT** grind thrust faces of No. 3 main bearing. **DO NOT** nick crank pin or bearing fillets. After grinding, remove rough edges from crankshaft oil holes and clean out all passages.

CAUTION: With the nodular cast iron crankshafts, it is important that the final paper or cloth polish be in the same direction as normal rotation in the engine.

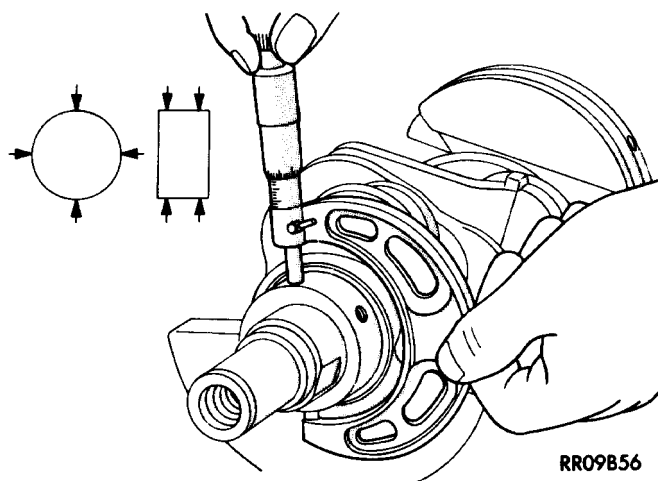


Fig. 57 Crankshaft Journal Measurements - Typical

CRANKSHAFT (Continued)

INSTALLATION - CRANKSHAFT

CRANKSHAFT MAIN BEARING LOCATION

The crankshaft is supported in five main bearings. All upper bearing shells in the crankcase have oil grooves and holes. All lower bearing shells installed in the (bedplate) main bearing cap are plain. Crankshaft end play is controlled by a flanged bearing on the number three main bearing journal (Fig. 58).

NOTE: The upper and lower main Bearing shells are Not interchangeable. The lower shell locating tabs prevent improper installation.

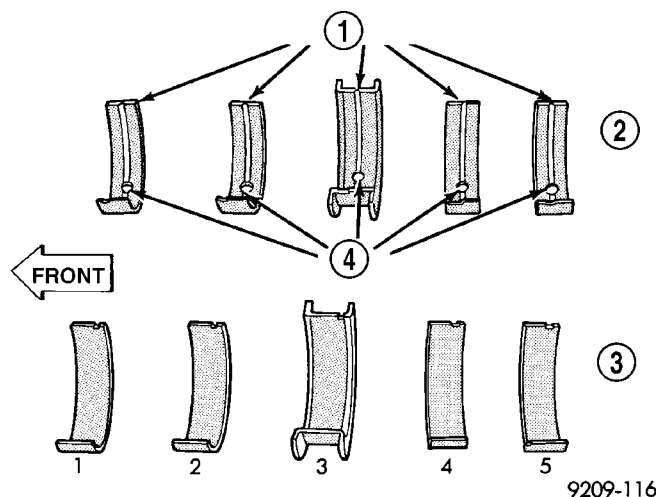


Fig. 58 Main Bearing Identification

- 1 - OIL GROOVES
- 2 - UPPER BEARINGS
- 3 - LOWER BEARINGS
- 4 - OIL HOLES

(1) Install the main bearing upper shells with the lubrication groove and oil hole in the engine block. Install O-ring into recess in the block (Fig. 59).

(2) Make certain oil holes in block line up with oil hole in bearings and bearing tabs seat in the block tab slots.

NOTE: If the crankshaft is sent out for machine work, it must be balanced as an assembly with the target ring installed.

(3) Clean crankshaft and target ring with MOPAR® brake parts cleaner and dry with compressed air to ensure that the crankshaft mating surface and target ring mounting holes are free from oil and lock patch debris.

NOTE: Always use NEW mounting screws whether installing original or new target ring.

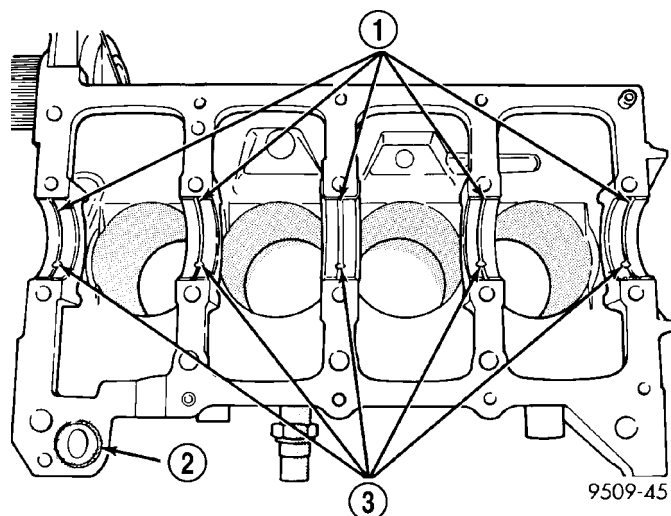


Fig. 59 Installing Main Bearing Upper Shell

- 1 - LUBRICATION GROOVES
- 2 - O-RING
- 3 - OIL HOLES

(4) Install **NEW** mounting screws finger tight starting with the #1 location. (Fig. 60) Make sure engagement occurs with the shoulder of the screw and mounting hole before starting all other screws.

(5) Torque all mounting screws with T30 torx bit to 13 N·m (110 in-lbs) following the torque sequence.

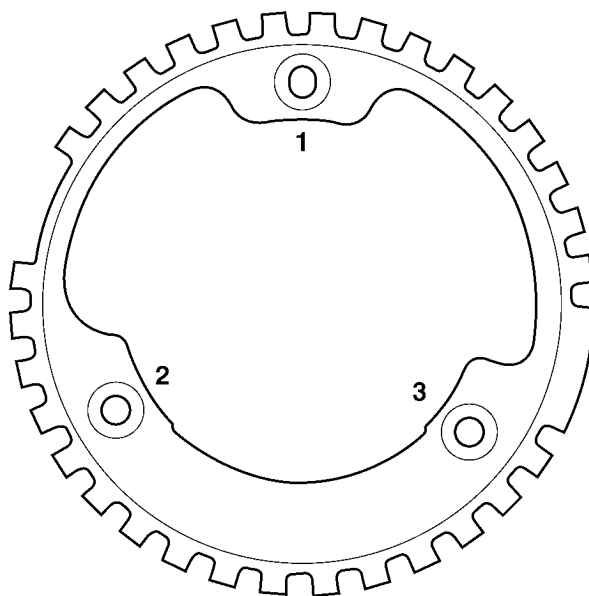


Fig. 60 Target Ring Torque Sequence

CAUTION: Use extreme care when handling crankshaft. Tone wheel damage can occur if crankshaft is mis-handled.

CRANKSHAFT (Continued)

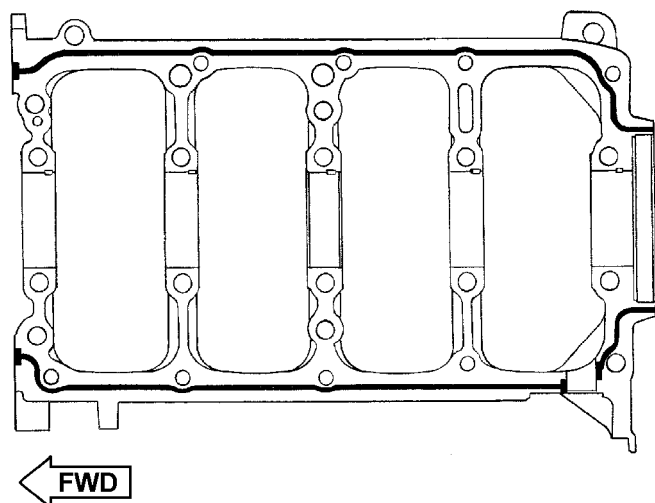
CAUTION: Do Not get oil on the bed plate mating surface. It will affect the ability of the sealer to seal the bed plate to cylinder block.

(6) Oil the bearings and journals and install crankshaft in engine the block.

CAUTION: Use only Mopar® Bed Plate Sealant on the bed plate or damage may occur to the engine.

(7) Install lower main bearings into main bearing cap/bed plate. Make certain the bearing tabs are seated into the bed plate slots and apply oil.

(8) Apply a 1.5 to 2.0 mm (0.059 to 0.078 in.) bead of Mopar® Bed Plate Sealant to cylinder block as shown in (Fig. 61). Install the main bearing/bed plate into the engine block.



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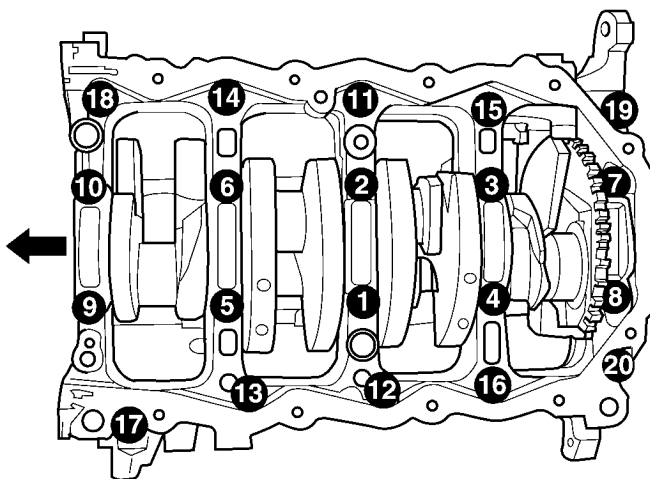
Fig. 61 Bed plate Sealing

(9) Before installing the bolts oil threads with clean engine oil, wipe off any excess oil.

(10) Install main bearing bed plate to engine block bolts 11, 17 and 20 finger tight. Tighten these bolts down together until the bed plate contacts the cylinder block (Fig. 62).

(11) To ensure correct thrust bearing alignment, perform the following steps:

- Step 1: Rotate crankshaft until number 4 piston is at TDC.
- Step 2: Move crankshaft rearward to limits of travel.
- Step 3: Then, move crankshaft forward to limits of travel.



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Fig. 62 Main Bearing Caps/Bed Plate Bolt Torque Sequence

- Step 4: Wedge an appropriate tool between the rear of the cylinder block (**NOT BED PLATE**) and the rear crankshaft counterweight. This will hold the crankshaft in it's furthest forward position.

- Step 5: Install and tighten bolts (1–10) in sequence shown in (Fig. 62) to 41 N·m (30 ft. lbs.).

- Step 6: Remove wedge tool used to hold crankshaft.

(12) Tighten bolts (1–10) again to 41 N·m (30 ft. lbs.) in sequence shown in (Fig. 62).

(13) Install main bearing bed plate to engine block bolts (11–20), with baffle studs in positions 12, 13 and 16 and torque each bolt to 34 N·m (25 ft. lbs.) in sequence shown in (Fig. 62).

(14) Tighten bolts (1–10) to 81 N·m (60 ft. lbs.) in sequence shown in (Fig. 62).

(15) Tighten bolts (11–20) again to 34 N·m (25 ft. lbs.) in sequence shown in (Fig. 62).

(16) After the main bearing bed plate is installed, check the crankshaft turning torque. The turning torque should not exceed 5.6 N·m (50 in. lbs.).

(17) Check crankshaft end play (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - STANDARD PROCEDURE).

NOTE: The connecting rod cap bolts should not be reused.

(18) Before installing **NEW** bolts, lubricate the threads with clean engine oil.

(19) Install each bolt finger tight then alternately torque each bolt to assemble the cap properly.

CRANKSHAFT (Continued)

(20) Tighten the connecting rod bolts using the 2 step torque-turn method. Tighten according to the following values:

CAUTION: Do not use a torque wrench for the second step.

1. Tighten the bolts to 27 N·m (20 ft. lbs.).
2. Tighten the connecting rod bolts an additional **1/4 TURN**.

(21) Install oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).

(22) Install oil pump pick-up tube. Torque fastener to 23 N·m (200 in. lbs.).

(23) Install the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(24) Install oil filter adapter and oil filter (Fig. 54) (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER ADAPTER - INSTALLATION).

(25) Install rear timing belt cover and camshaft sprocket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - INSTALLATION).

(26) Install front crankshaft oil seal and crankshaft sprocket (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - FRONT - INSTALLATION).

(27) Install the timing belt tensioner and pulley bracket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT TENSIONER & PULLEY - INSTALLATION).

(28) Install the timing belt, front engine mount bracket, and front timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION).

(29) Install crankshaft vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(30) Install crankshaft position sensor (Fig. 54).

(31) Install **NEW** oil filter.

(32) Remove engine from repair stand and position on Special Tools 6135 and 6710 Engine Dolly and Cradle. Install safety straps around the engine to cradle and tighten and lock them into position.

(33) Install the crankshaft rear oil seal (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - INSTALLATION).

(34) Install drive plate/flex plate. Apply Mopar® Lock & Seal Adhesive to bolt threads and tighten to 95 N·m (70 ft. lbs.).

(35) Attach transaxle to engine. Tighten attaching bolts to 101 N·m (75 ft. lbs.).

(36) Install the engine assembly (Refer to 9 - ENGINE - INSTALLATION).

CRANKSHAFT OIL SEAL - FRONT

REMOVAL

(1) Remove the accessory drive belts. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL)

(2) Remove the crankshaft vibration damper. (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL)

(3) Remove the timing belt. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL)

(4) Remove the crankshaft sprocket using Special Tool 6793 and insert C-4685-C2 (Fig. 63).

(5) Remove the crankshaft sprocket key from crankshaft (Fig. 64).

CAUTION: Do not nick shaft seal surface or seal bore.

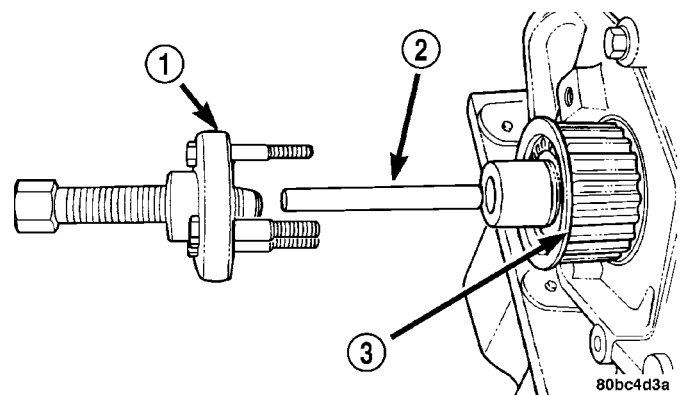


Fig. 63 Crankshaft Sprocket—Removal

- 1 - SPECIAL TOOL 6793
- 2 - SPECIAL TOOL C-4685-C2
- 3 - CRANKSHAFT SPROCKET

(6) Using Special Tool 6771, remove front crankshaft oil seal (Fig. 65). Do not damage the seal contact area on the crankshaft.

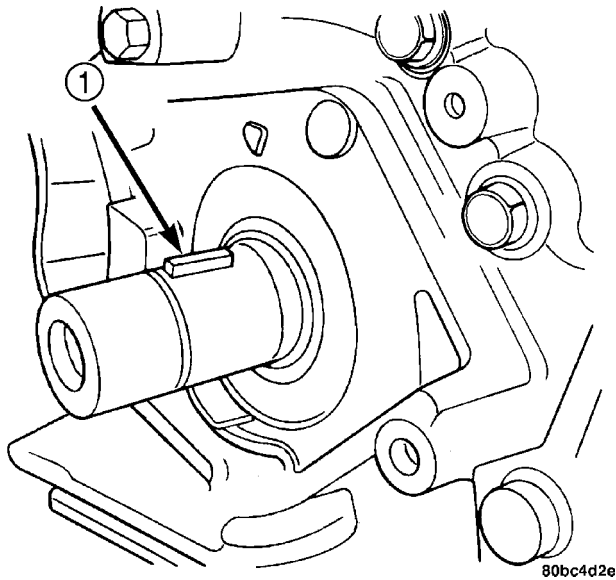
INSTALLATION

(1) Position seal into opening with seal spring towards the inside of engine. Using Special Tool 6780-1 (Fig. 66), install seal until flush with cover.

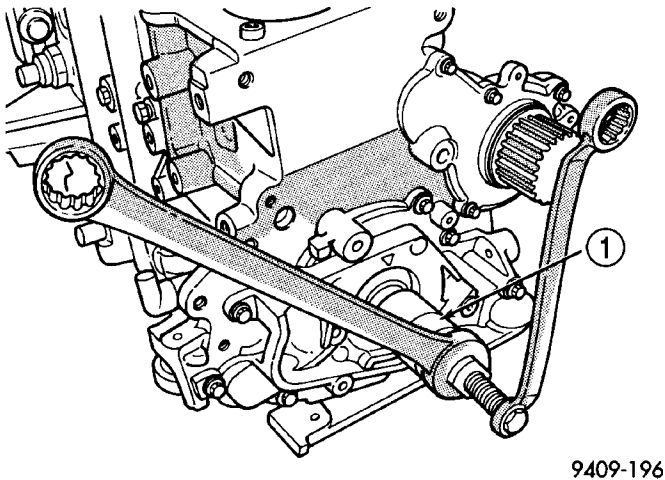
(2) Install the crankshaft sprocket key (Fig. 64).

(3) Install the crankshaft sprocket (Fig. 67) using Special Tool 6792.

NOTE: Make sure the word “front” on the sprocket is facing outward.

CRANKSHAFT OIL SEAL - FRONT (Continued)**Fig. 64 Crankshaft Key**

1 - CRANKSHAFT KEY

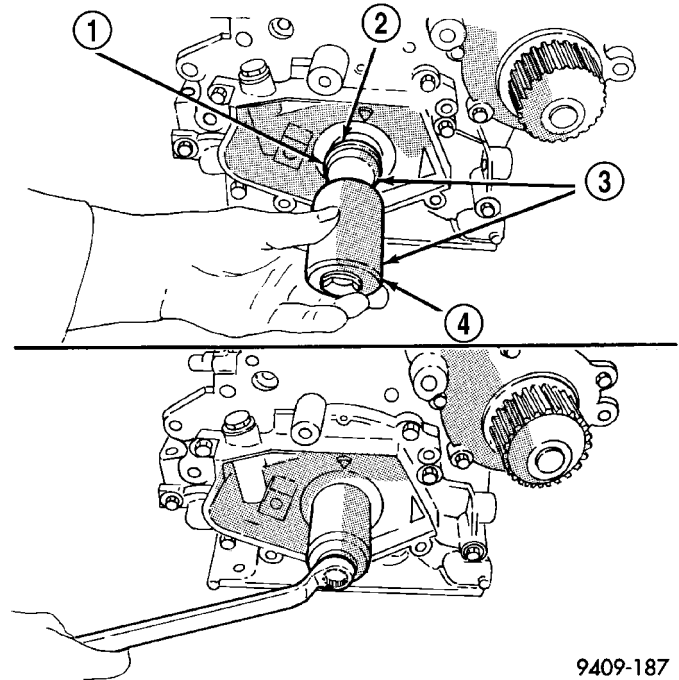
**Fig. 65 Front Crankshaft Oil Seal—Removal**

1 - SPECIAL TOOL 6771

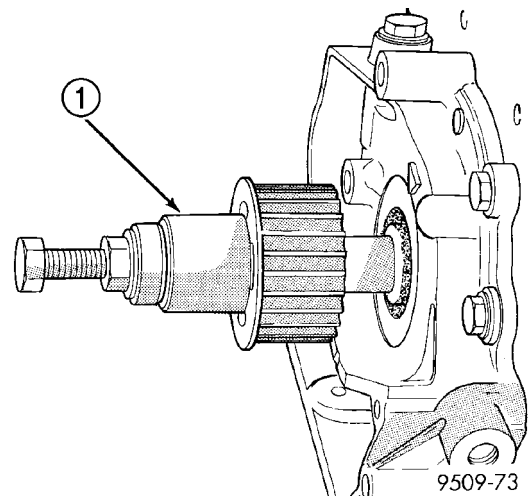
CAUTION: Use of Special Tool 6792 is required to install the crankshaft sprocket to the proper depth. Failure to use this tool will cause improper timing belt tracking.

(4) Install the timing belt. (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION)

(5) Install crankshaft vibration damper. (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION)

**Fig. 66 Front Crankshaft Oil Seal - Installation**

- 1 - PROTECTOR
- 2 - SEAL
- 3 - SPECIAL TOOL 6780-1
- 4 - INSTALLER

**Fig. 67 Crankshaft Sprocket - Installation**

1 - SPECIAL TOOL 6792

(6) Install accessory drive belts. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION)

CRANKSHAFT OIL SEAL - REAR

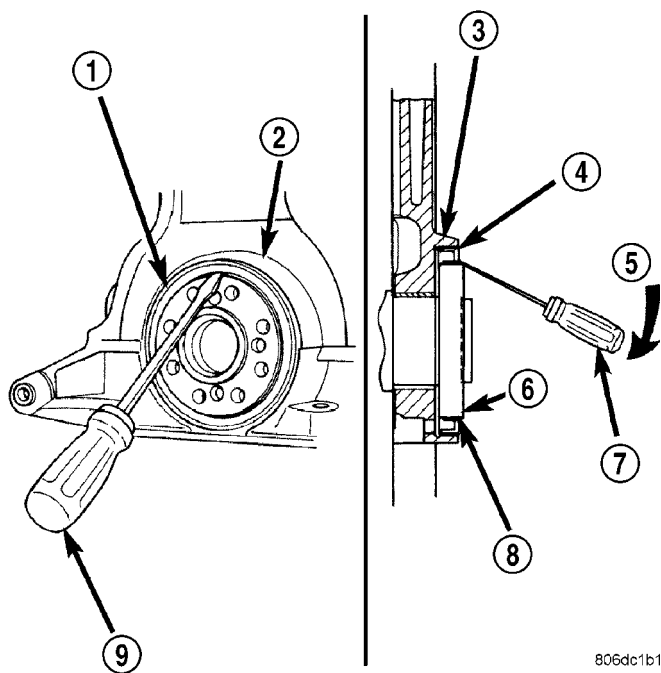
REMOVAL

(1) Remove the transaxle. (Refer to 21 - TRANSAXLE - REMOVAL) for procedure.

(2) Remove the flex plate. (Refer to 9 - ENGINE/ENGINE BLOCK/FLEX PLATE - REMOVAL)

(3) Insert a 3/16 flat bladed screwdriver between the dust lip and the metal case of the crankshaft seal. Angle the screwdriver (Fig. 68) through the dust lip against metal case of the seal. Pry out seal.

CAUTION: Do not permit the screwdriver blade to contact crankshaft seal surface. Contact of the screwdriver blade against crankshaft edge (chamfer) is permitted.



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Fig. 68 Rear Crankshaft Oil Seal—Removal

- 1 - REAR CRANKSHAFT SEAL
- 2 - ENGINE BLOCK
- 3 - ENGINE BLOCK
- 4 - REAR CRANKSHAFT SEAL METAL CASE
- 5 - PRY IN THIS DIRECTION
- 6 - CRANKSHAFT
- 7 - SCREWDRIVER
- 8 - REAR CRANKSHAFT SEAL DUST LIP
- 9 - SCREWDRIVER

INSTALLATION

CAUTION: If burr or scratch is present on the crankshaft edge (chamfer), cleanup with 400 grit sand paper to prevent seal damage during installation of new seal.

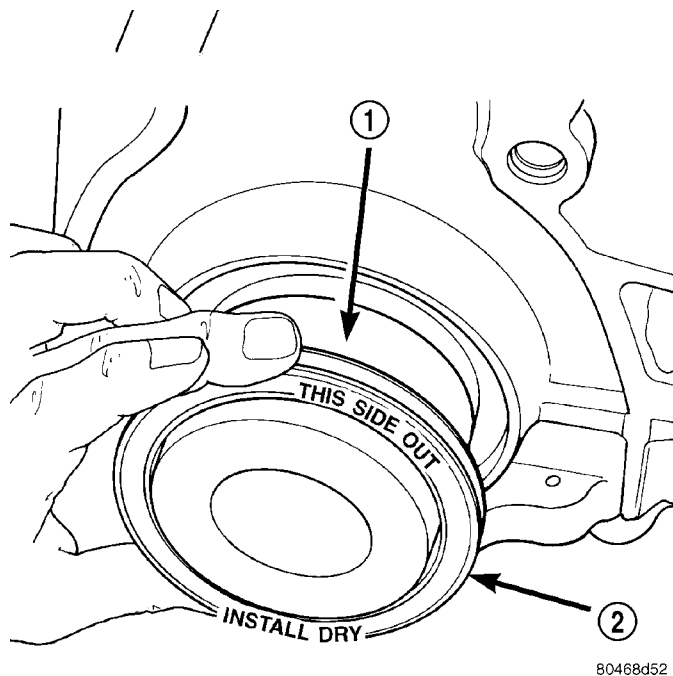
NOTE: When installing seal, no lube on seal is needed.

(1) Place Special Tool 6926-1 on crankshaft. This is a pilot tool with a magnetic base (Fig. 69).

(2) Position seal over pilot tool. Make sure you can read the words **THIS SIDE OUT** on seal (Fig. 69). Pilot tool should remain on crankshaft during installation of seal. Ensure that the lip of the seal is facing towards the crankcase during installation.

CAUTION: If the seal is driven into the block past flush, this may cause an oil leak.

(3) Drive the seal into the block using Special Tool 6926-2 and handle C-4171 (Fig. 70) until the tool bottoms out against the block (Fig. 71).



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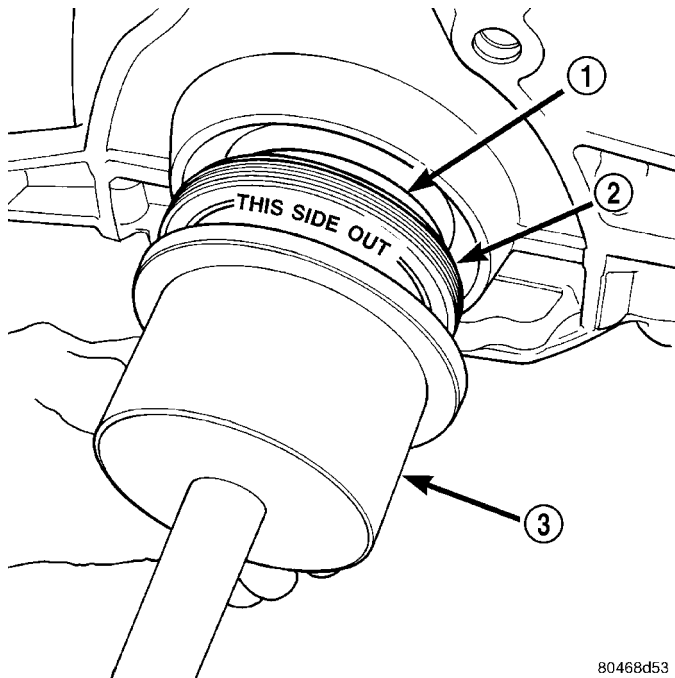
Fig. 69 Crankshaft Rear Seal and Special Tool 6926-1

- 1 - SPECIAL TOOL 6926-1 PILOT
- 2 - SEAL

(4) Install the flex plate. (Refer to 9 - ENGINE/ENGINE BLOCK/FLEX PLATE - INSTALLATION)

(5) Install the transaxle. (Refer to 21 - TRANSAXLE - INSTALLATION)

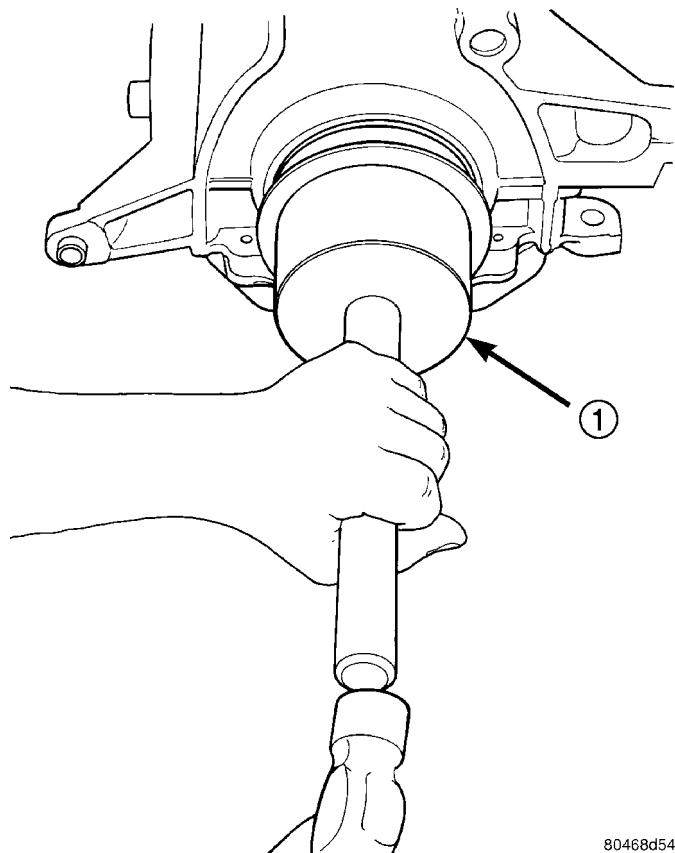
CRANKSHAFT OIL SEAL - REAR (Continued)



80468d53

Fig. 70 Crankshaft Seal Special Tool 6926-2

- 1 - SPECIAL TOOL 6926-1 PILOT
- 2 - SEAL
- 3 - SPECIAL TOOL 6926-2 INSTALLER



80468d54

Fig. 71 Crankshaft Rear Oil Seal - Installation

- 1 - SPECIAL TOOL 6926-2 INSTALLER

PISTON & CONNECTING ROD

DESCRIPTION

NOTE: The engine **DOES NOT** have provisions for a free wheeling valve train. Non free wheeling valve train means, in the event of a broken timing belt, pistons will contact the valves.

The pistons are made of a cast aluminum alloy. The pistons have pressed-in pins attached to forged powdered metal connecting rods. The pistons pin is offset 1 mm (0.0394 in.) towards the thrust side of the piston. The connecting rods are a cracked cap design and are not repairable. Hex head cap screws are used to provide alignment and durability in the assembly. The pistons and connecting rods are serviced as an assembly.

STANDARD PROCEDURE - CYLINDER BORE AND PISTON - FITTING

Piston and cylinder wall must be clean and dry. Piston diameter should be measured 90 degrees to piston pin about 14 mm (9/16 inch.) from the bottom of the skirt as shown in (Fig. 73). Cylinder bores should be measured halfway down the cylinder bore and transverse (measurement location B) to the engine crankshaft center line shown in (Fig. 72). (Refer to 9 - ENGINE - SPECIFICATIONS) Correct piston to bore clearance must be established in order to assure quiet and economical operation.

NOTE: Pistons and cylinder bores should be measured at normal room temperature, 70°F (21°C).

REMOVAL

- (1) Remove the cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
- (2) Remove the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
- (3) Remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation.** Mark piston with matching cylinder number (Fig. 74).

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods. Damage to connecting rod could occur.

- (4) Using a permanent ink or paint marker, identify cylinder number on each connecting rod cap (Fig. 75).

- (5) Pistons will have a stamping in the approximate location shown in (Fig. 74). These stamps will

PISTON & CONNECTING ROD (Continued)

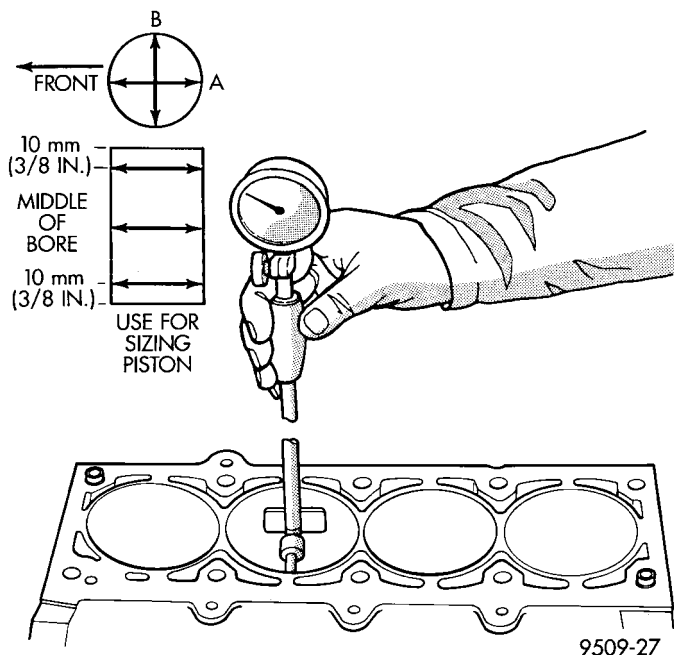


Fig. 72 Checking Cylinder Bore

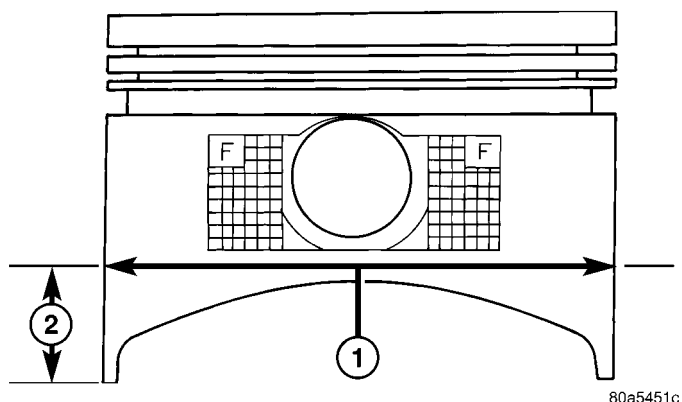


Fig. 73 Piston Measurement Location

- 1 - PISTON DIAMETER
2 - 14 mm (9/16 in.)

be either a directional arrow or a weight identification for the assembly. L is for light and H is for heavy. These assemblies should all be the same weight class. Service piston assemblies are marked with a S and can be used with either L or H production assemblies. The weight designation stamps should face toward the timing belt side of the engine.

(6) Pistons and connecting rods must be removed from top of cylinder block. Rotate crankshaft so that each connecting rod is centered in cylinder bore.

(7) Remove connecting rod bolts and cap. Care should be taken not to damage the fracture rod and cap surfaces.

NOTE: Do not reuse connecting rod bolts.

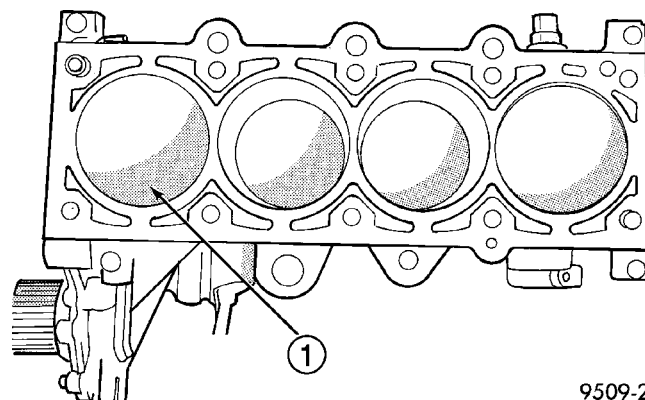


Fig. 74 Piston Markings

1 - WEIGHT DESIGNATION AND DIRECTIONAL ARROW WILL BE IMPRINTED IN THIS AREA

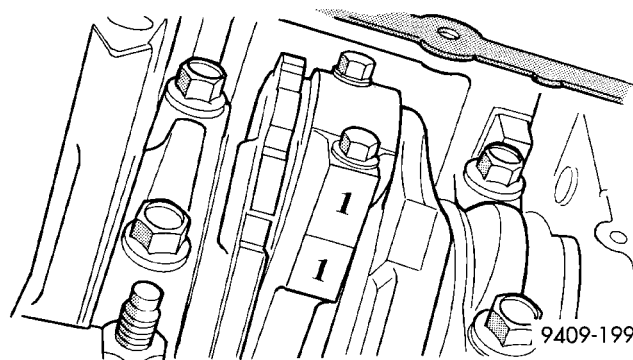


Fig. 75 Identify Connecting Rod to Cylinder - Typical

CAUTION: Care must be taken not to damage the fractured rod and cap joint surfaces, as engine damage may occur.

(8) To protect crankshaft journal and fractured rod surfaces, install Special Tool 8189, connecting rod guides onto connecting rod (Fig. 76). Carefully push each piston and rod assembly out of cylinder bore.

(9) Remove Special Tool 8189, connecting rod guides and re-install bearing cap on the mating rod.

NOTE: Piston and rods are serviced as an assembly.

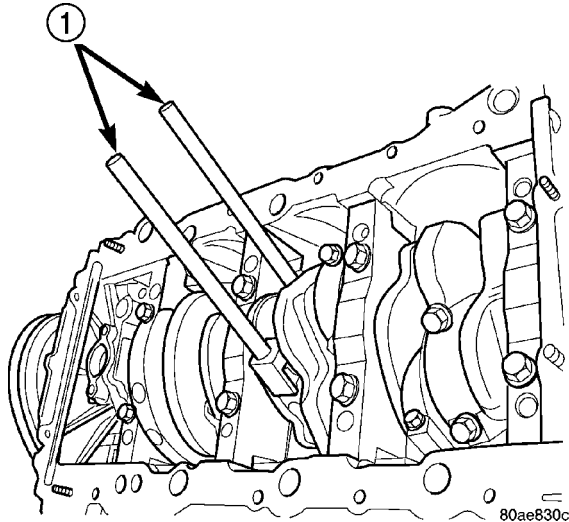
(10) Repeat procedure for each piston and connecting rod assembly.

(11) Remove piston rings (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON RINGS - REMOVAL).

INSTALLATION

(1) Install piston rings on piston (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON RINGS - INSTALLATION).

PISTON & CONNECTING ROD (Continued)

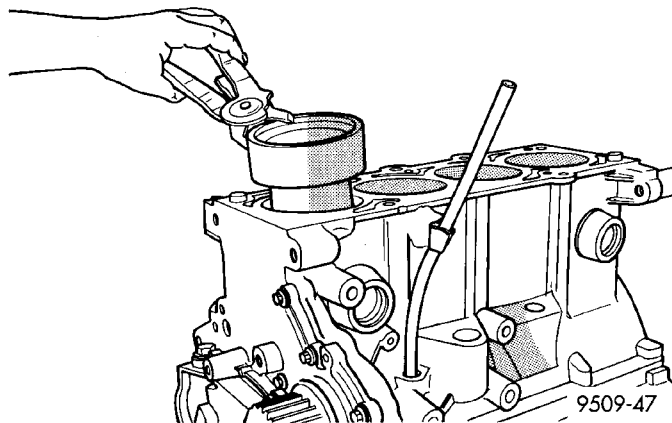
**Fig. 76 Connecting Rod Guides—Typical**

1 - SPECIAL TOOL 8189 CONNECTING ROD GUIDES

(2) Before installing pistons and connecting rod assemblies into the bore, ensure the compression ring gaps are staggered, and neither is in line with the oil ring rail gap (Fig. 84).

(3) Before installing the ring compressor, ensure the oil ring expander ends are butted and the rail gaps are located as shown in (Fig. 84). As viewed from top.

(4) Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston (Fig. 77). **Be sure position of rings does not change during this operation.**

**Fig. 77 Installing Piston**

(5) The weight stamp designation L or H will be in the front half of the piston should face toward the front of the engine (Fig. 74).

(6) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Lubricate connecting rod journal with clean engine oil.

(7) Install connecting rod upper bearing half into connecting rod. Install Special Tool 8189, connecting rod guides onto connecting rod (Fig. 76).

(8) Insert rod and piston assembly into cylinder bore and carefully guide rod over the crankshaft journal.

(9) Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal.

(10) Remove Special Tool 8189, connecting rod guides.

NOTE: The connecting rod cap bolts should not be reused.

(11) Before installing the **NEW** bolts, the threads should be coated with clean engine oil.

(12) Install connecting rod lower bearing half into connecting rod cap. Install connecting rod cap.

(13) Install each bolt finger tight then alternately torque each bolt to assemble the cap properly.

(14) Tighten the connecting rod bolts using the 2 step torque-turn method. Tighten according to the following values:

CAUTION: Do not use a torque wrench for the second step.

1. Tighten the bolts to 27 N·m (20 ft. lbs.).

2. Tighten the connecting rod bolts an additional **1/4 TURN**.

(15) Using a feeler gauge, check connecting rod side clearance (Fig. 78). (Refer to 9 - ENGINE - SPECIFICATIONS) for connecting rod side clearance.

(16) Install the cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

(17) Install the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

CONNECTING ROD BEARINGS

STANDARD PROCEDURE

CONNECTING ROD - FITTING

(1) For measuring connecting rod bearing clearance procedure and use of Plastigage (Refer to 9 - ENGINE - STANDARD PROCEDURE). For bearing clearance refer to Engine Specifications. (Refer to 9 - ENGINE - SPECIFICATIONS)

NOTE: The rod bearing bolts should not be reused.

(2) Before installing the **NEW** bolts the threads should be oiled with clean engine oil.

(3) Install each bolt finger tight then alternately torque each bolt to assemble the cap properly.

CONNECTING ROD BEARINGS (Continued)

(4) Tighten the connecting rod bolts using the 2 step torque-turn method. Tighten according to the following values:

CAUTION: Do not use a torque wrench for the second step.

1. Tighten the bolts to 27 N·m (20 ft. lbs.).
2. Tighten the connecting rod bolts an additional **1/4 TURN**.

(5) Using a feeler gauge, check connecting rod side clearance (Fig. 78). Refer to clearance specifications (Refer to 9 - ENGINE - SPECIFICATIONS).

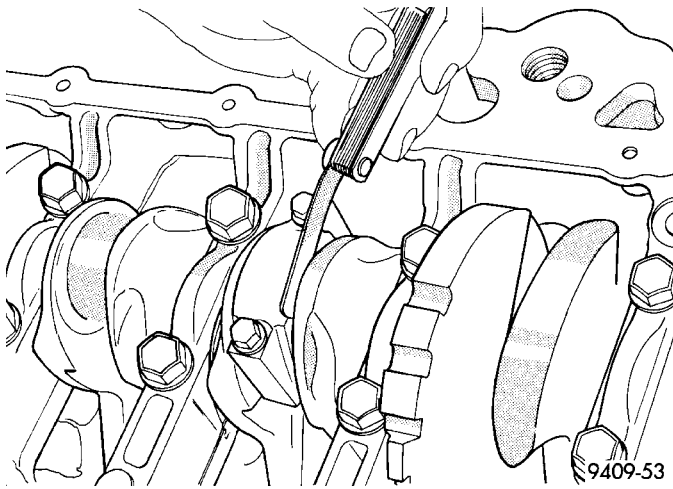


Fig. 78 Connecting Rod Side Clearance - Typical

PISTON RINGS

STANDARD PROCEDURE - PISTON RING - FITTING

(1) Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioned below normal ring travel in the cylinder bore. Check gap with feeler gauge (Fig. 79). For piston ring specifications (Refer to 9 - ENGINE - SPECIFICATIONS).

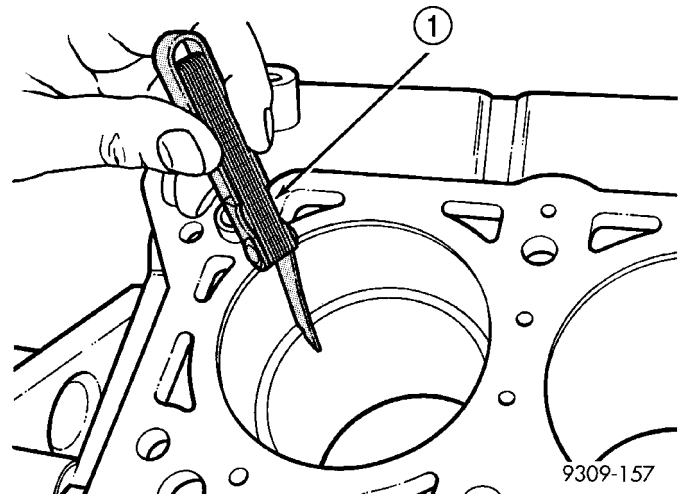


Fig. 79 Piston Ring Gap

1 - FEELER GAUGE

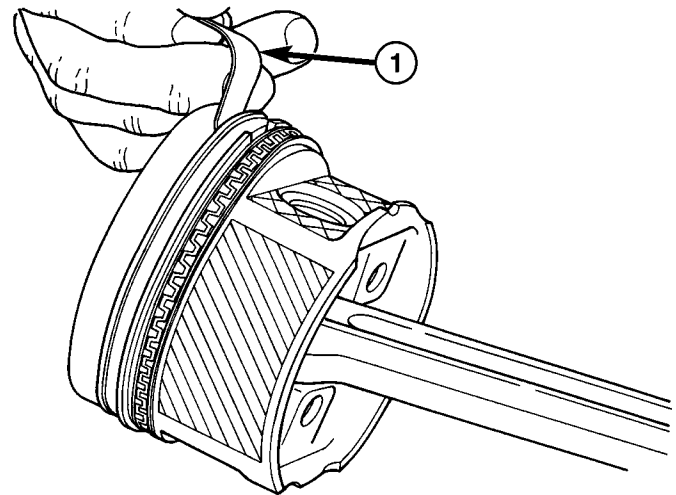


Fig. 80 Piston Ring Side Clearance

1 - FEELER GAUGE

(2) Check piston ring to groove side clearance (Fig. 80). For piston ring specifications (Refer to 9 - ENGINE - SPECIFICATIONS).

PISTON RINGS (Continued)

REMOVAL

(1) Using a suitable ring expander, remove upper and intermediate piston rings (Fig. 81).

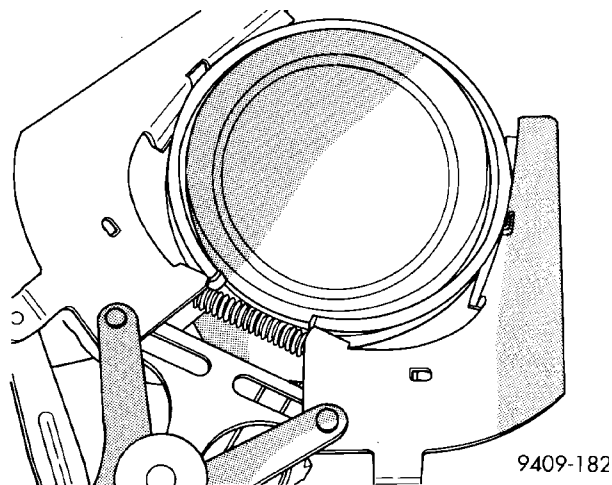


Fig. 81 Piston Rings—Removing and Installing

- (2) Remove the upper oil ring side rail, lower oil ring side rail and then oil ring expander from piston.
- (3) Clean ring grooves of any carbon deposits.

INSTALLATION

NOTE: The identification mark on face of upper and intermediate piston rings must point toward top of piston.

Install rings with manufacturers identification mark facing up, to the top of the piston (Fig. 82).

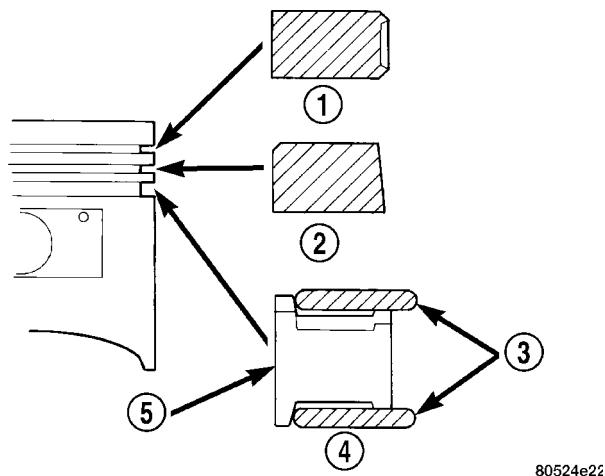


Fig. 82 Piston Ring Installation

- 1 - NO. 1 PISTON RING
- 2 - NO. 2 PISTON RING
- 3 - SIDE RAIL
- 4 - OIL RING
- 5 - SPACER EXPANDER

CAUTION: Install piston rings in the following order:

1. Oil ring expander.
2. Upper oil ring side rail.
3. Lower oil ring side rail.
4. No. 2 Intermediate piston ring.
5. No. 1 Upper piston ring.

(1) Install oil ring expander (Fig. 82).

(2) Install upper side rail first and then the lower side rail. Install the side rails by placing one end between the piston ring groove and the oil ring expander. Hold end firmly and press down the portion to be installed until side rail is in position. **Do not use a piston ring expander (Fig. 83).**

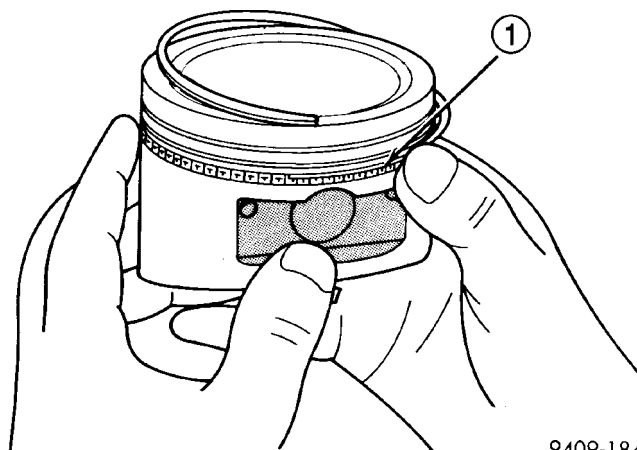


Fig. 83 Installing Side Rail

1 - SIDE RAIL END

(3) Install No. 2 piston ring and then No. 1 piston ring (Fig. 82).

(4) Position piston ring end gaps as shown in (Fig. 84).

(5) Position oil ring expander gap at least 45° from the side rail gaps but **not** on the piston pin center or on the thrust direction. Staggering ring gap is important for oil control.

STRUCTURAL COLLAR

REMOVAL

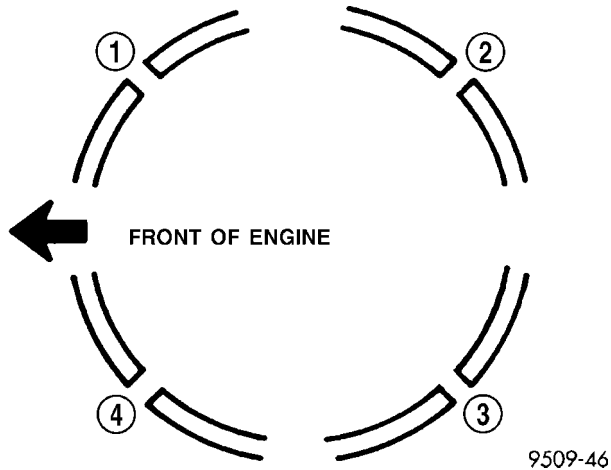
(1) Raise vehicle on hoist.

NOTE: To remove transaxle dust cover, the front bending strut must be removed.

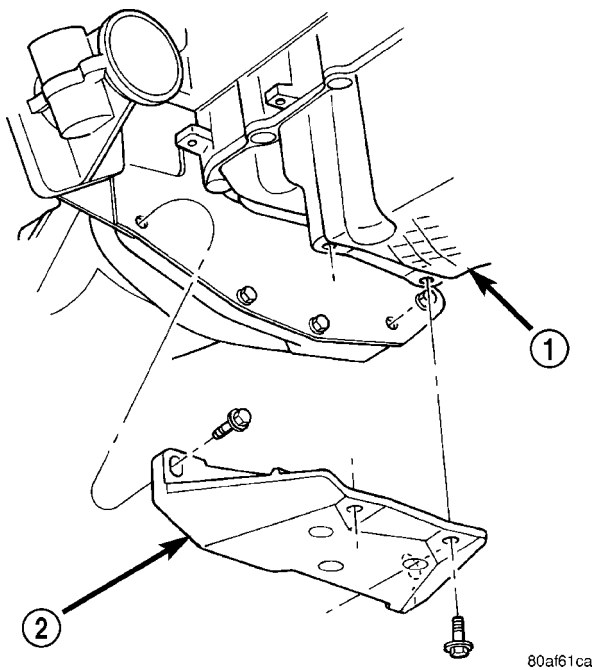
(2) Remove structural collar from oil pan to transaxle (Fig. 85).

INSTALLATION

CAUTION: The torque procedure for the structural collar must be followed, as damage to oil pan or collar could occur.

STRUCTURAL COLLAR (Continued)**Fig. 84 Piston Ring End Gap Position**

- 1 - GAP OF LOWER SIDE RAIL
- 2 - NO. 1 RING GAP
- 3 - GAP OF UPPER SIDE RAIL
- 4 - NO. 2 RING GAP AND SPACER EXPANDER GAP

**Fig. 85 Structural Collar - Removal/Installation**

- 1 - OIL PAN
- 2 - STRUCTURAL COLLAR

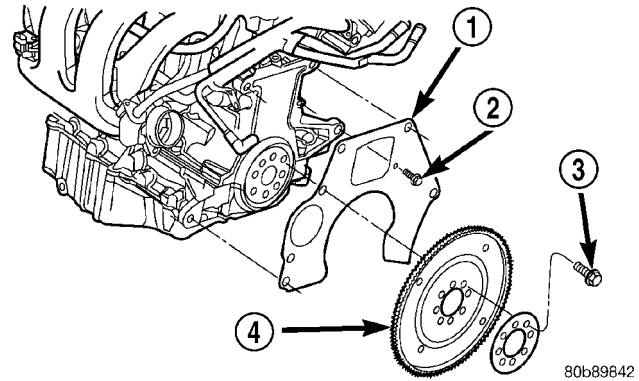
(1) Install the structural collar (Fig. 85) using the following 3 step torque sequence:

- Step 1: Install the collar to oil pan bolts and tighten to 3 N·m (30 in. lbs.).
- Step 2: Install collar to transaxle bolts and tighten to 108 N·m (80 ft. lbs.).
- Step 3: Final torque the collar to oil pan bolts to 54 N·m (40 ft. lbs.).

(2) Lower vehicle.

FLEX PLATE**REMOVAL**

- (1) Remove the transaxle. Refer to 21 - TRANS-AXLE for procedure.
- (2) Remove the flex plate attaching bolts (Fig. 86).
- (3) Remove the flex plate (Fig. 86).

**Fig. 86 Flex Plate**

- 1 - ADAPTOR PLATE
- 2 - BOLT
- 3 - BOLT (QTY. 8)
- 4 - FLEX PLATE

INSTALLATION

- (1) Position the drive plate on crankshaft (Fig. 86).
- (2) Apply Mopar® Lock & Seal Adhesive to flex plate bolt threads.
- (3) Install the flex plate bolts and tighten to 95 N·m (70 ft. lbs.) (Fig. 86).
- (4) Install the transaxle. Refer to 21 - TRANS-AXLE for procedure.

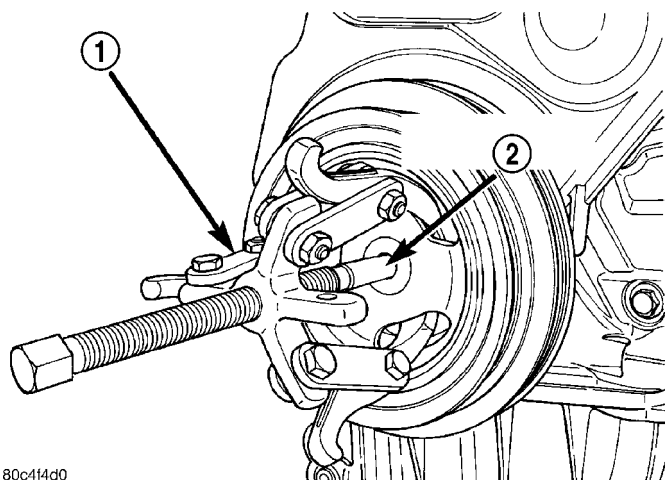
VIBRATION DAMPER**REMOVAL**

- (1) Raise vehicle on a hoist and remove accessory drive belt splash shield.
- (2) Remove accessory drive belts (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (3) Remove crankshaft vibration damper bolt. Remove damper using the large side of Special Tool 1026 and insert 6827-A (Fig. 87).

INSTALLATION

NOTE: Lubricate the threads of the M12 1.75 x 150 mm bolt using Mopar® Nickel Anti-seize Compound or equivalent, before beginning to press the damper on.

VIBRATION DAMPER (Continued)



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Fig. 87 Crankshaft Damper—Removal

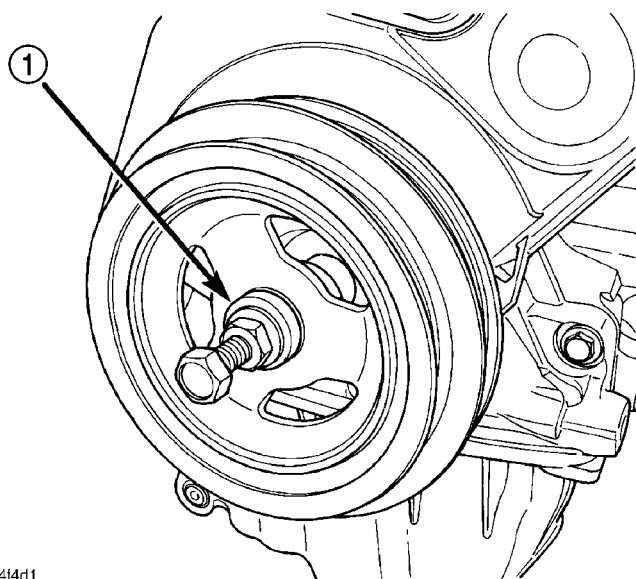
- 1 - SPECIAL TOOL 1026 3 - JAW PULLER
2 - SPECIAL TOOL 6827A INSERT

(1) Install crankshaft vibration damper using M12-1.75 x 150 mm bolt, washer, thrust bearing and nut from Special Tool 6792 (Fig. 88).

(2) Apply Mopar® Lock & Seal Adhesive (Medium Strength Threadlocker) to vibration damper bolt. Tighten vibration damper bolt to 136 N·m (100 ft. lbs.).

(3) Install accessory drive belts (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(4) Install the accessory drive belt splash shield and lower vehicle.



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Fig. 88 Crankshaft Damper—Installation

- 1 - SPECIAL TOOL 6792

ENGINE MOUNTING

DESCRIPTION

The engine mounting system (Fig. 89) and (Fig. 90) consist of a four-point system utilizing two load-carrying mounts and two torque struts. The load-carrying mounts are located on each frame rail. The right mount is a hydro-elastic mount and left mount is a conventional elastomeric isolator. The two torque controlling struts are attached at the front of the engine, straddling the right side load-carrying mount. The upper torque strut connects to the suspension strut tower and the lower torque strut connects to the suspension crossmember.

LEFT MOUNT

REMOVAL

(1) Raise vehicle approximately 30.5 cm (12 in.) on hoist

(2) Remove air cleaner assembly (Fig. 91).

(3) Remove battery and tray.

(4) Support transaxle with a suitable jack.

(5) Remove left front wheel.

(6) Remove left splash shield.

(7) Remove through bolt access plug at left side outer frame rail.

(8) Remove mount through bolt (Fig. 92).

(9) Disconnect transaxle shift cable from left mount and transaxle linkage.

(10) Remove left mount bracket to body frame rail fasteners (Fig. 93).

(11) Remove mount attaching bolts (Fig. 94) or (Fig. 95).

(12) Remove mount.

INSTALLATION

(1) Install mount and attaching bolts (Fig. 94) or (Fig. 95). Tighten bolts to 68 N·m (50 ft. lbs.).

(2) Install engine mount bracket to body frame rail and tighten fasteners to 28 N·m (250 in. lbs.) (Fig. 93).

(3) Position engine/transaxle for installation of through bolt. Install and tighten through bolt to 118 N·m (87 ft. lbs.) (Fig. 92).

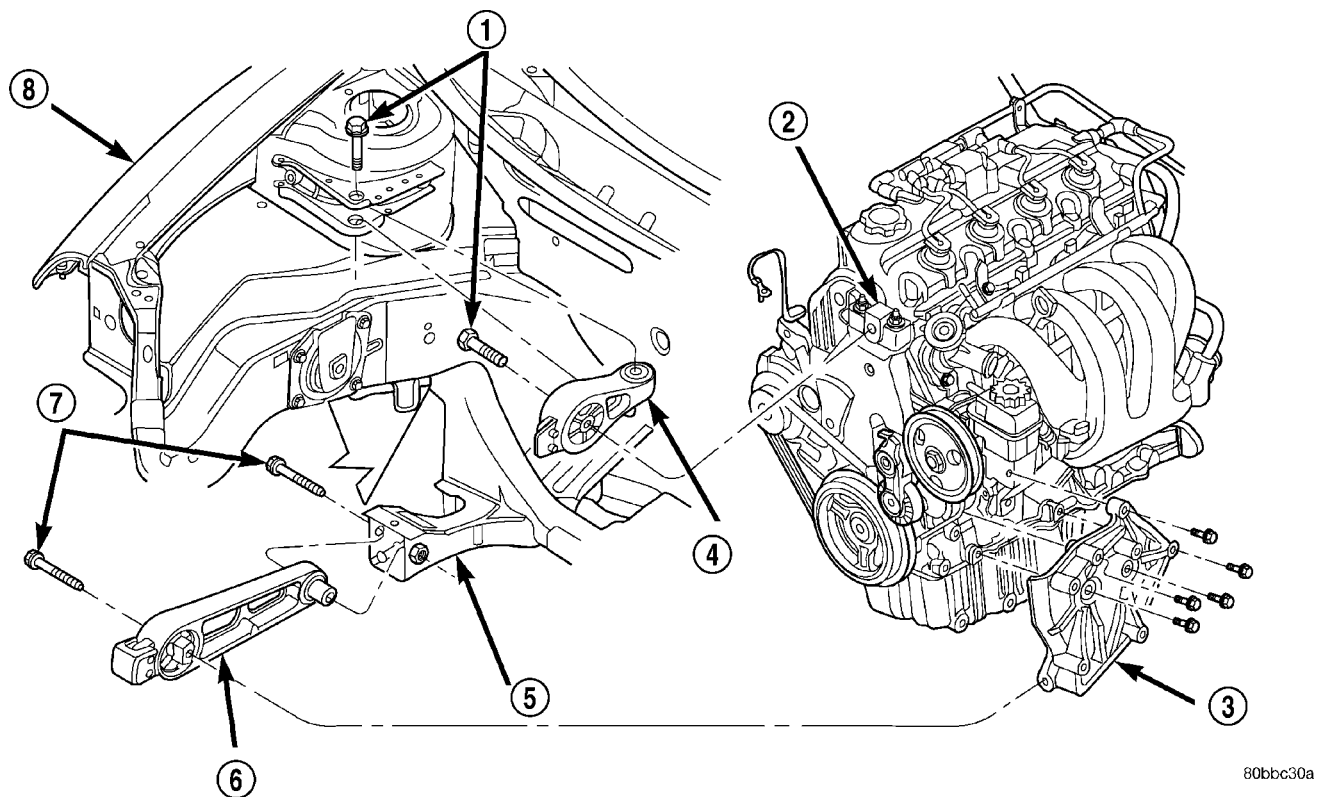
(4) Remove jack from under transaxle.

(5) Install through bolt access plug at left side outer frame rail.

(6) Install left splash shield and wheel.

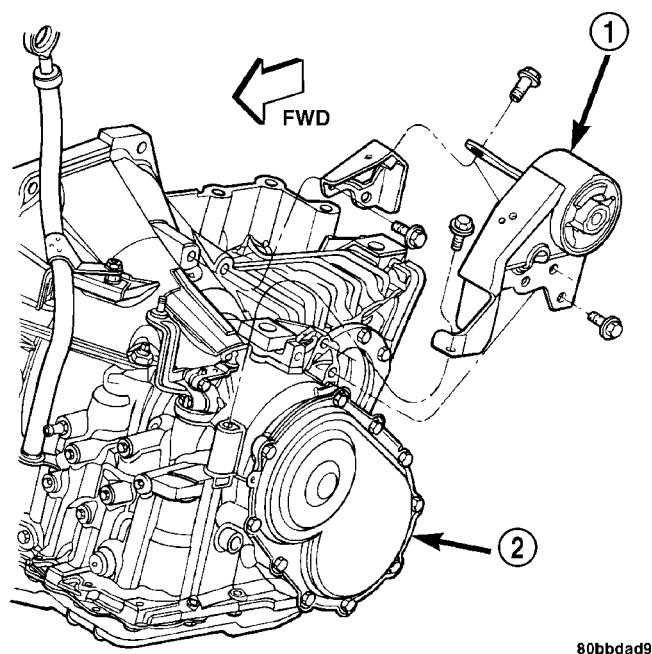
(7) Connect transaxle shift cable to engine mount and transaxle linkage.

LEFT MOUNT (Continued)

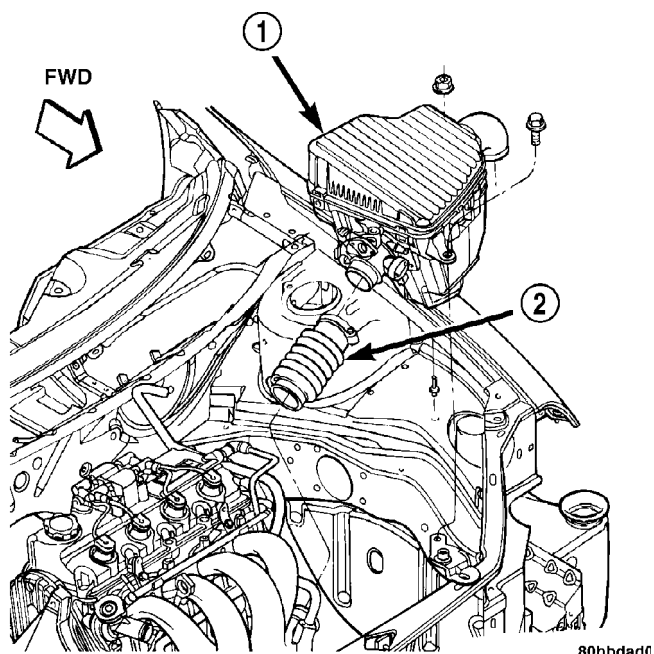
**Fig. 89 Engine Mounting - Right Side**

- 1 - BOLTS
- 2 - ENGINE MOUNT BRACKET
- 3 - TORQUE STRUT BRACKET
- 4 - UPPER TORQUE STRUT

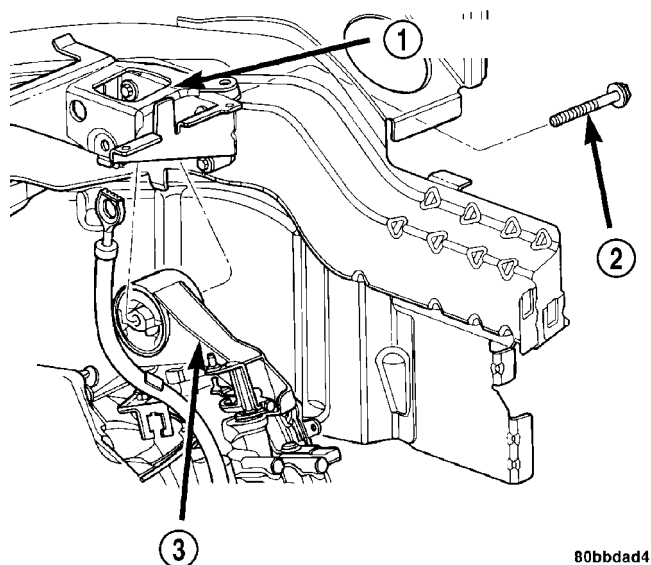
- 5 - CROSSMEMBER
- 6 - LOWER TORQUE STRUT
- 7 - BOLTS
- 8 - RIGHT FENDER

**Fig. 90 Engine Mounting - Left Side**

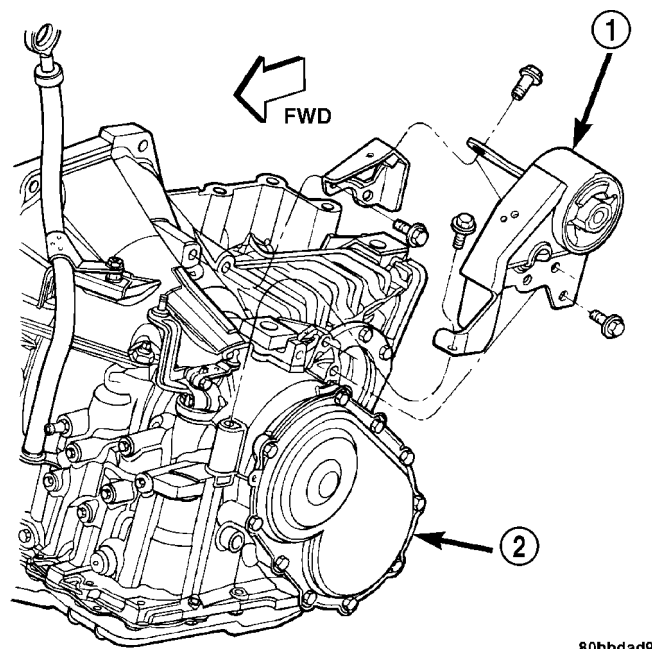
- 1 - MOUNT
- 2 - TRANSAXLE

**Fig. 91 Air Cleaner Assembly**

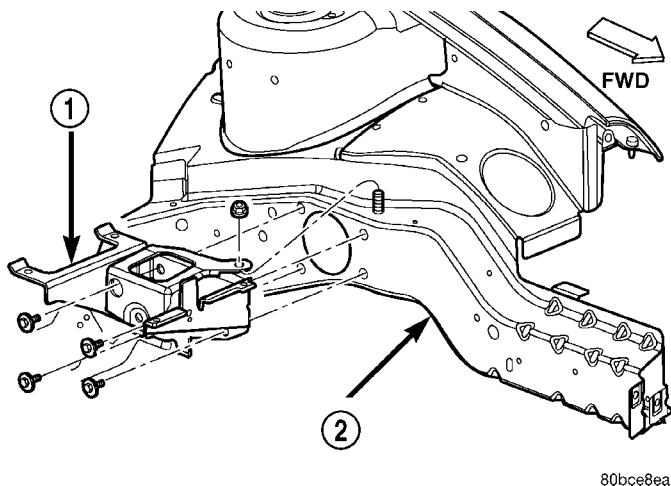
- 1 - AIR CLEANER ASSY.
- 2 - THROTTLE BODY DUCT

LEFT MOUNT (Continued)**Fig. 92 Left Mount Through Bolt**

- 1 - MOUNT BRACKET
2 - BOLT
3 - MOUNT

**Fig. 94 Left Mount (Automatic Transaxle)**

- 1 - MOUNT
2 - TRANSAXLE

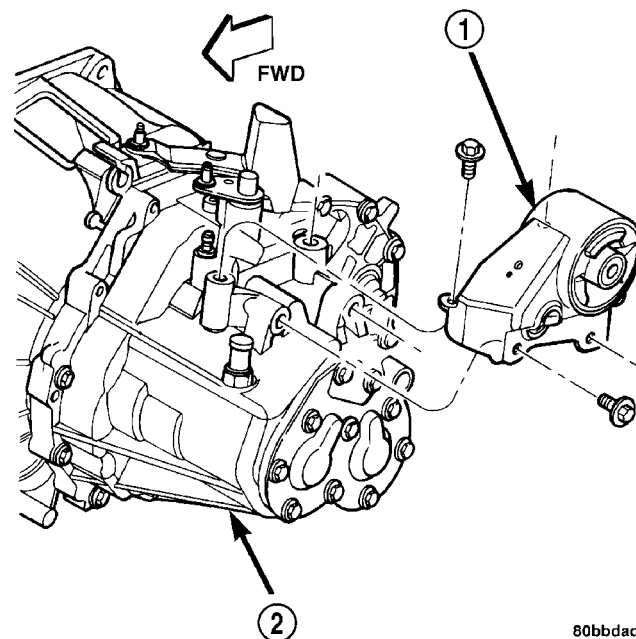
**Fig. 93 Left Mount Bracket**

- 1 - MOUNT BRACKET
2 - BODY FRAME RAIL

- (8) Install battery tray and battery.
(9) Install air cleaner assembly (Fig. 91).
(10) Lower vehicle.

ENGINE MOUNT BRACKET**REMOVAL**

- (1) Disconnect negative battery cable.
(2) Remove fastener securing ground strap to engine mount bracket.
(3) Remove upper torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - REMOVAL).

**Fig. 95 Left Mount (Manual Transaxle)**

- 1 - MOUNT
2 - TRANSAXLE

- (4) Remove power steering/air conditioning compressor drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
(5) Raise vehicle on hoist.
(6) Remove accessory drive belt splash shield (Fig. 96).

ENGINE MOUNT BRACKET (Continued)

(7) Remove lower torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - REMOVAL).

(8) Lower vehicle.

(9) Position a jack under engine. Raise jack enough to support engine weight.

(10) Remove engine mount through bolt access plug (Fig. 96)

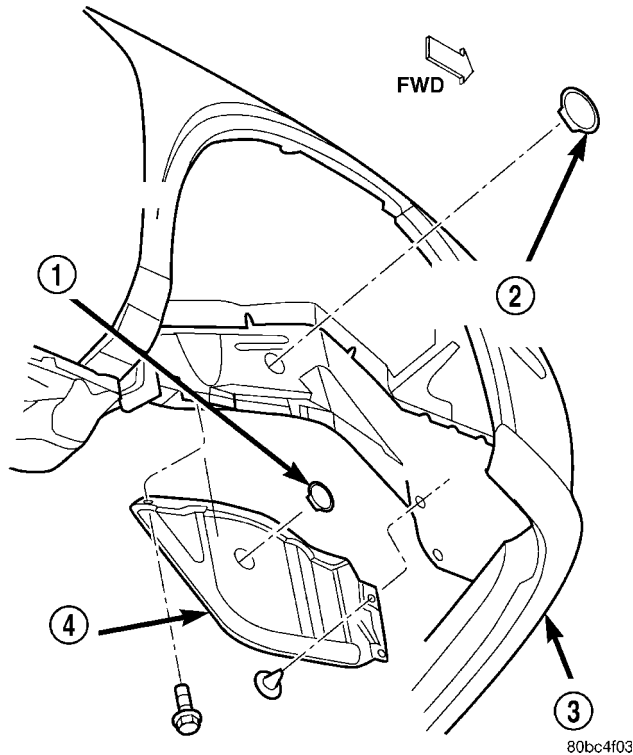


Fig. 96 Engine Mount Bolt Access Plug

- 1 - CRANKSHAFT BOLT ACCESS PLUG
- 2 - RIGHT MOUNT BOLT ACCESS PLUG
- 3 - FASCIA
- 4 - SPLASH SHIELD

(11) Remove right engine mount to engine mount bracket through bolt (Fig. 97).

(12) Lower engine enough with jack to remove lower engine mount bracket bolt (Fig. 98).

(13) Raise engine with jack to allow engine-to-body clearance for engine mount bracket removal.

(14) Remove fasteners securing power steering pump to engine mount bracket. **Do Not** disconnect lines from pump.

(15) Remove the two remaining bolts securing engine mount bracket to engine. Remove engine mount bracket (Fig. 98).

INSTALLATION

(1) Position engine mount bracket to its mounting location. Hand start the upper two bolts of the engine mount bracket (Fig. 98).

(2) Lower engine with jack.

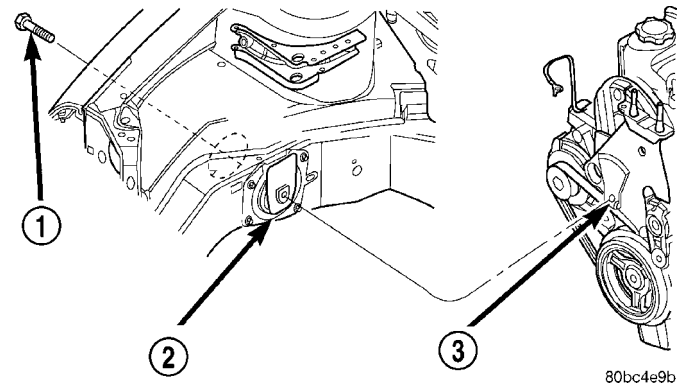


Fig. 97 Engine Mount to Bracket

- 1 - THROUGH BOLT
- 2 - RIGHT ENGINE MOUNT
- 3 - ENGINE MOUNT BRACKET

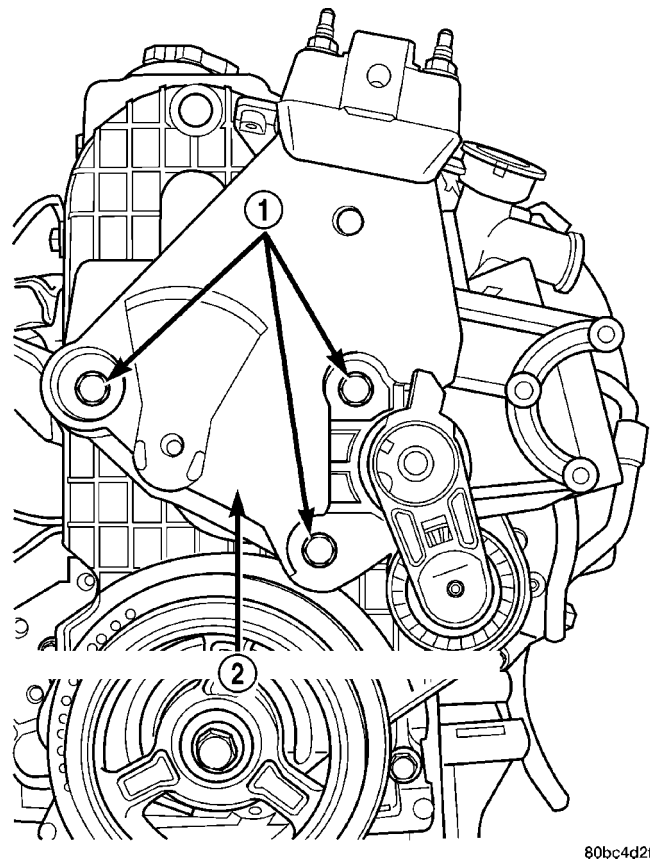


Fig. 98 Engine Mount Bracket Assembly

- 1 - BOLTS
- 2 - ENGINE MOUNT BRACKET ASSEMBLY

(3) Install lower engine mount bracket bolt. Tighten bolt to 61 N·m (45 ft. lbs.) (Fig. 98).

(4) Raise engine with jack.

(5) Tighten upper engine mount bracket bolts to 61 N·m (45 ft. lbs.) (Fig. 98).

(6) Install power steering pump fasteners.

(7) Lower engine with jack.

ENGINE MOUNT BRACKET (Continued)

(8) Install right engine mount to engine mount bracket through bolt. Tighten bolt to 118 N·m (87 ft. lbs.) (Fig. 97).

(9) Install mount bolt access plug (Fig. 96).

(10) Remove jack from under engine.

(11) Raise vehicle on hoist.

(12) Install lower torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - INSTALLATION).

(13) Install power steering/air conditioning compressor drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(14) Install accessory drive belt splash shield (Fig. 96).

(15) Lower vehicle.

(16) Install upper torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - INSTALLATION).

(17) Install fastener securing ground strap to engine mount bracket.

(18) Connect negative battery cable.

(19) Perform torque strut adjustment procedure (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - ADJUSTMENTS).

RIGHT MOUNT**REMOVAL**

(1) Remove engine mount bracket (Refer to 9 - ENGINE/ENGINE MOUNTING/ENGINE MOUNT BRACKET - REMOVAL).

NOTE: The right engine mount attaching holes are slightly oversize to compensate for manufacturing tolerances. The mount has been set at the manufacturing plant for proper powertrain alignment. Therefore, it is necessary to mark the position of the mount before the attaching bolts are loosened.

(2) Using a permanent ink marker or equivalent, mark the position of engine mount to the body frame rail.

(3) Remove bolts attaching mount to body (Fig. 99).

(4) Lower engine with jack.

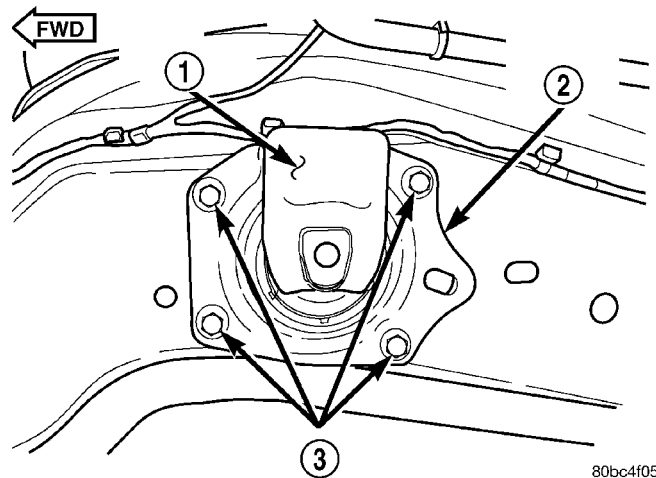
(5) Position right engine mount into timing belt cover hole (Fig. 100).

(6) Raise engine with jack.

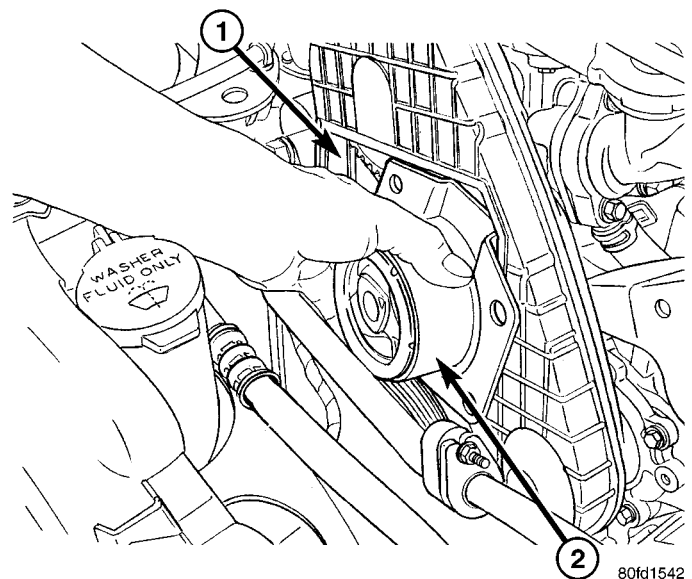
(7) Remove mount between engine and body frame rail. Mount removal may require engine position to be raised or lowered to allow mount removal clearance.

INSTALLATION

(1) Position right engine mount into timing belt cover hole (Fig. 100).

**Fig. 99 Engine Mount—Right**

- 1 - SNUBBER PAD
- 2 - RIGHT ENGINE MOUNT
- 3 - BOLTS

**Fig. 100 Right Engine Mount - Removal/Installation**

- 1 - TIMING BELT COVER HOLE
- 2 - RIGHT ENGINE MOUNT

(2) Lower engine with jack.

(3) Position the mount into the original position on body frame rail (Fig. 99).

NOTE: Engine mount must be installed in the original position on body frame rail. If mount was not marked or frame rail was replaced, perform the following procedure.

(4) Perform the following procedure if mount position was not previously marked or the frame rail was replaced:

- (a) Insert the new mount loosely in frame rail.

RIGHT MOUNT (Continued)

(b) Align the four holes in the mount with the mating holes in the rail such that the holes are concentric (frame rail holes centered in the mount holes).

(c) Using a permanent ink marker or equivalent, mark the position of engine mount to the body frame rail while maintaining mounting hole concentricity.

(5) Ensure the mount maintains originally marked position and install mount bolts. Tighten bolts to 28 N·m (250 in. lbs.) (Fig. 99).

(6) Raise engine with jack.

(7) Install the engine mount bracket (Refer to 9 - ENGINE/ENGINE MOUNTING/ENGINE MOUNT BRACKET - INSTALLATION).

(8) Perform torque strut adjustment procedure (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - ADJUSTMENTS).

TORQUE STRUT

REMOVAL

UPPER TORQUE STRUT

(1) Remove bolts attaching strut to shock tower bracket and engine mount bracket (Fig. 102).

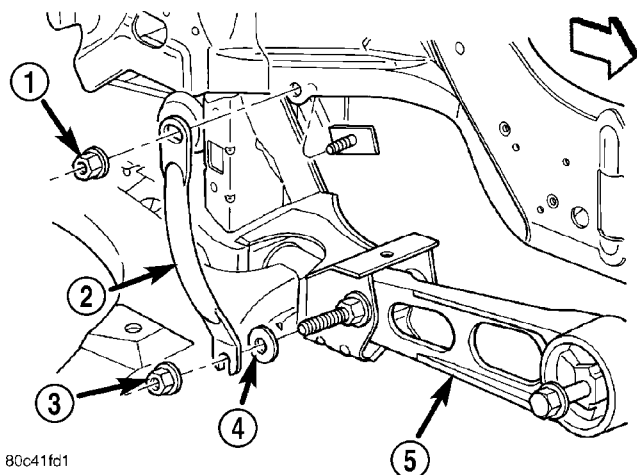
(2) Remove the upper torque strut.

LOWER TORQUE STRUT

(1) Raise vehicle on hoist.

(2) Remove accessory drive belt splash shield.

(3) Remove pencil strut (Fig. 101).



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Fig. 101 Pencil Strut

- 1 - NUT
- 2 - PENCIL STRUT
- 3 - NUT
- 4 - FLAT WASHER
- 5 - LOWER TORQUE STRUT

(4) Remove bolts attaching lower strut to cross-member and strut bracket (Fig. 102).

(5) Remove lower torque strut.

INSTALLATION

UPPER TORQUE STRUT

(1) Position the upper torque strut into mounting locations (Fig. 102).

(2) Install the mounting bolts and perform the torque strut adjustment procedure (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - ADJUSTMENTS).

LOWER TORQUE STRUT

(1) Position lower torque strut into mounting locations (Fig. 102).

(2) Install mounting bolts and perform torque strut adjustment procedure (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - ADJUSTMENTS).

(3) Install pencil strut (Fig. 101).

(4) Install accessory drive belt splash shield and lower vehicle.

ADJUSTMENTS

ENGINE TORQUE STRUT ADJUSTMENT

The upper and lower torque struts need to be adjusted together to assure proper engine positioning and engine mount loading. Whenever a torque strut bolt(s) is loosened, this procedure must be performed.

(1) Loosen the upper and lower torque strut attaching bolt at the suspension crossmember and shock tower bracket.

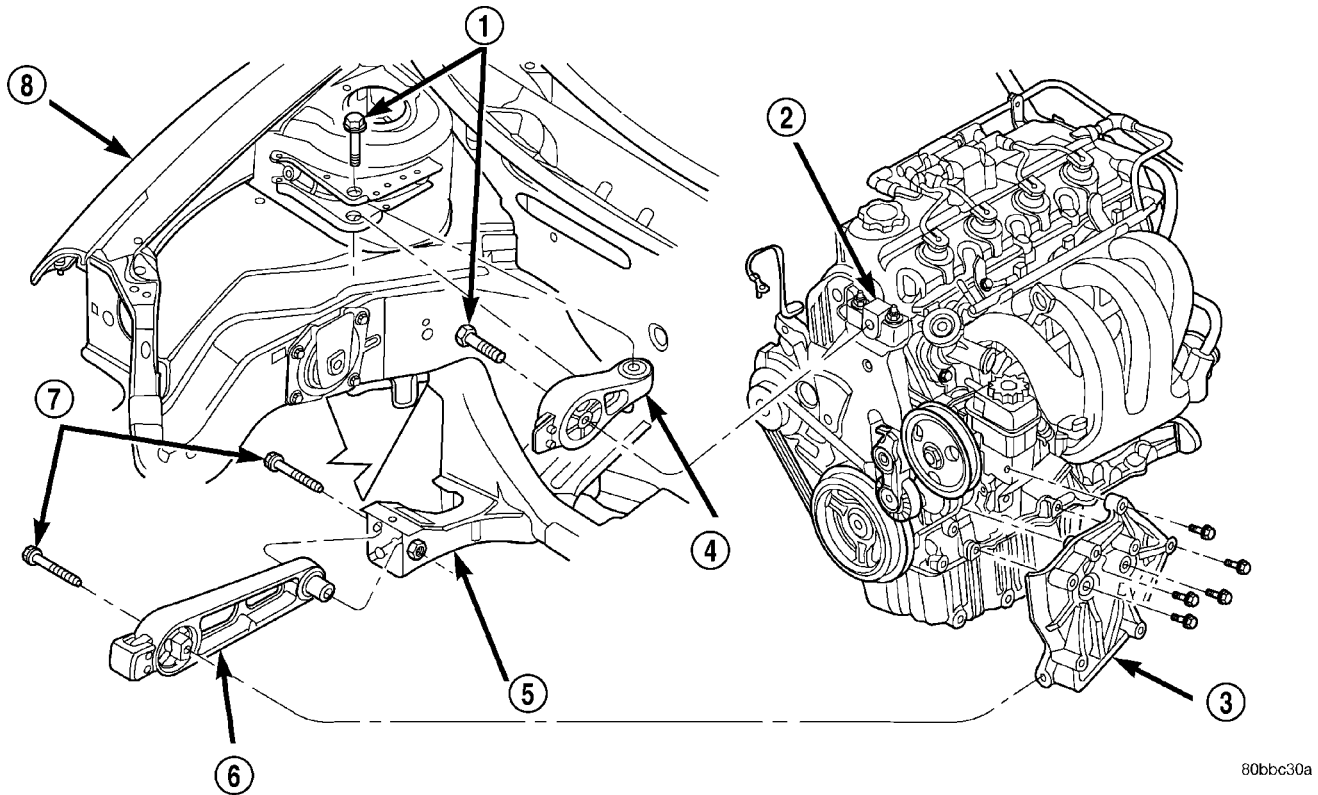
(2) The engine position may now be adjusted by positioning a suitable floor jack on the forward edge of the transmission bell housing (Fig. 103).

NOTE: The floor jack must be positioned as shown in (Fig. 103) to prevent minimal upward lifting of the engine.

(3) With the engine supported, remove the upper and lower torque strut attachment bolt(s) at shock tower bracket and suspension crossmember (Fig. 102). Verify that the torque struts are free to move within the shock tower bracket and crossmember. Reinstall the torque strut bolt(s), but do not tighten.

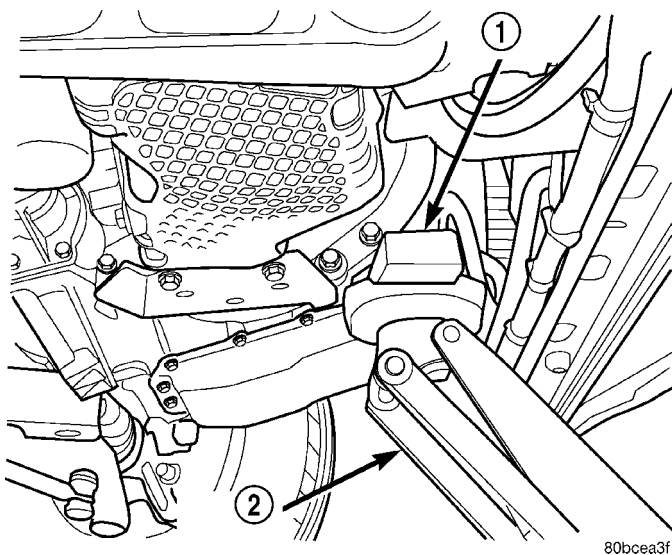
(4) Carefully apply upward force, allowing the upper engine to rotate rearward until the distance between the center of the rearmost attaching stud on the engine mount bracket (point "A") and the center of the hole for the washer hose clip on the shock tower bracket (point "B") is 119 mm (4.70 in.) (Fig. 104).

TORQUE STRUT (Continued)

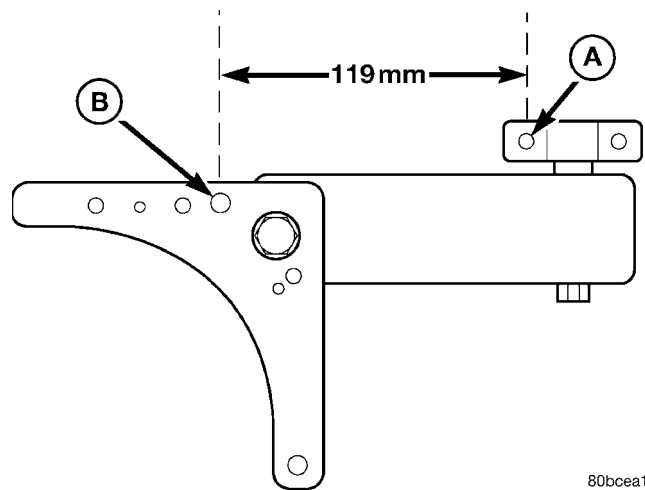
**Fig. 102 Torque Struts - Upper / Lower**

- 1 - BOLTS
- 2 - ENGINE MOUNT BRACKET
- 3 - TORQUE STRUT BRACKET
- 4 - UPPER TORQUE STRUT

- 5 - CROSSMEMBER
- 6 - LOWER TORQUE STRUT
- 7 - BOLTS
- 8 - RIGHT FENDER

**Fig. 103 Floor Jack Positioning**

- 1 - WOOD BLOCK
- 2 - FLOOR JACK

**Fig. 104 Engine Position Measurement**

(6) Remove the floor jack.

(5) With the engine held at the proper position, tighten both the upper and lower torque strut bolts to 118 N·m (87 ft. lbs.) (Fig. 102).

LUBRICATION

DESCRIPTION

The lubrication system is a full-flow filtration, pressure feed type. The oil pump (Fig. 105) is mounted in the front engine cover and driven by the crankshaft.

OPERATION

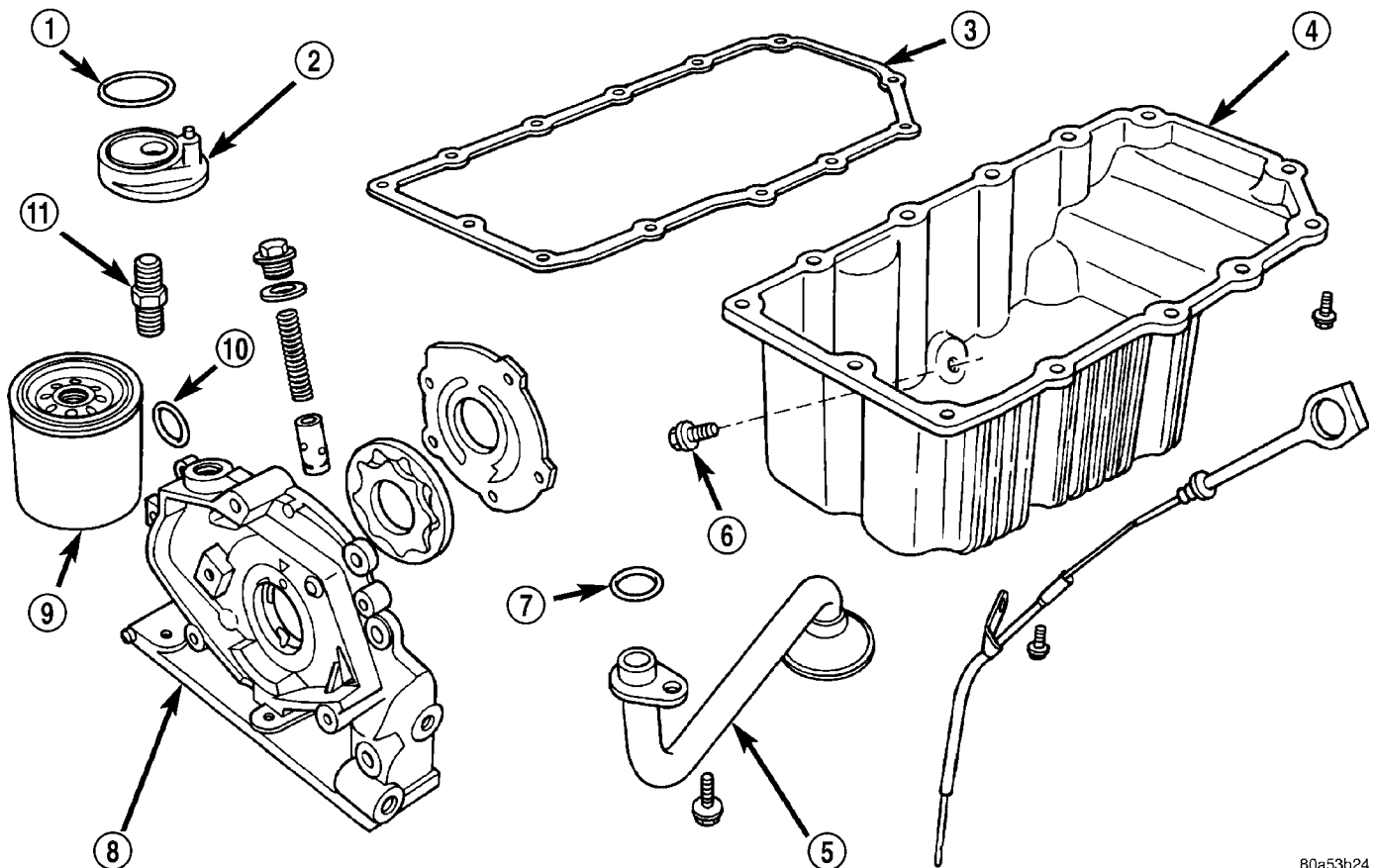
Refer to (Fig. 106) for lubrication system flow. Engine oil is drawn up through the pickup tube and is pressurized by the oil pump and routed through the full-flow filter to the main oil gallery running the length of the cylinder block. A diagonal hole in each bulkhead feeds oil to each main bearing. Drilled passages within the crankshaft route oil from the main bearing journals to the connecting rod journals. A vertical hole at the number five bulkhead routes pressurized oil through a restrictor up into the cylinder head. The restrictor that is integral to the cylinder head gasket, provides increased oil flow to the main gallery. The rocker shafts route oil to the rocker arms/hydraulic lash adjusters. Oil returning to the oil pan from the pressurized components supplies lubrication to the valve stems. The cylinder bores and wrist pins are splash lubricated from directed slots on the connecting rod thrust collar.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE OIL LEAK INSPECTION

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

(1) Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.



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Fig. 105 Engine Lubrication Components

- 1 - O-RING
- 2 - OIL FILTER ADAPTER
- 3 - OIL PAN GASKET
- 4 - OIL PAN
- 5 - OIL PICK-UP TUBE
- 6 - DRAIN PLUG

- 7 - O-RING
- 8 - OIL PUMP BODY
- 9 - FILTER
- 10 - O-RING
- 11 - NIPPLE

LUBRICATION (Continued)

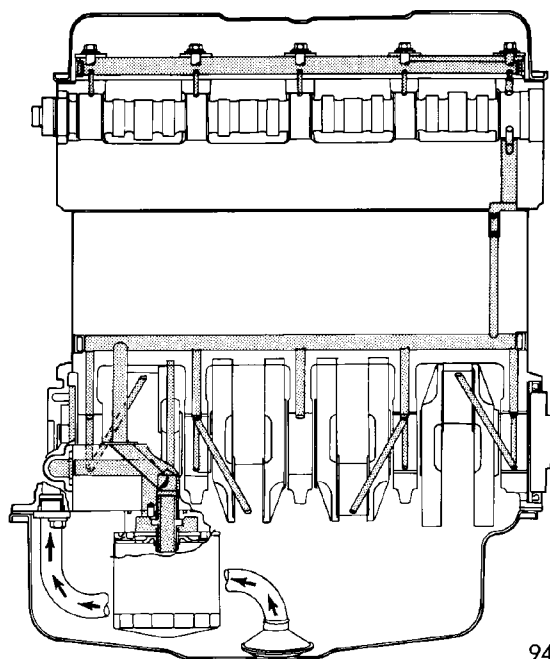


Fig. 106 Engine Lubrication System

(2) Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.

(3) Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair as necessary.

(4) If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.

(5) **If the oil leak source is not positively identified at this time**, proceed with the air leak detection test method as follows:

- Disconnect the fresh air hose (make-up air) at the cylinder head cover and plug or cap the nipple on the cover.

- Remove the PCV valve hose from the cylinder head cover. Cap or plug the PCV valve nipple on the cover.

- Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kPa (3 PSI) of test pressure.

- Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provides the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.

- If the leakage occurs at the crankshaft rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.

(6) If no leaks are detected, turn off the air supply. Remove the air hose, all plugs, and caps. Install the PCV valve and fresh air hose (make-up air). Proceed to next step.

(7) Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

NOTE: If oil leakage is observed at the dipstick tube to block location; remove the tube, clean and reseal using Mopar® Stud & Bearing Mount (press fit tube applications only), and for O-ring style tubes, remove tube and replace the O-ring seal.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

(1) Disconnect the battery.

(2) Raise the vehicle.

(3) Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak. If a leak is present in this area, remove transmission for further inspection.

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, oil gallery cup plug, bedplate to cylinder block mating surfaces and seal bore. See proper repair procedures for these items.

(4) If no leaks are detected, pressurize the crankcase as previously described.

CAUTION: Do not exceed 20.6 kPa (3 psi).

(5) If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

LUBRICATION (Continued)

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

(7) After the oil leak root cause and appropriate corrective action have been identified, replace component(s) as necessary.

DIAGNOSIS AND TESTING - CHECKING ENGINE OIL PRESSURE

Check oil pressure using a gauge at oil pressure switch location.

(1) Remove the oil pressure switch (Refer to 9 - ENGINE/LUBRICATION/OIL PRESSURE SENSOR/SWITCH - REMOVAL).

(2) Install oil pressure test gauge, Special Tool C-3292 with Adapter 8406. For Special Tool identification, (Refer to 9 - ENGINE - SPECIAL TOOLS).

CAUTION: If oil pressure is 0 at idle, Do Not Run engine at 3000 RPM.

(3) Warm engine to normal operating temperature.

(4) Monitor gauge readings at idle and 3000 rpm. For specifications (Refer to 9 - ENGINE - SPECIFICATIONS).

OIL

STANDARD PROCEDURE

STANDARD PROCEDURE - ENGINE OIL LEVEL CHECK

The best time to check engine oil level is after it has sat overnight, or if the engine has been running, allow the engine to be shut off for at least 5 minutes before checking oil level.

Checking the oil while the vehicle is on level ground will improve the accuracy of the oil level reading. Remove dipstick (Fig. 107) and observe oil level. Add oil only when the level is at or below the ADD mark (Fig. 108).

STANDARD PROCEDURE - ENGINE OIL AND FILTER CHANGE

Change engine oil at mileage and time intervals described in the Maintenance Schedule. (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION)

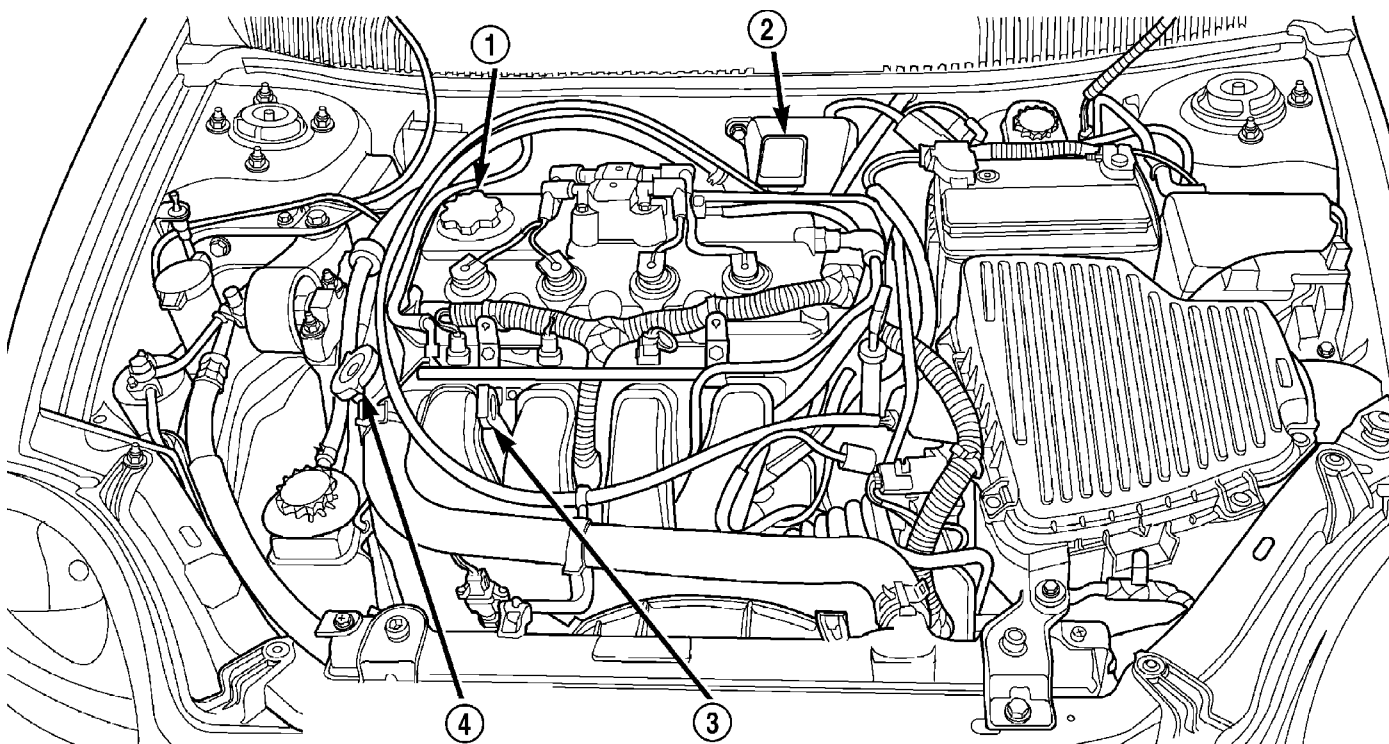


Fig. 107 Dipstick and Engine Oil Fill Locations

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1 - ENGINE OIL FILL

2 - ENGINE COOLANT RECOVERY CONTAINER

3 - ENGINE OIL DIPSTICK

4 - COOLING SYSTEM PRESSURE CAP

OIL (Continued)

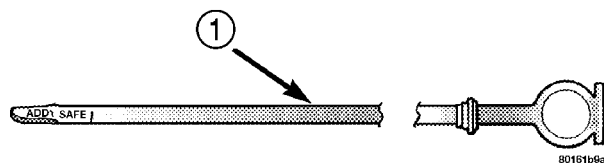


Fig. 108 Oil Level

1 - ENGINE OIL LEVEL DIPSTICK

WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY. CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.

Run engine until achieving normal operating temperature.

(1) Position the vehicle on a level surface and turn engine off.

(2) Remove oil fill cap (Fig. 107).

(3) Raise vehicle on hoist.

(4) Place a suitable oil collecting container under oil pan drain plug (Fig. 109).

(5) Remove oil pan drain plug and allow oil to drain into collecting container. Inspect drain plug threads for stretching or other damage. Replace drain plug and gasket if damaged.

(6) Remove oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL).

(7) Install and tighten oil pan drain plug to 27 N·m (20 ft. lbs.).

(8) Install new oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - INSTALLATION).

(9) Lower vehicle and fill crankcase with specified type and amount of engine oil (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION).

(10) Install oil fill cap.

(11) Start engine and inspect for leaks.

(12) Stop engine and inspect oil level.

NOTE: Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING listed above.

OIL FILTER

REMOVAL

CAUTION: When servicing the oil filter (Fig. 109), avoid deforming the filter. Use an appropriate oil filter removing tool. Position filter wrench strap close the seam at the base of the filter. The oil filter seam that joins the can to the base, is reinforced by the base plate.

(1) Turn filter counterclockwise to remove (Fig. 109).

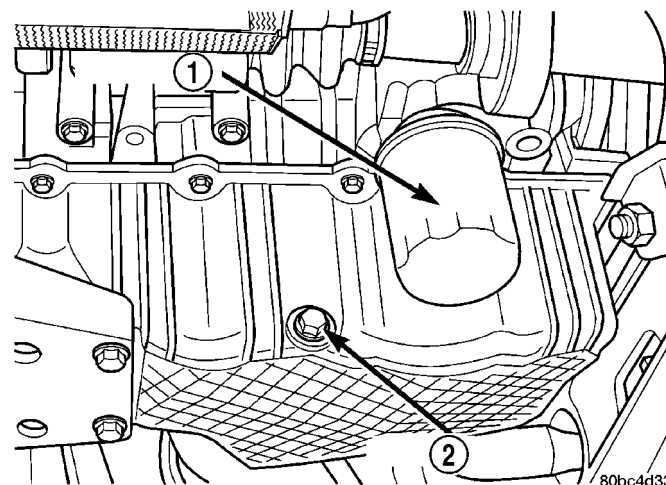


Fig. 109 Engine Oil Filter

1 - OIL FILTER
2 - DRAIN PLUG

INSTALLATION

(1) Clean and check the filter mounting surface. The surface must be smooth, flat and free of debris or old pieces of rubber.

(2) Lubricate new filter gasket.

(3) Screw filter on until gasket contacts base (Fig. 109). Tighten to 11 N·m (8 ft. lbs.).

OIL PAN

REMOVAL

(1) Disconnect negative cable from battery.

(2) Raise vehicle on hoist.

(3) Drain engine oil and remove oil filter.

(4) Remove oil filter adaptor from engine block (Fig. 110) (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER ADAPTER - REMOVAL).

(5) Remove structural collar (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COVER - REMOVAL).

(6) Remove intake manifold support bracket attaching bolts (Fig. 111).

OIL PAN (Continued)

- (7) Remove intake manifold support bracket (Fig. 111).
- (8) Remove transaxle dust cover (Fig. 111).
- (9) Remove oil pan bolts.
- (10) Remove oil pan.

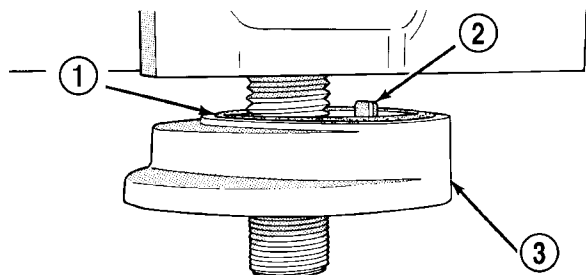


Fig. 110 Oil Filter Adaptor

- 1 - O-RING
2 - LOCATING ROLL PIN
3 - OIL FILTER ADAPTER

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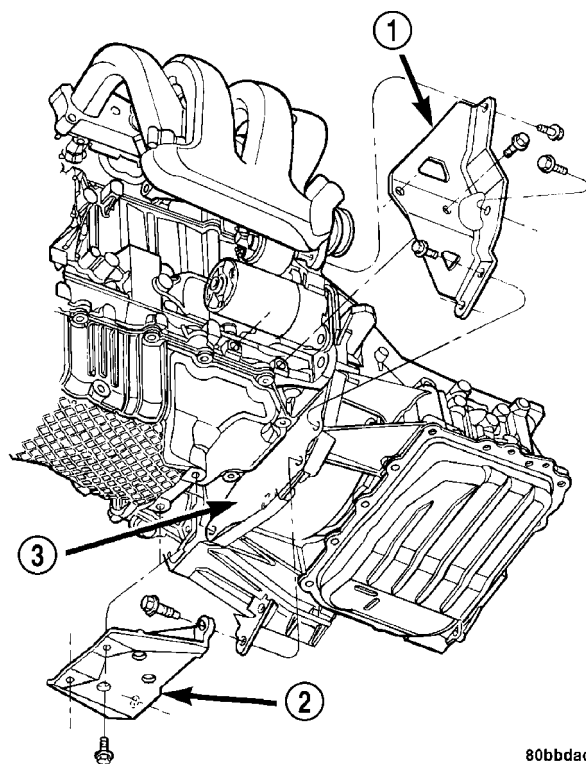


Fig. 111 Manifold Support Bracket, Structural Collar, and Dust Cover

- 1 - SUPPORT BRACKET
2 - STRUCTURAL COLLAR
3 - DUST COVER

INSTALLATION

- (1) Clean oil pan and all sealing surfaces.
- (2) Apply Mopar® Silicone Rubber Adhesive Sealant at the oil pump to engine block parting line (Fig. 112).

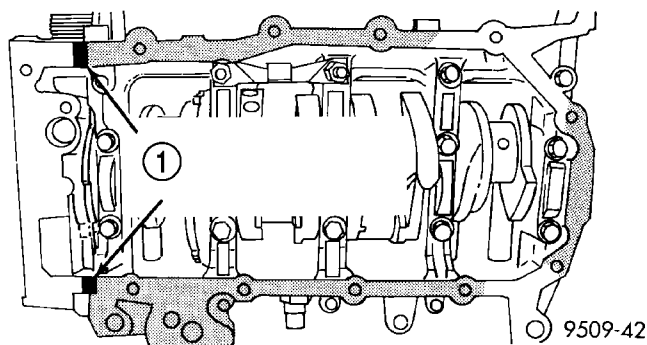


Fig. 112 Oil Pan Sealing

- 1 - PLACE A 1/8 INCH BEAD OF SEALER AT THE PARTING LINE OF THE OIL PUMP TO ENGINE BLOCK

- (3) Position a new oil pan gasket onto pan.
- (4) Install oil pan and tighten screws to 12 N·m (105 in. lbs.).
- (5) Install transaxle dust cover (Fig. 111).
- (6) Install intake manifold support bracket (Fig. 111).
- (7) Install structural collar (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COVER - INSTALLATION).
- (8) Install oil filter adaptor (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER ADAPTER - INSTALLATION).
- (9) Install oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - INSTALLATION).
- (10) Lower vehicle and fill engine crankcase with proper oil to correct level.

OIL PRESSURE SENSOR/ SWITCH

DESCRIPTION

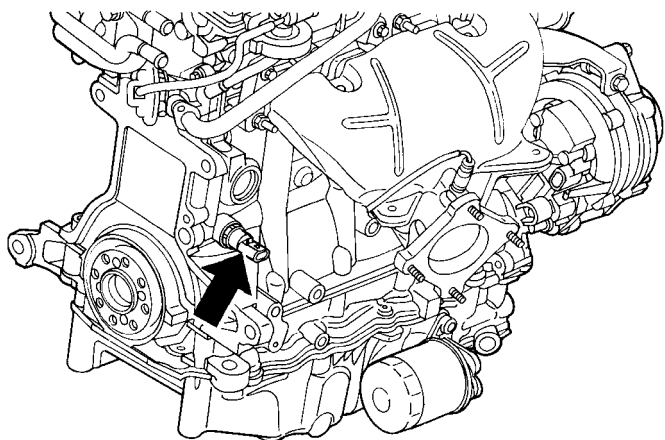
The oil pressure switch is located on the right rear side of the engine block (Fig. 113). The oil pressure switch is a pressure sensitive switch that is activated by the engine's oil pressure (in the main oil gallery). The switch is a two terminal device (one terminal is provided to the wiring harness and the other terminal is the switch's metal housing that screws into the engine block).

OPERATION

The oil pressure switch is normally "Closed." The switch changes from a "Closed" circuit to an "Open" circuit, on increasing pressure of 7 psig. The oil pressure switch changes from an "Open" circuit to a "Closed" circuit, on decreasing pressure, between 2 psig and 4 psig.

REMOVAL

- (1) Raise vehicle.

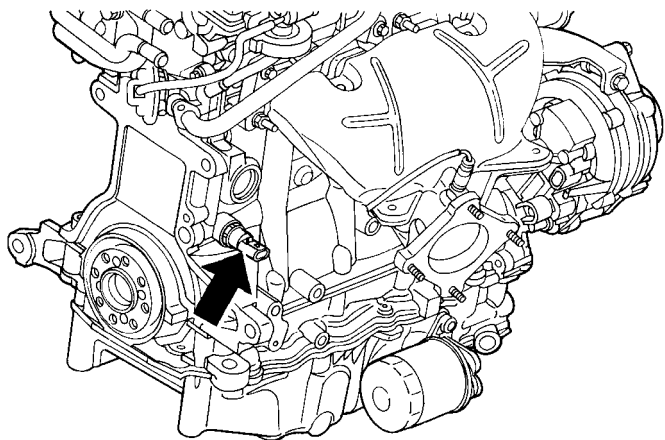
OIL PRESSURE SENSOR/SWITCH (Continued)

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Fig. 113 Oil Pressure Switch

(2) Position oil collecting container under pressure switch location.

(3) Disconnect oil pressure switch electrical connector and remove switch (Fig. 114).



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Fig. 114 Engine Oil Pressure Switch**INSTALLATION**

(1) Install oil pressure switch and connect electrical connector (Fig. 114).

(2) Lower vehicle.

(3) Start engine and allow to run a minimum of 2 minutes.

(4) Shut engine off and check engine oil level. Adjust level as necessary.

OIL PUMP**REMOVAL**

(1) Disconnect negative cable from battery.

(2) Remove front timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - REMOVAL).

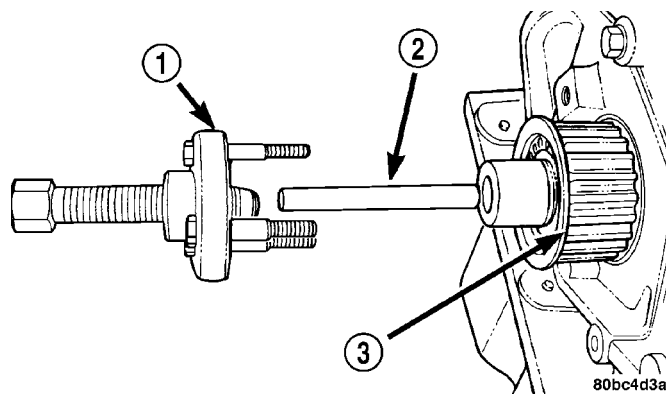
(3) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - REMOVAL).

(4) Remove timing belt tensioner assembly (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT TENSIONER ASSEMBLY - REMOVAL).

(5) Remove the camshaft sprocket and the rear timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - REMOVAL).

(6) Remove the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(7) Remove crankshaft sprocket using Special Tool 6793 and insert C-4685-C2 (Fig. 115).



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Fig. 115 Crankshaft Sprocket—Removal

1 - SPECIAL TOOL 6793

2 - SPECIAL TOOL C-4685-C2

3 - CRANKSHAFT SPROCKET

(8) Remove the oil pick-up tube.

(9) Remove fasteners securing oil pump to engine block. Remove oil pump (Fig. 116) and front crankshaft seal.

DISASSEMBLY

(1) To remove the relief valve, proceed as follows:

(2) Remove the threaded plug and gasket from the oil pump (Fig. 117).

CAUTION: Oil pump pressure relief valve must be installed as shown in (Fig. 117) or serious damage may occur.

(3) Remove spring and relief valve (Fig. 117).

(4) Remove oil pump cover screws, and lift off cover.

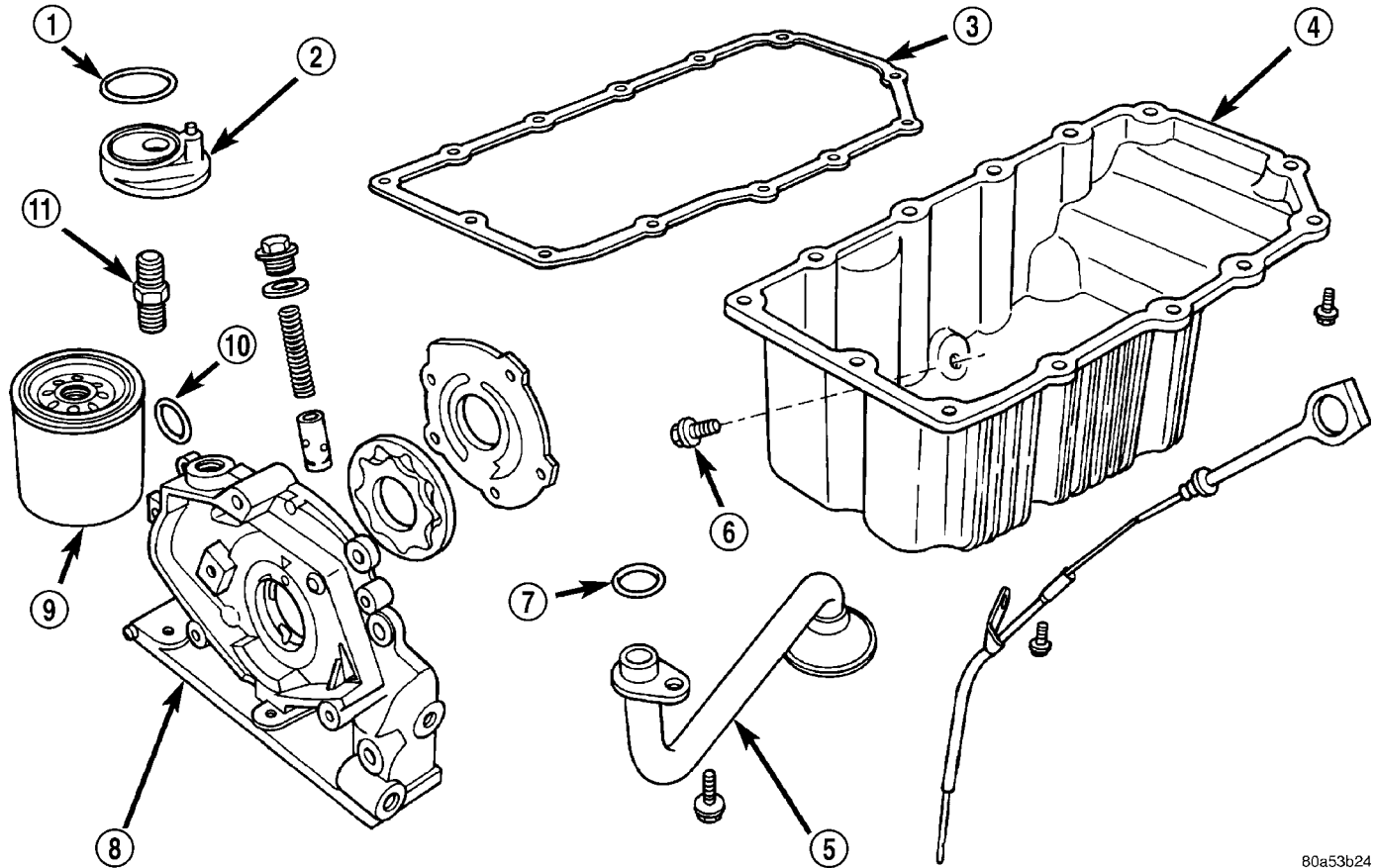
(5) Remove pump rotors.

(6) Wash all parts in a suitable solvent and inspect carefully for damage or wear (Fig. 118).

INSPECTION

(1) Clean all parts thoroughly. Mating surface of the oil pump should be smooth. Replace pump cover if scratched or grooved.

OIL PUMP (Continued)



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Fig. 116 Oil Pump and Tube

- 1 - O-RING
- 2 - OIL FILTER ADAPTER
- 3 - OIL PAN GASKET
- 4 - OIL PAN
- 5 - OIL PICK-UP TUBE
- 6 - DRAIN PLUG

- 7 - O-RING
- 8 - OIL PUMP BODY
- 9 - FILTER
- 10 - O-RING
- 11 - NIPPLE

(2) Lay a straightedge across the pump cover surface (Fig. 119). If a 0.076 mm (0.003 in.) feeler gauge can be inserted between cover and straight edge, cover should be replaced.

(3) Measure thickness and diameter of outer rotor. If outer rotor thickness measures 7.64 mm (0.301 in.) or less (Fig. 120), or if the diameter is 79.95 mm (3.148 in.) or less, replace outer rotor.

(4) If inner rotor measures 7.64 mm (0.301 in.) or less replace inner rotor (Fig. 121).

(5) Slide outer rotor into pump housing, press to one side with fingers and measure clearance between rotor and housing (Fig. 122). If measurement is 0.39 mm (0.015 in.) or more, replace housing only if outer rotor is in specification.

(6) Install inner rotor into pump housing. If clearance between inner and outer rotors (Fig. 123) is 0.203 mm (0.008 in.) or more, replace both rotors.

(7) Place a straightedge across the face of the pump housing, between bolt holes. If a feeler gauge

of 0.102 mm (0.004 inch) or more can be inserted between rotors and the straightedge, replace pump assembly (Fig. 124). **ONLY** if rotors are in specs.

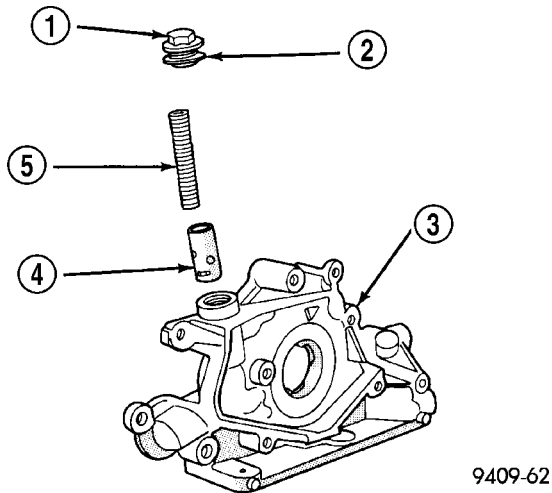
(8) Inspect oil pressure relief valve plunger for scoring and free operation in its bore. Small marks may be removed with 400-grit wet or dry sandpaper.

(9) The relief valve spring has a free length of approximately 60.7 mm (2.39 in.) it should test between 18 and 19 pounds when compressed to 40.5 mm (1.60 in.). Replace spring that fails to meet specifications.

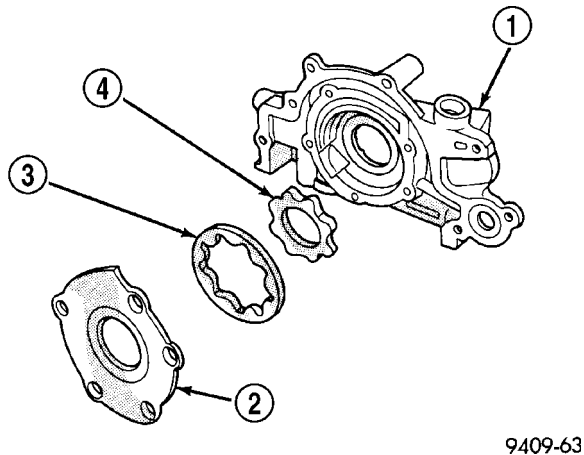
(10) If oil pressure is low and pump is within specifications, inspect for worn engine bearings, damaged or missing oil pick-up tube O-ring, clogged oil pick-up tube screen, clogged oil filter and stuck open pressure relief valve or other reasons for oil pressure loss.

ASSEMBLY

- (1) Install oil pump rotors (Fig. 118).

OIL PUMP (Continued)**Fig. 117 Oil Pressure Relief Valve**

- 1 - RETAINER CAP
- 2 - GASKET
- 3 - OIL PUMP BODY
- 4 - RELIEF VALVE
- 5 - SPRING

**Fig. 118 Oil Pump**

- 1 - OIL PUMP BODY
- 2 - OIL PUMP COVER
- 3 - OUTER ROTOR
- 4 - INNER ROTOR

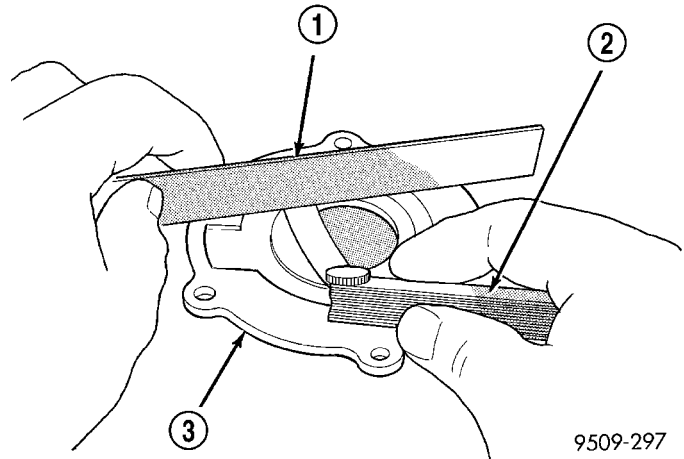
(2) Install oil pump cover and screws (Fig. 118). Tighten screws to 12 N·m (105 in. lbs.).

CAUTION: Oil pump pressure relief valve must be installed as shown in (Fig. 117) or serious damage may occur.

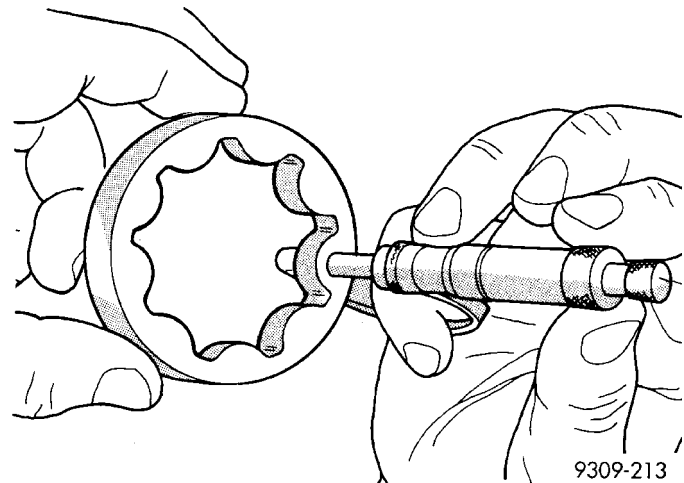
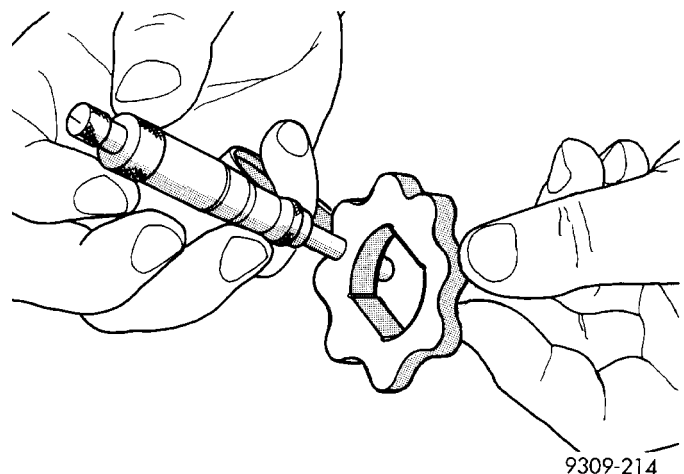
- (3) Install spring and relief valve (Fig. 117).
- (4) Install threaded plug and gasket to the oil pump (Fig. 117). Tighten plug to 41 N·m (30 ft. lbs.).

INSTALLATION

- (1) Make sure all surfaces are clean and free of oil and dirt.

**Fig. 119 Checking Oil Pump Cover Flatness**

- 1 - STRAIGHT EDGE
- 2 - FEELER GAUGE
- 3 - OIL PUMP COVER

**Fig. 120 Measuring Outer Rotor Thickness****Fig. 121 Measuring Inner Rotor Thickness**

OIL PUMP (Continued)

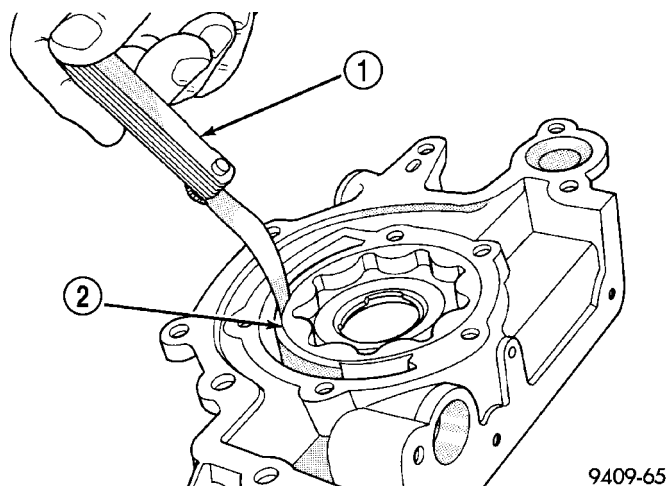


Fig. 122 Measuring Outer Rotor Clearance in Housing

- 1 - FEELER GAUGE
2 - OUTER ROTOR

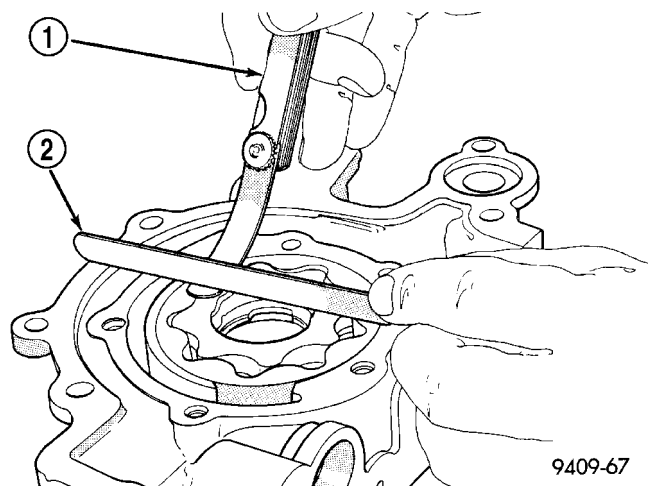


Fig. 124 Measuring Clearance Over Rotors

- 1 - FEELER GAUGE
2 - STRAIGHT EDGE

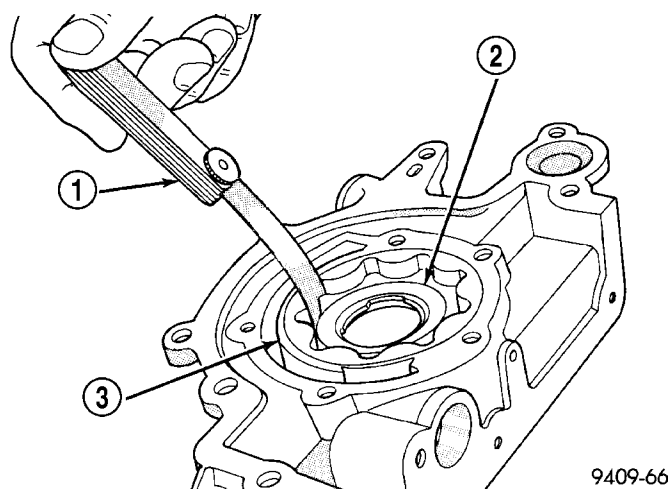


Fig. 123 Measuring Clearance Between Rotors

- 1 - FEELER GAUGE
2 - INNER ROTOR
3 - OUTER ROTOR

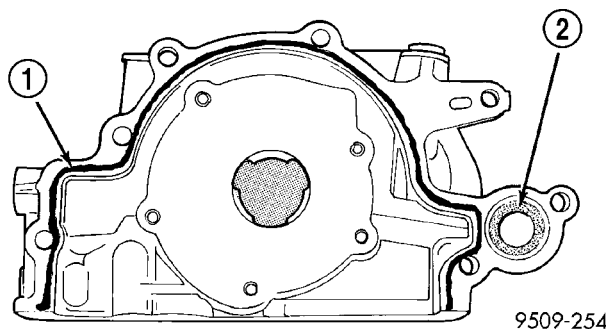


Fig. 125 Oil Pump Sealing

- 1 - APPLY GASKET MAKER TO OIL PUMP BODY FLANGE
2 - O-RING

NOTE: Make sure the word "front" on the crankshaft sprocket is facing outward.

(2) Apply Mopar® Gasket Maker to oil pump as shown in (Fig. 125). Install o-ring into oil pump body discharge passage.

(3) Prime oil pump before installation.

(4) Align oil pump rotor flats with flats on crankshaft as you install the oil pump to the block.

NOTE: Front crankshaft seal **MUST** be out of pump to align, or damage may result.

(5) Torque all oil pump attaching bolts to 28 N·m (250 in. lbs.).

(6) Install new front crankshaft seal using Special Tool 6780 (Fig. 126).

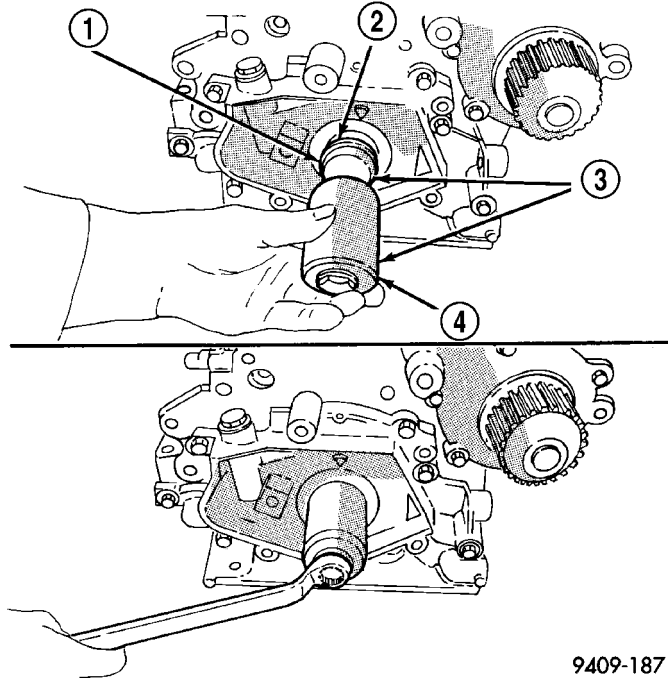
CAUTION: Use of Special Tool 6792 is required to install the crankshaft sprocket to the proper depth. Failure to use this tool will cause improper timing belt tracking.

(7) Install crankshaft sprocket, using Special Tool 6792 (Fig. 127).

(8) Install oil pick-up tube and oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(9) Install timing belt rear cover and camshaft sprocket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - INSTALLATION).

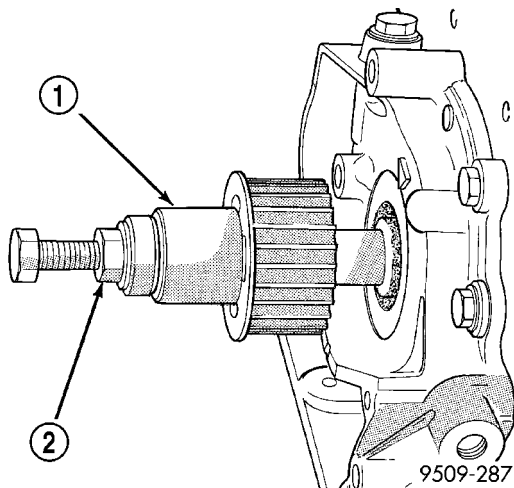
(10) Install timing belt tensioner assembly (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT TENSIONER ASSEMBLY - INSTALLATION).

OIL PUMP (Continued)

9409-187

Fig. 126 Front Crankshaft Seal—Installation

- 1 - PROTECTOR
- 2 - SEAL
- 3 - SPECIAL TOOL 6780-1
- 4 - INSTALLER



9509-287

Fig. 127 Crankshaft Sprocket—Installation

- 1 - SPECIAL TOOL 6792
- 2 - TIGHTEN NUT TO INSTALL

(11) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION).

(12) Install front timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - INSTALLATION).

(13) Fill engine crankcase with proper oil to correct level.

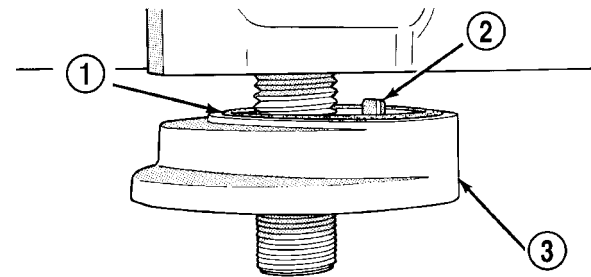
(14) Connect negative cable to battery.

OIL FILTER ADAPTER**REMOVAL**

(1) Remove the oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL).

(2) Remove assembly by unscrewing adaptor fitting (Fig. 128).

(3) Remove O-ring seal.



9409-59

Fig. 128 Engine Oil Filter Adapter to Engine Block

- 1 - O-RING
- 2 - LOCATING ROLL PIN
- 3 - OIL FILTER ADAPTER

INSTALLATION

(1) Position O-ring in the groove on adapter.

(2) Align roll pin into engine block and tighten assembly to 80 N·m (60 ft. lbs.) (Fig. 128).

(3) Install oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - INSTALLATION).

INTAKE MANIFOLD**DESCRIPTION**

The intake manifold is a molded plastic composition, attached to the cylinder head with fasteners. The manifold is a long branch design to enhance low and mid-range torque.

OPERATION

The intake manifold delivers air to the combustion chambers. This air allows the fuel delivered by the fuel injectors to ignite when the spark plugs fire.

INTAKE MANIFOLD (Continued)

DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKS

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

- (1) Start the engine.
- (2) Spray a small stream of water (Spray Bottle) at the suspected leak area.
- (3) If engine RPM'S change, the area of the suspected leak has been found.
- (4) Repair as required.

REMOVAL

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

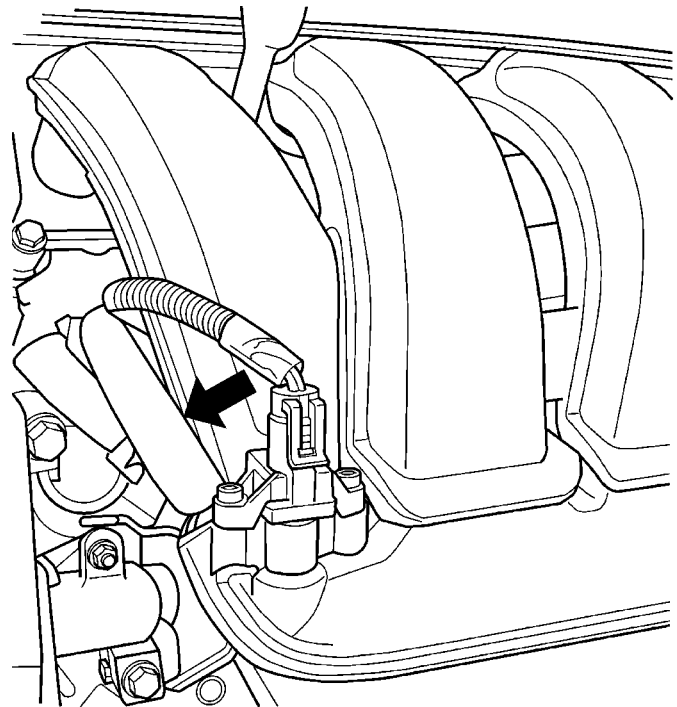
- (1) Perform fuel system pressure release procedure **before attempting any repairs** (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).
- (2) Disconnect negative cable from battery.
- (3) Remove the inlet air duct from intake manifold to throttle body.

WARNING: WRAP SHOP TOWELS AROUND FUEL HOSE TO CATCH ANY GASOLINE SPILLAGE

- (4) Disconnect fuel supply line quick connect at the fuel tube assembly (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).
- (5) Remove fuel rail assembly attaching screws and remove fuel rail assembly from engine. Cover injector holes with suitable covering.

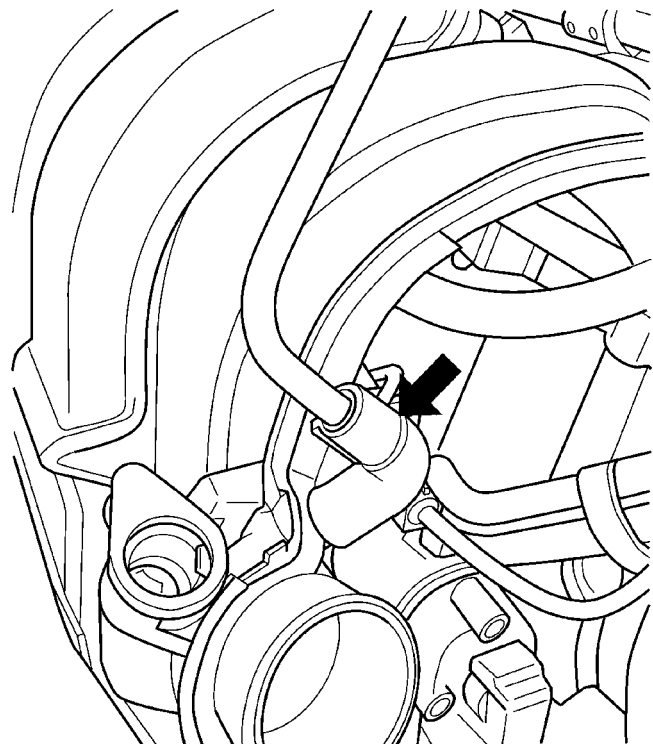
CAUTION: Do not set fuel injectors on their tips, damage may occur to the injectors

- (6) Disconnect brake booster hose (Fig. 129) and PCV hose (Fig. 130) from intake manifold.
- (7) Disconnect Manifold Absolute Pressure (MAP) sensor electrical connector (Fig. 131).
- (8) Disconnect knock sensor electrical connector (Fig. 132).



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Fig. 129 Brake Booster Hose



80bc4d40

Fig. 130 PCV Hose

INTAKE MANIFOLD (Continued)

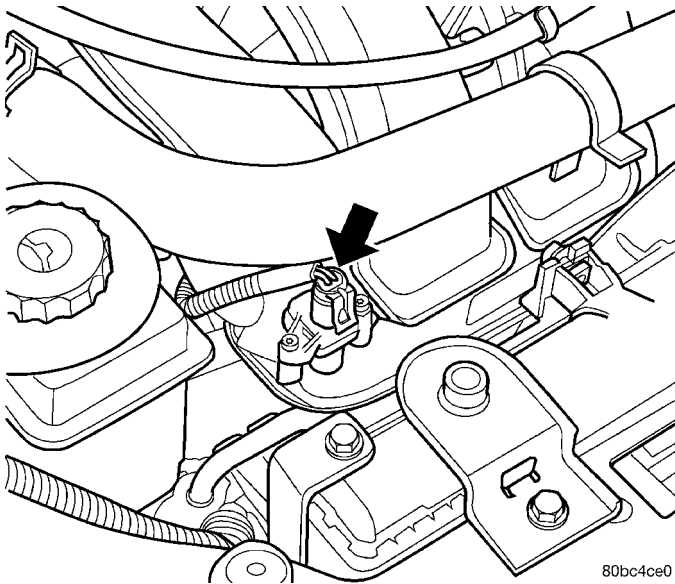


Fig. 131 MAP Sensor

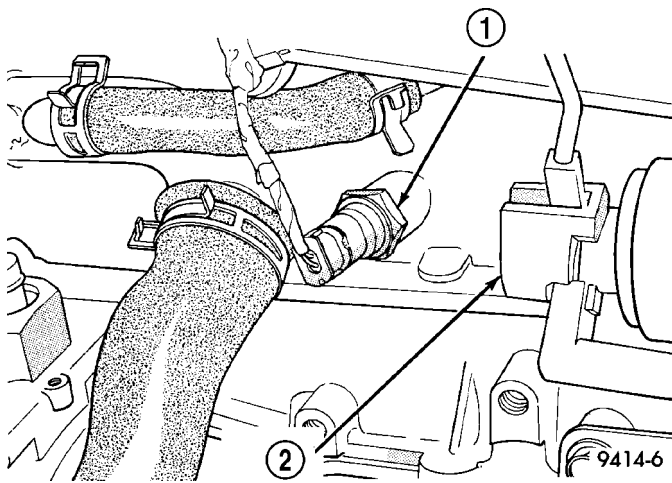


Fig. 132 Knock Sensor

- 1 - KNOCK SENSOR
2 - STARTER MOTOR

- (9) Disconnect wiring at starter.
(10) Remove the intake manifold to lower support bracket bolts (Fig. 133).
(11) Remove intake manifold screws and washers. Discard the fasteners. Remove intake manifold.

INSPECTION

- Inspect manifold for cracks or distortions.
- Check for torn or missing O-rings at the mating surface of the manifold (Fig. 134).

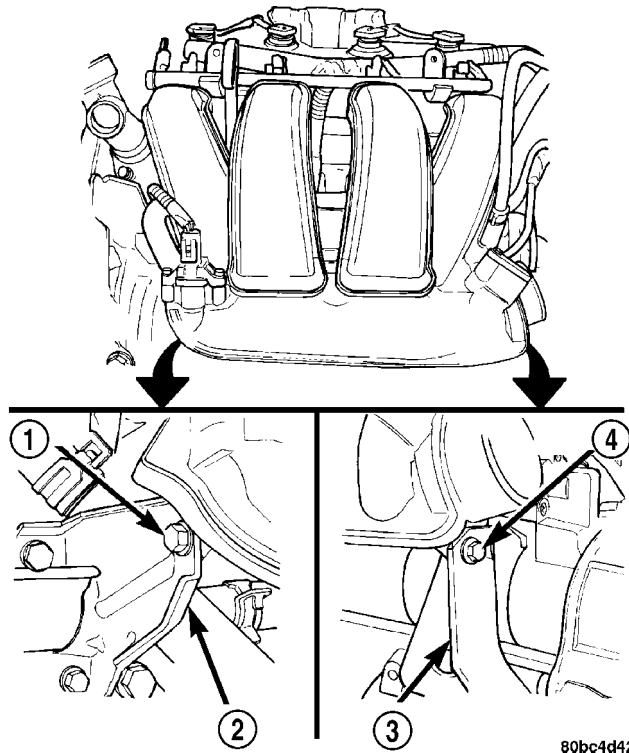


Fig. 133 Intake Manifold Lower Supports

- 1 - BOLT
2 - BRACKET
3 - BRACKET
4 - BOLT

INSTALLATION

Before installing manifold. Clean all mating surfaces. Replace all O-ring gaskets with new gaskets (Fig. 134). All intake manifold fasteners and washers are to be discarded and **NEW** fasteners and washers are to be used.

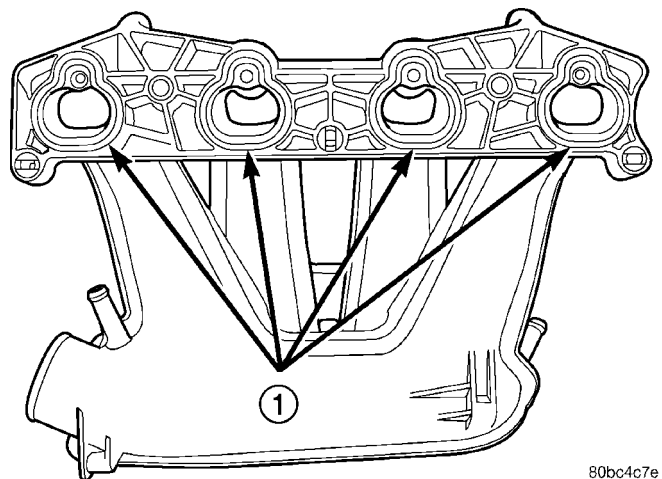


Fig. 134 Intake Manifold Gaskets

- 1 - INTAKE MANIFOLD O-RING GASKETS

INTAKE MANIFOLD (Continued)

(1) Install intake manifold onto cylinder head and tighten fasteners to 12 N·m (105 in. lbs.) in sequence shown in (Fig. 135).

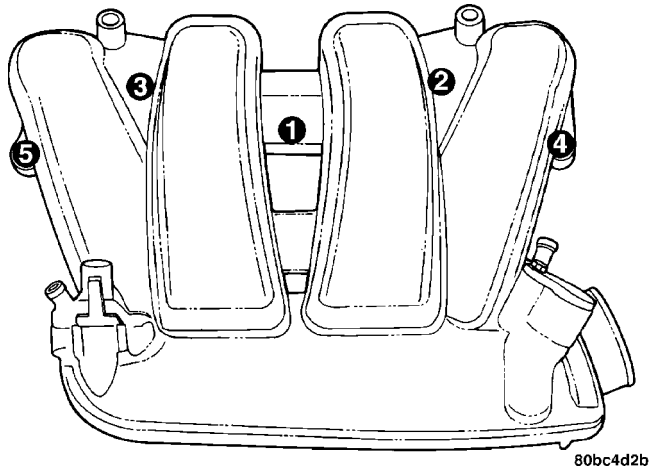


Fig. 135 Intake Manifold Tightening Sequence

(2) Install intake manifold to lower support bracket bolts (Fig. 133). Tighten bolts to 11 N·m (95 in. lbs.).

(3) Remove covering from fuel injector holes and insure the holes are clean. Install fuel rail assembly to intake manifold. Tighten screws to 23 N·m (200 in. lbs.).

(4) Connect PCV and brake booster hoses.

(5) Inspect quick connect fittings for damage, replace if necessary (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE). Apply a light amount of clean engine oil to fuel inlet tube. Connect fuel supply hose to fuel rail assembly. Check connection by pulling on connector to insure it locked into position.

(6) Connect Manifold Absolute Pressure (MAP) Sensor wiring connector (Fig. 131).

(7) Connect knock sensor connector, and wiring at starter.

(8) Install inlet air duct to intake manifold and throttle body. Tighten clamp to 3 N·m (30 in. lbs.).

(9) Connect negative cable to battery.

(10) With the DRB scan tool use ASD Fuel System Test to pressurize system to check for leaks.

CAUTION: When using the ASD Fuel System Test, the Auto Shutdown (ASD) relay will remain energized for 7 minutes or until the ignition switch is turned to the OFF position, or Stop All Test is selected.

INTAKE MANIFOLD - HIGH OUTPUT

DESCRIPTION

The intake manifold is a two piece cast aluminum design. The lower manifold section houses an electronic controlled manifold tuning valve for increased engine performance.

OPERATION

The intake manifold meters and delivers air to the combustion chambers. This air allows the fuel delivered by the fuel injectors to ignite; producing power.

The manifold tuning valve (MTV) allows additional flow volumes under certain engine operating conditions for increase engine performance.

REMOVAL - HIGH OUTPUT ENGINE

WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.

(1) Disconnect negative cable from battery.

(2) Perform fuel system pressure release procedure **before attempting any repairs.** (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE)

WARNING: WRAP SHOP TOWELS AROUND FUEL HOSE TO CATCH ANY GASOLINE SPILLAGE

(3) Disconnect fuel supply line quick connect at the fuel tube assembly. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE)

(4) Disconnect fuel injector connector and harness from injectors and fuel rail.

(5) Disconnect PCV hose from manifold (Fig. 137).

(6) Remove the inlet air duct from intake manifold to throttle body.

(7) Remove bolt attaching lower intake manifold to support bracket (Fig. 136).

(8) Remove engine oil dipstick from housing.

(9) Disconnect electrical connectors from MAP sensor and MTV actuator (Fig. 137).

(10) Remove bolts attaching intake manifold to cylinder head.

(11) Move manifold forward for access to wiring connections (Fig. 139).

(12) Disconnect the knock sensor (Fig. 138).

(13) Disconnect brake booster hose (Fig. 139).

(14) Remove intake manifold.

INTAKE MANIFOLD - HIGH OUTPUT (Continued)

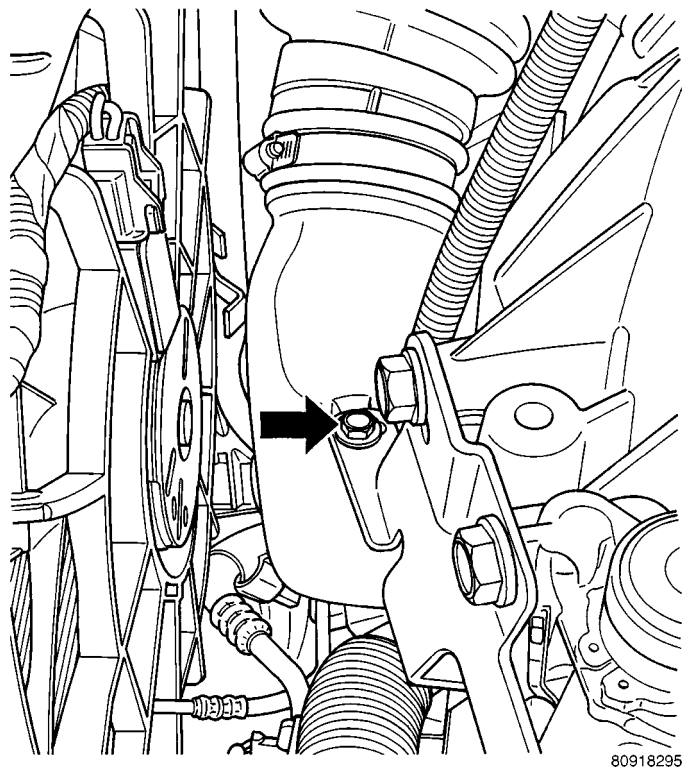


Fig. 136 Lower Manifold Support Bolt - (Under-body View)

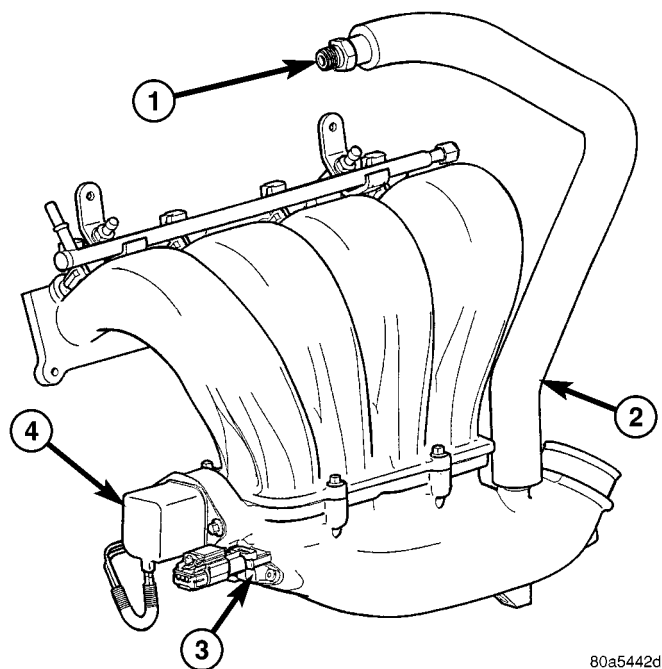


Fig. 137 MAP, MTV & PCV Locations

- 1 - PCV VALVE (SCREWS INTO CYLINDER HEAD COVER)
- 2 - PCV HOSE (WITH INSULATED SLEEVE)
- 3 - MAP SENSOR
- 4 - MTV ACTUATOR

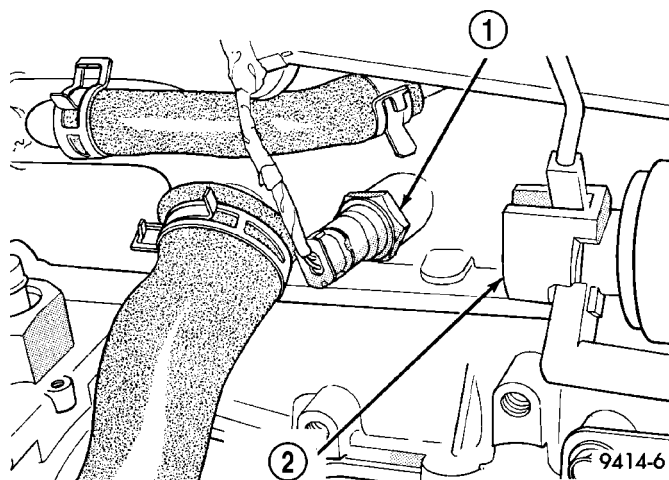


Fig. 138 Knock Sensor

- 1 - KNOCK SENSOR
- 2 - STARTER MOTOR

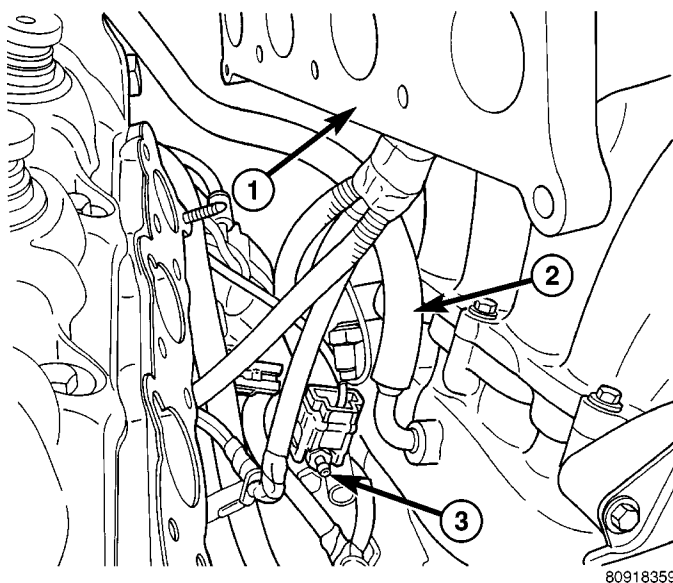
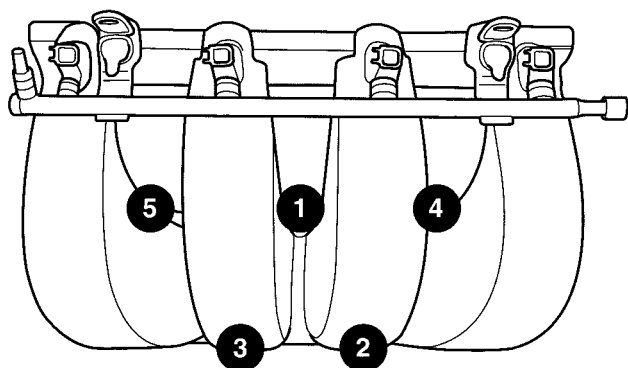


Fig. 139 Brake Booster Hose

- 1 - INTAKE MANIFOLD
- 2 - BRAKE BOOSTER HOSE
- 3 - STARTER WIRING

INSTALLATION - HIGH OUTPUT ENGINE

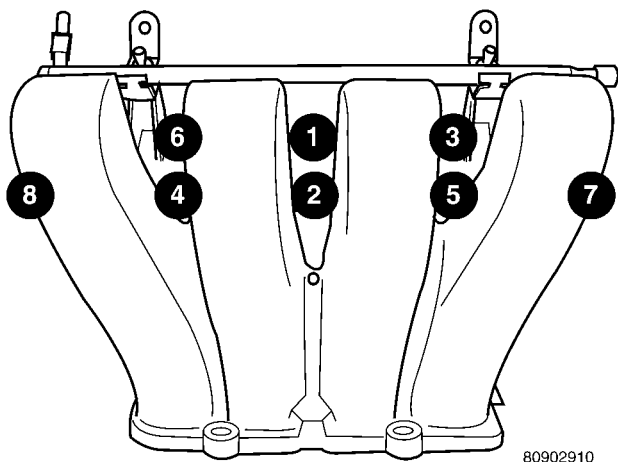
- (1) Clean manifold sealing surfaces.
- (2) If separated, install lower to upper manifold gasket and tighten bolt in sequence shown in (Fig. 140) to 12 N·m (105 in. lbs.).
- (3) Position new manifold gasket on cylinder head mounting surface, piloting on the 2 attaching studs.
- (4) Loosely position manifold in engine compartment.
- (5) Insert engine wiring harness between middle intake runners.
- (6) Connect the knock sensor (Fig. 138).
- (7) Connect brake booster hose (Fig. 139).

INTAKE MANIFOLD - HIGH OUTPUT (Continued)

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Fig. 140 LOWER INTAKE MANIFOLD TIGHTENING

(8) Position manifold to cylinder head and install fasteners. Tighten fasteners in sequence shown in (Fig. 141) to 12 N·m (105 in. lbs.).



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Fig. 141 Upper Intake Manifold Tightening Sequence

(9) Install bolt securing lower manifold to bracket (Fig. 136). Tighten bolt to 28 N·m (250 in. lbs.).

(10) Connect MAP sensor and MTV actuator electrical connection (Fig. 137).

(11) Install engine oil dipstick

(12) Connect inlet air duct to manifold and throttle body.

(13) Connect PCV hose to manifold (Fig. 137).

(14) Connect fuel injector connectors and harness to fuel rail.

(15) Connect fuel supply line to fuel rail. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE)

(16) Connect negative cable to battery.

EXHAUST MANIFOLD**DESCRIPTION**

The exhaust manifold is made of nodular cast iron for strength and high temperatures. The manifold attaches to the cylinder head.

OPERATION

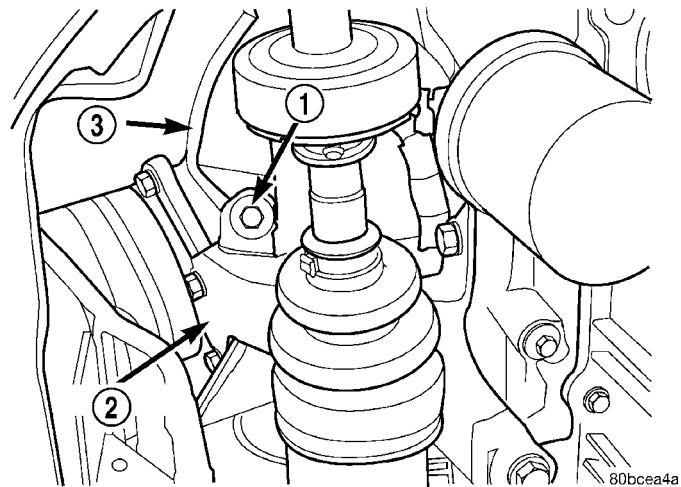
The exhaust manifold collects the exhaust gasses exiting the combustion chambers. Then it channels the exhaust gasses to the exhaust pipe attached to the manifold.

REMOVAL

(1) Disconnect negative cable from battery.

(2) Raise vehicle on hoist.

(3) Remove bolt attaching the wire harness heat shield to the exhaust manifold support bracket (Fig. 142).



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Fig. 142 Wire Harness Heat Shield Bolt

- 1 - BOLT
- 2 - BRACKET
- 3 - HEAT SHIELD

EXHAUST MANIFOLD (Continued)

- (4) Remove exhaust manifold support bracket (Fig. 143).

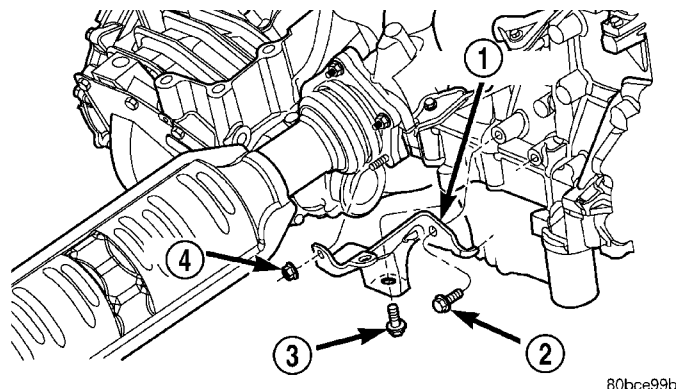


Fig. 143 Exhaust Manifold Support Bracket

- 1 - BRACKET
2 - BOLT (M10) - 54 N·m (40 ft. lbs.)
3 - BOLT (M12) - 95 N·m (70 ft. lbs.)
4 - NUT - 28 N·m (250 in. lbs.)

- (5) Remove fasteners attaching exhaust system flex joint to exhaust manifold flange. Move exhaust system rearward to clear flange studs.

- (6) Lower vehicle.
(7) Disconnect make-up air hose from rear of cylinder head cover.
(8) Disconnect oxygen sensor connector and harness clip.
(9) Remove heat shield attaching bolts (Fig. 144).

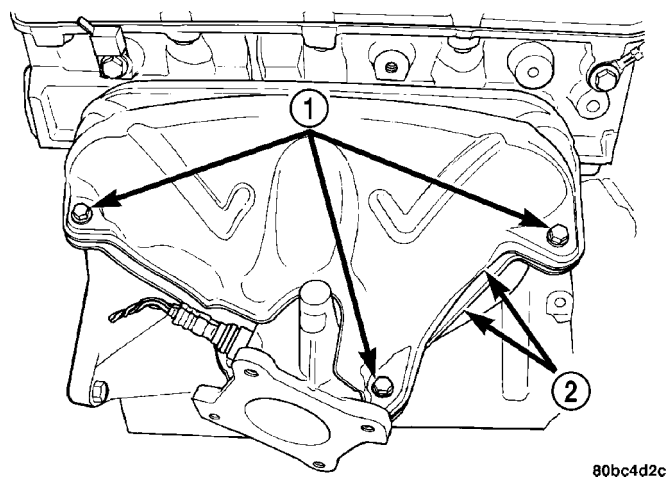


Fig. 144 Exhaust Manifold Heat Shields

- 1 - BOLTS
2 - HEAT SHIELDS

- (10) Remove upper heat shield for access to manifold bolts.
(11) Remove exhaust manifold bolts.
(12) Remove exhaust manifold from top of vehicle, between the cylinder head and cowl.

CLEANING

- (1) Discard gasket (if equipped) and clean all surfaces of manifold and cylinder head.

INSPECTION

- (1) Inspect manifold gasket surfaces for flatness with straight edge. Surface must be flat within 0.15 mm per 300 mm (0.006 in. per foot) of manifold length.
(2) Inspect manifolds for cracks or distortion. Replace manifold as necessary.

INSTALLATION

- (1) Position exhaust manifold and gasket in place.
(2) Install exhaust manifold bolts and tighten in sequence shown in (Fig. 145) to 23 N·m (200 in. lbs.).

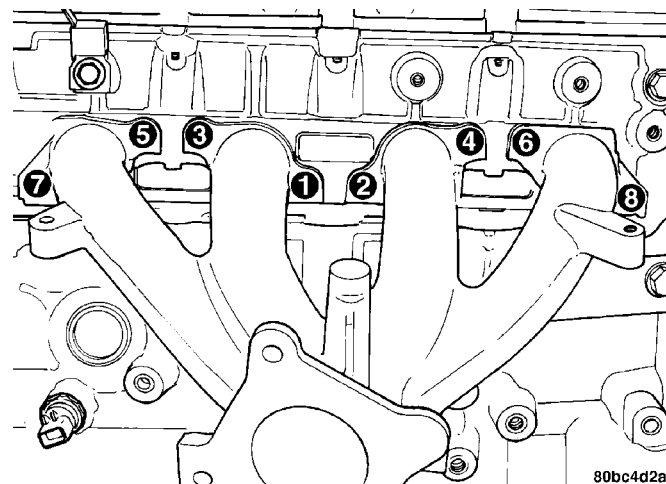


Fig. 145 Exhaust Manifold Tightening Sequence-Typical

- (3) Position lower and upper heat shield on exhaust manifold. Install heat shield bolts and tighten to 11 N·m (95 in. lbs.) (Fig. 144).

- (4) Connect oxygen sensor electrical connector and harness clip.

- (5) Connect make-up air hose on cylinder head cover port.

- (6) Raise vehicle.
(7) Install new flex joint to manifold flange gasket.
(8) Attach exhaust system to manifold flange and tighten fasteners to 28 N·m (250 in. lbs.).

- (9) Install exhaust manifold support bracket and tighten fasteners (Fig. 143).

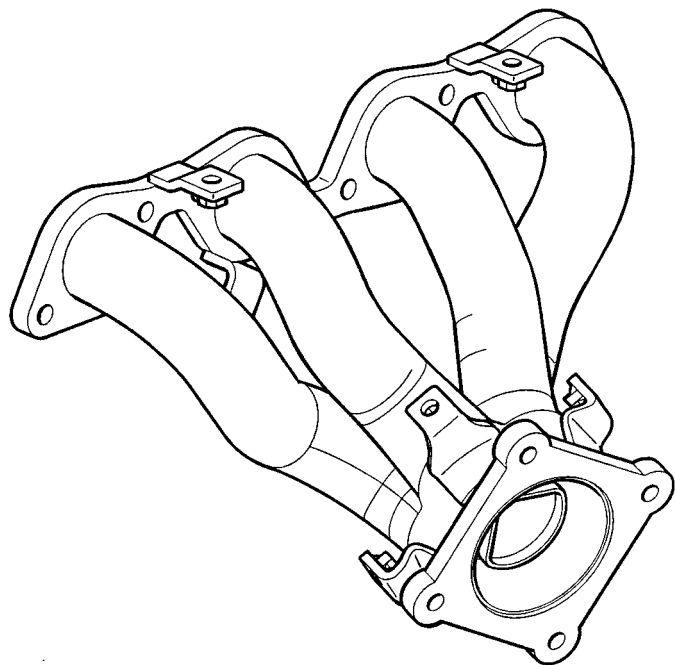
- (10) Install bolt attaching wire harness heat shield to support bracket (Fig. 142).

- (11) Lower vehicle.
(12) Connect negative cable to battery.

EXHAUST MANIFOLD - HIGH OUTPUT

DESCRIPTION

The exhaust manifold (Fig. 146) is a welded construction using lightweight tubular steel with stamped plate steel mounting flanges. The manifold attaches to the cylinder head.

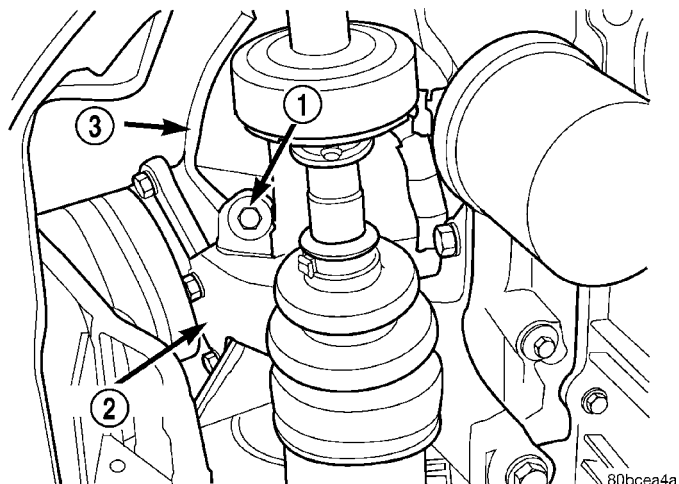


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Fig. 146 EXHAUST MANIFOLD - HIGH OUTPUT ENGINE

REMOVAL

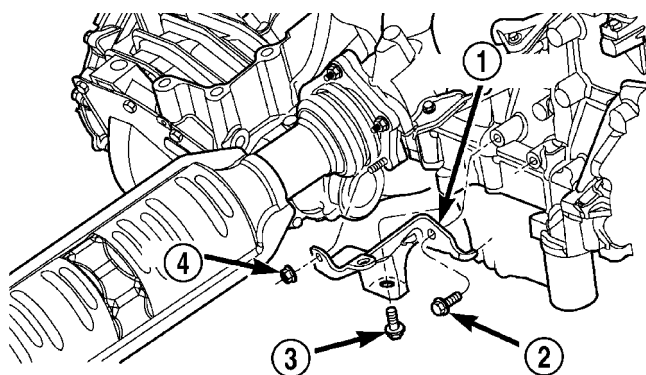
- (1) Disconnect negative cable from battery.
- (2) Raise vehicle on hoist.
- (3) Remove bolt attaching the wire harness heat shield to the exhaust manifold support bracket (Fig. 147).
- (4) Remove exhaust manifold support bracket (Fig. 148).
- (5) Remove fasteners attaching exhaust system flex joint to exhaust manifold flange. Move exhaust system rearward to clear flange studs.
- (6) Lower vehicle.
- (7) Disconnect make-up air hose from rear of cylinder head cover.
- (8) Disconnect oxygen sensor connector and harness clip.
- (9) Remove heat shield attaching bolts.
- (10) Remove upper heat shield for access to manifold bolts.
- (11) Remove exhaust manifold bolts.
- (12) Remove exhaust manifold from top of vehicle, between the cylinder head and cowl.



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Fig. 147 Wire Harness Heat Shield Bolt

- 1 - BOLT
- 2 - BRACKET
- 3 - HEAT SHIELD



80bce99b

Fig. 148 Exhaust Manifold Support Bracket

- 1 - BRACKET
- 2 - BOLT (M10) - 54 N·m (40 ft. lbs.)
- 3 - BOLT (M12) - 95 N·m (70 ft. lbs.)
- 4 - NUT - 28 N·m (250 in. lbs.)

INSTALLATION

- (1) Position exhaust manifold and gasket in place.
- (2) Install exhaust manifold bolts and tighten in sequence shown in (Fig. 149) to 23 N·m (200 in. lbs.).
- (3) Position lower and upper heat shield on exhaust manifold. Install heat shield bolts and tighten to 11 N·m (95 in. lbs.).
- (4) Connect oxygen sensor electrical connector and harness clip.
- (5) Connect make-up air hose on cylinder head cover port.
- (6) Raise vehicle.
- (7) Install new flex joint to manifold flange gasket.
- (8) Attach exhaust system to manifold flange and tighten fasteners to 28 N·m (250 in. lbs.).
- (9) Install exhaust manifold support bracket and tighten fasteners (Fig. 148).

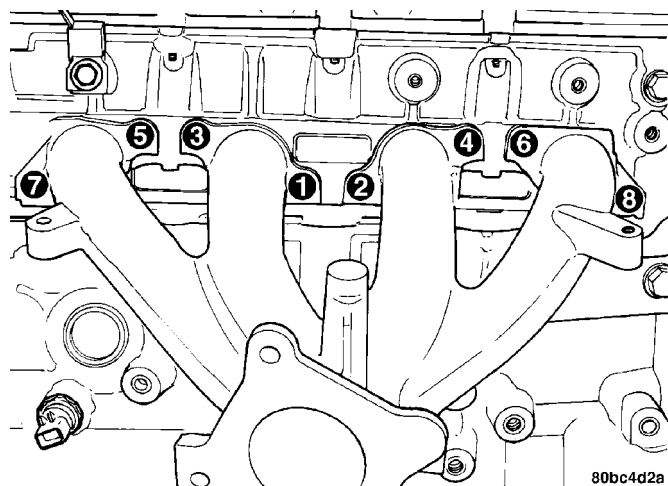
EXHAUST MANIFOLD - HIGH OUTPUT (Continued)

Fig. 149 Exhaust Manifold Tightening Sequence-Typical

- (10) Install bolt attaching wire harness heat shield to support bracket (Fig. 147).
- (11) Lower vehicle.
- (12) Connect negative cable to battery.

VALVE TIMING**STANDARD PROCEDURE - VALVE TIMING VERIFICATION**

- (1) Remove number one spark plug.
- (2) Using a dial indicator, set number one cylinder to TDC on the compression stroke.
- (3) Remove the access plug from the front timing belt cover (Fig. 153).
- (4) Check the timing mark on the camshaft sprocket. Mark should align with the arrow on the timing belt rear cover (Fig. 150).

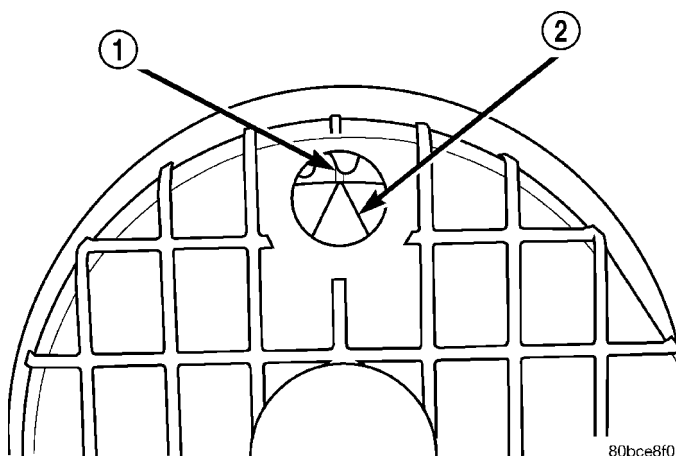


Fig. 150 Camshaft Timing Marks

- 1 - CAM SPROCKET TIMING MARK
- 2 - ARROW ON REAR COVER

TIMING BELT COVER(S)**REMOVAL****FRONT COVER**

- (1) Disconnect negative battery cable.
- (2) Remove fastener securing ground strap to engine mount bracket.
- (3) Remove upper torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - REMOVAL).
- (4) Remove power steering/air conditioning compressor drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (5) Raise vehicle on hoist.
- (6) Remove accessory drive belt splash shield.
- (7) Remove generator drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
- (8) Remove crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
- (9) Remove lower torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - REMOVAL).
- (10) Lower vehicle.
- (11) Position a jack under engine. Raise jack enough to support engine weight.
- (12) Remove right engine mount to engine mount bracket through bolt (Fig. 151).

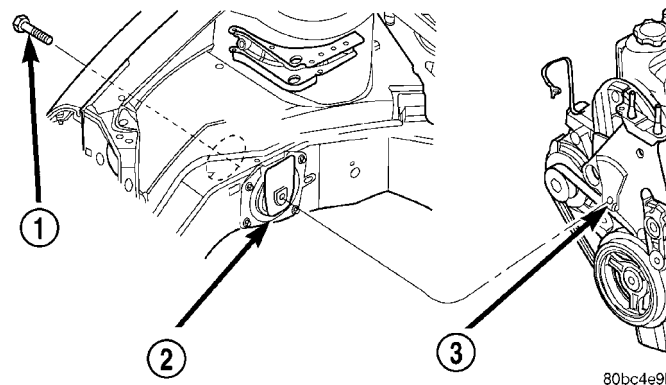


Fig. 151 Right Engine Mount to Bracket

- 1 - THROUGH BOLT
- 2 - RIGHT ENGINE MOUNT
- 3 - ENGINE MOUNT BRACKET

- (13) Lower engine enough with jack to remove lower engine mount bracket bolt (Fig. 152).
- (14) Raise engine with jack to allow engine-to-body clearance for engine mount bracket removal.
- (15) Remove power steering pump assembly and set aside. **Do Not** disconnect lines from pump.

TIMING BELT COVER(S) (Continued)

(16) Remove the two remaining bolts securing engine mount bracket to engine. Remove engine mount bracket (Fig. 152).

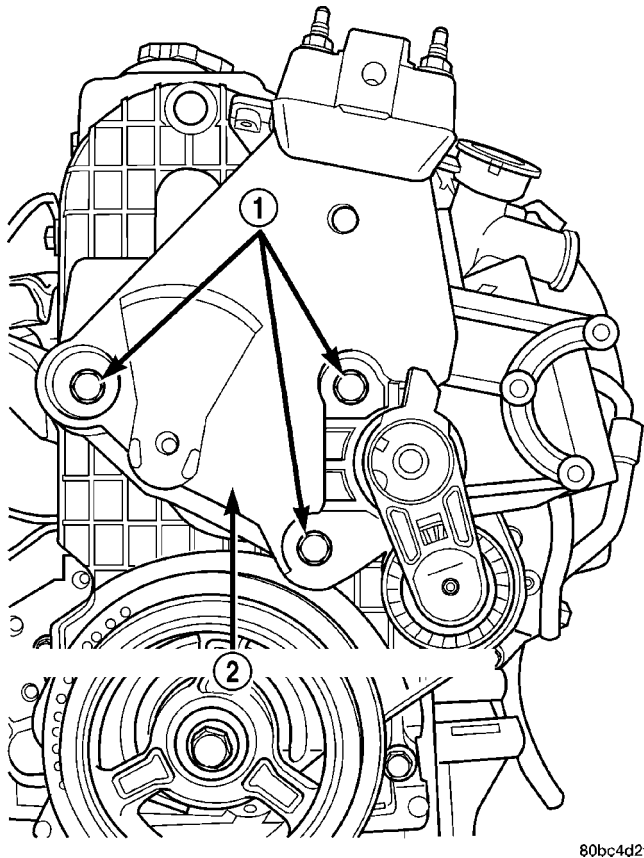


Fig. 152 Engine Mount Bracket

- 1 - BOLTS
2 - ENGINE MOUNT BRACKET ASSEMBLY

(17) Remove the front timing belt cover fasteners. Remove front timing belt cover (Fig. 153).

REAR COVER

(1) Remove front timing belt cover. Refer to FRONT COVER.

(2) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - REMOVAL).

(3) Remove timing belt tensioner/bracket assembly (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT TENSIONER ASSEMBLY - REMOVAL).

(4) Hold camshaft sprocket with Special Tools C-4687 and modified Adaptor C-4687-1 (Fig. 154), while removing attaching bolt.

NOTE: For Special Tool Identification, (Refer to 9 - ENGINE - SPECIAL TOOLS).

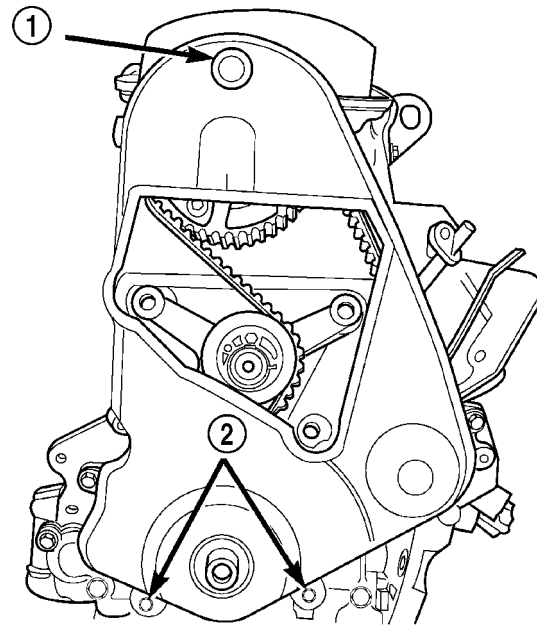


Fig. 153 Front Timing Belt Cover

- 1 - ACCESS PLUG
2 - BOLTS

- (5) Remove camshaft sprocket.
(6) Remove rear cover attaching bolts (Fig. 155).
(7) Remove rear cover (Fig. 155).

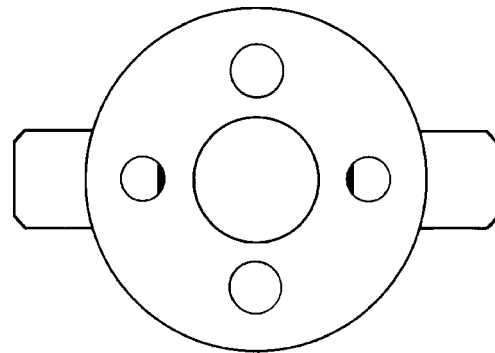
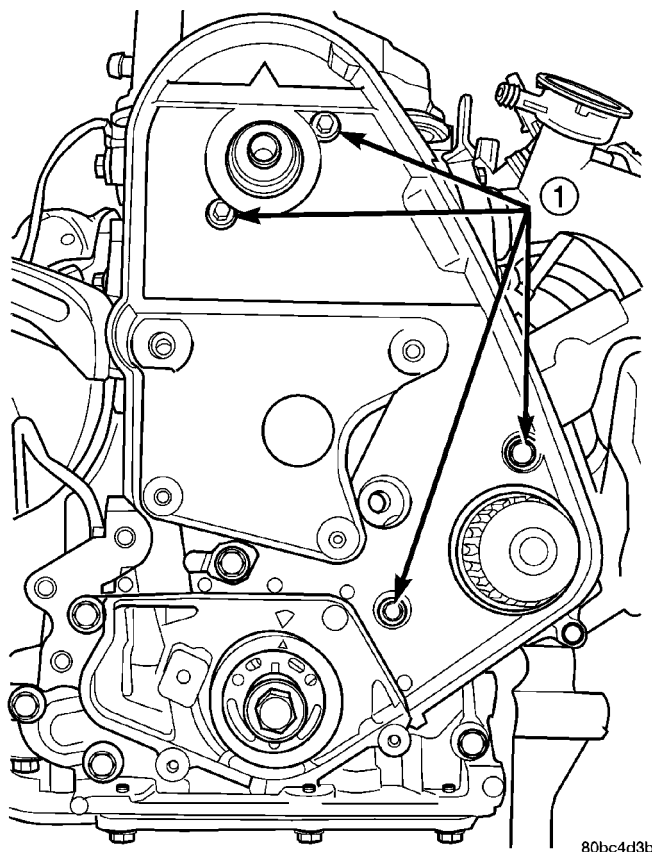


Fig. 154 Modification to Special Tool C-4687-1

- 1 - GRIND LOCATION
2 - 12.7 MM (1/2 IN.)
3 - 50.8 MM (2 IN.)

TIMING BELT COVER(S) (Continued)**Fig. 155 Rear Timing Belt Cover**

1 - BOLTS

INSTALLATION**REAR COVER**

- (1) Install rear cover and tighten bolts to 12 N·m (105 in. lbs.) (Fig. 155).
- (2) Install the camshaft sprocket on the camshaft.

CAUTION: DO NOT use an impact wrench (or any other air operated tool) for tightening the camshaft sprocket bolt. Damage to the camshaft timing pin can result. ONLY use a hand wrench while holding camshaft sprocket with Special Tool.

- (3) Install camshaft sprocket retaining bolt. While holding sprocket with Special Tools C-4687 and modified Adaptor C-4687-1, tighten attaching bolt to 115 N·m (85 ft. lbs.).

- (4) Install timing belt tensioner/bracket assembly (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT TENSIONER ASSEMBLY - INSTALLATION).

- (5) Install timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION).

- (6) Install front timing belt cover. Refer to FRONT COVER

FRONT COVER

- (1) Install front cover and tighten bolts to 12 N·m (105 in. lbs.) (Fig. 153).

- (2) Position engine mount bracket to its mounting location. Hand start the upper two bolts of the engine mount bracket (Fig. 152).

- (3) Lower engine with jack.

- (4) Install lower engine mount bracket bolt. Tighten bolt to 61 N·m (45 ft. lbs.) (Fig. 152).

- (5) Raise engine with jack.

- (6) Tighten upper engine mount bracket bolts to 61 N·m (45 ft. lbs.) (Fig. 152).

- (7) Install power steering pump assembly.

- (8) Lower engine with jack.

- (9) Install right engine mount to engine mount bracket through bolt. Tighten bolt to 118 N·m (87 ft. lbs.) (Fig. 151).

- (10) Remove jack from under engine.

- (11) Raise vehicle on hoist.

- (12) Install lower torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - INSTALLATION).

- (13) Install crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

- (14) Install accessory drive belts (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

- (15) Install accessory drive belt splash shield.

- (16) Lower vehicle.

- (17) Install upper torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - INSTALLATION).

- (18) Install fastener securing ground strap to engine mount bracket.

- (19) Connect negative battery cable.

- (20) Perform torque strut adjustment procedure (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - ADJUSTMENTS).

TIMING BELT AND SPROCKETS

REMOVAL

REMOVAL - TIMING BELT

(1) Remove front timing belt cover (Fig. 156) (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - REMOVAL).

(2) Remove spark plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - REMOVAL).

CAUTION: Align camshaft and crankshaft timing marks before removing the timing belt by rotating the engine **CLOCKWISE** with the crankshaft (Fig. 166).

(3) Loosen timing belt tensioner lock nut (Fig. 157).

(4) Insert a 6 mm Allen wrench into the hexagon opening located on the top plate of the belt tensioner

pulley. Rotate the top plate **CLOCKWISE** until there is enough slack in timing belt to allow for removal (Fig. 157).

(5) Remove timing belt.

CAUTION: Do not rotate the camshaft once the timing belt has been removed or damage to valve components may occur.

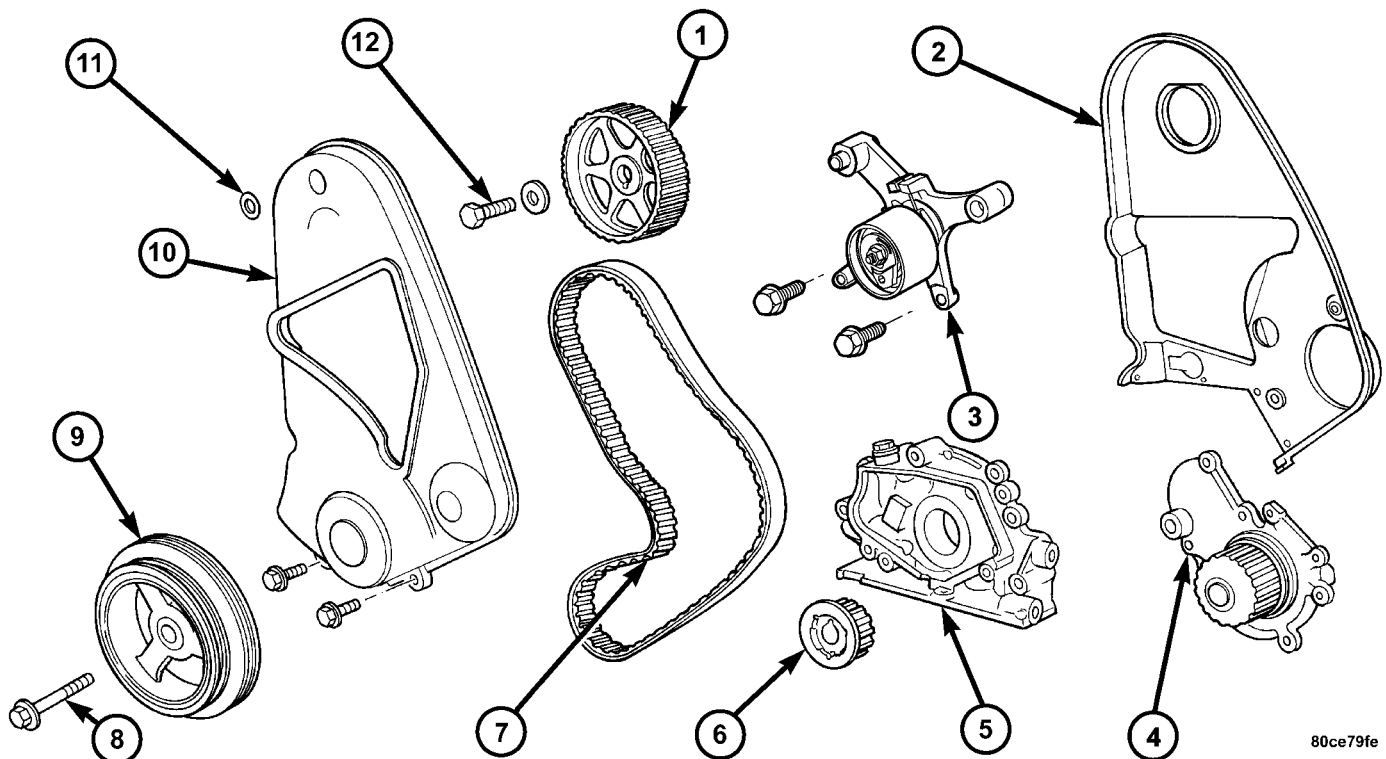
REMOVAL - CAMSHAFT SPROCKET

(1) Remove timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - REMOVAL).

(2) Hold camshaft sprocket with Special Tools C-4687 and modified Adaptor C-4687-1 (Fig. 158), while removing attaching bolt.

NOTE: For Special Tool Identification, (Refer to 9 - ENGINE - SPECIAL TOOLS).

(3) Remove camshaft sprocket.

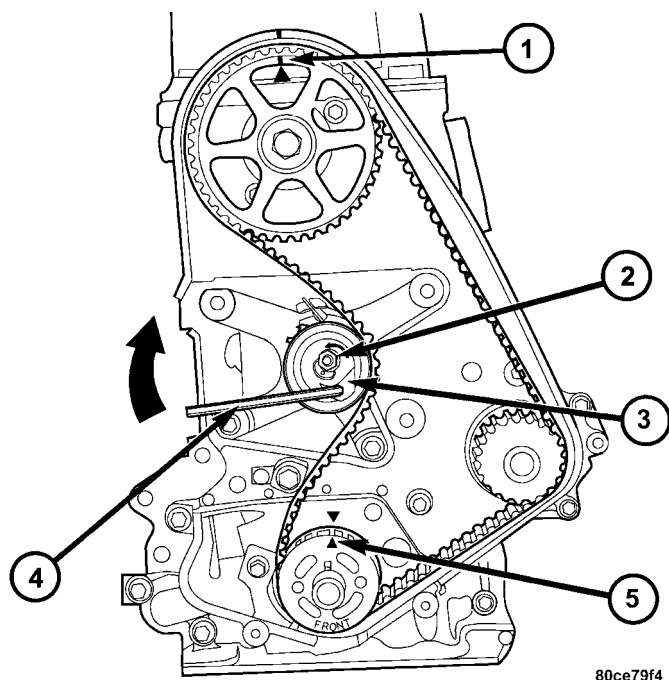


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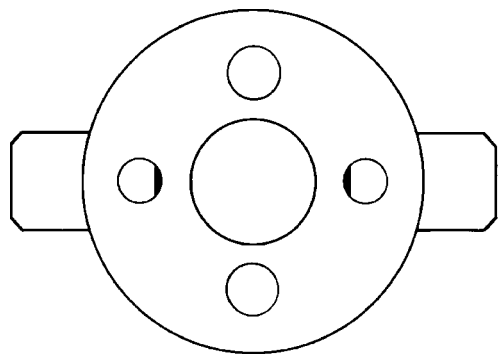
Fig. 156 Timing Belt System - Mechanical Tensioner

- 1 - CAMSHAFT SPROCKET
- 2 - REAR TIMING BELT COVER
- 3 - MECHANICAL TIMING BELT TENSIONER ASSEMBLY
- 4 - WATER PUMP
- 5 - OIL PUMP BODY
- 6 - CRANKSHAFT SPROCKET

- 7 - TIMING BELT
- 8 - BOLT
- 9 - CRANKSHAFT DAMPER
- 10 - FRONT TIMING BELT COVER
- 11 - ACCESS PLUG
- 12 - CAMSHAFT BOLT AND WASHER

TIMING BELT AND SPROCKETS (Continued)**Fig. 157 Timing Belt Removal**

- 1 - CAMSHAFT TIMING MARKS
- 2 - LOCK NUT
- 3 - TOP PLATE
- 4 - 6mm ALLEN WRENCH
- 5 - CRANKSHAFT TIMING MARKS

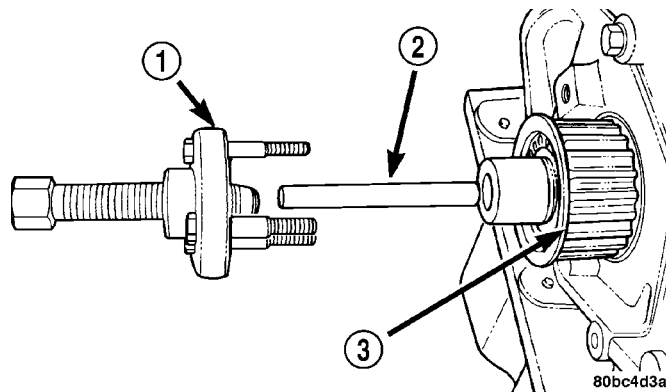
**Fig. 158 Modification to Special Tool C-4687-1**

- 1 - GRIND LOCATION
- 2 - 12.7 MM (1/2 IN.)
- 3 - 50.8 MM (2 IN.)

REMOVAL - CRANKSHAFT SPROCKET

(1) Remove timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT AND SPROCKETS - REMOVAL)

(2) Remove the crankshaft sprocket using Special Tool 6793 and insert C-4685-C2 (Fig. 159).

**Fig. 159 Crankshaft Sprocket Removal**

- 1 - SPECIAL TOOL 6793
- 2 - SPECIAL TOOL C-4685-C2
- 3 - CRANKSHAFT SPROCKET

INSTALLATION**INSTALLATION - CRANKSHAFT SPROCKET**

NOTE: Make sure the word "front" on the sprocket is facing outward.

CAUTION: Use of Special Tool 6792 is required to install the crankshaft sprocket to the proper depth. Failure to use this tool will cause improper timing belt tracking.

(1) Install the crankshaft sprocket (Fig. 160) using Special Tool 6792.

INSTALLATION - CAMSHAFT SPROCKET

(1) Install camshaft sprocket. While holding sprockets with Special Tools C-4687 and modified Adaptor C-4687-1, tighten attaching bolt to 115 N·m (85 ft. lbs.).

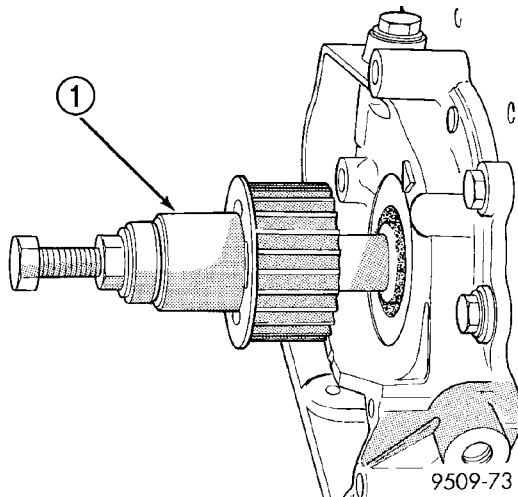
(2) Install timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION).

INSTALLATION - TIMING BELT

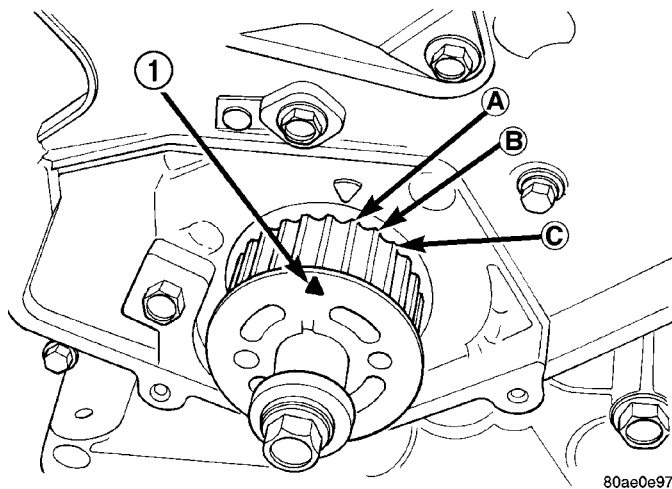
(1) Set crankshaft sprocket to TDC by aligning the sprocket with the arrow on the oil pump housing, then back off to 3 notches before TDC (Fig. 161).

(2) Set camshaft to TDC by aligning mark on sprocket with the arrow on the rear timing belt cover (Fig. 162).

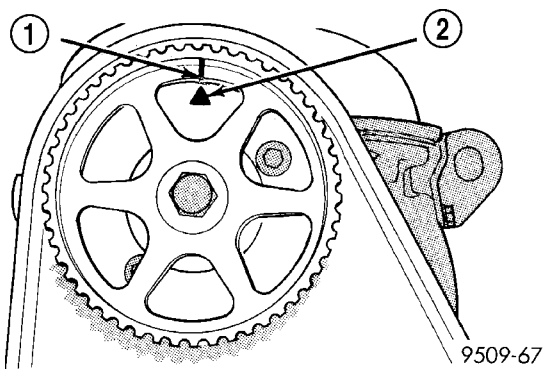
TIMING BELT AND SPROCKETS (Continued)

**Fig. 160 Crankshaft Sprocket Installation**

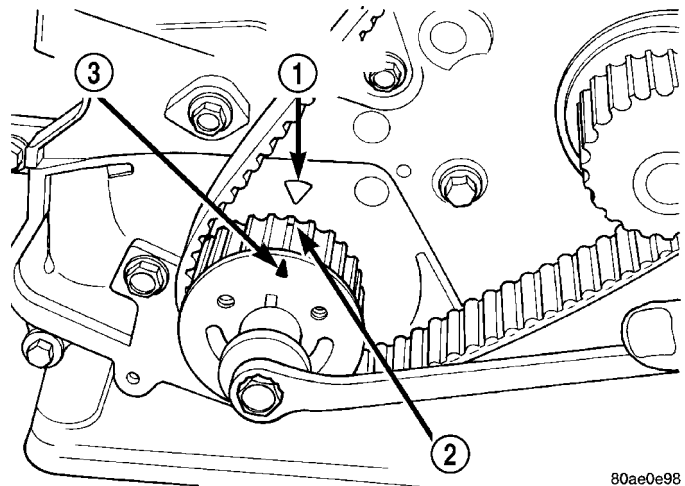
1 - SPECIAL TOOL 6792

**Fig. 161 Crankshaft Sprocket Timing**

1 - TDC MARK

**Fig. 162 Camshaft Timing Mark**1 - CAM SPROCKET TIMING MARK
2 - ARROW ON REAR COVER

(3) Move crankshaft to 1/2 mark before TDC (Fig. 163) for belt installation.

**Fig. 163 Adjusting Crankshaft Sprocket for Timing Belt**1 - TDC REFERENCE MARK
2 - 1/2 NOTCH LOCATION
3 - TDC MARK

(4) Install the timing belt. Starting at the crankshaft, go around the water pump sprocket, then around the camshaft sprocket, and finally route the back side of the timing belt around the timing belt tensioner pulley.

(5) Move crankshaft sprocket to TDC to take up belt slack.

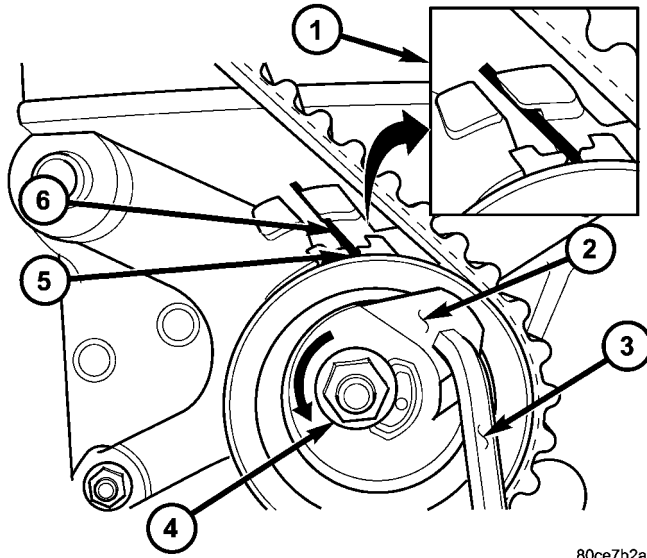
(6) Insert a 6 mm Allen wrench into the hexagon opening located on the top plate of the belt tensioner pulley. Rotate the top plate **COUNTERCLOCKWISE**. The tensioner pulley will move against the belt and the tensioner setting notch will eventually start to move clockwise. Watching the movement of the setting notch, continue rotating the top plate counterclockwise until the setting notch is aligned with the spring tang (Fig. 164). Using the allen wrench to prevent the top plate from moving, torque the tensioner lock nut to 30 N·m (22 ft. lbs.). Setting notch and spring tang should remain aligned after lock nut is torqued.

(7) Remove allen wrench and torque wrench.

NOTE: Repositioning the crankshaft to the TDC position must be done only during the **CLOCKWISE** rotation movement. If TDC is missed, rotate a further two revolutions until TDC is achieved. **DO NOT** rotate crankshaft counterclockwise as this will make verification of proper tensioner setting impossible.

(8) Rotate the crankshaft **CLOCKWISE** two complete revolutions manually for seating of the belt, until the crankshaft is repositioned at the TDC position. Verify that the camshaft and crankshaft timing marks are in proper position (Fig. 166).

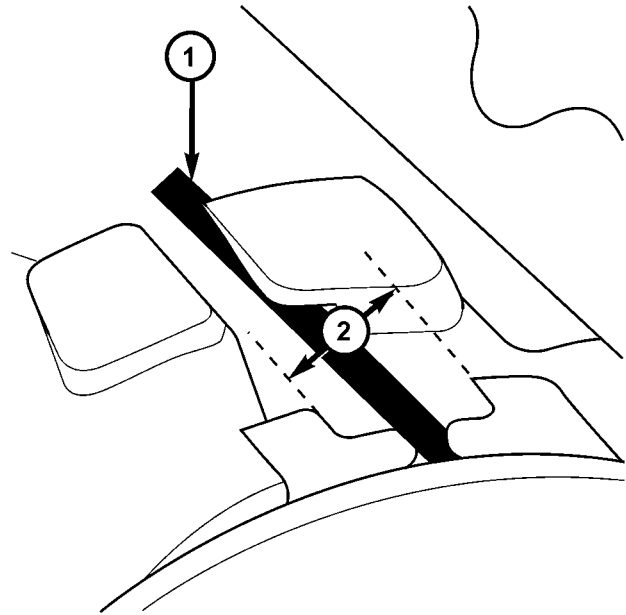
TIMING BELT AND SPROCKETS (Continued)



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Fig. 164 Timing Belt Tension Adjustment

- 1 - ALIGN SETTING NOTCH WITH SPRING TANG
- 2 - TOP PLATE
- 3 - 6mm ALLEN WRENCH
- 4 - LOCK NUT
- 5 - SETTING NOTCH
- 6 - SPRING TANG



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Fig. 165 Timing Belt Tension Verification

- 1 - SPRING TANG
- 2 - TOLERANCE WINDOW

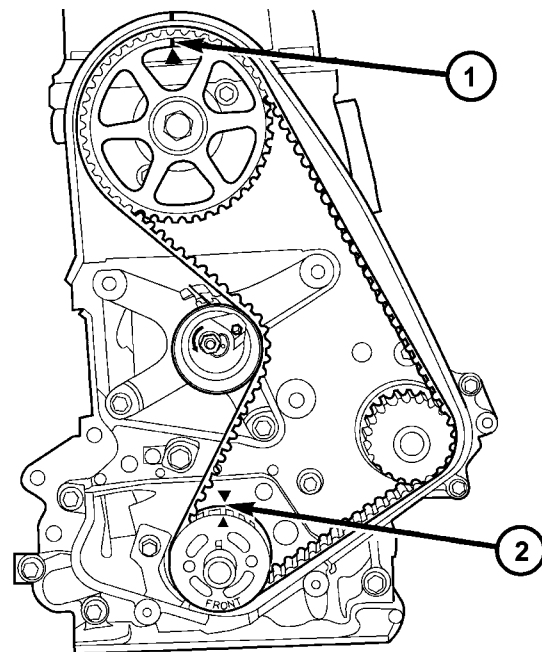
(9) Check if the spring tang is within the tolerance window (Fig. 165). If the spring tang is within the tolerance window, the installation process is complete and nothing further is required. If the spring tang is not within the tolerance window, repeat Steps 6 through 8.

(10) Install front timing belt cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - INSTALLATION).

(11) Install spark plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - INSTALLATION).

(12) Perform camshaft and crankshaft timing relearn procedure as follows:

- Connect the DRB III® scan tool to the data link (diagnostic) connector. This connector is located in the passenger compartment; at the lower edge of instrument panel near the steering column.
- Turn the ignition switch on.
- Access "Engine" diagnostics.
- Select "Miscellaneous" option.
- Select "ReLearn Cam Crank" option and follow directions on DRBIII® screen.



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Fig. 166 Crankshaft and Camshaft Timing

- 1 - CAMSHAFT TIMING MARKS
- 2 - CRANKSHAFT AT TDC

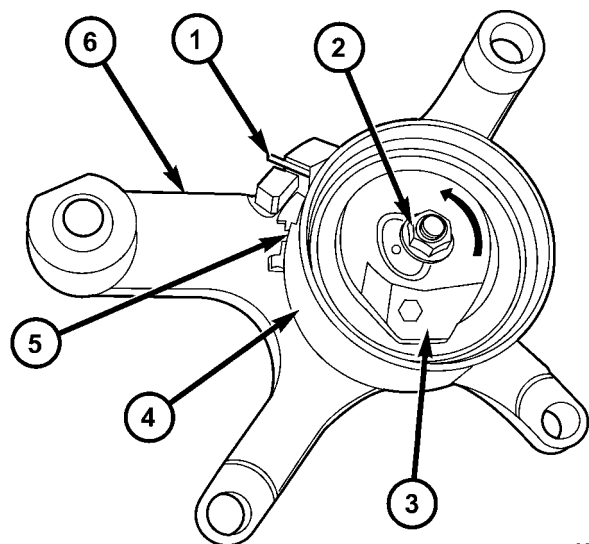
TIMING BELT TENSIONER ASSEMBLY

REMOVAL - WITH MECHANICAL TENSIONER

(1) Remove timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT AND SPROCKETS - REMOVAL).

(2) Remove bolts attaching the timing belt tensioner assembly to engine.

(3) Remove timing belt tensioner assembly (Fig. 167).



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Fig. 167 Timing Belt Tensioner Assembly

- 1 - SPRING TANG
- 2 - LOCK NUT
- 3 - TOP PLATE
- 4 - PULLEY
- 5 - SETTING NOTCH
- 6 - BRACKET

INSTALLATION - WITH MECHANICAL TENSIONER

(1) Position timing belt tensioner assembly to the engine. To ensure proper alignment of tensioner to engine block, temporarily install the engine mount bracket bolts into the upper holes of the timing belt tensioner. Install timing belt tensioner lower mounting bolts. Tighten lower mounting bolts to 31 N·m (23 ft. lbs.). Remove temporarily installed engine mount bracket bolts.

(2) Install timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION).