ENGINE 2.4L DOHC

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ENGINE 2.4L DOHC

DESCRIPTION

The 2.4 Liter (148 cu. in.) in-line four cylinder engine is a double over head camshaft with hydraulic lash adjusters and four valve per cylinder design. The engine is free-wheeling; meaning it has provisions for piston-to-valve clearance. However valve-to-valve interference can occur, if camshafts are rotated independently.

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 rear of the cylinder block (Fig. 1).

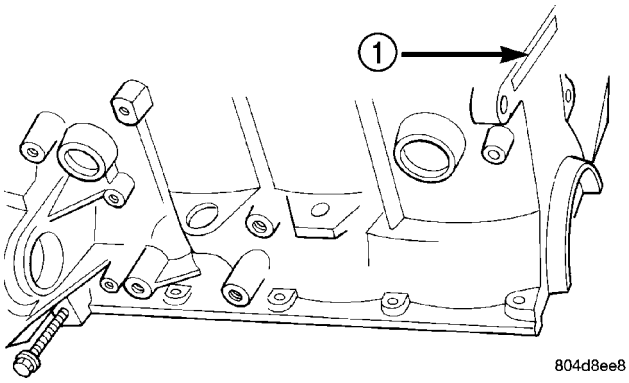


Fig. 1 Engine Identification

1 - ENGINE IDENTIFICATION LOCATION

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).

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

For turbocharger diagnosis, (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM - 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 2.4L DOHC (Continued)

DIAGNOSIS AND TESTING - ENGINE
DIAGNOSIS - PERFORMANCE

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

ENGINE 2.4L DOHC (Continued)

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

ENGINE 2.4L DOHC (Continued)

DIAGNOSIS AND TESTING - ENGINE
DIAGNOSIS - MECHANICAL

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

ENGINE 2.4L DOHC (Continued)

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

ENGINE 2.4L DOHC (Continued)

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

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.

(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.

ENGINE 2.4L DOHC (Continued)

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.

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.

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

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. 2)

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. 2)
- Drill motor with 3M Roloc™ Bristle Disc (white or yellow) (Fig. 2)

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.

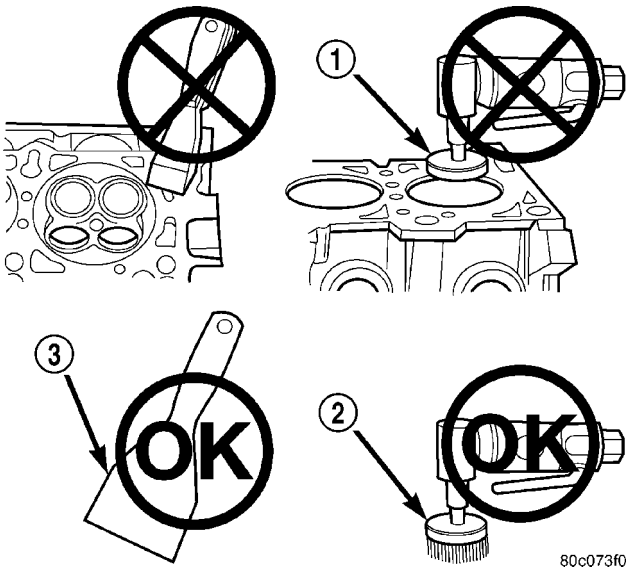


Fig. 2 Proper Tool Usage For Surface Preparation

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

ENGINE 2.4L DOHC (Continued)

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. 3).

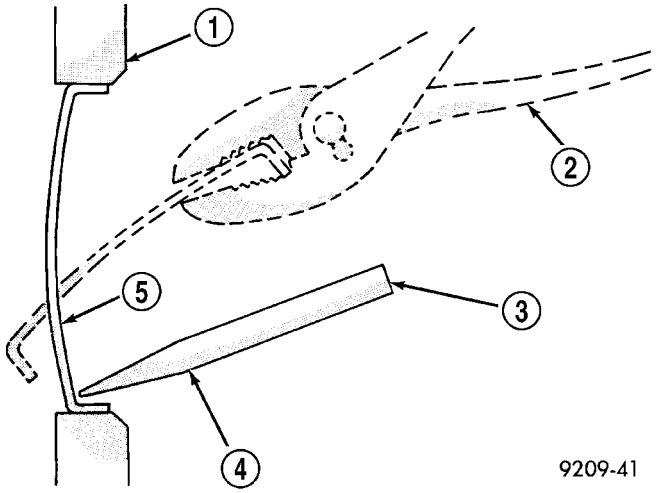


Fig. 3 Core Hole Plug Removal

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.

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.

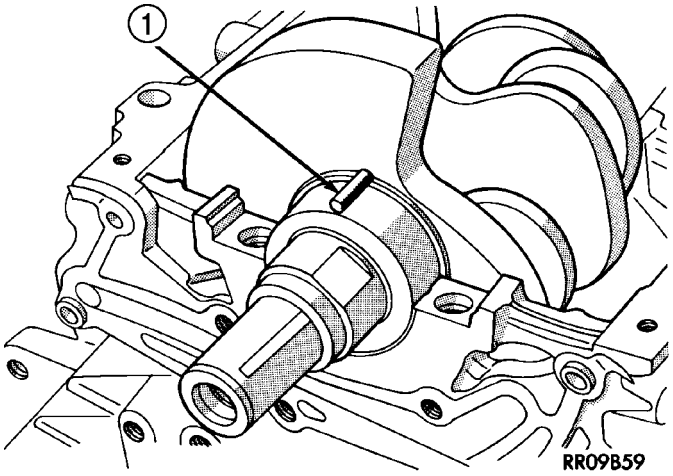


Fig. 4 Plastigage Placed in Lower Shell—Typical

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.

REMOVAL - ENGINE ASSEMBLY

(1) Perform fuel pressure release procedure, then disconnect and remove fuel line (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).

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

(3) Disconnect both cables from battery.

(4) Remove battery and battery tray (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL).

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

ENGINE 2.4L DOHC (Continued)

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

(7) Disconnect throttle and speed control cables from throttle body.

(8) Disconnect engine wiring harness at Powertrain Control Module (PCM).

(9) Disconnect positive cable from Power Distribution Center (PDC) and ground wire from vehicle body. Remove bolts attaching PDC and set aside.

(10) Disconnect wiring connectors at lower battery tray support.

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

(12) Disconnect brake booster vacuum hose from intake manifold.

(13) Disconnect the proportional purge hose from throttle body.

(14) Disconnect coolant reserve/recovery hose from coolant outlet connector.

(15) Disconnect heater hoses.

(16) Remove upper radiator hose.

(17) Remove lower radiator hose.

(18) Disconnect upper A/C line from A/C condenser.

(19) Disconnect A/C lines at junction near upper torque strut.

(20) Using Special Tool 6638A, disconnect clutch hydraulic line (Fig. 5) and (Fig. 6).

(a) Disconnect transmission shift linkage.

(b) Disconnect transmission electrical connectors.

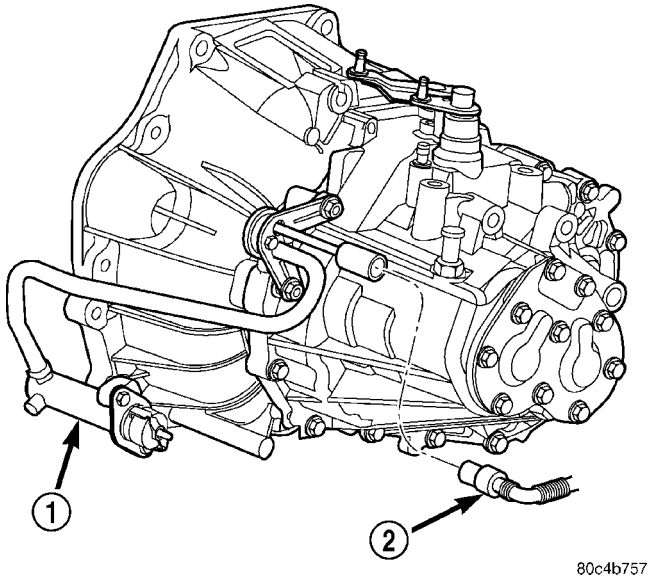


Fig. 5 Clutch Hydraulic Line to Slave Cylinder

1 - SLAVE CYLINDER
2 - HYDRAULIC TUBE

(21) Disconnect power steering hoses from radiator.

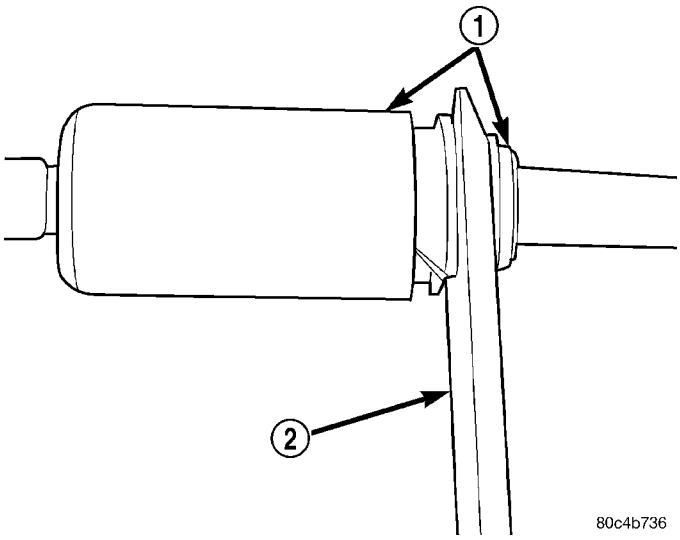


Fig. 6 Disconnecting Clutch Hydraulic Line

1 - QUICK CONNECT FITTING
2 - TOOL 6638A

(22) Disconnect radiator fan electrical connector and remove cooling module assembly.

(23) Hoist vehicle and remove front wheels.

(24) Remove right inner splash shield.

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

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

(27) Remove generator and support brackets.

(28) Remove charge air cooler hoses (Fig. 7).

(29) Drain engine oil.

(30) Disconnect the downstream oxygen sensor connector.

(31) Disconnect exhaust system from manifold (Fig. 8).

(32) Disconnect both power steering hoses from steering gear (Fig. 9).

(33) Remove upper and lower heat shields, elbow support bracket, turbocharger support bracket, and elbow (Fig. 10).

(34) Remove structural collar (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COLLAR - REMOVAL).

(35) Mark for orientation and remove drive plate to clutch module bolts.

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

(37) Lower vehicle and remove A/C compressor.

(38) Disconnect power steering lines from power steering pump.

(39) Remove power steering pump.

ENGINE 2.4L DOHC (Continued)

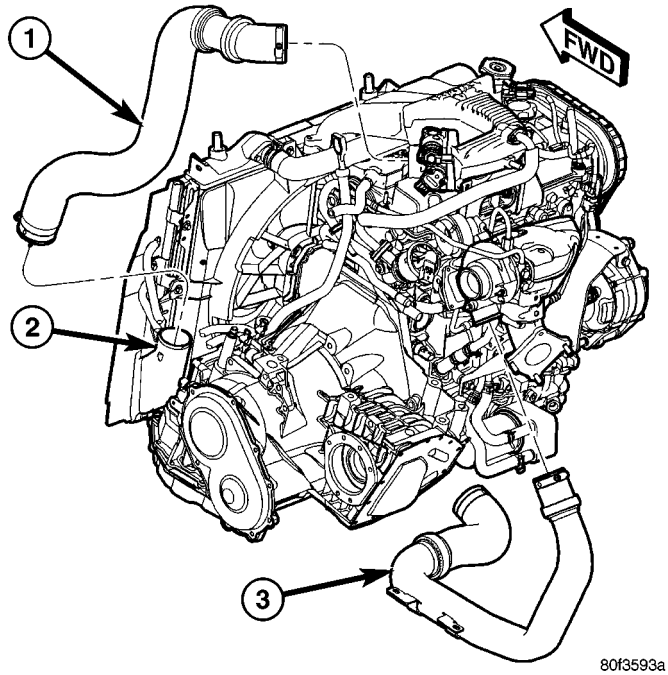


Fig. 7 Charge Air Cooler Hoses

1 - HOSE - CHARGE AIR COOLER TO THROTTLE BODY
2 - CHARGE AIR COOLER
3 - HOSE - TURBOCHARGER TO CHARGE AIR COOLER

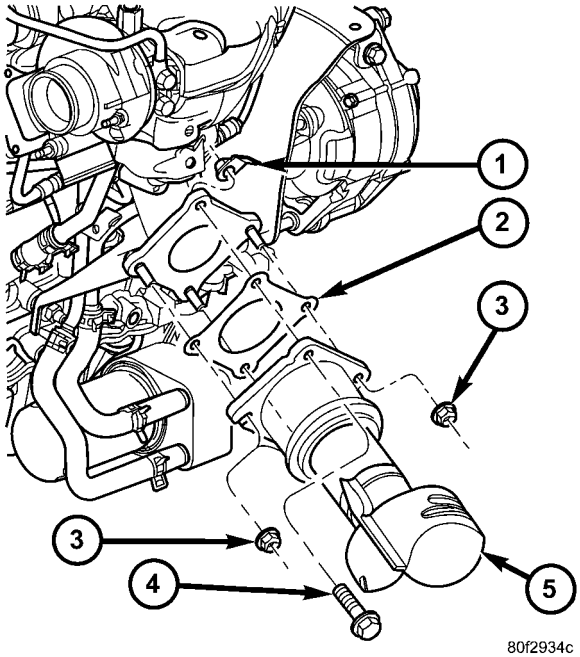


Fig. 8 Converter to Exhaust Manifold Connection - 2.4L Turbo

1 - FLAG NUT
2 - GASKET
3 - NUT
4 - BOLT
5 - CATALYTIC CONVERTER

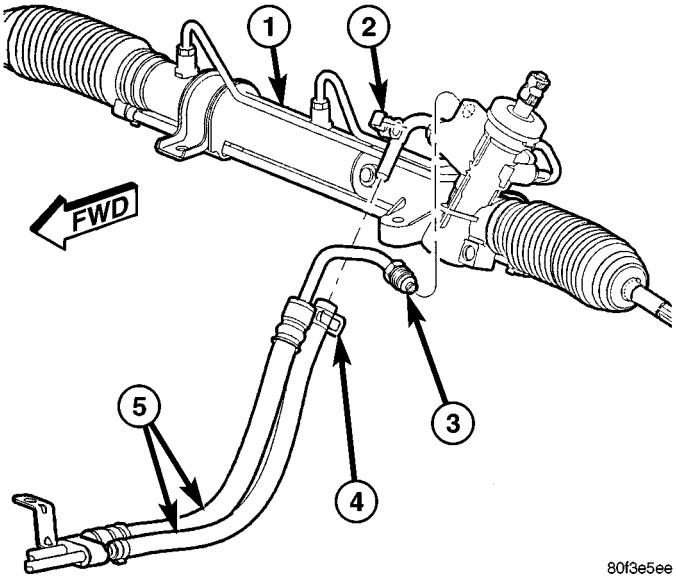


Fig. 9 Hoses At Power Steering Gear - 2.4L Turbo

1 - POWER STEERING GEAR
2 - ROUTING CLIP
3 - PRESSURE HOSE TUBE NUT
4 - RETURN HOSE CLAMP
5 - PRESSURE/RETURN HOSE ASSEMBLY

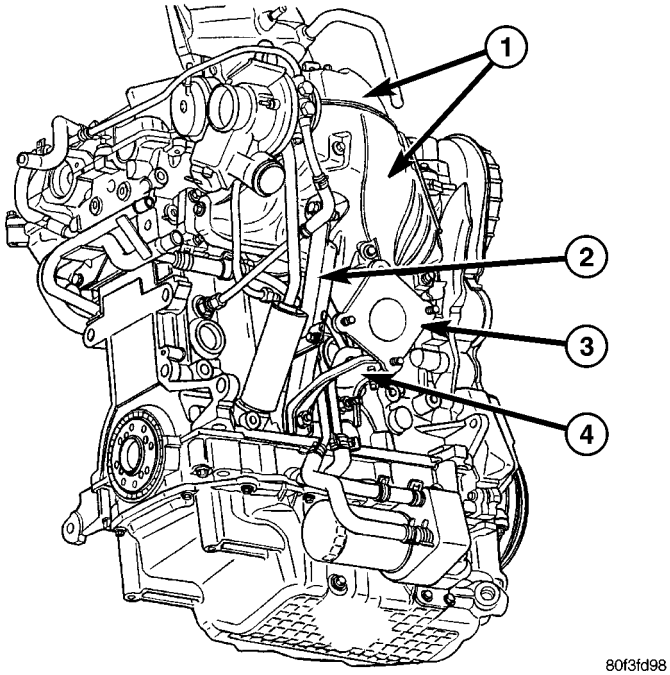


Fig. 10 Turbocharger Brackets and Heat Shields

1 - UPPER/LOWER HEAT SHIELDS
2 - TURBOCHARGER SUPPORT BRACKET
3 - ELBOW
4 - ELBOW SUPPORT BRACKET

ENGINE 2.4L DOHC (Continued)

(40) Raise vehicle enough to allow engine dolly, cradle, and posts, (Special Tools 6135, 6710, and 6848) to be installed under vehicle. For Special Tool identification (Refer to 9 - ENGINE - SPECIAL TOOLS).

(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. 13). 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. 13). Tighten straps and lock them into position.

WARNING: Safety straps MUST be used.

(43) Raise vehicle enough to determine if straps are secure 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 the upper engine torque strut.

(46) Remove right mount through bolt (Fig. 11) and left mount attaching bolts (Fig. 12).

(47) Raise 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.

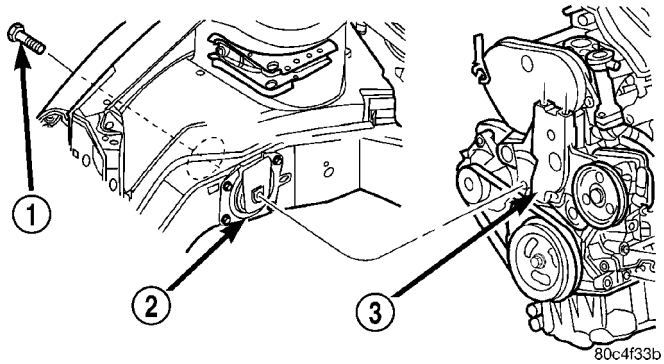


Fig. 11 Right Mount Through Bolt

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

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. 11) and (Fig. 12). Tighten bolts to 118 N·m (87 ft. lbs.).

(3) Install upper engine torque strut.

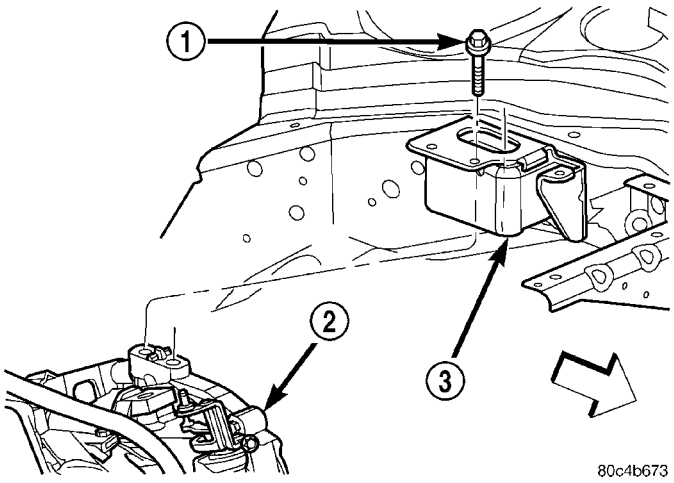


Fig. 12 Left Mount Bolts

1 - BOLT
2 - TRANSAXLE
3 - LEFT MOUNT

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

(5) Install power steering pump.

(6) Connect power steering lines to power steering pump.

(7) Install A/C compressor.

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

(9) Install drive plate to clutch module bolts.

(10) Install structural collar (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COLLAR - INSTALLATION).

NOTE: The upper shield must be installed first to prevent fatiguing the lower shield.

(11) Install elbow, turbocharger support bracket, elbow support bracket, and upper and lower heat shields (Fig. 10).

(12) Connect both power steering hoses to steering gear (Fig. 9).

(13) Connect exhaust system to manifold (Fig. 8).

(14) Connect the downstream oxygen sensor.

(15) Install charge air cooler hoses (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/CHARGE AIR COOLER AND PLUMBING - INSTALLATION).

(16) Install generator and mounting brackets (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).

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

ENGINE 2.4L DOHC (Continued)

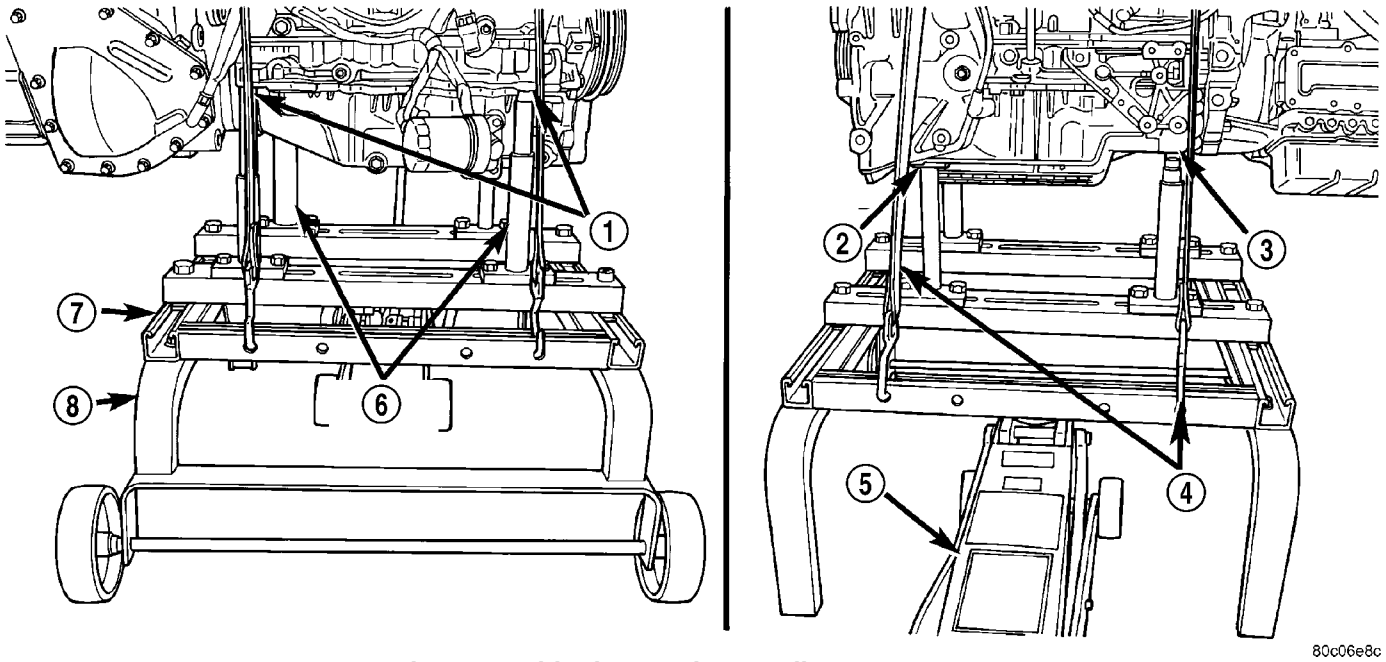


Fig. 13 Positioning Engine Cradle Support Post

1 - POST LOCATING HOLES IN BLOCK
2 - POST POSITIONED UNDER BRACKET
3 - POST LOCATING HOLE IN STRUT
4 - SAFETY STRAPS
5 - FLOOR JACK
6 - SPECIAL TOOL 6848
7 - SPECIAL TOOL 6135
8 - SPECIAL TOOL 6710

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

(19) Install right inner splash shield.

(20) Install wheels and lower vehicle.

(21) Install cooling module assembly, and connect radiator fan electrical connector.

(22) Connect power steering hoses to radiator.

(23) Connect clutch hydraulic line (Fig. 5).

(24) Connect transmission shift linkage.

(25) 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.

(26) Connect A/C lines at junction near upper torque strut.

(27) Connect upper A/C line to A/C condenser.

(28) Install upper and lower radiator hoses.

(29) Connect fuel line and heater hoses.

(30) Connect coolant reserve/recovery hose to coolant outlet connector.

(31) Connect brake booster vacuum hose to intake manifold.

(32) Connect the proportional purge hose to throttle body.

(33) Install all ground straps and connect engine wiring harness.

(34) Position PDC and install bolts.

(35) Connect positive battery cable to PDC and ground wire to vehicle body.

(36) Connect engine wiring harness at Powertrain Control Module (PCM).

(37) Connect throttle and speed control cables.

(38) Install battery tray and battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - INSTALLATION).

(39) Connect cables to battery.

(40) Install air cleaner housing assembly and connect clean air hose (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(41) Install oil filter. Fill engine crankcase with proper oil to correct level.

(42) Fill power steering system.

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

(44) Evacuate and recharge A/C system (Refer to 24 - HEATING & AIR CONDITIONING - STANDARD PROCEDURE).

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

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

(47) Adjust transmission linkage, if necessary.

ENGINE 2.4L DOHC (Continued)

SPECIFICATIONS

2.4L ENGINE

GENERAL SPECIFICATIONS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Type	In-Line OHV, DOHC	
Number of Cylinders	4	
Firing Order	1-3-4-2	
Compression Ratio		
Non-Turbo	9.5:1	
Turbo	8.1:1	
Max. Variation Between Cylinders	25%	
Displacement	2.4 Liters	148 cu. in.
Bore	87.5 mm	3.445 in.
Stroke	101.0 mm	3.976 in.
Compression Pressure	1172-1551 kPa	170-225 psi

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		
Non-Turbo	87.463-87.481 mm	3.4434-3.4441 in.
Turbo	87.436-87.454 mm	3.4424-3.4431 in.
Clearance @ 14 mm (0.551 in.) from bottom of skirt (Non-Turbo)	0.024-0.057 mm	0.0009-0.0022 in.
Clearance @ 22 mm (0.866 in.) from bottom of skirt (Turbo)	0.046-0.064 mm	0.0018-0.0025 in.
Weight	331-339 grams	11.67-11.95 oz.
Land Clearance (Diametrical)		
Non-Turbo	0.614-0.664 mm	0.024-0.026 in.
Turbo	0.556-0.674 mm	0.021-0.027 in.
Piston Length		
Non-Turbo	66.25 mm	2.608 in.
Turbo	61.43 mm	2.419 in.
Piston Ring Groove Depth No. 1		
Non-Turbo	4.640-4.784 mm	0.182-0.188 in.
Turbo	3.713-3.882 mm	0.146-0.153 in.
Piston Ring Groove Depth No. 2		
Non-Turbo	4.575-4.719 mm	0.180-0.185 in.
Turbo	4.118-4.297 mm	0.162-0.169 in.
Piston Ring Groove Depth No. 3		
Non-Turbo	4.097-4.236 mm	0.161-0.166 in.
Turbo	2.818-2.967 mm	0.110-0.116 in.

ENGINE 2.4L DOHC (Continued)

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance in Piston		
Non-Turbo	0.005-0.018 mm	0.0002-0.0008 in.
Turbo	0.004-0.014 mm	0.0001-0.0005 in.
Clearance in Connecting Rod		
Non-Turbo	Interference	
Turbo	0.007-0.018 mm	0.0002-0.0007 in.
Diameter		
Non-Turbo	21.99822.003 mm	0.8660-0.8662 in.
Turbo	21.997-22.000 mm	0.8660-0.8661 in.
End Play		
Non-Turbo	None	
Turbo	0.34-1.44 mm	0.0133-0.0566 in.
Length		
Non-Turbo	72.75-73.25 mm	2.864-2.883 in.
Turbo	65.41-65.85 mm	2.575-2.592 in.

PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Ring Gap-Top Compression Ring		
Non-Turbo	0.25-0.51 mm	0.0098-0.020 in.
Turbo	0.20-0.40 mm	0.0078-0.0157 in.
Wear Limit	0.8 mm	0.031 in.
Ring Gap-2nd Compression Ring		
Non-Turbo	0.23-0.48 mm	0.009-0.018 in.
Turbo	0.20-0.40 mm	0.007-0.015 in.
Wear Limit	0.8 mm	0.031 in.
Ring Gap-Oil Control Steel Rails		
Non-Turbo	0.25-0.64 mm	0.009-0.025 in.
Turbo	0.15-0.66 mm	0.005-0.025 in.
Wear Limit	1.0 mm	0.039 in.
Ring Side Clearance-Compression Rings		
Non-Turbo	0.030-0.080 mm	0.0011-0.0031 in.
Turbo	0.035-0.085 mm	0.001-0.003 in.
Wear Limit	0.10 mm	0.004 in.
Ring Side Clearance-Oil Ring Pack		
Non-Turbo	0.012-0.178 mm	0.0004-0.0070 in.
Turbo	0.027-0.176 mm	0.001-0.006 in.
Ring Width-Compression Rings		
Non-Turbo	1.47-1.50 mm	0.057-0.059 in.
Turbo Top Ring	1.17-1.19 mm	0.0460-0.0468 in.
Turbo 2nd Ring	1.472-1.49 mm	0.057-0.058 in.
Ring Width-Oil Ring Pack		
Non-Turbo	2.72–2.88 mm	0.107–0.1133 in.
Turbo	2.64-2.89 mm	0.103-0.113 in.

ENGINE 2.4L DOHC (Continued)

CONNECTING ROD

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bearing Clearance	0.025–0.071 mm	0.0009–0.0027 in.
Wear Limit	0.075 mm	0.003 in.
Bore Diameter-Piston Pin		
Non-Turbo	20.96–20.98 mm	0.8252–0.8260 in.
Turbo	22.007-22.015 mm	0.8664-0.8667 in.
Bore Diameter-Crankshaft End		
Non-Turbo	52.993-53.007 mm	2.0863-2.0868 in.
Turbo	52.992-53.008 mm	2.0862-2.0869 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)		
Non-Turbo	565.8 grams	19.96 oz.
Turbo	663.5 grams	23.4 oz.

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Connecting Rod Journal Diameter	49.984 - 50.000 mm	1.968 - 1.9685 in.
Main Bearing Journal Diameter	59.992 - 60.008 mm	2.362 - 2.3625 in.
Journal Out-of-Round (Max.)	0.0035 mm	0.0003 in.
Journal Taper (Max.)	0.007 mm	0.0001 in.
End Play	0.09 - 0.24 mm	0.0035 - 0.0094 in.
Wear Limit	0.38 mm	0.015 in.
Main Bearing Diametrical Clearance	0.018 - 0.062 mm	0.0007 - 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

DSECRIPTION	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 - 0.17 mm	0.0019 - 0.0066 in.
Lift (Zero Lash)		
Intake	8.25 mm	(0.324 in.)
Exhaust	6.60 mm	(0.259 mm)
Intake Valve Timing*		
Closes (ABDC)	51°	
Opens (BTDC)	1°	
Duration	232°	
Exhaust Valve Timing*		
Closes (ATDC)	7°	
Opens (BBDC)	47°	
Duration	234°	
Valve Overlap	8°	

* All reading in degrees. Timing points @4° from top of ramp.

ENGINE 2.4L DOHC (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 - 34.63 mm	1.353 - 1.363 in.
Seat Diameter - Exhaust	27.06 - 27.32 mm	1.065 - 1.075 in.
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	1.2 - 1.7 mm	0.047 - 0.066 in.
Service Limit	0.95 mm	(.0037 in.)
Exhaust	0.985 - 1.315 mm	0.038 - 0.051 in.
Service Limit	1.05 mm	.039 in.

VALVE STEM TIP

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

ENGINE 2.4L DOHC (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.
Service Limit	0.25 mm	0.010 in.
Exhaust	0.0736 - 0.094 mm	0.0029 - 0.0037 in.
Max. Allowable	0.101 mm	0.004 in.
Service Limit	0.25 mm	0.010 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.)	0.025 mm	0.001 in.
Inner Rotor Thickness (Min.)	9.40 mm	0.370 in.
Outer Rotor Thickness (Min.)	9.40 mm	0.370 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

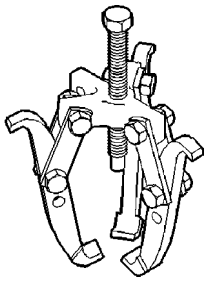
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Balance Shaft Carrier to Block-Bolts	54	40	-
Balance Shaft Gear Cover-Double Ended Fastener	12	-	105
Balance Shaft Sprocket-Bolt	28	-	250
Balance Shaft Chain Tensioner-Bolts	12	-	105
Balance Shaft Carrier Cover-Bolts	12	-	105
Camshaft Sprocket-Bolt	115	85	-
Connecting Rod Cap-Bolts	27 +¼ turn	20 +¼ turn	-
Crankshaft Main Bearing Cap/Bedplate			
-M8 Bolts	28	-	250
-M11 Bolts	75	55	-
Crankshaft Damper-Bolt	136	100	-
Crankshaft Target Ring	13	-	110
Cylinder Head-Bolts	Refer to Procedure		
Cylinder Head Cover-Bolts	12	-	105
Flex Plate to Crankshaft-Bolts	95	70	-

ENGINE 2.4L DOHC (Continued)

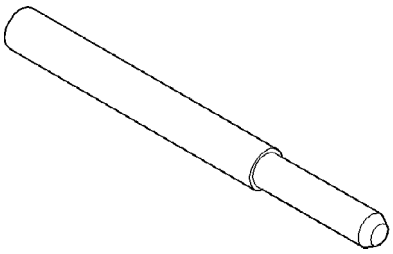
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Engine Support Bracket-Bolts	61	45	-
Intake Manifold-Bolts	23	-	200
Intake Manifold Support Bracket	28	20	-
Oil Cooler Connector Bolt	55	41	-
Oil Filter	14	10	-
Oil Filter Adapter-Bolts	12	-	105
Oil Jet Fastener	12	-	105
Oil Pan-Bolts	12	-	105
Oil Pan Drain-Plug	28	20	-
Oil Pump to Block-Bolts	28	20	-
Oil Pump Cover Plate-Bolts	13	-	118
Oil Pump Pick-up Tube-Bolt	23	-	200
PCV Valve	8	-	70
Spark Plugs	18	13	-
Timing Belt Cover - Front Upper and Lower-Bolts	6	-	50
Timing Belt Cover - Rear			
-M6 Bolts	12	-	105
-M8 Bolts	28	-	250
Timing Belt Idler Pulley	61	45	-
Timing Belt Tensioner Lock Bolt	25	-	220
Timing Belt Tensioner Assembly-Bolts	61	45	-

SPECIAL TOOLS

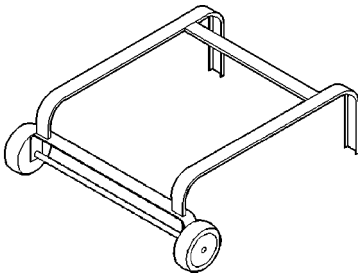
2.4L ENGINE



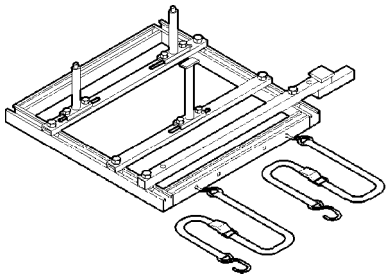
Puller 1026



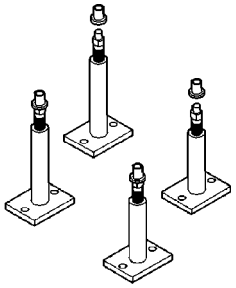
Crankshaft Damper Removal Insert 6827A



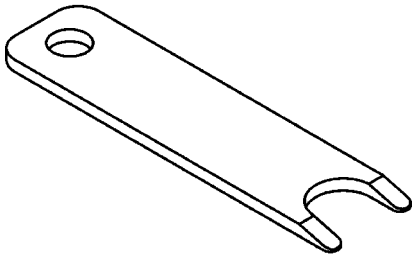
Dolly 6135



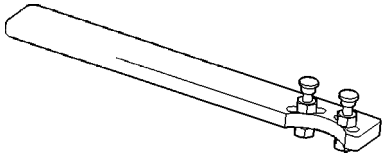
Cradle 6710



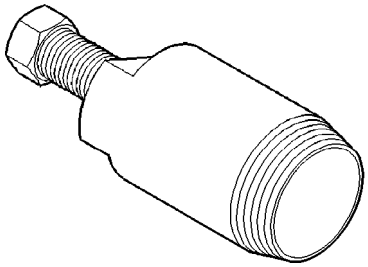
Post Kit Engine Cradle 6848



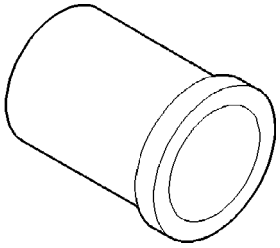
Clutch Line Disconnect 6638A



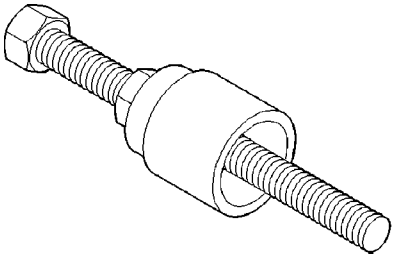
Camshaft Sprocket Holder 6847



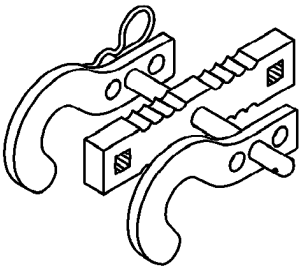
Camshaft Seal Remover C-4679-A



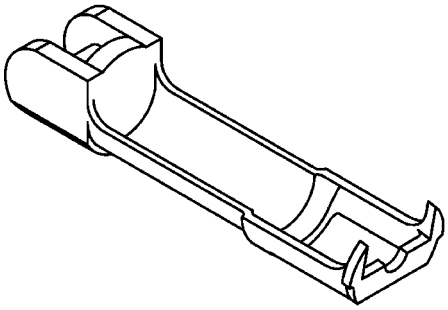
Camshaft Seal Installer MD-998306



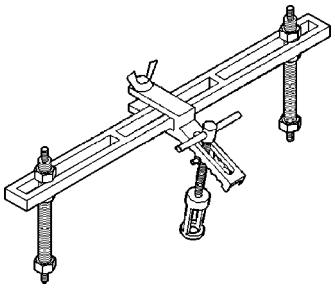
Crankshaft Damper/Sprocket Installer 6792



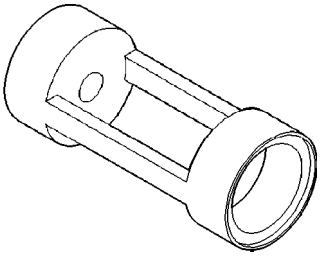
Valve Spring Compressor 8215-A



Adaptor 8436

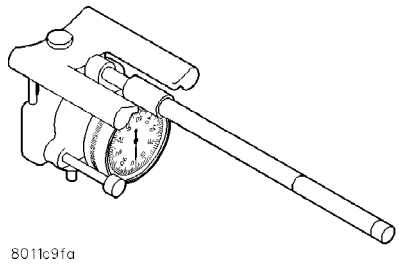


Valve Spring Compressor MD-998772-A

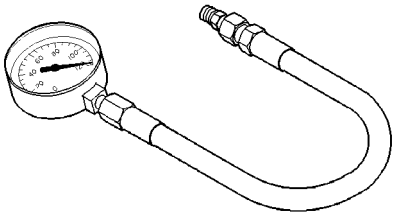


Valve Spring Compressor Adapter 6779

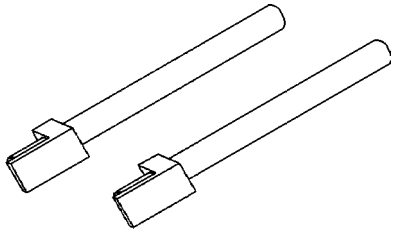
ENGINE 2.4L DOHC (Continued)



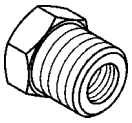
Cylinder Bore Gage C-119



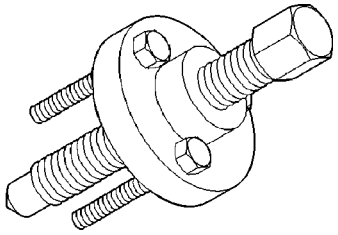
Oil Pressure Gage C-3292



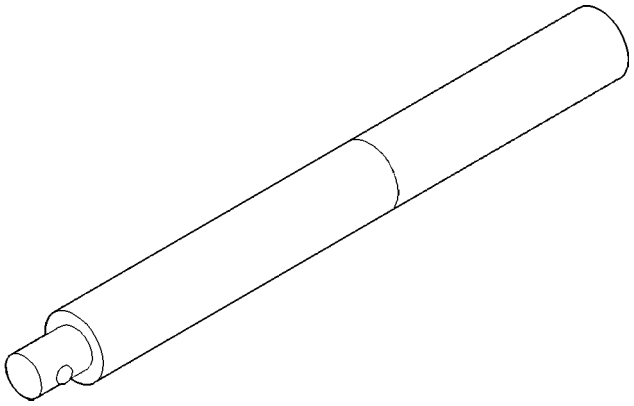
Connecting Rod Guides 8189



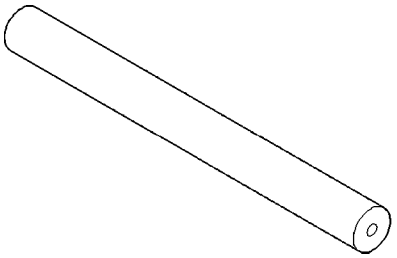
Adaptor 8406



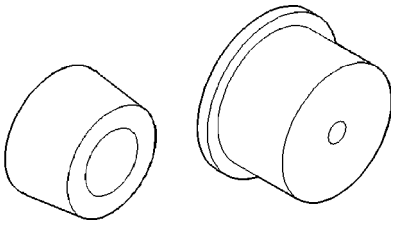
Crankshaft Sprocket Remover 6793



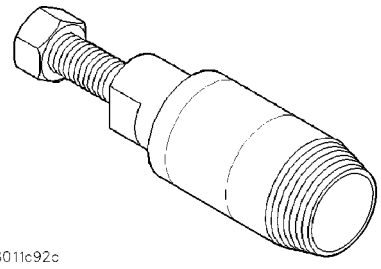
Driver Handle C-4171



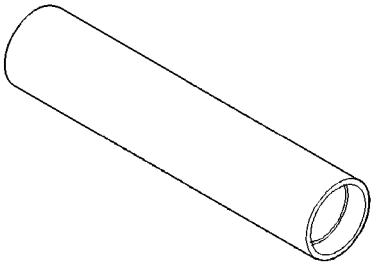
Crankshaft Sprocket Remover Insert C-4685-C2



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

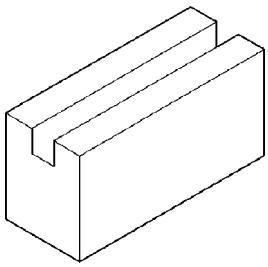


Crankshaft Front Seal Remover 6771

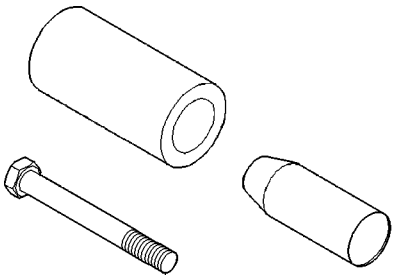


Balance Shaft Sprocket Installer 6052

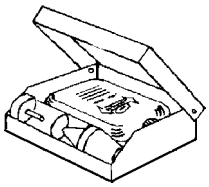
ENGINE 2.4L DOHC (Continued)



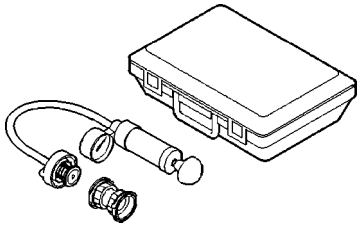
Post Adapter 8130



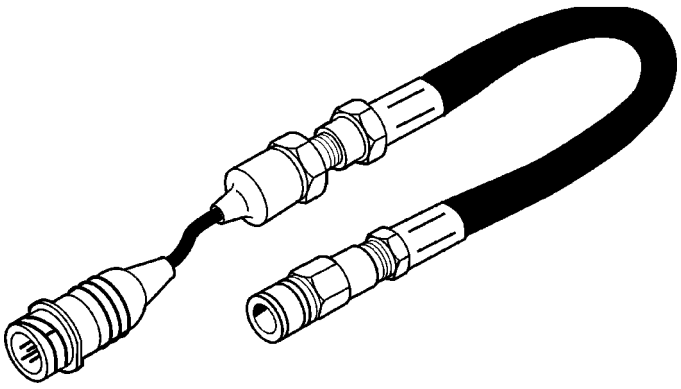
Front Crankshaft Oil Seal Installer 6780



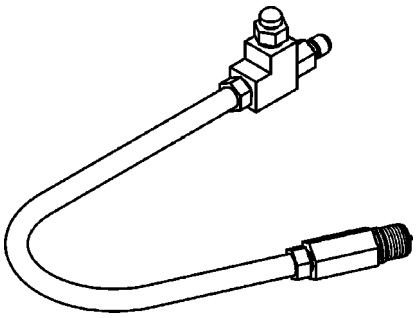
Combustion Leak Tester C-3685-A



Cooling System Tester 7700



Pressure Transducer CH7059



Cylinder Compression Pressure Adaptor 8116

DRB III® with PEP Module OT-CH6010A

AIR CLEANER ELEMENT

REMOVAL

(1) Remove the air cleaner housing cover screws (Fig. 14).
(2) Partially raise air cleaner housing cover.
(3) Remove air cleaner element.
(4) If necessary, clean the inside of the air cleaner housing.

INSTALLATION

(1) Install the air filter element on locator (Fig. 15) and then make sure that the element is locked in at the lip in the air cleaner housing (Fig. 16).
(2) Lower air cleaner housing cover until properly seated.
(3) Install the air cleaner housing cover screws (Fig. 14).

AIR CLEANER ELEMENT (Continued)

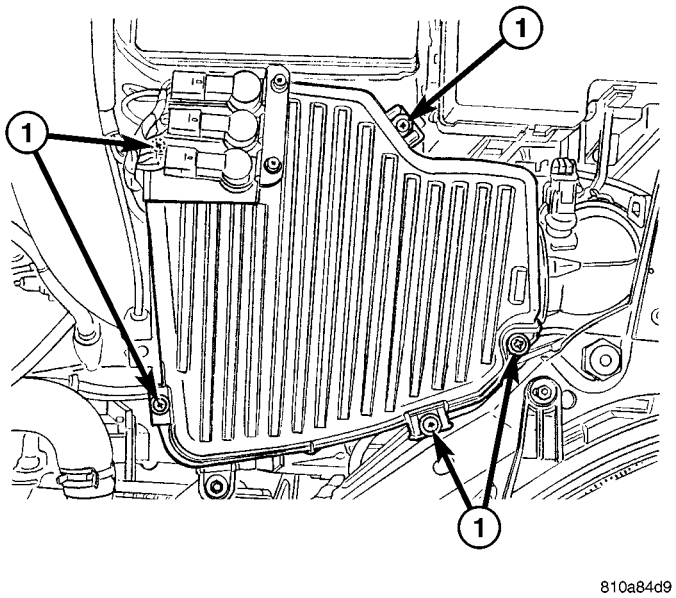


Fig. 14 Air Cleaner Housing Cover

1 - AIR CLEANER HOUSING COVER SCREWS (5)

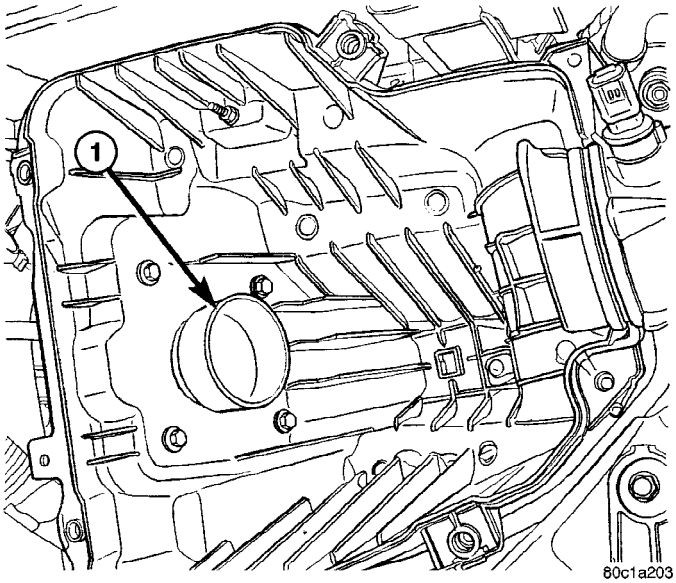


Fig. 15 Element Locator

1 - ELEMENT LOCATOR

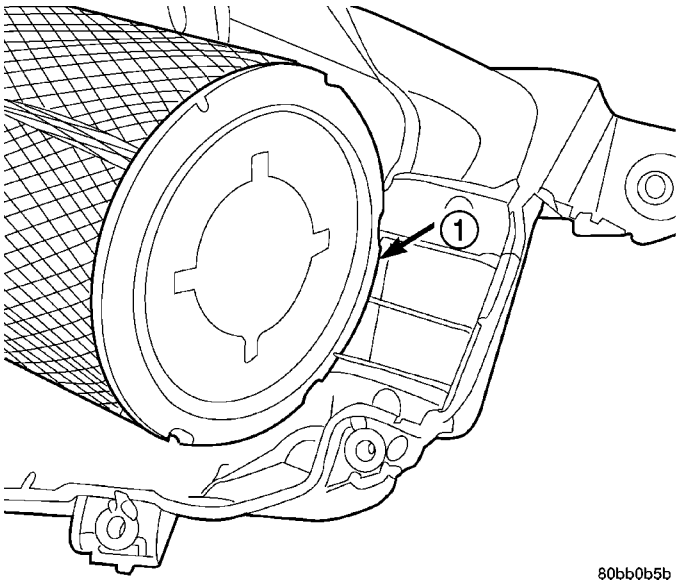


Fig. 16 Air Cleaner Housing Lip

1 - LIP

AIR CLEANER HOUSING

REMOVAL

(1) Disconnect clean air hose from air cleaner housing (Fig. 17).

(2) Disconnect ambient air temperature sensor (Fig. 17).

(3) Remove turbocharger solenoid bracket mounting screws (Fig. 17). Reposition turbocharger solenoid bracket.

(4) Disconnect make-up air hose from the side of air cleaner housing.

(5) Dislodge wiring harness clips on the side of the air cleaner housing.

(6) Remove air cleaner housing mounting screw and nut (Fig. 17).

(7) Pull air cleaner housing straight up to remove.

INSTALLATION

(1) Install air cleaner housing. Make sure that it is on the battery tray tab in the back and on the stud on the side.

(2) Install the nut and screw for air cleaner housing (Fig. 17). Tighten fasteners to 7.3 N·m (65 in. lbs.).

(3) Insert wiring harness clips on the side of the air cleaner housing.

(4) Connect make-up air hose to the side of air cleaner housing.

(5) Install turbocharger solenoid bracket mounting screws (Fig. 17).

(6) Connect ambient air temperature sensor (Fig. 17).

AIR CLEANER HOUSING (Continued)

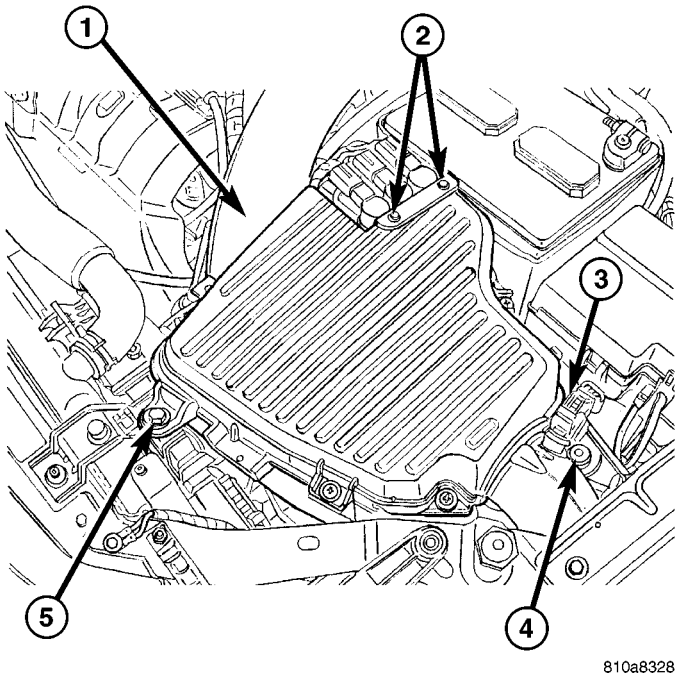


Fig. 17 Air Cleaner Housing Mounting

1 - CLEAN AIR HOSE
2 - SOLENOID MOUNTING BRACKET SCREWS
3 - AMBIENT AIR TEMPERATURE SENSOR
4 - AIR CLEANER HOUSING MOUNTING NUT
5 - AIR CLEANER HOUSING MOUNTING SCREW

(7) Connect clean air hose to air cleaner housing (Fig. 17).

CYLINDER HEAD

DESCRIPTION

The cross flow designed, aluminum cylinder head contains dual over-head camshafts with four valves per cylinder (Fig. 18). 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 multi-layer steel head gasket and retaining bolts.

Integral oil galleries provide lubrication passages to the hydraulic lash adjusters, camshafts, 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

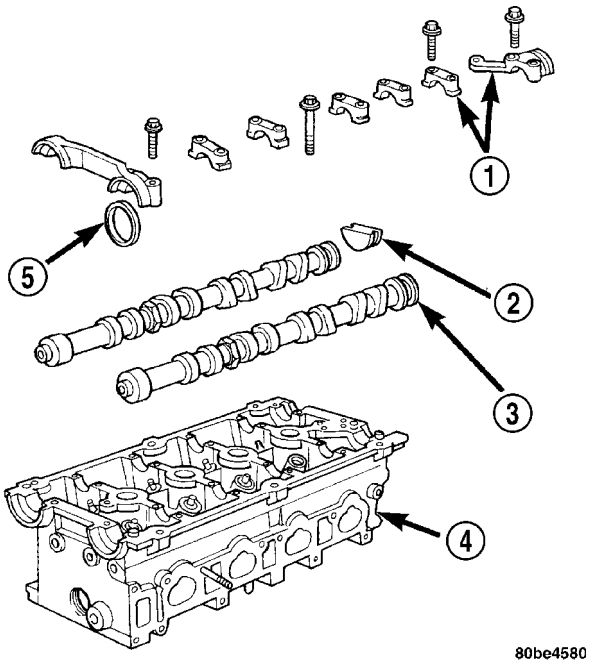


Fig. 18 Cylinder Head and Camshafts

1 - CAMSHAFT BEARING CAPS
2 - PLUG
3 - CAMSHAFT
4 - CYLINDER HEAD
5 - CAMSHAFT OIL SEAL

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.

CYLINDER HEAD (Continued)

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 cable from battery.

(3) Remove clean air hose and air cleaner housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).

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

(5) Disconnect the fuel supply line quick-connect at the fuel rail assembly (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).

(6) Remove heater tube support bracket from cylinder head.

(7) Remove upper radiator hose. Disconnect heater hoses from thermostat housing.

(8) Disconnect engine coolant temperature sensor connector.

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

(10) Disconnect exhaust pipe from manifold.

(11) Remove turbocharger heat shields (Fig. 19)

(12) Remove elbow support bracket (Fig. 19)

(13) Remove turbocharger support bracket (Fig. 19)

(14) Remove elbow (Fig. 19)

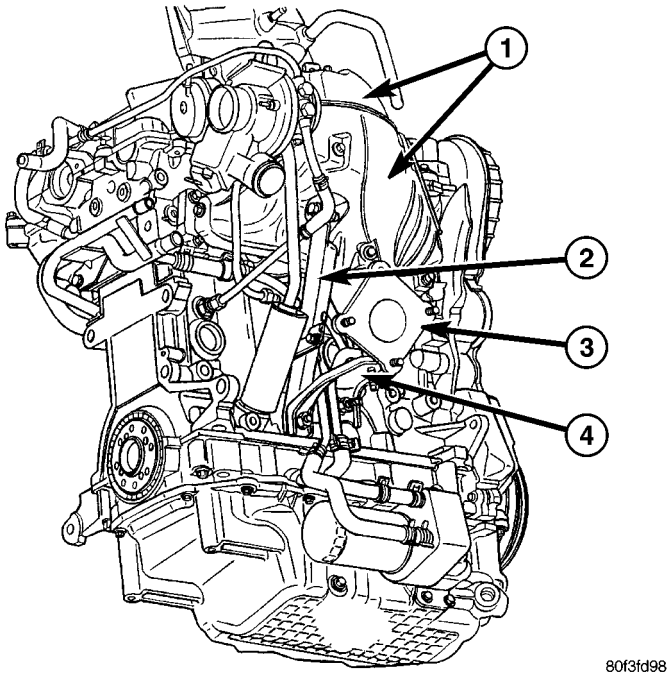


Fig. 19 Turbocharger Brackets and Heat Shields

1 - UPPER/LOWER HEAT SHIELDS
2 - TURBOCHARGER SUPPORT BRACKET
3 - ELBOW
4 - ELBOW SUPPORT BRACKET

(15) Remove oil return tube (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/LINES AND HOSES - REMOVAL) (Fig. 20).

(16) Remove oil supply line (Fig. 20).

(17) Remove coolant supply line (Fig. 20).

(18) Remove coolant return line (Fig. 20).

(19) Disconnect ignition coil wiring connector. Remove ignition coil and plug wires from engine.

(20) Disconnect camshaft position sensor wiring connector.

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

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

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

(24) Remove camshafts (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - REMOVAL).

(25) Remove rocker arms.

(26) Remove cylinder head bolts in the reverse sequence of tightening (Fig. 26).

(27) Remove cylinder head from engine block.

(28) Inspect and clean cylinder head and block sealing surfaces. Refer to Cleaning and Inspection in this section for procedures.

CYLINDER HEAD (Continued)

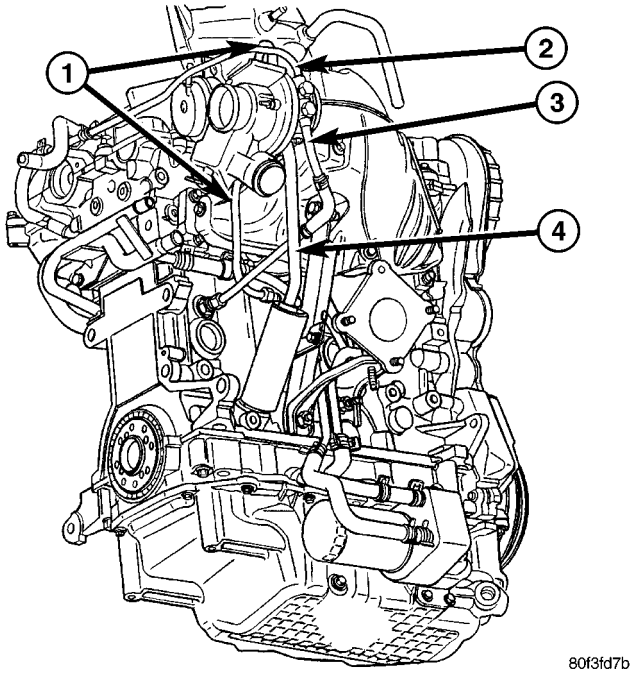


Fig. 20 Turbocharger Lines and Hoses

1 - OIL SUPPLY LINE
2 - COOLANT RETURN LINE
3 - COOLANT SUPPLY LINE
4 - OIL RETURN TUBE

NOTE: Ensure cylinder head bolt holes in the block are clean, dry (free of residual oil or coolant), and threads are not damaged.

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. 21).

(2) Inspect camshaft bearing journals for scoring.

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

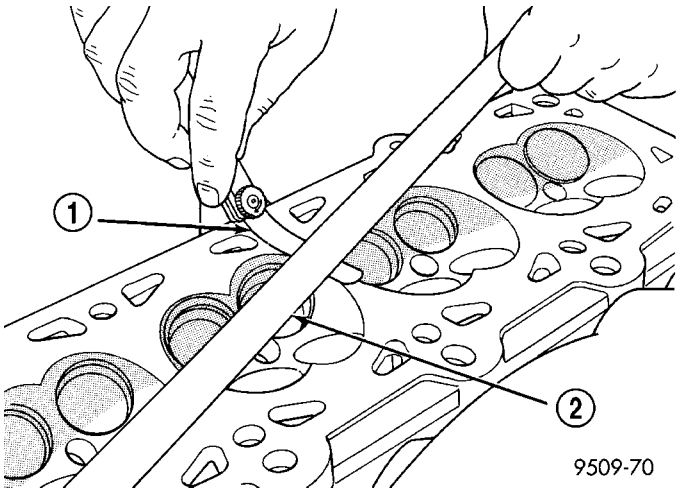


Fig. 21 Checking Cylinder Head Flatness

1 - FEELER GAUGE
2 - STRAIGHT EDGE

(4) Using a small hole gauge and a micrometer, measure valve guides in 3 places top, middle and bottom (Fig. 22). (Refer to 9 - ENGINE - SPECIFICATIONS) Replace guides if they are not within specification.

(5) Check valve guide height (Fig. 23).

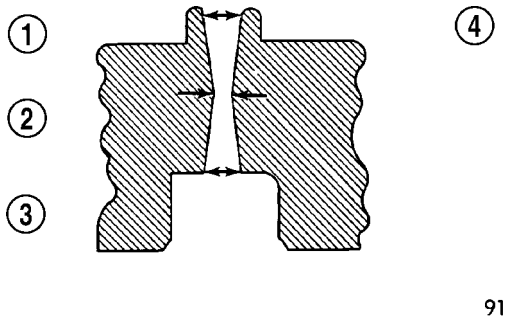


Fig. 22 Checking Wear on Valve Guide—Typical

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

INSTALLATION - CYLINDER HEAD

NOTE: The Cylinder head bolts should be examined BEFORE reuse. If the threads are necked down, the bolts should be replaced (Fig. 24).

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 should be replaced.

NOTE: Head gaskets for Non-Turbo and Turbo applications are NOT interchangeable.

CYLINDER HEAD (Continued)

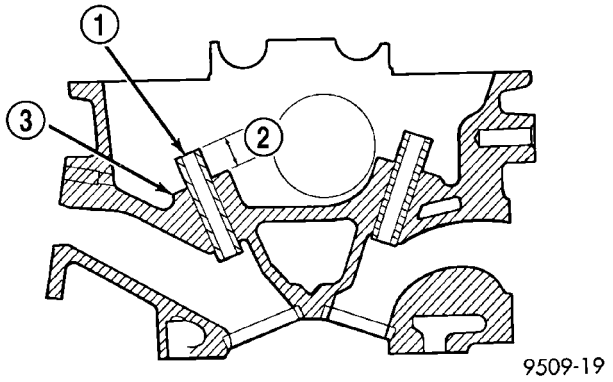


Fig. 23 Valve Guide Height

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

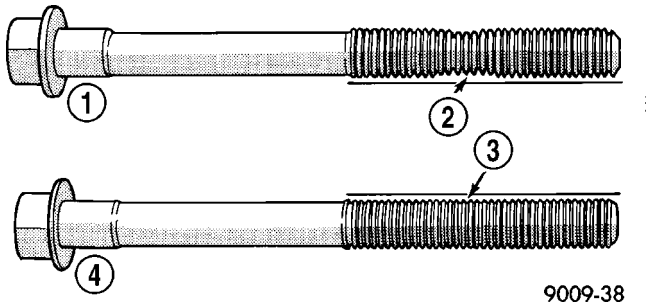


Fig. 24 Checking Bolts for Stretching (Necking)

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

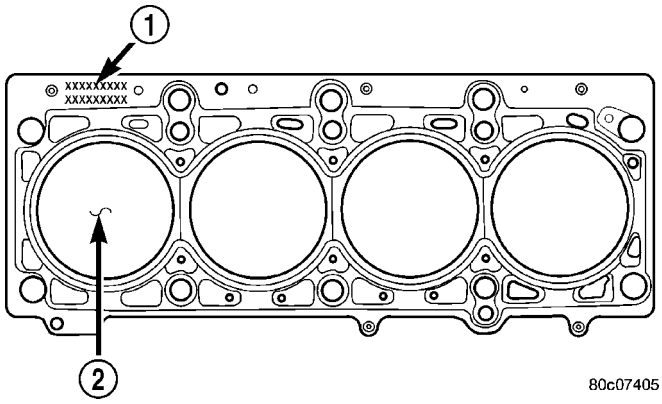


Fig. 25 Cylinder Head Gasket Positioning

1 - PART NUMBER FACES UP
2 - NO. 1 CYLINDER

(1) Position the new cylinder head gasket on engine block with the part number facing up (Fig. 25). Ensure gasket is seated over the locating dowels in block.

(2) Position cylinder head onto engine block.

(3) Before installing the bolts, the threads should be lightly coated with engine oil.

(4) Tighten the cylinder head bolts in the sequence shown in (Fig. 26). Using the 4 step torque-turn method, tighten according to the following values:

- First: All to 34 N·m (25 ft. lbs.)
- Second: All to 68 N·m (50 ft. lbs.)
- Third: All to 68 N·m (50 ft. lbs.)

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

- **Fourth: Turn all bolts an additional 1/4 Turn**

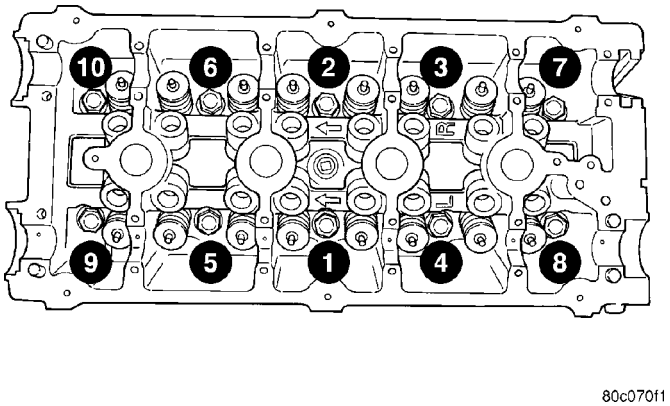


Fig. 26 Cylinder Head Tightening Sequence

(5) Install rocker arms and camshafts (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - INSTALLATION).

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

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

(8) Install camshaft sprockets and timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION).

(9) Connect cam sensor wiring connector.

(10) Install ignition coil and plug wires. Connect ignition coil wiring connector.

(11) Install coolant return line (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/LINES AND HOSES - INSTALLATION) (Fig. 20)

(12) Install coolant supply line (Fig. 20).

(13) Install oil supply line (Fig. 20).

(14) Install oil return tube (Fig. 20).

(15) Install exhaust elbow (Fig. 19)

(16) Install turbocharger support bracket (Fig. 19)

(17) Install elbow support bracket (Fig. 19)

(18) Install turbocharger heat shields (Fig. 19)

(19) Install exhaust pipe to manifold. Tighten fasteners to 28 N·m (20 ft. lbs.) (Fig. 19).

CYLINDER HEAD (Continued)

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

(21) Connect engine coolant temperature sensor connector.

(22) Connect upper radiator hose. Connect heater hoses to thermostat housing.

(23) Install heater tube support bracket to cylinder head.

(24) Install lower intake manifold support bracket (Fig. 19).

(25) Connect fuel supply line quick-connect at the fuel rail assembly (Refer to 14 - FUEL SYSTEM/ FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).

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

(27) Install clean air hose and air cleaner housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(28) Connect negative cable to battery.

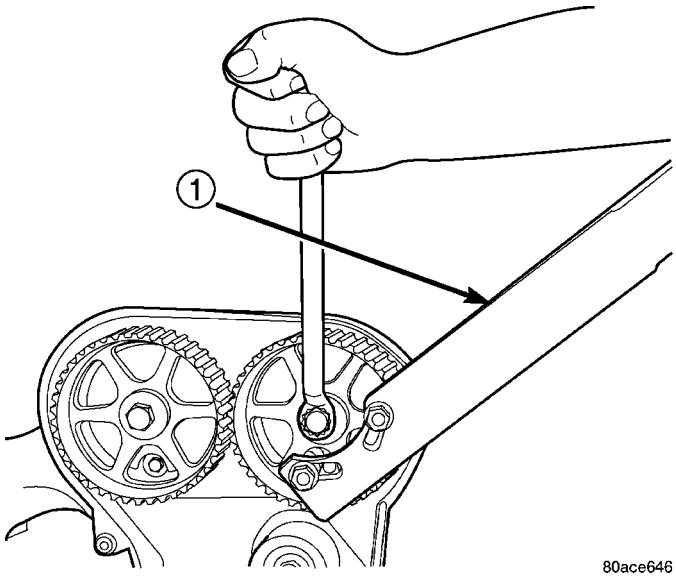


Fig. 27 Camshaft Sprocket - Removal/Installation

1 - SPECIAL TOOL 6847

CAMSHAFT OIL SEAL(S)

REMOVAL

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

(2) Hold each camshaft sprocket with Special Tool 6847 while removing center bolt (Fig. 27).

(3) Remove camshaft sprockets.

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

(5) Remove camshaft seal using Special Tool C-4679A (Fig. 28).

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

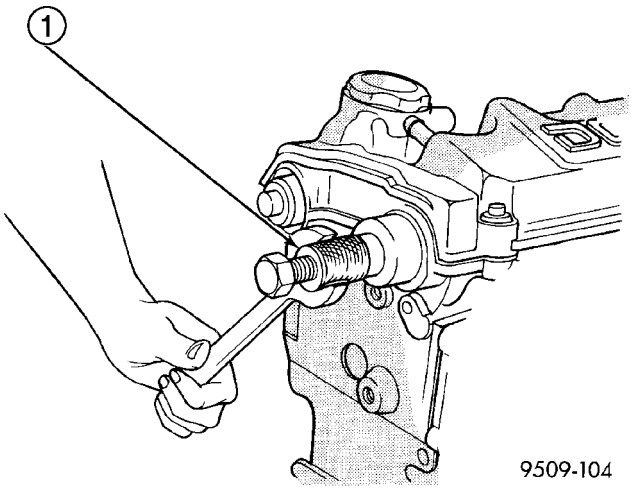


Fig. 28 Camshaft Oil Seal - Removal With C-4679A

1 - SPECIAL TOOL C-4679

INSTALLATION

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

(2) Install camshaft seals into cylinder head using Special Tool MD-998306 until flush with head (Fig. 29).

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

(4) Install camshaft sprockets. Hold each sprocket with Special Tool 6847 and tighten center bolt to 115 N·m (85 ft. lbs.) (Fig. 27).

(5) Install timing belt and front covers (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION) (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - INSTALLATION).

CAMSHAFT OIL SEAL(S) (Continued)

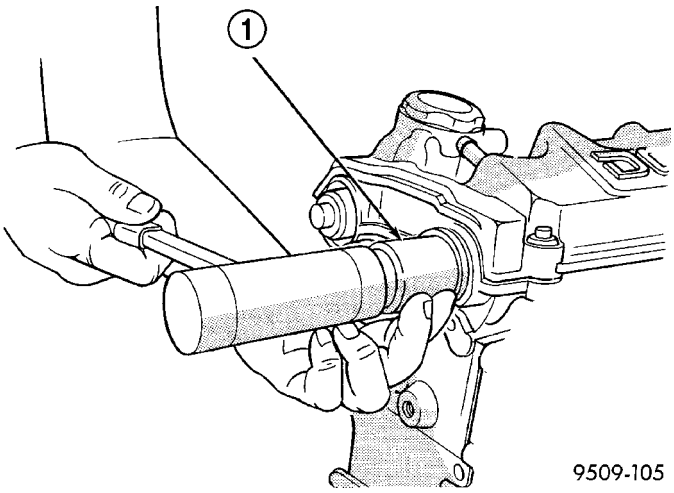


Fig. 29 Camshaft Seal - Installation

1 - SPECIAL TOOL MD-998306

CAMSHAFT(S)

DESCRIPTION

Both camshafts have six bearing journal surfaces and two cam lobes per cylinder (Fig. 30). Flanges at the rear journals control camshaft end play. Provision for a cam position sensor is located on the intake camshaft on the rear of the cylinder head. 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 - MEASURING CAMSHAFT END PLAY

(1) Oil camshaft journals and install camshaft **WITHOUT** rocker arms. Install rear cam caps and tighten screws to specified torque.

(2) Using a suitable tool, move camshaft as far rearward as it will go.

(3) Zero dial indicator (Fig. 31).

(4) Move camshaft as far forward as it will go.

(5) Record reading on dial indicator. For end play specification, (Refer to 9 - ENGINE - SPECIFICATIONS).

(6) If end play is excessive, check cylinder head and camshaft for wear; replace as necessary.

REMOVAL

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

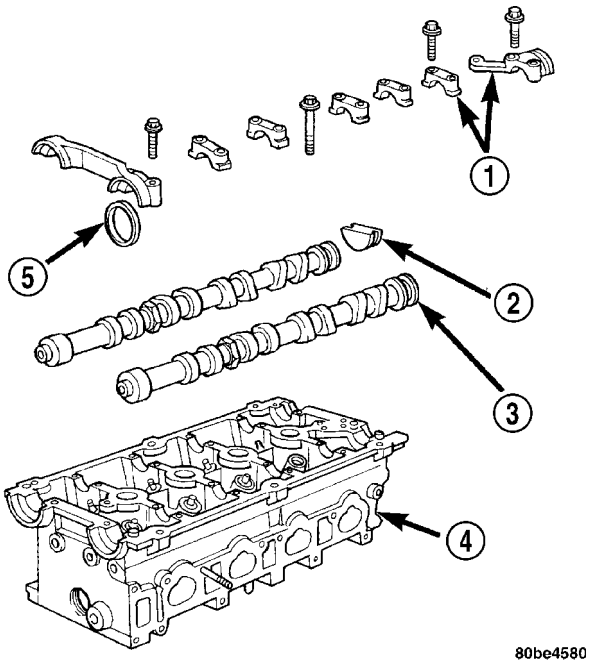


Fig. 30 Camshafts

1 - CAMSHAFT BEARING CAPS
2 - PLUG
3 - CAMSHAFT
4 - CYLINDER HEAD
5 - CAMSHAFT OIL SEAL

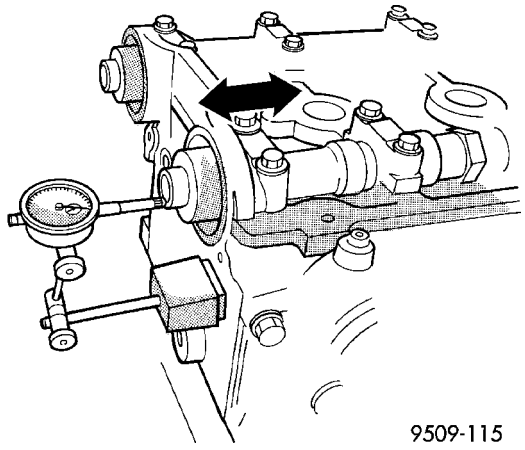


Fig. 31 Camshaft End Play - Typical

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

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

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

(5) Bearing caps are identified for location. Remove the outside bearing caps first (Fig. 32).

CAMSHAFT(S) (Continued)

(6) Loosen the camshaft bearing cap attaching fasteners in sequence shown (Fig. 33) one camshaft at a time.

CAUTION: Camshafts are not interchangeable. The intake cam number 6 thrust bearing face spacing is wider.

(7) Identify the camshafts before removing from the head. The camshafts are not interchangeable.
(8) Remove camshafts from cylinder head.

NOTE: If removing rocker arms, identify for reinstallation in the original position.

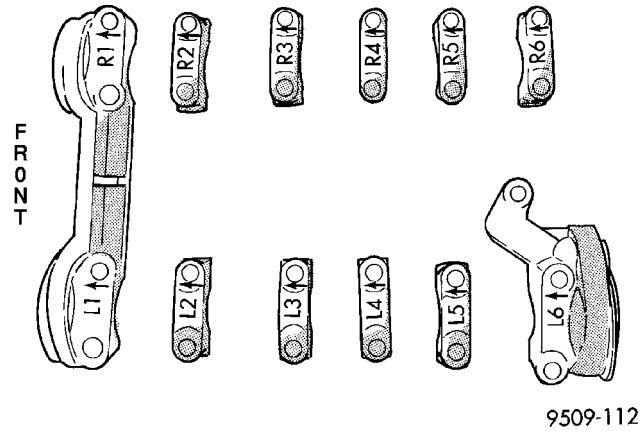


Fig. 32 Camshaft Bearing Cap Identification

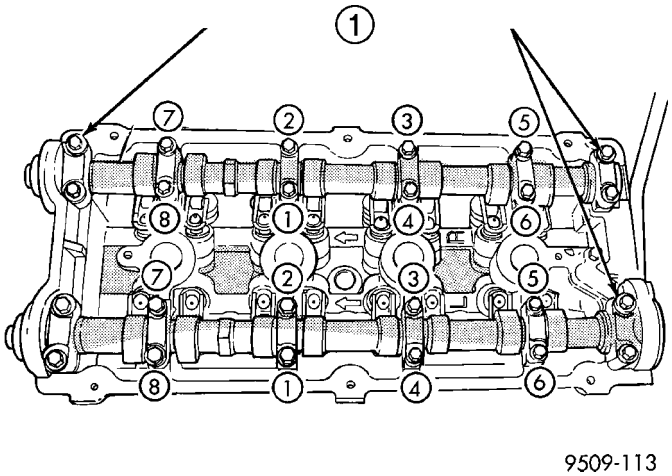


Fig. 33 Camshaft Bearing Cap - Removal

1 - REMOVE OUTSIDE BEARING CAPS FIRST

CLEANING

Clean camshaft with a suitable solvent.

INSPECTION

(1) Inspect camshaft bearing journals for damage and binding (Fig. 34). If journals are binding, check the cylinder head for damage. Also check cylinder head oil holes for clogging.

(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. 34) 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.).

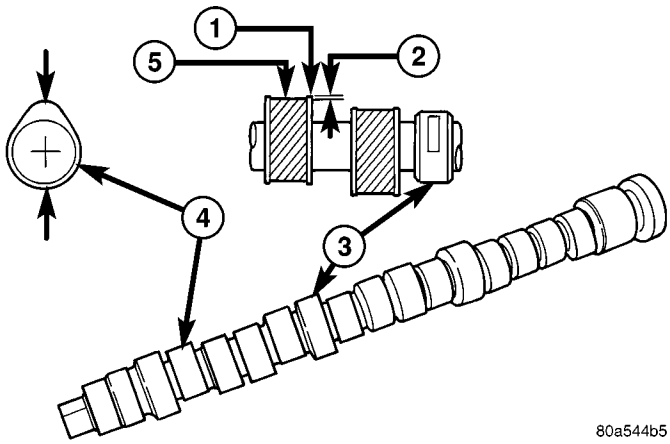


Fig. 34 Checking Camshaft(s) for Wear

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

INSTALLATION

CAUTION: Ensure that NONE of the pistons are at top dead center when installing the camshafts.

(1) Lubricate all camshaft bearing journals, rocker arms and camshaft lobes.
(2) Install all rocker arms in original positions, if reused.
(3) Position camshafts on cylinder head bearing journals. Install right and left camshaft bearing caps No. 2 – 5 and right No. 6. Tighten M6 fasteners to 12 N·m (105 in. lbs.) in sequence shown in (Fig. 35).
(4) Apply Mopar® Gasket Maker to No. 1 and No. 6 bearing caps (Fig. 36). Install bearing caps and tighten M8 fasteners to 28 N·m (250 in. lbs.).

NOTE: Bearing end caps must be installed before seals can be installed.

(5) Install camshaft oil seals (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT OIL SEAL(S) - INSTALLATION).
(6) Install camshaft target magnet and camshaft position sensor.

CAMSHAFT(S) (Continued)

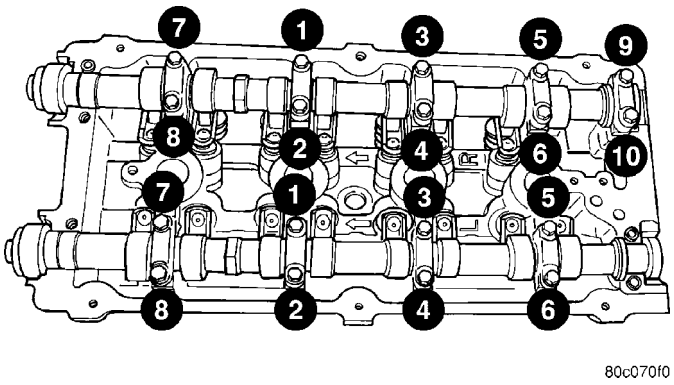


Fig. 35 Camshaft Bearing Cap Tightening Sequence

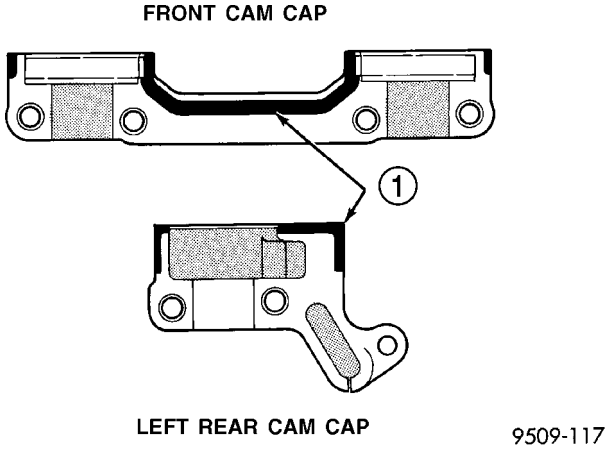


Fig. 36 Camshaft Bearing Cap Sealing

1 - 1.5 mm (.060 in.) DIAMETER BEAD OF MOPAR GASKET MAKER

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

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

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

CYLINDER HEAD COVER

REMOVAL

(1) Disconnect negative battery cable.

(2) Disconnect ignition coil connector.

(3) Disconnect spark plug wires and remove ignition coil (Fig. 37).

(4) Disconnect PCV and make-up air hoses from cylinder head cover (Fig. 37).

(5) Unclip wiring harness from cylinder head cover studs (Fig. 37).

(6) Remove nut securing coolant return line bracket to cylinder head cover stud (Fig. 38).

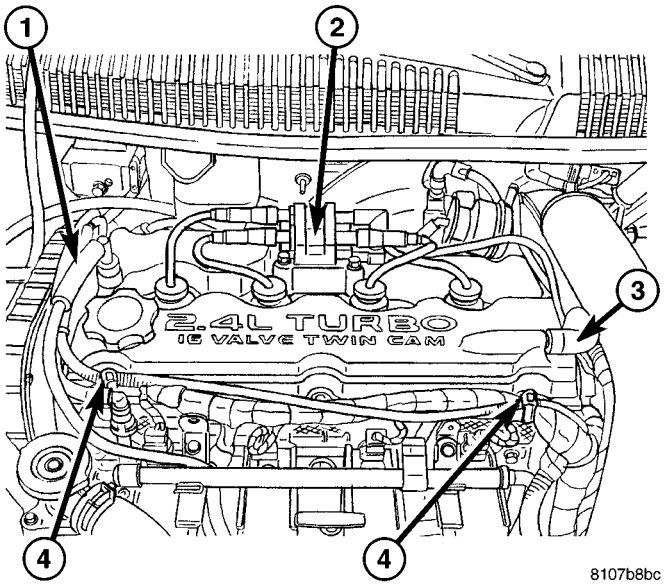


Fig. 37 PCV/Make-up Air Hoses & Ignition Coil

1 - PCV HOSE
2 - IGNITION COIL
3 - MAKE-UP AIR HOSE
4 - WIRING HARNESS CLIPS

NOTE: For reassembly purposes, note location of double ended studs.

(7) Remove cylinder head cover fasteners.

(8) Remove cylinder head cover from cylinder head.

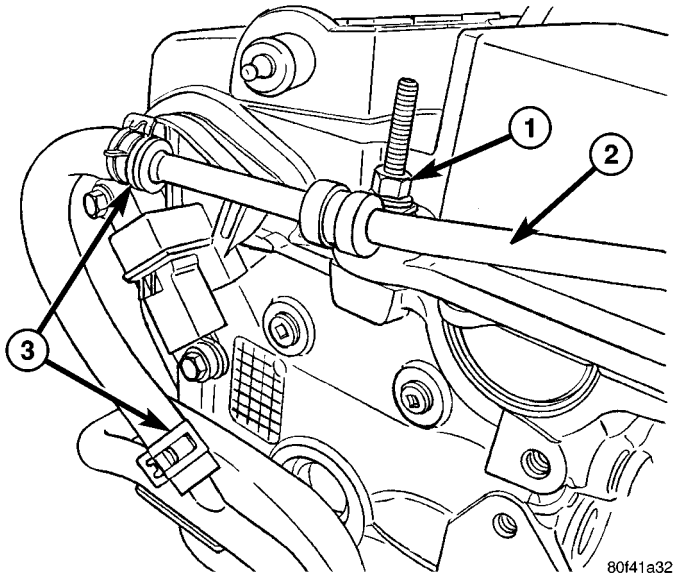


Fig. 38 Coolant Return Line Bracket

1 - NUT
2 - COOLANT RETURN LINE
3 - HOSE CLAMPS

CYLINDER HEAD COVER (Continued)

INSTALLATION

CAUTION: Do not allow oil or solvents to contact the timing belt as they can deteriorate the rubber and cause tooth skipping.

(1) Clean cylinder head cover sealing surface.
(2) Install new cylinder head cover gasket (Fig. 39) and spark plug well seals (Fig. 40).

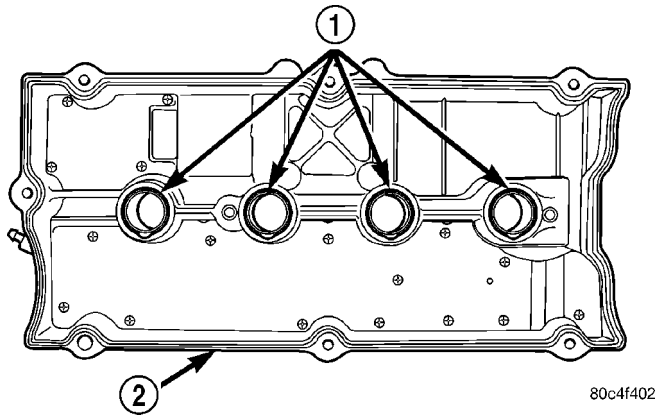


Fig. 39 Cylinder Head Cover Gasket and Spark Plug Well Seals

1 - SPARK PLUG WELL SEALS
2 - GASKET

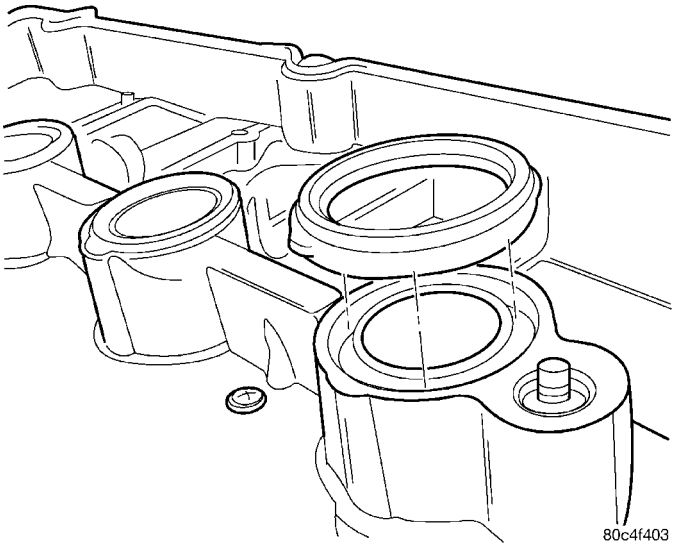


Fig. 40 Spark Plug Well Seals

(3) Apply Mopar® Engine RTV GEN II at the camshaft cap corners and at the top edges of the 1/2 round seal (Fig. 41).

NOTE: Inspect cylinder head cover fastener seal washers. Replace as necessary.

(4) Install cylinder head cover assembly to cylinder head. Install all fasteners, ensuring the double ended studs are in their proper location. Tighten fasteners in sequence shown in (Fig. 42). Using a 3 step torque method as follows:
(a) Tighten all bolts to 4.5 N·m (40 in. lbs.).
(b) Tighten all bolts to 9.0 N·m (80 in. lbs.).
(c) Tighten all bolts to 12 N·m (105 in. lbs.).

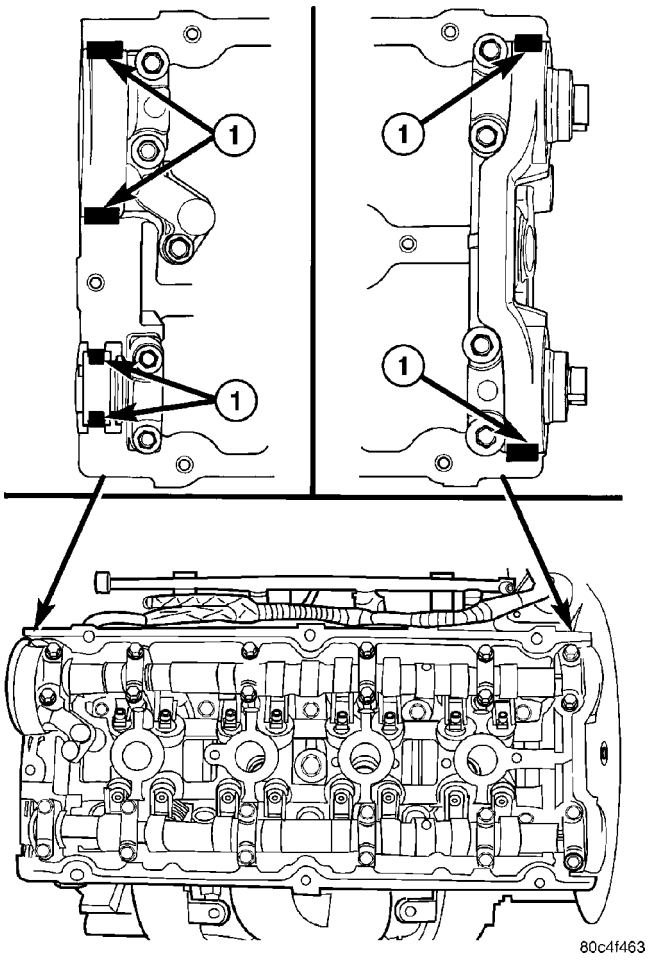


Fig. 41 Sealer Locations

1 – SEALER LOCATION

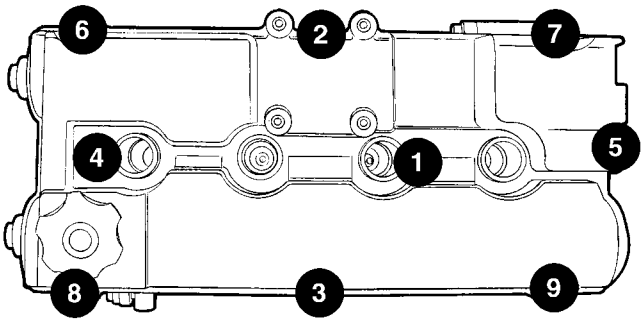


Fig. 42 Cylinder Head Cover Tightening Sequence

(5) Install nut securing coolant return line bracket to cylinder head cover stud (Fig. 38).

CYLINDER HEAD COVER (Continued)

(6) Clip wiring harness to cylinder head cover studs (Fig. 37).

(7) Install ignition coil and connect spark plug wires. Tighten ignition coil fasteners to 12 N·m (105 in. lbs.) (Fig. 37).

(8) Connect ignition coil connector.

(9) If the PCV valve was removed from cylinder head cover, apply Mopar® Thread Sealant with Teflon to threads and install valve to cylinder head cover. Tighten PCV valve to 8 N·m (70 in. lbs.).

(10) Connect PCV and make-up air hoses to cylinder head cover (Fig. 37).

(11) Connect negative battery cable.

HYDRAULIC LASH ADJUSTERS

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.

(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 cylinder 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) Rocker arm ears contacting valve spring retainer.

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

(10) 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

NOTE: This procedure is for in-vehicle service with camshafts installed.

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

(2) Remove rocker arm. (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARMS - REMOVAL)

(3) Remove hydraulic lash adjuster (Fig. 43).

(4) Repeat removal procedure for each hydraulic lash adjuster.

(5) If reusing, mark each hydraulic lash adjuster for reassembly in original position. Lash adjusters are serviced as an assembly.

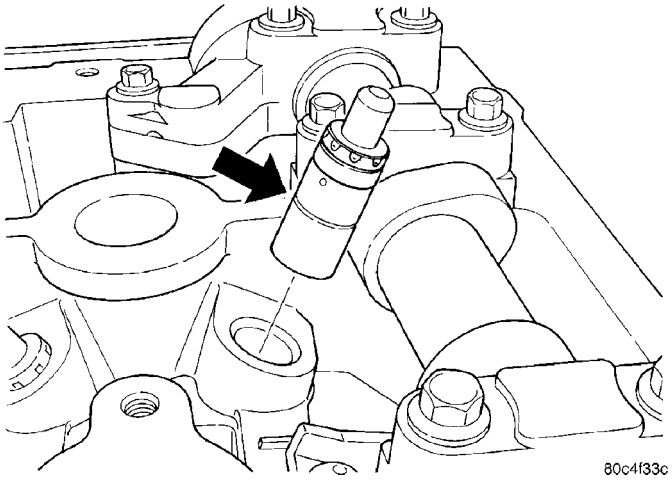


Fig. 43 Hydraulic Lash Adjuster

INSTALLATION

(1) Install hydraulic lash adjuster (Fig. 43). Ensure the lash adjusters are at least partially full of engine oil. This is indicated by little or no plunger travel when the lifter is depressed.

(2) Install rocker arm. (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARMS - INSTALLATION)

(3) Repeat installation procedure for each hydraulic lash adjuster.

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

INTAKE/EXHAUST VALVES & SEATS

DESCRIPTION

The valves are made of heat resistant steel. They have chrome plated stems to prevent scuffing. Viton rubber valve stem seals are integral with the spring seats. The valves have three-bead lock keepers to retain springs and to promote valve rotation.

OPERATION

The four valves per cylinder (two intake and two exhaust) are opened by using roller rocker arms which pivot on hydraulic lash adjusters.

CLEANING

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

ROCKER ARMS

REMOVAL

NOTE: This procedure is for in-vehicle service with camshafts installed.

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

(2) Remove spark plugs.

(3) Rotate engine until the camshaft lobe, on the follower being removed, is positioned on its base circle (heel). Also, the piston should be a minimum of 6.3 mm (0.25 in) below TDC position.

CAUTION: If cam follower assemblies are to be reused, always mark position for reassembly in their original positions.

(4) Using Special Tools 8215A and 8436 slowly depress valve assembly until rocker arm can be removed (Fig. 44).

(5) Repeat removal procedure for each rocker arm.

INSPECTION

Inspect the rocker arm for wear or damage (Fig. 45). Replace as necessary.

INSTALLATION

(1) Lubricate rocker arm with clean engine oil.

(2) Using Special Tools 8215A and 8436 slowly depress valve assembly until rocker arm can be installed on the hydraulic lifter and valve stem (Fig. 44).

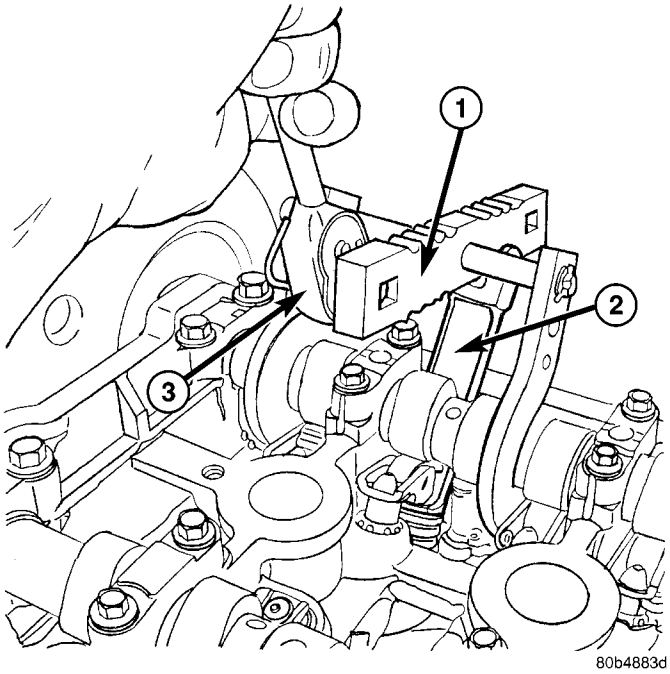


Fig. 44 Rocker Arm - Removal/Installation

1 - SPECIAL TOOL 8215A
2 - SPECIAL TOOL 8436
3 - 3/8″ DRIVE RACHET

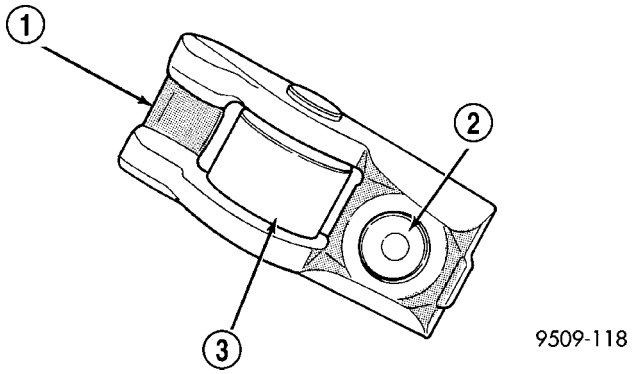


Fig. 45 Rocker Arm

1 - TIP
2 - LASH ADJUSTER POCKET
3 - ROLLER

(3) Repeat installation procedure for each rocker arm.

(4) Install spark plugs.

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

VALVE SPRINGS & SEALS

REMOVAL

REMOVAL - CYLINDER HEAD ON

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

(2) Remove camshafts (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - REMOVAL).

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

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

(5) Using Special Tool MD-998772-A with adapter 6779 (Fig. 46), compress valve springs and remove valve locks.

(6) Remove valve spring(s).

(7) Remove valve stem seal(s) by a using valve stem seal tool (Fig. 48).

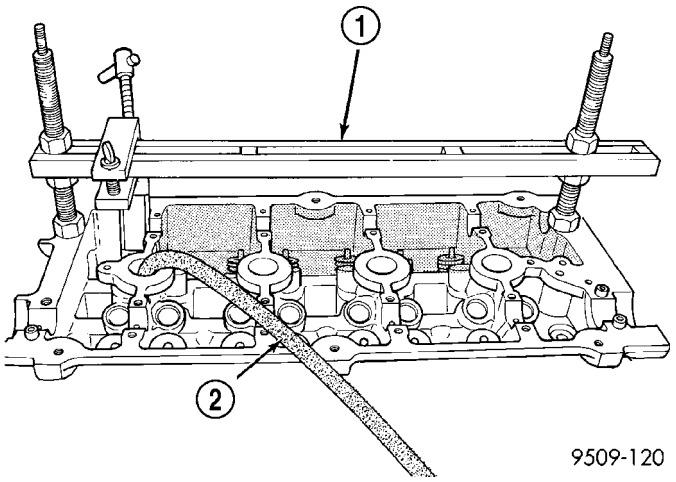


Fig. 46 Valve Spring - Removal/Installation

1 - VALVE SPRING COMPRESSOR MD 998772A
2 - AIR HOSE

REMOVAL - CYLINDER HEAD OFF

(1) With cylinder head removed from cylinder block, compress valve springs using a universal valve spring compressor.

(2) Remove valve retaining locks, valve spring retainers, valve stem seals and valve springs.

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

(4) Inspect the valves. (Refer to 9 - ENGINE/CYLINDER HEAD/VALVE SPRINGS - INSPECTION)

INSPECTION

(1) Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested for correct tension. Discard the springs that do not meet specifications. The following specifications apply to both intake and exhaust valves springs:

- Valve Closed Nominal Tension—76 lbs. @ 38.0 mm (1.50 in.)
- Valve Open Nominal Tension—136 lbs. @ 29.75 mm (1.17 in.)

(2) Inspect each valve spring for squareness with a steel square and surface plate, test springs from both ends. If the spring is more than 1.5 mm (1/16 inch) out of square, install a new spring.

INSTALLATION

INSTALLATION - CYLINDER HEAD ON

(1) Install valve seal/valve spring seat assembly (Fig. 47). Push the assembly down to seat it onto the valve guide.

(2) Install valve spring and retainer, use Special Tool MD-998772-A with adapter 6779 to compress valve springs only enough to install locks (Fig. 46). Correct alignment of tool is necessary to avoid nicking valve stems.

(3) Remove air hose and install spark plugs.

(4) Install camshafts (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - INSTALLATION).

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

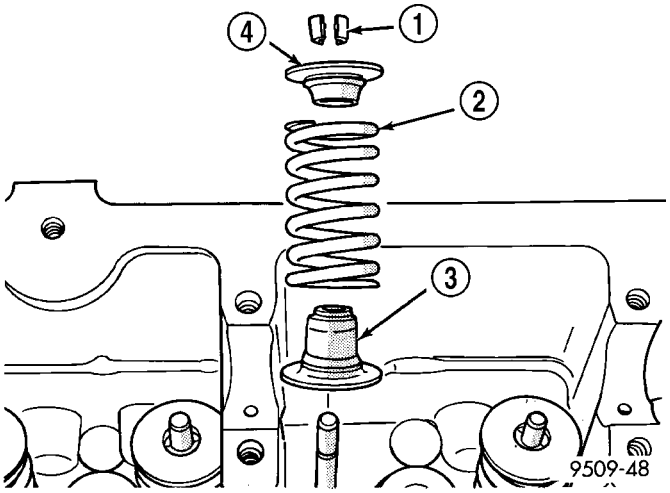


Fig. 47 Valve Stem Seal/Valve Spring Seat

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

VALVE SPRINGS & SEALS (Continued)

INSTALLATION - CYLINDER HEAD OFF

(1) Coat valve stems with clean engine oil and insert in cylinder head.

(2) Install new valve stem seals on all valves using a valve stem seal tool (Fig. 48). The valve stem seals should be pushed firmly and squarely over valve guide.

CAUTION: When oversize valves are used, the corresponding oversize valve seal must also be used. Excessive guide wear may result if oversize seals are not used with oversize valves.

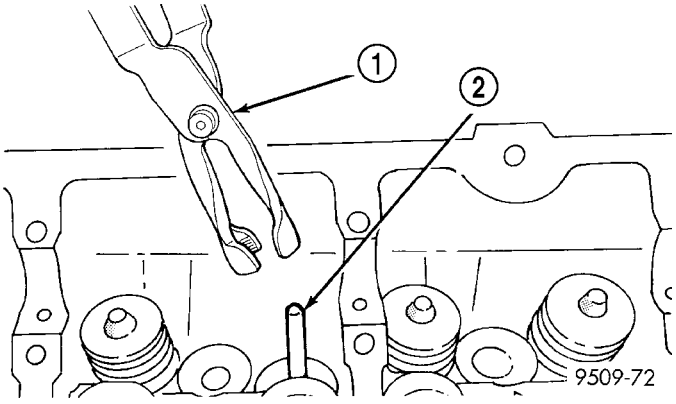


Fig. 48 Valve Stem Oil Seal Tool

1 - VALVE SEAL TOOL
2 - VALVE STEM

(3) Install valve springs and retainers. 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. Ensure both locks are in the correct location after removing tool.

(4) Check the valve spring installed height B after refacing the valve and seat (Fig. 49). Make sure measurements are taken from top of spring seat to the bottom surface of spring retainer. If height is greater than 38.75 mm (1.525 in.), install a 0.762 mm (0.030 in.) spacer under the valve spring seat to bring spring height back within specification.

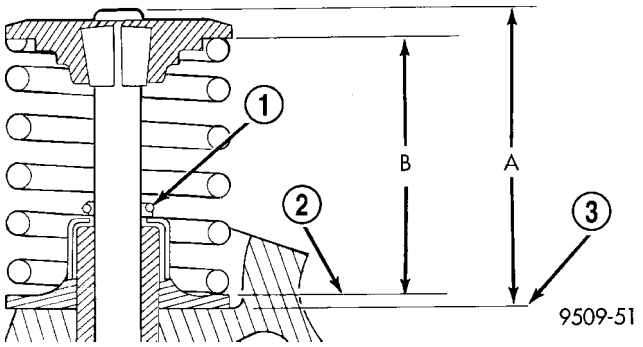


Fig. 49 Checking Spring Installed Height and Valve Tip Height Dimensions

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

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.

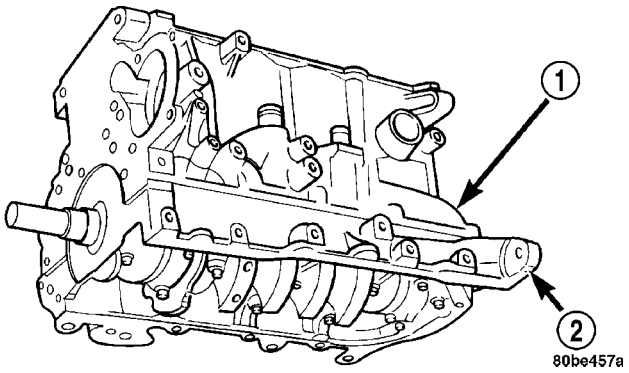


Fig. 50 Cylinder Block and Bed plate

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.

ENGINE BLOCK (Continued)

(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).

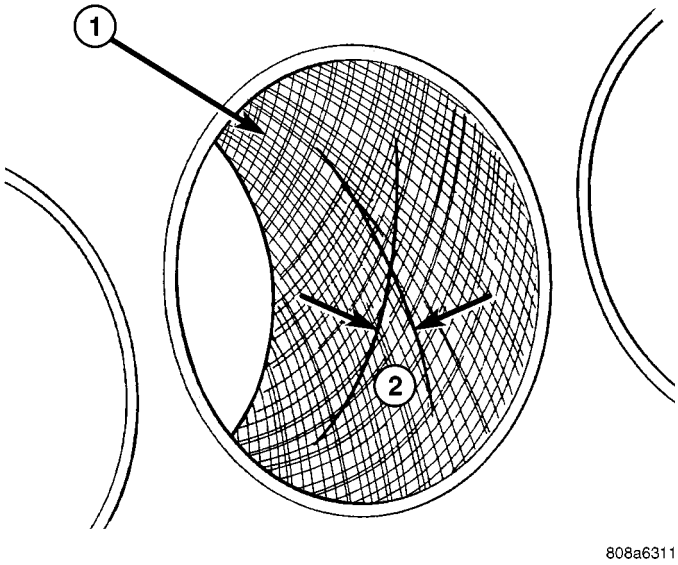


Fig. 51 Cylinder Bore Cross-Hatch Pattern

1 - CROSS-HATCH PATTERN
2 - 40°–60°

(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.

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.

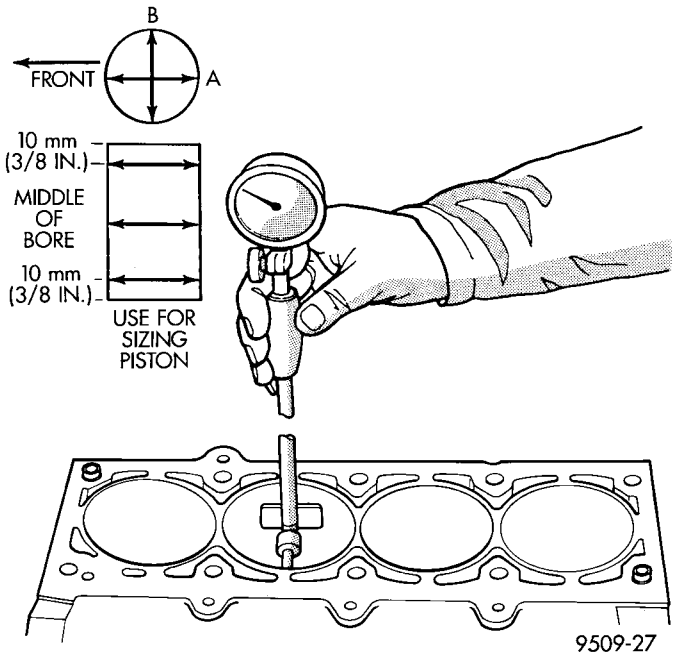


Fig. 52 Checking Cylinder Bore Size

ENGINE BLOCK (Continued)

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 - MEASURING CRANKSHAFT END PLAY

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

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

(3) Zero the dial indicator.

(4) Move crankshaft all the way to the front and read the dial indicator. (Refer to 9 - ENGINE - SPECIFICATIONS) for end play specification.

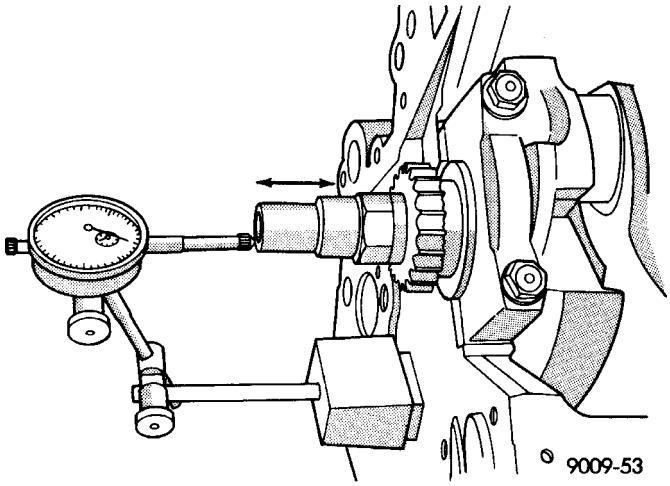


Fig. 53 Checking Crankshaft End Play - Typical

REMOVAL - CRANKSHAFT

NOTE: Crankshaft can not be removed when engine is in vehicle.

(1) Remove engine assembly from vehicle (Refer to 9 - ENGINE - REMOVAL).

(2) Separate transaxle from engine.

(3) Remove drive plate/flex plate.

(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 and remove oil filter.

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

(8) Remove engine mount support bracket.

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

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

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

(12) Remove the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(13) Remove oil pump pick-up tube.

(14) Remove the crankshaft sprocket and oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).

(15) Remove balance shafts and housing assembly (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - REMOVAL).

(16) Remove crankshaft position sensor.

NOTE: If piston/connecting rod replacement is necessary, remove cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

(17) Using a permanent ink or paint marker, identify cylinder number on each connecting rod cap (Fig. 54).

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.

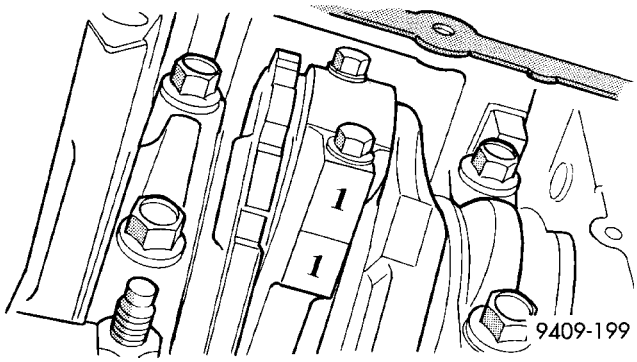


Fig. 54 Identify Connecting Rod to Cylinder-Typical

(19) Remove all bed plate bolts from the engine block (Fig. 55).

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

CRANKSHAFT (Continued)

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) Bed plate 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.

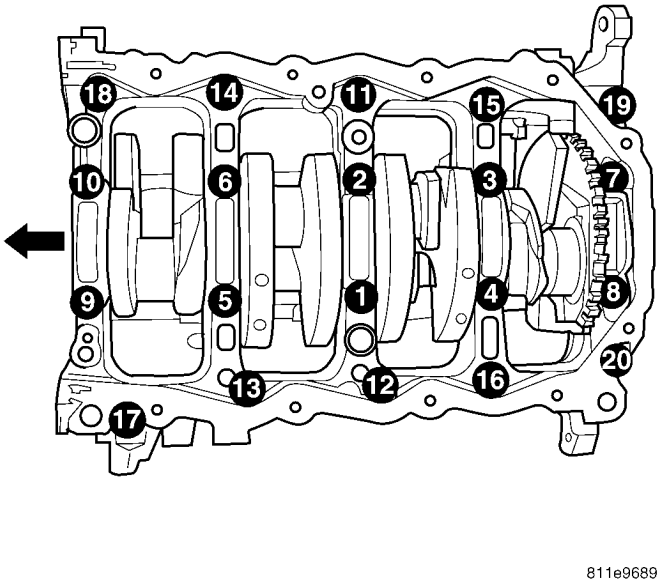


Fig. 55 Bed Plate Bolt Removal Sequence

(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. 56). 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.

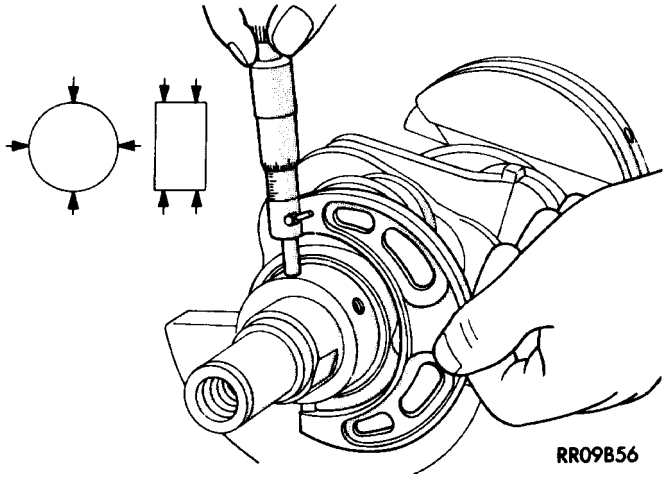


Fig. 56 Crankshaft Journal Measurements - Typical

INSTALLATION - CRANKSHAFT

CRANKSHAFT MAIN BEARING LOCATION

CAUTION: The upper and lower thrust bearing halves are NOT interchangeable. Make certain the bearing half with the oil groove and hole is installed in the engine block.

The crankshaft is supported in five main bearings. All upper bearing shells in the crankcase have oil grooves and holes. All lower bearing shells **except** for the thrust bearing half have oil grooves and holes (Fig. 57). Crankshaft end play is controlled by a flanged bearing on the number three main bearing journal.

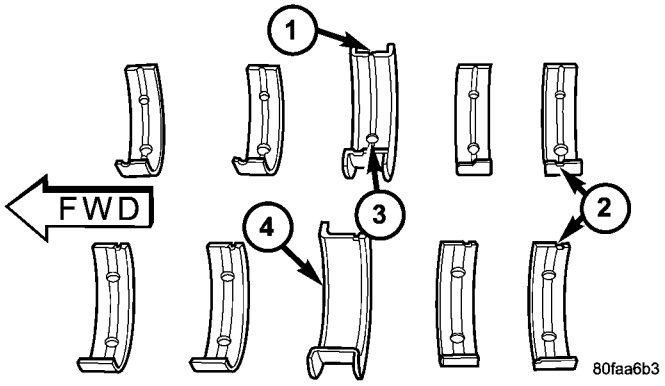


Fig. 57 Main Bearing Identification

1 - OIL GROOVE
2 - MAIN BEARINGS
3 - OIL HOLE
4 - LOWER THRUST BEARING PLAIN (NO OIL HOLE OR GROOVE)

CRANKSHAFT (Continued)

(1) Install the main bearing upper shells with the lubrication groove and oil hole in the engine block (Fig. 58).

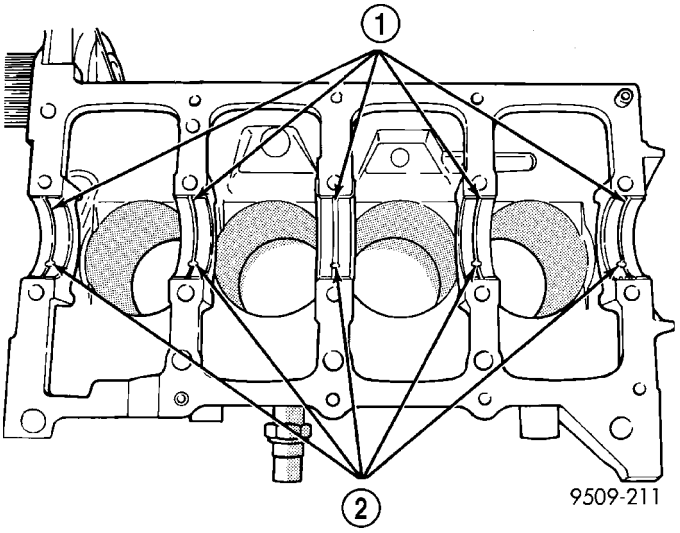


Fig. 58 Installing Main Bearing Upper Shell

1 - LUBRICATION GROOVES
2 - OIL HOLES

(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 balenced 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.

(4) Install **NEW** mounting screws finger tight starting with the #1 location. (Fig. 59) Make sure engagment 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.

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

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

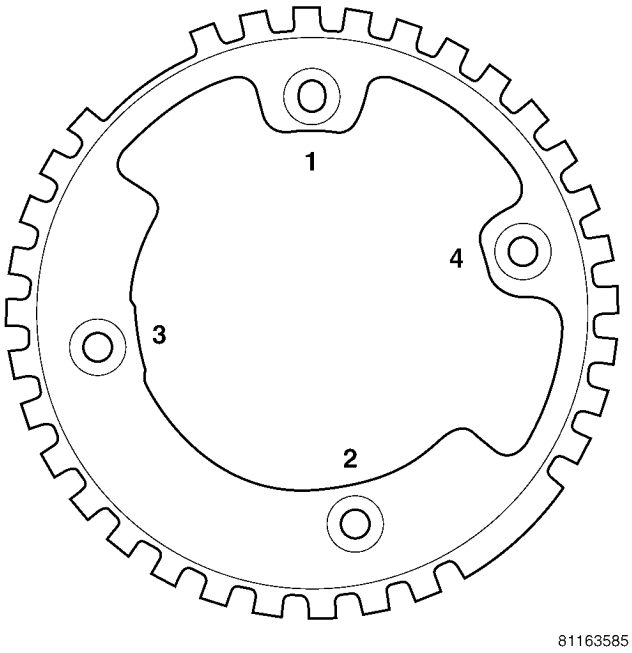


Fig. 59 Target Ring Torque Sequence

(6) Oil the bearings and journals. Install crankshaft in engine 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 bed plate as shown in (Fig. 60).Install the main bearing/bed plate onto the engine block.

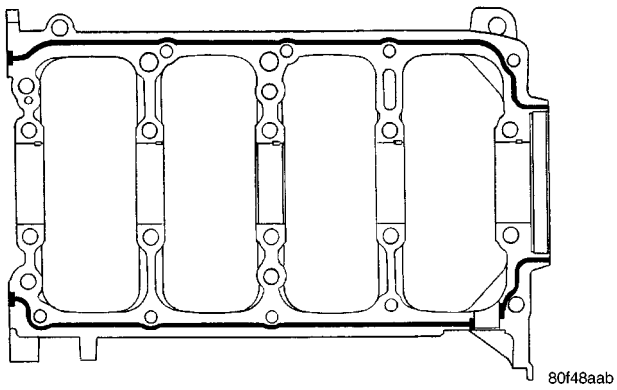


Fig. 60 Bed Plate Sealing

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

CRANKSHAFT (Continued)

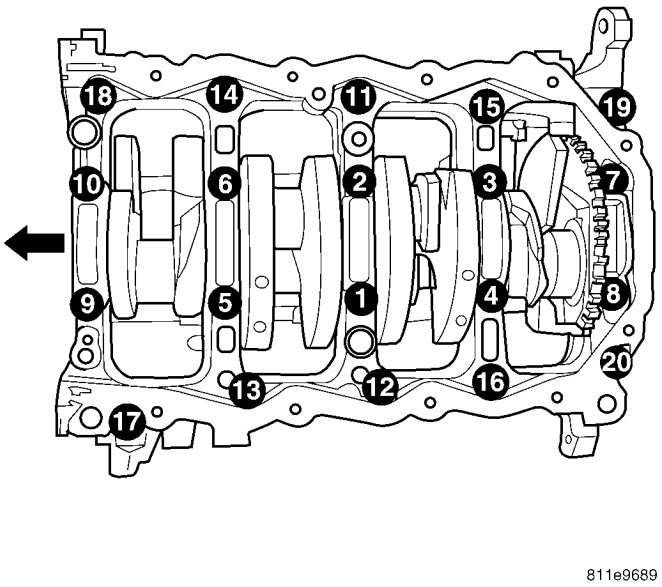


Fig. 61 Main Bearing Caps/Bed Plate Bolt Torque Sequence

(10) Install main bearing bedplate to engine block bolts 11, 17, and 20 finger tight. Tighten these bolts down together until the bed plate contacts the cylinder block (Fig. 61).

(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.
- 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. 61) 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. 61).

(13) Install main bearing bed plate to engine block bolts (11–20), and torque each bolt to 28 N·m (250 in. lbs.) in sequence shown in (Fig. 61).

(14) Tighten bolts (1–10) to 75 N·m (55 ft. lbs.) in sequence shown in (Fig. 61).

(15) Tighten bolts (11–20) again to 28 N·m (250 in. lbs.) in sequence shown in (Fig. 61).

(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).

(18) Install connecting rod bearings and caps. **Do Not Reuse Connecting Rod Bolts.** Torque connecting rod bolts to 27 N·m (20 ft. lbs.) plus 1/4 turn.

(19) Install balance shafts and housing assembly (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT - INSTALLATION).

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

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

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

(23) Install crankshaft position sensor.

(24) Install cylinder head if it was removed (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

(25) Install the rear timing belt cover (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 (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - INSTALLATION).

(28) Install the timing belt front covers (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - INSTALLATION).

(29) Install engine mount support bracket.

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

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

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

(3) Remove crankshaft sprocket using Special Tool 6793 and insert C-4685-C2 (Fig. 62).

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

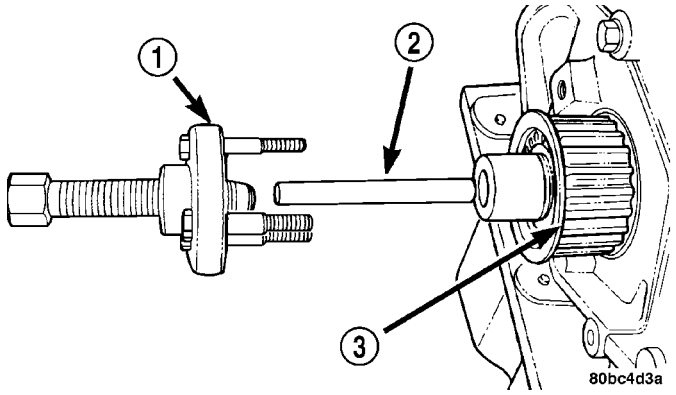


Fig. 62 Crankshaft Sprocket - Removal

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

(4) Using Tool 6771 to remove front crankshaft oil seal (Fig. 63). Be careful not to damage the seal surface of cover.

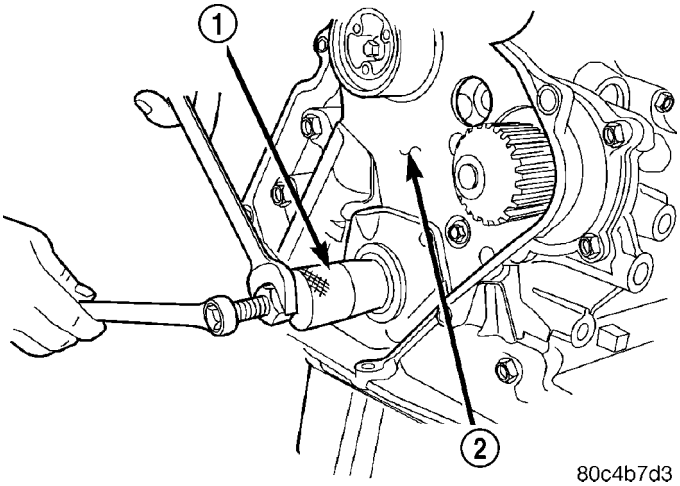


Fig. 63 Front Crankshaft Oil Seal - Removal

1 - SPECIAL TOOL 6771
2 - REAR TIMING BELT COVER

INSTALLATION

(1) Install new seal by using Special Tool 6780 (Fig. 64).

(2) Place seal into opening with seal spring towards the inside of engine. Install seal until flush with cover.

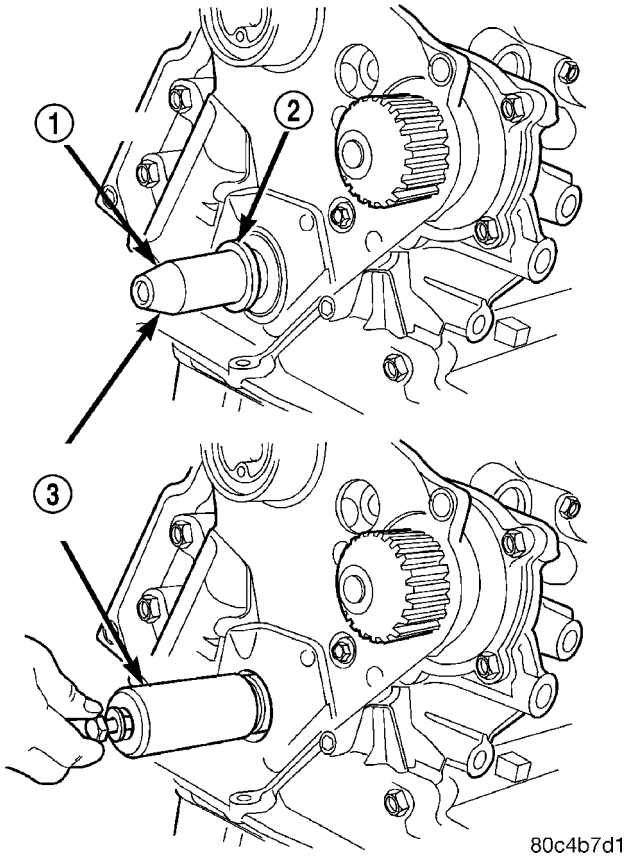


Fig. 64 Crankshaft Front Oil Seal - Installation

1 - PROTECTOR
2 - SEAL
3 - SPECIAL TOOL 6780

(3) Install crankshaft sprocket using Special Tool 6792 (Fig. 65).

(4) Install 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)

CRANKSHAFT OIL SEAL - FRONT (Continued)

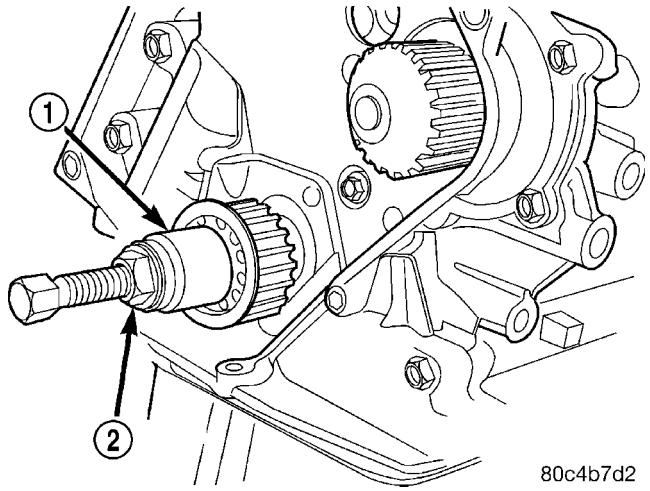


Fig. 65 Crankshaft Sprocket - Installation

1 - SPECIAL TOOL 6792
2 - TIGHTEN NUT TO INSTALL

CRANKSHAFT OIL SEAL - REAR

REMOVAL

(1) Remove transaxle. Refer to TRANSMISSION/TRANSAXLE - REMOVAL for procedure.

(2) Remove flex plate.

(3) Insert a 3/16 flat bladed screwdriver between the dust lip and the metal case of the crankshaft seal. Angle the screwdriver (Fig. 66)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.

INSTALLATION

CAUTION: If a 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.

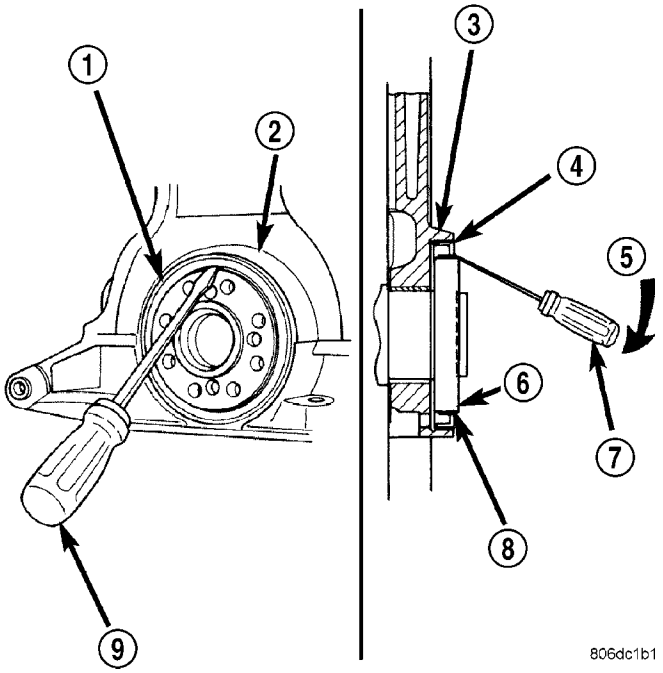


Fig. 66 Rear Crankshaft Oil Seal - Removal

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

(1) Place Special Tool 6926-1 Seal Guide on crankshaft (Fig. 67).

(2) Position seal over guide tool (Fig. 67). Guide 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. 68) until the tool bottoms out against the block (Fig. 69).

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

CRANKSHAFT OIL SEAL - REAR (Continued)

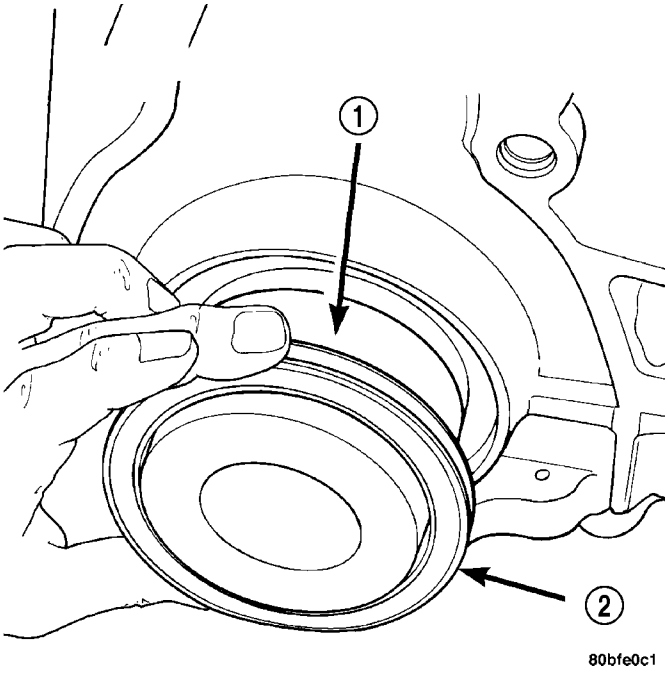


Fig. 67 Rear Crankshaft Seal and Special Tool 6926-1

1 - SPECIAL TOOL 6926–1 PILOT
2 - SEAL

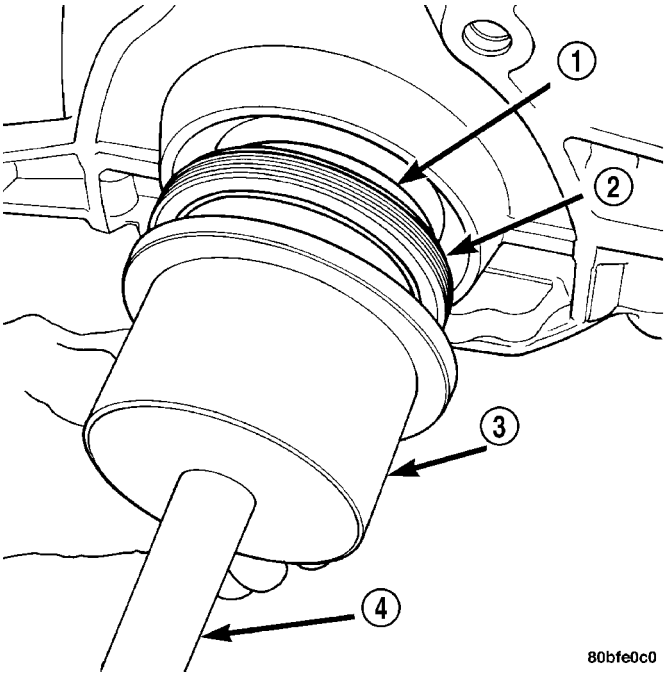


Fig. 68 Crankshaft Seal and Special Tools 6926-2 & C-4171

1 - SPECIAL TOOL 6926–1 PILOT
2 - SEAL
3 - SPECIAL TOOL 6926–2 INSTALLER
4 - SPECIAL TOOL C-4171

(5) Install transaxle. Refer to TRANSMISSION/ TRANSAXLE - INSTALLATION for procedure.

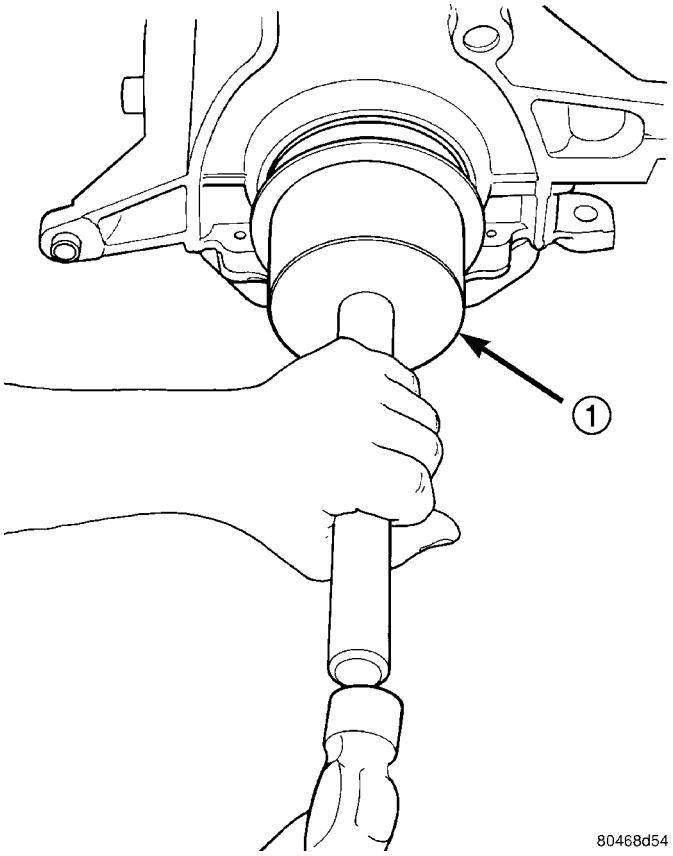


Fig. 69 Rear Crankshaft Seal - Installation

1 - SPECIAL TOOL 6926–2 INSTALLER

PISTON & CONNECTING ROD

DESCRIPTION

The pistons are made of a cast aluminum alloy. The pistons have full floating pins attached to forged steel 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 connecting rod has an oil squirt hole to provide extra cylinder wall lubrication. The pistons and connecting rods are serviced as an assembly.

STANDARD PROCEDURE - PISTON TO CYLINDER BORE FITTING

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

Piston and cylinder wall must be clean and dry. Piston diameter should be measured 90 degrees to piston pin.

PISTON & CONNECTING ROD (Continued)

• Measurement should be taken approximately 22 mm (0.866 in.) from the bottom of the skirt as shown in (Fig. 70).

Cylinder bores should be measured halfway down the cylinder bore and transverse (measurement location B) to the engine crankshaft center line shown in (Fig. 71). Refer to for Engine Specifications (Refer to 9 - ENGINE - SPECIFICATIONS). Correct piston to bore clearance must be established in order to assure quiet and economical operation.

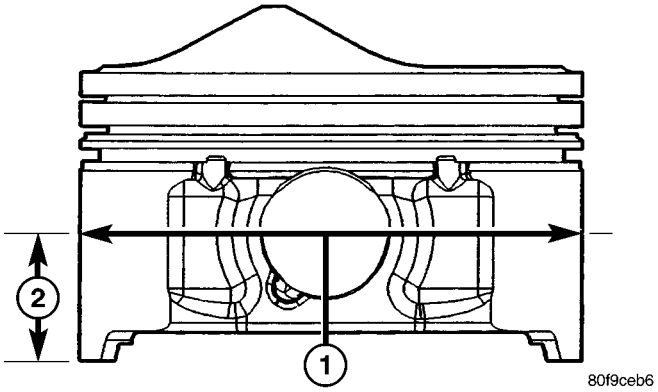


Fig. 70 Piston Measurement - Turbo

1 - PISTON DIAMETER
2 - 22 mm (0.866 in.)

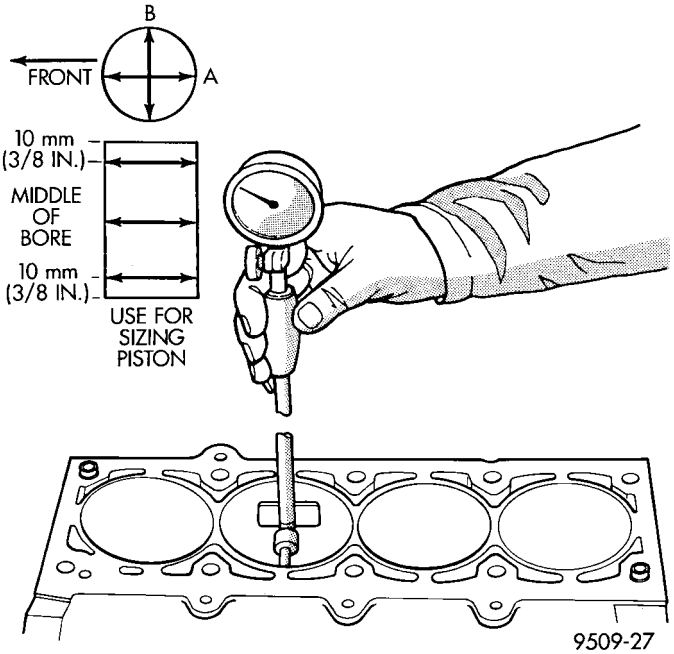


Fig. 71 Cylinder Bore Measurement

REMOVAL

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

(2) Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(3) Remove Balance Shaft Carrier Assembly (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT CARRIER - REMOVAL).

(4) 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**.

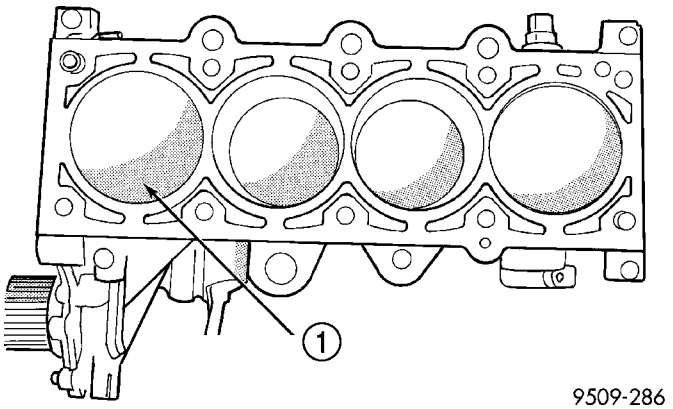


Fig. 72 Piston Markings

1 - DIRECTIONAL ARROW WILL BE IMPRINTED IN THIS AREA

(5) Pistons have a directional stamping in the front half of the piston facing towards the **front** of engine (Fig. 72).

(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) Using a permanent ink or paint marker, identify cylinder number on each connecting rod cap (Fig. 73).

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

(8) 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.

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

CAUTION: Do not damage the oil jet assembly when removing piston/connecting rod (Fig. 75).

(9) To protect crankshaft journal and fractured rod surfaces, install Special Tool 8189, connecting rod guides onto connecting rod (Fig. 74). Carefully push each piston and rod assembly out of cylinder bore.

PISTON & CONNECTING ROD (Continued)

(10) 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.

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

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

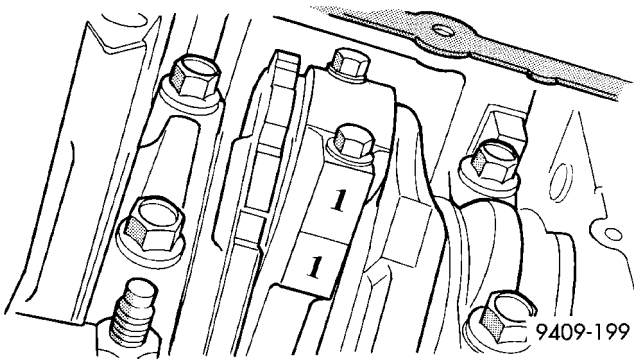


Fig. 73 Identify Connecting Rod to Cylinder - Typical

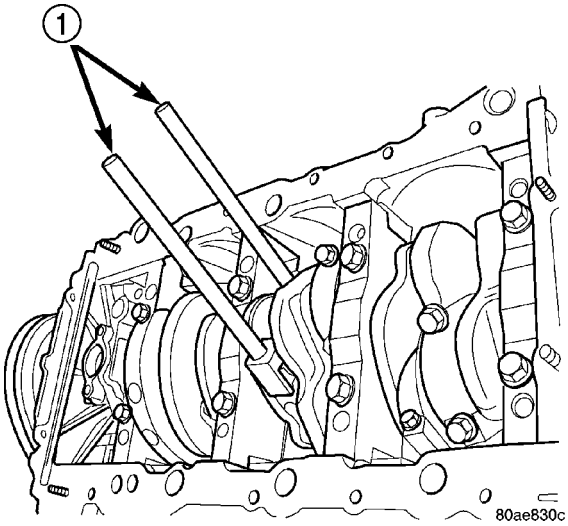


Fig. 74 Connecting Rod Guides - Typical

1 - SPECIAL TOOL 8189 CONNECTING ROD GUIDES

INSTALLATION

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

(2) Before installing pistons and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap (Fig. 76).

(3) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located as shown in (Fig. 76). As viewed from top.

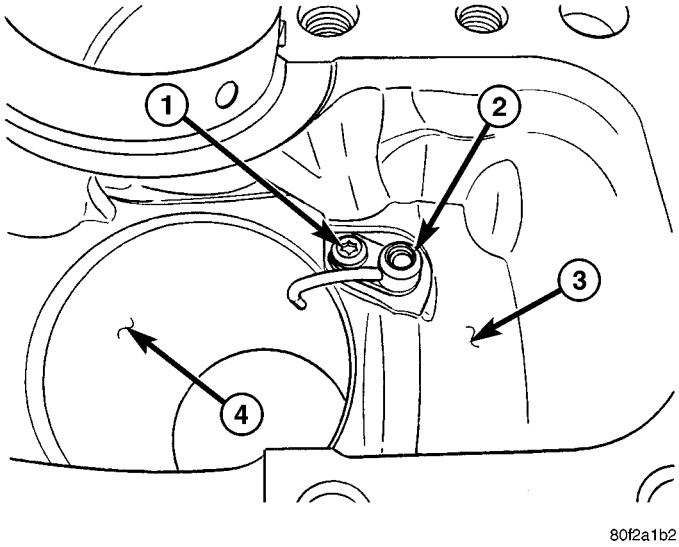


Fig. 75 Oil Jet Fastener - 2.4L Turbo

1 - FASTENER - 12 N·m (105 in. lbs.)
2 - OIL JET
3 - ENGINE BLOCK
4 - CYLINDER WALL

(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** .

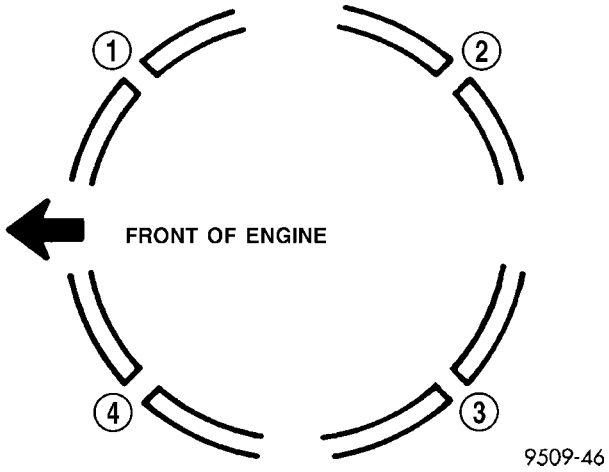


Fig. 76 Piston Ring End Gap Position

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

(5) The directional stamp on the piston should face toward the front of the engine (Fig. 72).

(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.

PISTON & CONNECTING ROD (Continued)

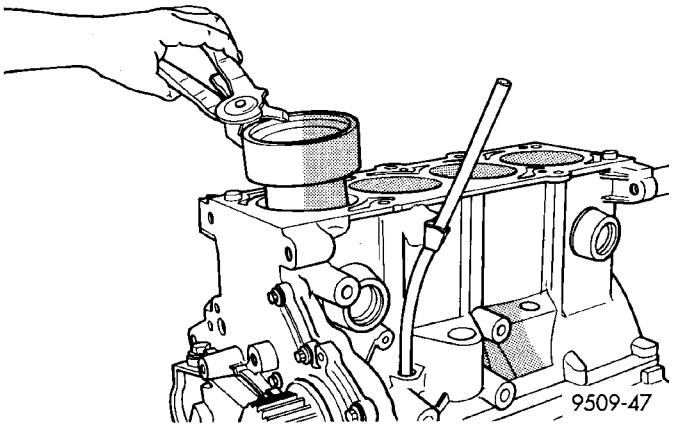


Fig. 77 Piston—Installation

(7) Install connecting rod upper bearing half into connecting rod. Install Special Tool 8189, connecting rod guides onto connecting rod (Fig. 74).

CAUTION: Do not damage the oil jet when installing the piston/connecting rod (Fig. 78).

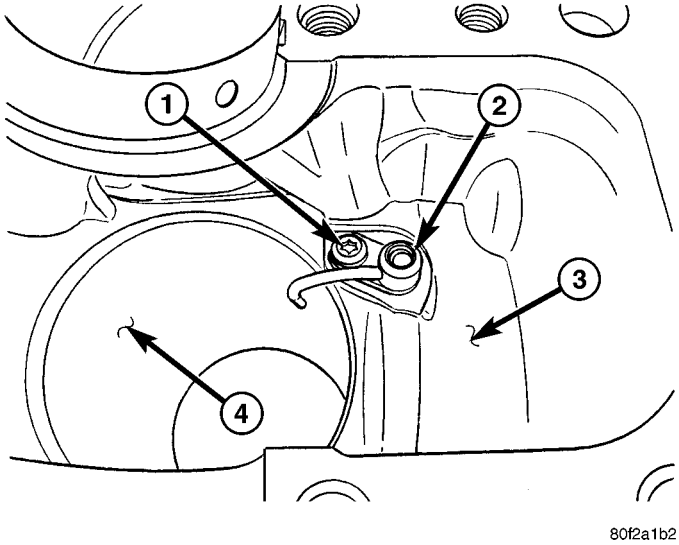


Fig. 78 Oil Jet Fastener - 2.4L Turbo

1 - FASTENER - 12 N·m (105 in. lbs.)
2 - OIL JET
3 - ENGINE BLOCK
4 - CYLINDER WALL

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

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

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

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

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

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

(13) 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.**

(14) Using a feeler gauge, check connecting rod side clearance (Fig. 79). (Refer to 9 - ENGINE - SPECIFICATIONS) for connecting rod side clearance.

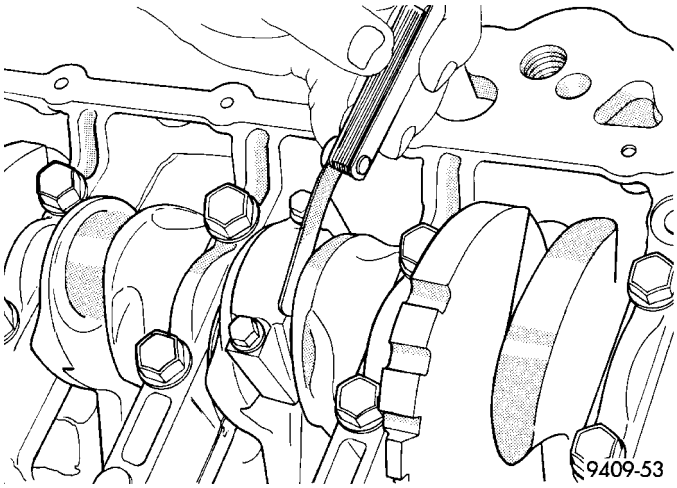


Fig. 79 Checking Connecting Rod Side Clearance - Typical

(15) Install Balance Shaft Carrier Assembly (Refer to 9 - ENGINE/VALVE TIMING/BALANCE SHAFT CARRIER - INSTALLATION).

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

(17) Install cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - 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.

(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. 80). Refer to clearance specifications (Refer to 9 - ENGINE - SPECIFICATIONS).

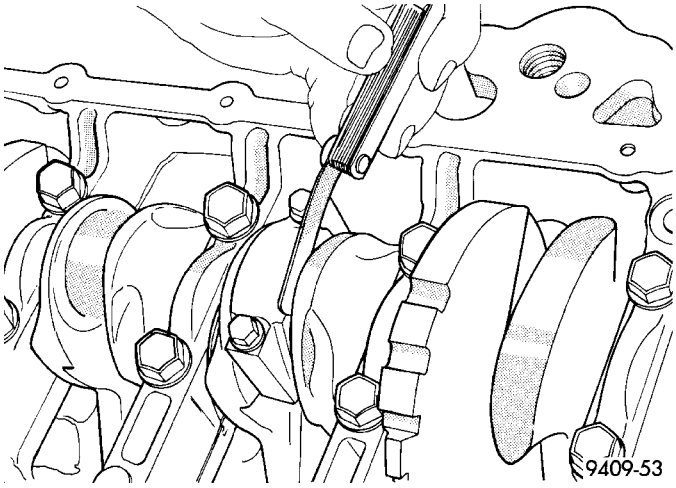


Fig. 80 Connecting Rod Side Clearance - Typical

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 positioning at least 12 mm (0.50 inch) from bottom of cylinder bore. Check gap with feeler gauge (Fig. 81). Refer to Engine Specifications.

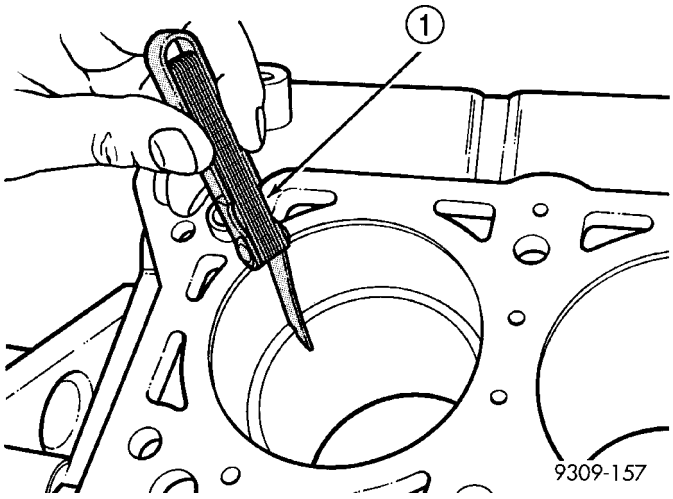


Fig. 81 Piston Ring Gap

1 - FEELER GAUGE

(2) Check piston ring to groove side clearance (Fig. 82). Refer to Engine Specifications.

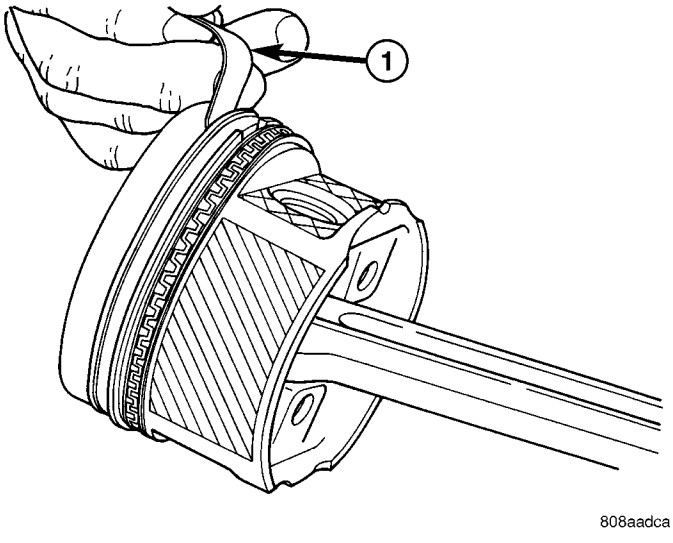


Fig. 82 Piston Ring Side Clearance

1 - FEELER GAUGE

PISTON RINGS (Continued)

REMOVAL

(1) Using a suitable ring expander, remove upper and intermediate piston rings (Fig. 83).

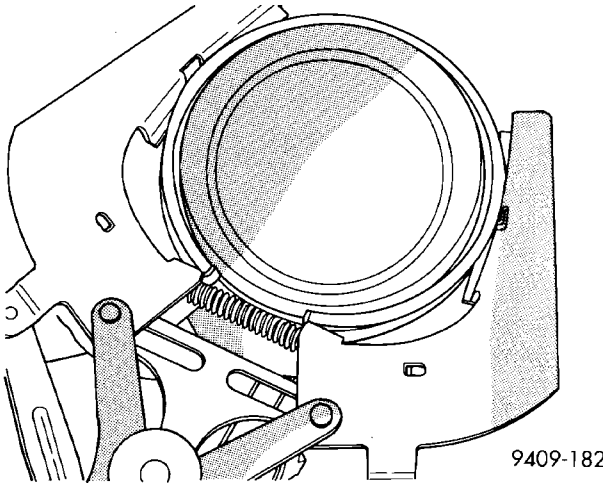


Fig. 83 Piston Rings—Removing and Installing

(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. 84).

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. 84).

(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. 85).**

(3) Install No. 2 piston ring and then No. 1 piston ring (Fig. 84).

(4) Position piston ring end gaps as shown in (Fig. 86).

(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.

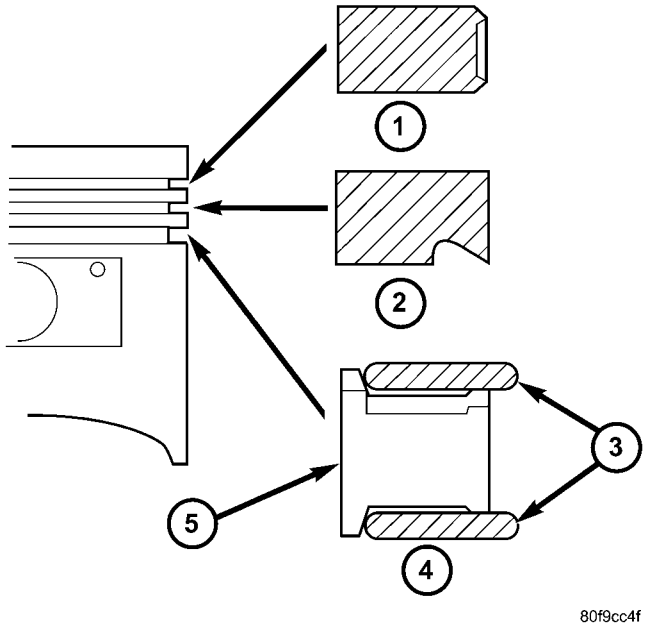


Fig. 84 Piston Ring Installation

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

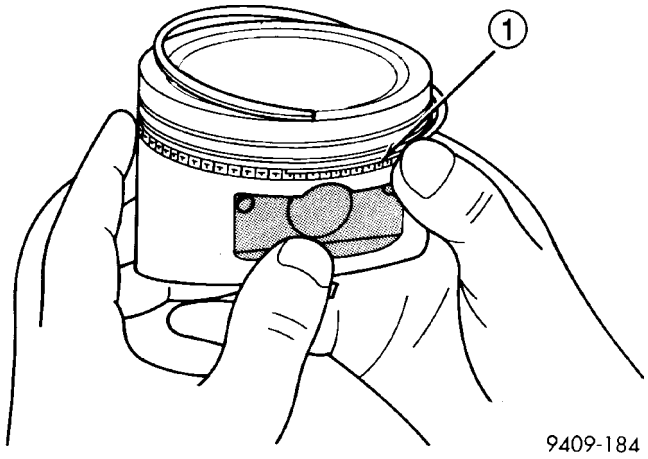


Fig. 85 Installing Side Rail

1 - SIDE RAIL END

STRUCTURAL COLLAR

REMOVAL

STRUCTURAL COLLAR

(1) Raise vehicle on hoist.

(2) Remove bolts attaching bending strut to engine and transaxle (Fig. 87). Remove strut.

(3) Remove bolts attaching collar and clutch slave cylinder to transaxle (Fig. 87).

STRUCTURAL COLLAR (Continued)

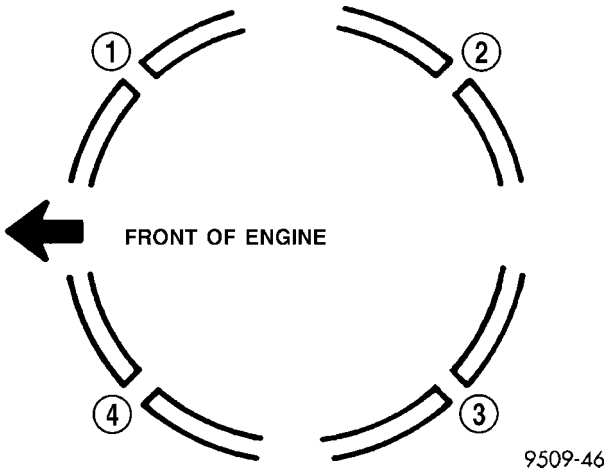


Fig. 86 Piston Ring End Gap Position

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

(4) Remove remaining bolts attaching collar to oil pan and transaxle (Fig. 87). Remove collar.

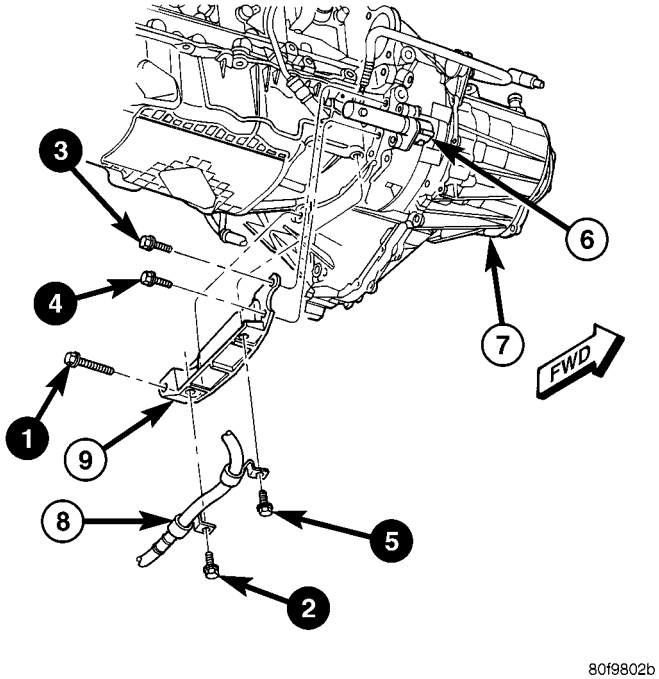


Fig. 87 Structural Collar and Bending Strut - (Manual Transaxle Equipped)

1–5 – BOLT TIGHTENING SEQUENCE
6 – HYDRAULIC CLUTCH SLAVE CYLINDER
7 – TRANSAXLE
8 – POWER STEERING HOSE
9 – COLLAR

INSTALLATION

STRUCTURAL COLLAR

CAUTION: Torque procedure for the structural collar and bending strut must be followed or damage could occur to oil pan, collar, and/or bending strut.

(1) Perform the following steps for installing structural collar and bending strut. Refer to (Fig. 87):

- Step 1: Place collar into position between transaxle and oil pan. Install collar to transaxle bolt (1), **hand start only**.
- Step 2: Position power steering hose support bracket (Fig. 87) and install collar to oil pan bolt (2), **hand tight only**.
- Step 3: Position clutch slave cylinder into mounting position and install bolts (3) and (4) **hand tight only**.
- Step 4: Position power steering hose support bracket and install the remaining collar to oil pan bolt (5) **hand tight only**.
- Step 5: Final torque all bolts in sequence shown in (Fig. 87) to the following torque values:
  - Bolt (1) to 101 N·m (75 ft. lbs.)
  - Bolts (2) and (5) to 61 N·m (45 ft. lbs.)
  - Bolts (3) and (4) to 28 N·m (20 ft. lbs.)

(2) Lower vehicle.

VIBRATION DAMPER

REMOVAL

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

(2) Remove crankshaft damper bolt.

(3) Remove damper by using Special Tool 1026 and Insert 6827A (Fig. 88).

INSTALLATION

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

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.

(2) Apply Mopar® Lock & Seal Adhesive (Medium Strength Threadlocker) to crankshaft damper bolt and tighten to 136 N·m (100 ft. lbs.) (Fig. 89).

VIBRATION DAMPER (Continued)

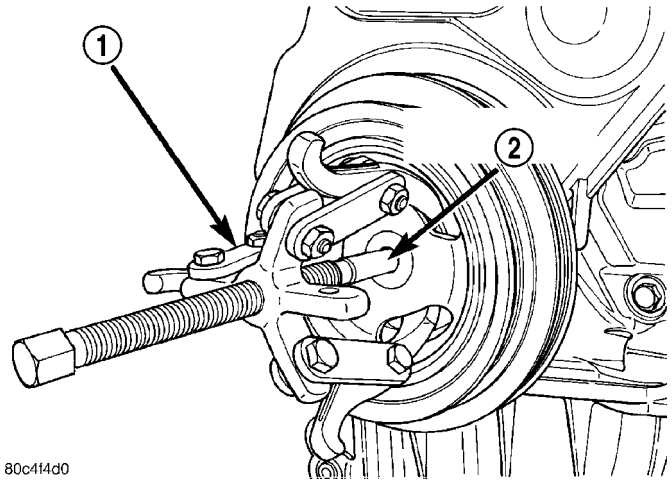


Fig. 88 Crankshaft Damper—Removal

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

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

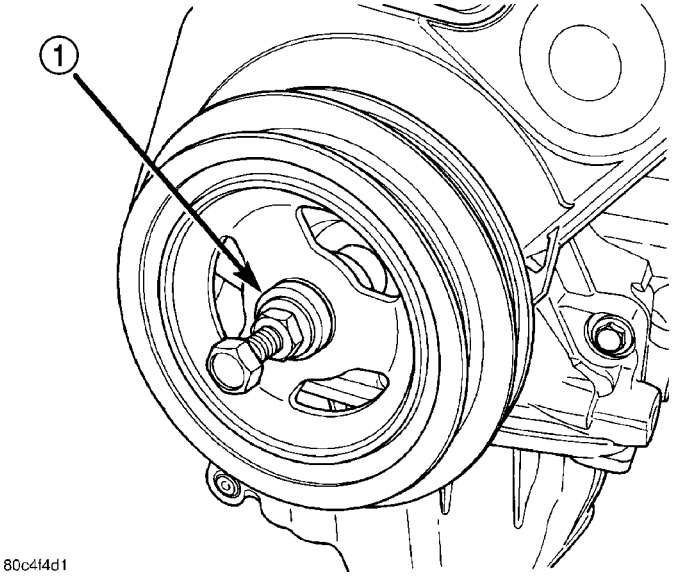


Fig. 89 Crankshaft Damper—Installation

1 - SPECIAL TOOL 6792

ENGINE MOUNTING

DESCRIPTION

The engine mounting system consists 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 two torque controlling struts are attached at the front of the engine, straddling the right side load-carrying mount. The upper strut connects to the suspension strut tower and the lower to the suspension crossmember.

LEFT MOUNT

REMOVAL

(1) Remove air cleaner assembly.
(2) Disconnect negative cable from battery.
(3) Remove bolts attaching the power distribution center (PDC) bracket to left mount and battery tray.
(4) Support transaxle with a suitable jack.
(5) Remove mount to transaxle bolts (Fig. 90).
(6) Remove left mount bracket to body frame rail fasteners (Fig. 90).
(7) Remove mount.

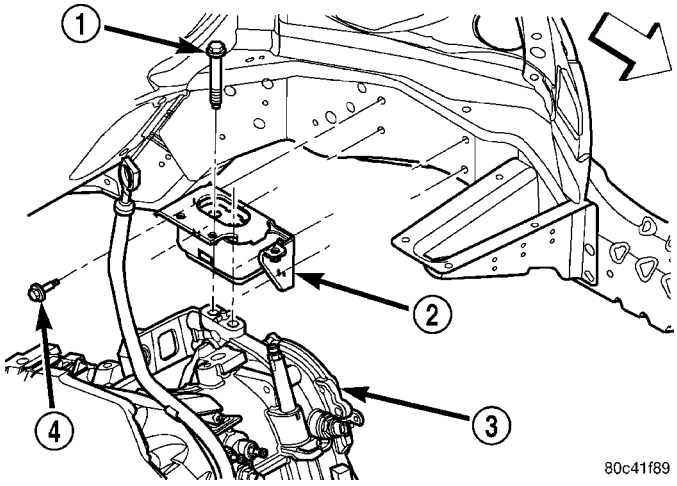


Fig. 90 Left Mount

1 - BOLT
2 - LEFT MOUNT
3 - TRANSAXLE
4 - BOLT

INSTALLATION

(1) Install engine mount bracket to body frame rail and tighten fasteners to 28 N·m (250 in. lbs.) (Fig. 90).
(2) Position engine/transaxle for installation of mount to transaxle bolts. Install and tighten bolts to 68 N·m (50 ft. lbs.) (Fig. 90).
(3) Remove jack from under transaxle.
(4) Install the power distribution center (PDC).
(5) Connect negative cable to battery.
(6) Install air cleaner assembly.

RIGHT MOUNT

REMOVAL

(1) Remove the engine assembly for the required clearance to access the engine mount (Refer to 9 - ENGINE - REMOVAL).

RIGHT MOUNT (Continued)

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. 91).

(4) Remove mount.

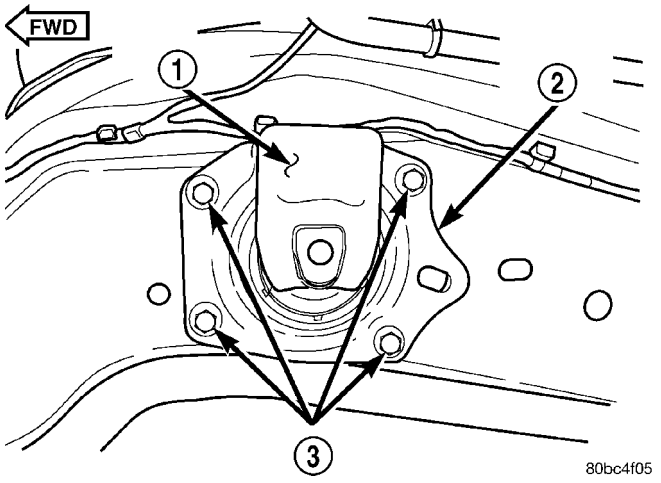


Fig. 91 Engine Mount—Right

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

INSTALLATION

(1) Position mount into the original position on body frame rail (Fig. 91).

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.

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

(a) Insert new mount loosely in frame rail.

(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.

(3) Ensure the mount maintains originally marked position and install mount bolts. Tighten bolts to 28 N·m (250 in. lbs.) (Fig. 91).

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

TORQUE STRUT

REMOVAL

REMOVAL - UPPER

(1) Remove bolts attaching upper torque strut to shock tower bracket and engine mount bracket (Fig. 92).

(2) Remove timing belt front upper cover (if A/C equipped).

(3) Remove the upper torque strut.

REMOVAL - LOWER

(1) Raise vehicle on hoist.

(2) Remove accessory drive belt splash shield (Fig. 93).

(3) Remove pencil strut (Fig. 94).

(4) Remove bolts attaching lower torque strut to crossmember and strut bracket (Fig. 94).

(5) Remove lower torque strut.

INSTALLATION

INSTALLATION - UPPER

(1) Position the upper torque strut into mounting location (Fig. 92).

(2) Move torque strut aside (towards right fender) and install timing belt front upper cover (if A/C equipped).

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

INSTALLATION - LOWER

(1) Position lower torque strut into mounting locations.

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

(3) Install pencil strut and tighten nuts to 58 N·m (43 ft. lbs.) (Fig. 94).

(4) Install accessory belt splash shield (Fig. 93) and lower vehicle.

TORQUE STRUT (Continued)

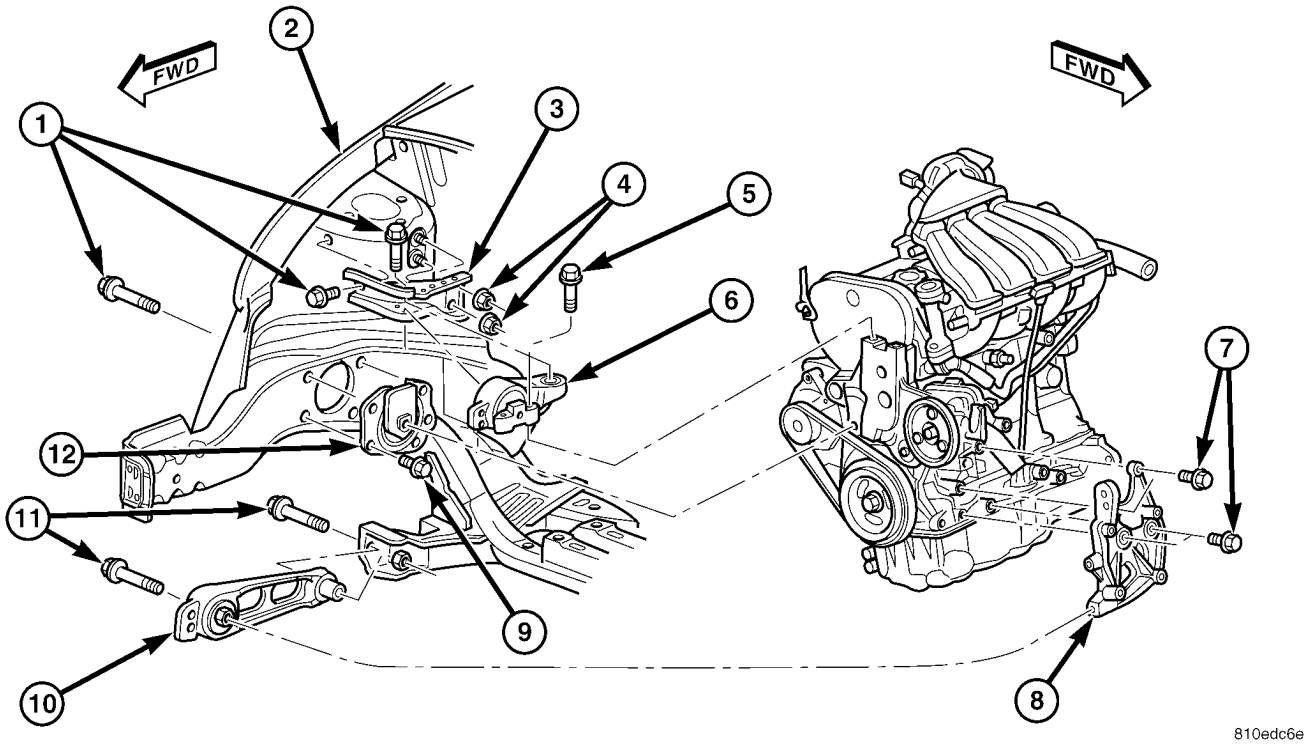


Fig. 92 Engine Mount - Right Side

1 - BOLT
2 - RIGHT FENDER
3 - UPPER TORQUE STRUT BRACKET
4 - NUTS
5 - BOLT
6 - UPPER TORQUE STRUT
7 - BOLT
8 - LOWER TORQUE STRUT BRACKET
9 - BOLT
10 - LOWER TORQUE STRUT
11 - BOLT
12 - RIGHT ENGINE MOUNT

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) Remove accessory drive belt splash shield (Fig. 93).

(2) Remove pencil strut (Fig. 94).

(3) Loosen the upper and lower torque strut attaching bolt at the suspension crossmember and shock tower bracket (Fig. 92).

(4) The engine position may now be adjusted by positioning a suitable floor jack on the forward edge of the transmission bell housing (Fig. 95).

NOTE: The floor jack must be positioned as shown in (Fig. 95) to prevent minimal upward lifting of the engine.

(5) With the engine supported, remove the upper and lower torque strut attachment bolt(s) at shock tower bracket and suspension crossmember (Fig. 92). 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.

(6) Carefully apply upward force, allowing the upper engine to rotate rearward until the distance between the center of the rearmost attaching bolt on the engine mount bracket (point “A”) and the center of the hole on the shock tower bracket (point “B”) is 119 mm (4.70 in.) (Fig. 96).

CAUTION: The engine must be held in position with jack until both the upper and lower torque strut bolts are tightened.

(7) With the engine held at the proper position, tighten both the upper and lower torque strut bolts to 115 N·m (85 ft. lbs.) (Fig. 92).

TORQUE STRUT (Continued)

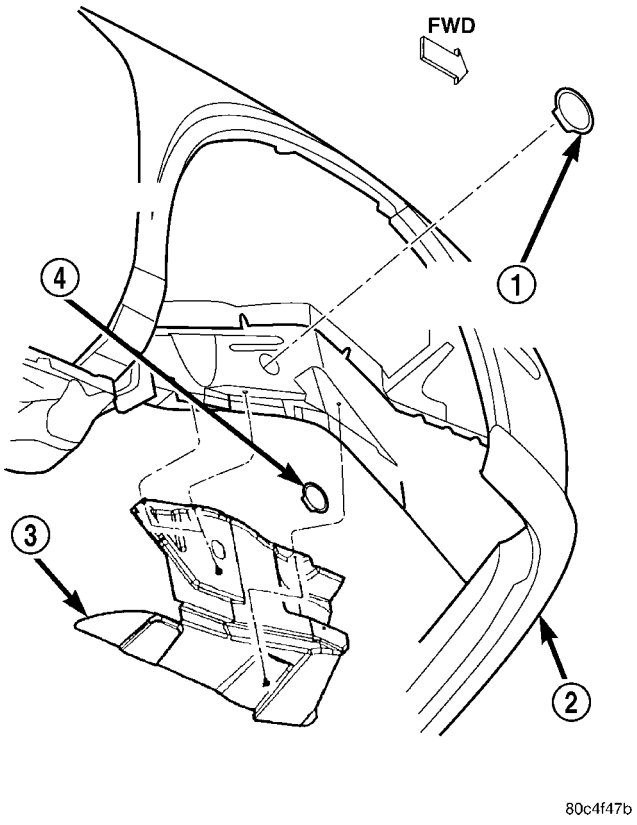


Fig. 93 Splash Shield

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

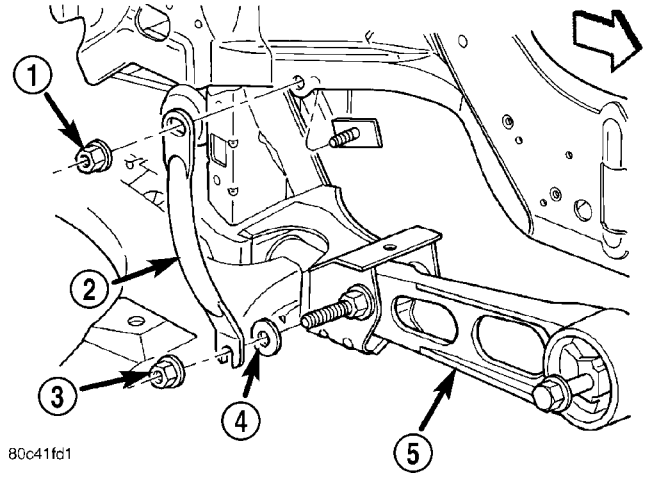


Fig. 94 Pencil Strut

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

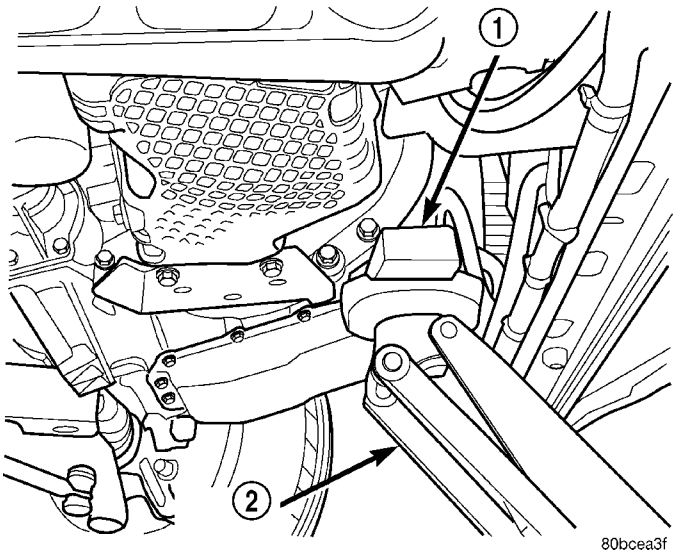


Fig. 95 Floor Jack Positioning

1 - WOOD BLOCK
2 - FLOOR JACK

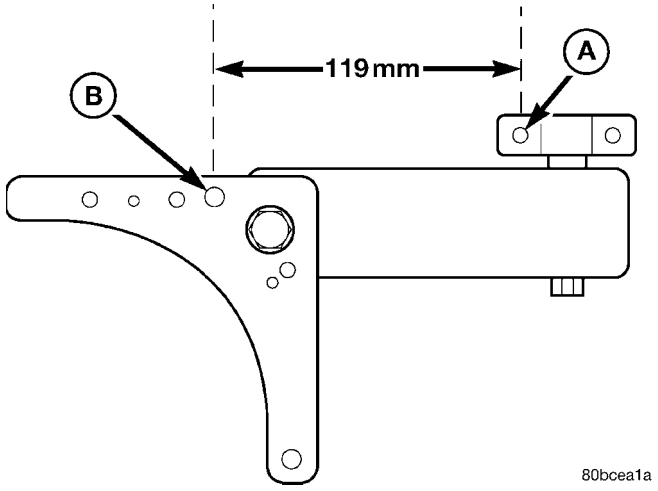


Fig. 96 Engine Position Measurement

(8) Remove the floor jack.

(9) Install pencil strut and tighten nuts to 58 N·m (43 ft. lbs.) (Fig. 94).

(10) Install accessory drive belt splash shield (Fig. 93).

LUBRICATION

DESCRIPTION

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

OPERATION

Engine oil 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 main bearing journals to connecting rod journals. Balance shaft lubrication is provided through an oil passage from the number one main bearing cap through the balance shaft carrier support leg. This passage directly supplies oil to the front bearings and internal machined passages in the shafts that routes oil from front to the rear shaft bearing journals. A vertical hole at the number five bulkhead routes pressurized oil through a restrictor (integral to the cylinder head gasket) up past a cylinder head bolt to an oil gallery running the length of the cylinder head. The camshaft journals are partially slotted to allow a predetermined amount of pressurized oil to pass into the bearing cap cavities. Lubrication of the camshaft lobes are provided by small holes in the camshaft bearing caps that are directed towards each lobe. Oil returning to the pan from pressurized components supplies lubrication to the valve stems. Cylinder bores and wrist pins are splash lubricated from directed slots on the connecting rod thrust collars.

DIAGNOSIS AND TESTING - CHECKING ENGINE OIL PRESSURE

(1) Disconnect and remove oil pressure switch. (Refer to 9 - ENGINE/LUBRICATION/OIL PRESSURE SENSOR/SWITCH - REMOVAL)

(2) Install Special Tools C-3292 Gauge with 8406 Adaptor fitting.

(3) Start engine and record oil pressure. Refer to Specifications for correct oil pressure requirements. (Refer to 9 - ENGINE - SPECIFICATIONS)

CAUTION: If oil pressure is 0 at idle, do not perform the 3000 RPM test

(4) If oil pressure is 0 at idle. Shut off engine, check for pressure relief valve stuck open, a clogged oil pick-up screen or a damaged oil pick-up tube O-ring.

(5) After test is complete, remove test gauge and fitting.

(6) Install oil pressure switch and connector. (Refer to 9 - ENGINE/LUBRICATION/OIL PRESSURE SENSOR/SWITCH - INSTALLATION)

OIL

STANDARD PROCEDURE

ENGINE OIL LEVEL CHECK

The best time to check engine oil level is after the vehicle 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. 97) and observe oil level. Add oil only when the level is at or below the MIN mark (Fig. 98).

CAUTION: Do not operate engine if the oil level is above the MAX mark on the dipstick. Excessive oil volume can cause oil aeration which can lead to engine failure due to loss of oil pressure or increase in oil temperature.

STANDARD PROCEDURE - ENGINE OIL AND FILTER CHANGE

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.

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

(1) Run engine until achieving normal operating temperature.

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

(3) Remove oil fill cap (Fig. 97).

(4) Raise vehicle on hoist.

(5) Place a suitable oil collecting container under oil pan drain plug.

OIL (Continued)

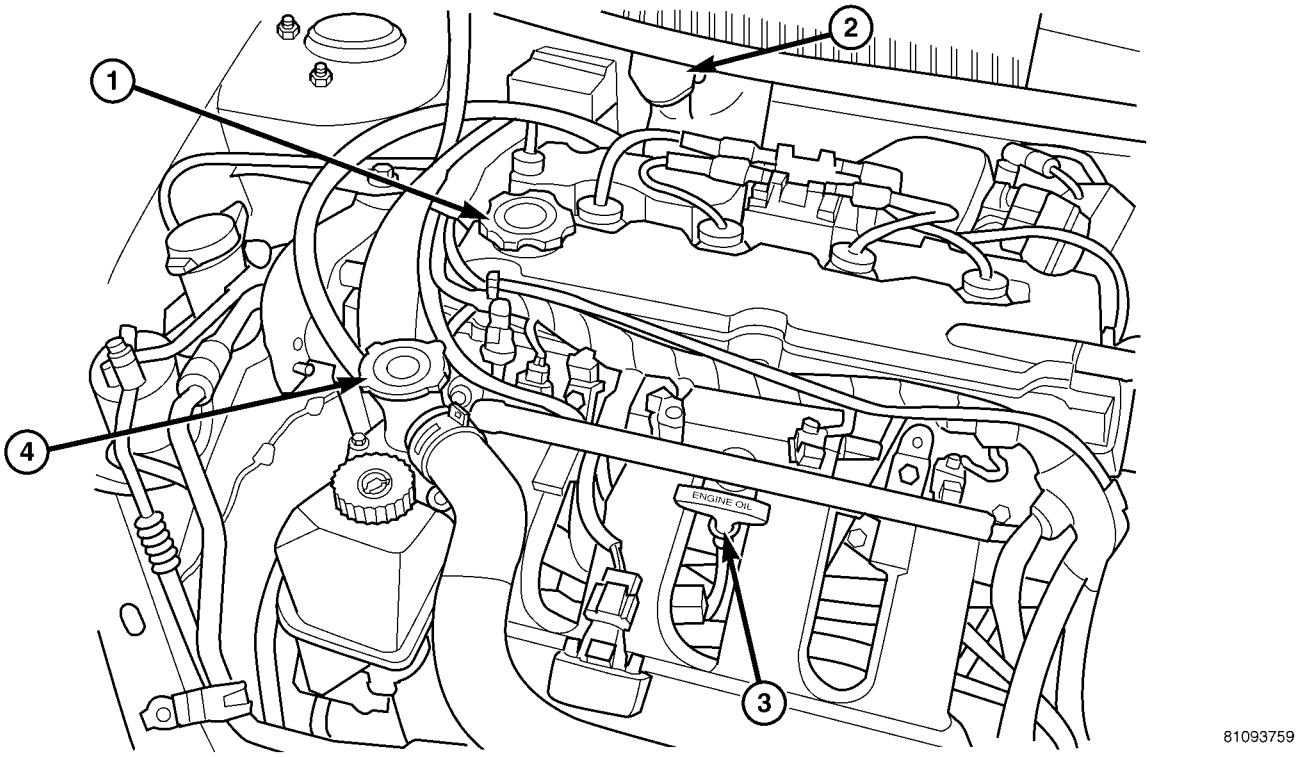


Fig. 97 Fluid Level Service Locations

1 - WASHER FLUID
2 - ENGINE OIL FILL
3 - COOLANT RECOVERY CONTAINER
4 - BRAKE MASTER CYLINDER
5 - CLUTCH MASTER CYLINDER
6 - ENGINE OIL DIPSTICK
7 - POWER STEERING FLUID
8 - COOLANT PRESSURE CAP

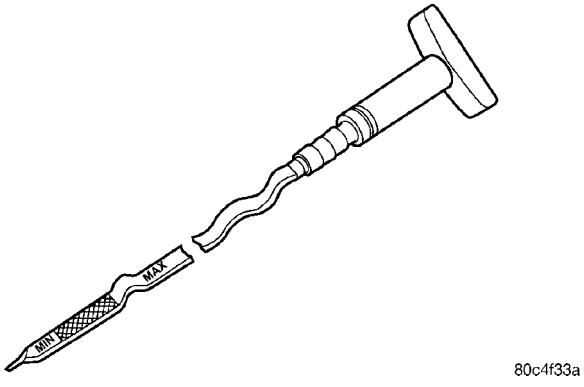


Fig. 98 Engine Oil Dipstick

(6) Remove oil pan drain plug (Fig. 99) and allow oil to drain into collecting container. Inspect drain plug threads for stretching or other damage. Replace drain plug and gasket if damaged.

(7) Remove oil filter (Fig. 99) (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL).

(8) Install oil pan drain plug. Torque drain plug to 28 N·m (20 ft. lbs.).

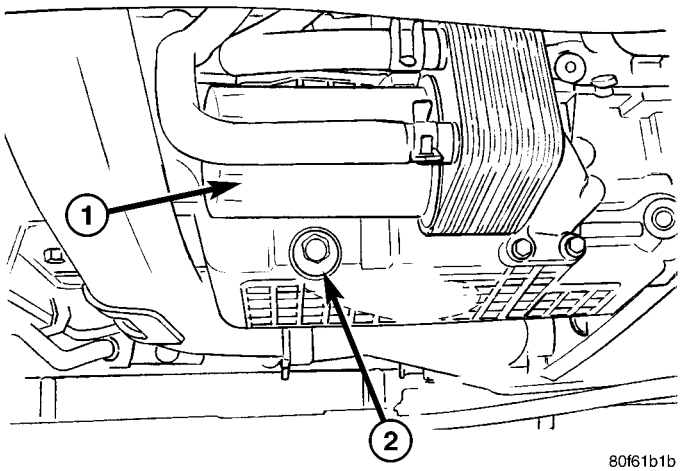


Fig. 99 Oil Filter and Drain Plug - 2.4L Turbo

1 - OIL FILTER
2 - DRAIN PLUG

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

OIL (Continued)

(10) Lower vehicle and fill crankcase with specified type and amount of engine oil (Refer to LUBRICATION & MAINTENANCE/SPECIFICATIONS - FLUID CAPACITIES) and (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION).
(11) Install oil fill cap (Fig. 97).
(12) Start engine and inspect for leaks.
(13) Stop engine and inspect oil level.

OIL FILTER SPECIFICATION

All engines are equipped with a high quality full-flow, disposable type oil filter. Replace oil filter with a Mopar® or the equivalent.

USED ENGINE OIL DISPOSAL

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 avoid deforming the filter can by installing the remove/install tool band strap against the can to base lock seam. The lock seam joining the can to the base is reinforced by the base plate.

(1) Using a suitable filter wrench, turn oil filter (Fig. 99) counterclockwise to remove.

INSTALLATION

(1) Clean and check filter mounting surface. The surface must be smooth, flat and free of debris or pieces of gasket.
(2) Lubricate new oil filter gasket.
(3) Screw oil filter (Fig. 99) on until the gasket contacts base. Tighten to 21 N·m (15 ft. lbs.).

OIL FILTER ADAPTER

REMOVAL

(1) Raise vehicle on hoist.
(2) Place a suitable oil collecting container under oil filter.
(3) Remove oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL).
(4) Remove oil cooler connector bolt. **DO NOT** disconnect coolant lines from oil cooler. Reposition oil cooler.
(5) Remove filter adapter attaching bolts (Fig. 100).
(6) Remove filter adapter and gasket (Fig. 100).

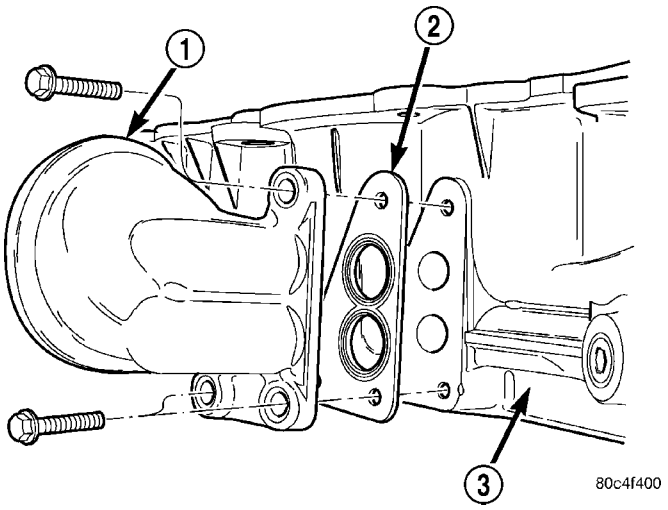


Fig. 100 Oil Filter Adaptor

1 - OIL FILTER ADAPTER
2 - GASKET
3 - OIL PAN

INSTALLATION

(1) Clean all gasket sealing surfaces.
(2) Install gasket and filter adaptor to oil pan (Fig. 100). Tighten bolts to 12 N·m (105 in. lbs.).
(3) Replace oil cooler seal. Lubricate seal and position oil cooler to oil filter adapter, aligning notch to tab. Install oil cooler connector bolt. Torque connector bolt to 55 N·m (41 ft. lbs.).
(4) Install oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - INSTALLATION).
(5) Lower vehicle and check engine oil level. Adjust level as necessary.

OIL PAN

REMOVAL

(1) Raise vehicle on hoist.
(2) Drain engine oil and remove oil filter.
(3) Remove accessory drive belt splash shield.
(4) Remove turbocharger to charge air cooler hose assembly (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/CHARGE AIR COOLER AND HOSES - REMOVAL).
(5) Remove oil cooler connector bolt. **DO NOT** disconnect coolant lines from oil cooler. Reposition oil cooler.
(6) Remove structural collar (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COLLAR - REMOVAL).
(7) Remove lower torque strut (Refer to 9 - ENGINE/ENGINE MOUNTING/TORQUE STRUT - REMOVAL).
(8) Remove oil filter adapter and gasket (Fig. 101).
(9) Remove oil pan and gasket (Fig. 101).

OIL PAN (Continued)

(10) Clean oil pan and all gasket surfaces.

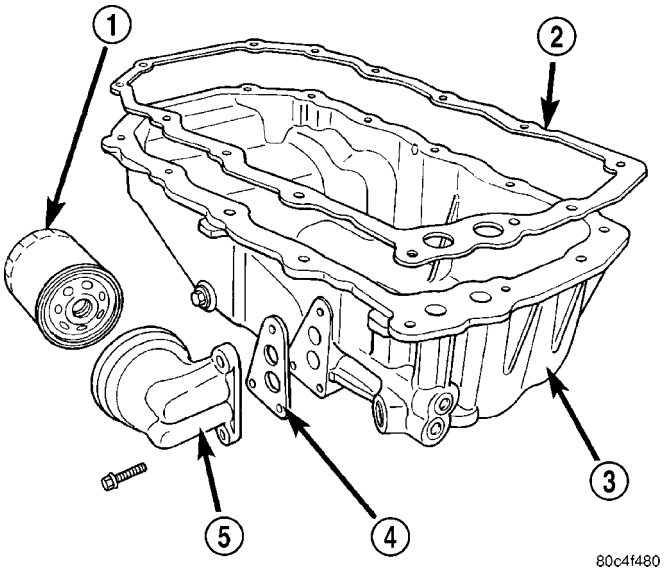


Fig. 101 Oil Pan

1 - OIL FILTER
2 - OIL PAN GASKET
3 - OIL PAN
4 - ADAPTER GASKET
5 - OIL FILTER ADAPTER

INSTALLATION

(1) Apply Mopar® Engine RTV GEN II at the oil pump to engine block parting lines (Fig. 102).

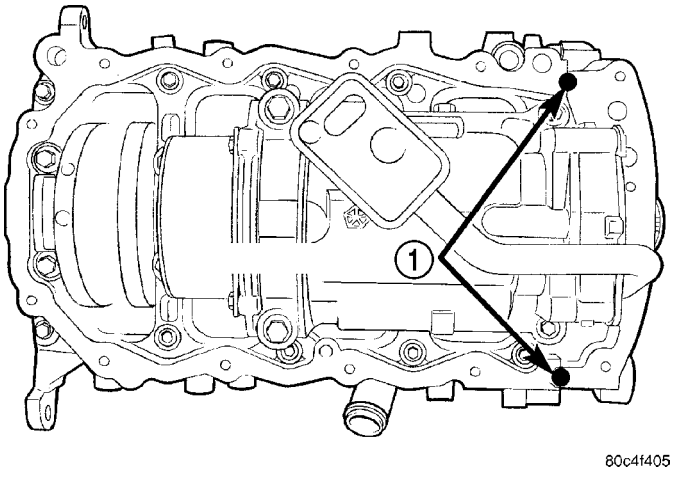


Fig. 102 Oil Pan Sealing

1 - SEALER LOCATIONS

(2) Install oil pan gasket to the block.

(3) Install pan gasket and pan. Tighten screws to 12 N·m (105 in. lbs.).

(4) Install oil filter adapter and gasket (Fig. 101). Tighten screws to 12 N·m (105 in. lbs.).

(5) Replace oil cooler seal. Lubricate seal and position oil cooler to oil filter adapter, aligning notch to tab. Install oil cooler connector bolt. Torque connector bolt to 55 N·m (41 ft. lbs.).

(6) Install oil drain plug and oil filter.

(7) Install structural collar (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COLLAR - INSTALLATION).

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

(9) Install turbocharger to charge air cooler hose assembly (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/CHARGE AIR COOLER AND HOSES - 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. 103). 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).

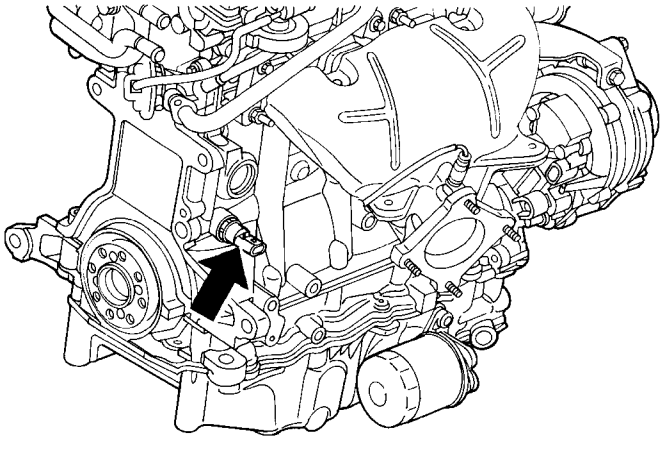


Fig. 103 Oil Pressure Switch

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.

OIL PRESSURE SENSOR/SWITCH (Continued)

REMOVAL

(1) Raise vehicle.
(2) Position oil collecting container under pressure switch location.
(3) Disconnect oil pressure switch electrical connector and remove switch (Fig. 104).

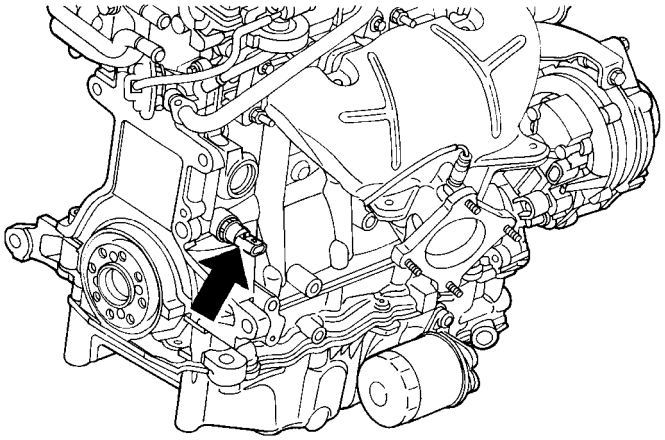


Fig. 104 Engine Oil Pressure Switch

INSTALLATION

(1) Install oil pressure switch and connect electrical connector (Fig. 104).
(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 timing belt (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT AND SPROCKETS - REMOVAL).
(3) Remove timing belt rear cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - REMOVAL).
(4) Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
(5) Remove crankshaft sprocket using Special Tools 6793 and C-4685-C2 (Fig. 105).
(6) Remove crankshaft key (Fig. 106).
(7) Remove oil pick-up tube.
(8) Remove oil pump (Fig. 107) and front crankshaft seal.

DISASSEMBLY

(1) Remove oil pump cover fasteners, and lift off cover (Fig. 108).

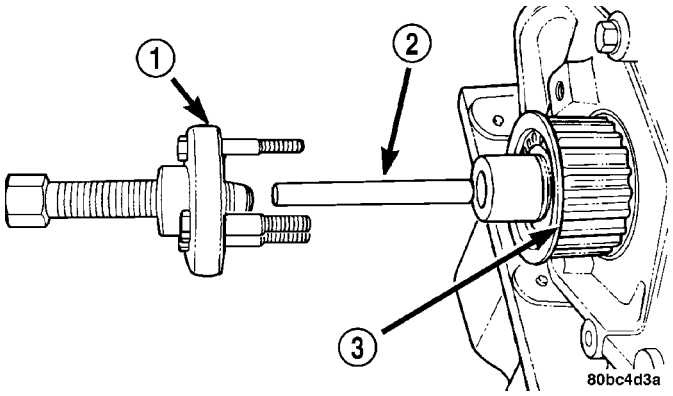


Fig. 105 Crankshaft Sprocket - Removal

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

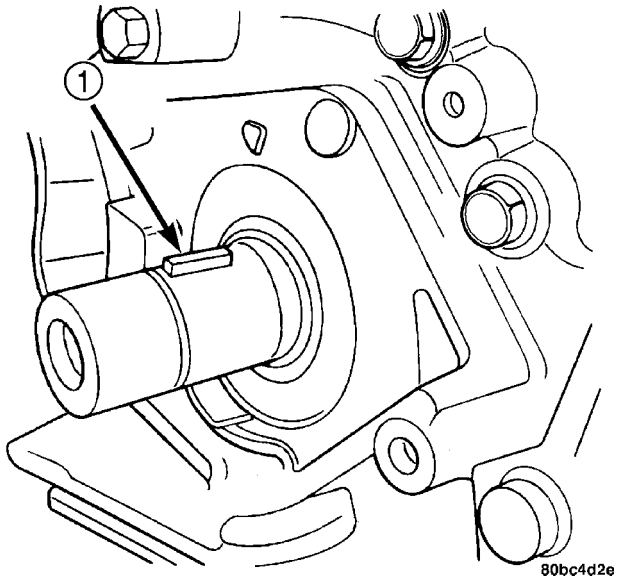


Fig. 106 Crankshaft Key

1 - CRANKSHAFT KEY

(2) Remove pump rotors (Fig. 108).
(3) Wash all parts in a suitable solvent and inspect carefully for damage or wear.

CLEANING

Clean all parts thoroughly.

INSPECTION

(1) Inspect the mating surface of the oil pump. Surface should be smooth. Replace pump cover if scratched or grooved.
(2) Lay a straightedge across the pump cover surface (Fig. 109). If a 0.025 mm (0.001 in.) feeler gauge can be inserted between cover and straight edge, cover should be replaced.

OIL PUMP (Continued)

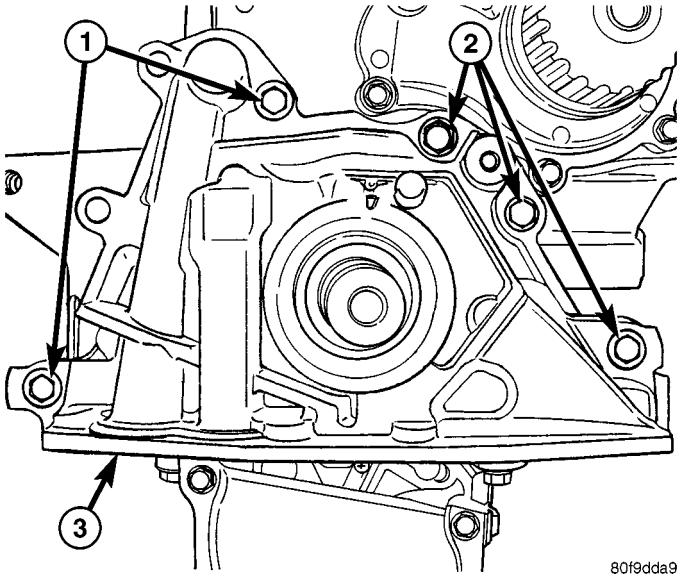


Fig. 107 Oil Pump

1 - BOLTS
2 - BOLTS
3 - OIL PUMP

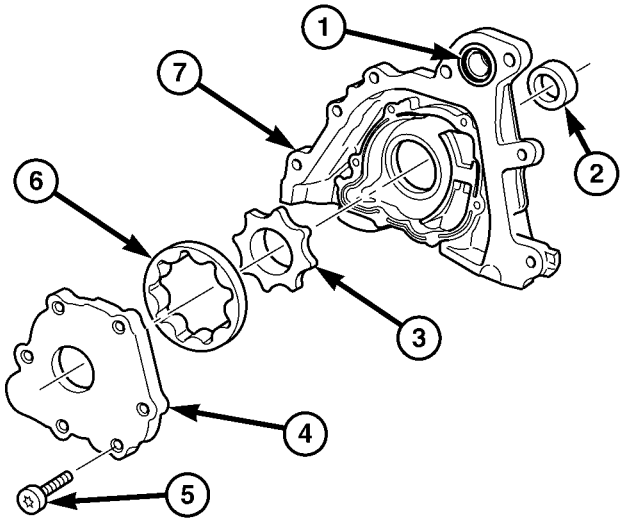


Fig. 108 Oil Pump

1 - O-RING
2 - FRONT CRANKSHAFT SEAL
3 - INNER ROTOR
4 - OIL PUMP COVER
5 - FASTENER
6 - OUTER ROTOR
7 - OIL PUMP BODY

(3) Measure thickness and diameter of outer rotor. If outer rotor thickness measures 10.699 mm (0.421 in.) or less (Fig. 110), or if the diameter is 85.924 mm (3.383 in.) or less, replace outer rotor.

(4) If inner rotor measures 10.699 mm (0.421 in.) or less replace inner rotor (Fig. 111).

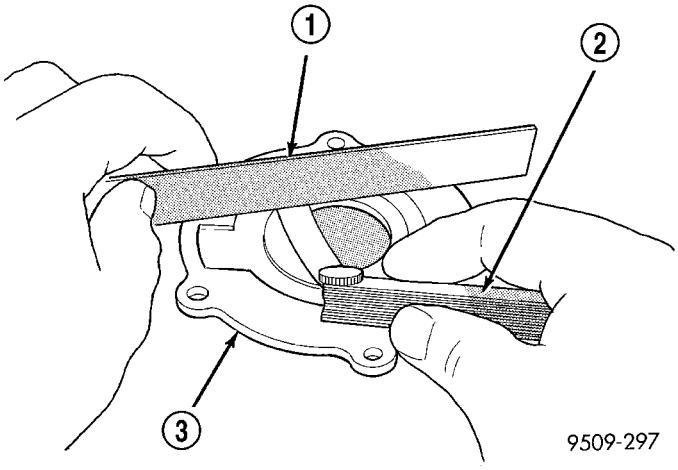


Fig. 109 Checking Oil Pump Cover Flatness

1 - STRAIGHT EDGE
2 - FEELER GAUGE
3 - OIL PUMP COVER

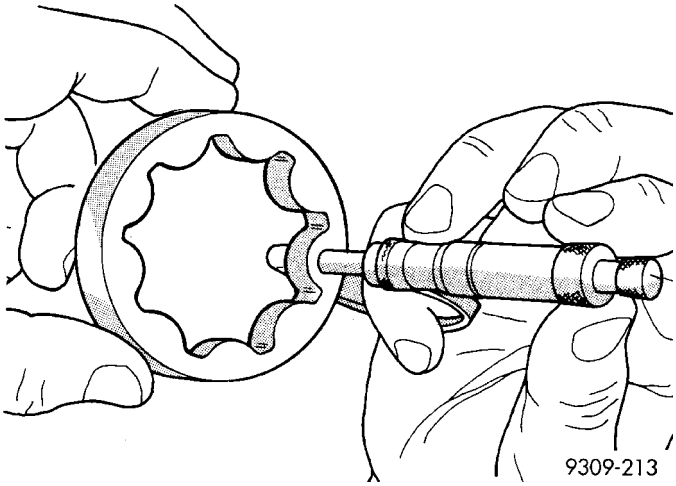


Fig. 110 Measuring Outer Rotor Thickness

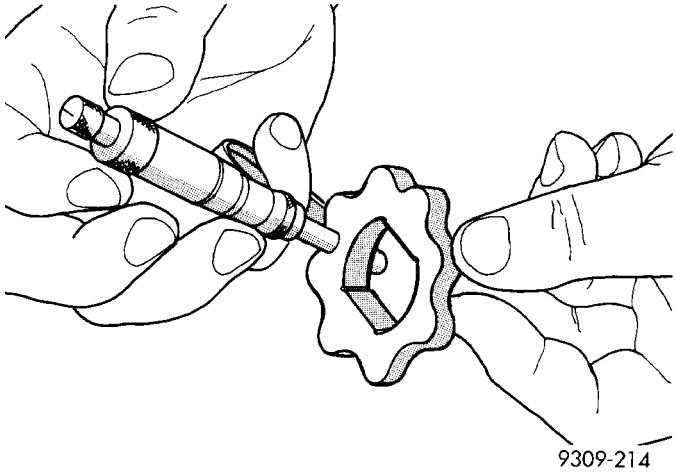


Fig. 111 Measuring Inner Rotor Thickness

OIL PUMP (Continued)

ASSEMBLY

(1) Assemble pump, using new parts as required. **Install the inner rotor with chamfer facing the cast iron oil pump cover.**

(2) Prime oil pump before installation by filling rotor cavity with engine oil.

(3) Install cover and tighten fasteners to 13 N·m (118 in. lbs.) (Fig. 108).

INSTALLATION

(1) Make sure all surfaces are clean and free of oil and dirt.

(2) Apply Mopar® Gasket Maker to oil pump as shown in (Fig. 112). Install O-ring into oil pump body discharge passage.

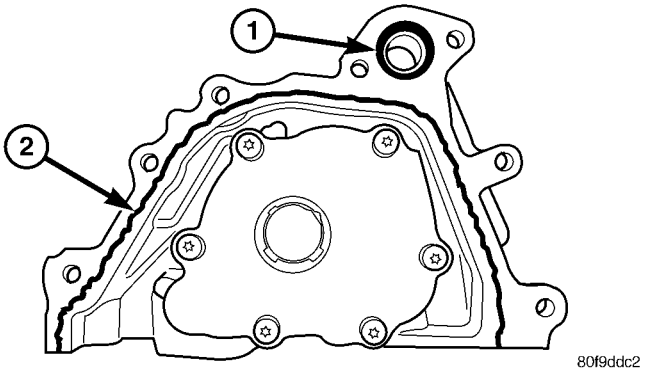


Fig. 112 Oil Pump Sealing

1 - O-RING
2 - SEALER LOCATION

(3) Prime oil pump with engine oil before installation.

(4) Align oil pump rotor flats with flats on crankshaft. Install the oil pump to the block (Fig. 107).

CAUTION: To align, the front crankshaft seal MUST be out of pump, or damage may result.

(5) Install new front crankshaft seal using Special Tool 6780 (Fig. 113).

(6) Install crankshaft key (Fig. 106).

CAUTION: The crankshaft sprocket is set to a predetermined depth from the factory for correct timing belt tracking. If removed, use of Special Tool 6792 is required to set the sprocket to original installation depth. An incorrectly installed sprocket will result in timing belt and engine damage.

(7) Install crankshaft sprocket using Special Tool 6792 (Fig. 114).

(8) Install oil pump pick-up tube.

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

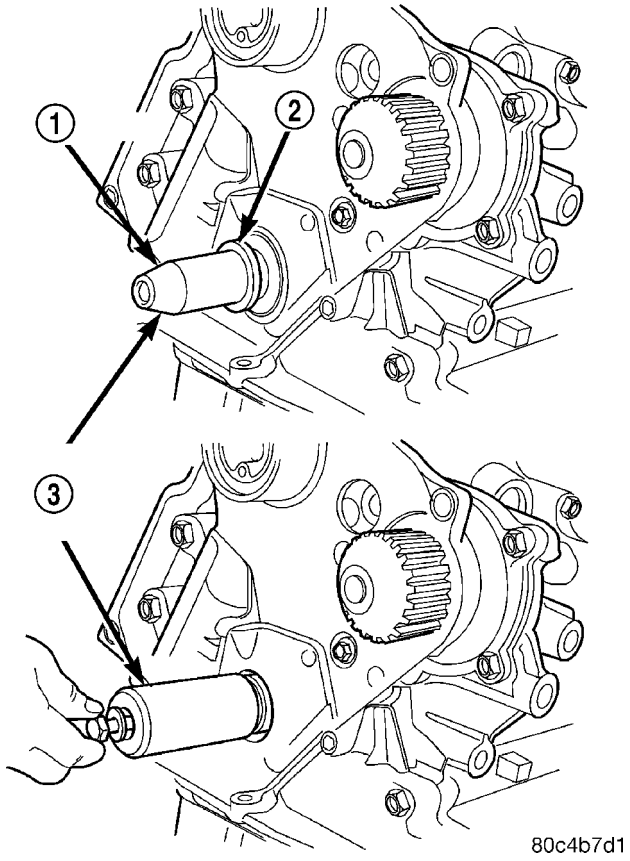


Fig. 113 Front Crankshaft Seal - Installation

1 - PROTECTOR
2 - SEAL
3 - SPECIAL TOOL 6780

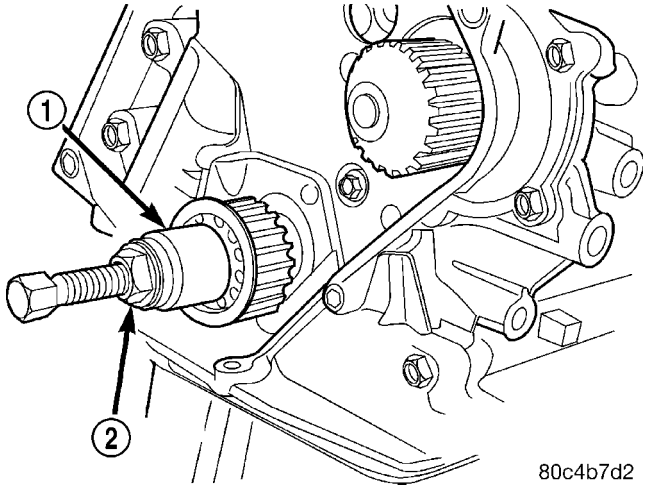


Fig. 114 Crankshaft Sprocket - Installation

1 - SPECIAL TOOL 6792
2 - TIGHTEN NUT TO INSTALL

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

OIL PUMP (Continued)

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

OIL JET

DESCRIPTION

The 2.4L Turbocharged engines are equipped with four oil jets installed in the engine block. The oil jets are provided engine oil pressure from the main oil gallery. The oil jets are used to cool the pistons. An integral check ball controls the flow of oil through the oil jet (Fig. 115).

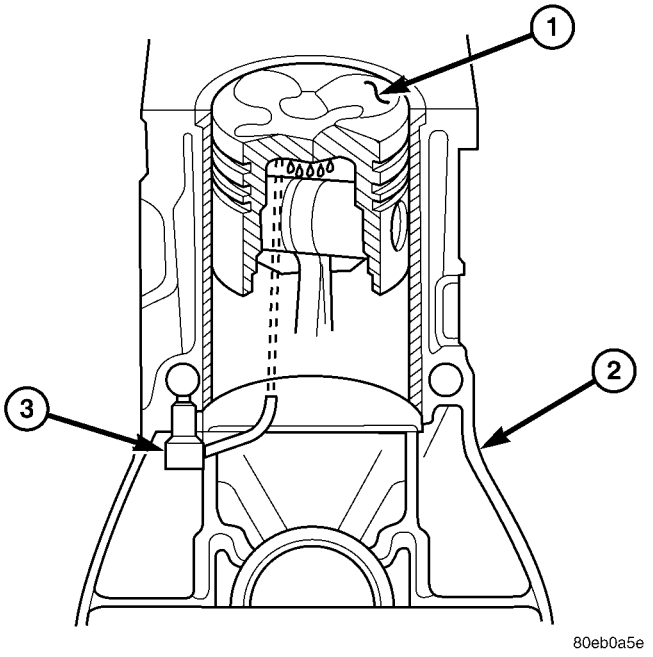


Fig. 115 Oil Jet - 2.4L Turbo

1 - PISTON ASSEMBLY
2 - ENGINE BLOCK
3 - OIL JET

REMOVAL

(1) Remove crankshaft (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - REMOVAL).

(2) Remove oil jet fastener (Fig. 116).

CAUTION: Do Not Pull on Oil Jet Tube

(3) Using pliers or other similar tool, pull oil jet from engine block.

INSTALLATION

(1) Inspect oil jet o-ring (Fig. 117).

(2) Lightly coat o-ring with clean engine oil.

(3) Push oil jet into engine block until it is fully seated.

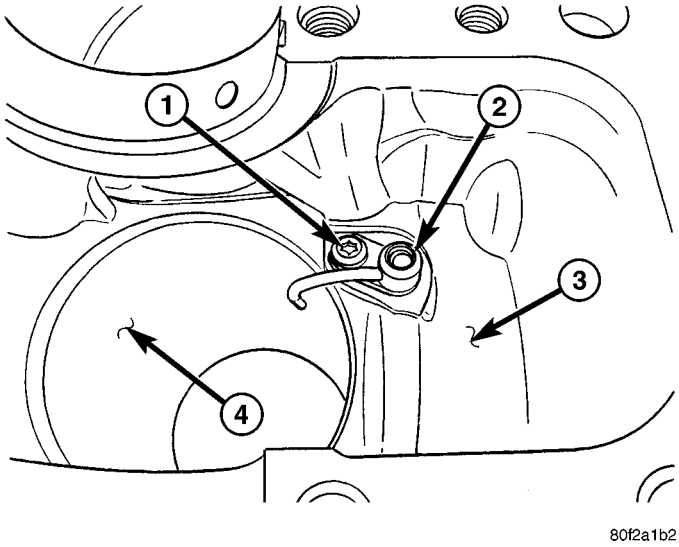


Fig. 116 Oil Jet Fastener - 2.4L Turbo

1 - FASTENER - 12 N·m (105 in. lbs.)
2 - OIL JET
3 - ENGINE BLOCK
4 - CYLINDER WALL

CAUTION: Ensure oil jet is fully seated in engine block before installing fastener. Do Not use the oil jet fastener to draw the oil jet into the engine block. Damage to oil jet may occur.

(4) Install oil jet fastener. Torque fastener to 12 N·m (105 in. lbs.) (Fig. 116).

(5) Install crankshaft (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - INSTALLATION).

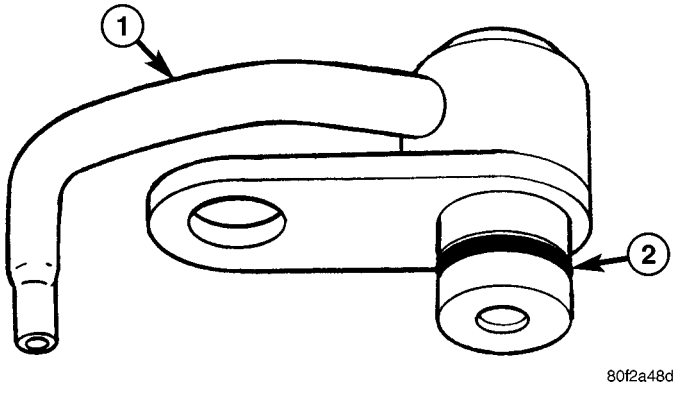


Fig. 117 Oil Jet O-ring

1 - OIL JET
2 - O-RING

OIL COOLER & LINES

DESCRIPTION

An engine oil cooler is used on the 2.4L Turbocharged engine. The cooler is a coolant-to-oil type and mounted between the oil filter and oil filter adapter (Fig. 118).

REMOVAL

(1) Raise vehicle on hoist.
(2) Drain cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).
(3) Disconnect oil cooler coolant hoses (Fig. 118).
(4) Remove oil filter.
(5) Remove oil cooler connector bolt (Fig. 119).
(6) Remove oil cooler.

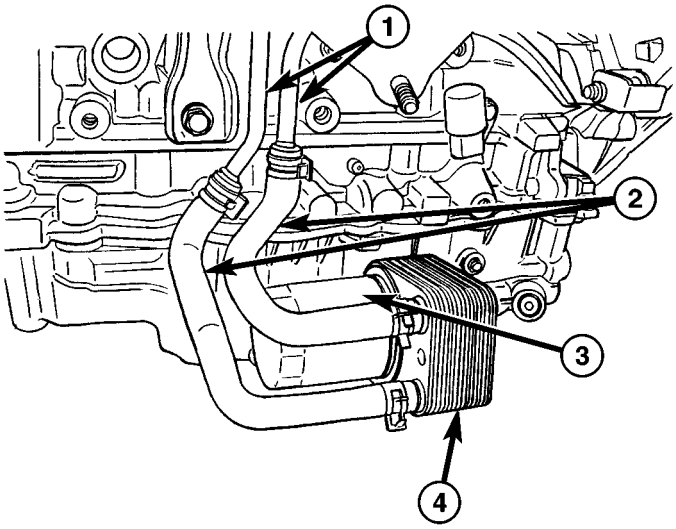


Fig. 118 Oil Cooler and Lines

1 - COOLANT TUBES
2 - COOLANT HOSES
3 - OIL FILTER
4 - OIL COOLER

INSTALLATION

(1) Replace oil cooler seal (Fig. 120).
(2) Lubricate seal and position oil cooler to oil filter adapter, aligning notch to tab (Fig. 121).
(3) Install oil cooler connector bolt. Torque connector bolt to 55 N·m (41 ft. lbs.) (Fig. 119).
(4) Install oil filter.
(5) Connect oil cooler coolant hoses (Fig. 118).
(6) Lower vehicle.
(7) Fill cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).

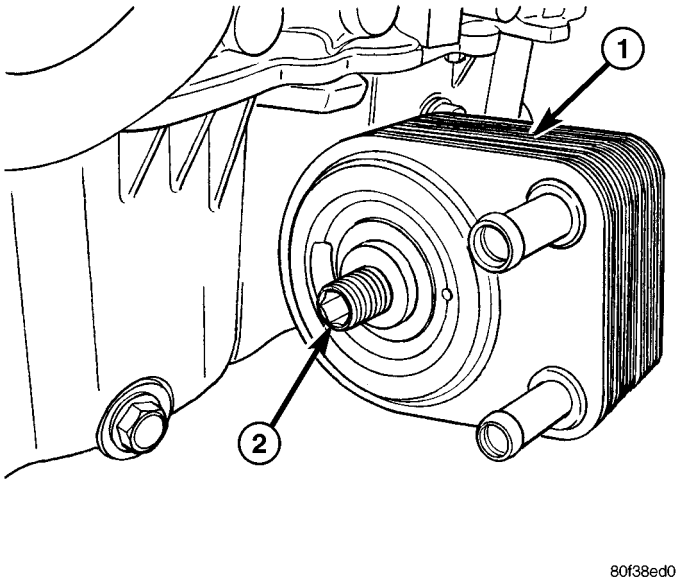


Fig. 119 Oil Cooler Connector Bolt

1 - OIL COOLER
2 - CONNECTOR BOLT

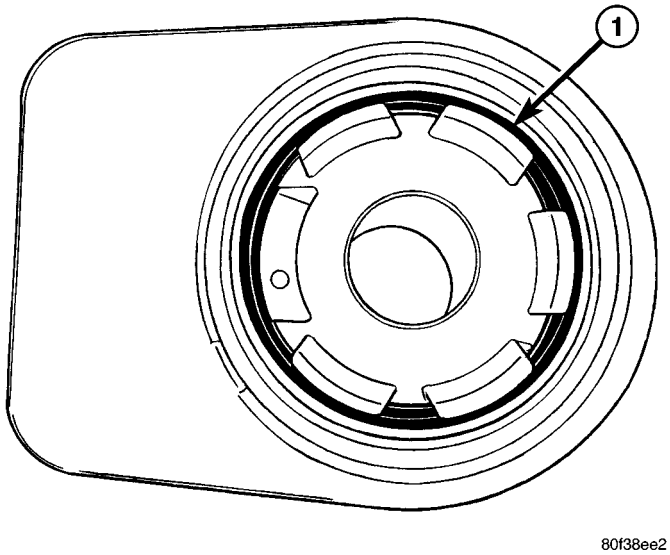


Fig. 120 Oil Cooler Seal

1 - OIL COOLER SEAL

INTAKE MANIFOLD

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.

INTAKE MANIFOLD (Continued)

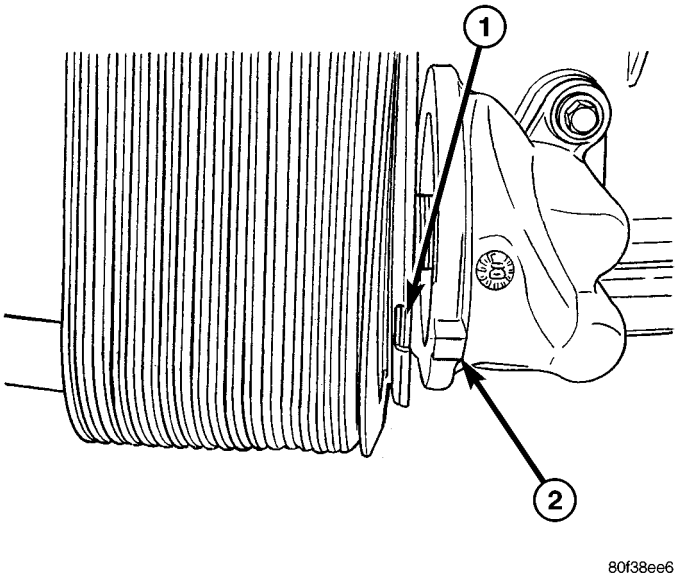


Fig. 121 Oil Cooler Alignment

1 - NOTCH
2 - TAB

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 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 battery cable.
(3) Remove fuel rail trim cover by pulling straight off fuel rail studs (Fig. 122).
(4) Disconnect charge air cooler to throttle body hose (Fig. 123).
(5) Disconnect vacuum hoses from throttle body and intake manifold.
(6) Disconnect throttle cable from throttle body.

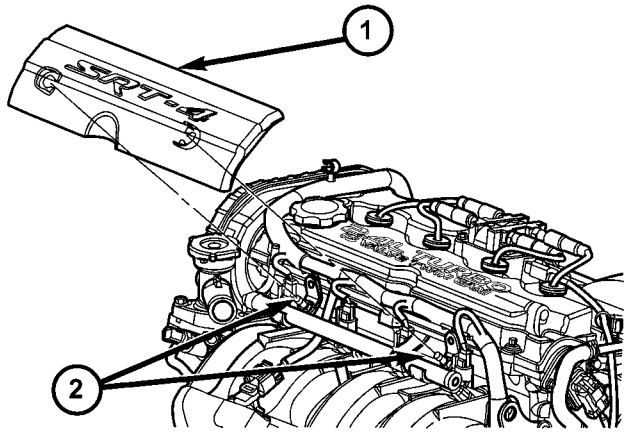


Fig. 122 Fuel Rail Cover

1 - COVER
2 - STUDS

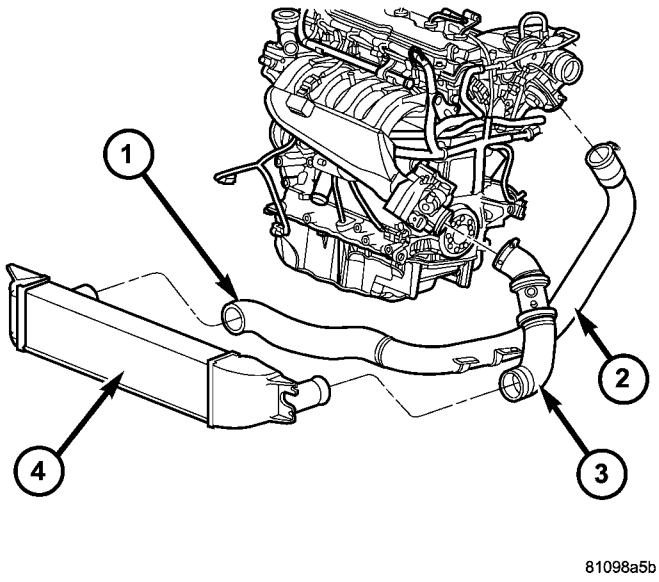


Fig. 123 Charge Air Cooler Hoses

1 - HOSE
2 - HOSE/TUBE - TURBOCHARGER TO CHARGE AIR COOLER
3 - HOSE - CHARGE AIR COOLER TO THROTTLE BODY
4 - CHARGE AIR COOLER

(7) Disconnect Throttle Position Sensor (TPS) and Idle Air Control (IAC) motor electrical connectors

INTAKE MANIFOLD (Continued)

(8) Remove intake manifold support bracket (Fig. 124).

(9) Disconnect fuel injector electrical connectors (Fig. 125). Unclip injector wiring harness from fuel rail.

(10) Disconnect MAP sensor electrical connector (Fig. 125).

(11) Disconnect the fuel supply line quick connect at the fuel rail assembly (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE) (Fig. 125).

WARNING: WRAP SHOP TOWELS AROUND HOSE TO CATCH ANY GASOLINE SPILLAGE.

(12) Remove intake manifold fasteners.

(13) Remove intake manifold.

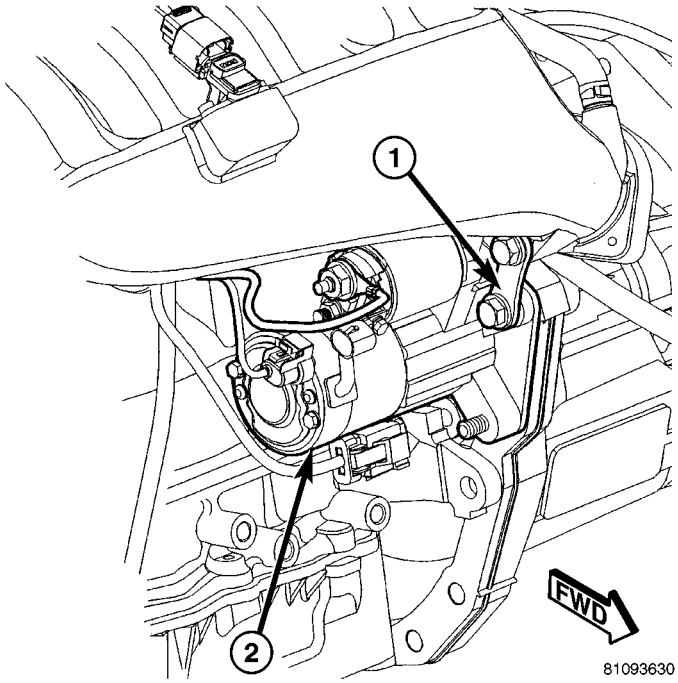


Fig. 124 Intake Manifold Support Bracket

1 - INTAKE MANIFOLD SUPPORT BRACKET
2 - STARTER

CLEANING

(1) Discard gasket(s).

(2) Clean all sealing surfaces.

INSPECTION

(1) Inspect manifold for cracks or distortion. Replace manifold if necessary.

(2) Inspect manifold for gasket surface damage or warpage. Replace manifold if necessary.

INSTALLATION

(1) Clean all gasket surfaces.

(2) Replace intake manifold gasket.

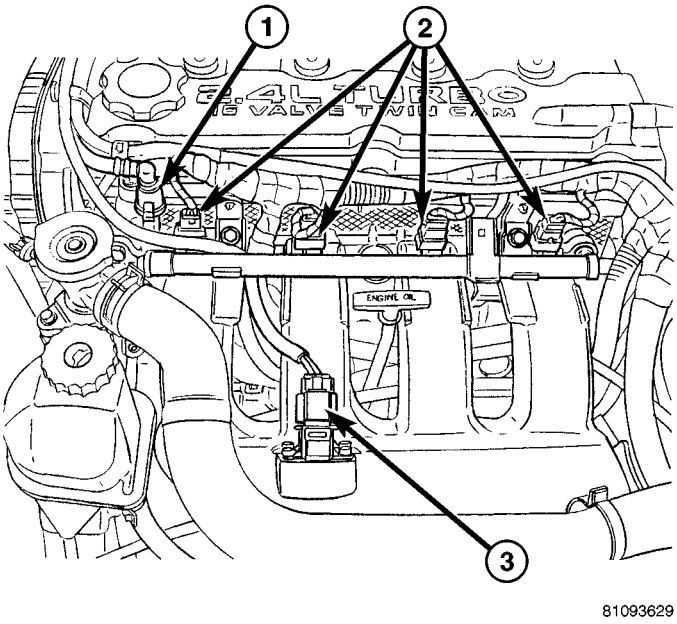


Fig. 125 Electrical and Fuel Line Connections

1 - FUEL SUPPLY LINE CONNECTION
2 - FUEL INJECTOR CONNECTORS
3 - MAP SENSOR

(3) Install intake manifold. Tighten fasteners to 23 N·m (200 in. lbs.).

(4) If removed, install the fuel rail assembly to intake manifold. Tighten screws to 23 N·m (200 in. lbs.).

(5) Inspect fuel supply line quick connect fitting for damage, replace if necessary (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE). Lubricate tube with clean engine oil. Connect fuel supply line to fuel rail assembly. Check connection by pulling on connector to insure it locked into position (Fig. 125).

(6) Connect MAP sensor electrical connector (Fig. 125).

(7) Connect fuel injector electrical connectors (Fig. 125). Clip injector wiring harness to fuel rail.

(8) Install intake manifold support bracket. Tighten fasteners to 23 N·m (200 in. lbs.) (Fig. 124).

(9) Connect Throttle Position Sensor (TPS) and Idle Air Control (IAC) motor electrical connectors.

(10) Connect throttle cable to throttle body.

(11) Connect vacuum hoses to throttle body and intake manifold.

(12) Connect charge air cooler to throttle body hose (Fig. 123).

(13) Install fuel rail trim cover by pushing it over fuel rail studs (Fig. 122).

(14) Connect negative cable to battery.

INTAKE MANIFOLD (Continued)

(15) With the DRBIII® scan tool use ASD Fuel System Test to pressurize the fuel 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.

EXHAUST MANIFOLD

REMOVAL

NOTE: DO NOT SEPARATE. The exhaust manifold is serviced as an assembly with the Turbocharger. (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/TURBOCHARGER - REMOVAL).

INSTALLATION

NOTE: DO NOT SEPARATE. The exhaust manifold is serviced as an assembly with the Turbocharger. (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/TURBOCHARGER - INSTALLATION).

TIMING BELT COVER(S)

REMOVAL

FRONT COVER—UPPER

(1) Remove upper torque strut attaching bolts and remove strut (Fig. 126).

(2) Remove torque strut bracket from strut tower (Fig. 126).

(3) Remove torque strut bracket from engine (Fig. 126).

(4) Remove upper timing belt cover fasteners (Fig. 127) and remove cover.

FRONT COVER—LOWER

(1) Disconnect negative battery cable.

(2) Raise vehicle on hoist. Remove right front wheel.

(3) Remove the acessory drive belt splash shield.

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

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

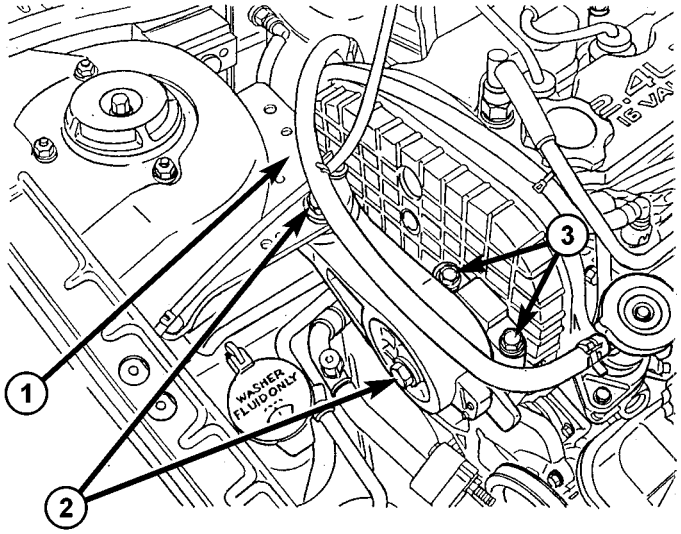


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Fig. 126 Upper Torque Strut and Bracket

1 - TORQUE STRUT BRACKET
2 - TORQUE STRUT MOUNTING BOLTS
3 - ENGINE BRACKET MOUNTING BOLTS

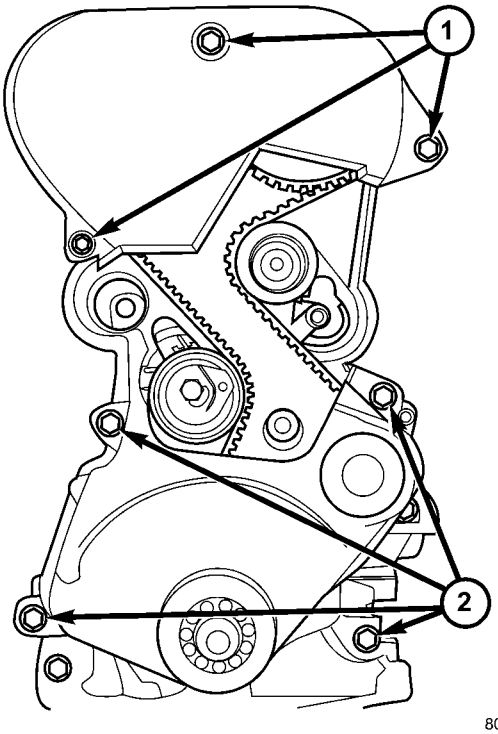

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Fig. 127 Front Timing Belt Covers

1 - UPPER COVER FASTENERS
2 - LOWER COVER FASTENERS

TIMING BELT COVER(S) (Continued)

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

(7) Disconnect exhaust system from manifold.

(8) Disconnect A/C pressure switch at rear of compressor housing.

(9) Lower vehicle and support engine with a jack.

(10) Remove upper torque strut attaching bolts and remove strut (Fig. 126).

(11) Remove power steering pump and bracket. Set pump aside. **Do not disconnect lines from pump.**

(12) With engine properly supported, remove right engine mount through bolt.

(13) Raise engine with jack until engine support bracket bolts are accessible (Fig. 128).

(14) Remove engine support bracket (Fig. 128).

(15) Remove timing belt cover fasteners and remove cover (Fig. 127).

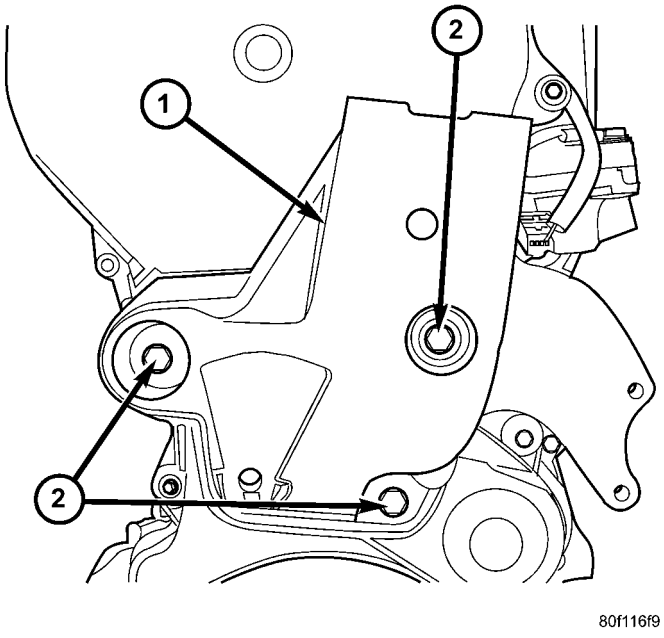

Fig. 128 Engine Support Bracket

1 - ENGINE SUPPORT BRACKET
2 - BOLTS - 61 N·m (45 ft. lbs.)

REAR COVER

(1) Remove front timing belt covers. Refer to above procedures.

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

(3) Remove timing belt idler pulley (Fig. 129).

(4) Remove camshaft sprockets. Use Special Tool 6847 to hold camshaft sprockets while removing the sprocket bolts (Fig. 130).

(5) Remove rear timing belt cover fasteners and remove cover from engine (Fig. 131).

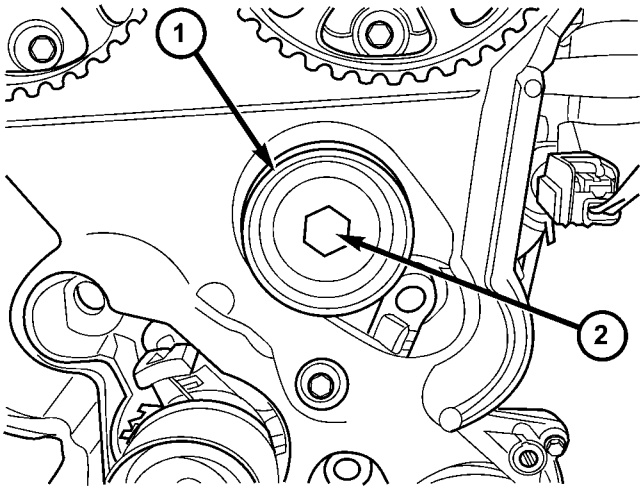

Fig. 129 Timing Belt Idler Pulley

1 - IDLER PULLEY
2 - BOLT

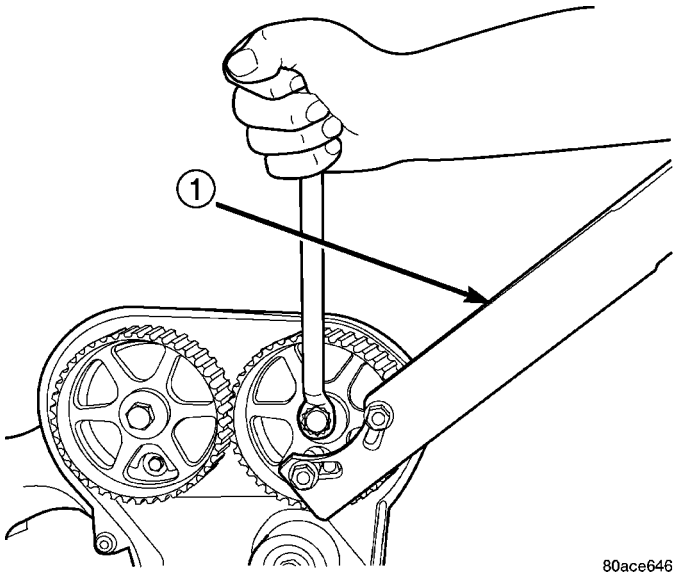

Fig. 130 Camshaft Sprocket—Removal/Installation

1 - SPECIAL TOOL 6847

INSTALLATION

FRONT COVER—UPPER

(1) Install timing belt cover and tighten fasteners to 6 N·m (50 in. lbs.) (Fig. 127).

(2) Install torque strut bracket to engine (Fig. 126).

(3) Install torque strut bracket to strut tower (Fig. 126).

TIMING BELT COVER(S) (Continued)

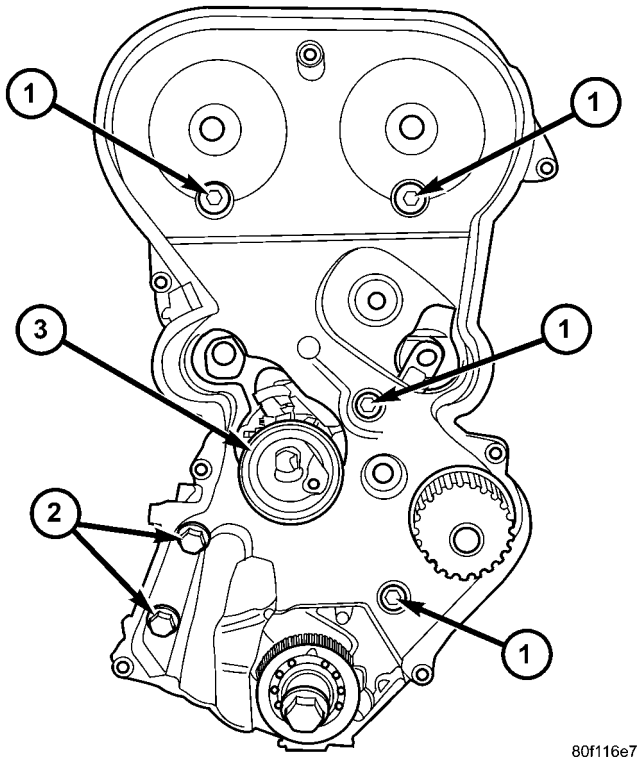

Fig. 131 Rear Timing Belt Cover Fasteners

1 - M6 BOLTS - 12 N·m (105 in. lbs.)
2 - M8 BOLTS - 28 N·m (250 in. lbs.)
3 - TIMING BELT TENSIONER

(4) Install upper torque strut attaching bolts (Fig. 126).

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

FRONT COVER—LOWER

(1) Install lower timing belt cover and tighten fasteners to 6 N·m (50 in. lbs.) (Fig. 127).

(2) Install engine support bracket (Fig. 128). Ensure the power steering pump is properly located in mounting location on bracket. Tighten mount bracket bolts to 61 N·m (45 ft. lbs.).

(3) Lower engine into mounting position and install right engine mount through bolt. Tighten bolt to 118 N·m (87 ft. lbs.).

(4) Install power steering pump and bracket.

(5) Install upper torque strut attaching bolts (Fig. 126).

(6) Raise vehicle.

(7) Connect exhaust system to manifold.

(8) Connect A/C pressure switch connector.

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

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

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

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

(13) Install acessory drive belt splash shield.

(14) Install right front wheel.

(15) Connect negative cable to battery.

REAR COVER

(1) Install rear timing belt cover and fasteners. Torque fasteners to values specified in (Fig. 131).

(2) Install timing belt idler pulley (Fig. 129). Torque timing belt idler pulley fastener to 61 N·m (45 ft. lbs.).

CAUTION: Do not use an impact wrench to tighten camshaft sprocket bolts. Damage to the camshaft-to-sprocket locating dowel pin may occur.

(3) Install camshaft sprockets. Hold sprockets with Special Tool 6847 while tightening center bolt to 115 N·m (85 ft. lbs.) (Fig. 130).

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

(5) Install front timing belt covers. Refer to above procedures.

TIMING BELT AND SPROCKETS

REMOVAL

REMOVAL - TIMING BELT

(1) Disconnect negative battery cable.

(2) Remove upper and lower front timing belt covers (Fig. 127). (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - REMOVAL).

CAUTION: When aligning crankshaft and camshaft timing marks always rotate engine from crankshaft. Camshaft should not be rotated after timing belt is removed. Damage to valve components may occur. Always align timing marks before removing timing belt.

(3) Before the removal of the timing belt, rotate crankshaft until the TDC mark on oil pump housing aligns with the TDC mark on crankshaft sprocket (trailing edge of sprocket tooth) (Fig. 132).

TIMING BELT AND SPROCKETS (Continued)

NOTE: The crankshaft sprocket TDC mark is located on the trailing edge of the sprocket tooth. Failure to align trailing edge of sprocket tooth to TDC mark on oil pump housing will cause the camshaft timing marks to be misaligned.

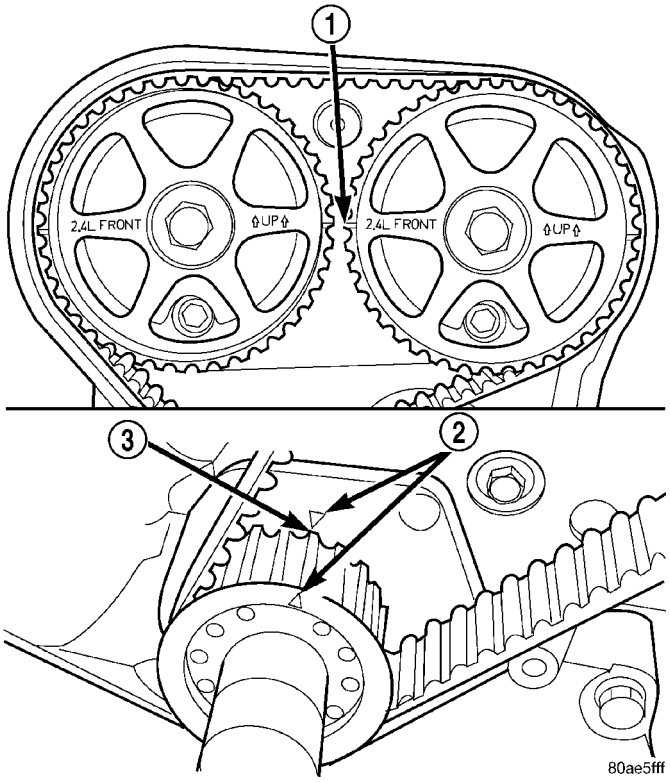

Fig. 132 Crankshaft and Camshaft Timing

1 - CAMSHAFT TIMING MARKS
2 - CRANKSHAFT TDC MARKS
3 - TRAILING EDGE OF SPROCKET TOOTH

(4) Loosen timing belt tensioner lock bolt (Fig. 133).

(5) Insert a 6 mm Allen wrench into the hexagon opening located on the top plate of the belt tensioner pulley (Fig. 133). Rotate the top plate **CLOCKWISE** until there is enough slack in timing belt to allow for removal.

(6) Remove timing belt.

CAUTION: If timing belt was damaged due to incorrect tracking (alignment), the belt tensioner pulley and bracket must be replaced as an assembly (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT TENSIONER & PULLEY - REMOVAL).

REMOVAL - CAMSHAFT SPROCKET(S)

(1) Remove upper and lower front timing belt covers (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - REMOVAL).

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

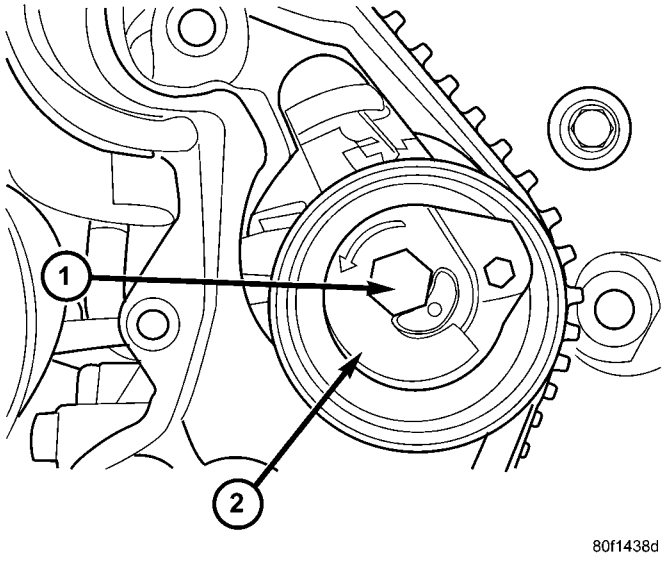

Fig. 133 Timing Belt Tensioner

1 - LOCK BOLT
2 - TOP PLATE

(3) Use Special Tool 6847 to hold camshaft sprockets while removing the sprocket bolt(s) (Fig. 134). Remove camshaft sprocket(s).

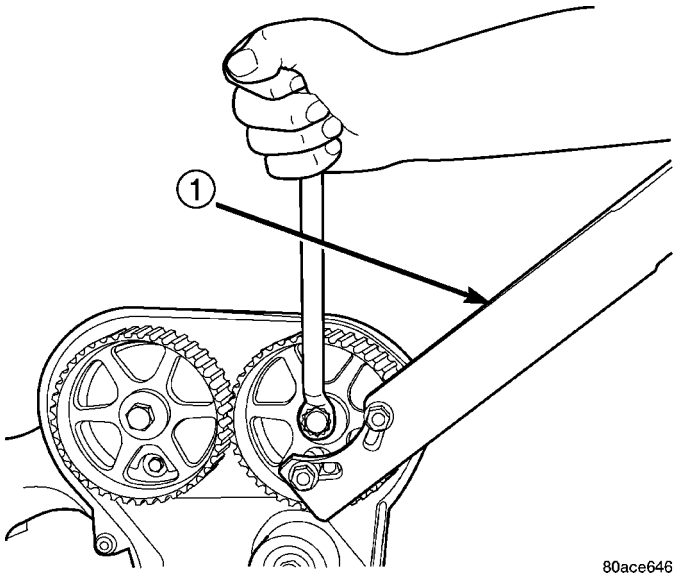

Fig. 134 Camshaft Sprocket—Removal/Installation

1 - SPECIAL TOOL 6847

REMOVAL - CRANKSHAFT SPROCKET

(1) Remove upper and lower front timing belt covers (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - REMOVAL).

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

(3) Remove crankshaft sprocket using Special Tool 6793 and insert C-4685-C2 (Fig. 135).

TIMING BELT AND SPROCKETS (Continued)

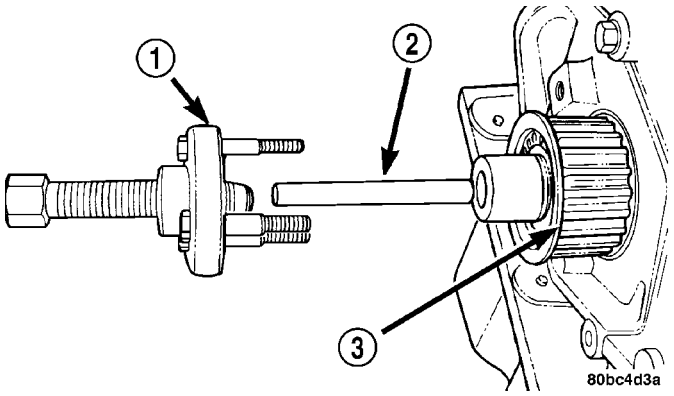

Fig. 135 Crankshaft Sprocket - Removal

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

INSTALLATION

INSTALLATION - CRANKSHAFT SPROCKET

CAUTION: The crankshaft sprocket is set to a predetermined depth from the factory for correct timing belt tracking. If removed, use of Special Tool 6792 is required to set the sprocket to original installation depth. An incorrectly installed sprocket will result in timing belt and engine damage.

(1) Install crankshaft sprocket using Special Tool 6792 (Fig. 136).
(2) Install timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT - INSTALLATION).
(3) Install upper and lower front timing belt covers (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - INSTALLATION).

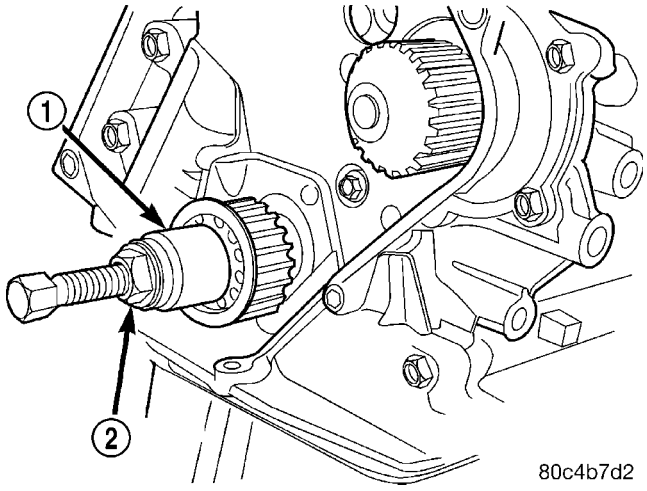

Fig. 136 Crankshaft Sprocket - Installation

1 - SPECIAL TOOL 6792
2 - TIGHTEN NUT TO INSTALL

INSTALLATION - CAMSHAFT SPROCKET(S)

CAUTION: Do not use an impact wrench to tighten camshaft sprocket bolts. Damage to the camshaft-to-sprocket locating dowel pin may occur.

(1) Install camshaft sprockets. Hold sprockets with Special Tool 6847 while tightening center bolt to 115 N·m (85 ft. lbs.) (Fig. 134).
(2) Install timing belt (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT - INSTALLATION).
(3) Install upper and lower front timing belt covers (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT COVER(S) - INSTALLATION).

INSTALLATION - TIMING BELT

(1) Set crankshaft sprocket to TDC by aligning the sprocket with the arrow on the oil pump housing.
(2) Set camshafts timing marks so that the exhaust camshaft sprocket is a 1/2 notch below the intake camshaft sprocket (Fig. 137).

CAUTION: Ensure that the arrows on both camshaft sprockets are facing up.

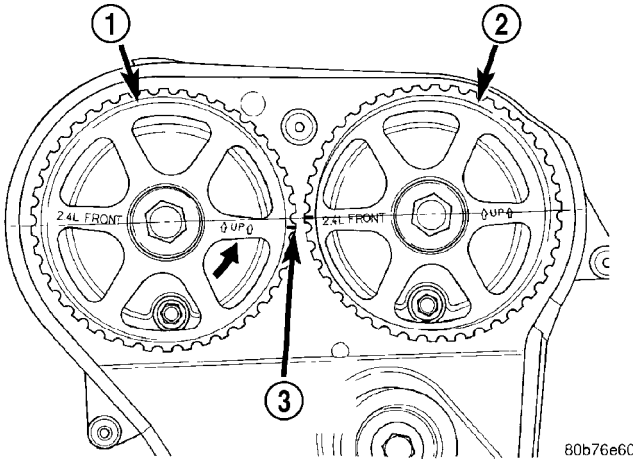

Fig. 137 Camshaft Sprocket Alignment For Timing Belt Installation

1 - CAMSHAFT SPROCKET-EXHAUST
2 - CAMSHAFT SPROCKET-INTAKE
3 - 1/2 NOTCH LOCATION

(3) Install timing belt. Starting at the crankshaft, go around the water pump sprocket, idler pulley, camshaft sprockets and then around the tensioner (Fig. 138).
(4) Move the exhaust camshaft sprocket counterclockwise (Fig. 138) to align marks and take up belt slack.

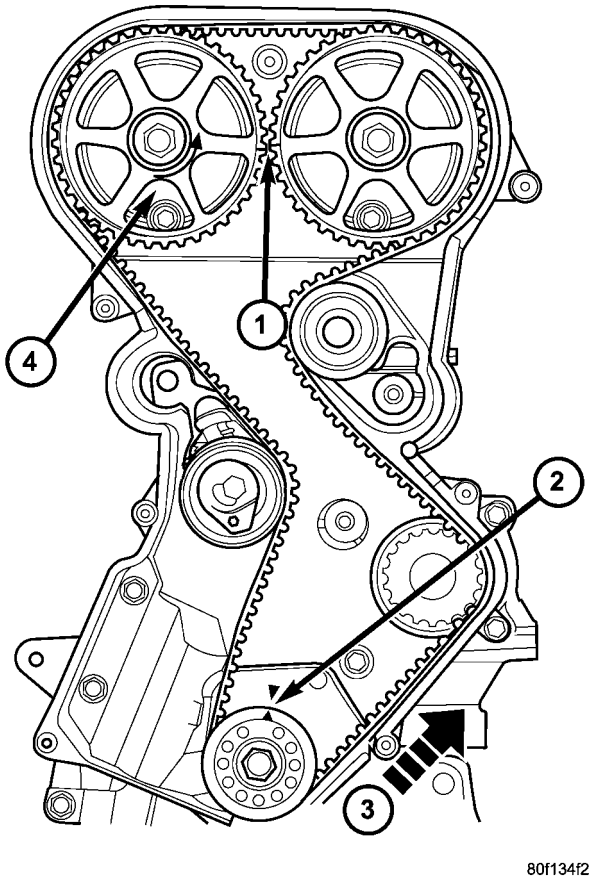

Fig. 138 Timing Belt Installation

1 - CAMSHAFT TIMING MARKS 1/2 NOTCH LOCATION
2 - CRANKSHAFT AT TDC
3 - INSTALL BELT IN THIS DIRECTION
4 - ROTATE CAMSHAFT SPROCKET TO TAKE UP BELT SLACK

(5) 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. 139). Using the allen wrench to prevent the top plate from moving, torque the tensioner lock bolt to 25 N·m (220 in. lbs.). Setting notch and spring tang should remain aligned after lock bolt is torqued.

(6) Remove allen wrench and torque wrench.

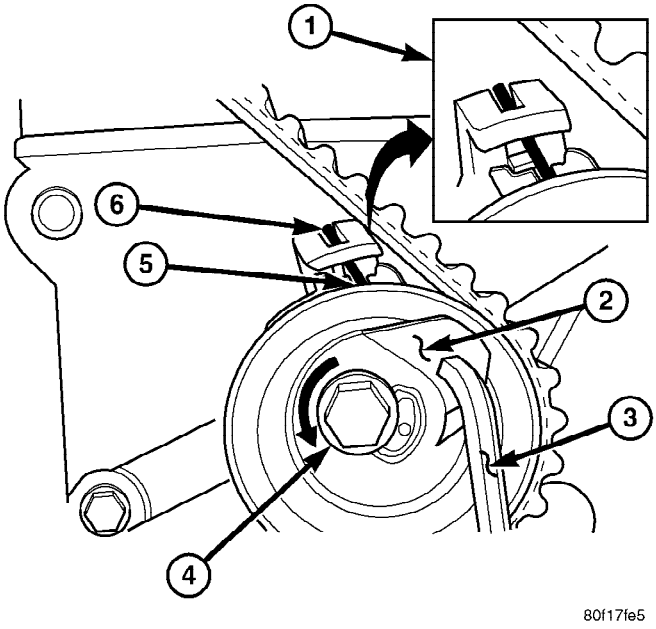

Fig. 139 Timing Belt Tension Adjustment

1 - ALIGN SETTING NOTCH WITH SPRING TANG
2 - TOP PLATE
3 - 6mm ALLEN WRENCH
4 - LOCK BOLT
5 - SETTING NOTCH
6 - SPRING TANG

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.

(7) 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. 140).

(8) Check if the spring tang is within the tolerance window (Fig. 141). 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 5 through 7.

(9) Install upper and lower front timing belt covers (Fig. 127). (Refer to 9 - ENGINE/VALVE TIMING/ TIMING BELT COVER(S) - INSTALLATION).

(10) Connect negative cable to battery.

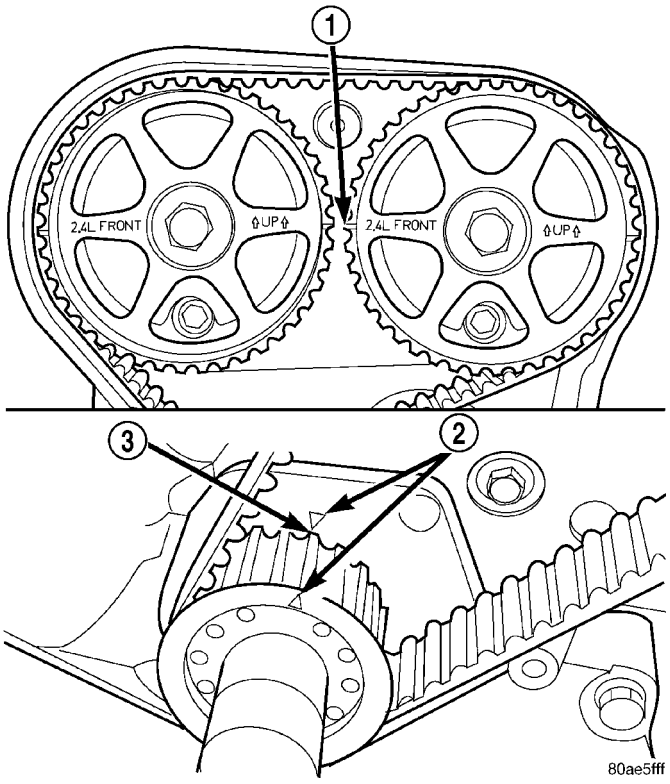

Fig. 140 Crankshaft and Camshaft Timing

1 - CAMSHAFT TIMING MARKS
2 - CRANKSHAFT TDC MARKS
3 - TRAILING EDGE OF SPROCKET TOOTH

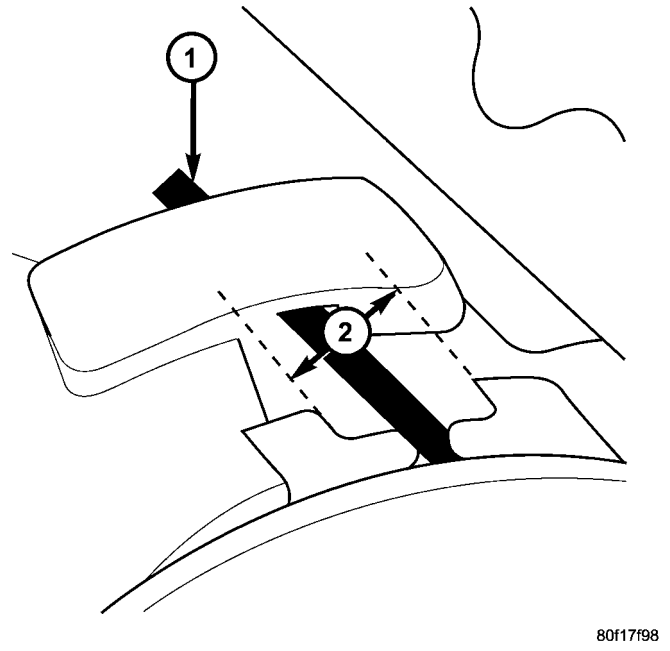

Fig. 141 Timing Belt Tension Verification

1 - SPRING TANG
2 - TOLERANCE WINDOW

TIMING BELT TENSIONER & PULLEY

REMOVAL

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

(2) Remove timing belt idler pulley.

(3) Hold camshaft sprocket with Special Tool 6847 while removing bolt (Fig. 142). Remove both camshaft sprockets.

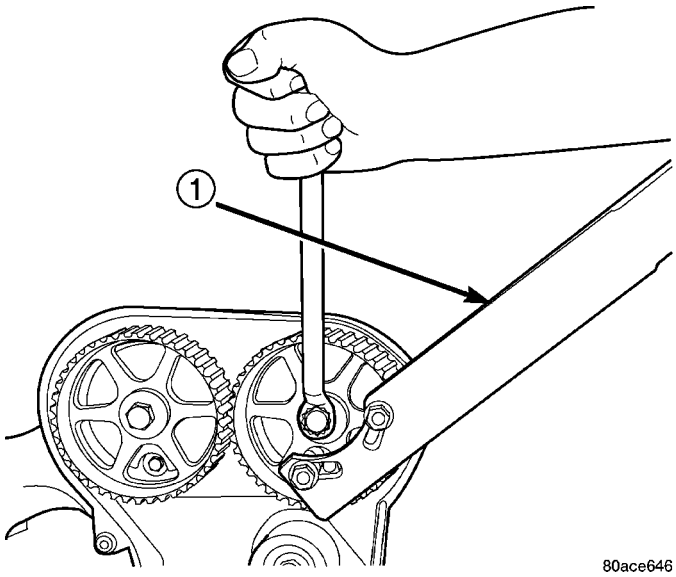

Fig. 142 Camshaft Sprockets

1 - SPECIAL TOOL 6847

(4) Remove rear timing belt cover fasteners and remove cover from engine (Fig. 143).

(5) Remove lower bolt attaching timing belt tensioner assembly to engine and remove tensioner **as an assembly** (Fig. 144).

INSTALLATION

(1) Align timing belt tensioner assembly to engine and install lower mounting bolt **but do not tighten** (Fig. 144). To properly align tensioner assembly to engine; temporarily install one of the engine bracket mounting bolts (M10) 5–7 turns into the tensioner assembly upper mounting location (Fig. 144).

(2) Torque the tensioner's lower mounting bolt to 61 N·m (45 ft. lbs.). Remove the upper bolt used for tensioner alignment.

(3) Install rear timing belt cover and fasteners (Fig. 143).

(4) Install timing belt idler pulley and torque mounting bolt to 61 N·m (45 ft. lbs.).

TIMING BELT TENSIONER & PULLEY (Continued)

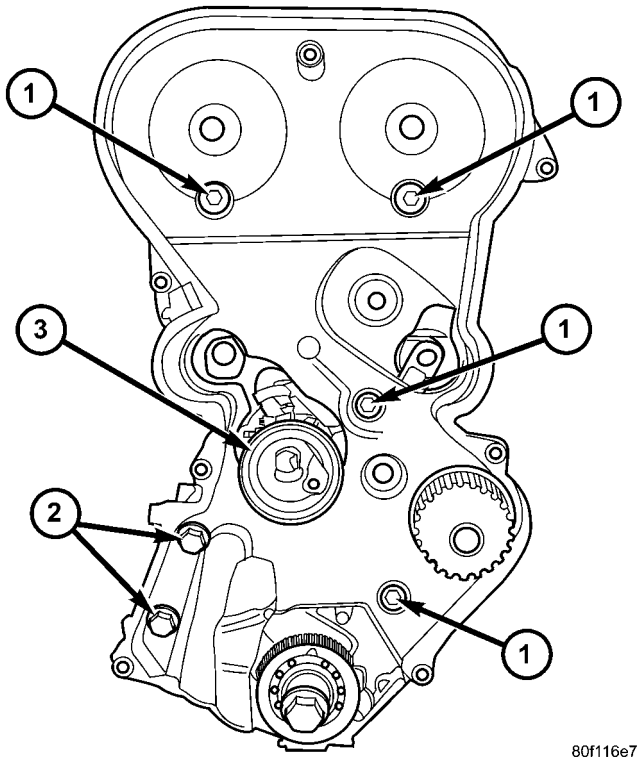

Fig. 143 Rear Timing Belt Cover Fasteners

1 - M6 BOLTS - 12 N·m (105 in. lbs.)
2 - M8 BOLTS - 28 N·m (250 in. lbs.)
3 - TIMING BELT TENSIONER

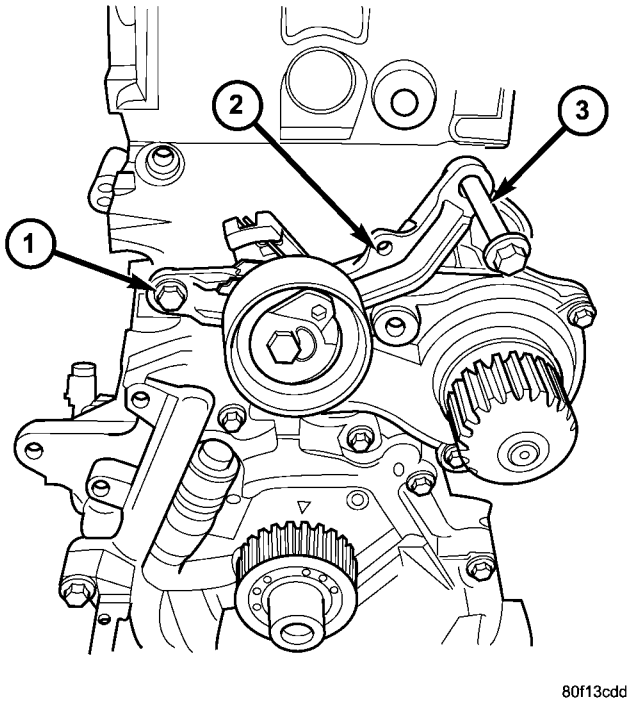

Fig. 144 Timing Belt Tensioner/Bracket Assembly

1 - BOLT
2 - TENSIONER ASSEMBLY
3 - BOLT-INSTALL FOR PROPER ALIGNMENT

CAUTION: Do not use an impact wrench to tighten camshaft sprocket bolts. Damage to the camshaft-to-sprocket locating dowel pin may occur.

(5) Install camshaft sprockets. Use Special Tool 6847 to hold sprockets (Fig. 142) and tighten bolts to 115 N·m (85 ft. lbs.).

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

BALANCE SHAFTS AND CARRIER ASSEMBLY

DESCRIPTION

The 2.4L engine is equipped with two nodular cast iron balance shafts installed in a cast aluminum carrier attached to the lower cylinder block (Fig. 145).

OPERATION

The balance shafts are driven by the crankshaft via a roller chain and sprockets. The balance shafts are connected by helical gears. The dual counter rotating shafts decrease second order vertical shaking forces caused by component movement.

REMOVAL

BALANCE SHAFTS/CHAIN/SPROCKETS

NOTE: For service procedures requiring only temporary relocation of carrier assembly refer to BALANCE SHAFT CARRIER procedure below.

(1) Drain engine oil.

(2) Remove the oil pan and pick-up tube (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(3) If replacing crankshaft sprocket, remove oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).

BALANCE SHAFTS AND CARRIER ASSEMBLY (Continued)

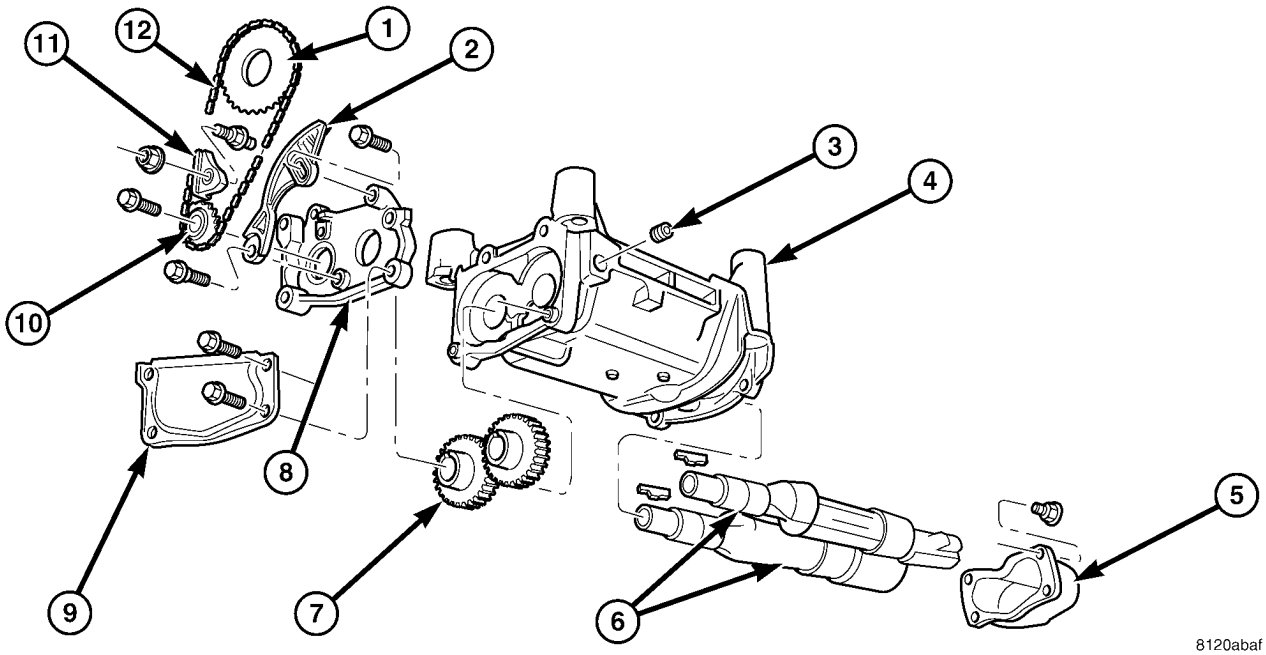

Fig. 145 Balance Shafts and Carrier Assembly

1 - SPROCKET
2 - TENSIONER
3 - PLUG
4 - CARRIER
5 - REAR COVER
6 - BALANCE SHAFTS
7 - GEARS
8 - GEAR COVER
9 - CHAIN COVER
10 - SPROCKET
11 - GUIDE
12 - CHAIN

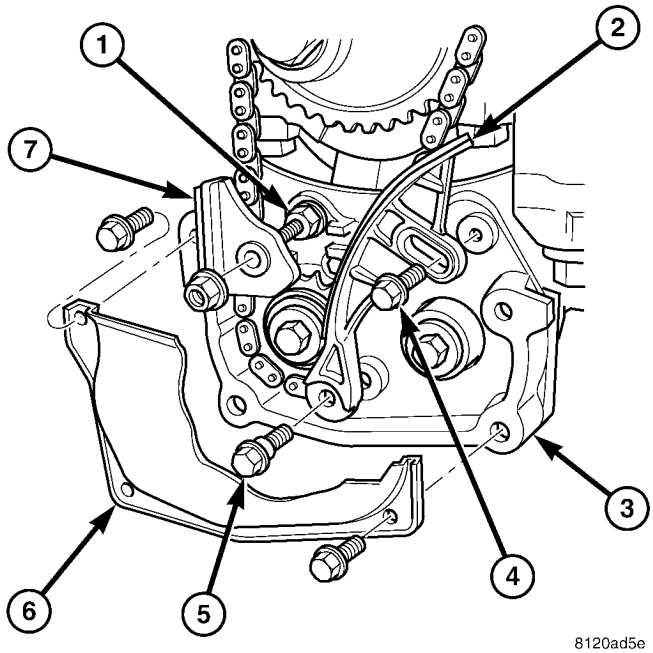

Fig. 146 Chain Cover, Guide and Tensioner

1 - STUD
2 - TENSIONER (ADJUSTER)
3 - GEAR COVER
4 - ADJUSTER SCREW
5 - SHOULDERED PIVOT SCREW
6 - CHAIN COVER (CUTAWAY)
7 - GUIDE

(4) Remove chain cover, guide and tensioner. Discard pivot screw and adjuster screw. (Fig. 146).

(5) Remove screw retaining balance shaft drive sprocket (Fig. 147). Remove chain and sprocket.

(6) Using two wide pry bars, work the crankshaft sprocket back and forth until it is off the crankshaft-shaft.

(7) Remove gear cover retaining stud (double ended to also retain chain guide). Remove cover and balance shaft gears (Fig. 148).

(8) Remove rear cover and balance shafts (Fig. 149).

(9) Remove four carrier to crankcase attaching bolts to separate carrier from engine bedplate.

BALANCE SHAFT CARRIER

The following components will remain intact during carrier removal: Gear cover, gears, balance shafts and the rear cover (Fig. 145).

(1) Drain engine oil.

(2) Remove the oil pan and pick-up tube (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(3) Remove chain cover, guide and tensioner (Fig. 146).

(4) Remove screw retaining balance shaft drive sprocket (Fig. 147).

BALANCE SHAFTS AND CARRIER ASSEMBLY (Continued)

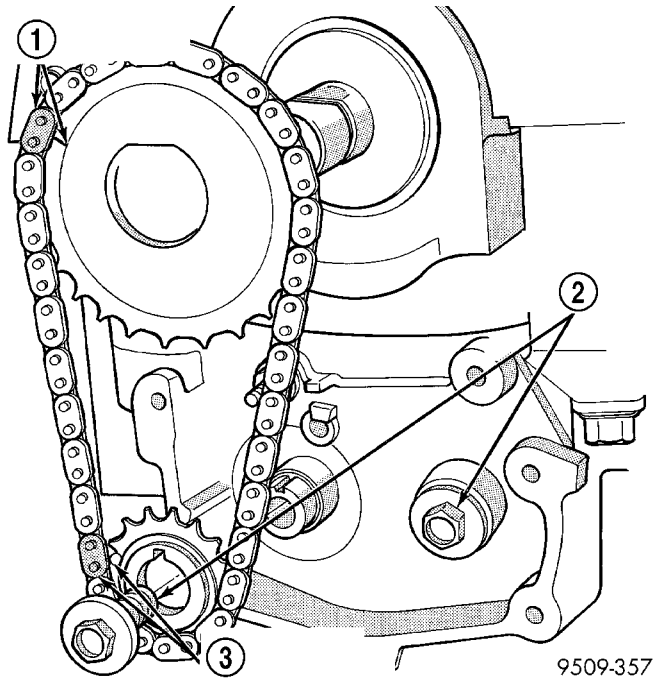

Fig. 147 Drive Chain and Sprockets

1 - NICKEL PLATED LINK AND MARK
2 - GEAR/SPROCKET SCREWS
3 - NICKEL PLATED LINK AND DOT

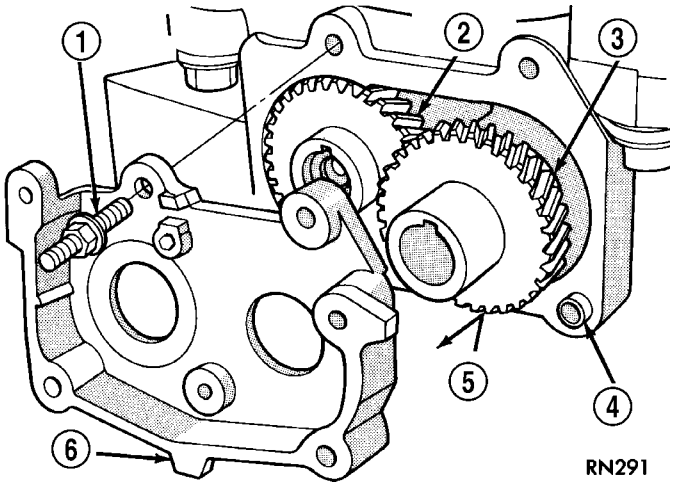

Fig. 148 Gear Cover and Gears

1 - STUD (DOUBLE ENDED)
2 - DRIVE GEAR
3 - DRIVEN GEAR
4 - CARRIER DOWEL
5 - GEAR(S)
6 - GEAR COVER

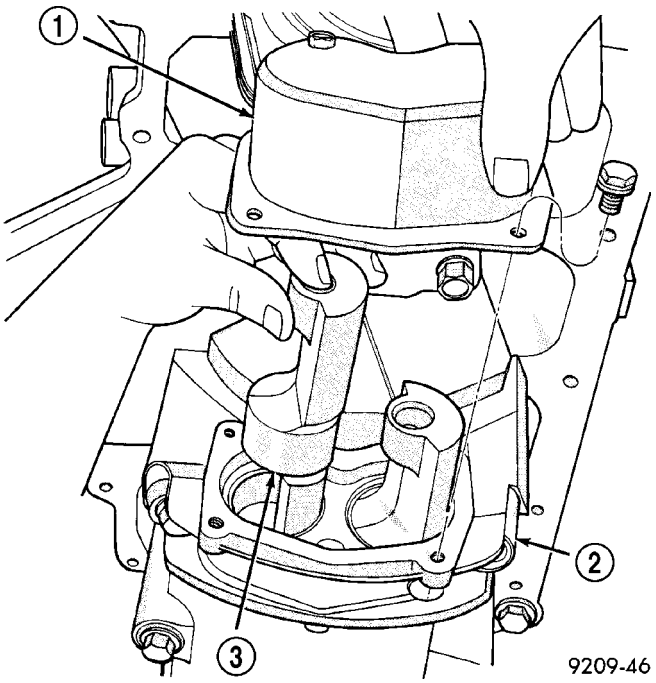

Fig. 149 Balance Shaft - Removal/Installation

1 - REAR COVER
2 - CARRIER
3 - BALANCE SHAFT

(5) Move balance shaft inboard through drive chain sprocket. Sprocket will hang in lower chain loop.

(6) Remove carrier to crankcase attaching bolts to remove carrier.

INSTALLATION

BALANCE SHAFT INSTALLATION/TIMING

Balance shaft and carrier assembly installation is the reverse of the removal procedure. **During installation crankshaft-to-balance shaft timing must be established. Refer to Timing procedure in this section.**

(1) With balance shafts installed in carrier (Fig. 145) position carrier on crankcase and install four attaching bolts and tighten to 54 N·m (40 ft. lbs.).

(2) Turn balance shafts until both shaft key ways are up, parallel to vertical centerline of engine. Install short hub drive gear on sprocket driven shaft and long hub gear on gear driven shaft. After installation gear and balance shaft keyways must be up with gear timing marks meshed as shown in (Fig. 150).

BALANCE SHAFTS AND CARRIER ASSEMBLY (Continued)

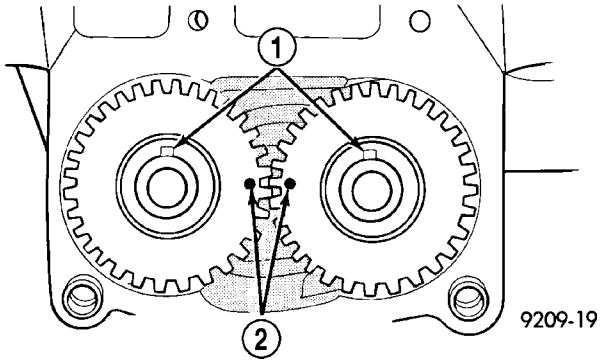

Fig. 150 Gear Timing

1 - KEY WAYS UP
2 - GEAR ALIGNMENT DOTS

(3) Install gear cover and tighten double ended stud/washer fastener to 12 N·m (105 in. lbs.).

(4) Align flat on balance shaft drive sprocket to the flat on crankshaft (Fig. 151).

(5) Install balance shaft drive sprocket on crankshaft using Special Tool 6052 (Fig. 152).

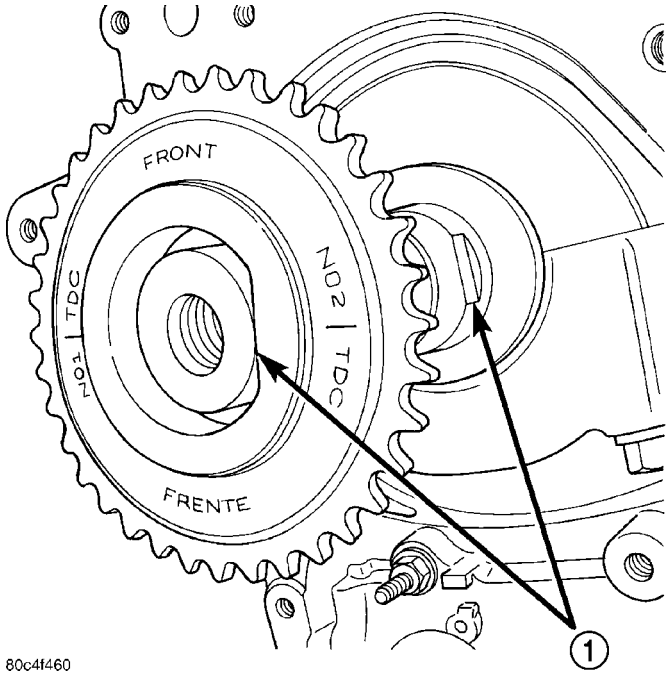

Fig. 151 Balance Shaft Sprocket Alignment to Crankshaft

1 - ALIGN FLATS

(6) Turn crankshaft until number 1 cylinder is at top dead center (TDC). The timing marks on the chain sprocket should line up with the parting line on the left side of number one main bearing cap. (Fig. 153).

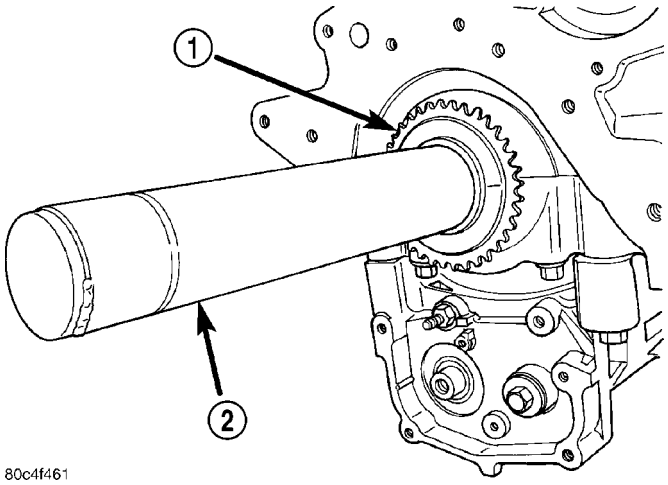

Fig. 152 Balance Shaft Drive

1 - SPROCKET
2 - SPECIAL TOOL 6052

(7) Place chain over crankshaft sprocket so that the plated link of the chain is over the number 1 cylinder timing mark on the balance shaft crankshaft sprocket (Fig. 153).

(8) Place balance shaft sprocket into the timing chain (Fig. 153) and align the timing mark on the sprocket (dot) with the (lower) plated link on the chain.

NOTE: The lower plated link is 8 links from the upper link.

(9) With balance shaft keyways pointing up (12 o'clock) slide the balance shaft sprocket onto the nose of the balance shaft. The balance shaft may have to be pushed in slightly to allow for clearance.

NOTE: THE TIMING MARK ON THE SPROCKET, THE (LOWER) NICKEL PLATED LINK, AND THE ARROW ON THE SIDE OF THE GEAR COVER SHOULD LINE UP WHEN THE BALANCE SHAFTS ARE TIMED CORRECTLY.

(10) If the sprockets are timed correctly, install the balance shaft bolts and tighten to 28 N·m (250 in. lbs.). A wood block placed between crankcase and crankshaft counterbalance will prevent crankshaft and gear rotation.

(11) **CHAIN TENSIONING:**

(a) Install chain tensioner loosely assembled with **new** shouldered pivot screw and adjuster screw.

(b) Position guide on double ended stud making sure tab on the guide fits into slot on the gear cover. Install and tighten nut/washer assembly to 12 N·m (105 in. lbs.).

BALANCE SHAFTS AND CARRIER ASSEMBLY (Continued)

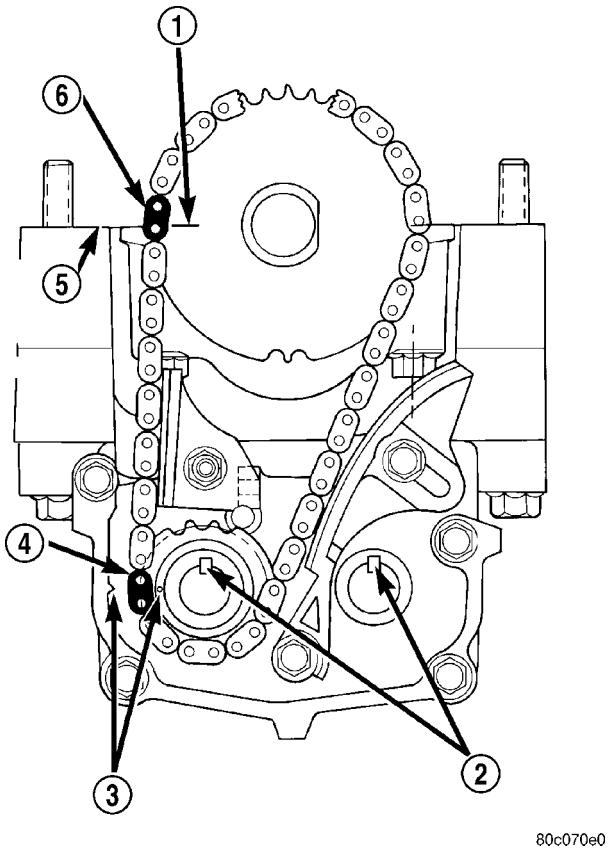

Fig. 153 Balance Shaft Timing

1 - MARK ON SPROCKET
2 - KEYWAYS UP
3 - ALIGN MARKS
4 - PLATED LINK
5 - PARTING LINE (BEDPLATE TO BLOCK)
6 - PLATED LINK

(c) Place a shim 1 mm (0.039 in.) thick x 70 mm (2.75 in.) long between tensioner and chain. Push tensioner and shim up against the chain. **Apply firm pressure 2.5–3 Kg (5.5–6.6 lbs.) directly behind the adjustment slot to take up all slack.** Chain must have shoe radius contact as shown in (Fig. 154).

(d) With the load applied, tighten top tensioner bolt first, then bottom pivot bolt. Tighten bolts to 12 N·m (105 in. lbs.). Remove shim.

(e) Install carrier covers and tighten screws to 12 N·m (105 in. lbs.).

(12) If removed, install oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).

(13) Install pick-up tube and oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

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

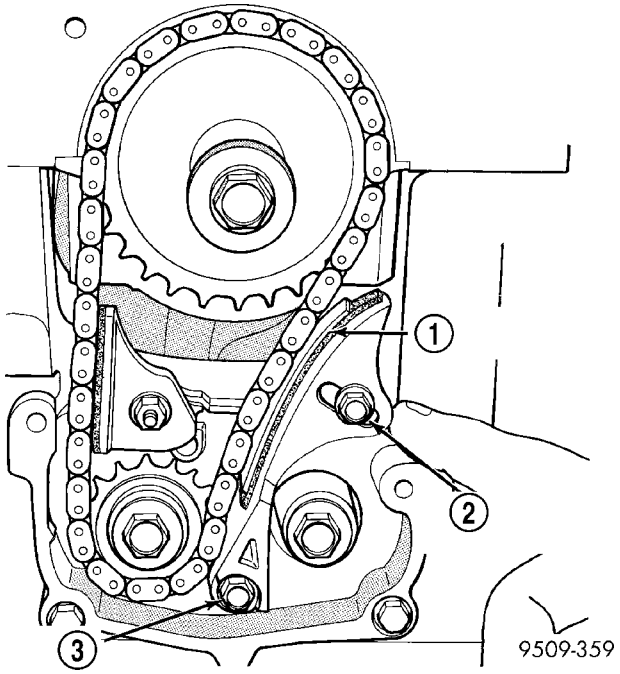

Fig. 154 Chain Tension Adjustment

1 - 1MM (0.039 IN.) SHIM
2 - TENSIONER (ADJUSTER) BOLT
3 - PIVOT BOLT