2011 ENGINE

3.8L - Service Information - Wrangler

DESCRIPTION

DESCRIPTION

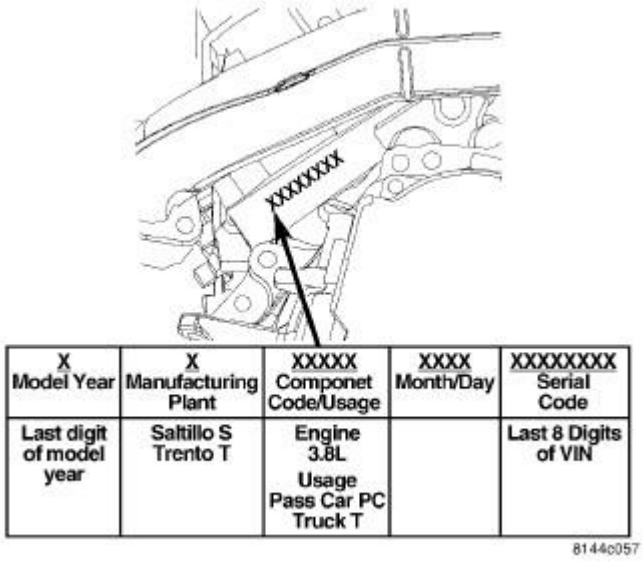

Fig. 1: Engine Identification
Courtesy of CHRYSLER GROUP, LLC

The 3.8 Liter (231 cu. in.) engine is 60° V-6 engines with cast iron cylinder blocks and aluminum cylinder heads. The engine uses a single, block mounted camshaft, roller lifters with pushrods to actuate the valves and either cracked cap, or standard cap, forged connecting rods. The engine does not have provisions for a free wheeling valve train.

The firing order is 1-2-3-4-5-6. The left cylinder bank is numbered 2, 4, and 6. The right cylinder bank is numbered 1, 3, and 5.

The engine identification number is located on the rear of the cylinder block just below the cylinder head.

DIAGNOSIS AND TESTING

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 **MECHANICAL** and **PERFORMANCE** for possible causes and corrections of malfunctions.

For fuel system diagnosis. Refer to **FUEL SYSTEM** article.

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

PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery.	1. Test battery. Charge or replace as necessary Refer to **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 **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 **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 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. Install new parts, as necessary. Refer to **DIAGNOSIS AND TESTING** .
	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.

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 pressure problem.
	5. Dirt in hydraulic lifters/lash adjusters.	5. Replace hydraulic lifters/lash adjusters.
	6. Worn rocker arms.	6. Inspect oil supply to rocker arms.
	7. Worn hydraulic lifters/lash adjusters.	7. Replace hydraulic lifters/lash adjusters.
	8. Worn valve guides.	8. Replace cylinder head assembly.
	9. Excessive runout of valve seats on valve faces.	9. Grind valve seats and valves.
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.
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 sensor/switch.	2. Replace oil pressure sensor/switch.
	3. Low oil pressure.	3. Check oil pressure sensor/switch 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.
OIL CONSUMPTION OR SPARK PLUGS FOULED	1. PCV system malfunction.	1. Check system and repair as necessary. Refer to **VALVE, POSITIVE CRANKCASE VENTILATION (PCV), 3.8L** .
	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. Replace cylinder head assembly.
	6. Valve stem seal(s) worn or	6. Replace seal(s).

	damaged.	

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 such as fouled, hot, oily, etc. Record cylinder number of spark plug for future reference.
4. Remove the Auto Shutdown (ASD) relay from the Power Distribution Center (PDC).
5. Insert compression gauge adaptor Special Tool (special tool #8116, Adapter, Pressure PEP) 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 **Engine - Special Tools**. .
6. Crank engine until maximum pressure is reached on gauge. Record this pressure as #1 cylinder pressure.
7. Repeat the previous step for all remaining cylinders.
8. Compression should not be less than 689 kPa (100 psi) and not vary more than 25 percent from cylinder to cylinder.
9. If one or more cylinders have abnormally low compression pressures, repeat the compression test.
10. 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.**

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.

OIL CONSUMPTION TEST AND DIAGNOSIS

DIAGNOSTIC PROCEDURES

The following diagnostic procedures are used to determine the source of excessive internal oil Consumption, these procedures and tests apply to vehicles with 50, 000 miles or less.

NOTE: Engine oil consumption may be greater than normal during engine break-in. Repairs should be delayed until vehicle has been driven at least 7, 500 miles.

Severe service (high ambient temperature, short trips, heavy loading, trailer towing, taxi, off-road, or law enforcement use) may result in greater oil consumption than normal.

Sustained high speed driving and high engine RPM operation may result in increased oil consumption.

Failure to comply with the recommended oil type and viscosity rating, as outlined in the owner's manual, may impact oil economy as well as fuel economy.

Oil consumption may increase with vehicle age and mileage due to normal engine wear.

NOTE: Because a few drops of external oil leakage per mile can quickly account for the loss of one quart of oil in a few hundred miles, ensure no external engine oil leaks are present.

- **Oil leakage is not the same as oil consumption and all external leakage must be eliminated before**

any action can be taken to verify and/or correct oil consumption complaints.

- **Verify that the engine has the correct oil level dipstick and dipstick tube installed.**
- **Verify that the engine is not being run in an overfilled condition. Check the oil level 15 minutes after a hot shutdown with the vehicle parked on a level surface. In no case should the level be above MAX or the FULL mark on the dipstick.**

OIL CONSUMPTION TEST

1. Check the oil level at least 15 minutes after a hot shutdown.
2. If the oil level is low, top off with the proper viscosity and API service level engine oil. Add one bottle of MOPAR® 4-In-1 Leak Detection Dye into the engine oil.
3. Tamper proof the oil pan drain plug, oil filter, dipstick and oil fill cap.
4. Record the vehicle mileage.
5. Instruct the customer to drive the vehicle as usual.
6. Ask the customer to return to the servicing dealer after accumulating 500 miles, Check the oil level at least 15 minutes after a hot shutdown. If the oil level is half way between the "FULL" and "ADD" mark continue with the next step.
7. Using a black light, re-check for any external engine oil leaks, repair as necessary, if no external engine oil leaks are present, continue with oil consumption diagnosis.

OIL CONSUMPTION DIAGNOSIS

1. Check the positive crankcase ventilation (PCV) system. Make sure the system is not restricted and the PCV valve has the correct part number and correct vacuum source (18-20 in. Hg at idle below 3000 ft. above sea level is considered normal).
2. Perform a **CYLINDER COMPRESSION PRESSURE TEST** and **CYLINDER-TO-CYLINDER LEAKAGE TEST** using the standard leak down gauge following manufacturers suggested best practices.

   NOTE: Verify the spark plugs are not oil saturated. If the spark plugs are oil saturated and compression is good it can be assumed the valve seals or valve guides are at fault.

3. If one or more cylinders have more than 15% leak down further engine tear down and inspection will be required.

TOP 19 REASONS THAT MAY LEAD TO ENGINE OIL CONSUMPTION

1. **Tapered and Out-of-Round Cylinders**

   The increased piston clearances permit the pistons to rock in the worn cylinders. While tilted momentarily, an abnormally large volume of oil is permitted to enter on one side of the piston. The rings, also tilted in the cylinder, permit oil to enter on one side. Upon reversal of the piston on each stroke, some of this oil is passed into the combustion chamber.

2. **Distorted Cylinders**

   This may be caused by unequal heat distribution or unequal tightening of cylinder head bolts. This condition presents a surface which the rings may not be able to follow completely. In this case, there may be areas where the rings will not remove all of the excess oil. When combustion takes place, this oil will be burned and cause high oil consumption.

3. **Improper operation of "PCV "system**

   The main purpose of the Positive Crankcase Ventilation (PCV) valve is to recirculate blow-by gases back from the crankcase area through the engine to consume unburned hydrocarbons. The PCV system usually has a one way check valve and a make up air source. The system uses rubber hoses that route crankcase blow by gases to the intake manifold. Vacuum within the engine intake manifold pulls the blow by gases out of the crankcase into the combustion chamber along with the regular intake air and fuel mixture.

   The PCV system can become clogged with sludge and varnish deposits and trap blow by gases in the crankcase. This degrades the oil, promoting additional formation of deposit material. If left uncorrected, the result is plugged oil rings, oil consumption, rapid ring wear due to sludge buildup, ruptured gaskets and seals due to crankcase pressurization.

4. **Worn Piston Ring Grooves**

   For piston rings to form a good seal, the sides of the ring grooves must be true and flat - not flared or shouldered. Piston rings in tapered or irregular grooves will not seal properly and, consequently, oil will pass around behind the rings into the combustion chamber.

5. **Worn, Broken or Stuck Piston Rings**

   When piston rings are broken, worn or stuck to such an extent that the correct tension and clearances are not maintained, this will allow oil to be drawn into the combustion chamber on the intake stroke and hot gases of combustion to be blown down the cylinder past the piston on the power stroke. All of these conditions will result in burning and carbon build up of the oil on the cylinders, pistons and rings.

6. **Cracked or Broken Ring Lands**

   Cracked or broken ring lands prevent the rings from seating completely on their sides and cause oil pumping. This condition will lead to serious damage to the cylinders as well as complete destruction of the pistons and rings. Cracked or broken ring lands cannot be corrected by any means other than piston replacement.

7. **Worn Valve Stems and Guides**

   When wear has taken place on valve stems and valve guides, the vacuum in the intake manifold will draw oil and oil vapor between the intake valve stems and guides into the intake manifold and then into the cylinder where it will be burned.

8. **Bent or Misaligned Connecting Rods**

Bent or misaligned connecting rods will not allow the pistons to ride straight in the cylinders. This will prevent the pistons and rings from forming a proper seal with the cylinder walls and promote oil consumption. In addition, it is possible that a bearing in a bent connect rod will not have uniform clearance on the connecting rod wrist pin. Under these conditions, the bearing will wear rapidly and throw off an excessive amount of oil into the cylinder.

9. **Fuel Dilution**

   If raw fuel is allowed to enter the lubrication system, the oil will become thinner and more volatile and will result in higher oil consumption. The following conditions will lead to higher oil consumption;

   - Excess fuel can enter and mix with the oil via a leaking fuel injector
   - Gasoline contaminated with diesel fuel
   - Restricted air intake
   - Excessive idling

10. **Contaminated Cooling Systems**

    Corrosion, rust, scale, sediment or other formations in the water jacket and radiator will prevent a cooling system from extracting heat efficiently. This is likely to cause cylinder distortion thus leading to higher oil consumption.

11. **Oil Viscosity**

    The use of oil with a viscosity that is too light may result in high oil consumption. Refer to the vehicle owner's manual for the proper oil viscosity to be used under specific driving conditions and/or ambient temperatures.

12. **Dirty Engine Oil**

    Failure to change the oil and filter at proper intervals may cause the oil to be so dirty that it will promote accumulation of sludge and varnish and restrict oil passages in the piston rings and pistons. This will increase oil consumption; dirty oil by nature is also consumed at a higher rate than clean oil.

13. **Crankcase Overfull**

    Due to an error in inserting the oil dip stick so that it does not come to a seat on its shoulder, a low reading may be obtained. Additional oil may be added to make the reading appear normal with the stick in this incorrect position which will actually make the oil level too high. If the oil level is so high that the lower ends of the connecting rods touch the oil in the oil pan excessive quantities of oil will be thrown on the cylinder walls and some of it will work its way up into the combustion chamber.

14. **Excessively High Oil Pressure**

    A faulty oil pressure relief valve may cause the oil pressure to be too high. The result will be that the engine will be flooded with an abnormally large amount of oil in a manner similar to that which occurs with worn bearings. This condition may also cause the oil filter to burst.

15. **Aftermarket Performance Chips and Modification**

    Increasing performance through the use of performance/power enhancement products to a stock or factory engine will increase the chance of excessive oil consumption.

16. **Lugging Engine**

    Lugging is running the engine at a lower RPM in a condition where a higher RPM (more power/torque) should be implemented. Especially susceptible on vehicles equipped with a manual transmission. This driving habit causes more stress loading on the piston and can lead to increases in engine oil consumption.

17. **Turbocharged Engines**

    There is a possibility for PCV "push-over" due to higher crankcase pressure (as compared to naturally aspirated engines) which is normal for turbocharged engines. This condition causes varying amounts of engine oil to enter the intake manifold, charge air cooler and associated plumbing to and from the charge air cooler, also a leaking turbocharger seal will draw oil into the combustion chamber where it will burn (blue smoke from tail pipe may be present) and form carbon deposits which contribute to further oil consumption as they interfere with proper engine function.

18. **Restricted Air Intake**

    Excessive restriction in the air intake system will increase engine vacuum and can increase oil consumption, an extremely dirty air filter would be one example of this situation.

19. **Intake Manifold port seals**

    Engines that have a "V" configuration and a "wet valley" (3.3/3.8L) could draw oil into the intake ports due to improper sealing between the intake manifold ports and cylinder head. Causes may include improper torque of intake manifold bolts, corrosion (aluminum intake manifold) and or warped sealing surface.

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 level indicator 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 outlet on the cover.
    - Remove the PCV valve hose from the cylinder head cover. Cap or plug the PCV valve outlet on the cover.
    - Attach an air hose with pressure gauge and regulator to the oil level indicator 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 information procedures.
    - If the leakage occurs at the crankshaft rear oil seal area, refer to **INSPECTION FOR REAR SEAL AREA LEAKS**.
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 oil level indicator tube to block location; remove the tube, clean and reseal using Mopar® Stud AND 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.
    1. Circular spray pattern generally indicates seal leakage or crankshaft damage.
    2. 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 appropriate repair procedures for these items.
4. If no leaks are detected, pressurize the crankcase as previously described.

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

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

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

DUST COVERS AND CAPS

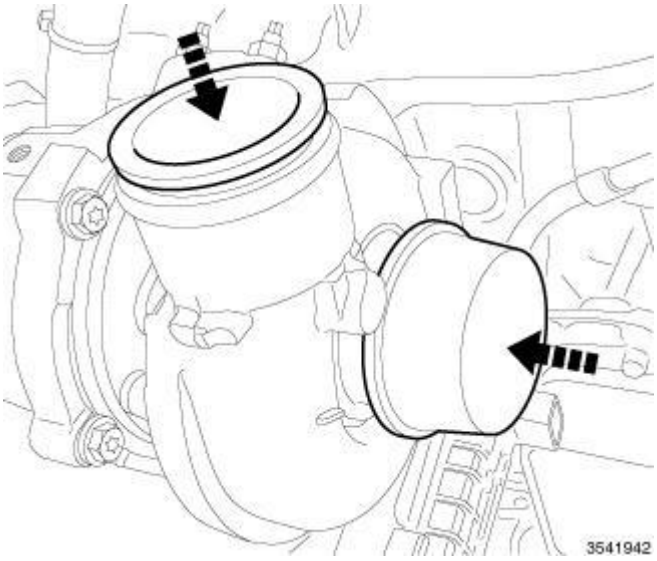

Fig. 2: Covers/Caps
Courtesy of CHRYSLER GROUP, LLC

Due to the high amounts of failures cased by dust, dirt, moisture and other foreign debris being introduced to the engine during service. Covers or caps are needed to reduce the possible damage that can be caused or created.

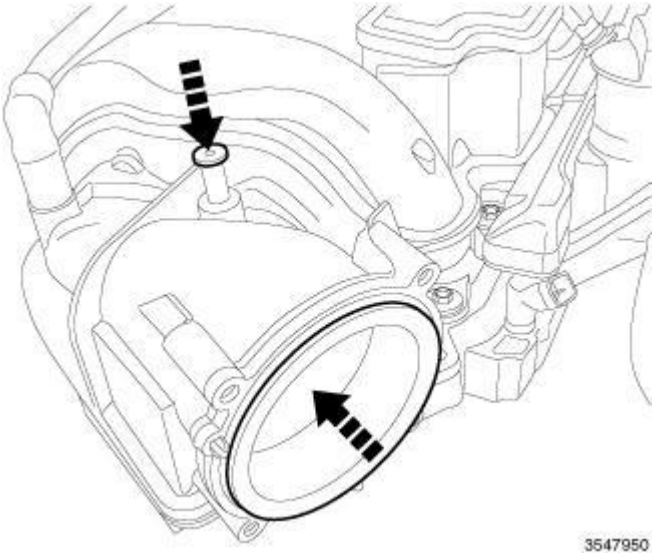

Fig. 3: Opening Cover
Courtesy of CHRYSLER GROUP, LLC

Covers over openings will reduce any possibilities for foreign materials to enter the engine systems. Using miller tool (special tool #10368, Set, Universal Protective Cap), Select the appropriated cover needed to the procedure.

ENGINE GASKET SURFACE PREPARATION

Fig. 4: Proper Tool Usage For Surface Preparation
Courtesy of CHRYSLER GROUP, LLC

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 (1).
- Abrasive pad or paper to clean cylinder block and head.
- High speed power tool with an abrasive pad or a wire brush (2).

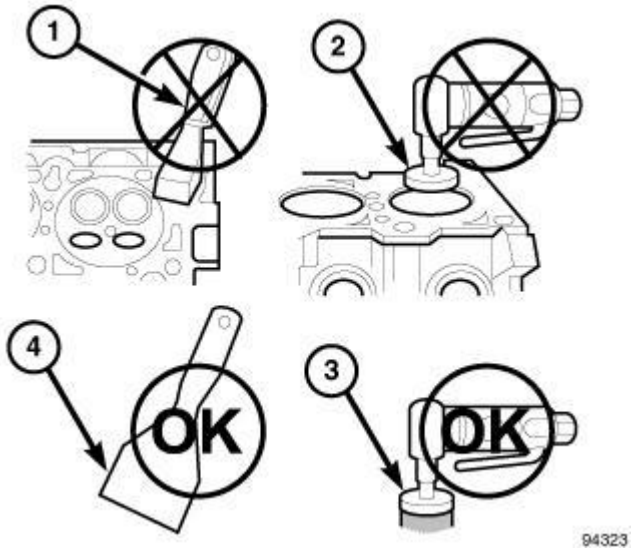

Fig. 5: Proper Tool Usage For Surface Preparation
Courtesy of CHRYSLER GROUP, LLC

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 (4).
- High speed power tool with a plastic bristle brush style disc.

Sealing surfaces must be free of grease or oil residue. Clean surfaces with Mopar® brake parts cleaner (or equivalent).

MEASURING BEARING CLEARANCE USING PLASTIGAGE

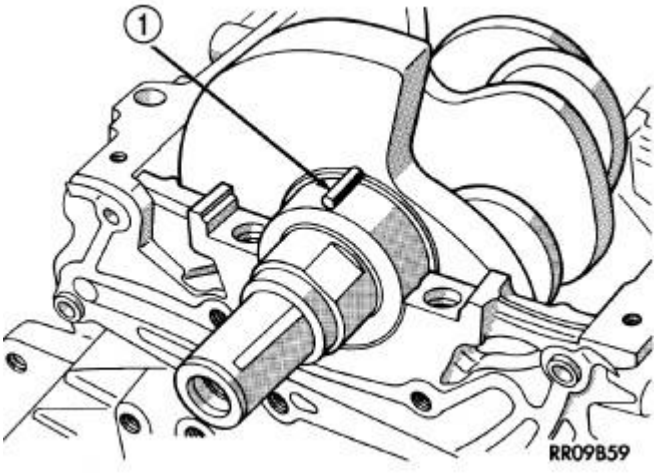

Fig. 6: Plastigage Placed In Lower Shell
Courtesy of CHRYSLER GROUP, LLC

1 - 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. Refer to **Fig. 6**. (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.
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 the clearance measurements to specifications. Refer to **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.

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 4 oz. / 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.

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.

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.

ENGINE CORE AND OIL GALLERY PLUGS

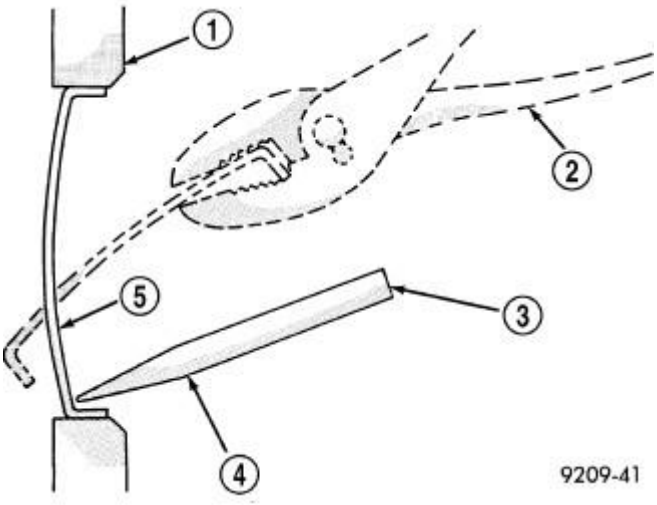

Fig. 7: Removing Core Plug
Courtesy of CHRYSLER GROUP, LLC

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

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. Refer to **Fig. 7**.

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.

SPECIFICATIONS

SPECIFICATIONS

GENERAL DESCRIPTION

DESCRIPTION	SPECIFICATION	
	Metric	Standard

Engine Type	60° V-6 Engine	
Number of Cylinders	6	
Displacement 3.8L	3.8 Liters	231 cu. in.
Bore 3.8L	96.0 mm	3.779 cu.in.
Stroke	87 mm	3.425 in.
Compression Ratio 3.8L	-	9.6:1
Firing Order	-	1-2-3-4-5-6
Compression Pressure-Minimum	689.5 kPa	100 psi.
Cylinder Compression (Max. Difference Between Cylinders	-	25%

CYLINDER BLOCK

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Cylinder Bore Diameter (Standard) 3.8L	95.993-96.007 mm	3.7792-3.780 in.
Out of Round (Service Limits)	0.076 mm	0.003 in.
Taper (Service Limits)	0.051 mm	0.002 in.
Lifter Bore Diameter (early)	22.980-23.010 mm	0.905-0.906 in.
Lifter Bore Diameter (Late)	21.42-21.45 mm	0.843-0.844 in.
Deck Surface Flatness (Max.)	0.1 mm	0.004 in.

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Connecting Rod Journal Diameter	57.985-58.005 mm	2.2829-2.2837 in.
Main Bearing Journal Diameter	63.987-64.013 mm	2.5192-2.5202 in.
Journal Out-of-Round (Max.)	0.005 mm	0.0002 in.
Journal Taper (Max.)	0.003 mm	0.0001 in
End Play	0.09-0.24 mm	0.0036-0.0095 in.
Wear Limit	0.381 mm	0.015 in.
Main Bearing Diametrical Clearance 1-2-3-4	0.011-0.055 mm	0.0005-0.0022 in.
Wear Limit	0.076 mm	0.003 in.

CONNECTING RODS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Bearing Clearance	0.019-0.067 mm.	0.0007-0.0026 in.
Wear Limit	0.074 mm	0.003 in.
Side Clearance	0.135-0.405 mm	0.005-0.016 in.
Wear Limit	0.45 mm	0.017 in.

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Piston Diameter 3.8L-Measured 33.01 mm (1.30 in) From Piston Top	95.968-95.998 mm.	3.778-3.779 in.
Clearance in Bore @ Size Location (New)	-0.005-0.039 mm	-0.0002-0.0015 in.
Weight 3.8L	426 ± 5 grams	15.03 ± 0.1764 oz.

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Type	Press Fit in Rod (Serviced as a Assembly)	
Clearance in Piston @ 21C (70°F)	0.006-0.019 mm	0.0002-0.0007 in.
Clearance in Connecting Rod	Interference Fit	
Diameter	22.87-22.88 mm	0.9007-0.9009 in.
Length 3.8L	71.25-71.75 mm	2.805-2.824 in.

PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Ring End Gap		
Top Compression Ring	0.20-0.36 mm	0.008-0.014 in.
Second Compression Ring	0.30-0.55 mm	0.012-0.022 in.
Oil Control (Steel Rails)	0.25-0.76 mm	0.010-0.030 in.
Wear Limit-Compression Rings	0.75 mm	0.030 in.
Wear Limit-Oil Control Steel Rails	1.88 mm	0.074 in.
Ring Side Clearance		
Top Compression Ring 3.8L	0.030-0.069 mm	0.0012-0.0027 in.
Second Compression Ring 3.8L	0.041-0.085 mm	0.0016-0.0033 in.
Oil Ring (Steel Ring)	0.015-0.225 mm	0.0006-0.0089 in.
Side Clearance Wear Limit- Top Ring	0.10 mm	0.004 in.
Side Clearance Wear Limit-2nd Ring	0.13 mm	0.005
Radial Wall Wear Limit Oil Ring Pack	0.038 mm	0.0015
Ring Width-Top Compression Ring 3.8L	1.175-1.190 mm	0.0462-0.0468
Ring Width-2nd Compression Ring 3.8L	1.47-1.49 mm	0.0579-0.0587 in.

Ring Width-Oil Ring (Steel Rails) 3.8L	0.435-0.490 mm	0.017-0.019

CAMSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Journal Diameter		
#1	50.724-50.775 mm	1.997-1.999 in.
#2	50.317-50.368 mm	1.9809-1.9829 in.
#3	49.936-49.987 mm	1.9659-1.9679 in.
#4	49.530-49.581 mm	1.9499-1.9520 in.
Bearing Clearance-Diametrical	0.025-0.101 mm	0.001-0.004 in.
Bearing Clearance (Max.Allowable)	0.127 mm	0.005 in.
End Play	0.254-0.508 mm	0.010-0.020 in.
Camshaft Bearing Diameter		
#1	50.800-50.825	1.9999-2.0009 in.
#2	50.393-50.419 mm	1.9839-1.9849 in.
#3	50.013-50.038 mm	1.9690-1.9699 in.
#4	49.606-49.632 mm	1.9529-1.954 in.
Exhaust Valve Timing		
Closes-3.8L (ATDC)	-	18°
Opens-3.8L (BBDC)	-	46°
Duration-3.8L	-	244°
Intake Valve Timing		
Closes-3.8L (ABDC)	-	63°
Opens-3.8L (ATDC)	-	1°
Duration-3.8L	-	242°
Valve Overlap-3.8L	-	17°

HYDRAULIC LIFTER

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Type	Hydraulic Roller	
Outside Diameter (early)	22.949-22.962 mm	0.903-0.904 in.
Outside Diameter (Late)	21.387-21.405 mm	0.842-0.843 in.
Clearance in Block (early)	0.020-0.061 mm	0.0007-0.0024 in.
Clearance in Block (Late)	0.015-0.063 mm	0.0006-0.0025 in.

CYLINDER HEAD

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**

Gasket Thickness (Compressed)	0.65-0.75 mm	0.0026-0.0030 in.

VALVES

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Face Angle-Intake	-	45-45.5°
Face Angle-Exhaust	-	45-45.5°
Head Diameter-Intake	47.87-48.13 mm	1.88-1.89 in.
Head Diameter-Exhaust	35.37-35.63 mm	1.39-1.40 in.
Valve Lift (Zero Lash)-Intake and Exhaust-3.8L	11.0 mm	0.433 in.
Valve Length-Intake	125.84-126.6 mm	4.95-4.98 in.
Valve Length-Exhaust	127.20-127.96	5.00-5.04 in.
Valve Stem to Tip Height (valve tip to spring seat washer)-Intake	48.1-49.7 mm	1.89-1.95 in.
Valve Stem to Tip Height (valve tip to spring seat washer)-Exhaust	48.53-50.09 mm	1.91-1.97 in.

VALVE SEAT

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Angle	-	44.5-45°
Run Out (Service Limits)	0.0762 mm	0.003 in.
Width-Intake and Exhaust	1.50-2.00 mm	0.057-0.078 in.

VALVE GUIDE

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Guide Bore Diameter (Std.)	6.975-7.00 mm	0.274-0.275 in.

VALVE MARGIN

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Intake	0.825-0.973 mm	0.032-0.038 in.
Exhaust	1.565-1.713 mm	0.061-0.067 in.

VALVE STEM DIAMETER

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Intake (Standard)	6.935-6.953 mm	0.2718-0.2725 in.
Exhaust (Standard)	6.906-6.924 mm	0.2718-0.2725 in.

VALVE STEM TO GUIDE CLEARANCE

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Intake	0.025-0.065 mm	0.001-0.0025 in.
Exhaust	0.059-0.094 mm	0.002-0.0037 in.
Max Allowable-Intake (Rocking Method)	0.247 mm	0.010 in.
Max Allowable-Exhaust (Rocking Method)	0.414 mm	0.016 in.

PUSH RODS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Length	135.438 mm	5.33 in.

VALVE SPRING

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Free Length-Type A	51.1 mm	2.02 in.
Wire Diameter Type A	4.20-4.28 mm	0.15-0.19 in.
Number of Coils Type A	7.0	
Spring Tension (Valve Closed) Type A	376.4-424.4 N @ 41.9 mm	84.6-95.4 lbs. @ 1.65 in.
Spring Tension (Valve Open) Type A	884.9-983.3 N @ 30.4 mm	199.0-221.0 lbs. @ 1.22 in.
Installed Height	41.1-42.7 mm	1.61-1.68 in

LUBRICATION

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
At Curb Idle Speed* (Minimum with engine at operating temperature)	34.47 kPa	5 psi
At 3000 RPM	205-551 kPa	30-80 psi
Oil Filter By-Pass Valve Setting	62-103 kPa	9-15 psi
Oil Pressure Switch Actuating Pressure	14-28 Kpa	2-4 psi
CAUTION: ***If pressure is ZERO at curb idle, DO NOT run engine at 3000 rpm.**		

OIL PUMP

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**

Clearance Over rotors-Inner and Outer	0.10 mm	0.004 in.
Cover Out-Of-Flat (Max.)	0.025 mm	0.001 in.
Inner Rotor Thickness	7.64 mm	0.301 in.
Outer Rotor Thickness (Min)	7.64 mm	0.301 in.
Outer Rotor Clearance (Max)	0.039 mm	0.015 in.
Outer Rotor Diameter (Min)	79.95 mm	3.148 in.
Tip Clearance Between Rotors (Max)	0.20 mm	0.008 in.

TORQUE SPECIFICATIONS

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Camshaft Sprocket - Bolt	54	40	-
Camshaft Thrust Plate - Bolts	12	-	105
Cracked Connecting Rod Cap - Bolts	Refer to **ROD, PISTON AND CONNECTING, INSTALLATION**.		
Crankshaft Main Bearing Cap - Bolts	41 + 1/4 turn	30 + 1/4 turn	-
Crankshaft Main Bearing Cap Cross Bolts (3.8L)	61	45	-
Crankshaft Oil Seal Retainer Rear - Bolts	12	-	105
Crankshaft Damper - Bolt	54	40	-
Cylinder Block Drain Plugs	20	15	-
Cylinder Head - Bolts	Refer to **CYLINDER HEAD, INSTALLATION**.		
Cylinder Head Cover - Bolts	12	-	105
Flex Plate to Crankshaft	88	65	-
Engine Mounting	Refer to **ENGINE MOUNTING**		
Exhaust Manifold - Bolts	23	-	200
Intake Manifold - Lower - Bolts	23	-	200
Intake Manifold - Lower Gasket Retainer - Bolts	12	-	105
Intake Manifold Upper - Bolts	12	-	105
Lifter Yoke Retainer - Bolts	12	-	105
Oil Filter Attaching Fitting	54	40	-
Oil Cooler Attaching Fitting	27	20	-
Oil Filter	20	15	-
Oil Filter Adapter - Bolts	28	-	250
Oil Gallery Plug	27	20	-
Oil Pan - Bolts	12	-	105
Oil Pan Drain Plug	27	20	-
Oil Pressure Switch	23	-	200
Oil Pump Cover Plate - Screws	12	-	105
Oil Pump Pick-up Tube - Bolt	28	-	250
Oil Dipstick Housing - Bolts	48	35	-

Rocker Arm Shaft - Bolts	23	-	200
Spark Plug	16	12	-
Thermostat Housing	12	-	105
Timing Chain Case Cover			
- M8 Bolt	27	20	-
- M10 Bolt	54	40	-
Water Pump - Bolts	12	-	105
Water Pump Pulley - Bolts	28	-	250

REMOVAL

REMOVAL

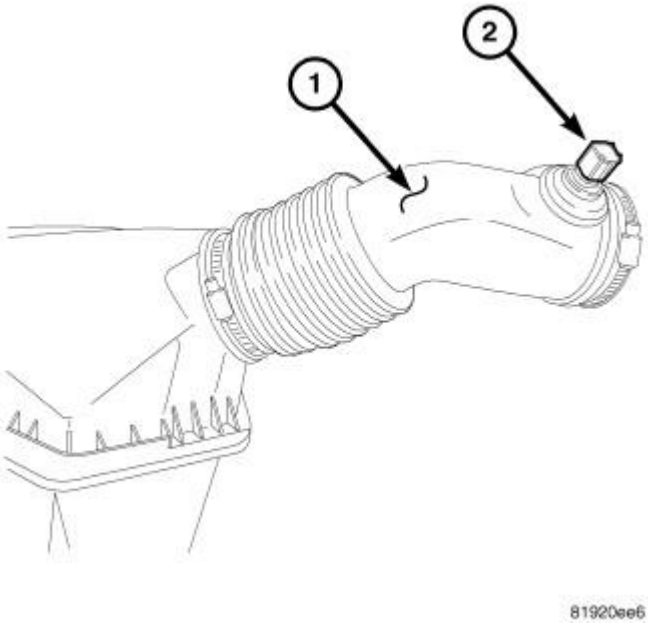

Fig. 8: Rubber Air Intake Tube & Intake Manifold Air Temperature (IAT) Sensor
Courtesy of CHRYSLER GROUP, LLC

1. Perform fuel pressure release procedure. Refer to **FUEL SYSTEM PRESSURE RELEASE** .
2. Disconnect negative battery cable.
3. Disconnect the Inlet Air Temp Sensor (IAT) (2), and remove air cleaner hose (1) and housing.

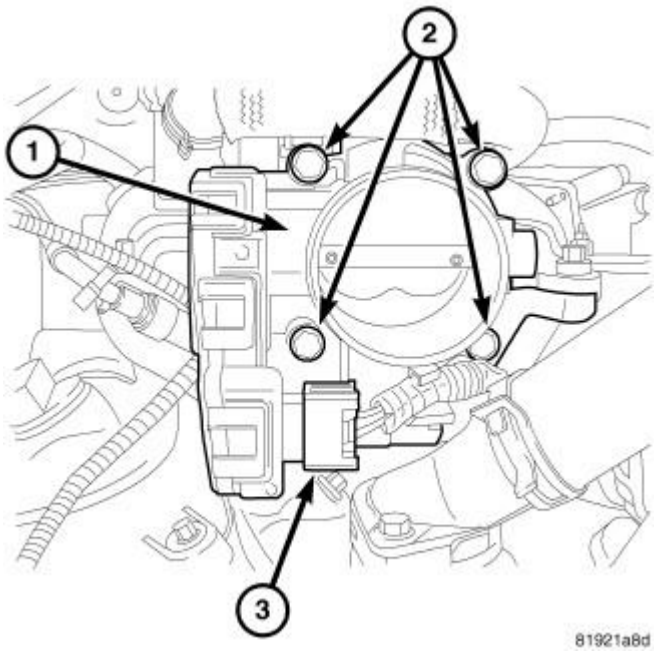

Fig. 9: Throttle Body, Bolts & Connector
Courtesy of CHRYSLER GROUP, LLC

4. Evacuate and recover the air conditioning.
5. Disconnect the throttle control connectors (3) from the throttle body.

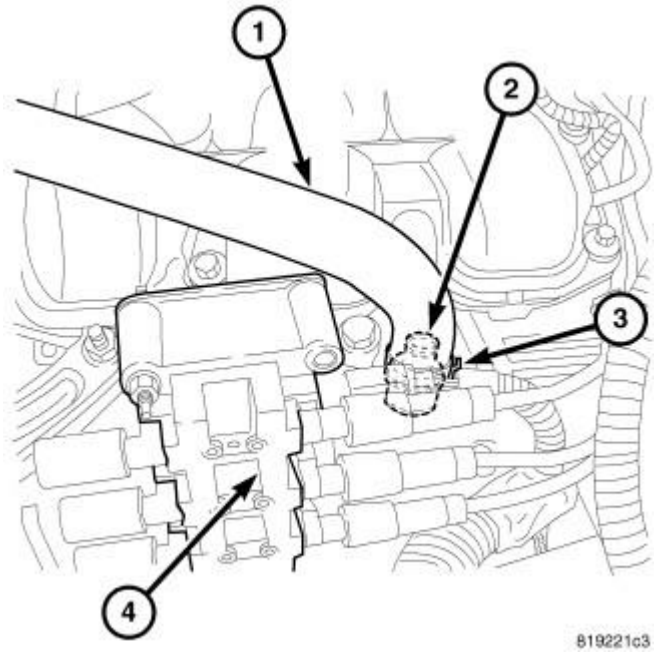

Fig. 10: PCV Valve Location 3.8L
Courtesy of CHRYSLER GROUP, LLC

6. Disconnect the PCV hose (1) at the left cylinder head cover.

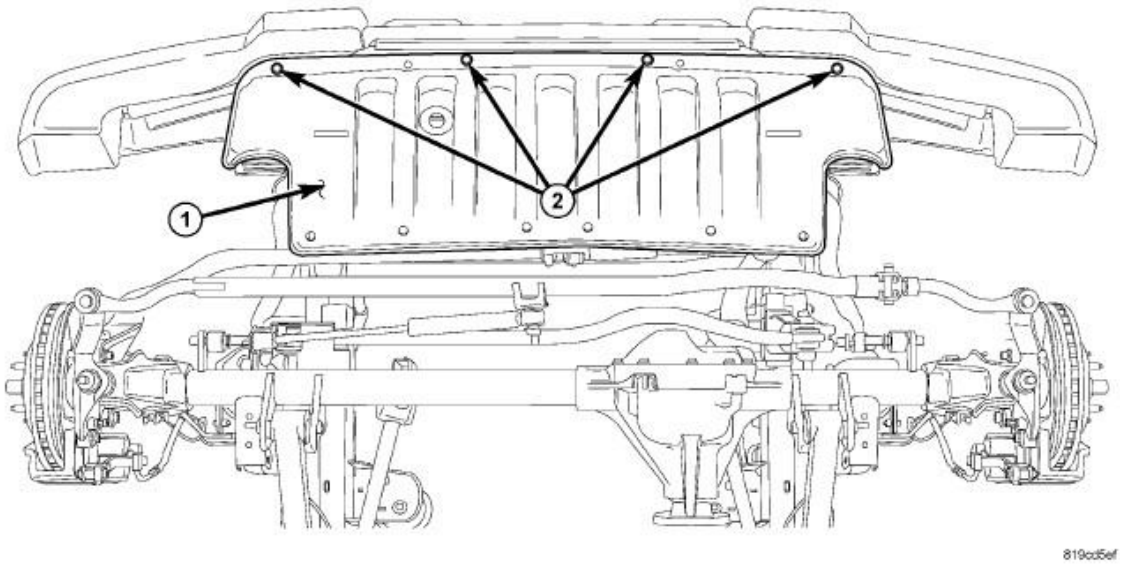

Fig. 11: Front Splash Shield & Push Pin Fasteners
Courtesy of CHRYSLER GROUP, LLC

7. Remove the front splash shield (1).
8. Drain the cooling system.
9. Disconnect the upper radiator hose from the thermostat housing and the lower radiator hose from the radiator.
10. Disconnect the heater hoses and coolant reservoir hose.

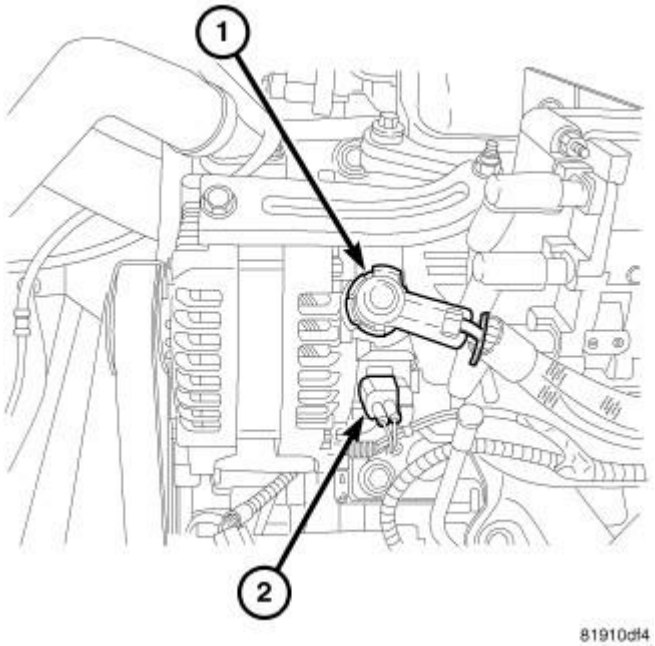

Fig. 12: Generator Electrical Connectors 3.8L
Courtesy of CHRYSLER GROUP, LLC

11. Disconnect the generator electrical connectors (1, 2).

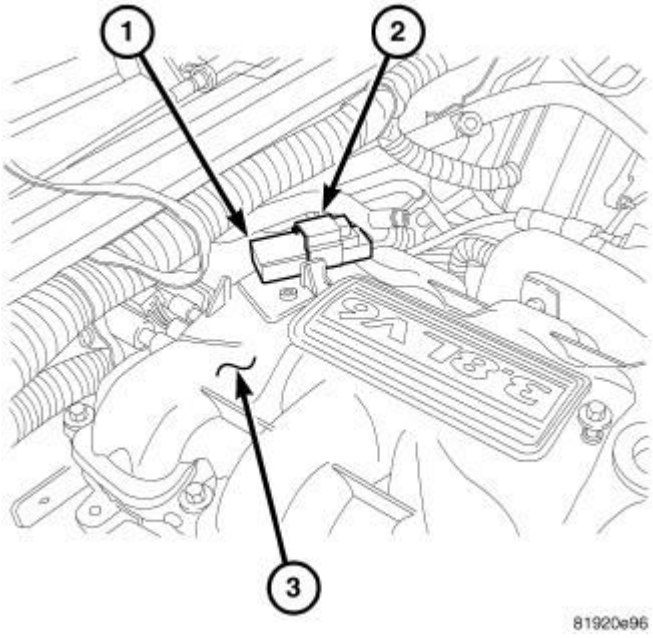

Fig. 13: MAP Sensor & Upper Intake Manifold
Courtesy of CHRYSLER GROUP, LLC

12. Disconnect the throttle position (TP), idle air control (IAC) motor, oxygen (HO2), cam position (CMP), manifold absolute pressure (MAP) (2) and the two engine wiring harness connectors. Free the harness from the cover studs and set harness aside.
13. Disconnect the purge solenoid harness connector.

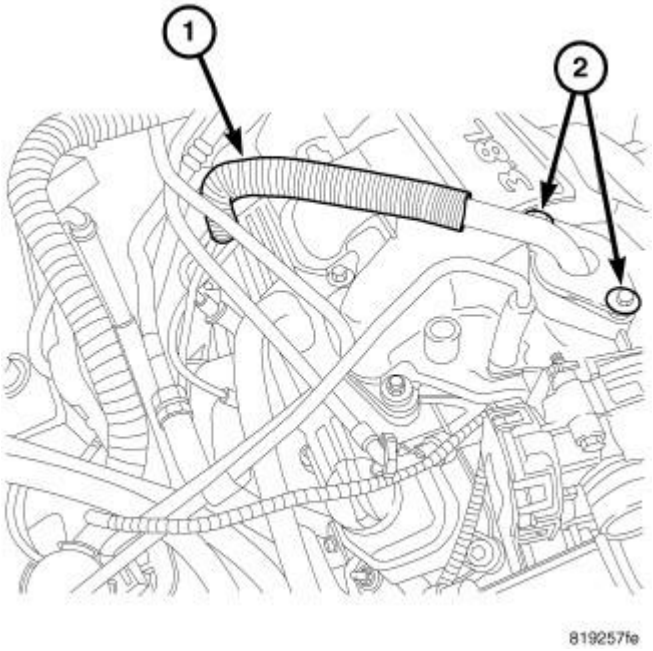

Fig. 14: EGR Tube, Flange & Fasteners
Courtesy of CHRYSLER GROUP, LLC

14. Disconnect the EVAP hose from the throttle body.
15. Remove the EGR tube (1). Refer to **VALVE, EXHAUST GAS RECIRCULATION (EGR), 3.8L, REMOVAL** .

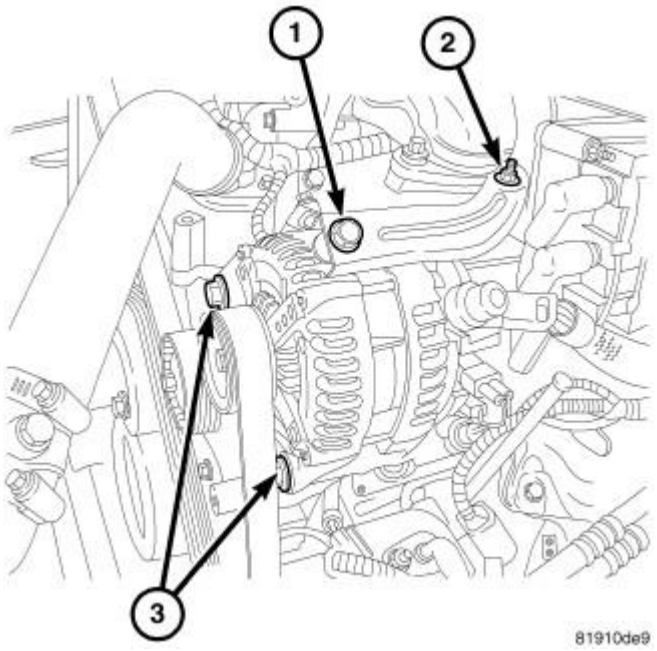

Fig. 15: Generator Mounting 3.8L
Courtesy of CHRYSLER GROUP, LLC

16. Remove the drive belts.
17. Remove the generator (3).

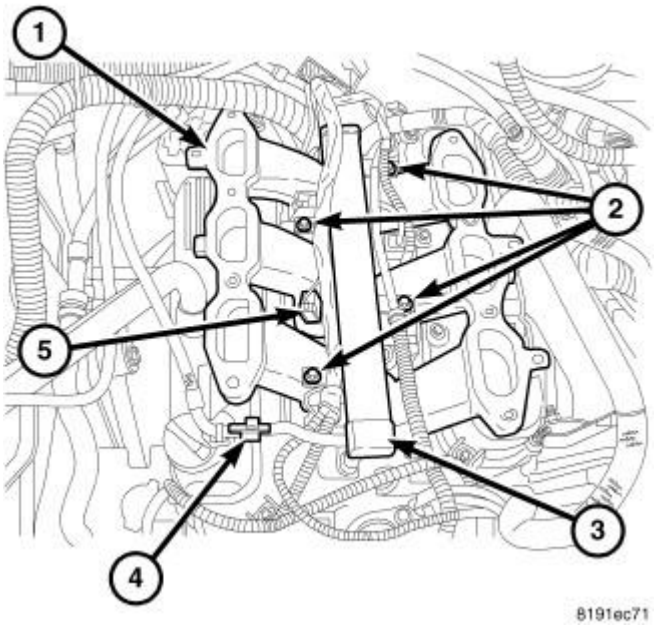

Fig. 16: Fuel Injectors, Line, Rail & Fasteners 3.8L
Courtesy of CHRYSLER GROUP, LLC

18. Disconnect the fuel line from fuel rail (4).
19. Remove engine wiring harness retainer from left cylinder head cover and oil level indicator tube.

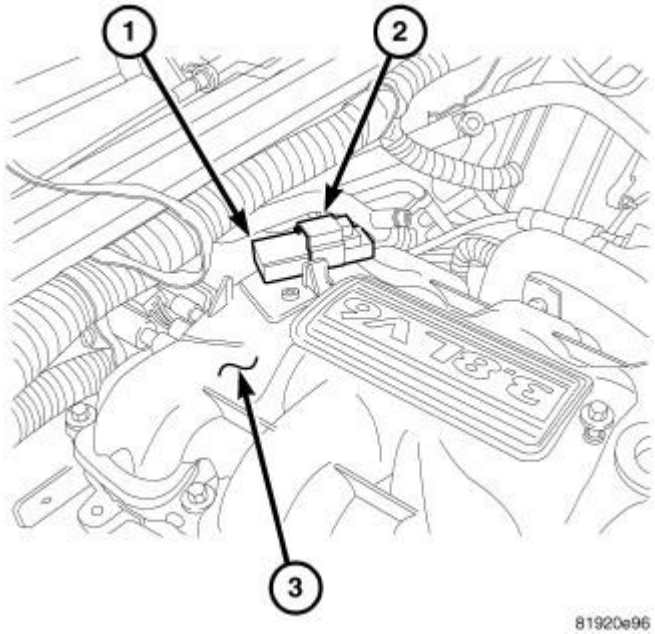

Fig. 17: MAP Sensor & Upper Intake Manifold
Courtesy of CHRYSLER GROUP, LLC

20. Disconnect the knock sensor wiring harness connector.

21. Remove the upper intake manifold (3).

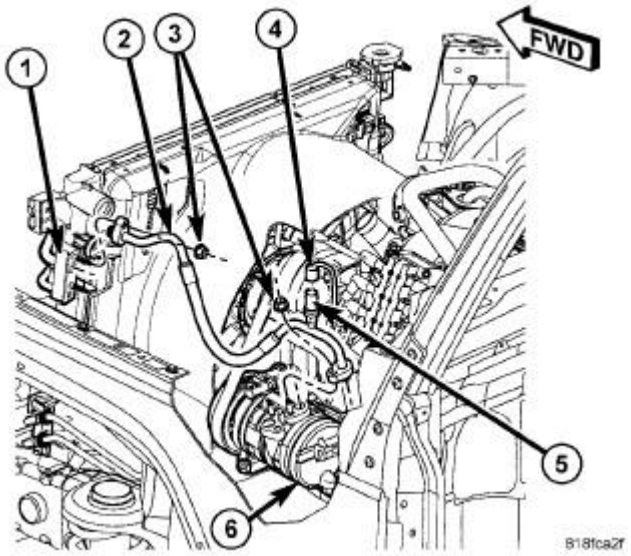

Fig. 18: A/C Discharge Line Assembly & Fasteners
Courtesy of CHRYSLER GROUP, LLC

22. Disconnect the A/C electrical connector.
23. Disconnect the A/C discharge line (2) from the compressor. Cover and seal all openings of hoses and compressor.

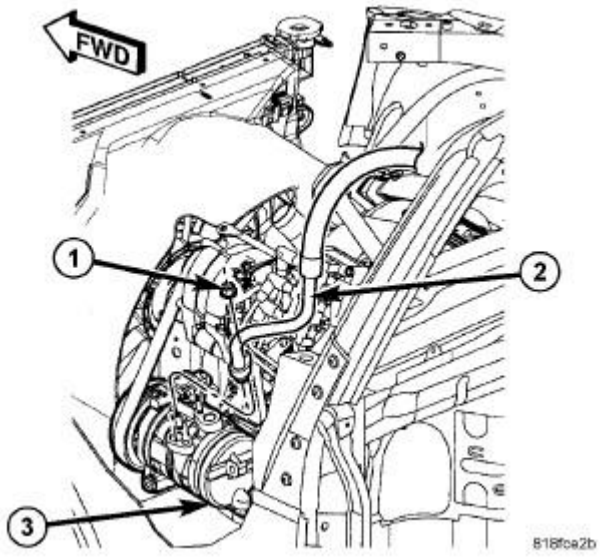

Fig. 19: A/C Suction Line Assembly & Fasteners
Courtesy of CHRYSLER GROUP, LLC

24. Disconnect the A/C suction line (2) from the compressor. Cover and seal all openings of hoses and

compressor.

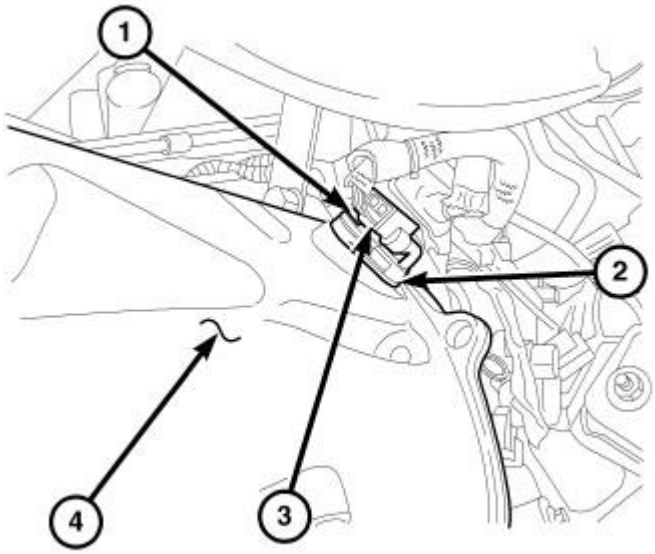

Fig. 20: Sensor Mounting Bolt, Crankshaft Position (CKP) Sensor, Sensor Electrical Connector & Transmission Bellhousing
Courtesy of CHRYSLER GROUP, LLC

25. Disconnect the oil pressure sending unit (OPS).
26. Disconnect the coolant hose at the engine oil cooler.
27. Remove the crankshaft sensor (2), (CKP).

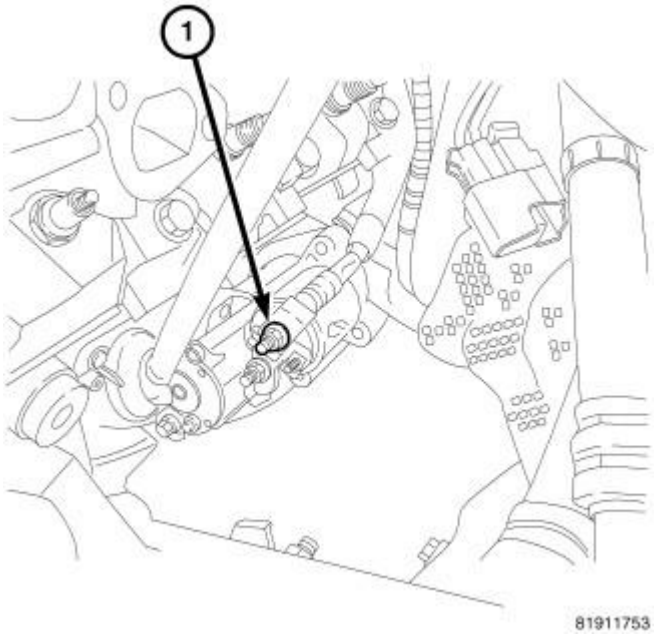

Fig. 21: Starter Battery Cable - 3.8L
Courtesy of CHRYSLER GROUP, LLC

28. Disconnect the in block heater (if equipped).
29. Disconnect the starter wiring (1) and remove starter.

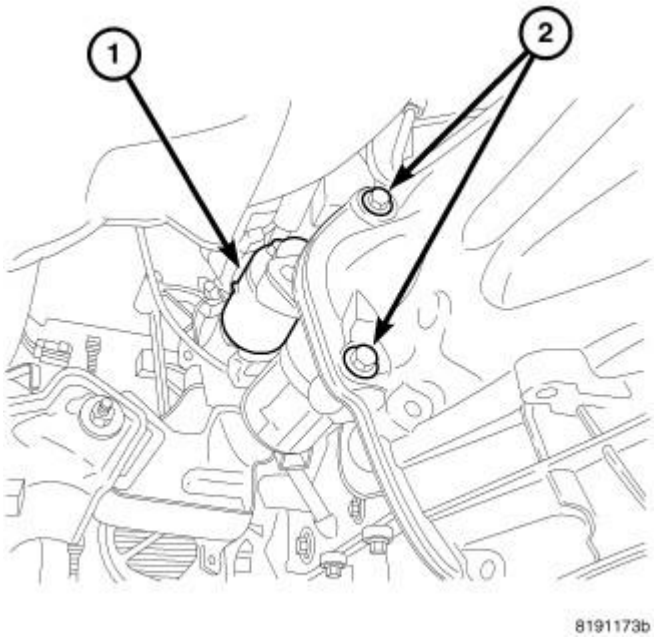

Fig. 22: Starter Mounting - 3.8L
Courtesy of CHRYSLER GROUP, LLC

30. Remove the starter (1).
31. Remove the flex plate inspection cover. (If equipped).
32. Rotate the engine at the crankshaft pulley bolt and remove the torque converter bolts. (If equipped).

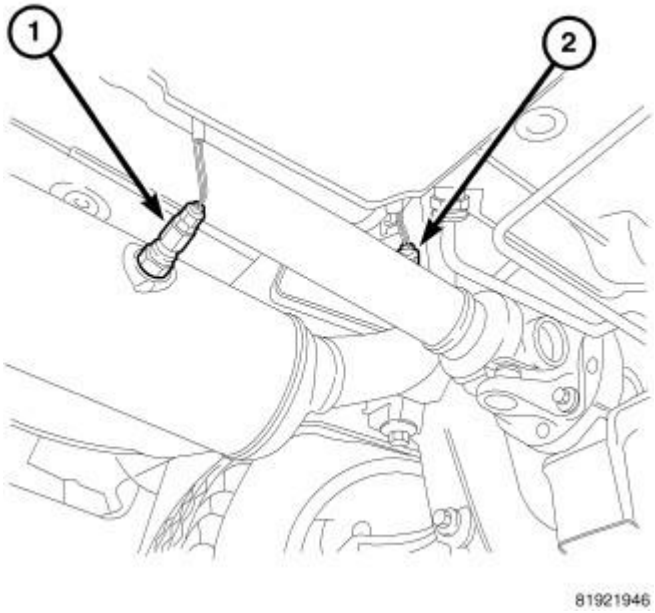

Fig. 23: O2 Sensors Left Side
Courtesy of CHRYSLER GROUP, LLC

33. Disconnect the left side oxygen sensors (1, 2).

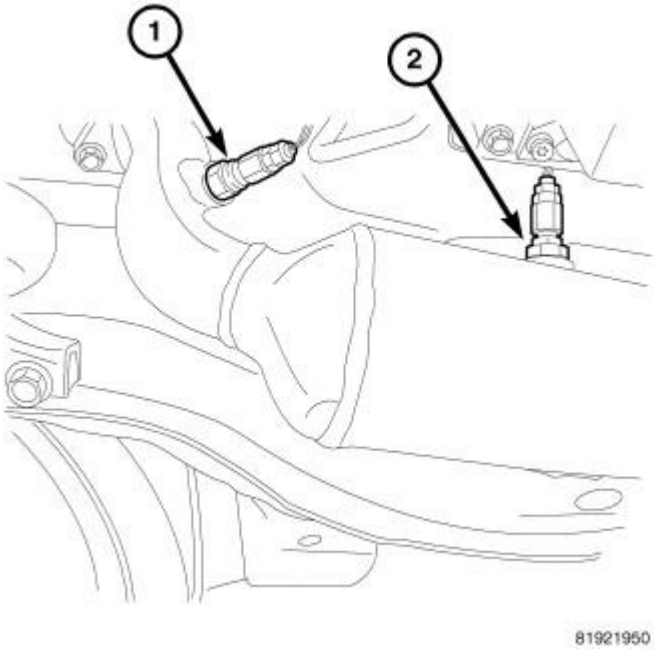

Fig. 24: O2 Sensors Right Side
Courtesy of CHRYSLER GROUP, LLC

34. Disconnect the right side oxygen sensors (1, 2).
35. Disconnect the exhaust pipes from the manifolds.

36. Remove the left and right exhaust manifolds.

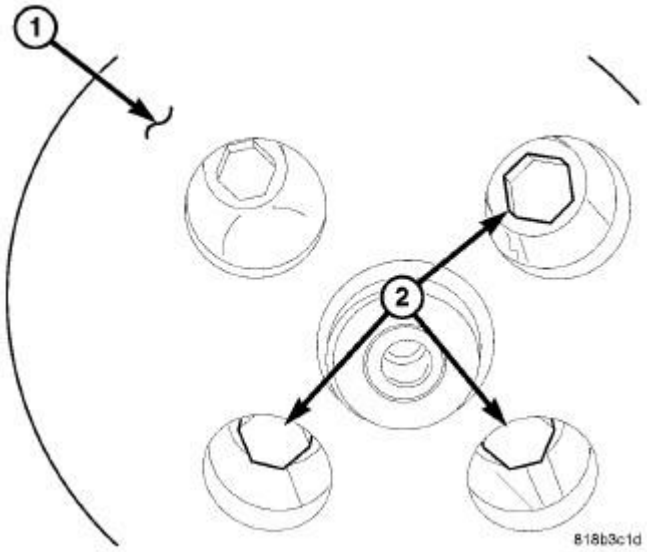

Fig. 25: Power Steering Pump & Mounting Bolts
Courtesy of CHRYSLER GROUP, LLC

37. Remove the power steering pump mounting bolts (2) and pump, with hoses attached.
38. Remove the engine mount thru bolts.

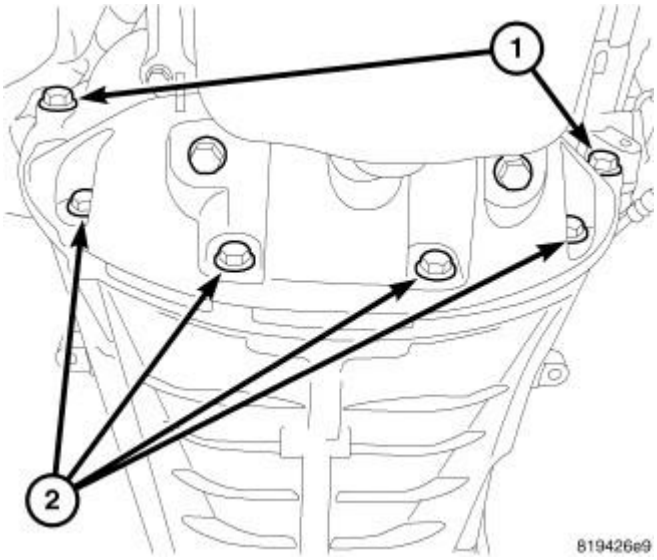

Fig. 26: 3.8L Structural Cover Mounting Bolts
Courtesy of CHRYSLER GROUP, LLC

39. Remove the structural cover mounting bolts (1, 2), and cover. (If equipped).
40. Support the transmission using a suitable jack.
41. Connect engine lifting chain to engine, and lift the engine using a suitable hoist.

42. Lift the engine using a suitable hoist.
43. Separate the transmission from the engine.

INSTALLATION

INSTALLATION

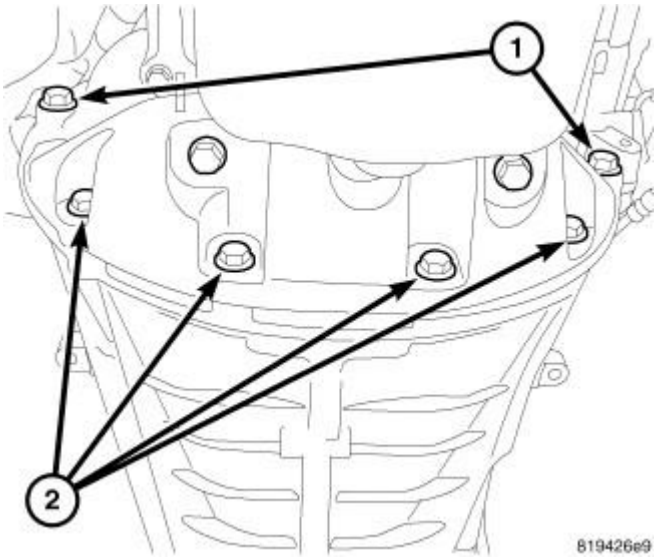

Fig. 27: 3.8L Structural Cover Mounting Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Position the engine in the vehicle.
2. Install the transmission bellhousing to engine mounting bolts. Refer to **INSTALLATION** . Refer to **INSTALLATION** .
3. Tighten the engine mount thru bolts. Refer to **INSULATOR, ENGINE MOUNT, FRONT, INSTALLATION** and **INSULATOR, ENGINE MOUNT, REAR, INSTALLATION**.
4. Install the torque converter bolts. (If equipped). Refer to **INSTALLATION** .
5. Install the structural cover (1). Refer to **COVER, STRUCTURAL DUST, INSTALLATION**.

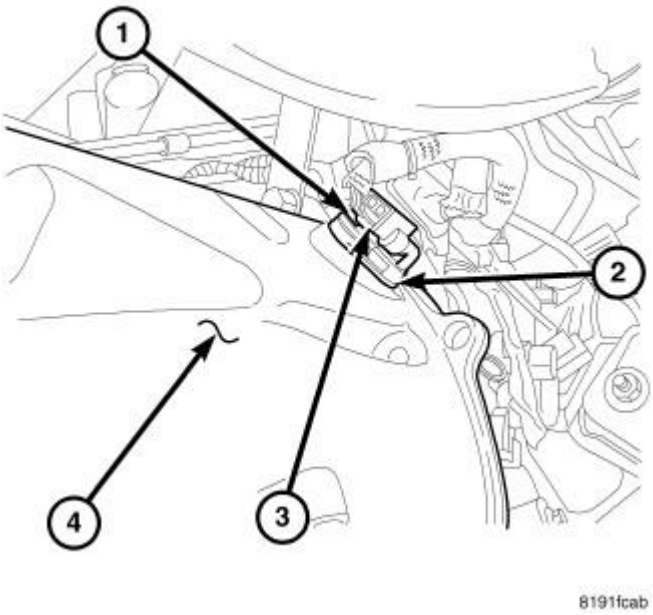

Fig. 28: Sensor Mounting Bolt, Crankshaft Position (CKP) Sensor, Sensor Electrical Connector & Transmission Bellhousing
Courtesy of CHRYSLER GROUP, LLC

6. Install the crank position sensor (2) (CKP).

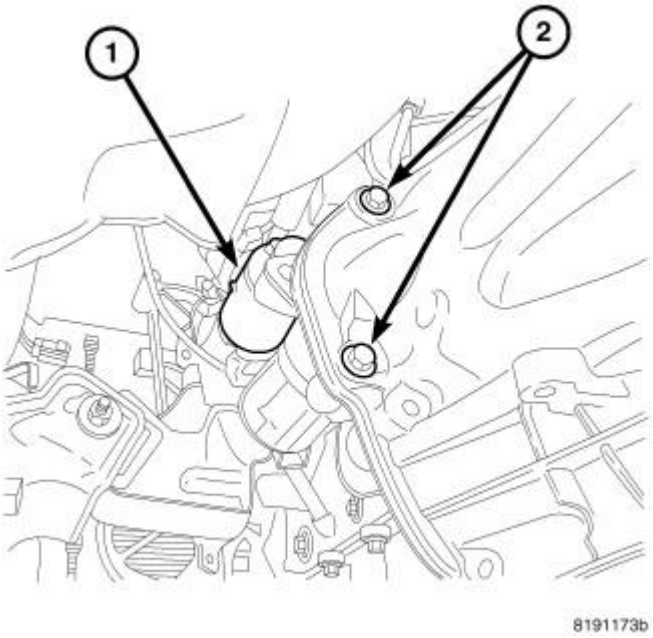

Fig. 29: Starter Mounting - 3.8L
Courtesy of CHRYSLER GROUP, LLC

7. Install the starter (1). Refer to **STARTER, INSTALLATION** .

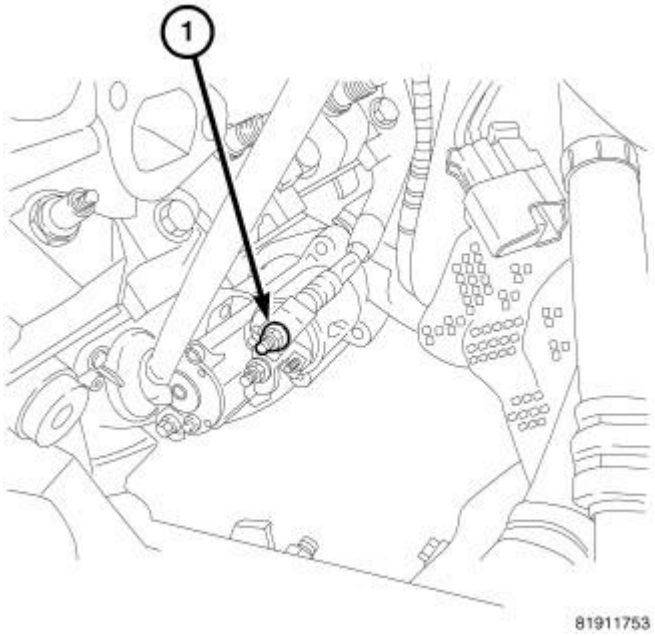

Fig. 30: Starter Battery Cable - 3.8L
Courtesy of CHRYSLER GROUP, LLC

8. Install the flex plate inspection cover. (If equipped).
9. Connect the starter wiring (1). Refer to **STARTER, INSTALLATION** .

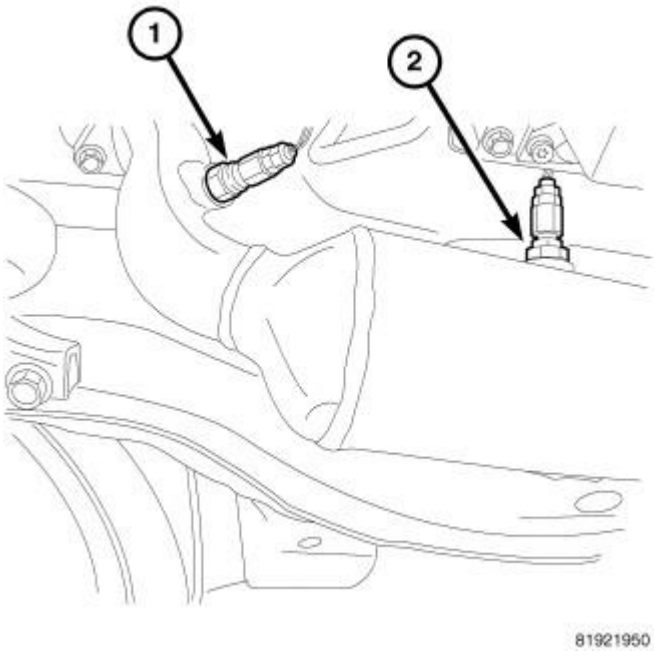

Fig. 31: O2 Sensors Right Side
Courtesy of CHRYSLER GROUP, LLC

10. Connect the knock sensor electrical connector.

11. Install the left and right exhaust manifolds.
12. Connect the exhaust system and connect the right side O2 sensors (1, 2).

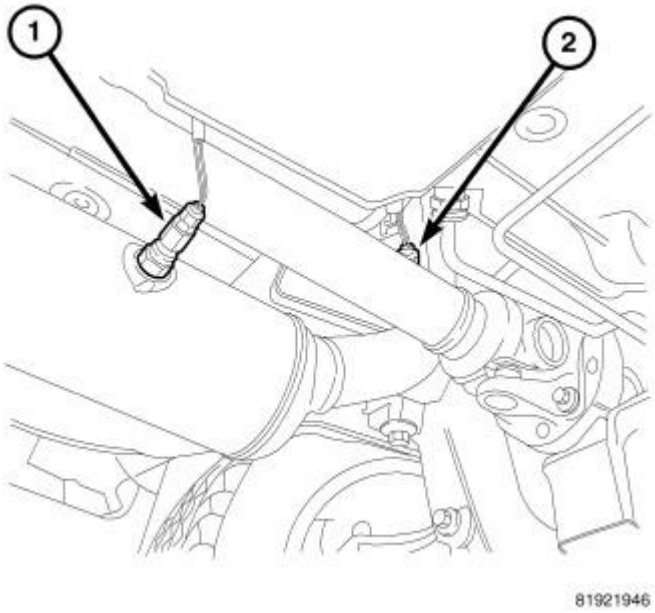

Fig. 32: O2 Sensors Left Side
Courtesy of CHRYSLER GROUP, LLC

13. Connect the left side O2 sensors (1, 2).
14. Connect the in block heater (if equipped).
15. Connect the coolant hose at the engine oil cooler.

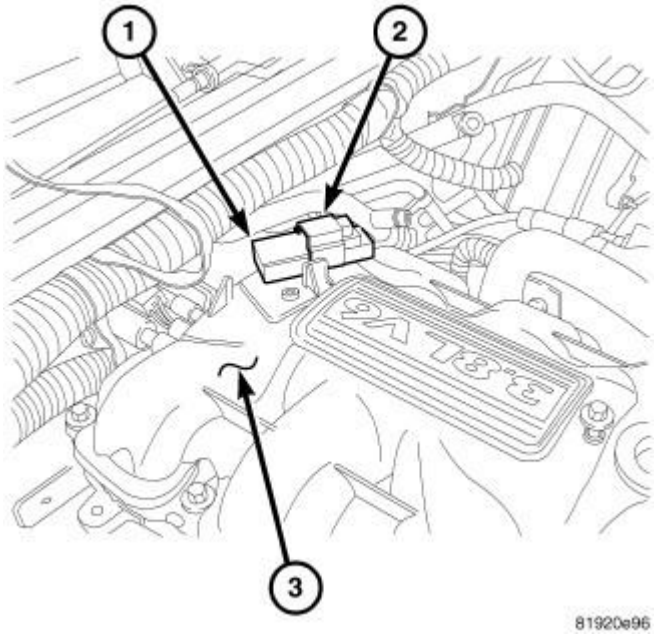

Fig. 33: MAP Sensor & Upper Intake Manifold
Courtesy of CHRYSLER GROUP, LLC

16. Connect the oil pressure sending unit (OPS) wiring harness connector.
17. Install the upper intake manifold (3). Refer to **MANIFOLD, INTAKE, INSTALLATION** and **MANIFOLD, INTAKE, LOWER, INSTALLATION**.

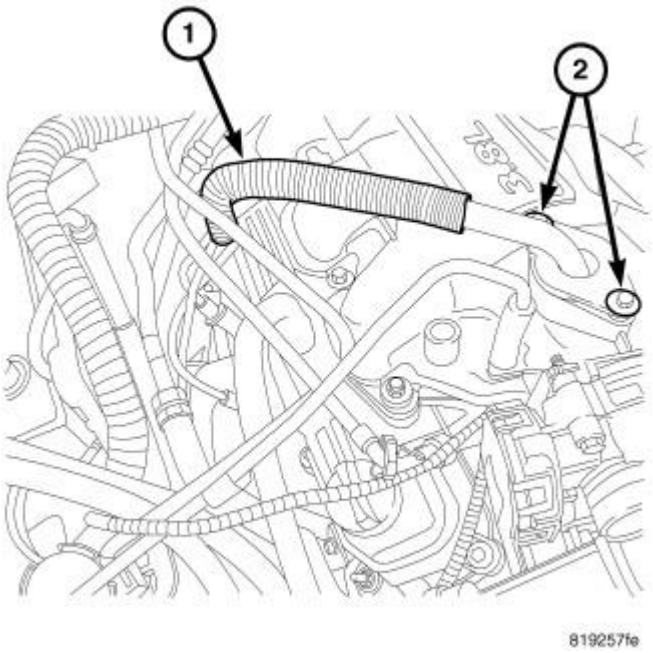

Fig. 34: EGR Tube, Flange & Fasteners
Courtesy of CHRYSLER GROUP, LLC

18. Install the EGR tube (1). Refer to **VALVE, EXHAUST GAS RECIRCULATION (EGR), 3.8L, INSTALLATION** .
19. Connect the engine vacuum harnesses.

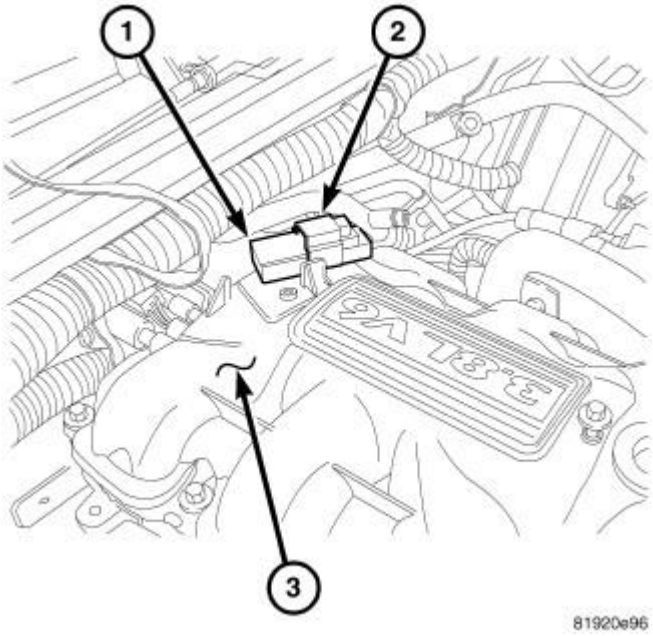

Fig. 35: MAP Sensor & Upper Intake Manifold
Courtesy of CHRYSLER GROUP, LLC

20. Route the engine harness to the left cylinder head and attach the purge solenoid.
21. Connect the throttle position (TP), idle air control (IAC) motor, oxygen (H02), cam position (CMP), manifold absolute pressure (MAP) (2), and the engine wiring harness connectors.

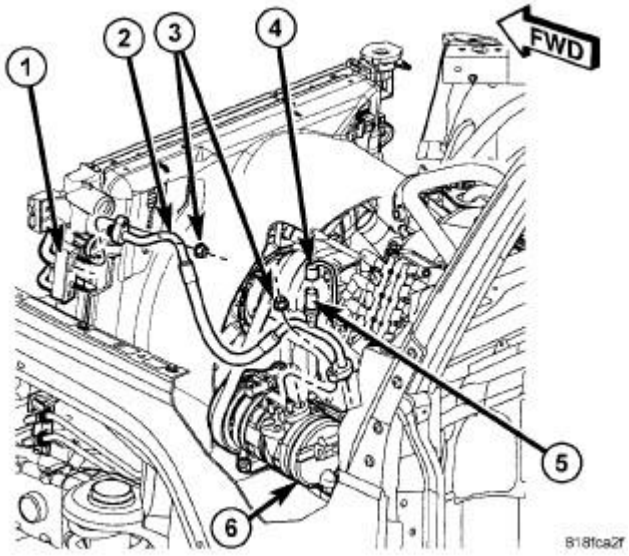

Fig. 36: A/C Discharge Line Assembly & Fasteners
Courtesy of CHRYSLER GROUP, LLC

22. Connect the A/C discharge line (2) at the compressor. Refer to **COMPRESSOR, A/C, INSTALLATION** .

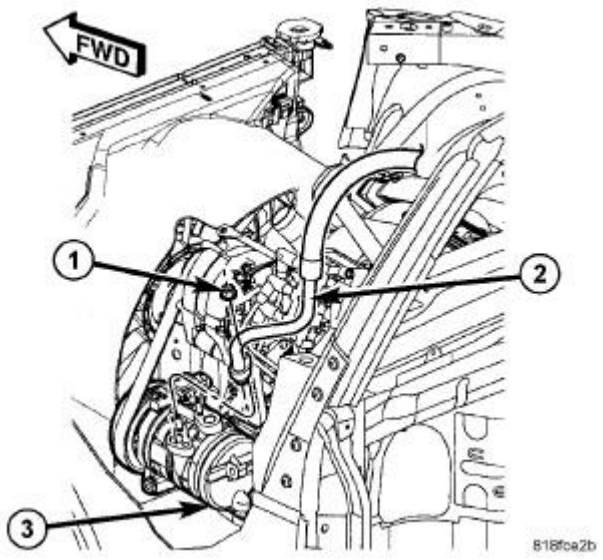

Fig. 37: A/C Suction Line Assembly & Fasteners
Courtesy of CHRYSLER GROUP, LLC

23. Connect the A/C suction line (2) at the compressor and compressor electrical connector. Refer to **COMPRESSOR, A/C, INSTALLATION** .

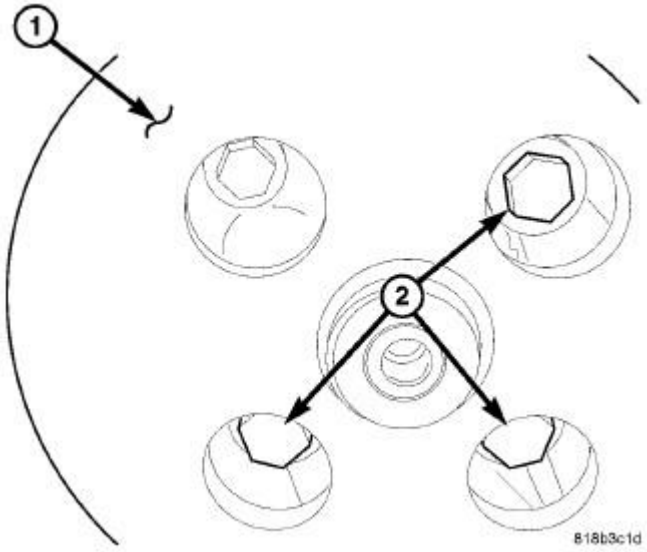

Fig. 38: Power Steering Pump & Mounting Bolts
Courtesy of CHRYSLER GROUP, LLC

24. Install the power steering pump (1). Refer to **PUMP, INSTALLATION** .

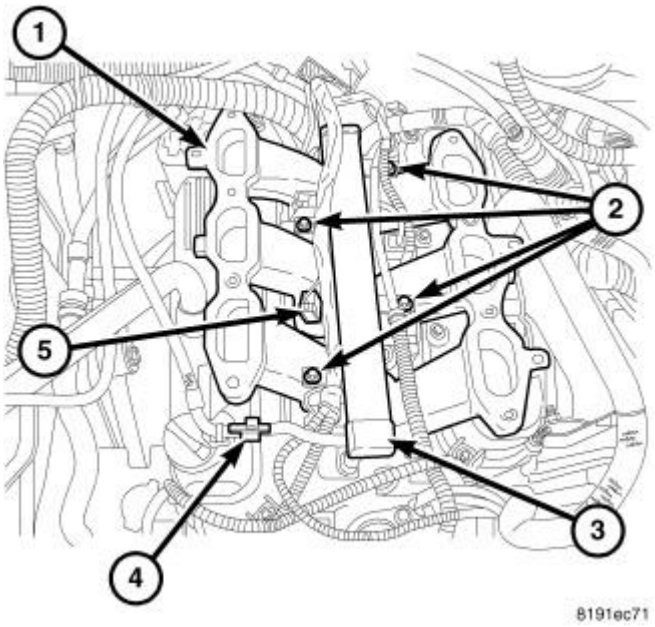

Fig. 39: Fuel Injectors, Line, Rail & Fasteners 3.8L
Courtesy of CHRYSLER GROUP, LLC

25. Connect the fuel line (4) to the fuel rail.

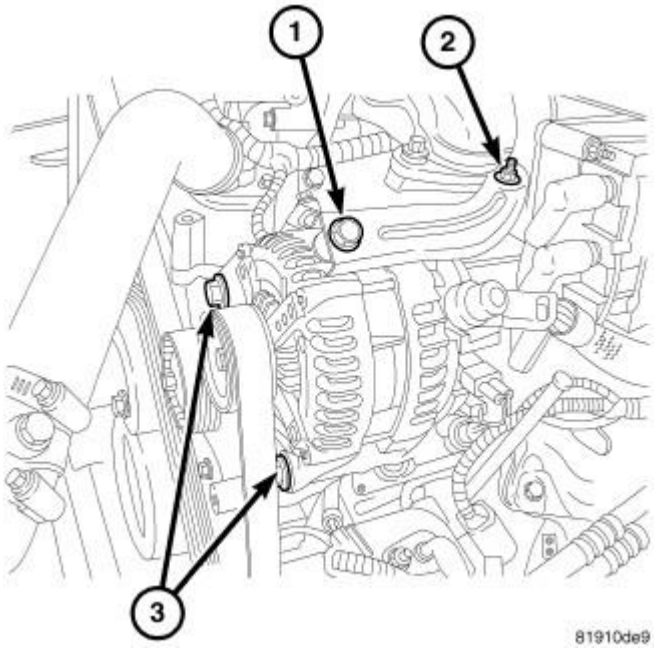

Fig. 40: Generator Mounting 3.8L
Courtesy of CHRYSLER GROUP, LLC

26. Install the generator (3). Refer to **GENERATOR, INSTALLATION** .

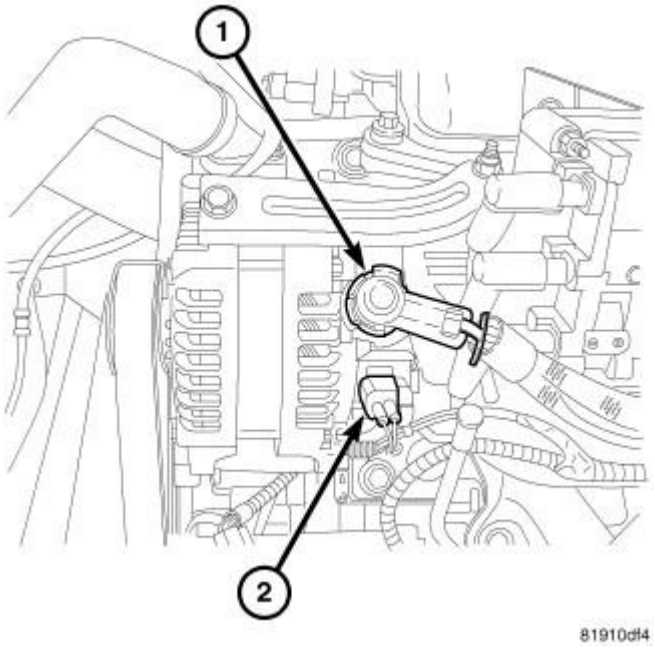

Fig. 41: Generator Electrical Connectors 3.8L
Courtesy of CHRYSLER GROUP, LLC

27. Reconnect the generator wiring. (1, 2). Refer to **GENERATOR, INSTALLATION** .
28. Install the drive belt.

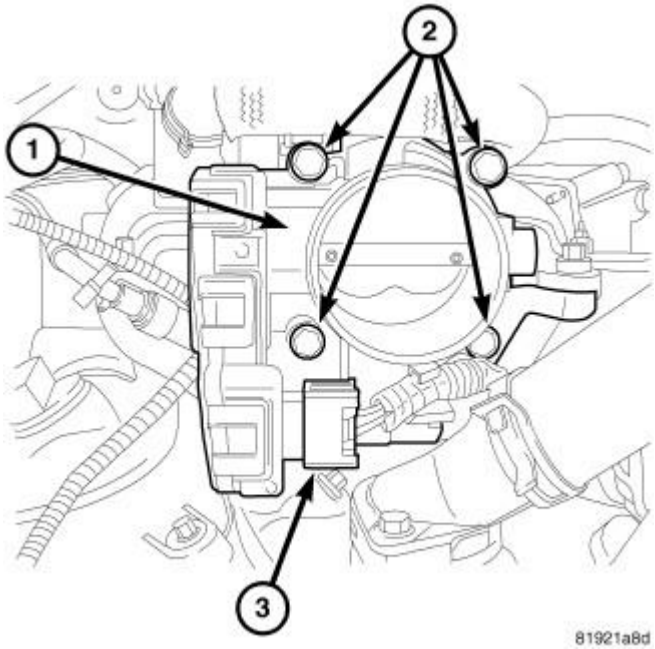

Fig. 42: Throttle Body, Bolts & Connector
Courtesy of CHRYSLER GROUP, LLC

29. Connect the radiator, coolant reservoir and heater hoses.

30. Connect the throttle wiring harness (ETC) (3).

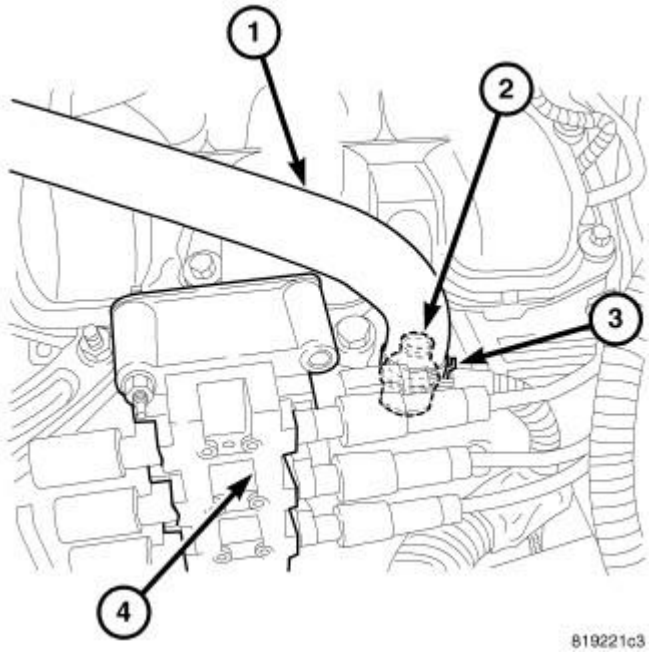

Fig. 43: PCV Valve Location 3.8L
Courtesy of CHRYSLER GROUP, LLC

31. Install the PCV hose (1).
32. Fill the cooling system. Refer to **STANDARD PROCEDURE** .

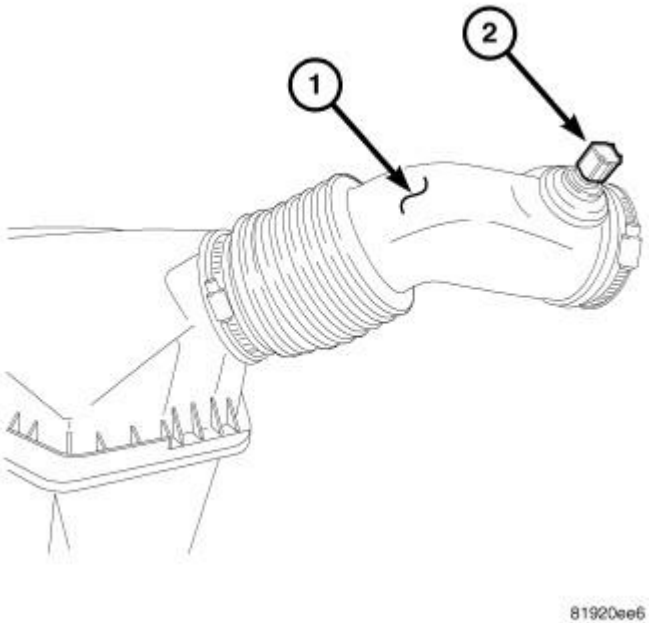

Fig. 44: Rubber Air Intake Tube & Intake Manifold Air Temperature (IAT) Sensor
Courtesy of CHRYSLER GROUP, LLC

33. Install the air cleaner housing, inlet hose (1) and inlet air temp sensor (IAT) (2). Refer to **AIR CLEANER, INSTALLATION**.
34. Evacuate and recharge A/C system. Refer to **PLUMBING, STANDARD PROCEDURE** .
35. Install new oil filter. Fill engine crankcase with proper oil to correct level. Refer to **CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS** .

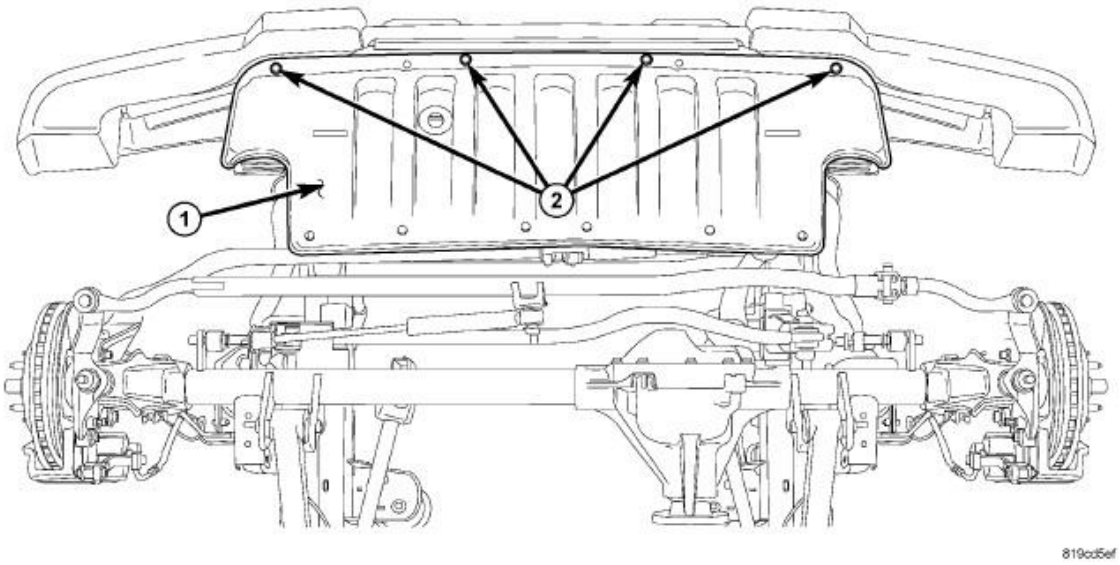

Fig. 45: Front Splash Shield & Push Pin Fasteners
Courtesy of CHRYSLER GROUP, LLC

36. Install the front splash shield (1).
37. Connect negative cable to battery.
38. Start engine and run until operating temperature is reached.

NOTE: The Cam/Crank Variation Relearn procedure must be performed anytime there has been a repair/replacement made to a powertrain system, for example: flywheel, valvetrain, camshaft and/or crankshaft sensors or components. Refer to DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure .

SPECIAL TOOLS

SPECIAL TOOLS

	1023 - Puller (Originally Shipped In Kit Number(s) 8678.)
	10368 - Set, Universal Protective Cap
	5048 - Puller, Bearing (Originally Shipped In Kit Number(s) 6303, 6672.)

	6341A - Remover, Seal (Originally Shipped In Kit Number(s) 6671.) 7700 - Tester, Cooling System (Originally Shipped In Kit Number(s) 7700-A.) 8116 - Adapter, Pressure PEP (Originally Shipped In Kit Number(s) 8201, 8201CC, 8204, 8204CC.) 8189 - Guide Pins (Originally Shipped In Kit Number(s) 8180, 8180CC, 8263, 8263CC.) 8406 - Adapter, Oil Pressure (Originally Shipped In Kit Number(s) 8650, 8652, 8653, 8700, 8700CC.) 8450 - Insert, Crankshaft (Originally Shipped In Kit Number(s) 8664, 8665, 8665CC, 8702.) 8452 - Installer, Crankshaft Sprocket (Originally Shipped In Kit Number(s) 8664, 8665, 8665CC, 8702.) 8453 - Compressor, Valve Spring (Originally Shipped In Kit Number(s) 8664, 8665, 8665CC, 8702.) 8464 - Adapter, Valve Spring (Originally Shipped In Kit Number(s) 8664, 8665, 8665CC, 8702, 9577.) 8539 - Remover, Sprocket (Originally Shipped In Kit Number(s) 8650, 8652, 8653, 8700, 8700CC.) C-3059A - Remover/Installer C-3292A - Gauge, Pressure C-3339A - Set, Dial Indicator (Originally Shipped In Kit Number(s) 9202.) C-3422-D - Compressor, Valve Spring C-3501 - Hone W/Oil, AMMCO Cylinder C-3685-A - Bloc-Chek Kit C-4992-1 - Installer (Originally Shipped In Kit Number(s) 6672, 6822.) C-4992-2 - Guide (Originally Shipped In Kit Number(s) 6672, 6822.) C-647 - Spring Tester C-823 - Hone, Cylinder

AIR INTAKE SYSTEM

AIR CLEANER

REMOVAL

REMOVAL

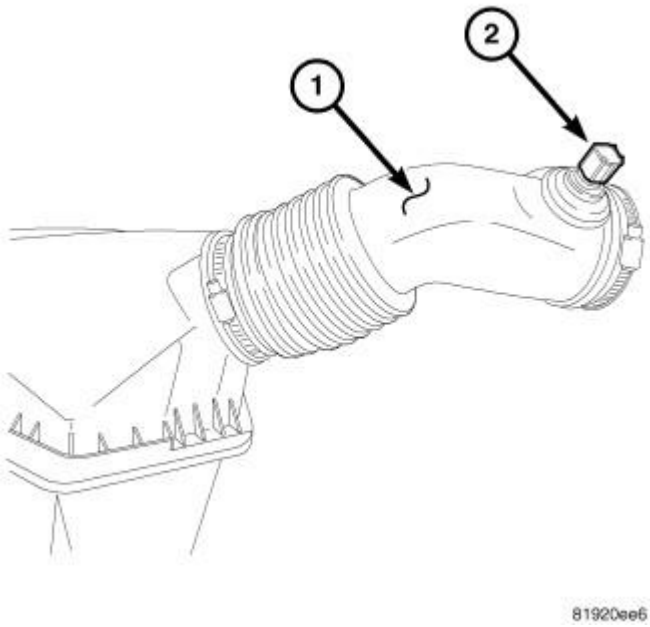

Fig. 46: Rubber Air Intake Tube & Intake Manifold Air Temperature (IAT) Sensor
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect the IAT sensor (2).
2. Disconnect the CCV hose.
3. Separate the air inlet tube from the throttle body.
4. Remove the air cleaner cover bolts.
5. Lift cover and pull toward the engine and remove cover tabs from air cleaner housing.
6. Lift cover and remove the filter.

INSTALLATION

INSTALLATION

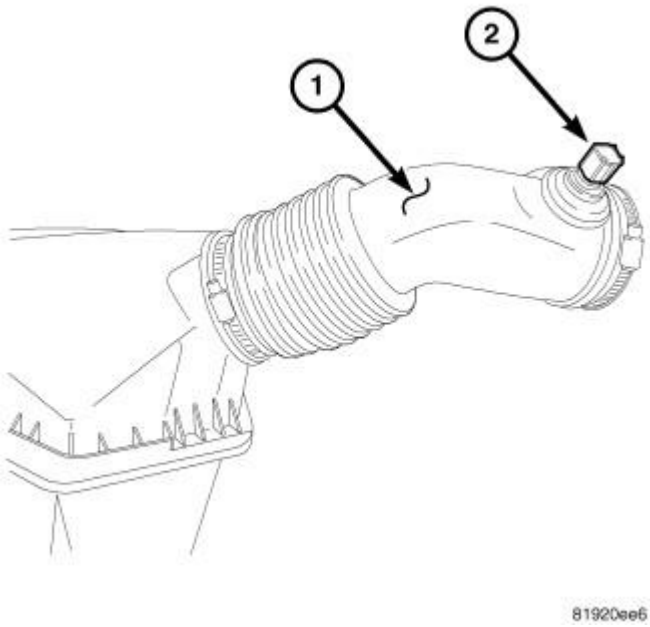

Fig. 47: Rubber Air Intake Tube & Intake Manifold Air Temperature (IAT) Sensor
Courtesy of CHRYSLER GROUP, LLC

1. Install the air filter element into air box.
2. Move cover so that the tabs insert into the air cleaner housing.
3. Position the cover down over the element and lower housing and tighten the fasteners.
4. Connect the air inlet tube to the throttle body and tighten the clamp.
5. Connect the IAT sensor (2).
6. Connect the CCV hose.

BODY, AIR CLEANER

REMOVAL

REMOVAL

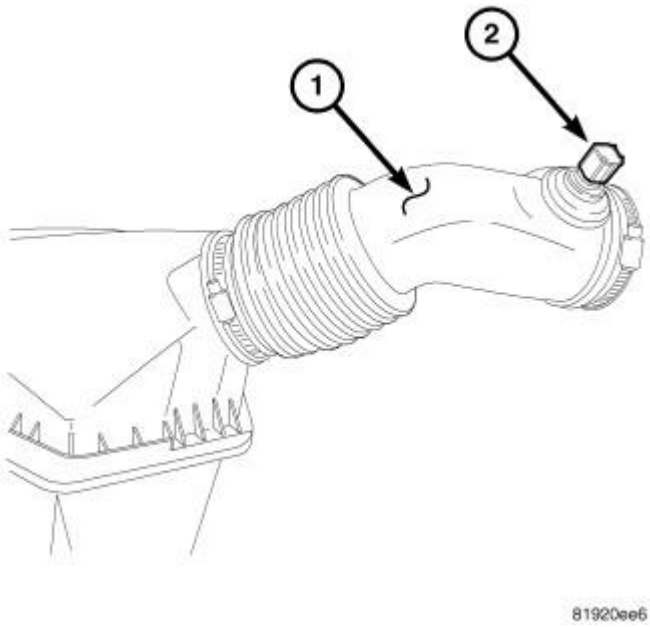

Fig. 48: Rubber Air Intake Tube & Intake Manifold Air Temperature (IAT) Sensor
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect the negative battery cable.
2. Disconnect the inlet air temperature sensor (2).
3. Disconnect the CCV hose from the air cleaner cover.
4. Remove the air inlet tube to throttle body.
5. Remove the bolt for air cleaner housing at upper radiator cross member.
6. Pull air box up and off over the single locating pin.
7. Remove air box from vehicle.

INSTALLATION

INSTALLATION

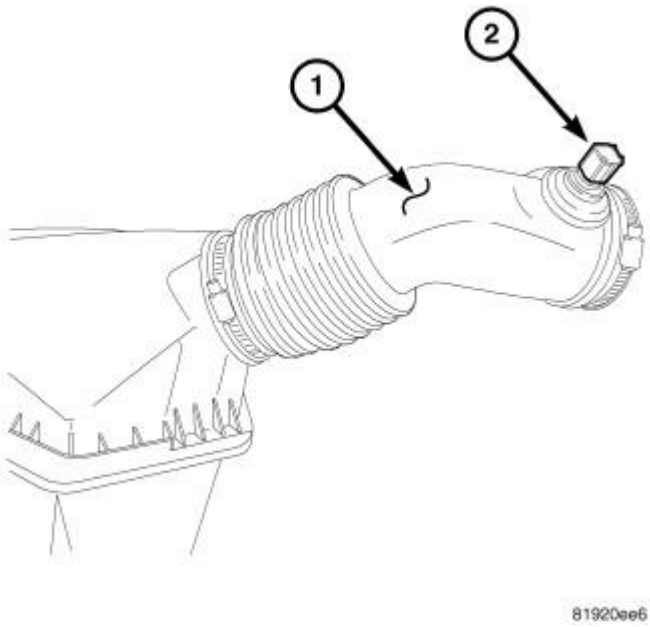

Fig. 49: Rubber Air Intake Tube & Intake Manifold Air Temperature (IAT) Sensor
Courtesy of CHRYSLER GROUP, LLC

1. Install air cleaner housing into vehicle and onto the locating pin.
2. Install bolt to hold air cleaner housing to the upper radiator cross member.
3. Install the air inlet tube to the throttle body and tighten clamp.
4. Connect the IAT sensor (2).
5. Connect the CCV hose to the air cleaner cover.
6. Connect the negative battery cable.

CYLINDER HEAD

DESCRIPTION

DESCRIPTION

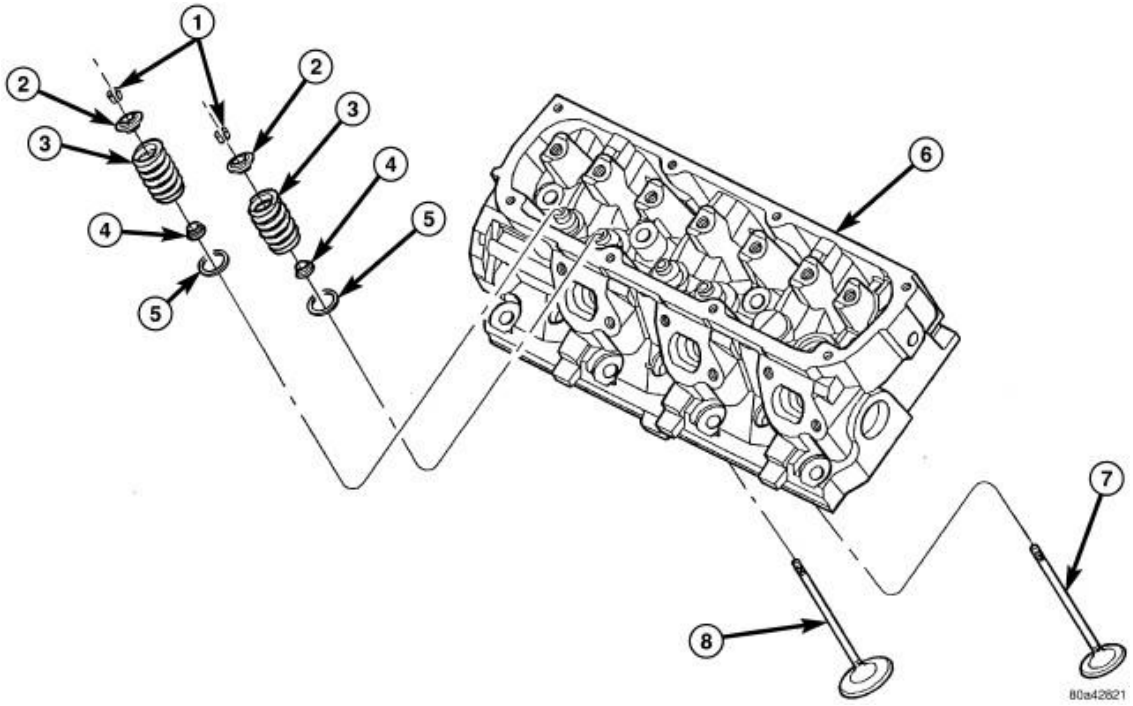

Fig. 50: Valve Components
Courtesy of CHRYSLER GROUP, LLC

1 - VALVE LOCKS	5 - SPRING SEATS
2 - RETAINERS	6 - CYLINDER HEAD
3 - VALVE SPRINGS	7 - VALVE - EXHAUST
4 - VALVE STEM SEALS	8 - VALVE - INTAKE

The aluminum cylinder heads (6) are designed to create high flow combustion chambers to improve performance, while minimizing the change to the burn rate in the chamber. The cylinder head incorporates the combustion chamber. Two valves (7, 8) per-cylinder are used with inserted valve seats (5) and guides. A multi-layer steel (MLS) type gasket is used between the cylinder head and engine block.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - CYLINDER HEAD GASKET

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

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

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

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

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

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test. Refer to **CYLINDER COMPRESSION PRESSURE TEST**. An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50-70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

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

VISUAL TEST METHOD

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

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

COOLING SYSTEM TESTER METHOD

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

Install Cooling System Tester (special tool #7700, Tester, Cooling System) 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 (special tool #C-3685-A, Bloc-Chek Kit) or equivalent. Perform test following the procedures supplied with the tool kit.

REMOVAL

REMOVAL

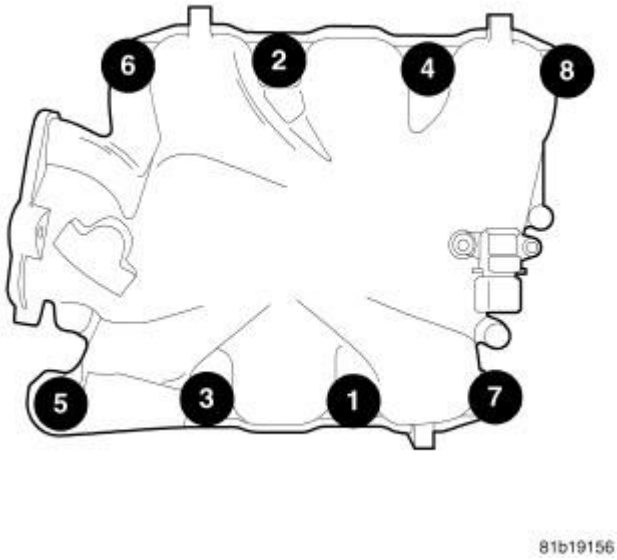

Fig. 51: Intake Manifold Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

1. Drain the cooling system. Refer to **STANDARD PROCEDURE** .
2. Disconnect negative cable from battery.
3. Remove upper and lower intake manifolds.

WARNING: INTAKE MANIFOLD GASKET IS MADE OF VERY THIN METAL AND MAY CAUSE PERSONAL INJURY, HANDLE WITH CARE.

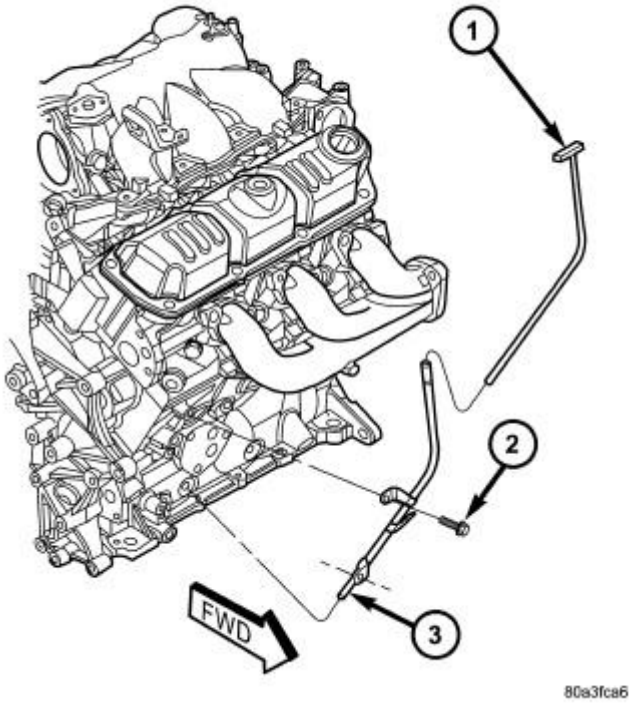

Fig. 52: Oil Level Indicator, Bolt & Tube
Courtesy of CHRYSLER GROUP, LLC

1 - INDICATOR
2 - BOLT
3 - TUBE

4. Remove the cylinder head covers. Refer to **COVER(S), CYLINDER HEAD, LEFT, REMOVAL** and **COVER(S), CYLINDER HEAD, RIGHT, REMOVAL**.
5. Remove the spark plugs from cylinder head.
6. Remove the oil level indicator and tube.

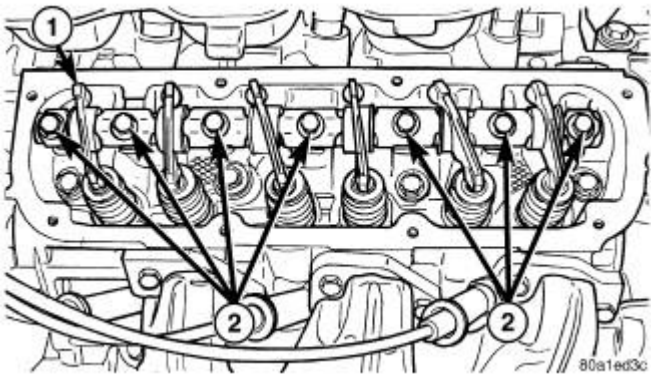

Fig. 53: Rocker Arms, Shaft Assembly & Bolts
Courtesy of CHRYSLER GROUP, LLC

1 - ROCKER ARMS AND SHAFT ASSEMBLY
2 - ROCKER SHAFT BOLTS

7. Remove exhaust manifold(s). Refer to **MANIFOLD, EXHAUST, LEFT, REMOVAL** and **MANIFOLD, EXHAUST, RIGHT, REMOVAL**.
8. Remove rocker arm and shaft assemblies (2). Remove push rods and. Refer to **ROCKER ARM, VALVE, REMOVAL**.**mark positions to ensure installation in original locations.**

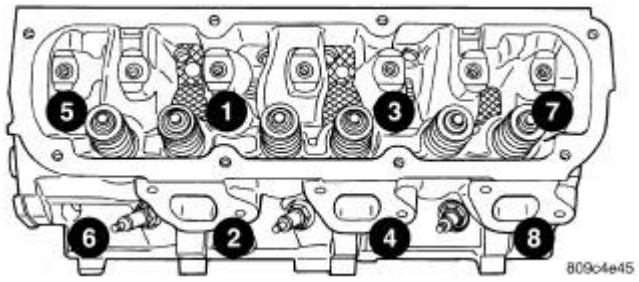

Fig. 54: Cylinder Head Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

9. Remove the eight head bolts from each cylinder head and remove cylinder heads.

CLEANING

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 **Engine - Standard Procedure**. Be careful not to gouge or scratch the aluminum head sealing surface.

Clean all engine oil passages.

INSPECTION

INSPECTION

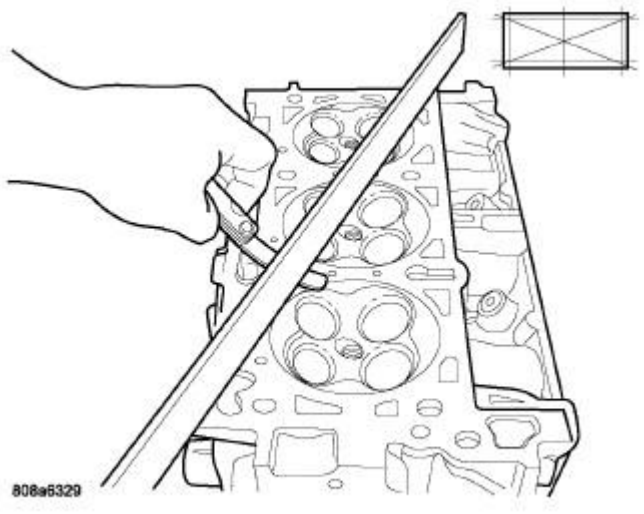

Fig. 55: Checking Cylinder Head Flatness
Courtesy of CHRYSLER GROUP, LLC

1. Before cleaning, check for leaks, damage and cracks.
2. Clean cylinder head and oil passages. Refer to **Engine/Cylinder Head - Cleaning**.
3. Check cylinder head for flatness. Refer to **Fig. 55**.
4. Cylinder head must be flat within:

- Standard dimension = less than 0.05 mm (0.002 inch.)
- Service Limit = 0.2 mm (0.008 inch.)
- Grinding Limit = Maximum of 0.2 mm (0.008 inch.) is permitted.

CAUTION: 0.20 mm (0.008 in.) MAX is a combined total dimension of the stock removal limit from cylinder head and block top surface (Deck) together.

INSTALLATION

INSTALLATION

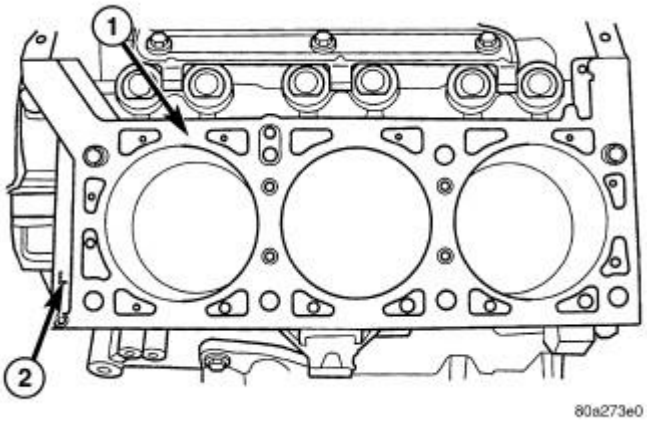

Fig. 56: Head Gasket Identification
Courtesy of CHRYSLER GROUP, LLC

1 - CYLINDER HEAD GASKET
2 - LOCATION IDENTIFICATION (L = LEFT BANK, R = RIGHT BANK)

1. Clean all sealing surfaces of engine block and cylinder heads. Refer to **Engine - Standard Procedure**.
2. Position new gasket(s) on engine block. Refer to **Fig. 56**. The left bank gasket is identified with the "L" stamped in the exposed area of the gasket located at front of engine (shown in illustration). Refer to **Fig. 56**. The right bank gasket is identified with a "R" stamped in the exposed area of the gasket also, but is located at the rear of the engine.

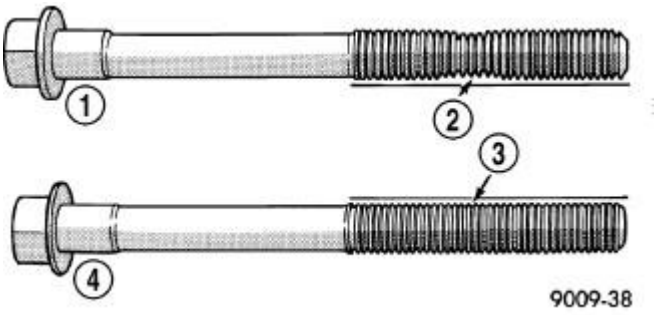

Fig. 57: Checking Cylinder Head Bolts For Stretching (Necking)
Courtesy of CHRYSLER GROUP, LLC

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

3. **The cylinder head bolts should be examined BEFORE reuse. If the threads are necked down, the bolts must be replaced** .
4. 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.

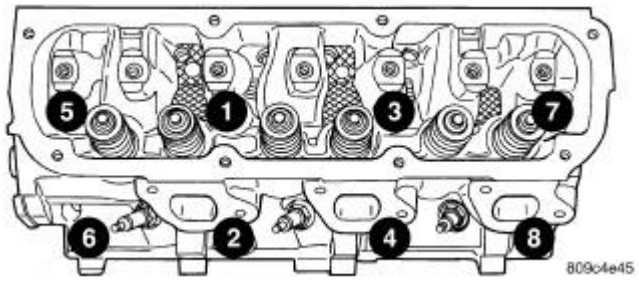

Fig. 58: Cylinder Head Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

5. Tighten the cylinder head bolts 1-8 in the sequence shown in illustration. Refer to **Fig. 58**. Using the 4 step torque turn method, tighten according to the following values:
   - Step 1: Bolts 1 - 8 to 61 N.m (45 ft. lbs.)
   - Step 2: Bolts 1 - 8 to 88 N.m (65 ft. lbs.)
   - Step 3: Bolts 1 - 8 (again) to 88 N.m (65 ft. lbs.)
   - Step 4: Bolts 1 - 8 turn an additional 1/4 Turn. **(Do not use a torque wrench for this step.)**

NOTE: Bolt torque after 1/4 turn should be over 122 N.m (90 ft. lbs.). If not, replace the bolt.

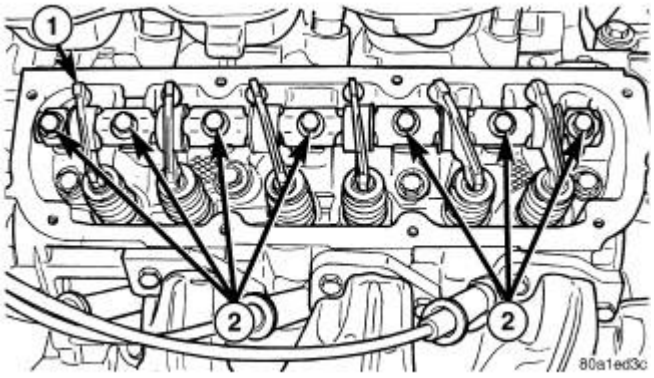

Fig. 59: Rocker Arms, Shaft Assembly & Bolts
Courtesy of CHRYSLER GROUP, LLC

1 - ROCKER ARMS AND SHAFT ASSEMBLY
2 - ROCKER SHAFT BOLTS

6. Inspect and replace worn or bent push rods.
7. Install the push rods.
8. Install the rocker arm and shaft assemblies (2). Refer to **ROCKER ARM, VALVE, INSTALLATION**.
9. Install the cylinder head covers. Refer to **COVER(S), CYLINDER HEAD, LEFT, INSTALLATION** and **COVER(S), CYLINDER HEAD, RIGHT, INSTALLATION**.

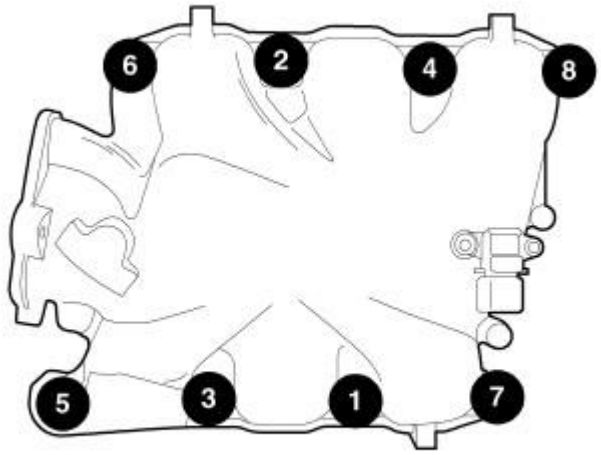

Fig. 60: Intake Manifold Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

10. Install the exhaust manifolds. Refer to **MANIFOLD, EXHAUST, LEFT, INSTALLATION** and **MANIFOLD, EXHAUST, RIGHT, INSTALLATION**.
11. Install new O-ring on oil level indicator tube. Install oil level indicator tube assembly. Refer to **Fig. 60**.
12. Install upper and lower intake manifolds. Refer to **MANIFOLD, INTAKE, INSTALLATION** and **MANIFOLD, INTAKE, LOWER, INSTALLATION**.
13. Fill the cooling system. Refer to **STANDARD PROCEDURE** .
14. Connect negative cable to battery.

COVER(S), CYLINDER HEAD

DESCRIPTION

DESCRIPTION

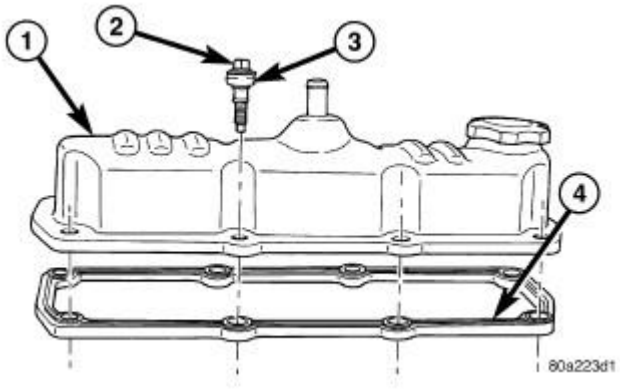

Fig. 61: Cylinder Head Cover & Gasket
Courtesy of CHRYSLER GROUP, LLC

1 - CYLINDER HEAD COVER
2 - BOLT
3 - SEAL (SERVICED WITH BOLT)
4 - GASKET

The cylinder head covers (1) are made of composite material. The covers are sealed with steel reinforced silicon rubber gaskets. The cylinder head cover uses rubber isolators at each fastener location.

NOTE: Due to the tight packaging near the cylinder head covers, which makes spill clean-up difficult, a spill during an engine oil change may be misinterpreted as an oil leak. When investigating an oil leak in the location of the cylinder head covers and intake manifold. For determining the source of a leak, refer to ENGINE OIL LEAK INSPECTION.

COVER(S), CYLINDER HEAD, LEFT

REMOVAL

REMOVAL

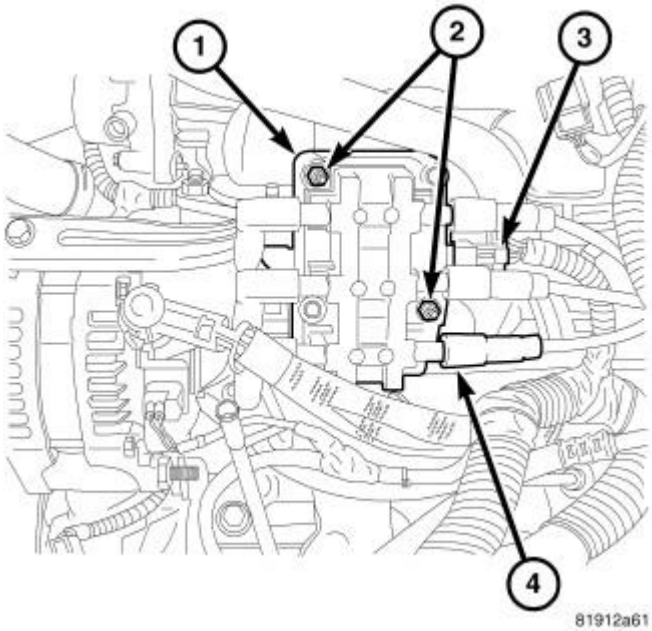

Fig. 62: Ignition Coil Pack 3.8L
Courtesy of CHRYSLER GROUP, LLC

1. Remove the ignition coil pack (1).
2. Disconnect spark plug wires from spark plugs.

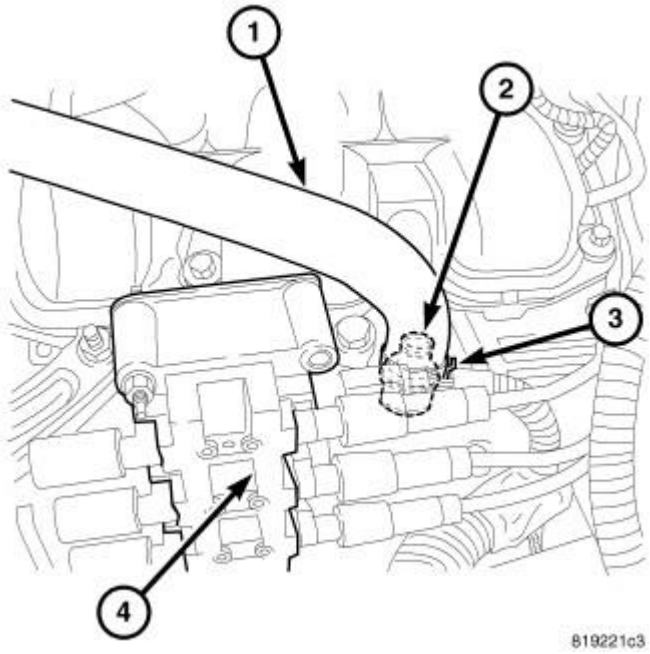

Fig. 63: PCV Valve Location 3.8L
Courtesy of CHRYSLER GROUP, LLC

3. Disconnect PCV hose (1) from cylinder head cover.

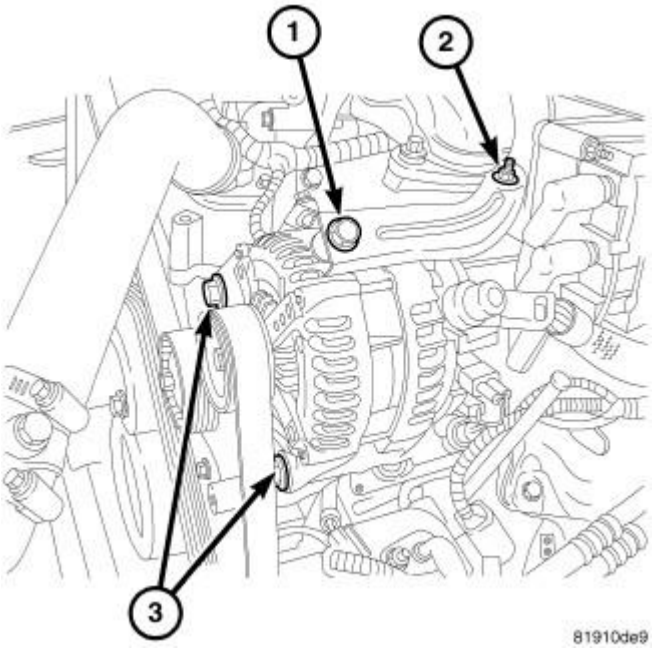

Fig. 64: Generator Mounting 3.8L
Courtesy of CHRYSLER GROUP, LLC

4. Remove the generator support bracket (1, 2).
5. Remove cylinder head cover bolts.

6. Remove cylinder head cover and gasket.

INSTALLATION

INSTALLATION

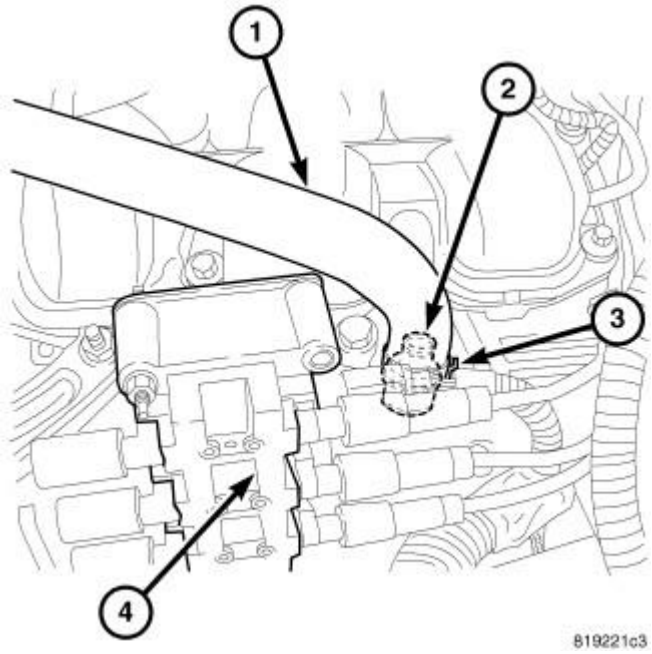

Fig. 65: PCV Valve Location 3.8L
Courtesy of CHRYSLER GROUP, LLC

1. Clean cylinder head and cylinder head cover mating surfaces. Inspect cylinder head cover surface for flatness. Replace gasket as necessary.
2. Assemble gasket to cylinder cover by inserting the fasteners through each bolt hole on cover and gasket.
3. Install the cylinder head cover and bolts.
4. Tighten cylinder head cover bolts to 12 N.m (105 in. lbs.).
5. Connect PCV hose (1).

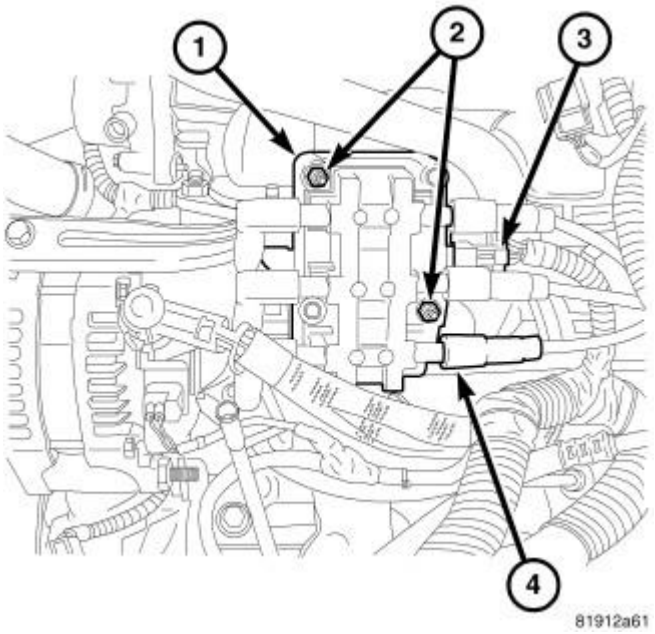

Fig. 66: Ignition Coil Pack 3.8L
Courtesy of CHRYSLER GROUP, LLC

6. Install the ignition coil pack (1) and plug wires.

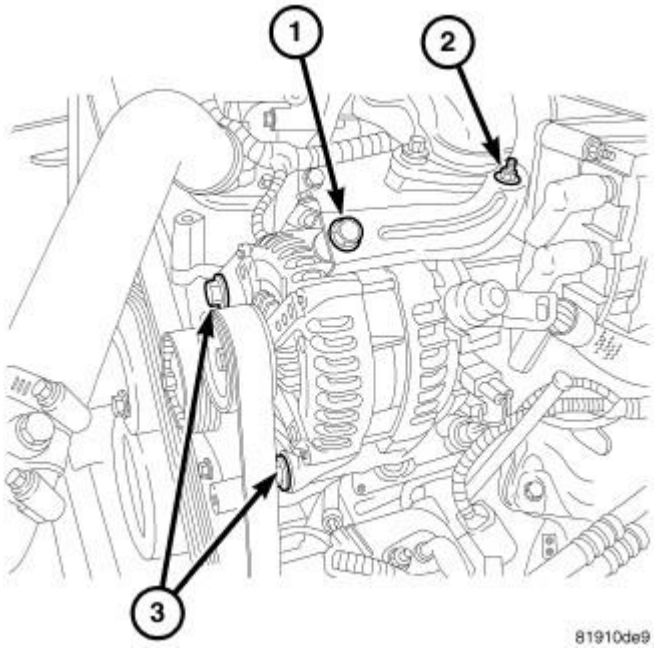

Fig. 67: Generator Mounting 3.8L
Courtesy of CHRYSLER GROUP, LLC

7. Install the generator support bracket (1, 2).
8. Connect spark plug wires to spark plugs.

COVER(S), CYLINDER HEAD, RIGHT

REMOVAL

REMOVAL

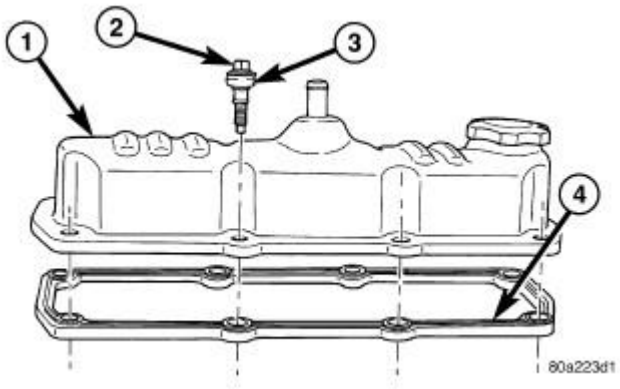

Fig. 68: Cylinder Head Cover & Gasket
Courtesy of CHRYSLER GROUP, LLC

1 - CYLINDER HEAD COVER
2 - BOLT
3 - SEAL (SERVICED WITH BOLT)
4 - GASKET

1. Disconnect negative cable from battery.
2. Disconnect spark plug wires from plugs.
3. Disconnect CCV hose from cylinder head cover.
4. Remove cylinder head cover bolts.
5. Remove cylinder head cover (1) and gasket (4).

INSTALLATION

INSTALLATION

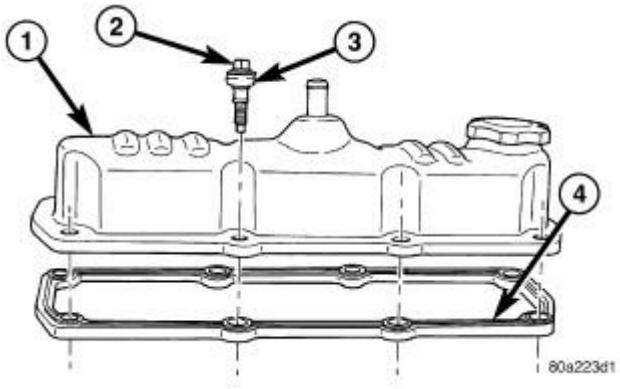

Fig. 69: Cylinder Head Cover & Gasket
Courtesy of CHRYSLER GROUP, LLC

1 - CYLINDER HEAD COVER
2 - BOLT
3 - SEAL (SERVICED WITH BOLT)
4 - GASKET

1. Clean cylinder head and cylinder head cover mating surfaces. Inspect cylinder head cover surface for flatness. Replace gasket as necessary.
2. Inspect seal on the cover bolt for wear or damage. Replace bolt assembly (2) as necessary.
3. Inspect the PCV hose for damage. replace as necessary.

NOTE: The cylinder head cover bolts (2) contain a torque limiter sleeve and a seal. The seal and torque sleeve is replaced with the bolt.

4. Assemble gasket to cylinder cover by inserting the bolt assemblies through each bolt hole on the cover and gasket (4).

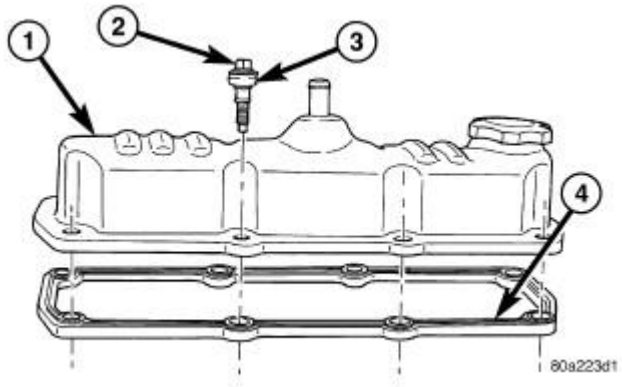

Fig. 70: Cylinder Head Cover & Gasket
Courtesy of CHRYSLER GROUP, LLC

1 - CYLINDER HEAD COVER
2 - BOLT
3 - SEAL (SERVICED WITH BOLT)
4 - GASKET

5. Install cylinder head cover and bolts (2).
6. Tighten cylinder head cover bolts to 12 N.m (105 in. lbs.).
7. Connect CCV hose to cylinder head cover.
8. Connect spark plug wires to spark plugs.
9. Connect negative cable to battery.

ROCKER ARM, VALVE

DESCRIPTION

ROCKER ARMS

The rocker arms are installed on the rocker arm shaft. The rocker arms and shaft assembly is attached to the cylinder head with seven billeted bolts and retainers. The rocker arms are made of stamped steel.

PUSH ROD

The pushrods are made of steel and are a hollow design. The pushrods are positioned between the hydraulic lifter and the rocker arm.

OPERATION

ROCKER ARMS

The rocker arm pivots are on the rocker shaft. Rocker arms are used to translate up and down motions provided by the camshaft, hydraulic roller lifter, and pushrod on one end, into a down and up motions on the valve stem on the opposing end.

PUSH ROD

The pushrod is a solid link between the hydraulic roller lifter and the rocker arm. Also, the pushrod supplies engine oil from the hydraulic lifter to the rocker arm.

REMOVAL

REMOVAL

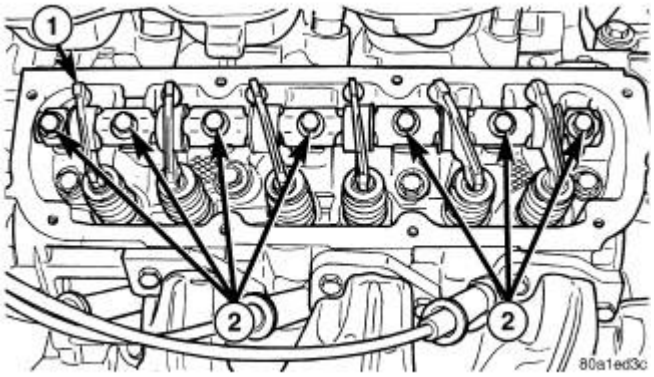

Fig. 71: Rocker Arms, Shaft Assembly & Bolts
Courtesy of CHRYSLER GROUP, LLC

1 - ROCKER ARMS AND SHAFT ASSEMBLY
2 - ROCKER SHAFT BOLTS

1. Remove the cylinder head cover(s). Refer to **COVER(S), CYLINDER HEAD, LEFT, REMOVAL** and **COVER(S), CYLINDER HEAD, RIGHT, REMOVAL**.

NOTE: Rocker arm shaft bolts are captured to the shaft.

2. Loosen the rocker shaft bolts, rotating one turn each, until all valve spring pressure is relieved. Refer to **Fig. 71**.
3. Remove the rocker arms and shaft assembly. Refer to **Fig. 71**.
4. For rocker arm disassembly procedures. Refer to **ROCKER ARM, VALVE, DISASSEMBLY**.

DISASSEMBLY

DISASSEMBLY

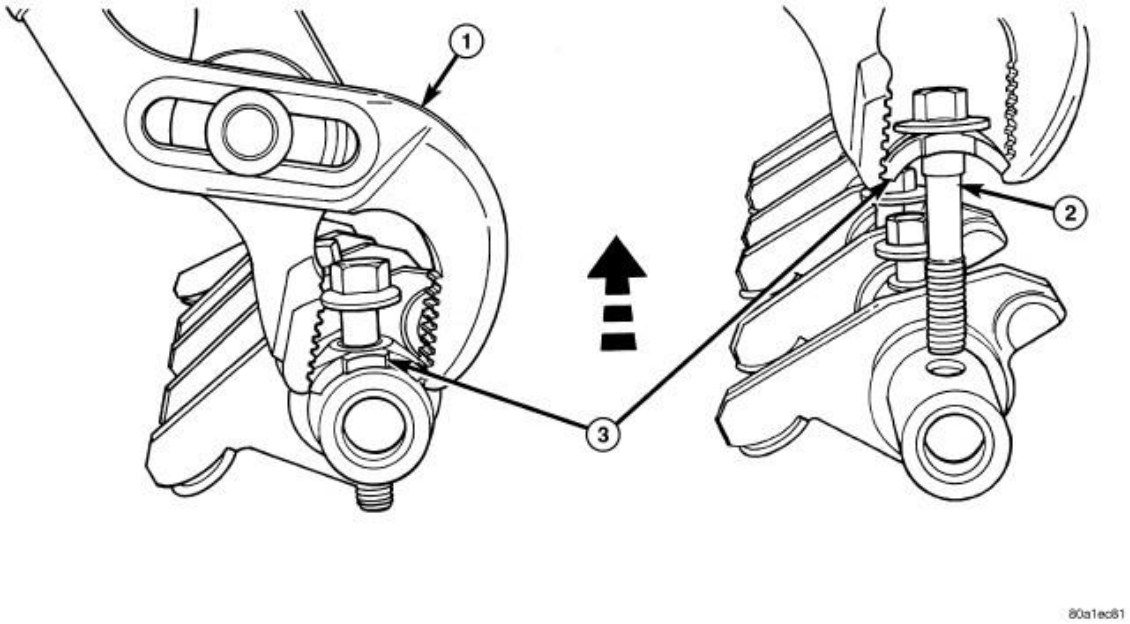

Fig. 72: Removing Rocker Arm Retainer
Courtesy of CHRYSLER GROUP, LLC

1 - ADJUSTABLE PLIERS	3 - ROCKER ARM RETAINER
2 - BILLETED ROCKER SHAFT BOLT	

CAUTION: Do not attempt to drive the billeted bolt from the rocker shaft. This can damage the rocker arm retainer and bolt assembly.

1. Remove the rocker arm retainer and bolt by performing the following procedure:
    1. Using adjustable pliers, grip the edges of the retainer. Refer to **Fig. 72**.
    2. Apply an upward force with a slight rocking motion until the retainer disengages from shaft. Refer to **Fig. 72**.

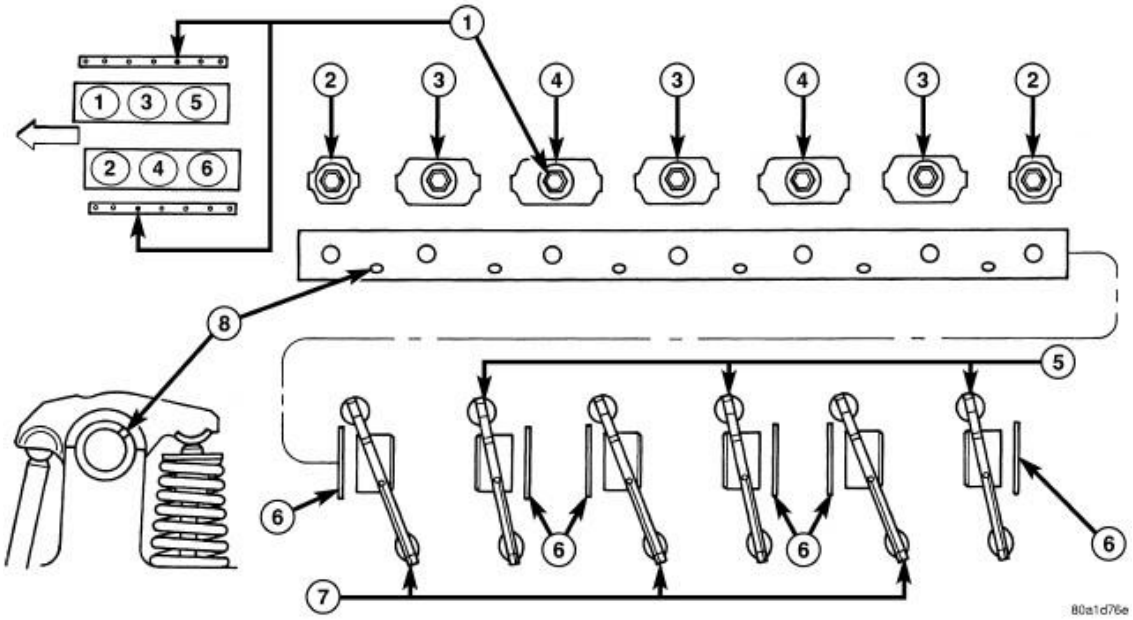

Fig. 73: Rocker Arms & Shaft Assembly Positioning
Courtesy of CHRYSLER GROUP, LLC

1 - BOLT (ROCKER SHAFT OIL FEED - LONGER LENGTH)	5 - ROCKER ARM - EXHAUST
2 - SHAFT RETAINER/SPACER - 21.5 mm (0.84 in.)	6 - WASHER
3 - SHAFT RETAINER/SPACER - 37.5 mm (1.47 in.)	7 - ROCKER ARM - INTAKE (LARGER OFFSET)
4 - SHAFT RETAINER/SPACER - 40.9 mm (1.61 in.)	8 - ROCKER ARMS LUBRICATION FEED HOLE (POSITION UPWARD AND TOWARD VALVE SPRING)

2. Remove rocker arms. Refer to **Fig. 73**. Identify the component locations for reassembly in original locations.

ASSEMBLY

ASSEMBLY

1. Install rocker arms on the shaft. Install in the original positions if re-used. **Ensure** the rocker shaft, all the retainers and washers are properly positioned and installed in the correct locations.
2. Install rocker arms and shaft to the cylinder head. Refer to **ROCKER ARM, VALVE, INSTALLATION**.

INSTALLATION

INSTALLATION

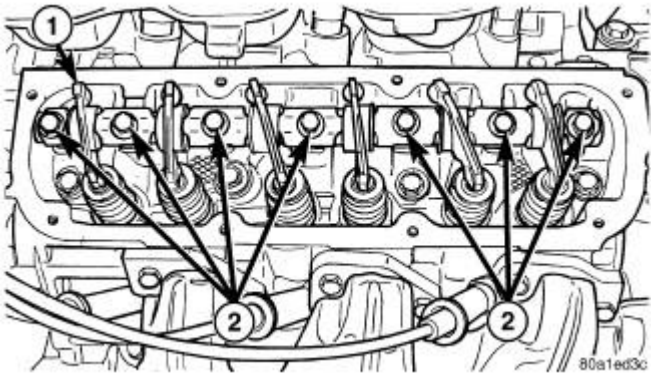

Fig. 74: Rocker Arms, Shaft Assembly & Bolts
Courtesy of CHRYSLER GROUP, LLC

1 - ROCKER ARMS AND SHAFT ASSEMBLY
2 - ROCKER SHAFT BOLTS

CAUTION: Ensure the longer shaft retaining bolt is installed in the proper location on the rocker shaft. Refer to ROCKER ARM, VALVE, ASSEMBLY.

1. Position the rocker arm and shaft assemblies on the pedestal mounts.

CAUTION: Ensure all pushrods are properly located on the lifter and the rocker arm socket.

2. Align each rocker arm socket with each pushrod end.

CAUTION: The rocker arm shaft should be tightened down slowly, starting with the center bolts. Allow 20 minutes lifter bleed down time after installation of the rocker shafts before engine operation.

3. Slowly tighten rocker shaft bolts evenly until shaft is seated. Tighten bolts to 23 N.m (200 in. lbs.). Refer to **Fig. 74**.
4. Install the cylinder head cover(s). Refer to **COVER(S), CYLINDER HEAD, LEFT, INSTALLATION** and **COVER(S), CYLINDER HEAD, RIGHT, INSTALLATION**.

SEAL(S), VALVE GUIDE

DESCRIPTION

DESCRIPTION

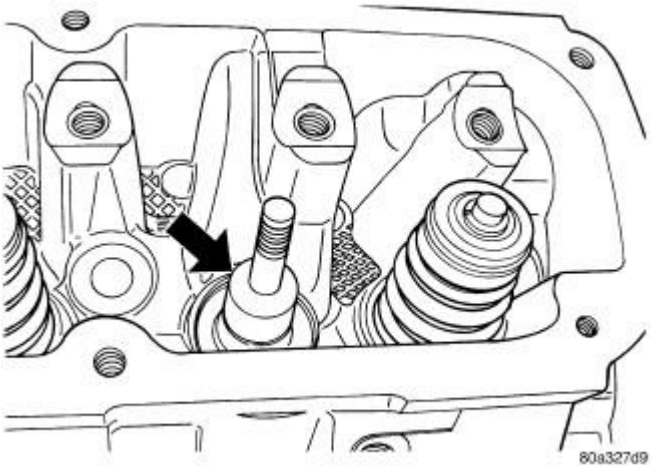

Fig. 75: Valve Stem Seal
Courtesy of CHRYSLER GROUP, LLC

The valve stem seals are made of Viton rubber. The seals are positioned over the valve stem and seated on the valve guide. Refer to **Fig. 75**.

REMOVAL

REMOVAL

1. Remove the valve springs. Refer to **SPRING(S), VALVE, REMOVAL**.
2. Remove the valve stem seal.

INSTALLATION

INSTALLATION

1. Install the valve stem seal squarely over the valve guide, using the valve stem as a guide. Do not force the seal against top of the valve guide.
2. Install the valve spring. Refer to **SPRING(S), VALVE, INSTALLATION**.

SPRING(S), VALVE

DESCRIPTION

DESCRIPTION

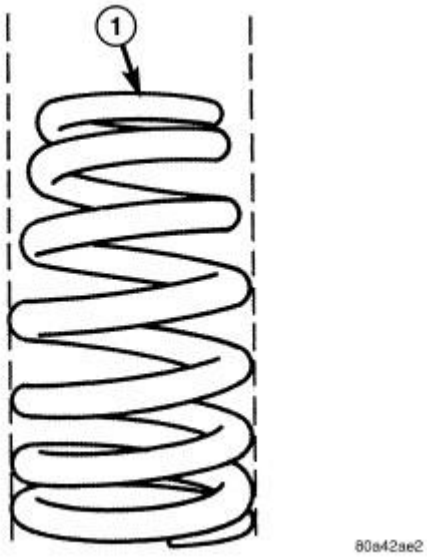

Fig. 76: Valve Spring
Courtesy of CHRYSLER GROUP, LLC

1 - VALVE SPRING (TOP - SMALLER DIAMETER)

There are two interchangeable, floating (spring rotates during operation), valve spring designs. Type A may be identified by the counterclockwise (spring spirals down and to the left) appearance, And Type B may be identified by the clockwise (spring spirals down and to the right) appearance. Both of the valve springs are a bee-hive shaped design but have different specifications. Refer to **Fig. 76**.

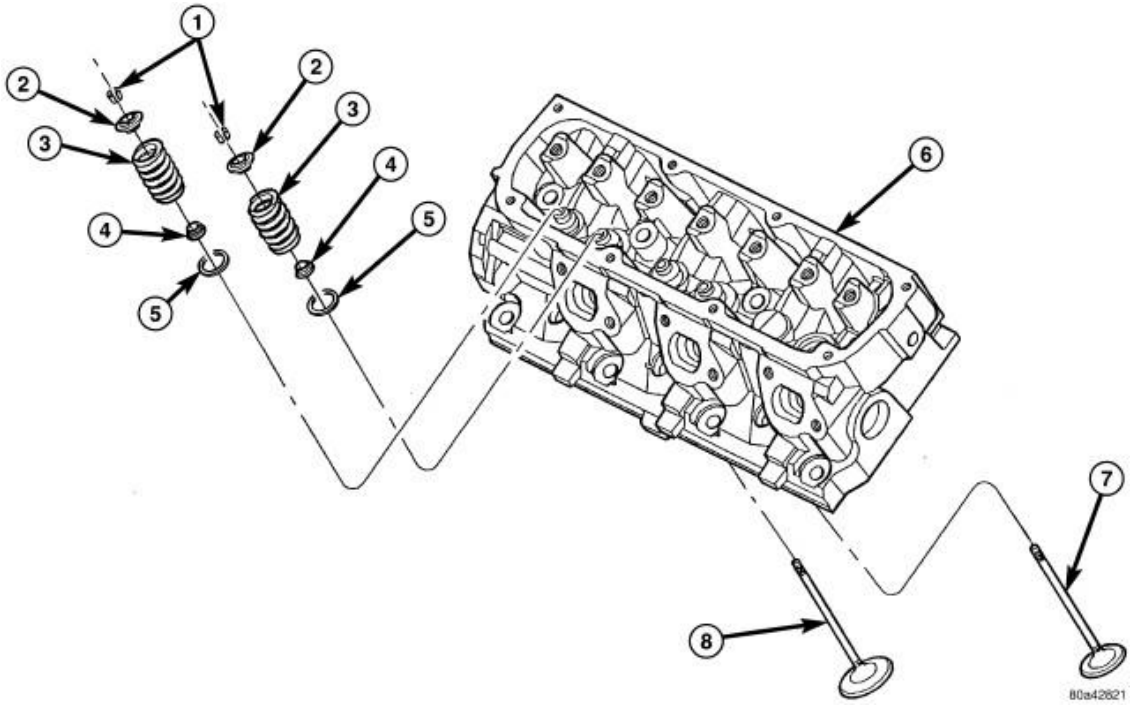

Fig. 77: Cylinder Head & Valve Components
Courtesy of CHRYSLER GROUP, LLC

1 - VALVE LOCKS	5 - SPRING SEATS
2 - RETAINERS	6 - CYLINDER HEAD
3 - VALVE SPRINGS	7 - VALVE - EXHAUST
4 - VALVE STEM SEALS	8 - VALVE - INTAKE

The springs are seated on a steel washer on the cylinder head with retainers and locks retaining the springs. Refer to **Fig. 77**. The springs are installed with the smaller diameter against spring retainer. Refer to **Fig. 76**.

OPERATION

OPERATION

The valve spring returns the valve against its seat for a positive seal of the combustion chamber.

REMOVAL

CYLINDER HEAD OFF

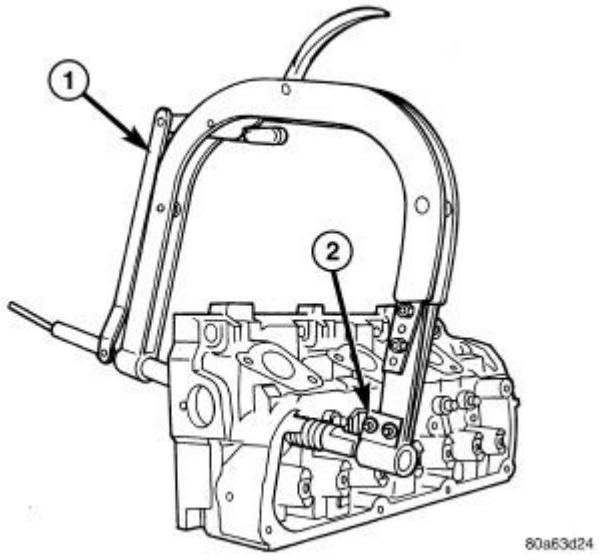

Fig. 78: Removing/Installing Valve Spring
Courtesy of CHRYSLER GROUP, LLC

1 - SPECIAL TOOL C-3422-D SPRING COMPRESSOR
2 - SPECIAL TOOL 8464 ADAPTER

1. With the cylinder head on a bench, position Special Tool (special tool #C-3422-D, Compressor, Valve Spring) with (special tool #8464, Adapter, Valve Spring) Adapter on the valve and spring retainer. Refer to **Fig. 78**.

2. Compress the spring only enough to remove the valve retainer locks.
3. Slowly release the spring tension and remove the valve spring and retainer.
4. For removal of the valve stem seal. Refer to **SEAL(S), VALVE GUIDE, REMOVAL**.

IN VEHICLE

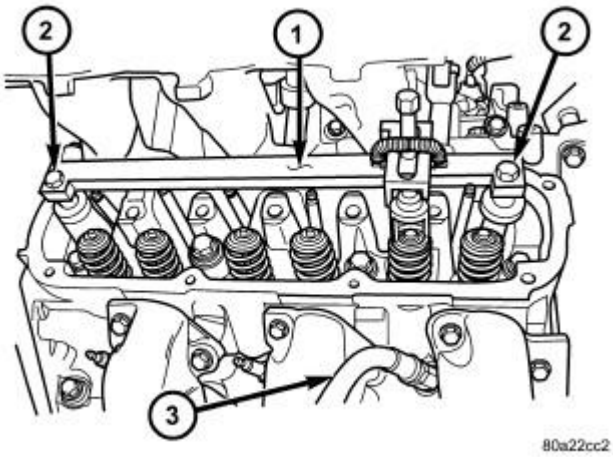

Fig. 79: Removing/Installing Valve Spring - Head On
Courtesy of CHRYSLER GROUP, LLC

1 - SPECIAL TOOL 8453
2 - BOLTS - SPECIAL TOOL ATTACHING
3 - AIR SUPPLY HOSE ADAPTER

1. Disconnect negative cable from battery.
2. Remove spark plug wires and all spark plugs.
3. Remove cylinder head cover(s). Refer to **COVER(S), CYLINDER HEAD, LEFT, REMOVAL** and **COVER(S), CYLINDER HEAD, RIGHT, REMOVAL**.

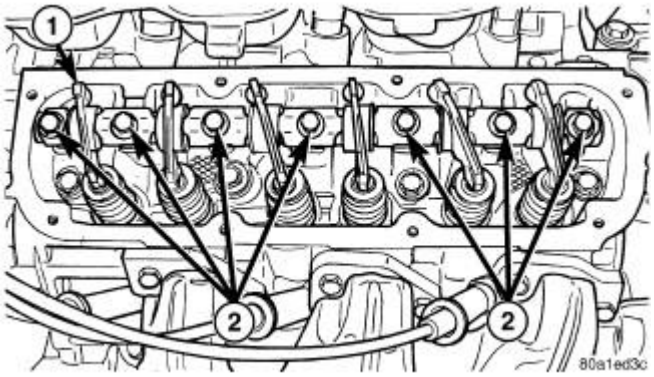

Fig. 80: Rocker Arms, Shaft Assembly & Bolts
Courtesy of CHRYSLER GROUP, LLC

1 - ROCKER ARMS AND SHAFT ASSEMBLY
2 - ROCKER SHAFT BOLTS

4. Remove rocker arms and shaft (1). Refer to **ROCKER ARM, VALVE, REMOVAL**.
5. Rotate engine until the piston in the cylinder bore requiring spring removal is at TDC.

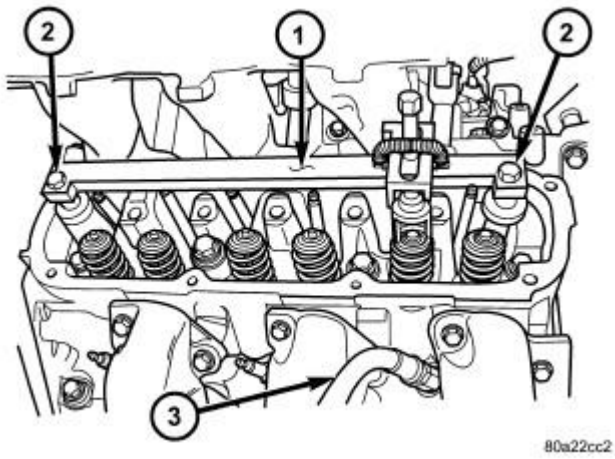

Fig. 81: Removing/Installing Valve Spring - Head On
Courtesy of CHRYSLER GROUP, LLC

1 - SPECIAL TOOL 8453
2 - BOLTS - SPECIAL TOOL ATTACHING
3 - AIR SUPPLY HOSE ADAPTER

6. Install Special Tool (special tool #8453, Compressor, Valve Spring) (1) to the cylinder head. Tighten the attaching bolts to 23 N.m (200 in. lbs.).
7. Install a spark plug adapter (3) in the spark plug hole. Connect air hose that can supply 620.5-689 kPa (90-100 psi) of air pressure to adapter. This is to hold valves in place while servicing components.
8. Locate the forcing screw and spring retainer adapter assembly over the spring requiring removal.
9. Slowly turn the forcing screw clockwise (compressing the valve spring) until the valve keepers can be removed.
10. Turn forcing screw counterclockwise to relieve spring tension. Remove retainer and valve spring.
11. Repeat procedure for each cylinder requiring valve spring removal.

INSPECTION

INSPECTION

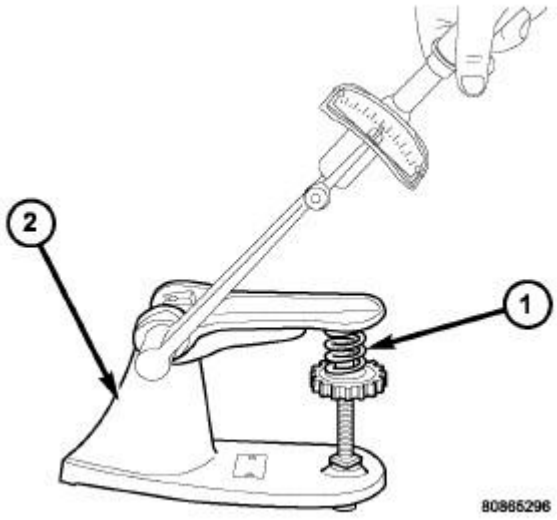

Fig. 82: Testing Valve Spring
Courtesy of CHRYSLER GROUP, LLC

1 - SPECIAL TOOL C-647

NOTE: The are two different types of valve springs used that are interchangeable, but have different specifications. Refer to SPRING(S), VALVE, DESCRIPTION.

Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested. Refer to **Fig. 82**. **As an example;** the compression length of a spring to be tested is 38.00 mm (1.496 in.). Turn the table of Tool (special tool #C-647, Spring Tester) until surface is in line with the 38.00 mm (1.496 in.) mark on the threaded stud and the zero mark on the front. Place spring over stud on the table and lift compressing lever to set tone device. Pull on torque wrench until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to **Engine - Specifications** to obtain specified height and allowable tensions. Replace any springs that do not meet specifications.

INSTALLATION

CYLINDER HEAD OFF

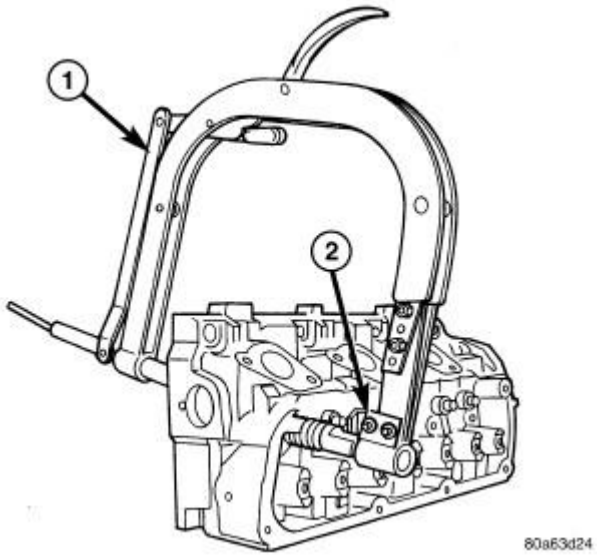

Fig. 83: Removing/Installing Valve Spring
Courtesy of CHRYSLER GROUP, LLC

1 - SPECIAL TOOL C-3422-D SPRING COMPRESSOR
2 - SPECIAL TOOL 8464 ADAPTER

1. If removed, install a new valve stem seal. Refer to **SEAL(S), VALVE GUIDE, INSTALLATION**.
2. Position valve spring and retainer on spring seat.
3. Using Special Tool (special tool #C-3422-D, Compressor, Valve Spring) with (special tool #8464, Adapter, Valve Spring) Adapter, compress the spring only enough to install the valve retainer locks. Refer to **Fig. 83**. Install valve retainer locks.

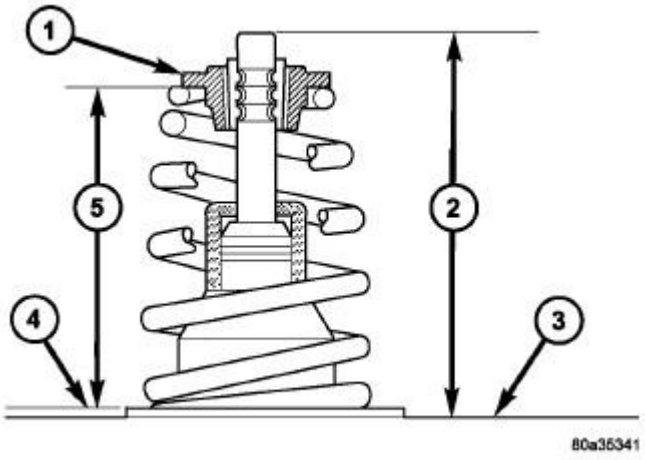

Fig. 84: Valve Spring Installed
Courtesy of CHRYSLER GROUP, LLC

1 - VALVE SPRING RETAINER
2 - VALVE INSTALLED HEIGHT
3 - CYLINDER HEAD SURFACE
4 - VALVE SPRING SEAT SURFACE
5 - VALVE SPRING INSTALLED HEIGHT

4. Slowly release the spring tension. Ensure the retainer locks are seated properly. Refer to **Fig. 84**.

IN VEHICLE

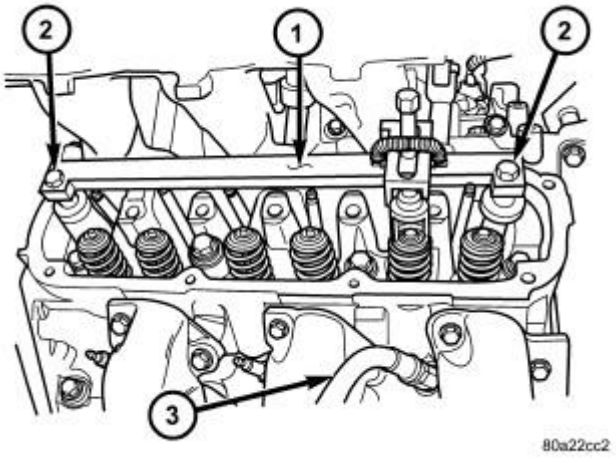

Fig. 85: Removing/Installing Valve Spring - Head On
Courtesy of CHRYSLER GROUP, LLC

1 - SPECIAL TOOL 8453
2 - BOLTS - SPECIAL TOOL ATTACHING
3 - AIR SUPPLY HOSE ADAPTER

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

CAUTION: Do not pinch seal between retainer and top of valve guide.

2. Follow the same procedure on the remaining 5 cylinders using the firing sequence 1-2-3-4-5-6. **Make sure piston in cylinder is at TDC on the valve spring that is being covered.**
3. Remove spark plug adapter tool (3).

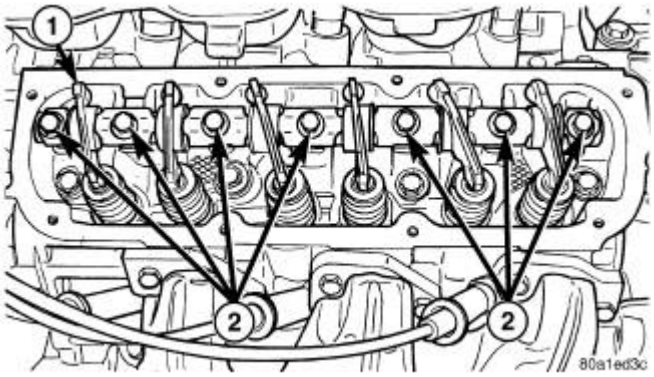

Fig. 86: Rocker Arms, Shaft Assembly & Bolts
Courtesy of CHRYSLER GROUP, LLC

1 - ROCKER ARMS AND SHAFT ASSEMBLY
2 - ROCKER SHAFT BOLTS

4. Install rocker arms and shaft assembly (1).
5. Install cylinder head covers.
6. Install spark plugs and connect wires.
7. Connect negative cable to battery.

VALVES, INTAKE AND EXHAUST

DESCRIPTION

DESCRIPTION

The valves have chrome plated valve stems with four-bead lock grooves. The valve stem seals are made of Viton rubber.

OPERATION

OPERATION

The two valves per cylinder are opened using roller hydraulic lifters, push rods, and rocker arms.

STANDARD PROCEDURE

STANDARD PROCEDURE - REFACING VALVES AND VALVE SEATS

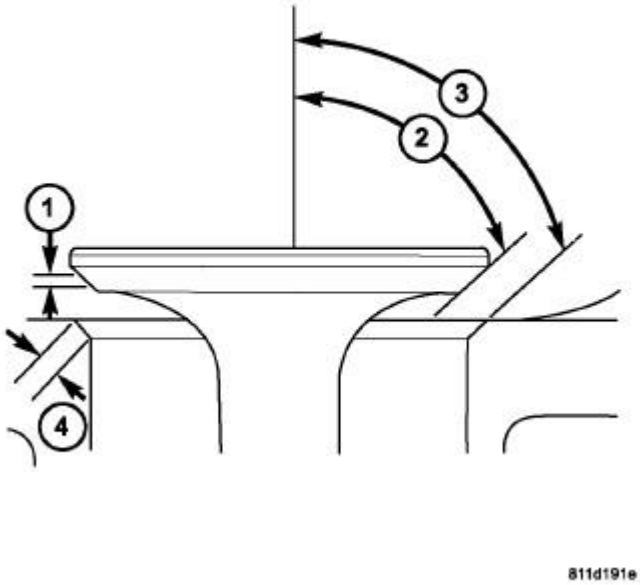

Fig. 87: Valve Face & Seat
Courtesy of CHRYSLER GROUP, LLC

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

The intake and exhaust valves and seats are machined to specific angles. Refer to **Fig. 87**.

VALVES

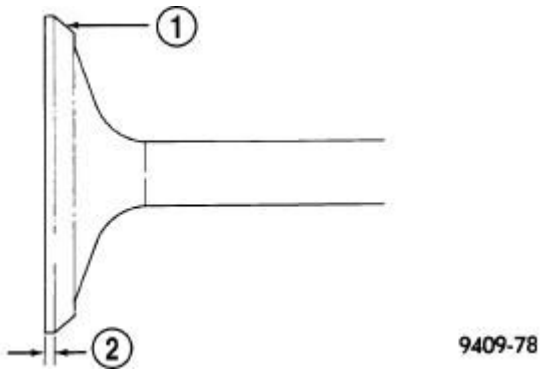

Fig. 88: Intake & Exhaust Valve Refacing
Courtesy of CHRYSLER GROUP, LLC

1 - VALVE FACE

2 - VALVE MARGIN

1. Inspect the remaining margin after the valves are refaced. Refer to **Fig. 88**. Refer to **Engine - Specifications**.

VALVE SEATS

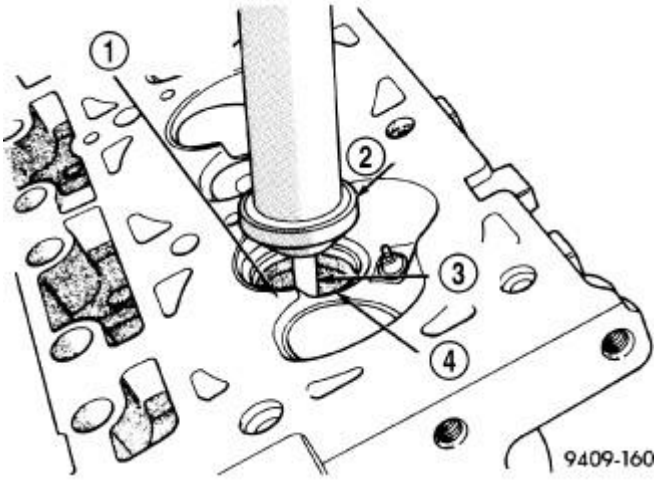

Fig. 89: Refacing Valve Seats
Courtesy of CHRYSLER GROUP, LLC

1 - REFACING STONE MUST NOT CUT INTO CYLINDER HEAD
2 - STONE
3 - PILOT
4 - SEAT

CAUTION: Remove metal from valve seat only. Do not remove material from cylinder head. Refer to Fig. 89.

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

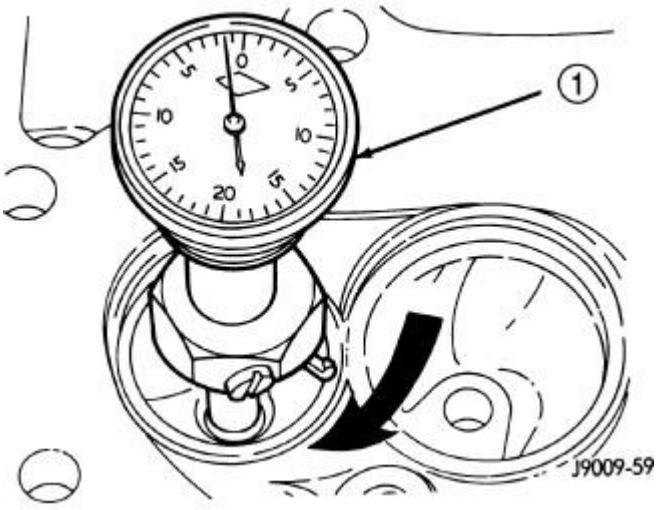

Fig. 90: Measurement Of Valve Seat Runout
Courtesy of CHRYSLER GROUP, LLC

1 - DIAL INDICATOR

2. Measure the concentricity of valve seat using dial indicator. Refer to **Fig. 90**. Total runout should not exceed 0.051 mm (0.002 in.) total indicator reading.
3. Inspect the valve seat using Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to top edge of valve face, lower valve seat with a 15 degree stone. If the blue is transferred to the bottom edge of valve face raise valve seat with a 65 degrees stone.

NOTE: Valve seats which are worn or burned can be reworked, provided that correct angle and seat width are maintained. Otherwise cylinder head must be replaced.

4. When seat is properly positioned the width of intake and exhaust seats should be 1.50-2.00 mm (0.059-0.078 in.). Refer to **Fig. 87**.

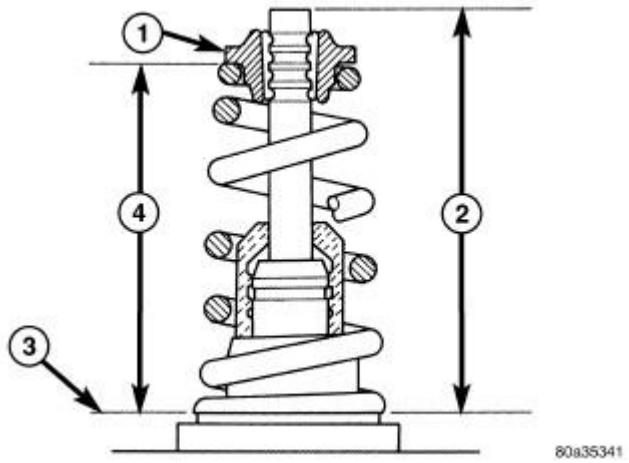

Fig. 91: Checking Valve & Spring Installed Height
Courtesy of CHRYSLER GROUP, LLC

1 - SPRING RETAINER
2 - VALVE INSTALLED HEIGHT* - 48.1-49.7 mm (1.89-1.95 in.)
3 - CYLINDER HEAD SURFACE
4 - SPRING INSTALLED HEIGHT* - 41.1-42.7 mm (1.61-1.68 in.)
*(MEASURED FROM TOP OF SPRING SEAT)

5. After grinding the valve seats or faces, install the valve in cylinder head and check valve installed height by measuring from valve tip to spring seat. Refer to **Fig. 91**. Remove valve from cylinder head and grind valve tip until within specifications. Check valve tip for scoring. The tip chamfer should be reground (if necessary) to prevent seal damage when the valve is installed.
6. Check the valve spring installed height after refacing the valve and seat. Refer to **Fig. 91**.

If valves and/or seats are reground, measure the installed height of springs, make sure measurements are taken from top of spring seat to the bottom surface of spring retainer. Refer to Fig. 91. If height is greater than specifications, install a 0.794 mm (0.0312 in.) spacer in head counterbore to bring spring height back within specifications.

REMOVAL

REMOVAL

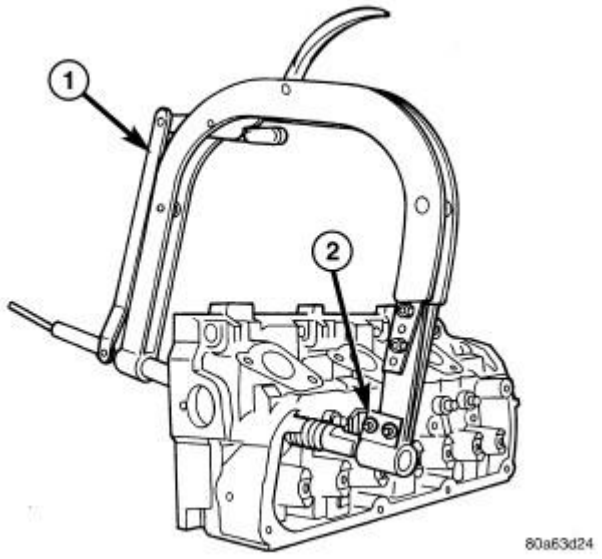

Fig. 92: Removing/Installing Valve Spring
Courtesy of CHRYSLER GROUP, LLC

1 - SPECIAL TOOL C-3422-D SPRING COMPRESSOR
2 - SPECIAL TOOL 8464 ADAPTER

1. With cylinder head removed, compress valve springs using Valve Spring Compressor Tool (special tool #C-3422-D, Compressor, Valve Spring) with adapter (special tool #8464, Adapter, Valve Spring). Refer to **Fig. 92**.

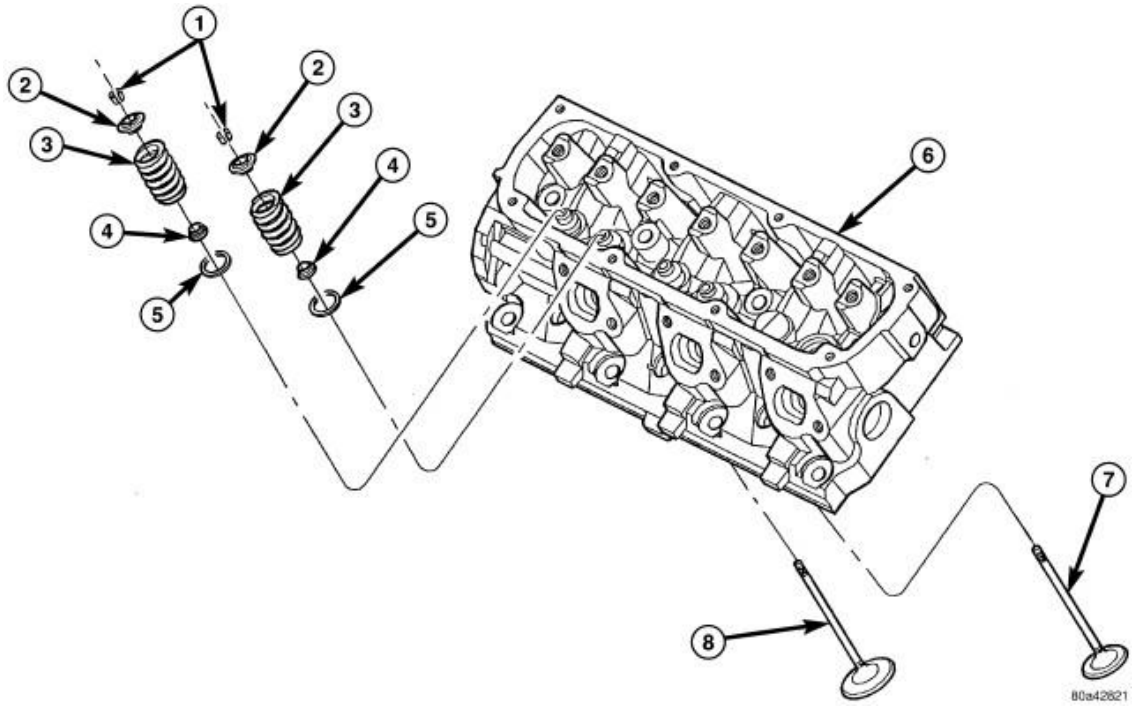

Fig. 93: Cylinder Head & Valve Components
Courtesy of CHRYSLER GROUP, LLC

1 - VALVE LOCKS	5 - SPRING SEATS
2 - RETAINERS	6 - CYLINDER HEAD
3 - VALVE SPRINGS	7 - VALVE - EXHAUST
4 - VALVE STEM SEALS	8 - VALVE - INTAKE

2. Remove valve retaining locks. Refer to **Fig. 93**.
3. Slowly release valve spring compressor. Remove valve spring retainer, valve spring, and valve stem seal.
4. Before removing valves, **remove any burrs from valve stem lock grooves to prevent damage to the valve guides.** Identify valves to insure installation in original location.

CLEANING

CLEANING

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

INSPECTION

INSPECTION

VALVES

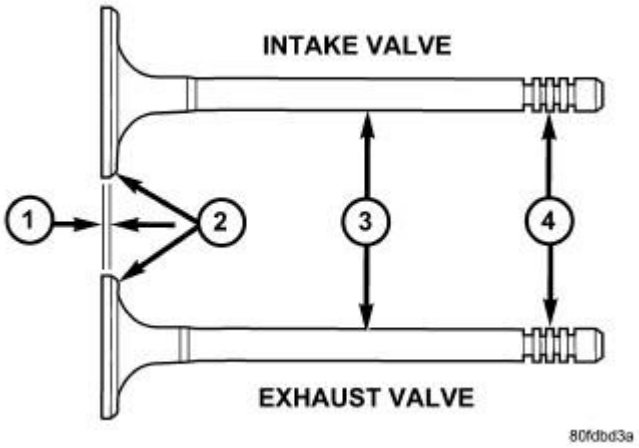

Fig. 94: Intake & Exhaust Valves
Courtesy of CHRYSLER GROUP, LLC

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

1. Clean and inspect valves thoroughly. Replace burned, warped and cracked valves.
2. Measure valve stems for wear. Refer to **Fig. 94**. For valve specifications, refer to **Engine - Specifications**.

NOTE: Valve stems are chrome plated and should not be polished. Refer to Fig. 94.

VALVE GUIDES

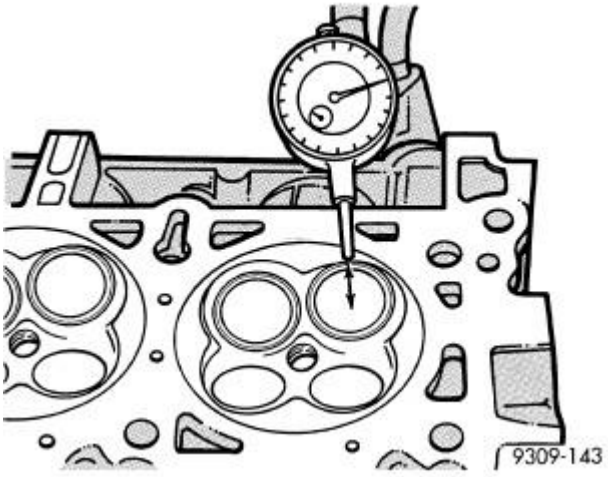

Fig. 95: Measuring Valve Guide Wear
Courtesy of CHRYSLER GROUP, LLC

1. Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.
2. Measure valve stem-to-guide clearance as follows:
3. Install valve into cylinder head so it is 15 mm (0.590 inch.) off the valve seat. A small piece of hose may be used to hold valve in place.
4. Attach dial indicator Tool (special tool #C-3339A, Set, Dial Indicator) to cylinder head and set it at right angle of valve stem being measured. Refer to **Fig. 95**.
5. Move valve to and from the indicator. For clearance specifications, refer to **Engine - Specifications**.

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

INSTALLATION

INSTALLATION

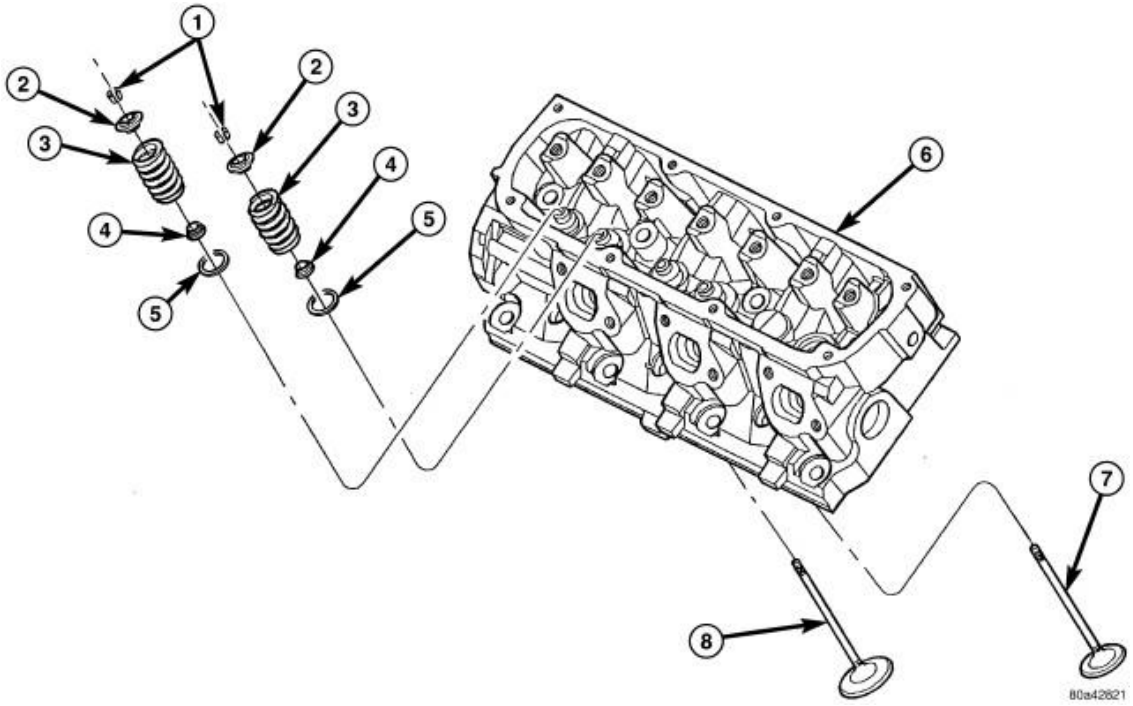

Fig. 96: Cylinder Head & Valve Components
Courtesy of CHRYSLER GROUP, LLC

1 - VALVE LOCKS	5 - SPRING SEATS
2 - RETAINERS	6 - CYLINDER HEAD
3 - VALVE SPRINGS	7 - VALVE - EXHAUST
4 - VALVE STEM SEALS	8 - VALVE - INTAKE

1. Coat valve stems with clean engine oil and insert them in cylinder head. Refer to **Fig. 96**.
2. Install valve spring seat on head. Refer to **Fig. 96**.

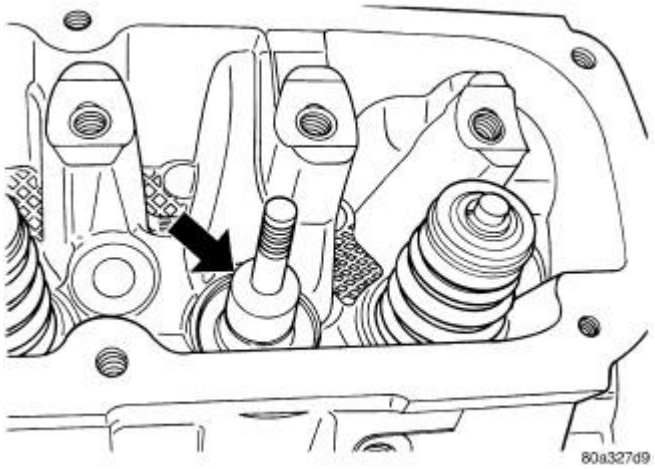

Fig. 97: Valve Stem Seal

Courtesy of CHRYSLER GROUP, LLC

3. Install new seals on all valve stems and over valve guides Install valve springs and valve retainers. Refer to**Fig. 97**.
4. Install the valve springs. Refer to **SPRING(S), VALVE, INSTALLATION**.

ENGINE BLOCK

DESCRIPTION

DESCRIPTION

The cylinder block is made of cast iron and is a deep skirt design.

STANDARD PROCEDURE

STANDARD PROCEDURE - CYLINDER BORE HONING

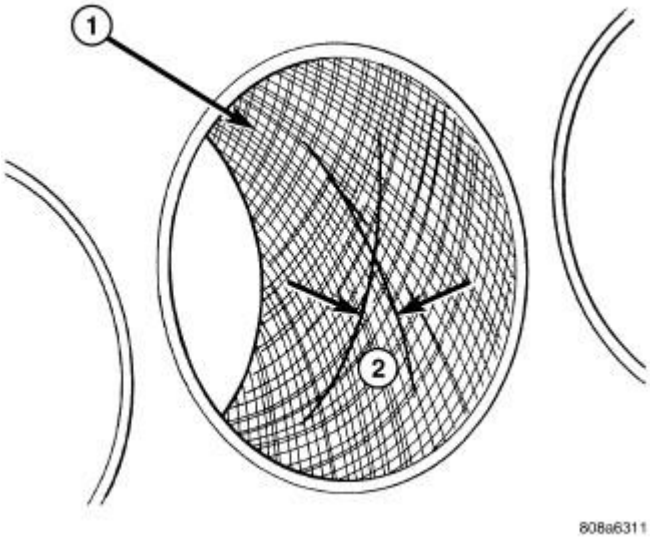

Fig. 98: Cylinder Bore Cross-Hatch Pattern
Courtesy of CHRYSLER GROUP, LLC

1 - CROSS-HATCH PATTERN
2 - 40°-60°

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

tool #C-3501, Hone W/Oil, AMMCO Cylinder) 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 (2), the cross hatch angle is most satisfactory for proper seating of rings.
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.

INSPECTION

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 **Engine - Standard Procedure**.
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. Refer to **Engine - Specifications**. If the cylinder walls are badly scuffed or scored, the cylinder block should be replaced, and new pistons and rings fitted.

Measure the cylinder bore at three levels in directions A and B. 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 **Engine - Specifications**.

BEARING(S), CONNECTING ROD

STANDARD PROCEDURE

STANDARD PROCEDURE - MEASURING CONNECTING ROD BEARING CLEARANCE

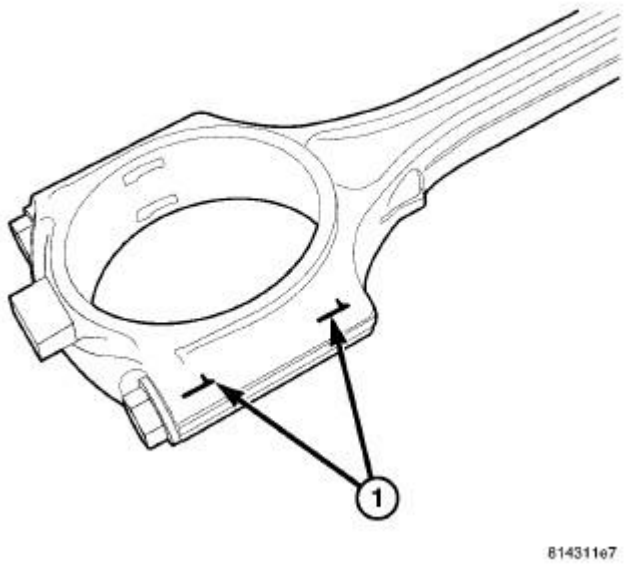

Fig. 99: Connecting Rod To Cylinder Identification
Courtesy of CHRYSLER GROUP, LLC

1 - PAINT MARK OR SCRIBE

The bearing caps are not interchangeable and should be marked (1) at removal to ensure correct assembly. The bearing shells must be installed with the tangs inserted into the machined grooves in the rods and caps. Install cap with the tangs on the same side as the rod. Fit all rods on one bank until complete. Connecting rod bearings are available in the standard size and the following undersizes: 0.025 mm (0.001 in.) and 0.250 mm (0.010 in.).

CAUTION: Install the bearings in pairs. Do not use a new bearing half with an old bearing half. Do not file the rods or bearing caps.

Measure connecting rod journal for taper and out-of-round. Refer to **Engine - Specifications**.

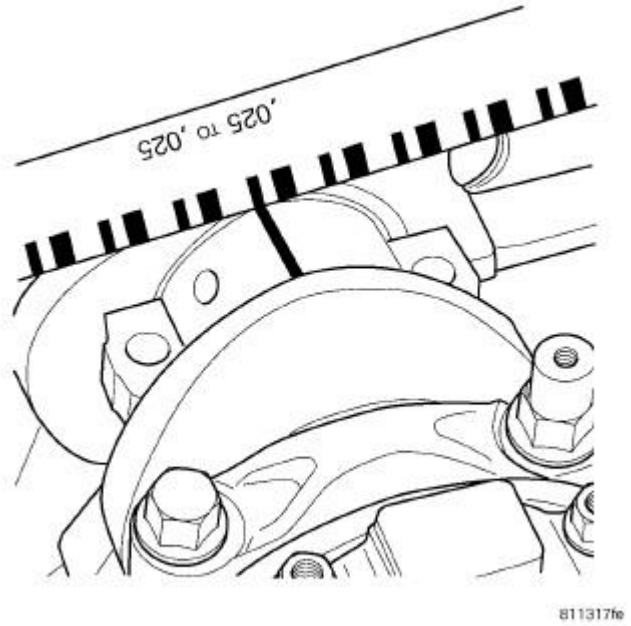

Fig. 100: Measuring Connecting Rod Bearing Clearance
Courtesy of CHRYSLER GROUP, LLC

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

1. Rotate the crankshaft until the connecting rod to be checked is at the bottom of its stroke.
2. Remove oil film from surface to be checked. Plastigage is soluble in oil.
3. Place a piece of Plastigage across the entire width of the bearing shell in the bearing cap approximately 6.35 mm (1/4 in.) off center and away from the oil hole. In addition, suspect areas can be checked by placing Plastigage in that area.
4. Assemble the rod cap with Plastigage in place. Tighten the rod cap to the specified torque. **Do not rotate the crankshaft while assembling the cap or the Plastigage may be smeared, giving inaccurate results.**
5. Remove the bearing cap and compare the width of the flattened Plastigage with the scale provided on the package. Locate the band closest to the same width. This band indicates the amount of oil clearance. Differences in readings between the ends indicate the amount of taper present. Record all readings taken **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale. If the bearing clearance exceeds wear limit specification, replace the bearing.** Refer to **Engine - Specifications**.

BEARING(S), CRANKSHAFT, MAIN

STANDARD PROCEDURE

STANDARD PROCEDURE - MAIN BEARING FITTING

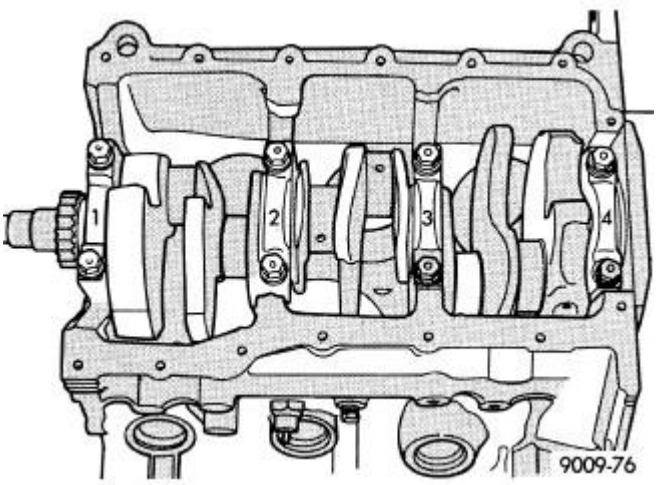

Fig. 101: Main Bearing Cap Identification
Courtesy of CHRYSLER GROUP, LLC

Bearing caps are not interchangeable and should be marked at removal to insure correct assembly. Upper and lower bearing halves are NOT interchangeable. Lower main bearing halves of 1, 3 and 4 are interchangeable. Upper main bearing halves of 1, 3 and 4 are interchangeable.

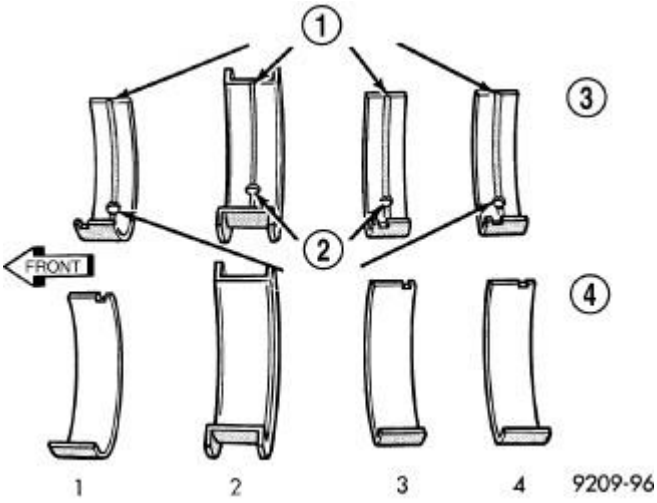

Fig. 102: Main Bearing Identification
Courtesy of CHRYSLER GROUP, LLC

Upper and lower main bearing, position 2 bearing halves are flanged to carry the crankshaft thrust loads and are NOT interchangeable with any other bearing halves in the engine. All bearing cap bolts removed during service procedures are to be cleaned and lubricated with engine oil before installation. Bearing shells are available in standard and the following undersizes: 0.025 mm (0.001 in.) and 0.254 mm (0.010 in). Never install an undersize bearing that will reduce clearance below specifications.

PLASTIGAGE METHOD-ENGINE IN-VEHICLE

NOTE: The total clearance of the main bearings can only be determined with the engine

in the vehicle by removing the weight of the crankshaft. This can be accomplished by either of two following methods:

1. Preferred method:
    a. Shim the bearings adjacent to the bearing to be checked in order to remove the clearance between upper bearing shell and the crankshaft. This can be accomplished by placing a minimum of 0.254 mm (0.010 in.) shim (e. g. cardboard, matchbook cover, etc.) between the bearing shell and the bearing cap on the adjacent bearings and tightening bolts to 14-20 N.m (10-15 ft. lbs.).
        a. When checking #1 main bearing shim #2 main bearing.
        b. When checking #2 main bearing shim #1 AND #3 main bearing.
        c. When checking #3 main bearing shim #2 AND #4 main bearing.
        d. When checking #4 main bearing shim #3 main bearing.

NOTE: Remove all shims before reassembling engine.

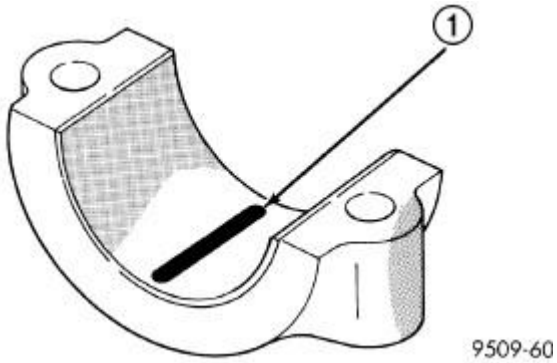

Fig. 103: Plastigage Placed In Lower Shell
Courtesy of CHRYSLER GROUP, LLC

2. Alternative Method:
    a. Support the weight of the crankshaft with a jack under the counterweight adjacent to the bearing being checked.
3. Remove oil film from surface to be checked. Plastigage is soluble in oil.
4. Place a piece of Plastigage (1) 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. (In addition, suspected areas can be checked by placing the Plastigage in the suspected area). Torque the bearing cap bolts of the bearing being checked to the proper specifications.
5. Remove the bearing cap and compare the width of the flattened Plastigage (1) with the scale provided on the package. Locate the band closest to the same width. This band shows the amount of clearance in thousandths. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.** Refer to **Engine - Specifications**.

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

PLASTIGAGE METHOD-ENGINE OUT-OF-VEHICLE

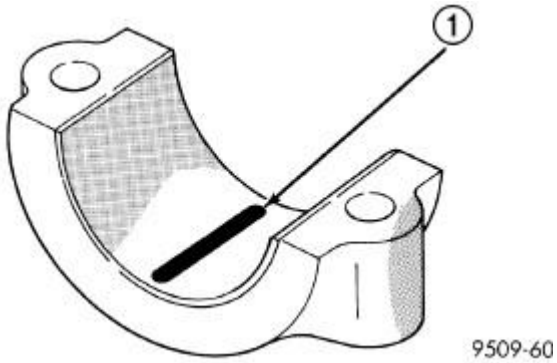

Fig. 104: Plastigage Placed In Lower Shell
Courtesy of CHRYSLER GROUP, LLC

1. With engine in the inverted position (crankshaft up) and mounted on a repair stand, remove main journal cap.
2. Remove oil from journal and bearing shell.
3. Cut Plastigage (1) to same length as width of the bearing and place it in parallel with the journal axis (1).
4. Carefully install the main bearing cap and tighten the bolts to specified torque. Refer to **Engine - Specifications**.

CAUTION: Do not rotate crankshaft or the Plastigage will be smeared.

5. Carefully remove the bearing cap and measure the width of the Plastigage (1) at the widest part using the scale on the Plastigage package. Refer to **Engine - Specifications** for proper clearances. If the clearance exceeds the specified limits, replace the main bearing(s) with the appropriate size, and if necessary, have the crankshaft machined to next undersize.

CRANKSHAFT BEARING OIL CLEARANCE

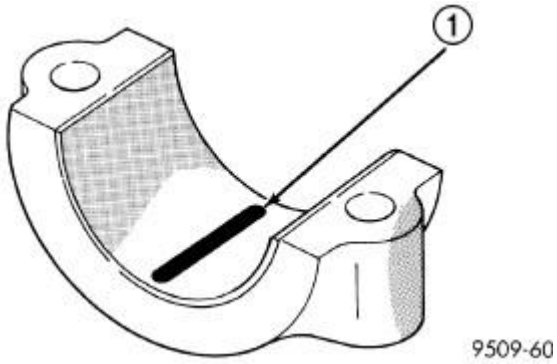

Fig. 105: Plastigage Placed In Lower Shell
Courtesy of CHRYSLER GROUP, LLC

Inspect the crankshaft bearing journals.

Engine crankshaft bearing clearances can be determined by use of Plastigage (1) or the equivalent. The following is the recommended procedures for the use of Plastigage with the engine in the vehicle or engine on a repair stand.

REMOVAL

REMOVAL

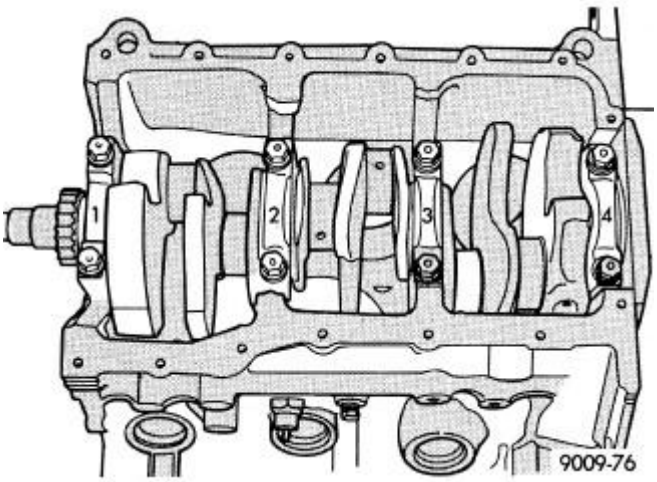

Fig. 106: Main Bearing Cap Identification
Courtesy of CHRYSLER GROUP, LLC

1. Remove the oil pan. Refer to **PAN, OIL, REMOVAL**.
2. Identify main bearing caps before removal.
3. Remove bearing caps one at a time. Remove upper half of bearing by inserting Remover (special tool #C-3059A, Remover/Installer) into the oil hole of crankshaft.
4. Slowly rotate crankshaft clockwise, forcing out upper half of bearing shell.

INSTALLATION

INSTALLATION

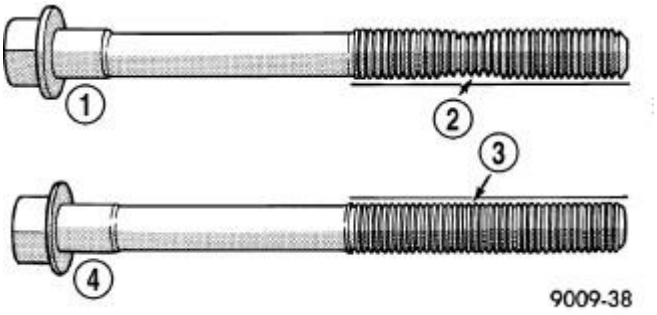

Fig. 107: Checking Cylinder Head Bolts For Stretching (Necking)
Courtesy of CHRYSLER GROUP, LLC

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

NOTE: One main bearing should be selectively fitted while all other main bearing caps are properly tightened.

1. For main bearing fitting procedure, Refer to **BEARING(S), CRANKSHAFT, MAIN, STANDARD PROCEDURE**.
2. Start bearing in place, and insert Remover (special tool #C-3059A, Remover/Installer) into oil hole of crankshaft.
3. Slowly rotate crankshaft counterclockwise sliding the bearing into position.
4. Inspect main cap bolts (4) for stretching. Replace bolts that are stretched.

NOTE: The main cap bolts (4) should be examined before reuse. Bolt stretch can be checked by holding a scale or straight edge against the threads (2). If all the threads do not contact the scale (2) the bolt must be replaced.

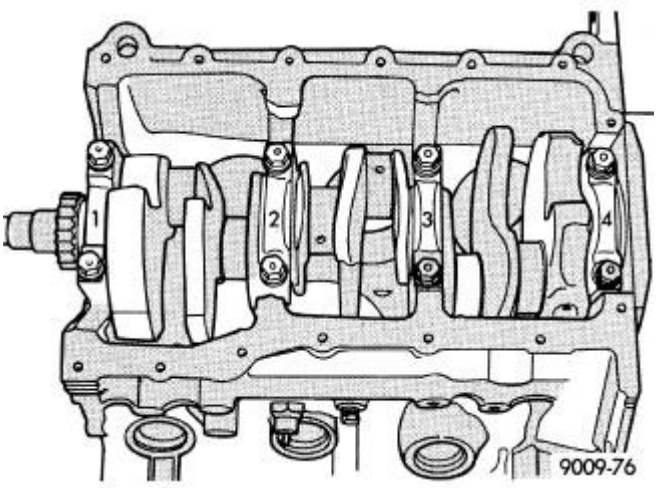

Fig. 108: Main Bearing Cap Identification
Courtesy of CHRYSLER GROUP, LLC

5. Install each main cap and tighten bolts finger tight.
6. Tighten number 1, 3 and 4 main cap bolts to 41 N.m + 1/4 Turn (30 ft. lbs.+ 1/4 Turn).
7. Rotate the crankshaft until the number 6 piston is at TDC.
8. To ensure correct thrust bearing alignment the following procedure must be done:
   a. Move crankshaft all the way to the rear of its travel.
   b. Then, move crankshaft all the way to the front of its travel.
   c. Wedge an appropriate tool between the rear of the cylinder block and rear crankshaft counterweight. This will hold the crankshaft in it's most forward position.

d. Tighten the #2 Thrust Bearing cap bolts to 41 N.m + 1/4 Turn (30 ft. lbs.+ 1/4 Turn). Remove the holding tool.

9. Install oil pan. Refer to **PAN, OIL, INSTALLATION**.
10. Fill engine crankcase with proper oil to correct level.

CAMSHAFT, ENGINE

DESCRIPTION

DESCRIPTION

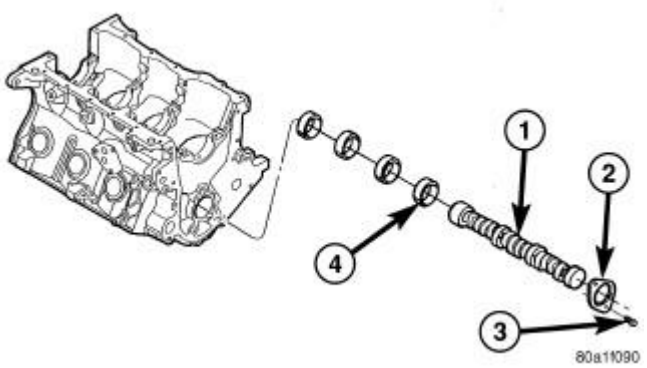

Fig. 109: Camshaft, Thrust Plate, Bolt & Bearings
Courtesy of CHRYSLER GROUP, LLC

1 - CAMSHAFT
2 - THRUST PLATE
3 - BOLT
4 - CAMSHAFT BEARINGS (SERVICED WITH BLOCK)

The nodular iron camshaft (1) is mounted in the engine block and supported with four steel backed aluminum bearings (4). A thrust plate (2), located in front of the first bearing, is bolted to the block and controls the camshaft end play.

OPERATION

OPERATION

The camshaft is driven by the crankshaft through a timing chain and sprockets. The camshaft has precisely machined (egg-shaped) lobes to provide accurate valve timing and duration.

REMOVAL

REMOVAL

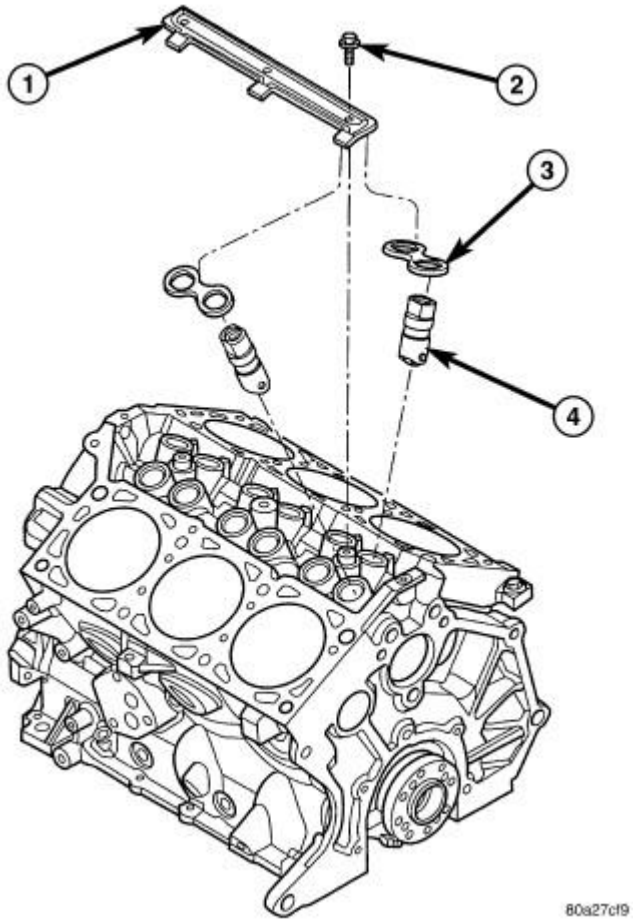

Fig. 110: Yoke Retainer, Bolt, Aligning Yoke & Hydraulic Lifter
Courtesy of CHRYSLER GROUP, LLC

1 - YOKE RETAINER
2 - BOLT - YOKE RETAINER
3 - ALIGNING YOKE
4 - HYDRAULIC LIFTER

1. Remove the radiator and cooling fans from the vehicle.
2. Remove the cylinder heads. Refer to **CYLINDER HEAD, REMOVAL**.
3. Remove the timing chain and camshaft sprocket. Refer to **CHAIN AND SPROCKETS, TIMING, REMOVAL**.
4. Remove the yoke retainer (1).
5. Remove the hydraulic lifters (4). Refer to **LIFTER(S), HYDRAULIC, REMOVAL**. Identify each tappet for reinstallation in original location.

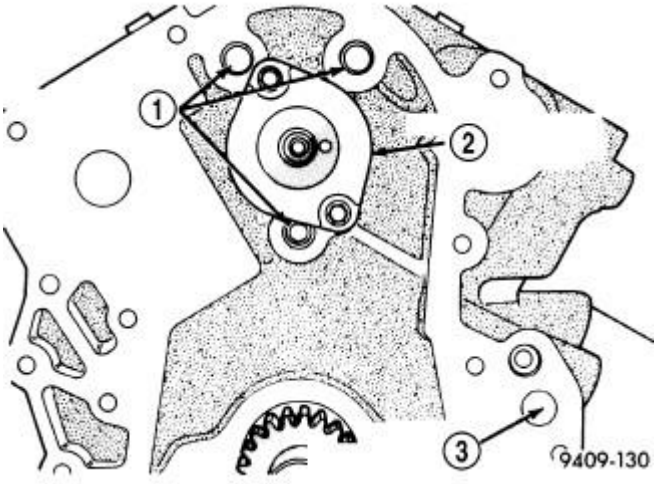

Fig. 111: Oil Gallery Cup Plugs, Camshaft Thrust Plate & Oil Feed Gallery
Courtesy of CHRYSLER GROUP, LLC

1 - OIL GALLERY CUP PLUGS
2 - CAMSHAFT THRUST PLATE
3 - OIL FEED GALLERY FROM PUMP

6. Remove camshaft thrust plate (2).

NOTE: Slowly remove the camshaft from the engine taking precautions not to damage the camshaft bearings.

7. Install a long bolt into front of camshaft to facilitate removal of the camshaft.
8. Carefully remove the camshaft,

NOTE: The camshaft bearings are serviced with the engine block.

INSPECTION

INSPECTION

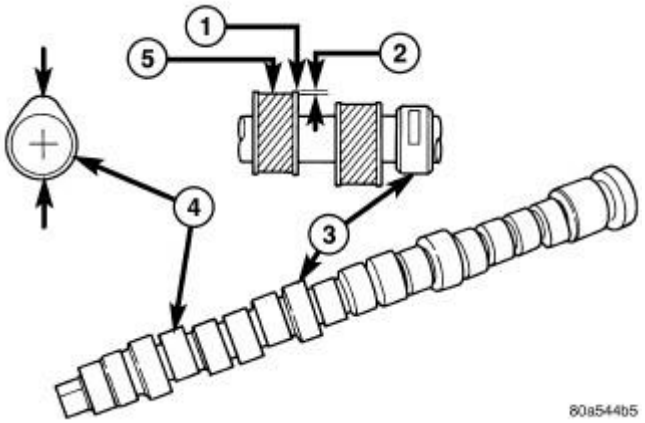

Fig. 112: Inspecting Cam Lobes & Bearing Surfaces
Courtesy of CHRYSLER GROUP, LLC

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

1. Check the cam lobes (4) and bearing surfaces (3) for abnormal wear and damage. Replace camshaft as required.

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

2. Measure the lobe (2) actual wear (unworn area - wear zone = actual wear) 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.).

INSTALLATION

INSTALLATION

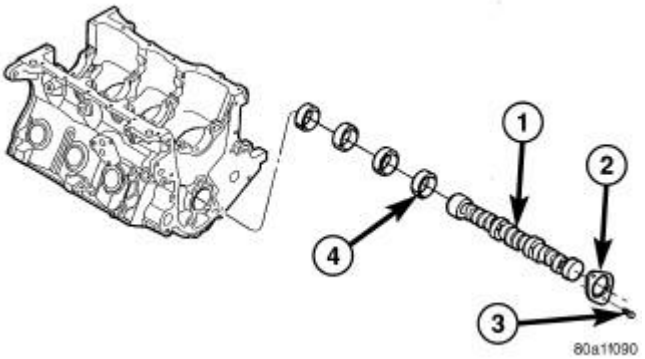

Fig. 113: Camshaft, Thrust Plate, Bolt & Bearings
Courtesy of CHRYSLER GROUP, LLC

1 - CAMSHAFT
2 - THRUST PLATE
3 - BOLT
4 - CAMSHAFT BEARINGS (SERVICED WITH BLOCK)

1. Lubricate camshaft lobes (1) and camshaft bearing journals (4) with engine oil.
2. Install a long bolt into the camshaft to assist in the installation of the camshaft.
3. Carefully install the camshaft (1) in engine block.
4. Install camshaft thrust plate (2) and bolts (3). Tighten to 12 N.m (105 in. lbs.) torque.
5. Measure camshaft end play. If not within specifications, replace thrust plate. Refer to **Engine - Specifications**.
6. Install the timing chain and sprockets. Refer to **CHAIN AND SPROCKETS, TIMING, INSTALLATION**.

NOTE: When camshaft is replaced, all of the hydraulic lifters must be replaced.

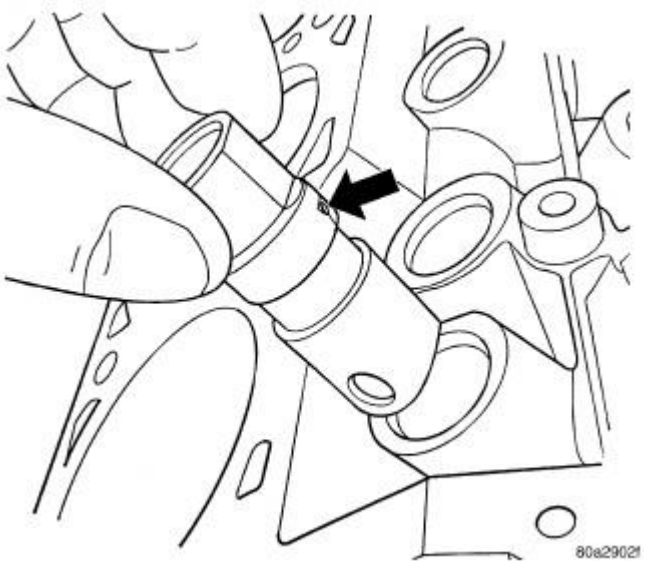

Fig. 114: Lifter Lubrication Hole
Courtesy of CHRYSLER GROUP, LLC

7. Install the hydraulic lifters with lubrication hole in the upward position. Refer to **LIFTER(S), HYDRAULIC, INSTALLATION**.
8. Install the timing chain cover. Refer to **COVER(S), ENGINE TIMING, INSTALLATION**.
9. Install the cylinder heads. Refer to **CYLINDER HEAD, INSTALLATION**.
10. Install the cylinder head covers. Refer to **COVER(S), CYLINDER HEAD, LEFT, INSTALLATION**

and **COVER(S), CYLINDER HEAD, RIGHT, INSTALLATION**.

11. Install the lower and upper intake manifolds. Refer to **MANIFOLD, INTAKE, INSTALLATION** and **MANIFOLD, INTAKE, LOWER, INSTALLATION**.
12. Install the radiator and cooling fan.

COVER, STRUCTURAL DUST

REMOVAL

REMOVAL

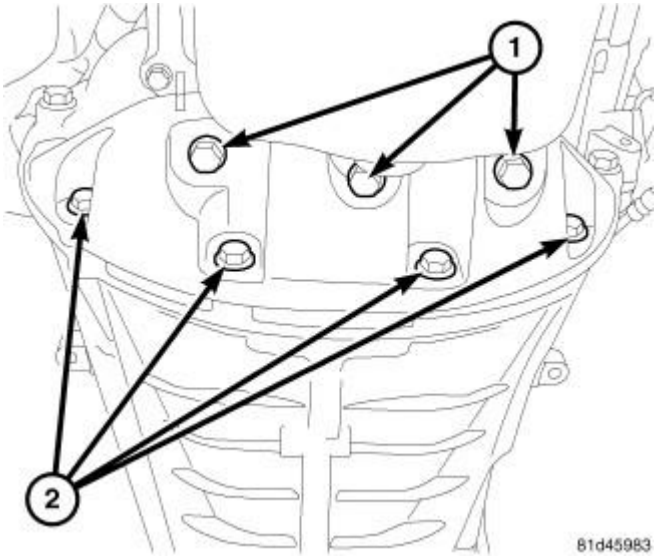

Fig. 115: 3.8L Structural Cover Mounting Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Raise vehicle on hoist.
2. Remove the bolts retaining structural cover to transmission (1, 2).
3. Remove the bolts retaining structural cover to engine.
4. Remove the structural cover.

INSTALLATION

INSTALLATION

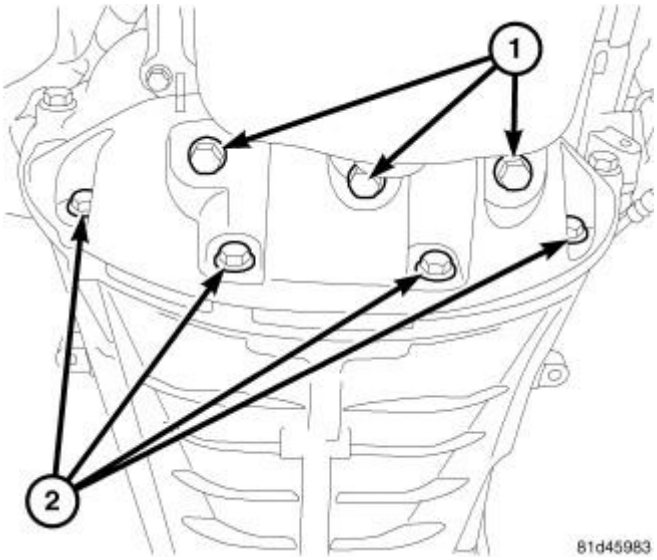

Fig. 116: 3.8L Structural Cover Mounting Bolts
Courtesy of CHRYSLER GROUP, LLC

CAUTION: The structural cover must be installed as described in the following steps. Failure to do so will cause severe damage to the cover or the oil pan.

1. Position the structural cover in the vehicle.
2. Install the bolts retaining the cover-to-oil pan (1). DO NOT tighten the bolts at this time.
3. Install the cover-to-transmission bolts (2). Do NOT tighten at this time.

CAUTION: The structural dust cover must be held tightly against both the engine and the transmission bell housing during the tightening sequence. Failure to do so may cause severe damage to the cover.

4. Tighten the two cover-to-transmission bolts to less than 25 lb. in. The cover must be flush to the transmission bellhousing machined surface.
5. Starting with the cover-to-oil pan bolts (1), tighten bolts to 54 N.m (40 ft. lbs.).
6. Tighten the cover-to-transmission bolts to 54 N.m (40 ft. lbs.).

CRANKSHAFT

DESCRIPTION

DESCRIPTION

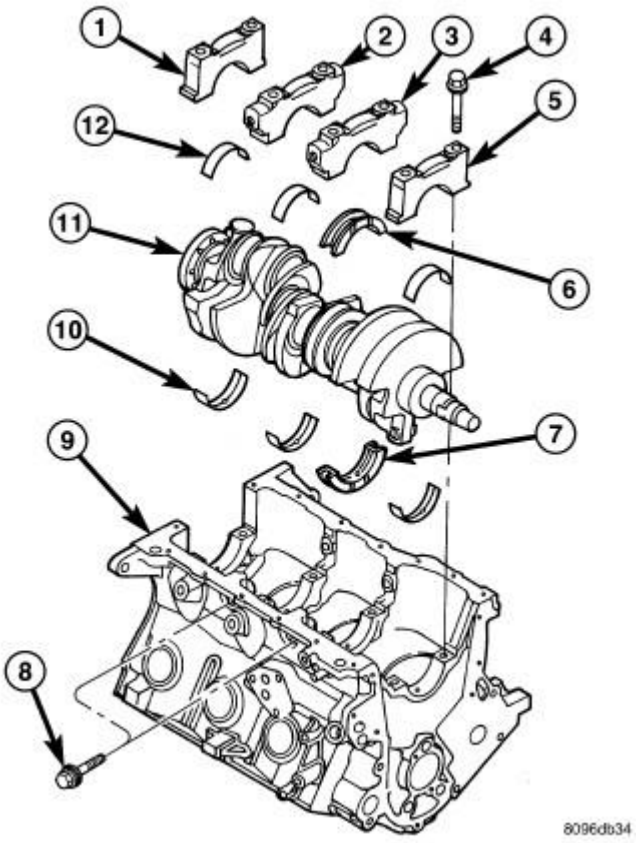

Fig. 117: Crankshaft & Main Bearings
Courtesy of CHRYSLER GROUP, LLC

1 - MAIN BEARING CAP No. 4
2 - MAIN BEARING CAP No. 3
3 - MAIN BEARING CAP No. 2
4 - MAIN BEARING CAP BOLT
5 - MAIN BEARING CAP No. 1
6 - THRUST MAIN BEARING - LOWER
7 - THRUST MAIN BEARING - UPPER
8 - MAIN BEARING CAP CROSS BOLT
9 - ENGINE BLOCK
10 - MAIN BEARING - UPPER
11 - CRANKSHAFT
12 - MAIN BEARING - LOWER

The nodular iron crankshaft is supported by four main bearings, with number two position (3) providing thrust bearing location. Each main bearing cap has two vertical retaining bolts. The two center main caps have horizontal bolts (8) to add increased rigidity to the lower engine block. Crankshaft end sealing is provided by front and rear rubber seals.

STANDARD PROCEDURE

STANDARD PROCEDURE - MEASURING CRANKSHAFT END PLAY

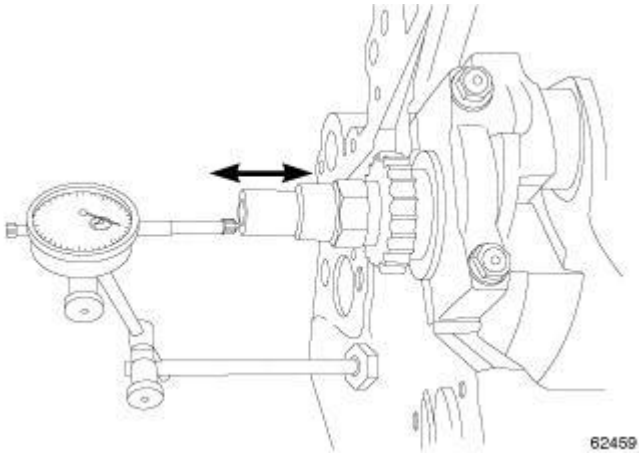

Fig. 118: Measuring Crankshaft End Play
Courtesy of CHRYSLER GROUP, LLC

1. Mount a dial indicator to front of engine with the locating probe on nose of crankshaft.
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. For end play specification, refer to **Engine - Specifications**.

REMOVAL

REMOVAL

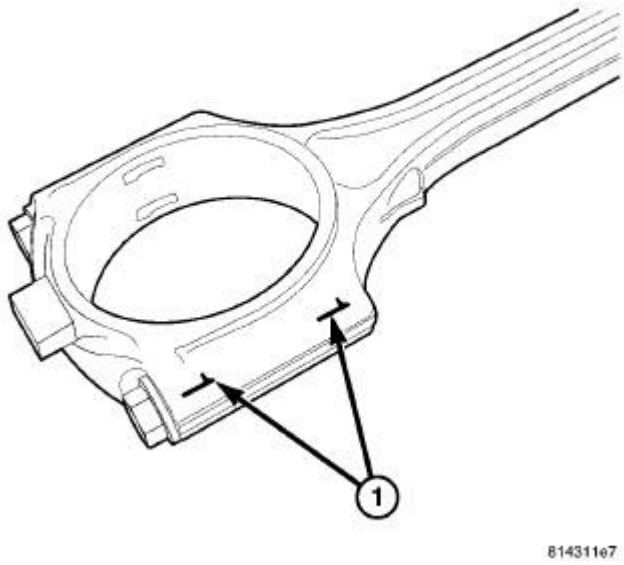

Fig. 119: Connecting Rod To Cylinder Identification
Courtesy of CHRYSLER GROUP, LLC

1 - PAINT MARK OR SCRIBE

1. Remove the engine assembly. Refer to **REMOVAL**.
2. Mount engine on an engine stand.
3. Remove the oil filter.
4. Remove the oil pan and oil pick-up tube. Refer to **PAN, OIL, REMOVAL**.
5. Remove the timing chain cover. Refer to **COVER(S), ENGINE TIMING, REMOVAL**.
6. Remove timing chain and sprockets. Refer to **CHAIN AND SPROCKETS, TIMING, REMOVAL**.
7. Remove crankshaft rear oil seal and retainer. Refer to **RETAINER, CRANKSHAFT REAR OIL SEAL, REMOVAL**.
8. Rotate the crankshaft until connecting rod cap is accessible.
9. Paint mark or scribe the connecting rod cap position (1).
10. Remove connecting rod bearing cap. Use care to prevent damage to the crankshaft bearing surfaces.
11. Repeat removal procedure for each connecting rod cap.

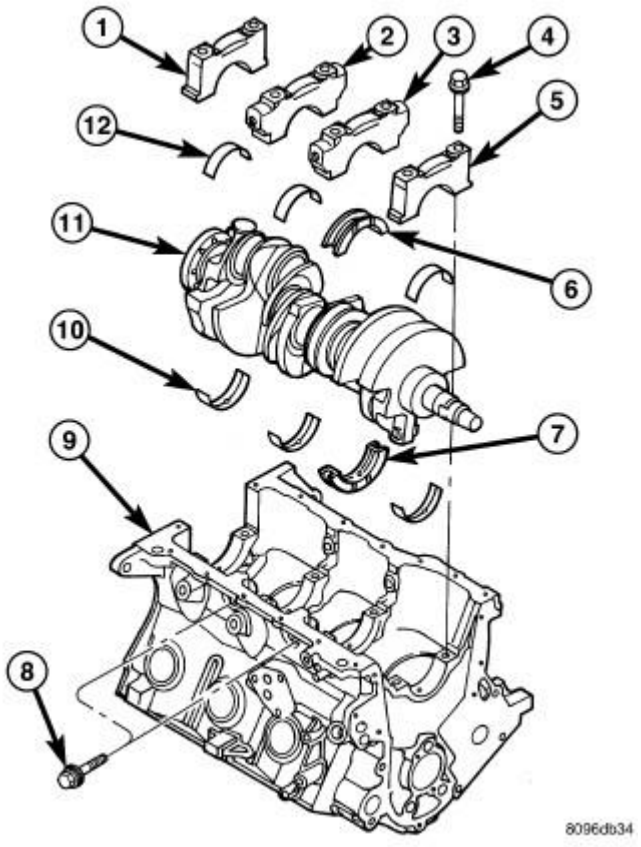

Fig. 120: Crankshaft & Main Bearings
Courtesy of CHRYSLER GROUP, LLC

1 - MAIN BEARING CAP No. 4
2 - MAIN BEARING CAP No. 3
3 - MAIN BEARING CAP No. 2
4 - MAIN BEARING CAP BOLT
5 - MAIN BEARING CAP No. 1
6 - THRUST MAIN BEARING - LOWER
7 - THRUST MAIN BEARING - UPPER
8 - MAIN BEARING CAP CROSS BOLT
9 - ENGINE BLOCK
10 - MAIN BEARING - UPPER
11 - CRANKSHAFT
12 - MAIN BEARING - LOWER

12. Remove and discard the main bearing cross bolts and washers (8).

NOTE: Install new cross bolt and washer assembly (8) upon reassembly.

13. Remove the main bearing cap bolts (4).
14. Remove the main bearing caps (1, 2, 3, 5).
15. Remove the crankshaft (11) from engine block.

INSTALLATION

INSTALLATION

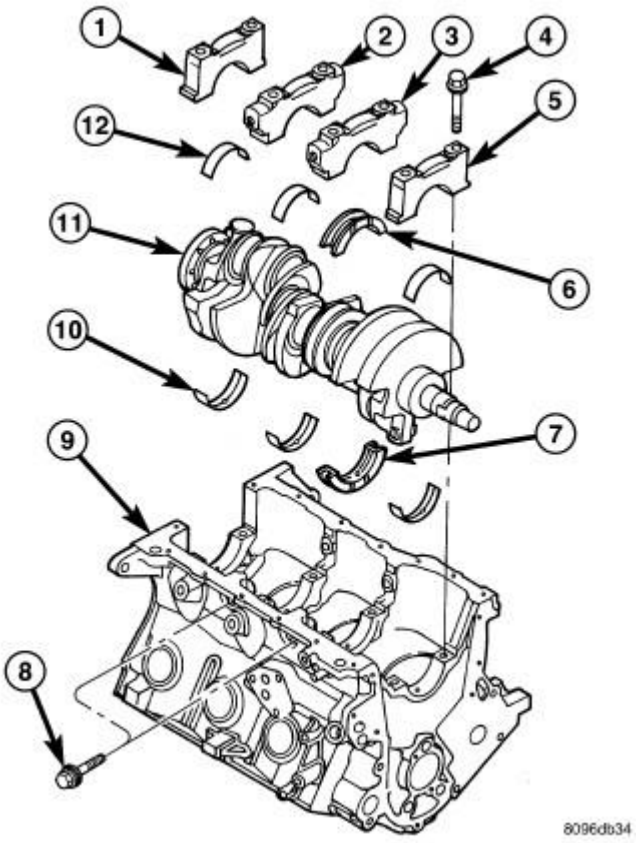

Fig. 121: Crankshaft & Main Bearings
Courtesy of CHRYSLER GROUP, LLC

1 - MAIN BEARING CAP No. 4
2 - MAIN BEARING CAP No. 3
3 - MAIN BEARING CAP No. 2
4 - MAIN BEARING CAP BOLT
5 - MAIN BEARING CAP No. 1
6 - THRUST MAIN BEARING - LOWER
7 - THRUST MAIN BEARING - UPPER
8 - MAIN BEARING CAP CROSS BOLT
9 - ENGINE BLOCK

10 - MAIN BEARING - UPPER
11 - CRANKSHAFT
12 - MAIN BEARING - LOWER

1. Lubricate with engine oil and install the crankshaft main bearing halves in the engine block.
2. Position the crankshaft (11) in engine block.
3. Perform main bearing fitting procedure. Refer to **BEARING(S), CRANKSHAFT, MAIN, STANDARD PROCEDURE**.

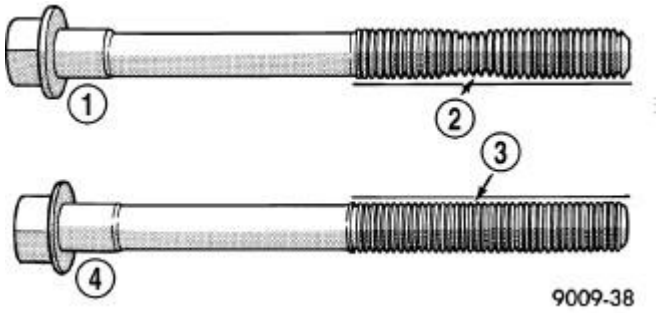

Fig. 122: Checking Cylinder Head Bolts For Stretching (Necking)
Courtesy of CHRYSLER GROUP, LLC

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

4. Inspect main cap bolts for stretching (2). Replace bolts that are stretched.

NOTE: The main cap bolts should be examined before reuse. Bolt stretch can be checked by holding a scale or straight edge (2) against the threads. If all the threads (3) do not contact the scale (2) the bolt must be replaced.

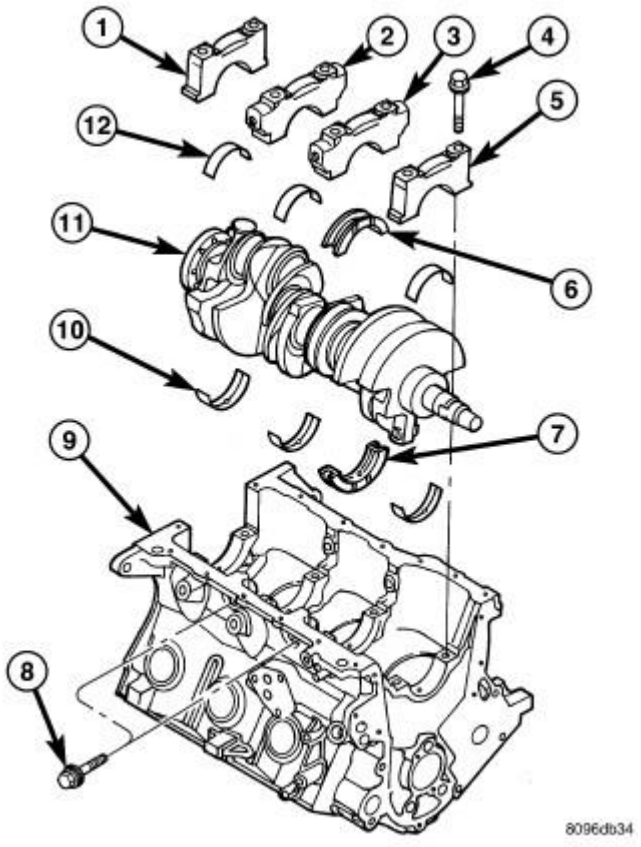

Fig. 123: Crankshaft & Main Bearings
Courtesy of CHRYSLER GROUP, LLC

1 - MAIN BEARING CAP No. 4
2 - MAIN BEARING CAP No. 3
3 - MAIN BEARING CAP No. 2
4 - MAIN BEARING CAP BOLT
5 - MAIN BEARING CAP No. 1
6 - THRUST MAIN BEARING - LOWER
7 - THRUST MAIN BEARING - UPPER
8 - MAIN BEARING CAP CROSS BOLT
9 - ENGINE BLOCK
10 - MAIN BEARING - UPPER
11 - CRANKSHAFT
12 - MAIN BEARING - LOWER

5. Install the main bearing caps (1, 2, 3, 5) and bolts. Tighten bolts to 41 N.m (30 ft. lbs.) plus 1/4 turn.

NOTE: Install new cross bolt and washer assembly upon reassembly.

6. Install and tighten the NEW cross bolts and washer assemblies (8) to 61 N.m (45 ft. lbs.).
7. Position and install the connecting rod and bearing caps on the crankshaft. Refer to **BEARING(S), CONNECTING ROD, STANDARD PROCEDURE**.
8. Install the crankshaft rear oil seal. Refer to **RETAINER, CRANKSHAFT REAR OIL SEAL, INSTALLATION**.
9. Install the crankshaft sprocket. Refer to **CHAIN AND SPROCKETS, TIMING, INSTALLATION**.
10. Install the timing chain and camshaft sprocket. Refer to **CHAIN AND SPROCKETS, TIMING, INSTALLATION**.
11. Install the timing chain cover. Refer to **COVER(S), ENGINE TIMING, INSTALLATION**.
12. Install the oil pick-up tube and oil pan. Refer to **PAN, OIL, INSTALLATION**.
13. Install the engine assembly. Refer to **INSTALLATION**.

DAMPER, VIBRATION

REMOVAL

REMOVAL

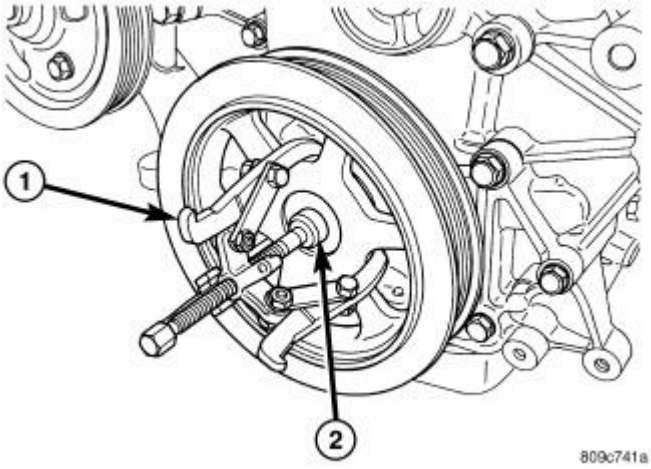

Fig. 124: Vibration Damper - Removal
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect and isolate the negative battery cable.
2. Raise and secure vehicle on hoist. Refer to **HOISTING, STANDARD PROCEDURE** .
3. Remove the accessory drive belt. Refer to **BELT, SERPENTINE, REMOVAL** .
4. Remove vibration damper bolt.
5. Place Crankshaft Insert (special tool #8450, Insert, Crankshaft) (2) into crankshaft nose.
6. Position Puller (special tool #1023, Puller) (1) on damper. Turn puller forcing screw until damper releases from crankshaft.
7. Remove the crankshaft vibration damper.

INSTALLATION

INSTALLATION

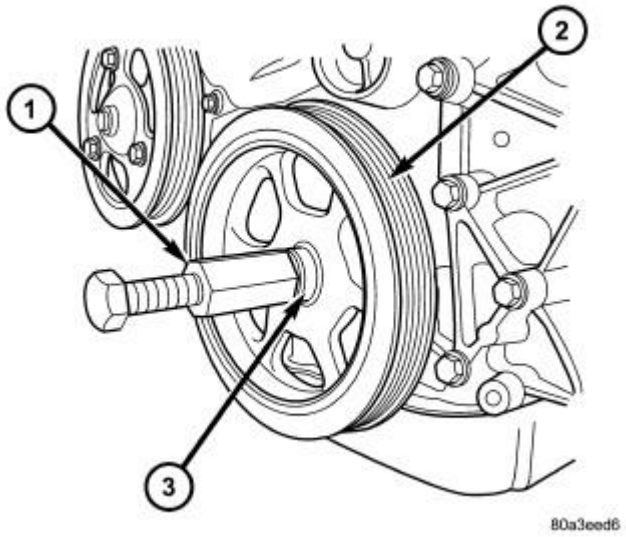

Fig. 125: Vibration Damper - Installation
Courtesy of CHRYSLER GROUP, LLC

1 - FORCING SCREW / NUT FROM SPECIAL TOOL 8452
2 - VIBRATION DAMPER
3 - THRUST BEARING / WASHER

1. Install crankshaft vibration damper using the forcing screw, nut, and thrust bearing/washer (3) from Special Tool (special tool #8452, Installer, Crankshaft Sprocket) (1).

NOTE: To minimize friction and prolong tool life, lubricate the threads on the forcing screw of Special Tool (special tool #8452, Installer, Crankshaft Sprocket).

2. Position vibration damper on crankshaft.
3. Screw Special Tool (special tool #8452, Installer, Crankshaft Sprocket) (1) into crankshaft until the bolt seats. Turn the nut to install damper until it seats fully.
4. Remove Special Tool (special tool #8452, Installer, Crankshaft Sprocket).
5. Install vibration damper bolt. Torque bolt to 54 N.m (40 ft. lbs.).
6. Install the accessory drive belt. Refer to **BELT, SERPENTINE, INSTALLATION** .
7. Connect negative cable to battery.

FLEXPLATE

REMOVAL

REMOVAL

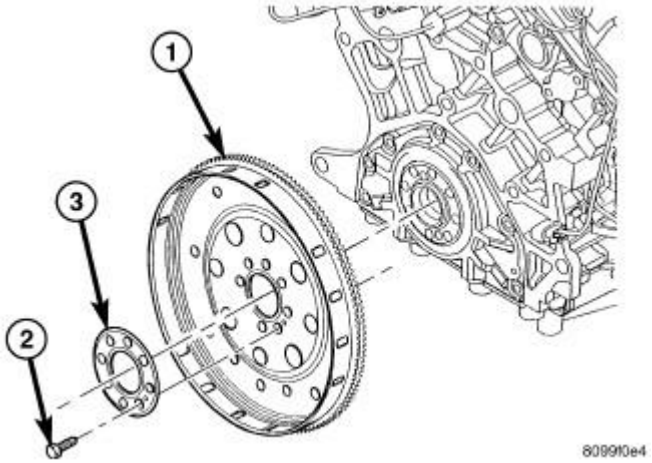

Fig. 126: Flex Plate
Courtesy of CHRYSLER GROUP, LLC

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

1. Remove the transmission.
2. Remove flex plate attaching bolts.
3. Remove the flex plate (1).

INSTALLATION

INSTALLATION

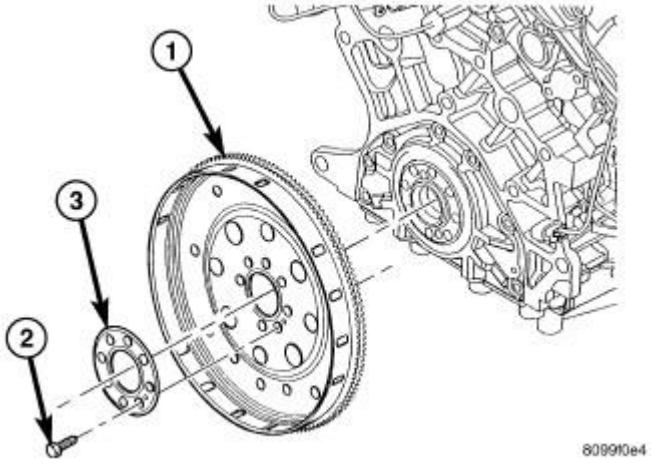

Fig. 127: Flex Plate

Courtesy of CHRYSLER GROUP, LLC

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

1. Position the flex plate (1) with backing plate (3) on the crankshaft.
2. Apply Mopar® Lock AND Seal Adhesive to the eight flex plate bolts (2).
3. Install the flex plate bolts (2). Tighten the bolts to 81 N.m (60 ft. lbs.).
4. Install the transmission. Refer to **INSTALLATION** .

NOTE: The Cam/Crank Variation Relearn procedure must be performed anytime there has been a repair/replacement made to a powertrain system, for example: flywheel, valvetrain, camshaft and/or crankshaft sensors or components. Refer to DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure .

LIFTER(S), HYDRAULIC

DESCRIPTION

DESCRIPTION

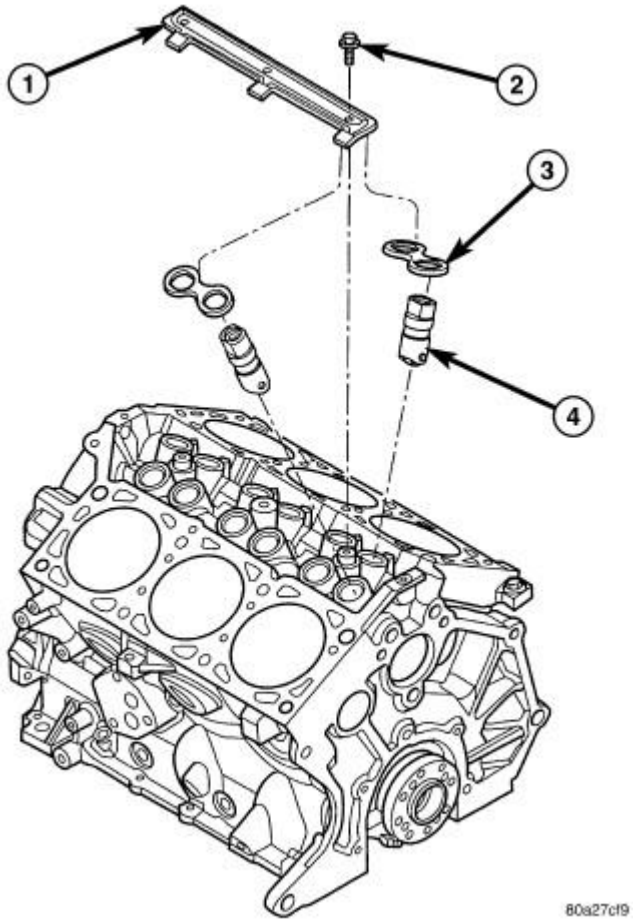

Fig. 128: Yoke Retainer, Bolt, Aligning Yoke & Hydraulic Lifter
Courtesy of CHRYSLER GROUP, LLC

1 - YOKE RETAINER
2 - BOLT - YOKE RETAINER
3 - ALIGNING YOKE
4 - HYDRAULIC LIFTER

The hydraulic lifters are a roller type design and are positioned in the cylinder block with the lubrication whole facing upward. The lifters are aligned and retained by a yoke (3) and a retainer (1).

Lifter alignment is maintained by machined flats on lifter body. Lifters are fitted in pairs into six aligning yokes. The aligning yokes (3) are secured by a yoke retainer (1).

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - HYDRAULIC LIFTERS

HYDRAULIC LIFTERS DIAGNOSIS - PRELIMINARY STEP

Before disassembling any part of the engine to correct lifter noise, check the engine oil pressure. Refer to **LUBRICATION, DIAGNOSIS AND TESTING**.

Check engine oil level. The oil level in the pan should never be above the MAX mark on dipstick, or below the MIN mark. Either of these two conditions could cause noisy lifters.

OIL LEVEL TOO HIGH

If oil level is above the MAX mark on dipstick, it is possible for the connecting rods to dip into the oil while engine is running and create foaming. Foam in oil pan would be fed to the hydraulic lifters by the oil pump causing them to become soft and allow valves to seat noisily.

OIL LEVEL TOO LOW

Low oil level may allow pump to take in air which when fed to the lifters it causes them to become soft and allows valves to seat noisily. Any leaks on intake side of pump, through which air can be drawn, will create the same lifter noise. Check the lubrication system from the intake strainer to the oil pump cover, including the relief valve retainer cap. When lifter noise is due to aeration, it may be intermittent or constant, and usually more than one lifter will be noisy. When oil level and leaks have been corrected, the engine should be operated at fast idle to allow all of the air inside of the lifters to be bled out.

VALVE TRAIN NOISE

To determine source of valve train noise, operate engine at idle with cylinder head covers removed and listen for source of the noise.

NOTE: Worn valve guides or cocked springs are sometimes mistaken for noisy lifters. If such is the case, noise may be dampened by applying side thrust on the valve spring. If noise is not appreciably reduced, it can be assumed the noise is in the tappet. Inspect the rocker arm push rod sockets and push rod ends for wear.

Valve lifter noise ranges from light noise to a heavy click. A light noise is usually caused by excessive leak-down around the unit plunger which will necessitate replacing the lifter, or by the plunger partially sticking in the lifter body cylinder. A heavy click is caused either by a lifter check valve not seating, or by foreign particles becoming wedged between the plunger and the lifter body causing the plunger to stick in the down position. This heavy click will be accompanied by excessive clearance between the valve stem and rocker arm as valve closes. In either case, lifter assembly should be removed for inspection.

REMOVAL

REMOVAL

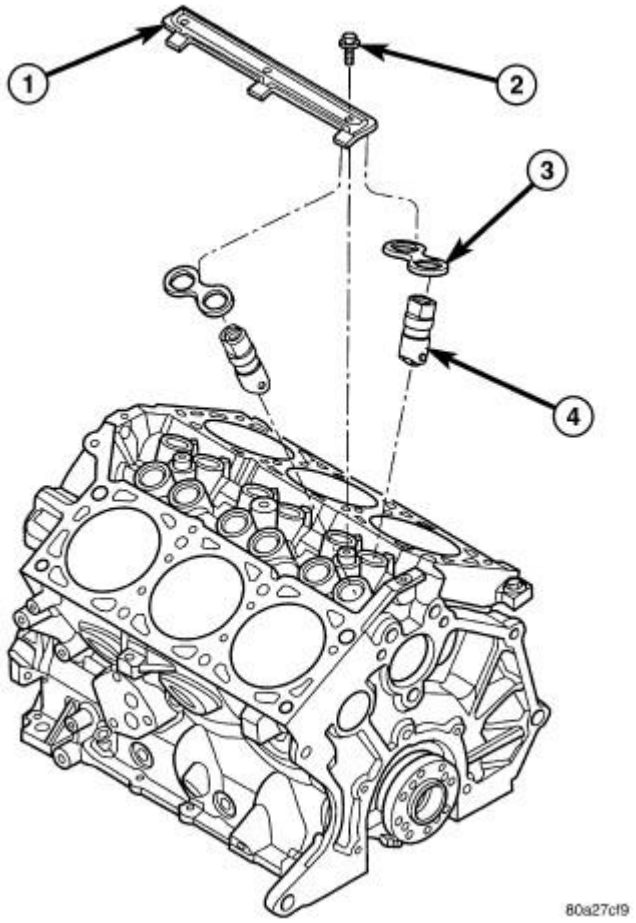

Fig. 129: Yoke Retainer, Bolt, Aligning Yoke & Hydraulic Lifter
Courtesy of CHRYSLER GROUP, LLC

1 - YOKE RETAINER
2 - BOLT - YOKE RETAINER
3 - ALIGNING YOKE
4 - HYDRAULIC LIFTER

1. Remove the cylinder head(s). Refer to **CYLINDER HEAD, REMOVAL**.
2. Remove the yoke retainer (1) and aligning yokes (3).
3. Remove the hydraulic lifters. If lifters are to be reused, identify each lifter to ensure installation in original location.

INSTALLATION

INSTALLATION

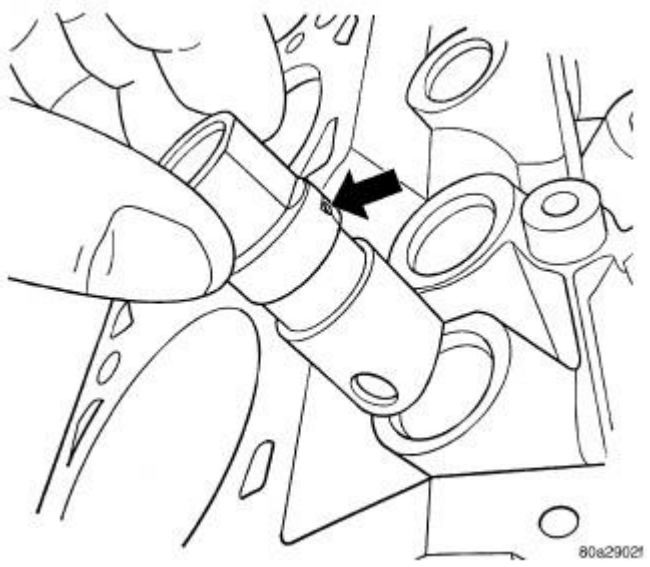

Fig. 130: Lifter Lubrication Hole
Courtesy of CHRYSLER GROUP, LLC

1. Lubricate the lifters with engine oil.

NOTE: Position the lifter in bore with the lubrication hole facing upward.

2. Install the hydraulic lifters with the lubrication hole facing upward towards middle of block. Install lifters in original positions, if reused.

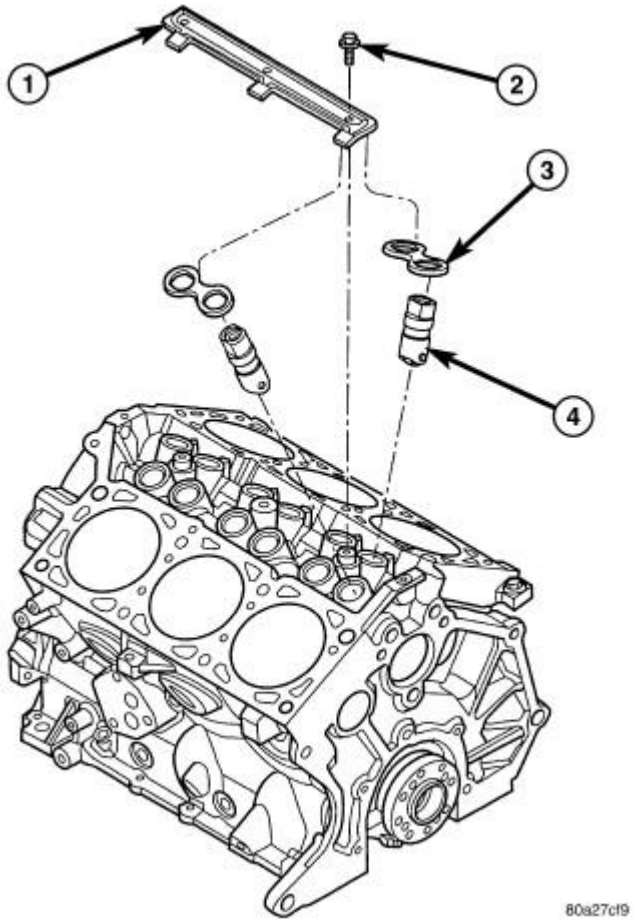

Fig. 131: Yoke Retainer, Bolt, Aligning Yoke & Hydraulic Lifter
Courtesy of CHRYSLER GROUP, LLC

1 - YOKE RETAINER
2 - BOLT - YOKE RETAINER
3 - ALIGNING YOKE
4 - HYDRAULIC LIFTER

3. Install lifter aligning yokes (3).
4. Install yoke retainer (1) and torque screws (2) to 12 N.m (105 in. lbs.).
5. Install the cylinder heads. Refer to **CYLINDER HEAD, INSTALLATION**.
6. Start and operate engine. Warm up to normal operating temperature.

CAUTION: To prevent damage to valve mechanism, engine must not be run above fast idle until all hydraulic lifters have filled with oil and have become quiet.

RETAINER, CRANKSHAFT REAR OIL SEAL

REMOVAL

REMOVAL

NOTE: Any time the rear crank oil seal has been removed from the engine block, a new seal assembly must be installed. Do not re-use a real crank oil seal assembly once it has been removed.

1. Remove the transmission or. Refer to **REMOVAL** . Refer to **REMOVAL** .
2. Remove the flex plate or for vehicles equipped with a manual transmission, the flywheel. Refer to **FLEXPLATE, REMOVAL**. Refer to **FLYWHEEL, REMOVAL** .

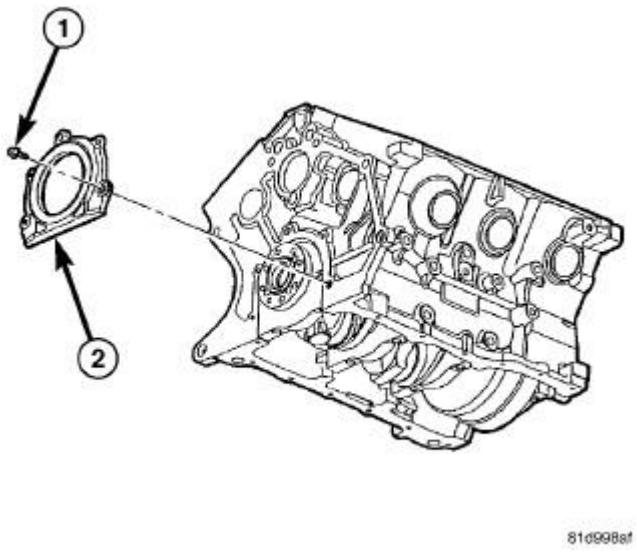

Fig. 132: Crankshaft Rear Oil Seal & Bolt
Courtesy of CHRYSLER GROUP, LLC

1 - BOLT
2 - RETAINER - OIL SEAL

3. Remove oil seal retainer bolts (1).
4. Remove oil seal retainer (2).
5. Clean engine block and retainer of oil and gasket material. Make sure surfaces are clean and free of oil.

INSTALLATION

INSTALLATION

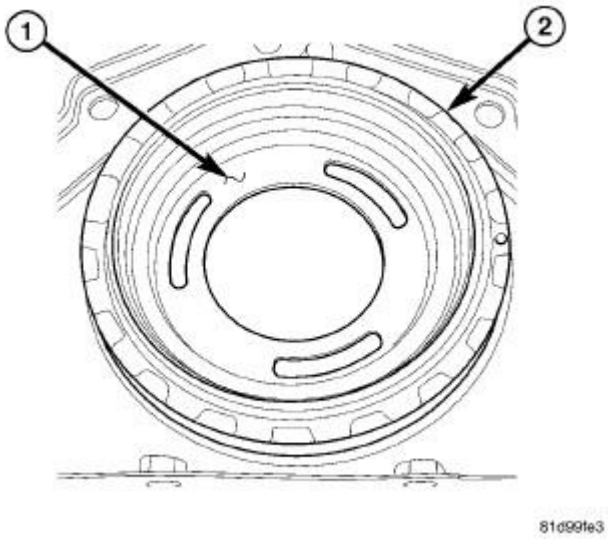

Fig. 133: Rear Crankshaft Oil Seal & Retainer
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Before installing a new rear oil seal assembly, ensure that the plastic installation sleeve (1) is present in the seal assembly. The new seal cannot be properly installed without the plastic installation sleeve, and if the seal assembly is installed without it, oil leakage will result.

1. Remove any original sealer, oil, or debris from the rear oil seal retainer assembly mounting area.
2. Place a bead (approximately 1/4 in. diameter) of Mopar® Engine RTV GEN II in the lower corners of the rear crankshaft oil seal retainer mounting surface, where the seal retainer meets the oil pan (the T-Joint).
3. Place the rear crankshaft oil seal assembly over the rear crankshaft flange. Do not press the seal assembly over the rear crankshaft flange at this time.
4. Using both hands, one on each side of the rear crankshaft flange, press the rear crankshaft oil seal over the rear crankshaft flange.
5. Ensure that the extruded dowels in the rear of the crankshaft oil seal retainer are seated in the locating holes in the rear of the engine block.
6. Install the five rear crankshaft oil seal retainer fasteners. Do not tighten at this time.
7. Remove and discard the plastic installation sleeve (1).
8. Tighten the five rear crankshaft oil seal retainer fasteners to 11.8 N.m (105 in. lbs.).
9. Install the flex plate or flywheel. Refer to **FLEXPLATE, INSTALLATION**. Refer to **FLYWHEEL, INSTALLATION** .
10. Install the transmission or. Refer to **INSTALLATION** . Refer to **INSTALLATION** .

RING(S), PISTON

STANDARD PROCEDURE

STANDARD PROCEDURE - PISTON RING FITTING

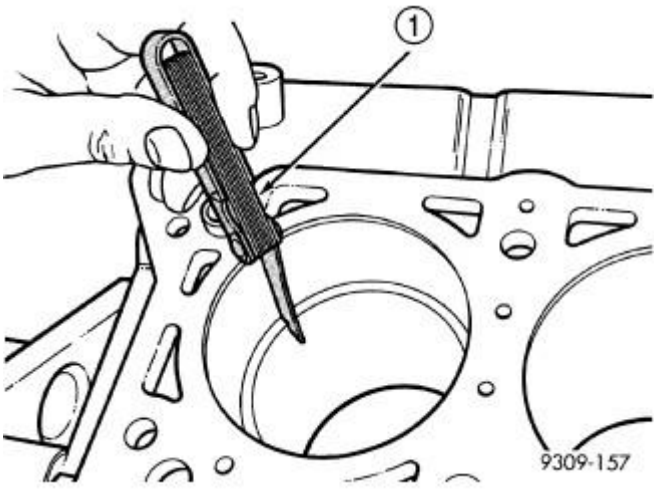

Fig. 134: Checking Piston Ring Gap
Courtesy of CHRYSLER GROUP, LLC

1 - FEELER GAUGE

1. Wipe cylinder bore clean. Insert the ring and push down with piston to ensure squareness in bore to approximately 12 mm (0.50 in.) from top of cylinder bore. Check ring gap with a feeler gauge (1). For clearance specification, refer to **Engine - Specifications**.

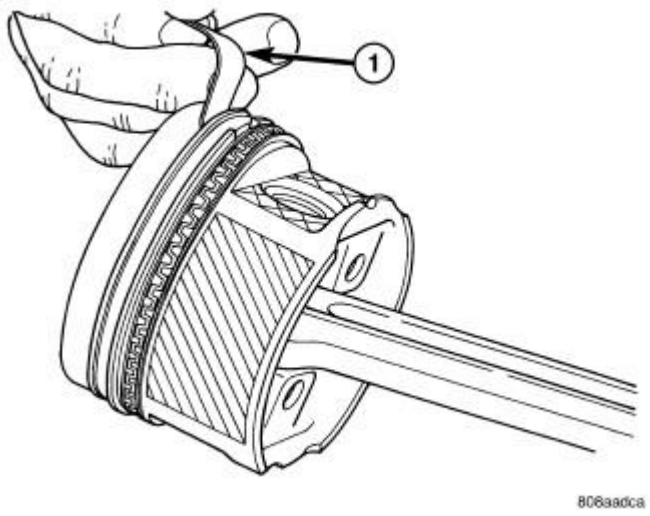

Fig. 135: Checking Piston Ring To Groove Side Clearance
Courtesy of CHRYSLER GROUP, LLC

1 - FEELER GAUGE

2. Check piston ring to groove side clearance (1). For clearance specification, refer to **Engine -**

Specifications. .

REMOVAL

REMOVAL

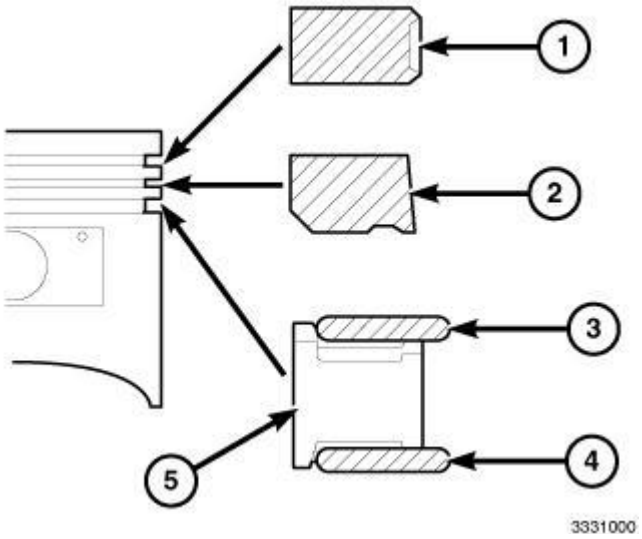

Fig. 136: Piston Ring Removal/Installation Sequence
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical piston shown in illustration.

1. Remove the piston and connecting rod(s). Refer to **ROD, PISTON AND CONNECTING, REMOVAL**.

CAUTION: To avoid damage to the piston rings, they must be removed in the following order:

- **No. 1 (upper) piston ring (1)**
- **No. 2 (intermediate) piston ring (2)**
- **Oil ring upper side rail (3)**
- **Oil ring lower side rail (4)**
- **Oil ring expander (5)**

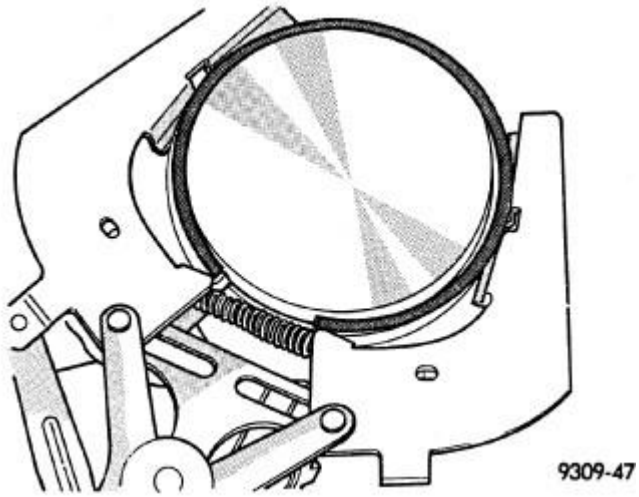

Fig. 137: Removing/Installing Upper & Intermediate Rings
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical piston shown in illustration.

2. Remove the No. 1 (upper) piston ring using a ring expander tool.
3. Remove the No. 2 (intermediate) piston ring using a ring expander tool.

Fig. 138: Removing/Installing Piston Ring Side Rail
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical piston shown in illustration. Do not use a piston ring expander to remove the oil ring side rails.

4. Remove the oil ring upper side rail.
5. Remove the oil ring lower side rail.
6. Remove the oil ring expander (1).

INSTALLATION

INSTALLATION

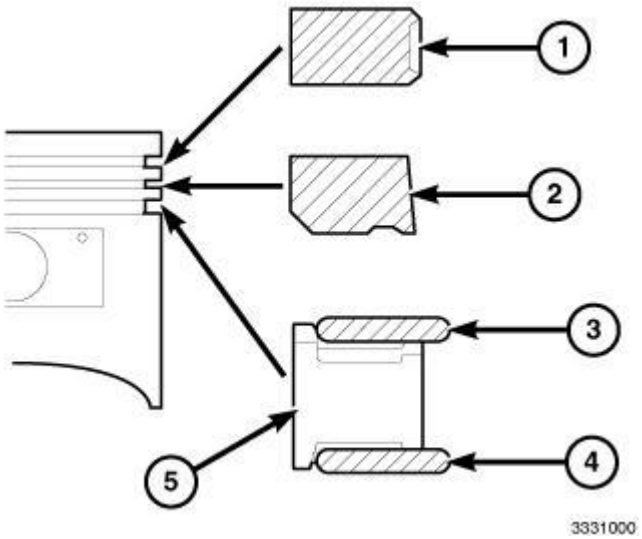

Fig. 139: Piston Ring Removal/Installation Sequence
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical piston shown in illustration.

1. If required, fit new rings to the piston. Refer to **RING(S), PISTON, STANDARD PROCEDURE**.

CAUTION: To avoid damage to the piston rings, they must be installed in the following order:

- **Oil ring expander (5)**
- **Oil ring lower side rail (4)**
- **Oil ring upper side rail (3)**
- **No. 2 (intermediate) piston ring (2)**
- **No. 1 (upper) piston ring (1)**

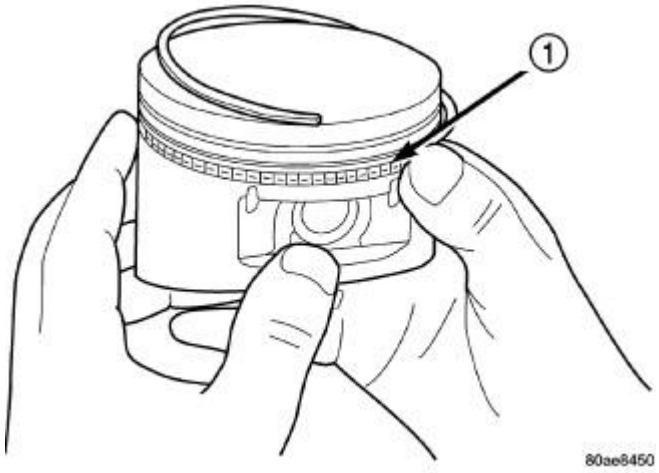

Fig. 140: Removing/Installing Piston Ring Side Rail
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical piston shown in illustration. Do not use a piston ring expander to install the oil ring side rails.

2. Install the oil ring expander (1).
3. Install the oil ring lower side rail by placing one end between the piston ring groove and the oil ring expander. Hold this end firmly and press down the portion to be installed until the side rail is in position.
4. Install the oil ring upper side rail in the same manner as the lower side rail.

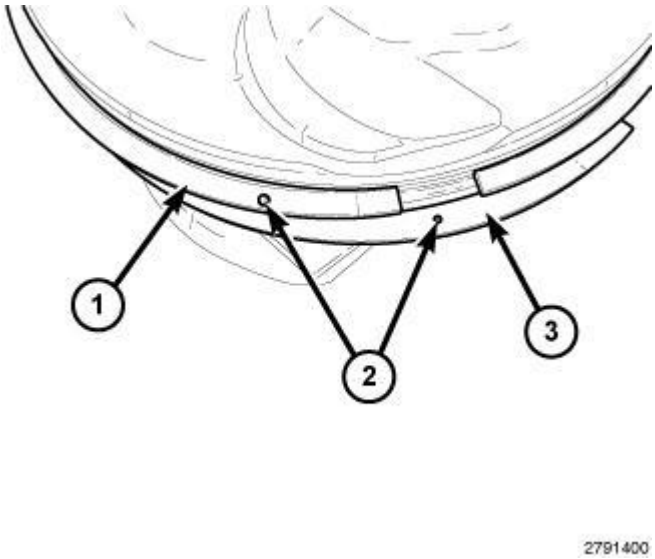

Fig. 141: Dot Marks On Piston Rings
Courtesy of CHRYSLER GROUP, LLC

NOTE: The No. 1 (upper) piston ring (1) and No. 2 (intermediate) piston ring (3) have a different cross section. Install the rings with manufacturers I.D. mark (dot) (2) facing up, towards the top of the piston.

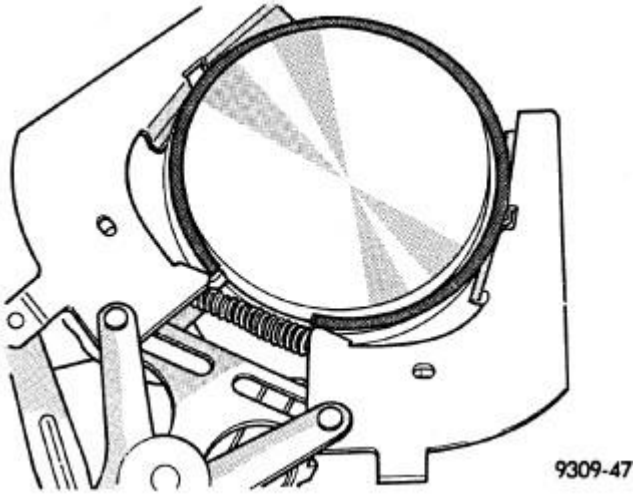

Fig. 142: Removing/Installing Upper & Intermediate Rings
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical piston shown in illustration.

5. Install the No. 2 (intermediate) piston ring using a ring expander tool.
6. Install the No. 1 (upper) piston ring using a ring expander tool.
7. Rotate the rings around the piston, the rings must rotate in the grooves with out binding.

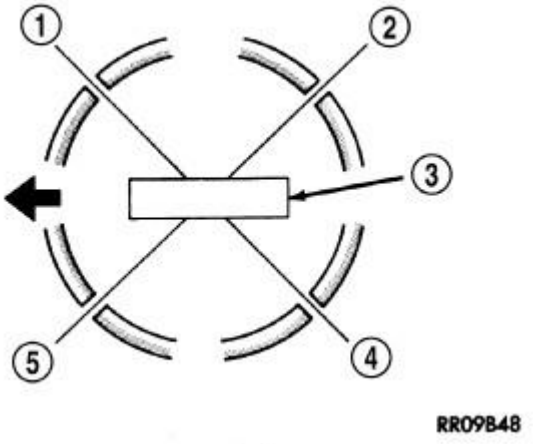

Fig. 143: Piston Ring End Gap Position
Courtesy of CHRYSLER GROUP, LLC

8. Position the piston ring end gaps as follows:
   - Oil ring expander gap (5)
   - Oil ring lower side rail end gap (4)
   - Oil ring upper side rail end gap (1)
   - No. 2 (intermediate) ring end gap (5)
   - No. 1 (upper) ring end gap (2)

9. Install the piston and connecting rod(s). Refer to **ROD, PISTON AND CONNECTING, INSTALLATION**.

ROD, PISTON AND CONNECTING

DESCRIPTION

DESCRIPTION

CAUTION: DO NOT STAMP the connecting rods during identification. The use of a scribe or a paint mark is acceptable.

NOTE: The connecting rods in this engine are a cracked cap design. The cracked cap design is easily identified by the connecting rod cap bolts rather than the traditional forged connecting rod cap nuts. The connecting rod caps must be paint marked or scribed to identify the accompanying connecting rod. Connecting rod caps ARE NOT interchangeable between connecting rods.

The pistons are made of cast aluminum alloy and are a strutless, short skirt design. The piston rings consist of two compression rings and a three piece oil ring. Piston pins connect the piston to the forged steel connecting rods. The piston pins are a press fit into the connecting rod small bore. The piston, pin and connecting rod are serviced as an assembly.

STANDARD PROCEDURE

FITTING CONNECTING RODS

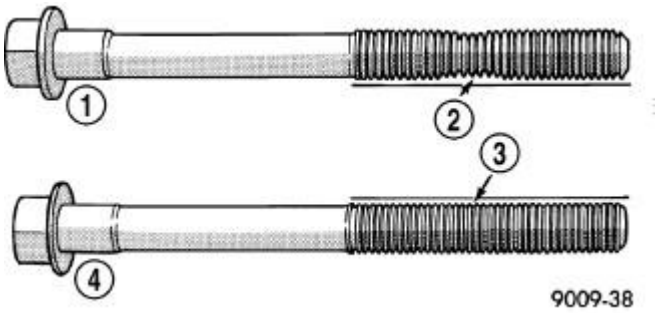

Fig. 144: Checking Cylinder Head Bolts For Stretching (Necking)
Courtesy of CHRYSLER GROUP, LLC

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

NOTE: The connecting rod cap bolts (4) should be examined before reuse. Bolt stretch

can be checked by holding a scale or straight edge against the threads. If all the threads do not contact the scale (2) the bolt (1) must be replaced.

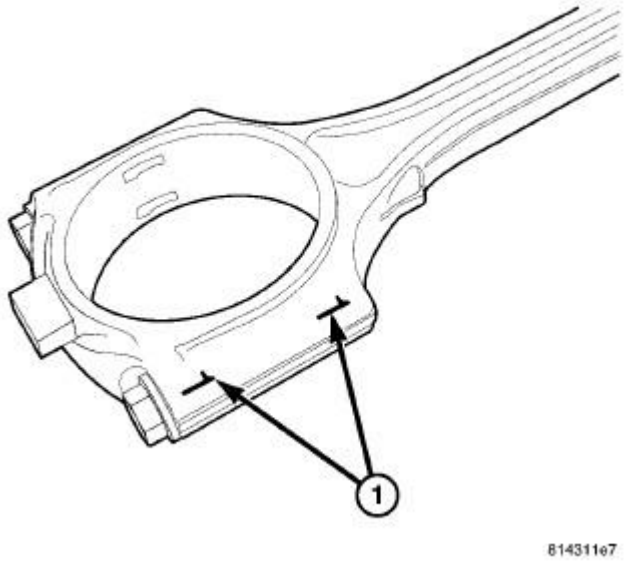

Fig. 145: Connecting Rod To Cylinder Identification
Courtesy of CHRYSLER GROUP, LLC

1 - PAINT MARK OR SCRIBE

The bearing caps are not interchangeable or reversible, and should be marked (1) at removal to ensure correct reassembly. Cracked bearing caps stay with the cracked rod. The bearing shells must be installed with the tangs inserted into the machined grooves in the rods and caps. Install cap with the tangs on the same side as the rod. For connecting rod bearing fitting. Refer to **BEARING(S), CONNECTING ROD, STANDARD PROCEDURE**. Fit all connecting rods on one bank until complete.

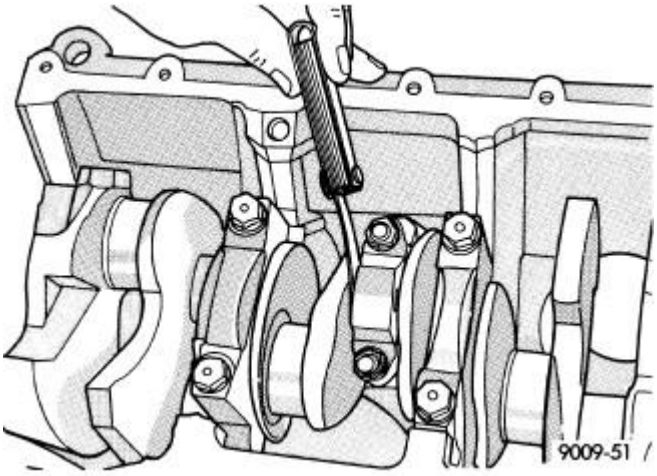

Fig. 146: Checking Connecting Rod Side Clearance
Courtesy of CHRYSLER GROUP, LLC

1. Before installing the bolts, the threads should be lubricated with engine oil.
2. Install bolts finger tight then alternately torque each bolt to assemble the cap properly.
3. Install the connecting rod cap bolts following this three step torque plus angle method:
    - Step 1: Tighten both bolts to 7 N.m (5 ft. lbs)
    - Step 2: Tighten both bolts to 28 N.m (21 ft. lbs)
    - Step 3: Tighten both bolts an additional 90°
4. Using a feeler gauge, check connecting rod side clearance. Refer to **Engine - Specifications**.

FITTING PISTONS

NOTE: Pistons and connecting rods are machined to tight weight tolerances and need not be sorted in any way.

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

Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line. Refer to **Engine - Specifications**. **Pistons and cylinder bores should be measured at normal room temperature, 21°C (70°F).**

REMOVAL

REMOVAL

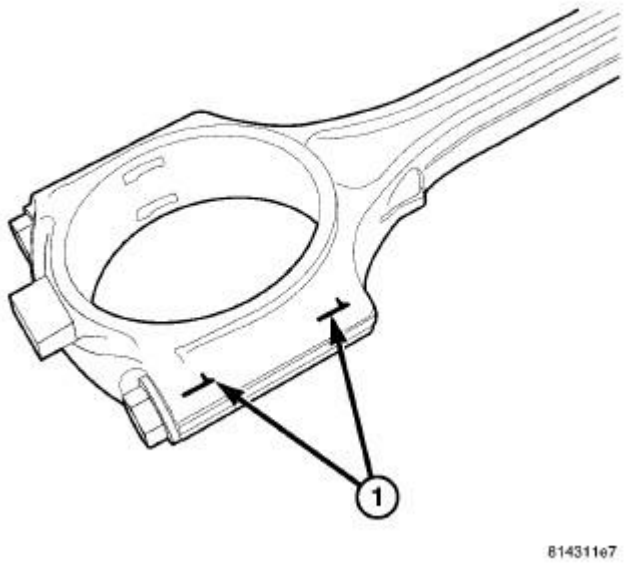

Fig. 147: Connecting Rod To Cylinder Identification
Courtesy of CHRYSLER GROUP, LLC

1 - PAINT MARK OR SCRIBE

NOTE: Refer to the connecting rod Description before beginning repair. Refer to Engine/Engine Block/ROD, Piston and Connecting - Description.

1. Disconnect and isolate the negative battery cable.
2. Remove the cylinder heads. Refer to **CYLINDER HEAD, REMOVAL**.
3. Remove the oil pan. Refer to **PAN, OIL, REMOVAL**.
4. Remove the top ridge of cylinder bores with a reliable ridge reamer, if necessary, before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation. Pistons and connecting rods must be removed from top of cylinder block. When removing piston and connecting rod assemblies from the engine, rotate crankshaft so that each connecting rod is centered in cylinder bore.**
5. Inspect connecting rods and connecting rod caps for cylinder identification (1). Identify them if necessary.

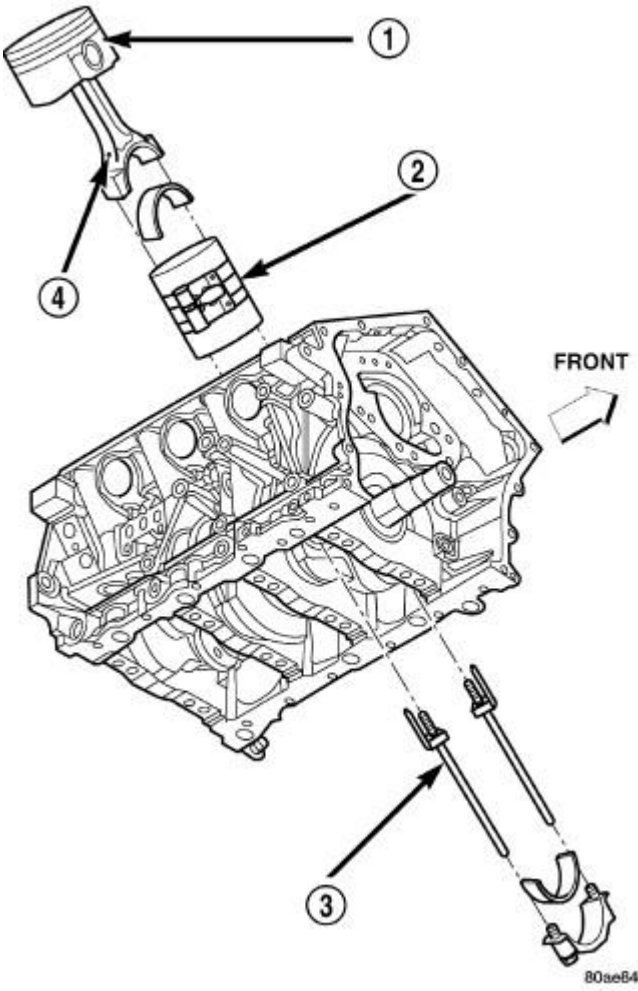

Fig. 148: Removing/Installing Piston & Connecting Rod Assembly
Courtesy of CHRYSLER GROUP, LLC

1 - "F" TOWARD FRONT OF ENGINE
2 - RING COMPRESSOR
3 - SPECIAL TOOL 8189
4 - OIL SQUIRT HOLE

6. Remove connecting rod cap. Install Guide Pins (special tool #8189, Guide Pins) (3) on connecting rod to guide cracked connecting rod (4).
7. Remove each piston (1) and connecting rod assembly (4) out of the cylinder bore.

NOTE: Be careful not to nick crankshaft journals.

8. After removal, install bearing cap on the mating rod.

INSTALLATION

INSTALLATION

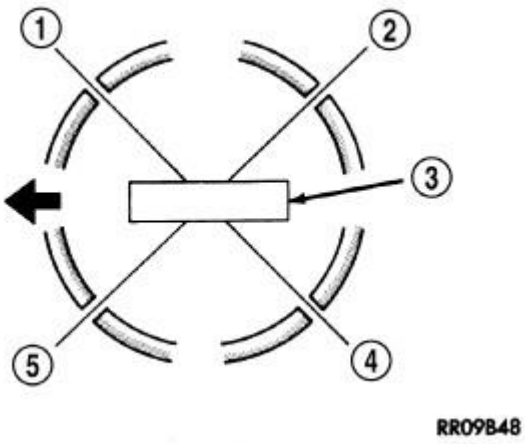

Fig. 149: Piston Ring End Gap Position
Courtesy of CHRYSLER GROUP, LLC

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

NOTE: Refer to the connecting rod Description before beginning repair. Refer to Engine/Engine Block/ROD, Piston and Connecting - Description. .

1. Before installing pistons and connecting rod assemblies into the bore, ensure that compression ring gaps (2, 5) are staggered so that neither is in line with oil ring rail gap (1, 4).

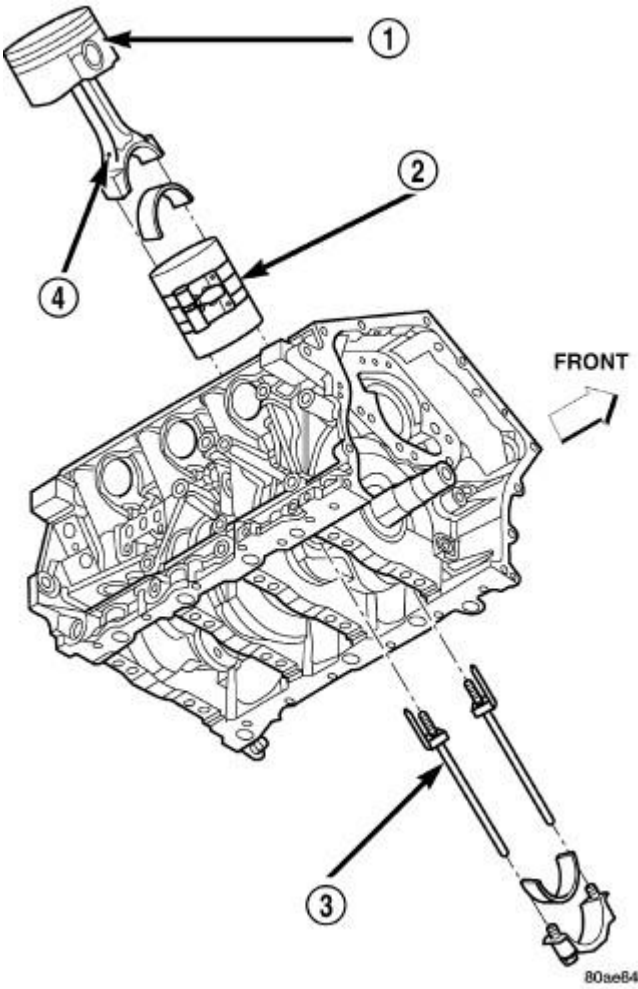

Fig. 150: Removing/Installing Piston & Connecting Rod Assembly
Courtesy of CHRYSLER GROUP, LLC

1 - "F" TOWARD FRONT OF ENGINE
2 - RING COMPRESSOR
3 - SPECIAL TOOL 8189
4 - OIL SQUIRT HOLE

2. Lubricate the piston (1) and rings with clean engine oil. Position a ring compressor (2) over the piston and rings, and tighten the compressor (2). **Be sure position of rings does not change during this operation.**
3. Position upper bearing onto connecting rod. Lubricate bearing with oil.
4. Install Guide Pins (special tool #8189, Guide Pins) (3) on the connecting rod.

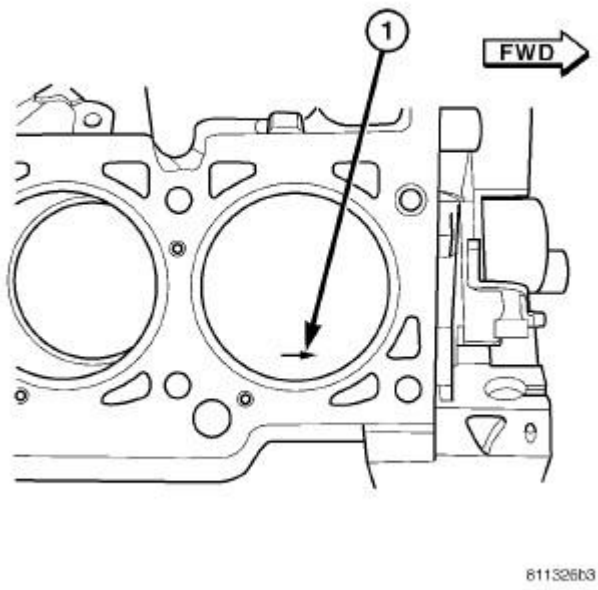

Fig. 151: Proper Piston Orientation
Courtesy of CHRYSLER GROUP, LLC

1 - ARROW FACES FRONT OF ENGINE

5. The pistons are marked with an arrow (1) on top of the piston. Install piston with this mark positioned to front of engine on both cylinder banks.

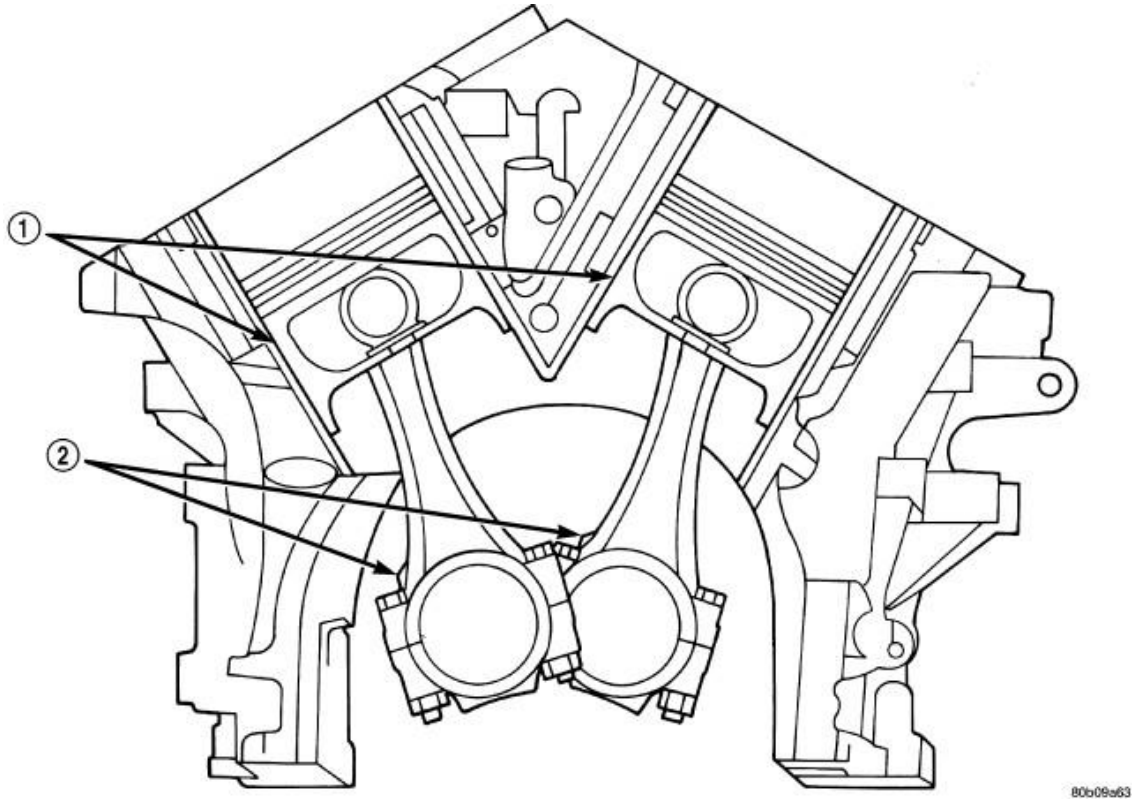

Fig. 152: Piston & Connecting Rod Positioning
Courtesy of CHRYSLER GROUP, LLC

1 - MAJOR THRUST SIDE OF PISTON
2 - OIL SQUIRT HOLE

6. The connecting rod oil squirt hole (2) faces the major thrust (right) side of the engine block (1).

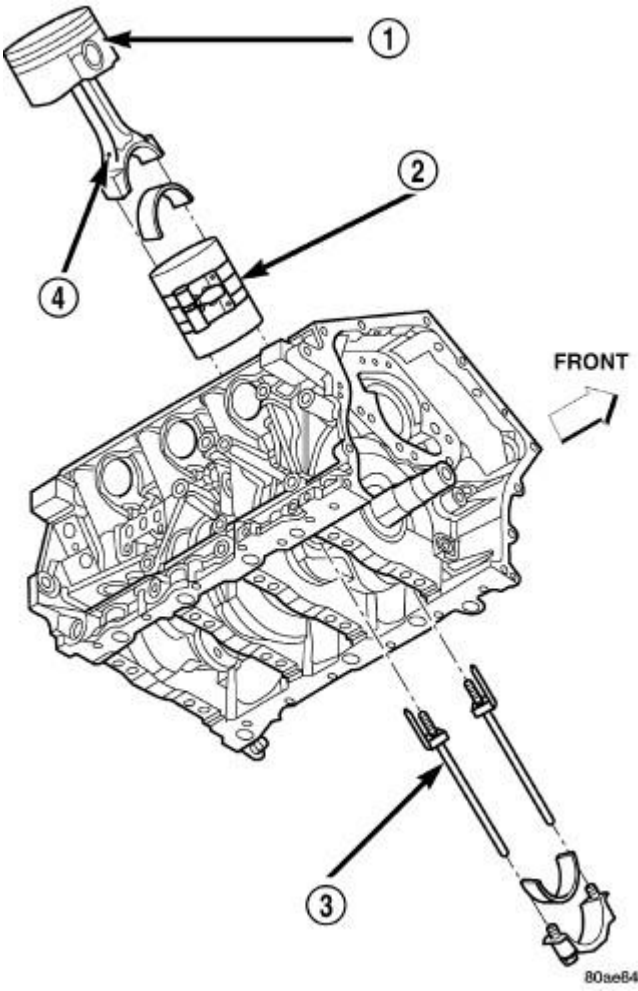

Fig. 153: Removing/Installing Piston & Connecting Rod Assembly
Courtesy of CHRYSLER GROUP, LLC

1 - "F" TOWARD FRONT OF ENGINE
2 - RING COMPRESSOR
3 - SPECIAL TOOL 8189
4 - OIL SQUIRT HOLE

7. Rotate crankshaft until the connecting rod journal is located in the center of the cylinder bore. Insert connecting rod and piston into cylinder bore by tapping down on the piston (1) using a hammer handle. At the same time, guide connecting rod (4) into position on connecting rod journal.
8. Install lower bearing shell and the appropriate connecting rod cap.
9. Install the connecting rod cap bolts following this three step torque plus angle method:
   - Step 1: Tighten both bolts to 7 N.m (5 ft. lbs)
   - Step 2: Tighten both bolts to 28 N.m (21 ft. lbs)
   - Step 3: Tighten both bolts an additional 90°
10. Repeat procedure for each piston and connecting rod installation.

11. Install the cylinder heads. Refer to **CYLINDER HEAD, INSTALLATION**.
12. Install the oil pan. Refer to **PAN, OIL, INSTALLATION**.
13. Fill engine crankcase with proper oil to correct level. Refer to **OIL, STANDARD PROCEDURE**.
14. Connect negative cable to battery.

SEAL, CRANKSHAFT OIL, FRONT

REMOVAL

REMOVAL

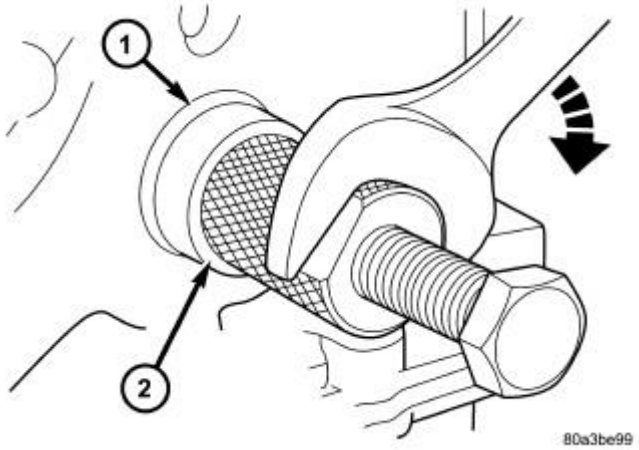

Fig. 154: Engaging Tool Into Seal
Courtesy of CHRYSLER GROUP, LLC

1 - SEAL
2 - SPECIAL TOOL 6341A

1. Disconnect negative cable from battery.
2. Remove accessory drive belt. Refer to **BELT, SERPENTINE, REMOVAL** .
3. Remove crankshaft damper. Refer to **DAMPER, VIBRATION, REMOVAL**.
4. Position Special Tool (special tool #6341A, Remover, Seal) (2) on crankshaft nose. Carefully screw the tool into the seal (1) until it engages firmly. Be careful not to damage that crankshaft seal surface of cover

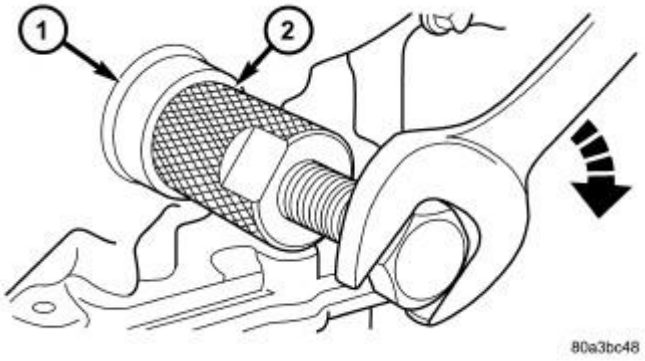

Fig. 155: Crankshaft Front Seal Removal
Courtesy of CHRYSLER GROUP, LLC

1 - SEAL
2 - SPECIAL TOOL 6341A

5. Remove oil seal (1) by turning the forcing screw until the seal disengages from the cover.

INSTALLATION

INSTALLATION

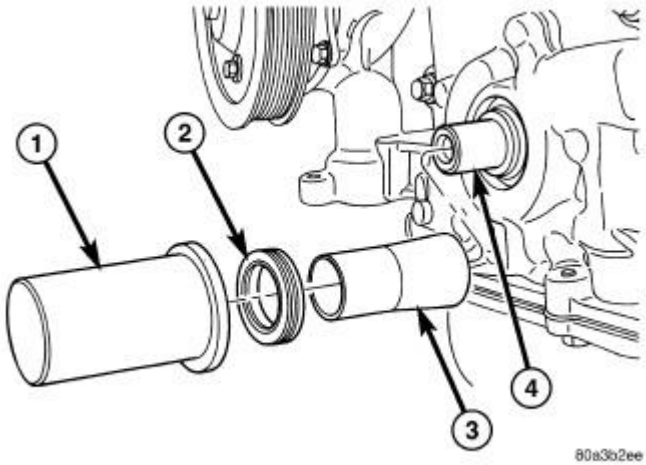

Fig. 156: Crankshaft Front Seal Installation
Courtesy of CHRYSLER GROUP, LLC

1 - SPECIAL TOOL C-4992-1
2 - SEAL
3 - SPECIAL TOOL C-4992-2
4 - CRANKSHAFT

1. Position Special Tool (special tool #C-4992-2, Guide) Guide (3), on the crankshaft nose.

2. Position new seal (2) over the guide with the seal spring in the direction of the engine front cover.
3. Install seal using Special Tool (special tool #C-4992-1, Installer) (1) until seal is flush with cover.
4. Install crankshaft damper. Refer to **DAMPER, VIBRATION, INSTALLATION**.
5. Install accessory drive belt. Refer to **BELT, SERPENTINE, INSTALLATION** .
6. Lower vehicle and connect negative cable to battery.

ENGINE MOUNTING

INSULATOR, ENGINE MOUNT, FRONT

REMOVAL

REMOVAL

1. Disconnect the negative cable from the battery.
2. Remove the engine oil filter.
3. Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.
4. Remove the cylinder block-to-insulator mount bolts and the nut from the engine insulator mount through bolt.
5. Using the jack, raise the engine high enough to remove the engine insulator mount thru bolt and the insulator mount.

INSTALLATION

INSTALLATION

1. Position the insulator mount and install the insulator mount through bolt.
2. Lower the engine until the cylinder block-to-insulator mount bolts can be installed.
3. Remove the jack and block of wood.
4. Torque the cylinder block-to-insulator mount bolts to 61 N.m (45 ft. lbs.).
5. Install and torque the through bolt retaining nut to 61 N.m (45 ft. lbs.).

INSULATOR, ENGINE MOUNT, REAR

REMOVAL

REMOVAL

MANUAL TRANSMISSIONS

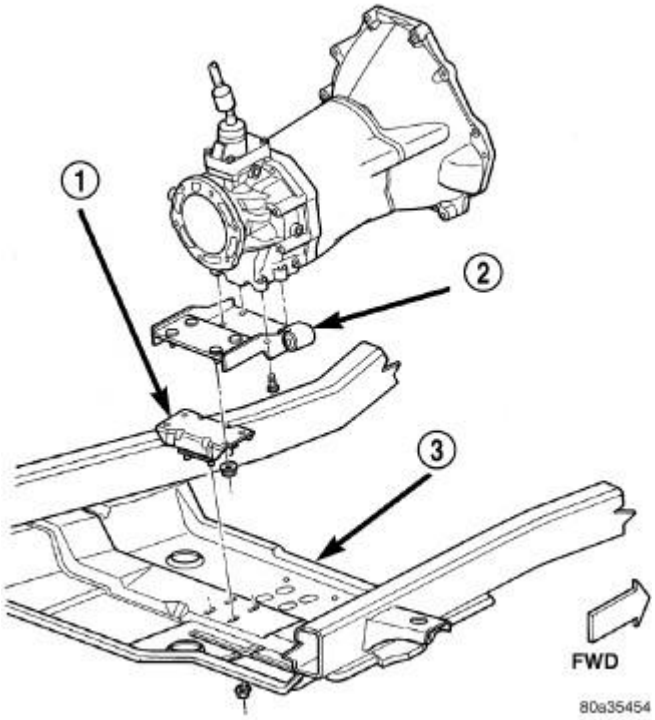

Fig. 157: Rear Mount (Manual Transmission)
Courtesy of CHRYSLER GROUP, LLC

1 - CUSHION
2 - BRACKET
3 - SKID PLATE

1. Disconnect negative cable from battery.
2. Raise the vehicle and support the transmission.
3. Remove the nuts holding the support cushion to the skid plate.
4. Remove nuts holding support cushion to transmission support bracket.
5. Remove the support cushion (2). Refer to **Fig. 158**.
6. Remove bolts holding transmission support bracket to transmission.
7. Remove the transmission support bracket.

AUTOMATIC TRANSMISSIONS

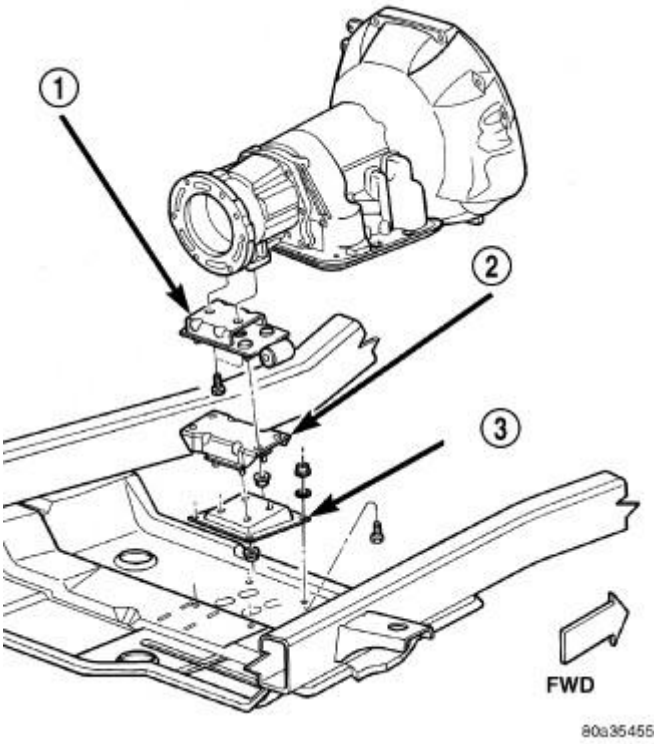

Fig. 158: Rear Mount (Automatic Transmission)
Courtesy of CHRYSLER GROUP, LLC

1 - BRACKET
2 - CUSHION
3 - BRACKET

1. Disconnect negative cable from battery.
2. Raise the vehicle and support the transmission.
3. Remove the nuts holding the support cushion to the skid plate.
4. Remove nuts holding support cushion to transmission support bracket. Remove the support cushion (2). Refer to **Fig. 158**.
5. Remove the bolts holding the transmission support bracket to transmission.
6. Remove the transmission support bracket.

INSTALLATION

INSTALLATION

MANUAL TRANSMISSION

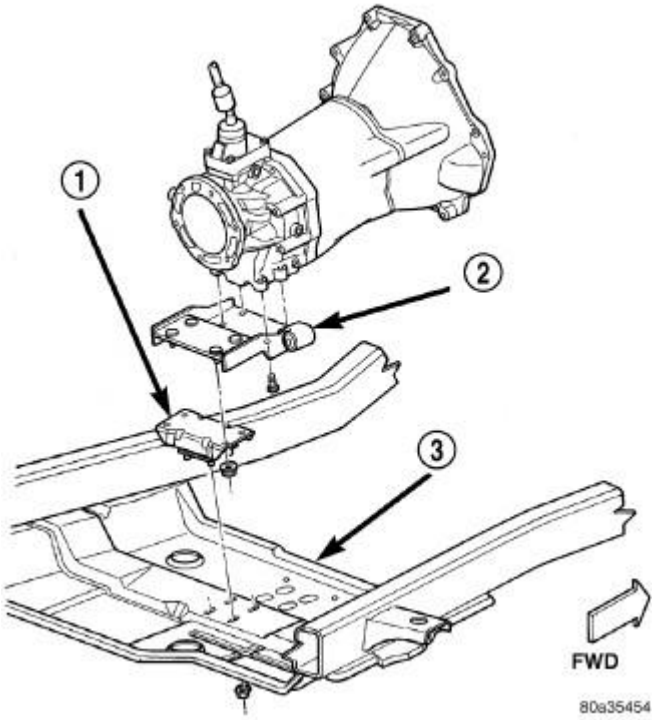

Fig. 159: Rear Mount (Manual Transmission)
Courtesy of CHRYSLER GROUP, LLC

1 - CUSHION
2 - BRACKET
3 - SKID PLATE

1. Position the skid plate to the studs of the support cushion and install the nuts. Tighten the nuts to 28 N.m (21 ft. lbs.) torque.
2. Install the skid plate bolts to the sill and tighten to 75 N.m (55 ft. lbs.) torque.
3. Remove the transmission support.
4. Lower the vehicle.
5. Connect negative cable to battery.
6. Position the transmission mount bracket to the transmission and install the bolts.
7. Tighten the bolts to 54 N.m (40 ft. lbs.) torque.
8. Position the support cushion (2) to the transmission mount bracket and install nuts. Refer to **Fig. 159**.

AUTOMATIC TRANSMISSION

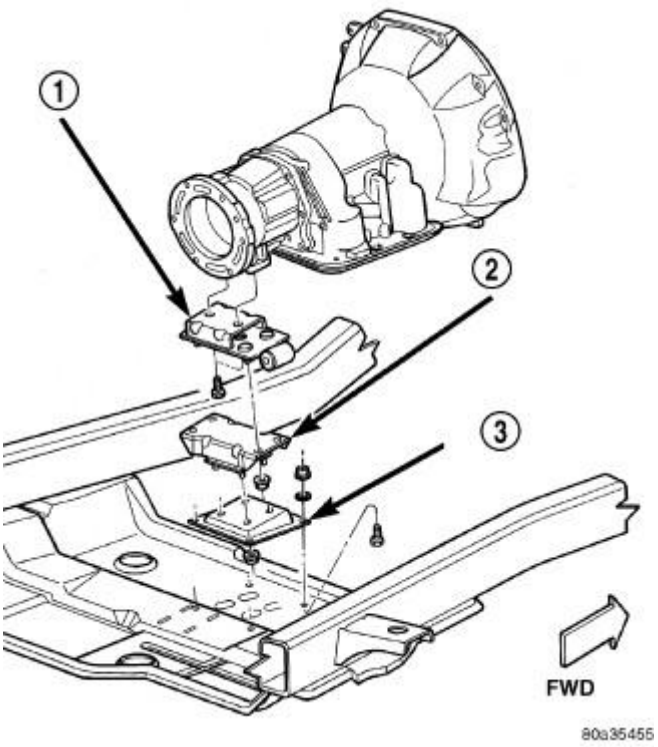

Fig. 160: Rear Mount (Automatic Transmission)
Courtesy of CHRYSLER GROUP, LLC

1 - BRACKET
2 - CUSHION
3 - BRACKET

1. Position the skid plate to the studs of the support cushion and install the nuts. Tighten the nuts to 28 N.m (21 ft. lbs.) torque.
2. Install the skid plate bolts to the sill and tighten to 75 N.m (55 ft. lbs.) torque.
3. Remove the transmission support.
4. Lower the vehicle.
5. Connect negative cable to battery.
6. Position the transmission mount bracket to the transmission and install the bolts. Tighten the bolts to 54 N.m (40 ft. lbs.) torque.
7. Position the support cushion (2) to the transmission mount bracket and install nuts. Refer to **Fig. 160**. Tighten the nuts to 41 N.m (30 ft. lbs.) torque.
8. If the support cushion bracket was removed from the skid plate, position the bracket on the skid plate and install the nuts and bolts. Tighten the nuts to 28 N.m (21 ft. lbs.) torque.

LUBRICATION

DESCRIPTION

DESCRIPTION

The lubrication system is a full flow filtration pressure feed type. The oil pump is mounted in the timing chain cover and is driven by the crankshaft

OPERATION

OPERATION

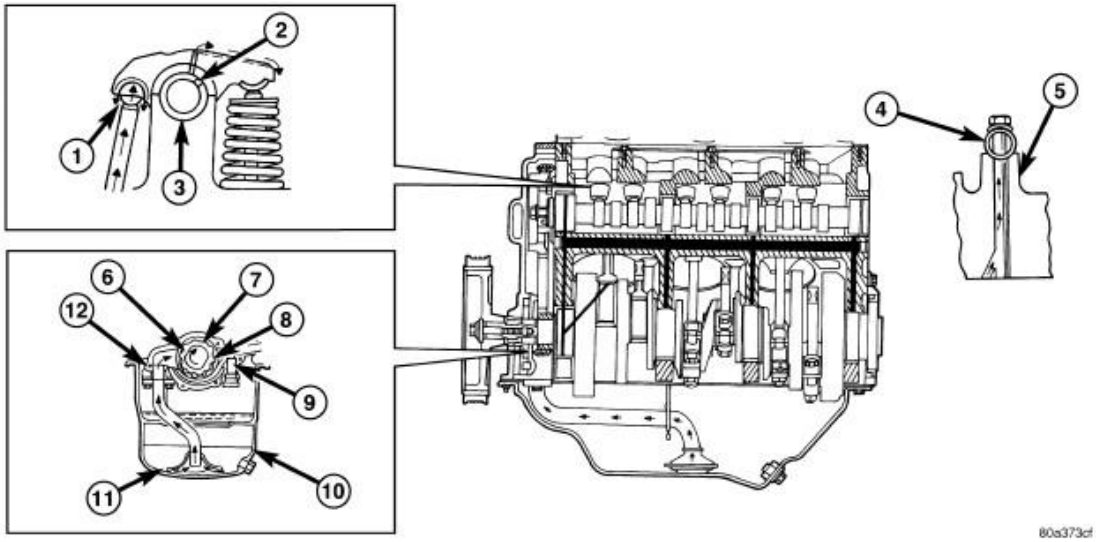

Fig. 161: Engine Lubrication Operation System
Courtesy of CHRYSLER GROUP, LLC

1 - OIL SUPPLY FOR BALL SOCKET THROUGH PUSH ROD	7 - OUTER ROTOR
2 - OIL SUPPLY PASSAGE FROM SHAFT TO ROCKER ARM	8 - INNER ROTOR
3 - ROCKER SHAFT	9 - RELIEF VALVE
4 - OIL FLOWS TO ONLY ONE PEDASTAL ON EACH HEAD; THIRD FROM REAR ON RIGHT HEAD, THIRD FROM FRONT ON LEFT HEAD	10 - OIL PAN
5 - ROCKER SHAFT TOWER	11 - OIL SCREEN
6 - CRANKSHAFT	12 - OIL PUMP CASE

Oil from the oil pan is pumped by a internal gear type oil pump directly coupled to the crankshaft. The pressure is regulated by a relief valve located in the timing chain cover. The oil is pumped through an oil filter and feeds a main oil gallery. This oil gallery feeds oil under pressure to the main and rod bearings, camshaft bearings. Passages in the cylinder block feed oil to the hydraulic lifters and rocker shaft brackets which feeds the rocker arm pivots. Refer to Fig. 161.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE OIL PRESSURE

1. Disconnect and remove oil pressure switch. Refer to **SWITCH, OIL PRESSURE, REMOVAL**.
2. Install Special Tools (special tool #C-3292A, Gauge, Pressure) Gauge with (special tool #8406, Adapter, Oil Pressure) Adaptor. For Special Tool identification, refer to **Engine - Special Tools**.
3. Start engine and record oil pressure. Refer to Oil Pressure in Engine Specifications for the correct pressure. Refer to **Engine - Specifications**.

FILTER, ENGINE OIL

REMOVAL

REMOVAL

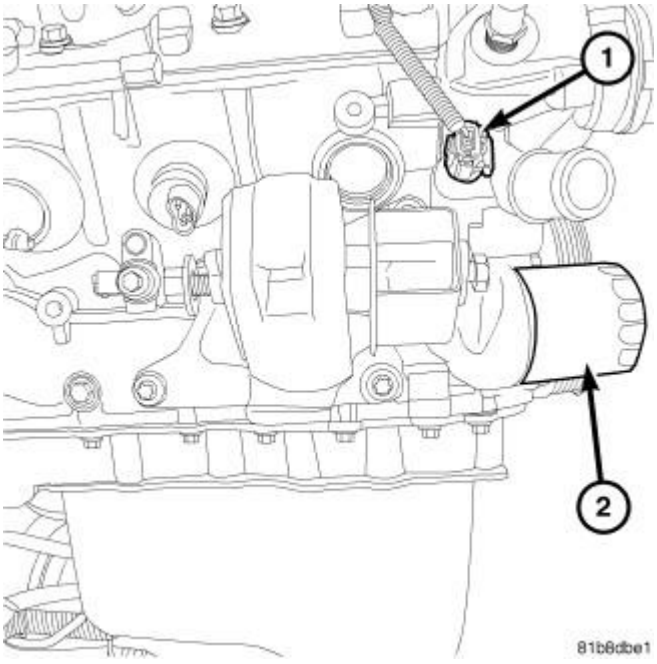

Fig. 162: Oil Pressure Switch & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

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 suitable oil filter wrench, turn filter (2) counterclockwise to remove from oil filter adapter. Properly discard used oil filter.

INSTALLATION

INSTALLATION

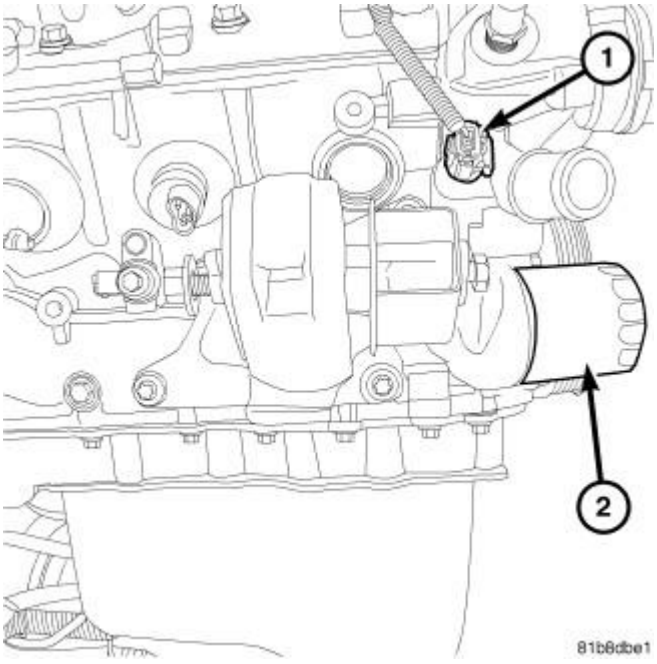

Fig. 163: Oil Pressure Switch & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

1. Wipe oil filter adapter base clean and inspect gasket contact surface.
2. Lubricate gasket of new filter with clean engine oil.
3. Install new filter (2) until gasket contacts base. Tighten filter 1 turn or 20 N.m (15 ft. lbs.). Use filter wrench if necessary.
4. Start engine and check for leaks.

OIL

STANDARD PROCEDURE

ENGINE OIL AND FILTER CHANGE

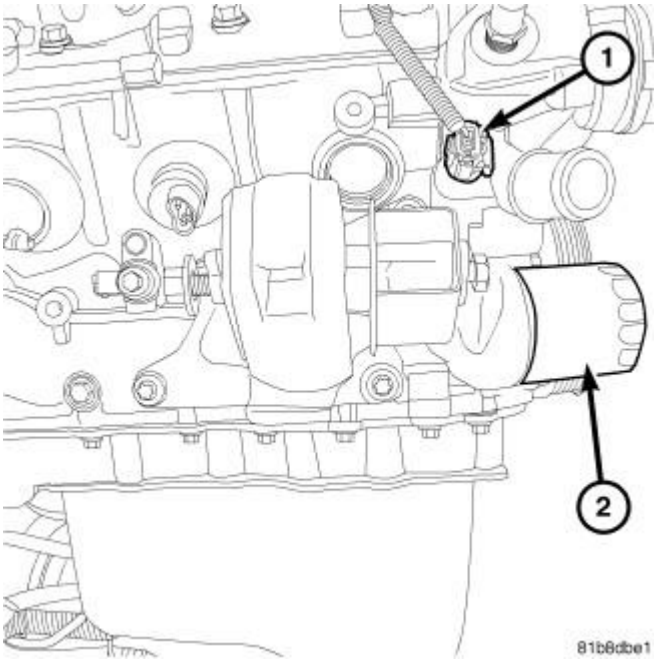

Fig. 164: Oil Pressure Switch & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

Change engine oil at mileage and time intervals described in the Maintenance Schedule. Refer to **MAINTENANCE SCHEDULES, DESCRIPTION** .

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

Run engine until achieving normal operating temperature.

1. Open hood, remove oil fill cap.
2. Place a suitable drain pan under crankcase drain.
3. Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.
4. Remove oil filter (2).
5. Install and tighten drain plug in crankcase.
6. Install new oil filter (2).
7. Lower vehicle and fill crankcase with specified type and amount of engine oil.
8. Install oil fill cap.

9. Start engine and inspect for leaks.
10. Stop engine and inspect oil level.

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

PAN, OIL

REMOVAL

REMOVAL

1. Disconnect negative cable from battery and remove engine oil level indicator tube.
2. Remove engine oil level indicator tube.

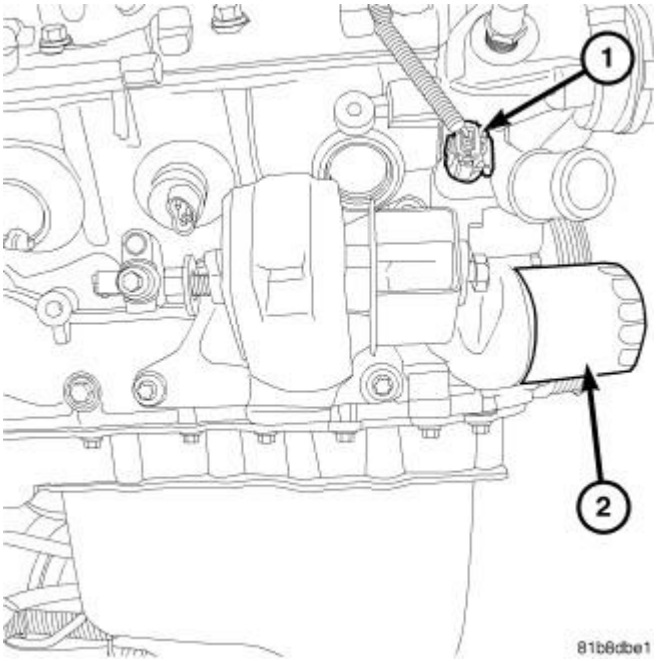

Fig. 165: Oil Pressure Switch & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

3. Raise vehicle on hoist and drain engine oil, and remove the oil filter (2).

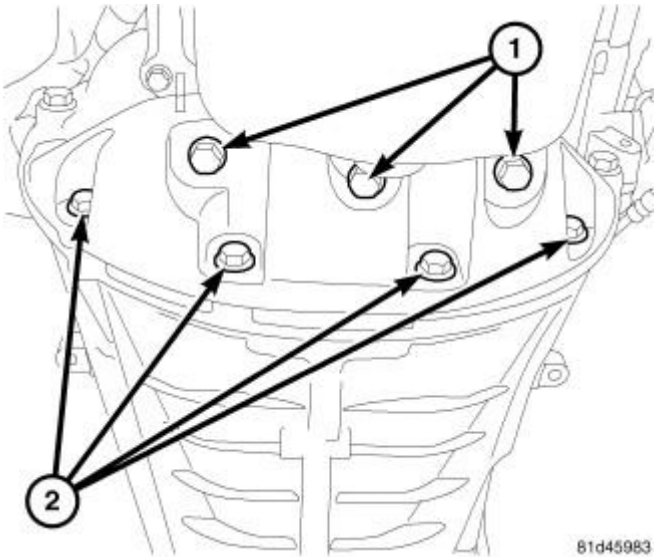

Fig. 166: 3.8L Structural Cover Mounting Bolts
Courtesy of CHRYSLER GROUP, LLC

4. Remove the structural cover fasteners (1, 2) and structural cover. Refer to **COVER, STRUCTURAL DUST, REMOVAL**.

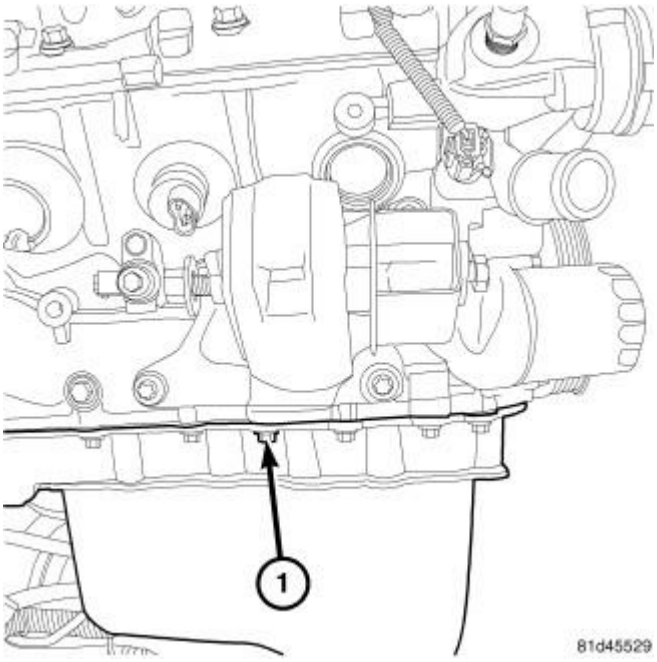

Fig. 167: Oil Pan Fasteners
Courtesy of CHRYSLER GROUP, LLC

NOTE: Do not remove the lower oil pan bolts. Only remove the upper oil pan-to-engine block bolts (1).

5. Remove the oil pan fasteners (1), oil pan and gasket.

CLEANING

CLEANING

1. Clean oil pan with solvent and wipe dry with a clean cloth.
2. Clean all gasket material from mounting surfaces of pan and block.
3. Clean oil screen and pick-up tube in clean solvent.

INSPECTION

INSPECTION

1. Inspect oil drain plug and plug hole for stripped or damaged threads and repair as necessary. Install a new drain plug gasket. Tighten to 27 N.m (20 ft. lbs.).
2. Inspect oil pan mounting flange for bends or distortion. Straighten flange if necessary.
3. Inspect condition of oil screen and pick-up tube, clean or replace as necessary.

INSTALLATION

INSTALLATION

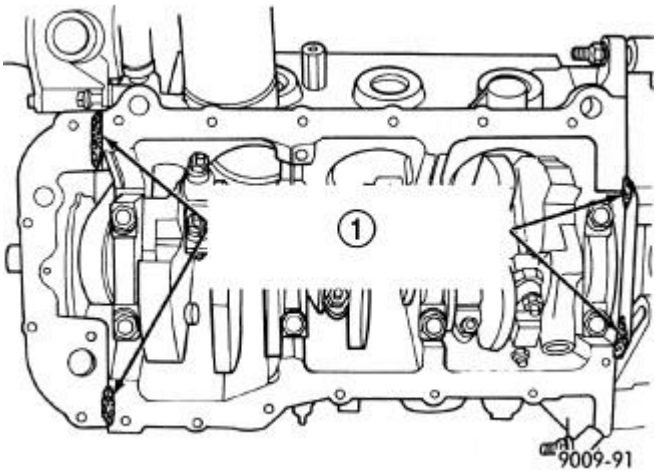

Fig. 168: Oil Pan Sealing Locations
Courtesy of CHRYSLER GROUP, LLC

1 - SEALER LOCATIONS

1. Thoroughly clean sealing surfaces of any oil, dirt, or original sealer, and apply a 1/8 inch bead (1) of Mopar® Engine RTV GEN II at the parting line of the chain case cover (1) and the rear seal retainer (1).
2. Position a new pan gasket on oil pan.

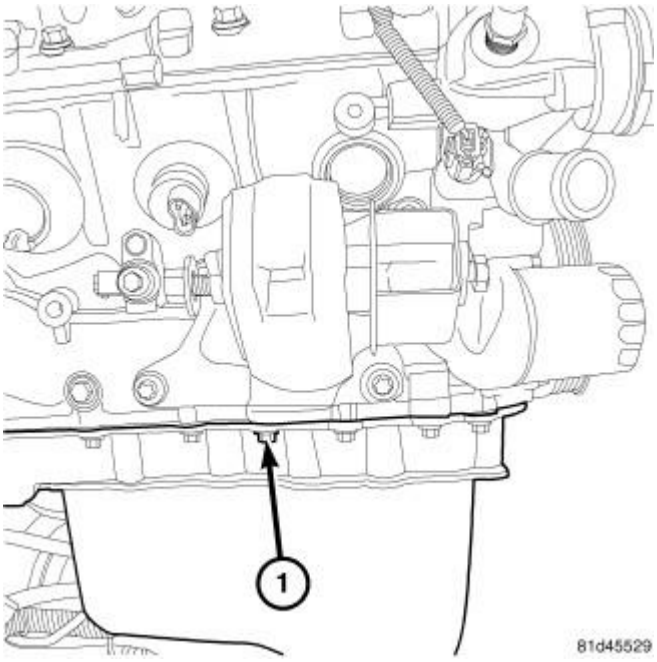

Fig. 169: Oil Pan Fasteners
Courtesy of CHRYSLER GROUP, LLC

3. Install oil pan and tighten fasteners (1) to 12 N.m (105 in. lbs.).

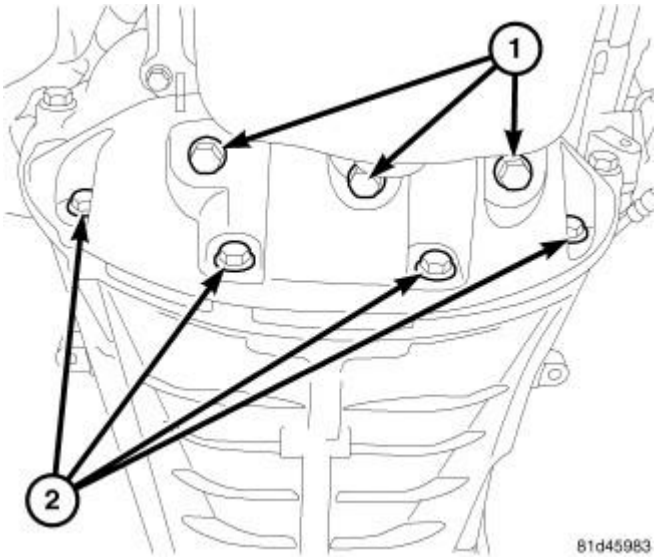

Fig. 170: 3.8L Structural Cover Mounting Bolts
Courtesy of CHRYSLER GROUP, LLC

4. Install the structural cover and tighten fasteners (1, 2). Refer to **COVER, STRUCTURAL DUST, INSTALLATION**.
5. Lower vehicle and install oil level indicator.

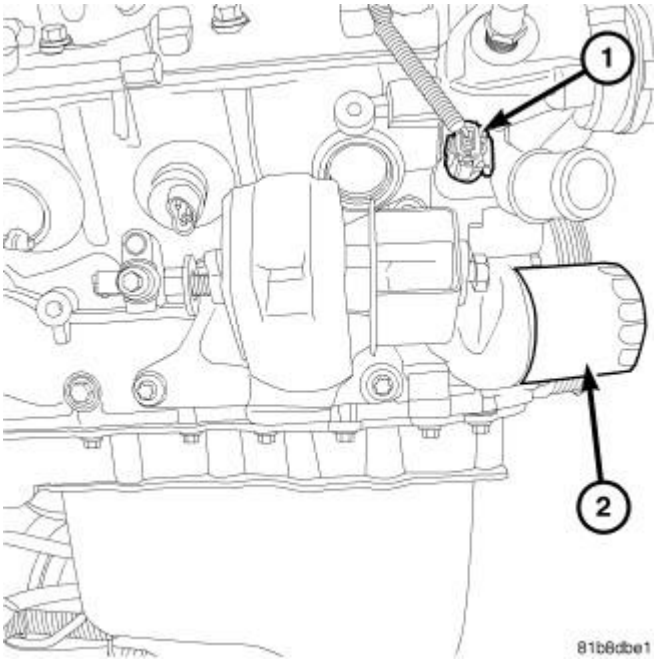

Fig. 171: Oil Pressure Switch & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

6. Install new oil filter (2).
7. Fill crankcase with oil to proper level.
8. Connect negative cable to battery.

PUMP, ENGINE OIL

DESCRIPTION

DESCRIPTION

The oil pump is located in the timing chain cover. It is driven by the crankshaft.

REMOVAL

REMOVAL

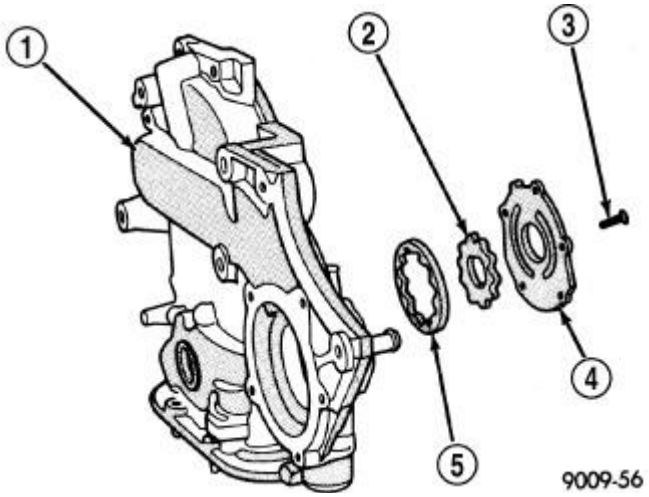

Fig. 172: Oil Pump Assembly
Courtesy of CHRYSLER GROUP, LLC

1 - CHAIN CASE COVER
2 - OIL PUMP INNER ROTOR
3 - SCREW
4 - OIL PUMP COVER
5 - OIL PUMP OUTER ROTOR

The oil pump (1) is contained within the timing chain cover housing.

1. Remove oil pan.
2. Remove the timing chain cover.
3. Disassemble oil pump from timing chain cover.
4. Clean and Inspect oil pump components.

DISASSEMBLY

DISASSEMBLY

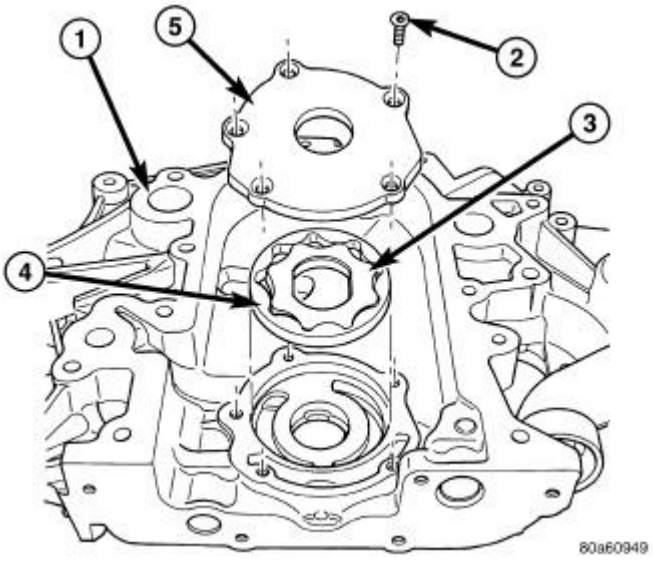

Fig. 173: Disassembling/Assembling Oil Pump
Courtesy of CHRYSLER GROUP, LLC

1 - TIMING CHAIN COVER
2 - SCREWS
3 - INNER ROTOR
4 - OUTER ROTOR
5 - COVER

1. Remove oil pump cover screws (2), and lift off cover (5).
2. Remove oil pump rotors (3, 4).
3. Clean and inspect oil pump components.

INSPECTION

INSPECTION

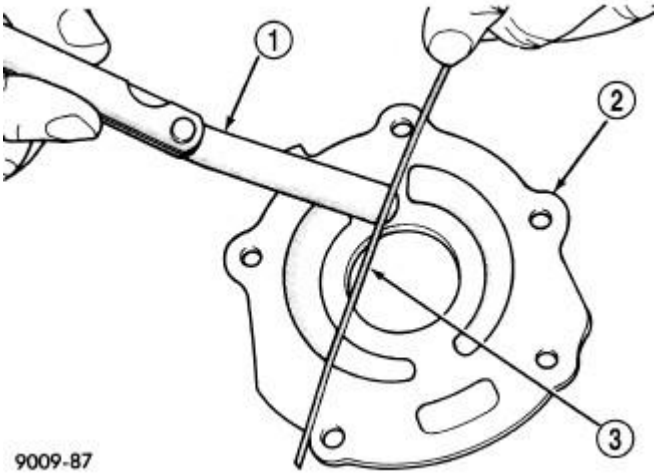

Fig. 174: Checking Oil Pump Cover Flatness
Courtesy of CHRYSLER GROUP, LLC

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

1. Inspect mating surface of the chain case cover. Surface should be smooth. Replace cover if scratched or grooved.
2. Lay a straightedge across the pump cover surface. Refer to **Fig. 174**. If a 0.025 mm (0.001 in.) feeler gauge can be inserted between cover and straight edge, cover should be replaced.

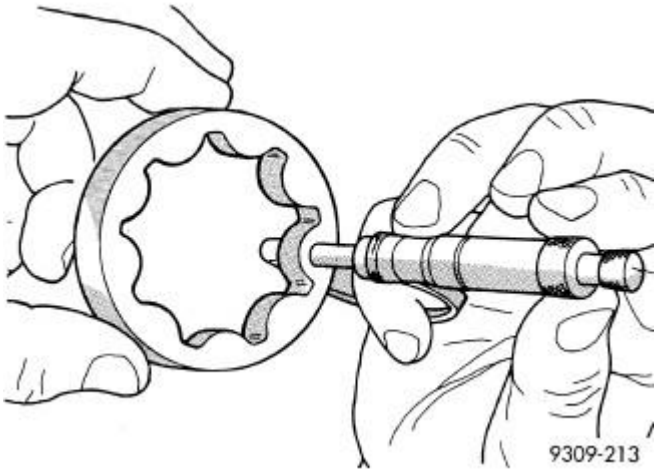

Fig. 175: Measuring Outer Rotor Thickness
Courtesy of CHRYSLER GROUP, LLC

3. Measure thickness and diameter of outer rotor. If outer rotor thickness measures 7.64 mm (0.301 in.) or less, or if the diameter is 79.95 mm (3.148 in.) or less, replace outer rotor. Refer to **Fig. 175**.

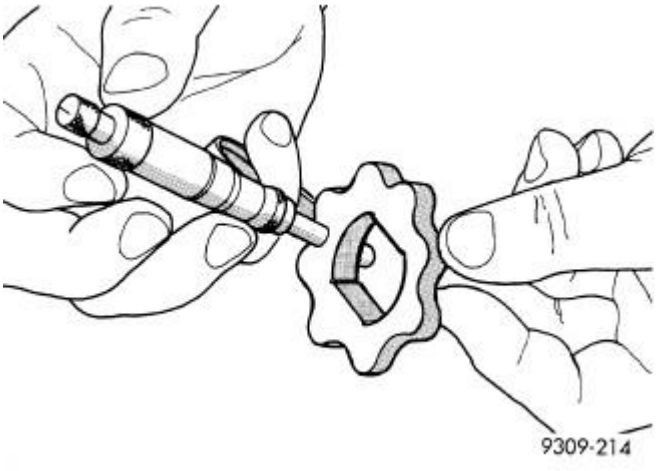

Fig. 176: Measuring Inner Rotor Thickness
Courtesy of CHRYSLER GROUP, LLC

4. If inner rotor thickness measures 7.64 mm (0.301 in.) or less, replace inner rotor. Refer to **Fig. 176**.

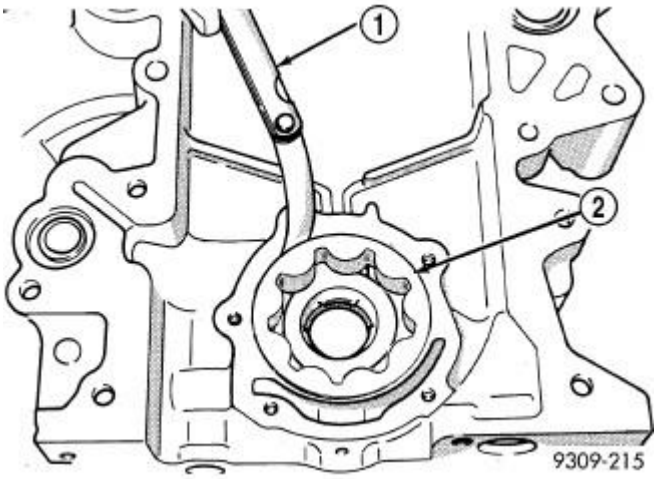

Fig. 177: Measuring Outer Rotor Clearance In Housing
Courtesy of CHRYSLER GROUP, LLC

1 - FEELER GAUGE
2 - OUTER ROTOR

5. Install outer rotor into chain case cover. Press rotor to one side with fingers and measure clearance between rotor and chain case cover. Refer to **Fig. 177**. If measurement is 0.39 mm (0.015 in.) or more, replace chain case cover, only if outer rotor is in specification.

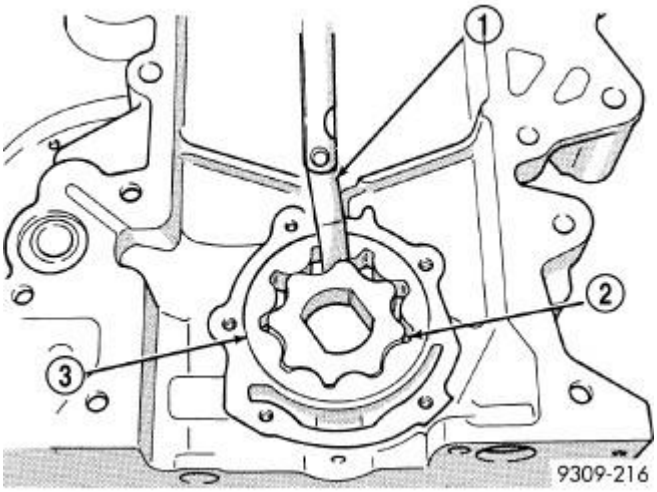

Fig. 178: Measuring Clearance Between Rotors
Courtesy of CHRYSLER GROUP, LLC

1 - FEELER GAUGE
2 - INNER ROTOR
3 - OUTER ROTOR

6. Install inner rotor into chain case cover. If clearance between inner and outer rotors is 0.203 mm (0.008 in.) or more, replace both rotors. Refer to **Fig. 178**.

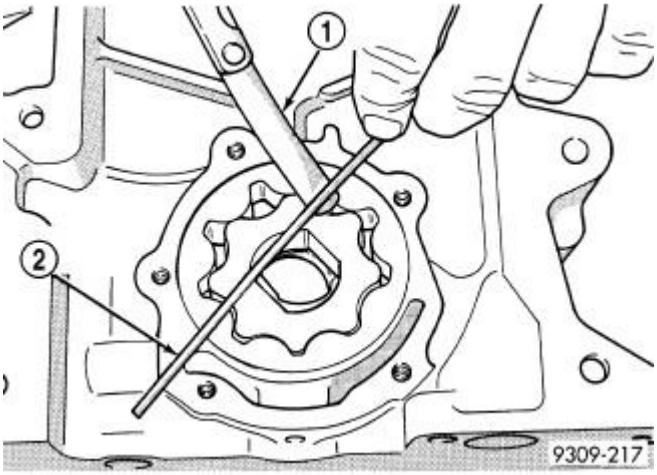

Fig. 179: Measuring Clearance Over Rotors
Courtesy of CHRYSLER GROUP, LLC

1 - FEELER GAUGE
2 - STRAIGHT EDGE

7. Place a straightedge across the face of the chain case cover, between bolt holes. If a feeler gauge of 0.10 mm (0.004 in.) or more can be inserted between rotors and the straightedge, replace pump assembly.

Refer to **Fig. 179**. **ONLY** if rotors are in specs.

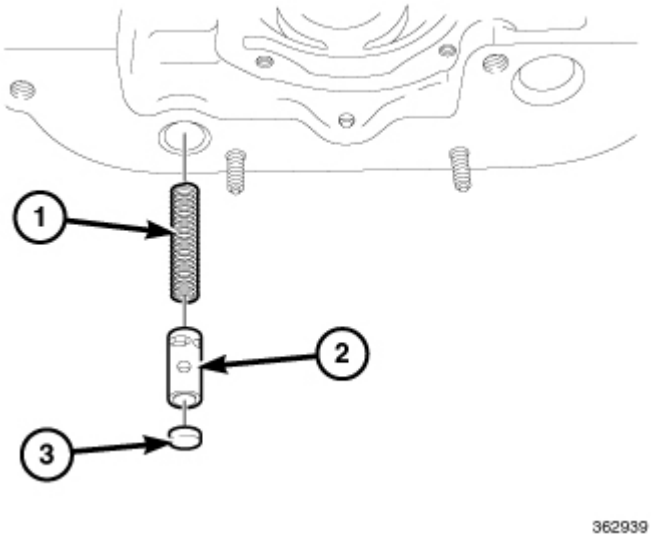

Fig. 180: Oil Pressure Relief Valve
Courtesy of CHRYSLER LLC

1 - SPRING
2 - RELIEF VALVE
3 - RETAINER CAP

8. Remove oil pressure relief valve. Refer to **VALVE, OIL PRESSURE RELIEF, REMOVAL**.
9. Inspect oil pressure relief valve and bore. Inspect for scoring, pitting and free valve operation in bore. Refer to **Fig. 180**. Small marks may be removed with 400-grit wet or dry sandpaper.
10. The relief valve spring has a free length of approximately 49.5 mm (1.95 inches) it should test between 19.5 and 20.5 pounds when compressed to 34 mm (1-11/32 inches). Replace spring that fails to meet specifications.
11. If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other reasons for oil pressure loss.

ASSEMBLY

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 screws to 12 N.m (105 in. lbs.).
4. If removed, install the oil pressure relief valve. Refer to **VALVE, OIL PRESSURE RELIEF, INSTALLATION**.

INSTALLATION

INSTALLATION

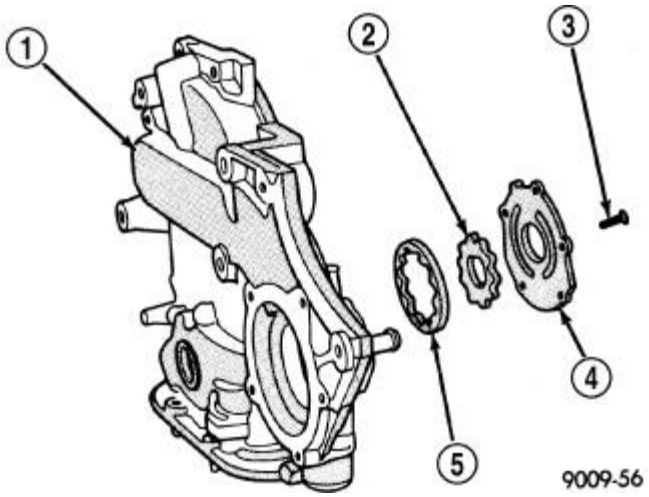

Fig. 181: Oil Pump Assembly
Courtesy of CHRYSLER GROUP, LLC

1 - CHAIN CASE COVER
2 - OIL PUMP INNER ROTOR
3 - SCREW
4 - OIL PUMP COVER
5 - OIL PUMP OUTER ROTOR

1. Install oil pump assembly (2, 4, 5).
2. Install timing chain cover.

SWITCH, OIL PRESSURE

DESCRIPTION

DESCRIPTION

The engine oil pressure switch is located on the timing cover, in front of the engine. The normally closed switch provides an input through a single wire to the low pressure indicator light on the instrument cluster.

OPERATION

OPERATION

The oil pressure switch provides a ground for the instrument cluster low oil pressure indicator light. The switch receives oil pressure input from the engine main oil gallery. When engine oil pressure is greater than 27.5 Kpa (4 psi), the switch contacts open, providing a open circuit to the low pressure indicator light. For wiring circuits and diagnostic information, refer to Appropriate Wiring/Diagnostic Information.

REMOVAL

REMOVAL

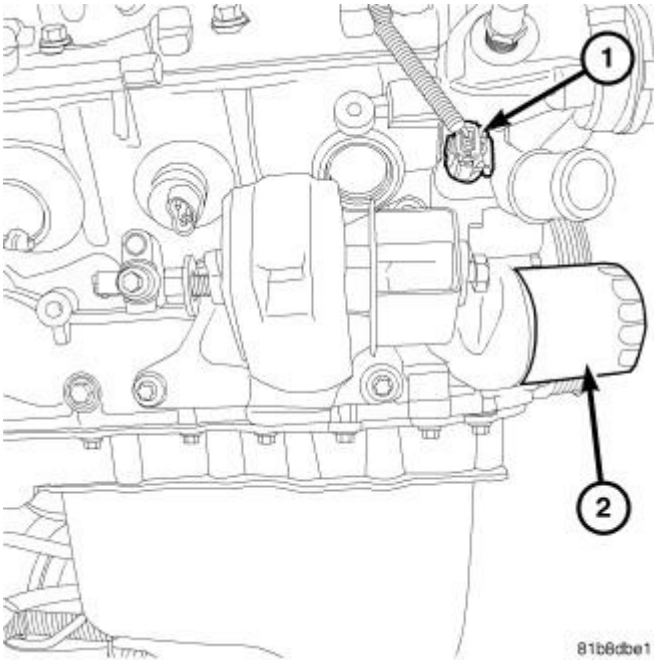

Fig. 182: Oil Pressure Switch & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

1. Raise vehicle on hoist.
2. Disconnect electrical connector from switch.
3. Remove oil pressure switch (1).

INSTALLATION

INSTALLATION

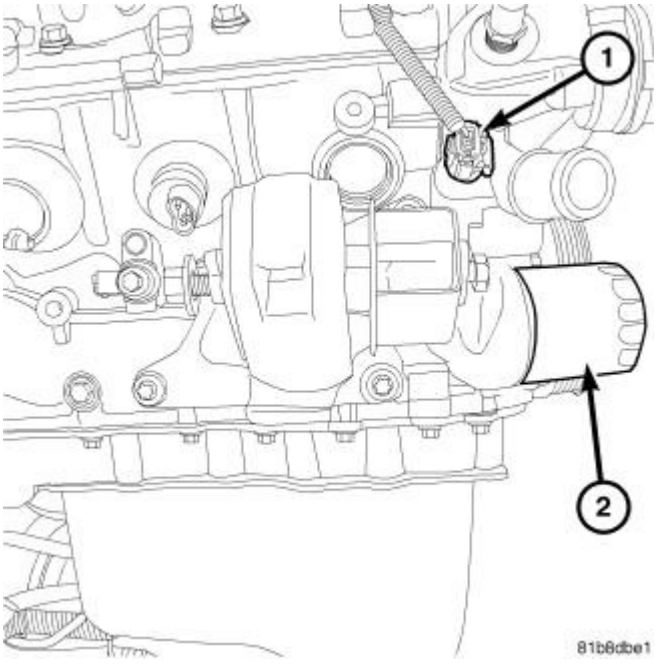

Fig. 183: Oil Pressure Switch & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

1. Install oil pressure switch (1). Torque oil pressure switch to 23 N.m (200 in. lbs.).
2. Connect electrical connector to switch.
3. Lower the vehicle.
4. Start engine and check for leaks.
5. Check engine oil level. Adjust as necessary.

VALVE, OIL PRESSURE RELIEF

REMOVAL

REMOVAL

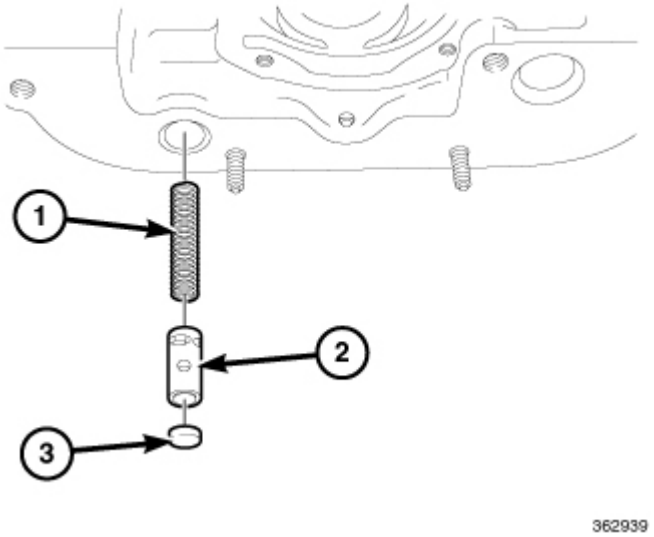

Fig. 184: Oil Pressure Relief Valve
Courtesy of CHRYSLER LLC

1 - SPRING 2 - RELIEF VALVE 3 - RETAINER CAP

1. Remove the oil pan. Refer to **PAN, OIL, REMOVAL**.
2. Drill a 3.175 mm (1/8 in.) hole in the center of the retainer cap (3). Insert a self-threading sheet metal screw into the cap.
3. Using suitable pliers, remove the cap and discard.
4. Remove spring and relief valve.

INSTALLATION

INSTALLATION

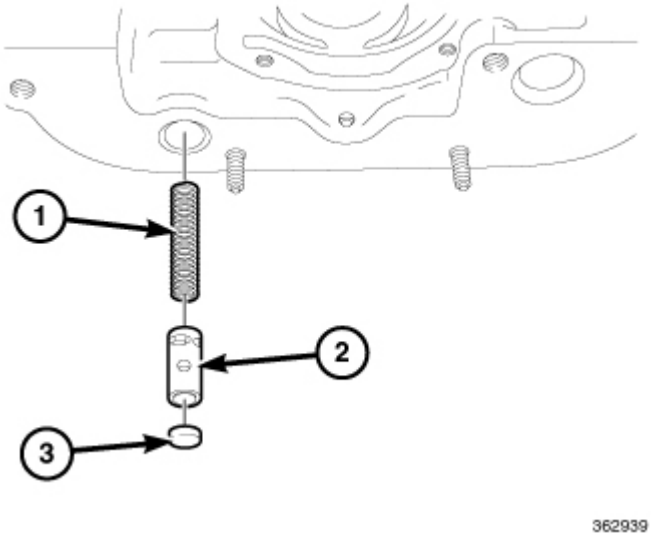

Fig. 185: Oil Pressure Relief Valve
Courtesy of CHRYSLER LLC

1 - SPRING 2 - RELIEF VALVE 3 - RETAINER CAP

NOTE: Always use a new relief valve. Do not reuse the old relief valve, it could have been damaged during removal.

1. Clean the relief valve, spring and bore.

NOTE: Lubricate the relief valve with clean engine oil before installing.

2. Install the spring (1) into the housing.
3. Install the relief valve (2) into housing, open end first.
4. Install a new retainer cap (3), open end out, until the cap is 1.75 mm (0.068 in.) to 2.25 mm (0.088 in.) past the sealing surface.
5. Install the oil pan. Refer to **PAN, OIL, INSTALLATION**.
6. Fill the crankcase with the proper oil to the correct level.

MANIFOLDS

MANIFOLD, EXHAUST, LEFT

REMOVAL

REMOVAL

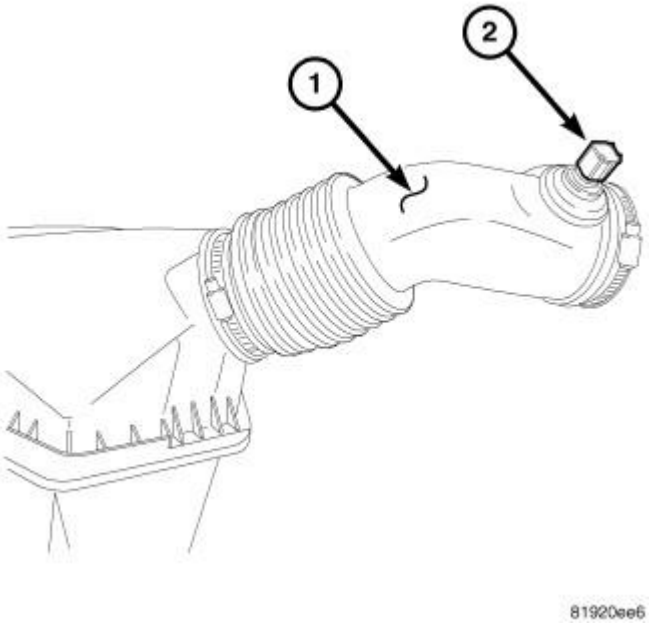

Fig. 186: Rubber Air Intake Tube & Intake Manifold Air Temperature (IAT) Sensor
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect battery negative cable.
2. Remove the fresh air hose (1).
3. Disconnect left cylinder bank spark plug wires.

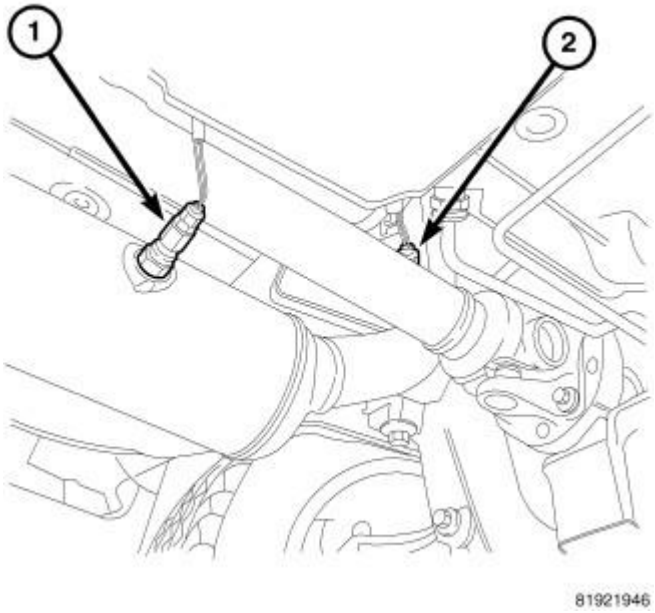

Fig. 187: O2 Sensors Left Side
Courtesy of CHRYSLER GROUP, LLC

4. Remove heat shield attaching bolts.
5. Remove bolts attaching exhaust to manifold.
6. Disconnect the left side oxygen sensors (1, 2).
7. Remove bolts attaching exhaust manifold to cylinder head.
8. Remove the exhaust manifold.

CLEANING

CLEANING

1. Discard gasket (if equipped) and clean all surfaces of manifold and cylinder head.

INSPECTION

INSPECTION

Inspect exhaust manifolds for damage or cracks and check distortion of the cylinder head mounting surface and exhaust crossover mounting surface with a straightedge and thickness gauge.

Manifold surface flatness limits should not exceed 1.0 mm (0.039 in.).

INSTALLATION

INSTALLATION

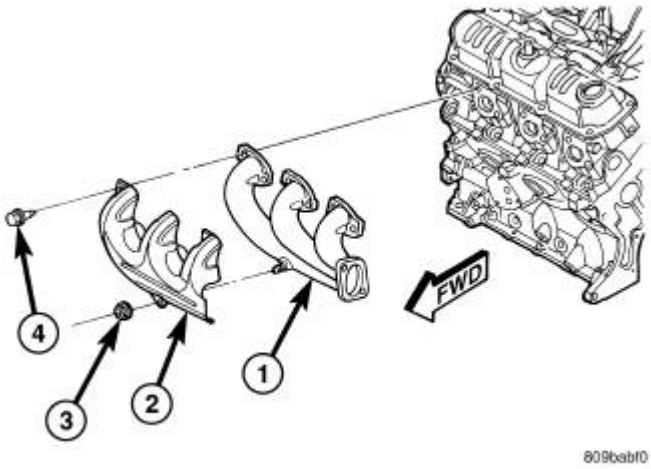

Fig. 188: Exhaust Manifold - Left
Courtesy of CHRYSLER GROUP, LLC

1 - EXHAUST MANIFOLD - LEFT BANK
2 - HEAT SHIELD
3 - NUT - HEAT SHIELD
4 - BOLT - EXHAUST MANIFOLD

1. Position exhaust manifold (1) on cylinder head. Install bolts to center runner (cylinder #4) and initial tighten to 2.8 N.m (25 in. lbs.).
2. Position heat shield (2) on manifold.
3. Install the remaining manifold attaching bolts. Tighten all bolts to 23 N.m (200 in. lbs.).
4. Install and tighten heat shield attaching nut (3) to 12 N.m (105 in. lbs.).

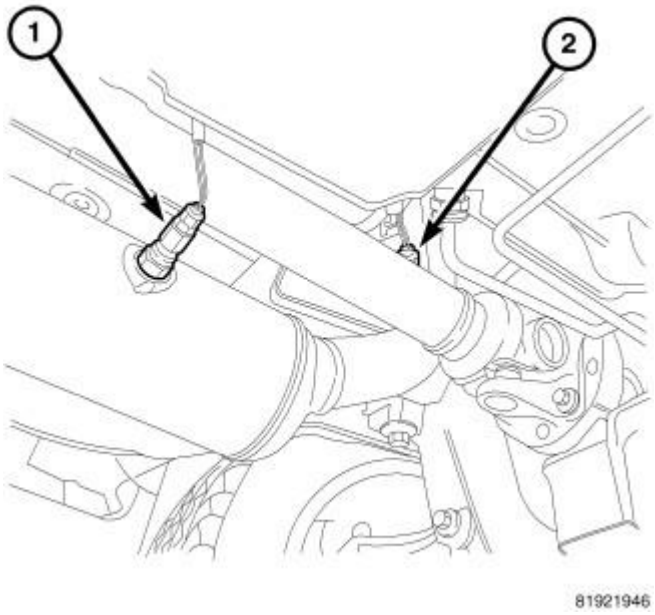

Fig. 189: O2 Sensors Left Side
Courtesy of CHRYSLER GROUP, LLC

5. Attach exhaust pipe to exhaust manifold and tighten bolts to 41 N.m (30 ft. lbs.).
6. Connect the left side oxygen sensors (1, 2).
7. Connect battery negative cable.

MANIFOLD, EXHAUST, RIGHT

REMOVAL

REMOVAL

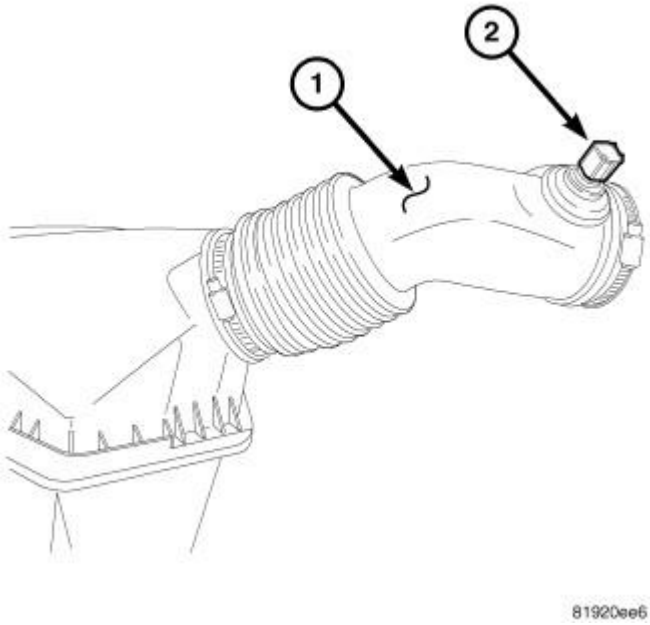

Fig. 190: Rubber Air Intake Tube & Intake Manifold Air Temperature (IAT) Sensor
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect battery negative cable.
2. Separate the exhaust pipe at the exhaust manifold.
3. Remove the air cleaner hose (1) and housing.

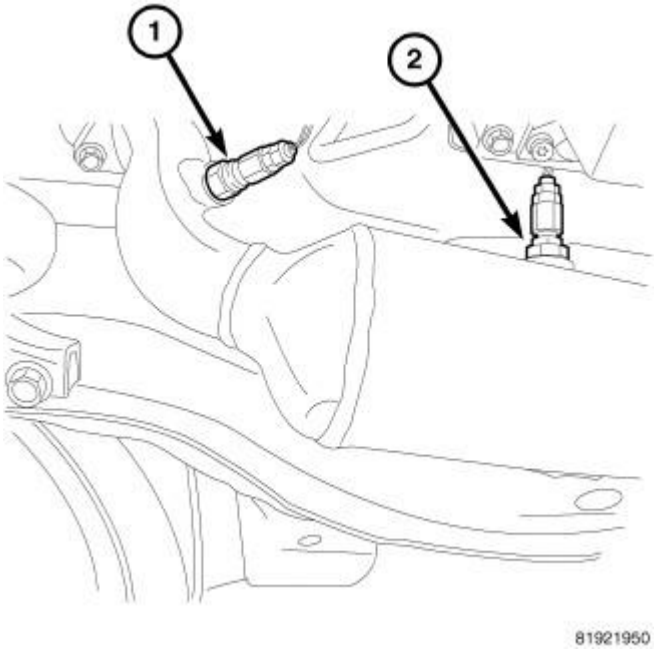

Fig. 191: O2 Sensors Right Side
Courtesy of CHRYSLER GROUP, LLC

4. Disconnect the TPS, IAC and purge vacuum hose from the throttle body.
5. Disconnect the spark plug wires at the spark plugs.
6. Disconnect the oxygen sensors (1, 2).
7. Remove bolts attaching exhaust manifold to cylinder head and remove manifold.
8. Inspect and clean manifold.

CLEANING

CLEANING

1. Discard gasket (if equipped) and clean all surfaces of manifold and cylinder head.

INSPECTION

INSPECTION

Inspect exhaust manifolds for damage or cracks and check distortion of the cylinder head mounting surface and exhaust crossover mounting surface with a straightedge and thickness gauge.

Manifold surface flatness limits should not exceed 1.0 mm (0.039 in.).

INSTALLATION

INSTALLATION

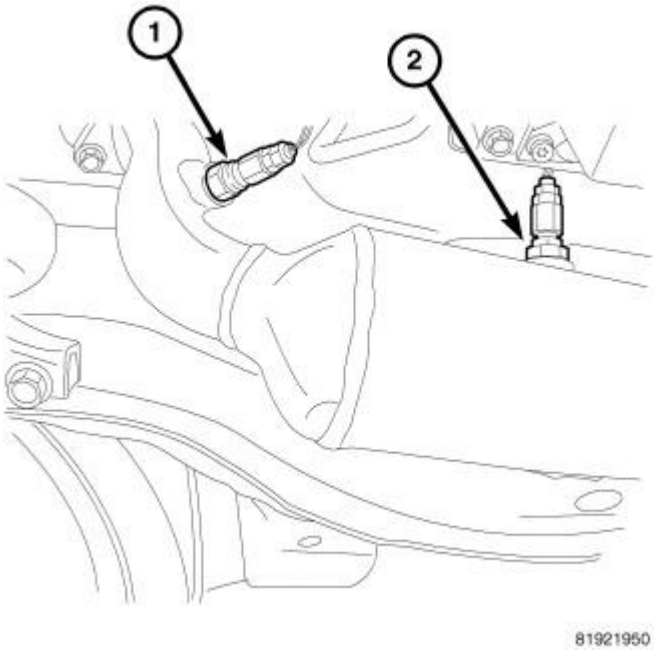

Fig. 192: O2 Sensors Right Side
Courtesy of CHRYSLER GROUP, LLC

1. Position exhaust manifold on cylinder head and install bolts to center runner (cylinder # 3) and initial

tighten to 2.8 N.m (25 in. lbs.).

2. Install the remaining manifold attaching bolts. Tighten all bolts to 23 N.m (200 in. lbs.).
3. Connect the oxygen sensors (1, 2).
4. Connect the spark plug wires to the spark plugs.

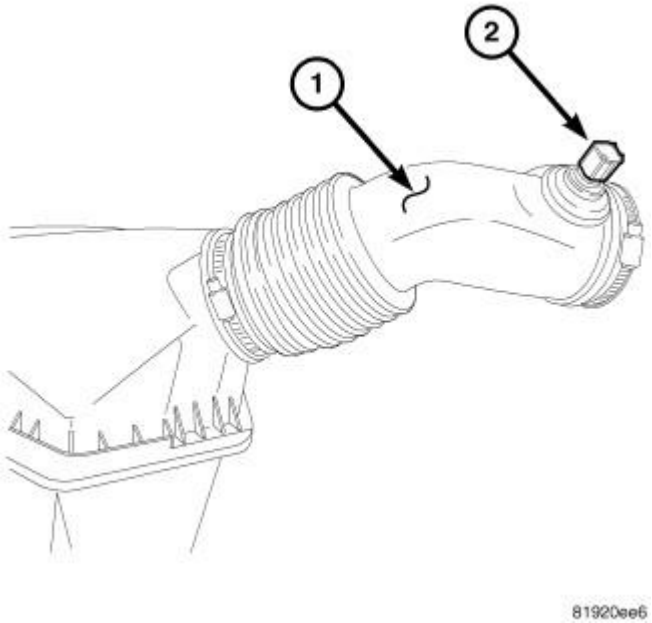

Fig. 193: Rubber Air Intake Tube & Intake Manifold Air Temperature (IAT) Sensor
Courtesy of CHRYSLER GROUP, LLC

5. Connect the IAC, TPS and the EVAP hose to the throttle body.
6. Attach exhaust pipe to exhaust manifold.
7. Install the air cleaner housing and hose (1).
8. Connect battery negative cable.

MANIFOLD, INTAKE

DESCRIPTION

DESCRIPTION

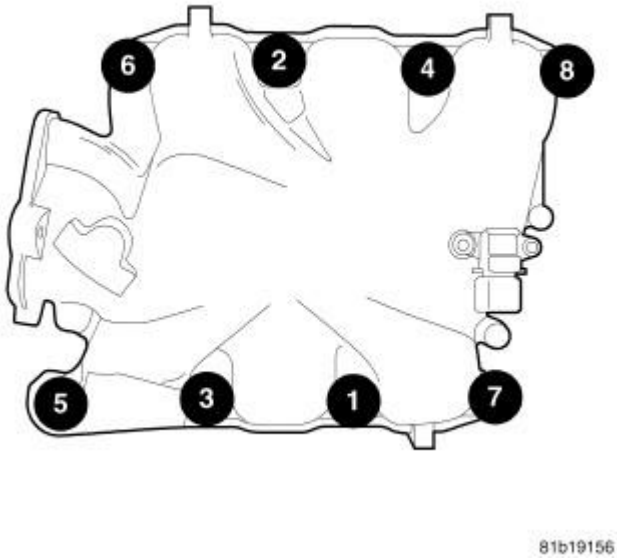

Fig. 194: Intake Manifold Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

The intake system is made up of an upper and lower intake manifold. The upper intake manifold is made of a composite material for the 3.8L engine. The lower intake manifold also provides coolant crossover between cylinder heads and houses the coolant thermostat.

The intake manifold utilizes a compact design with very low restriction and outstanding flow balance. This design allows the engine to perform with a wide torque curve while increasing higher rpm horsepower.

If, for some reason, the molded-in vacuum ports break, the composite manifold can be salvaged. The vacuum ports are designed to break at the shoulder, if overloaded. Additional material in the shoulder area provides sufficient stock to repair. Also, if the special screws that attach the MAP sensor, power steering reservoir, and the EGR tube become stripped, an oversized screw is available to repair the stripped-out condition.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKS

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or the fan. Do not wear loose clothing.

1. Start the engine.
2. Spray a small stream of water (Spray Bottle) at the suspected leak area.
3. If engine RPM'S change, the area of the suspected leak has been found.

4. Repair as required.

STANDARD PROCEDURE

MANIFOLD STRIPPED THREAD REPAIR

The composite upper intake manifold thread bosses, if stripped out, can be repaired by utilizing a repair screw available through Mopar® parts. Repair screws are available for the following manifold attached components:

- MAP sensor
- Power steering reservoir
- EGR tube
- Throttle cable bracket

The repair screws require a unique tightening torque specification from the original screw. Refer to the following chart for specification.

DESCRIPTION	TORQUE*
STRIP-OUT REPAIR SCREWS ONLY	
MAP Sensor Repair Screw	4 N.m (35 in. lbs.)
Power Steering Reservoir Repair Screw	9 N.m (80 in. lbs.)
EGR Tube Attaching Repair Screw	9 N.m (80 in. lbs.)
Throttle Cable Bracket Repair Screw	9 N.m (80 in. lbs.)
*Install Slowly Using Hand Tools Only	

INTAKE MANIFOLD VACUUM PORT REPAIR

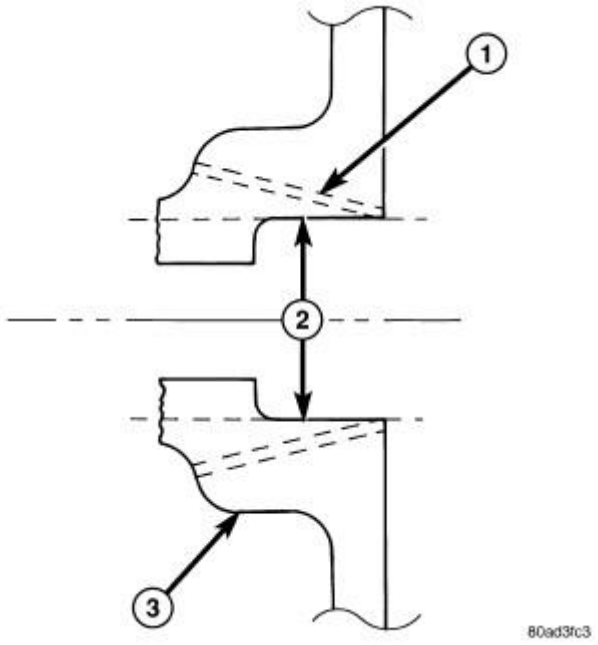

Fig. 195: Intake Manifold Port Repair
Courtesy of CHRYSLER GROUP, LLC

1 - BRAKE BOOSTER PORT = 1/4"-18 NPT PIPE TAP
1 - LDP/SPEED CONTROL PORT = 1/8"-18 NPT PIPE TAP
2 - DRILL BIT = 7/16" BRAKE BOOSTER PORT
2 - DRILL BIT = 11/32" LDP/SPEED CONTROL PORT
3 - INTAKE MANIFOLD

NOTE: While performing this procedure, avoid getting the manifold material residue into the plenum chamber.

The composite intake manifold vacuum ports can be repaired. Although, if the manifold plenum chamber is damaged or cracked, the manifold must be replaced.

To repair a broken or damaged vacuum port on the composite intake manifold, perform the following procedure:

PARTS REQUIRED	TOOLS REQUIRED
Brass Port - 1/4" O.D. x 1/8" pipe thread (LDP/Speed Control Port)	Pipe Tap - 1/8" - 18 NPT Drill Bit - 11/32" File/Sandpaper
Brass Port - 1/2" O.D. x 1/4" pipe thread (Brake Booster Port)	Pipe Tap - 1/4" - 18 NPT Drill Bit - 7/16" File/Sandpaper

1. File or sand the remaining port back until a flat surface is obtained (plane normal to port axis).
2. Drill out the port base using a 7/16" (brake booster port) or 11/32" (LDP/speed control port) drill bit.
3. Using a 1/4"-18 NPT (brake booster port) or 1/8"-18 NPT (LDP/speed control port) pipe tap, cut internal threads. Use caution to start tap in a axis same as original port.
4. Apply Mopar® Thread Sealant to threads of repair port (s).
5. Install repair port (s). Do not over torque repair port (s).

REMOVAL

REMOVAL

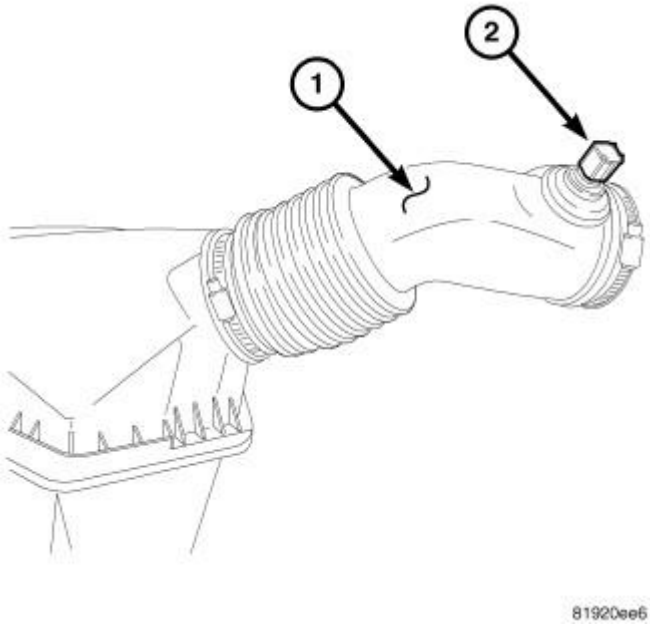

Fig. 196: Rubber Air Intake Tube & Intake Manifold Air Temperature (IAT) Sensor
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect and isolate the negative battery cable.
2. Disconnect the Inlet Air Temperature (IAT) sensor electrical connector (2).
3. Remove air inlet resonator to throttle body hose assembly (1).

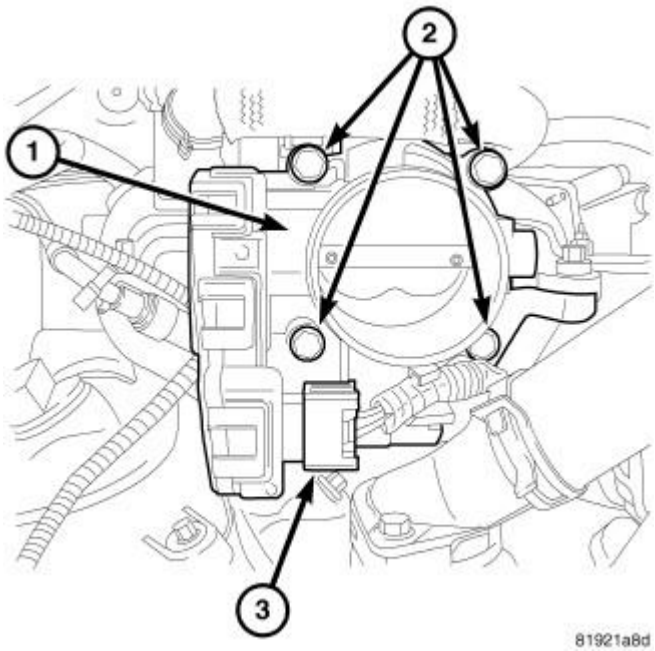

Fig. 197: Throttle Body, Bolts & Connector
Courtesy of CHRYSLER GROUP, LLC

4. Disconnect the throttle body (1) electrical connector (3).
5. Disconnect the EVAP hose at the throttle body.

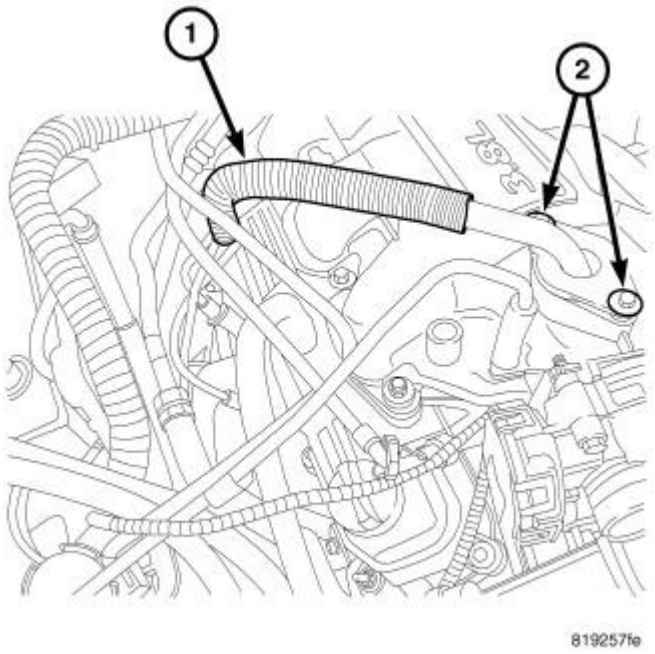

Fig. 198: EGR Tube, Flange & Fasteners
Courtesy of CHRYSLER GROUP, LLC

6. Remove the EGR tube (1). Refer to **TUBE, EXHAUST GAS RECIRCULATION (EGR), REMOVAL** .

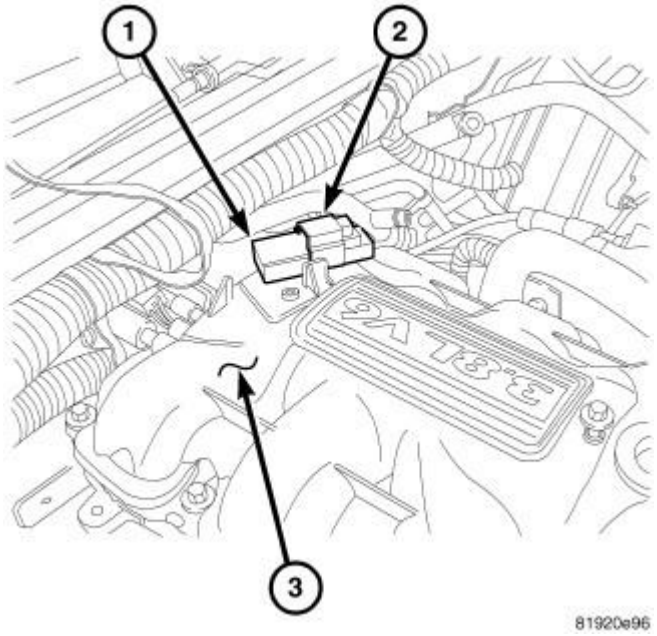

Fig. 199: MAP Sensor & Upper Intake Manifold
Courtesy of CHRYSLER GROUP, LLC

7. Disconnect the Manifold Absolute Pressure (MAP) sensor (1) electrical connector (2) at the rear of the intake manifold (3).

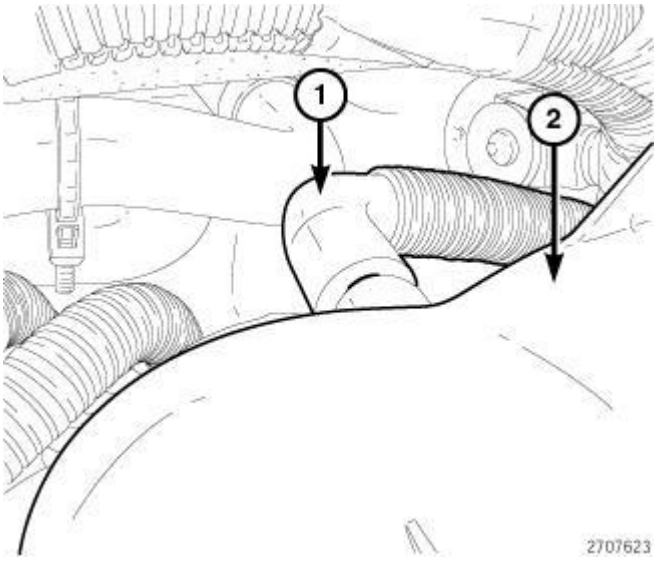

Fig. 200: Power Brake Booster Hose & Intake Manifold
Courtesy of CHRYSLER GROUP, LLC

8. Disconnect the power brake booster hose (1) at the rear of the intake manifold (2) and position aside.

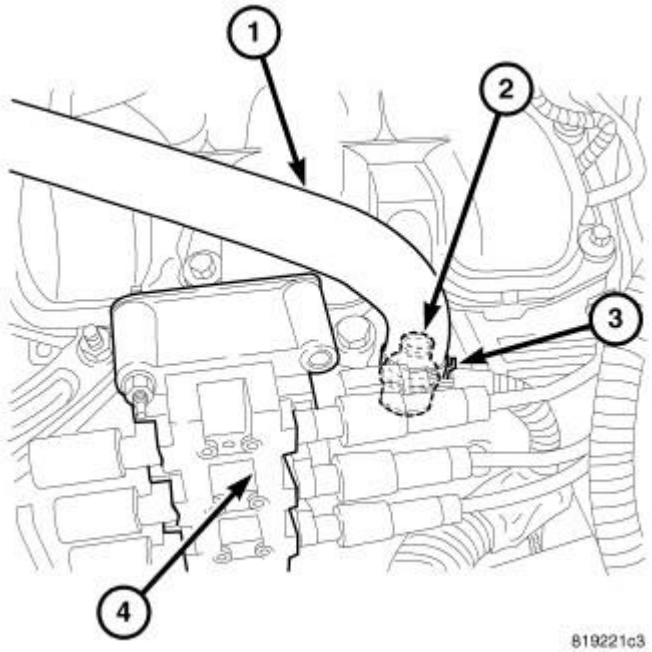

Fig. 201: PCV Valve Location 3.8L
Courtesy of CHRYSLER GROUP, LLC

9. Disconnect the PCV hose (1) from the upper intake manifold.

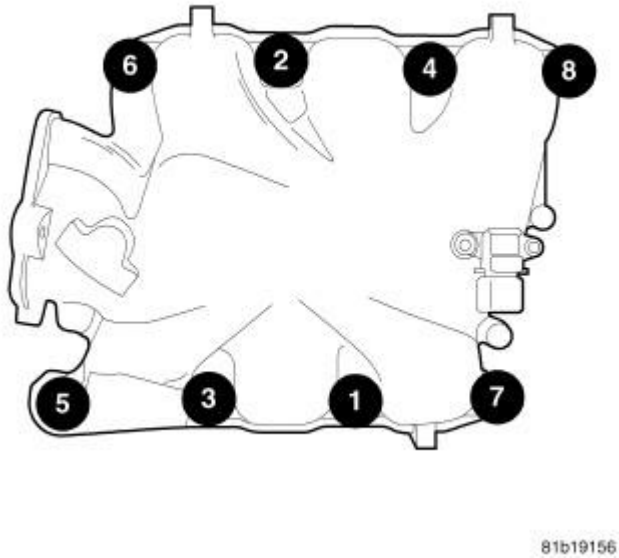

Fig. 202: Intake Manifold Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

10. Remove the upper intake manifold bolts and remove the manifold.
11. Cover the lower intake manifold ports with a suitable cover while the upper manifold is removed.

12. Clean and inspect the upper intake manifold.

CLEANING

CLEANING

1. Discard gasket(s).
2. Clean all sealing surfaces.

INSPECTION

INSPECTION

Check manifold for:

- Damage and cracks.
- Mounting surface distortion by using a straightedge and thickness gauge.

INSTALLATION

INSTALLATION

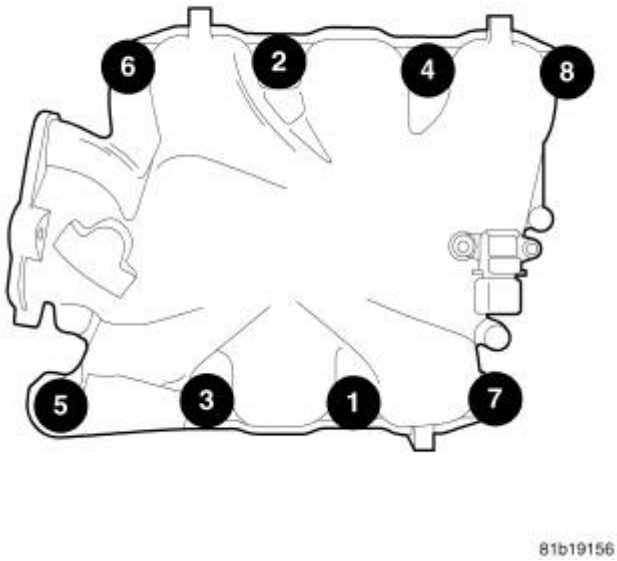

Fig. 203: Intake Manifold Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

1. Clean the gasket surfaces and remove the covering from the lower intake manifold ports.
2. Inspect the intake manifold gasket condition (gaskets can be re-used if not damaged).
3. Position the intake manifold gaskets into the seal channels and press lightly into place.

4. Position the upper intake manifold onto the lower intake manifold.
5. Apply Mopar® Lock and Seal Adhesive (Medium Strength Threadlocker) to each upper intake manifold bolt.
6. Install the intake manifold bolts and tighten bolts in the sequence shown in illustration to 12 N.m (105 in. lbs.).

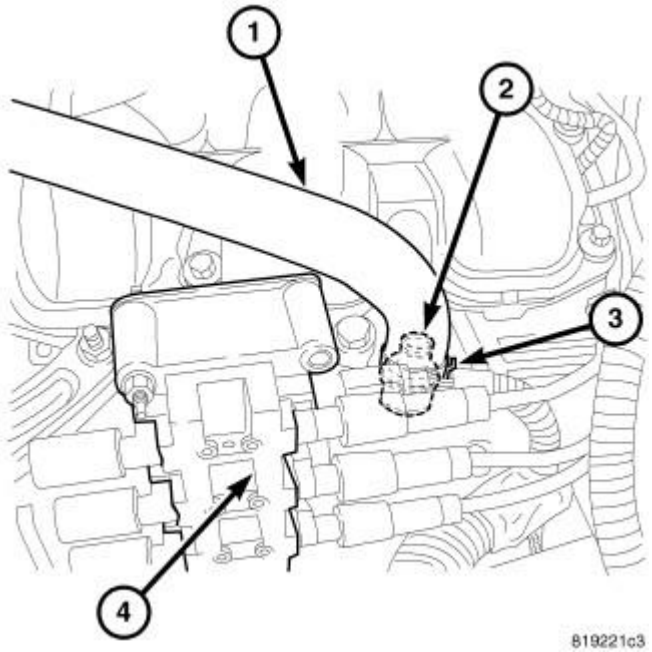

Fig. 204: PCV Valve Location 3.8L
Courtesy of CHRYSLER GROUP, LLC

7. Connect the PCV hose (1) to the upper intake manifold.

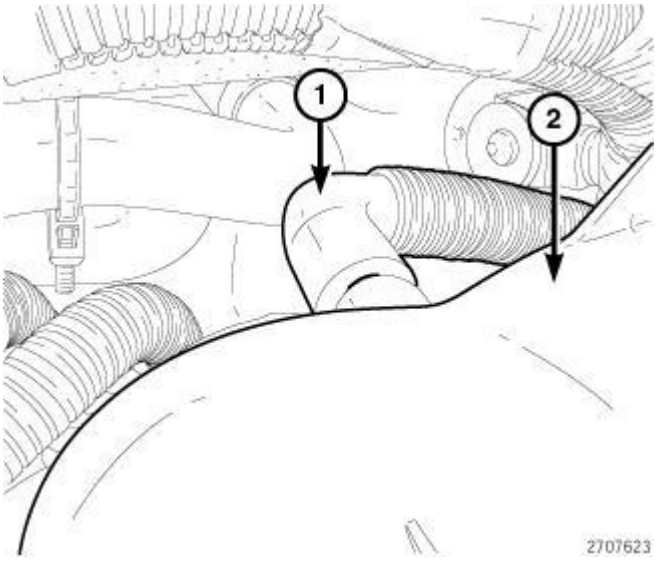

Fig. 205: Power Brake Booster Hose & Intake Manifold
Courtesy of CHRYSLER GROUP, LLC

8. Connect the power brake booster hose (1) at the rear of the intake manifold (2).

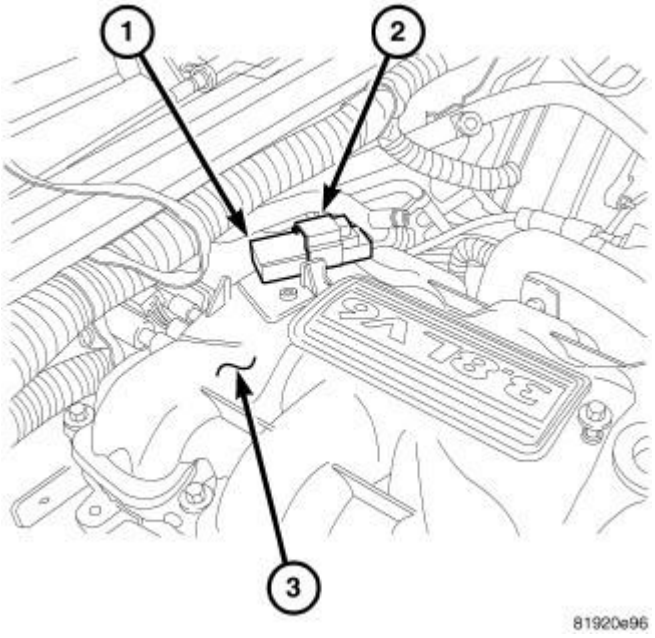

Fig. 206: MAP Sensor & Upper Intake Manifold
Courtesy of CHRYSLER GROUP, LLC

9. If removed, install the MAP sensor (1) at the rear of the intake manifold (3) by pushing down on the MAP sensor while rotating clockwise about 1/4 turn.
10. Connect the MAP sensor electrical connector (2).

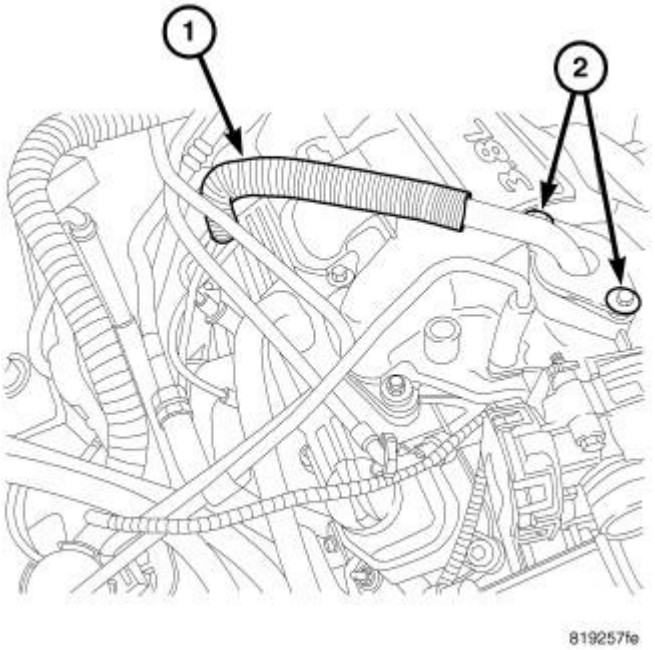

Fig. 207: EGR Tube, Flange & Fasteners

Courtesy of CHRYSLER GROUP, LLC

CAUTION: The special screws used for attaching the EGR tube to the manifold must be installed slowly using hand tools only. This requirement is to prevent the melting of material that causes stripped threads. If threads become stripped, an oversize repair screw is available.

11. Install the EGR tube (1). Refer to **TUBE, EXHAUST GAS RECIRCULATION (EGR), INSTALLATION** .

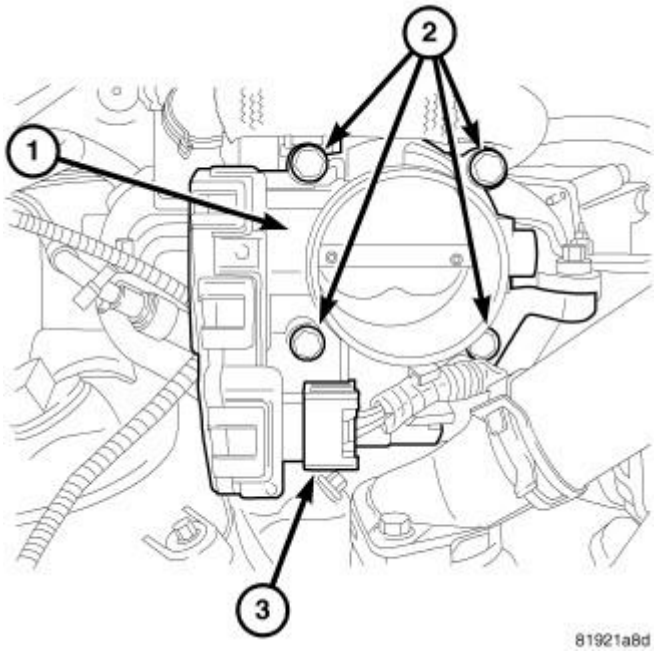

Fig. 208: Throttle Body, Bolts & Connector
Courtesy of CHRYSLER GROUP, LLC

12. Connect the EVAP hose to the throttle body (1).
13. Connect the throttle body electrical connector (3).

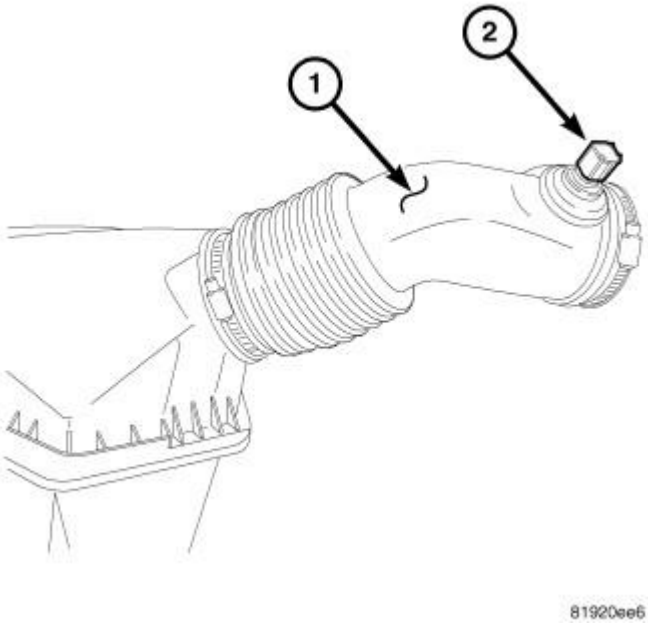

Fig. 209: Rubber Air Intake Tube & Intake Manifold Air Temperature (IAT) Sensor
Courtesy of CHRYSLER GROUP, LLC

14. Install the air cleaner and air inlet hose assembly (1).
15. Connect the inlet air temperature (IAT) sensor electrical connector (2).
16. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).

MANIFOLD, INTAKE, LOWER

REMOVAL

REMOVAL

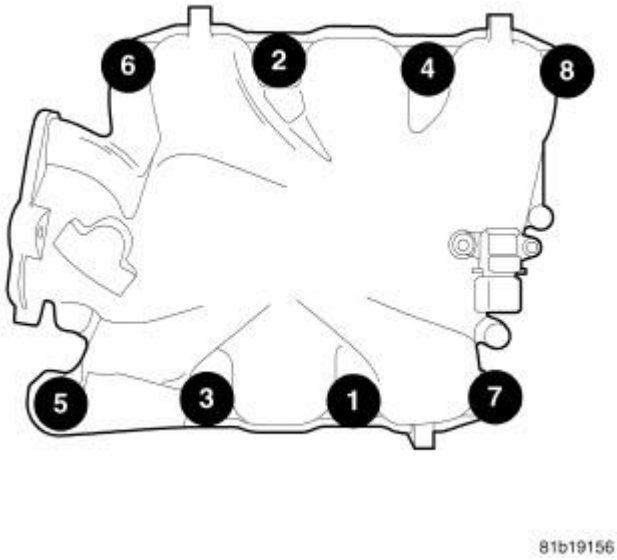

Fig. 210: Intake Manifold Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

1. Perform fuel system pressure release procedure. Refer to **FUEL SYSTEM PRESSURE RELEASE** .
2. Drain the cooling system.
3. Remove the upper intake manifold. Refer to **MANIFOLD, INTAKE, REMOVAL** and **MANIFOLD, INTAKE, LOWER, REMOVAL**.

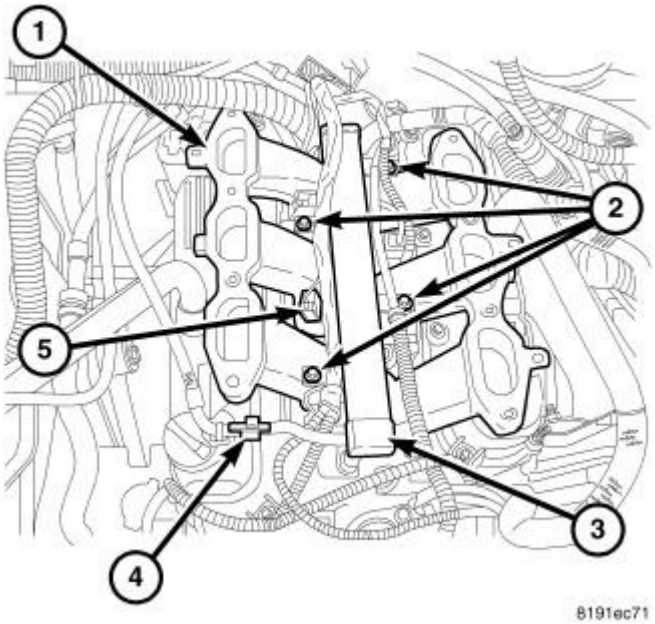

Fig. 211: Fuel Injectors, Line, Rail & Fasteners 3.8L
Courtesy of CHRYSLER GROUP, LLC

4. Remove the fuel line (4). Refer to **STANDARD PROCEDURE - QUICK-CONNECT FITTINGS** .
5. Remove ignition coil and bracket.
6. Disconnect heater supply hose and engine coolant temperature sensor.

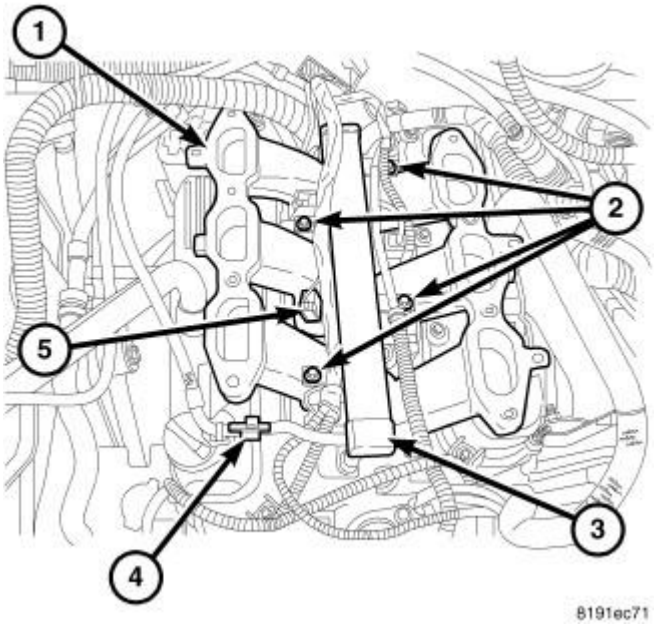

Fig. 212: Fuel Injectors, Line, Rail & Fasteners 3.8L
Courtesy of CHRYSLER GROUP, LLC

7. Disconnect the fuel injector wire harness.
8. Remove the fuel injectors and rail assembly (3). Refer to **RAIL, FUEL, REMOVAL** .
9. Remove radiator upper hose.

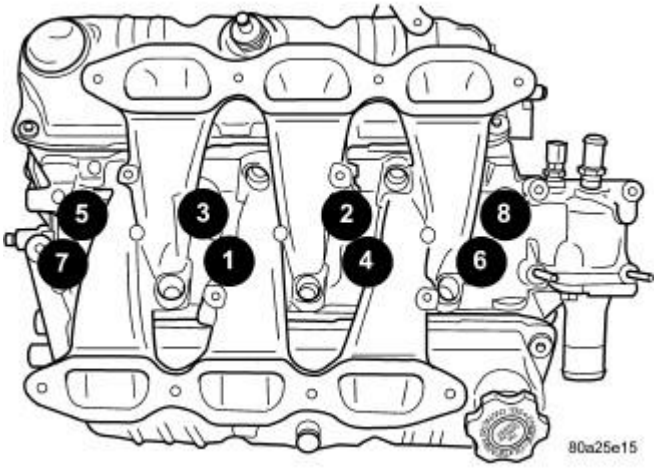

Fig. 213: Lower Manifold Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

10. Remove the intake manifold bolts.
11. Remove lower intake manifold.

WARNING: INTAKE MANIFOLD GASKET IS MADE OF VERY THIN METAL AND MAY CAUSE PERSONAL INJURY, HANDLE WITH CARE.

12. Remove intake manifold seal retainers screws. Remove intake manifold gasket.

CLEANING

CLEANING

1. Discard gasket(s).
2. Clean all sealing surfaces.

INSPECTION

INSPECTION

Check for:

- Damage and cracks of each section.
- Clogged water passages in end cross-overs (if equipped).
- Check for cylinder head mounting surface distortion using a straightedge and thickness gauge. Refer to **Engine/Cylinder Head - Inspection**.

INSTALLATION

INSTALLATION

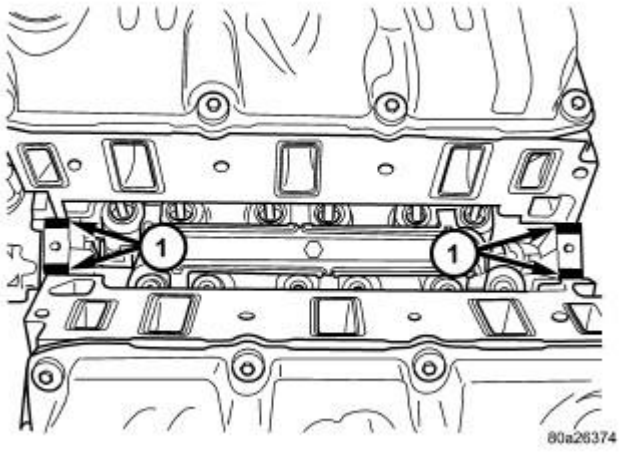

Fig. 214: Intake Manifold Gasket Sealing Locations
Courtesy of CHRYSLER GROUP, LLC

1 - SEALER LOCATIONS

1. Place a bead (approximately 1/4 in. diameter) of Mopar® Engine RTV GEN II onto each of the **four** manifold to cylinder head gasket corners (1).
2. Carefully install the new intake manifold gasket. Tighten end seal retainer screws to 12 N.m (105 in. lbs.).

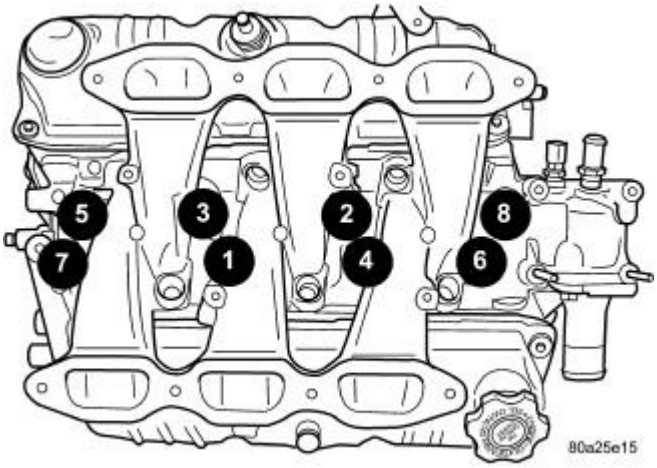

Fig. 215: Lower Manifold Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

3. Install lower intake manifold. Install the bolts and torque to 1 N.m (10 in. lbs.). Then torque bolts to 22 N.m (200 in. lbs.) in sequence shown in illustration. Then torque again to 22 N.m (200 in. lbs.). After intake manifold is in place, **inspect to make sure seals are in place.**

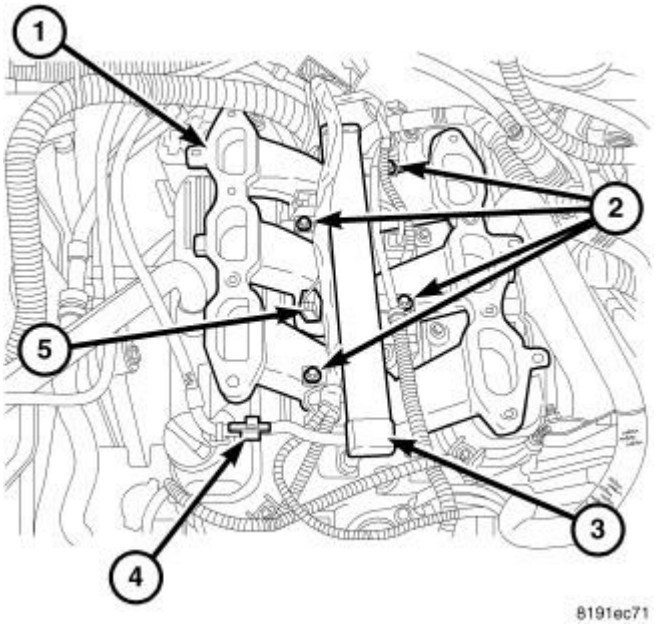

Fig. 216: Fuel Injectors, Line, Rail & Fasteners 3.8L

Courtesy of CHRYSLER GROUP, LLC

4. Install the fuel injectors and rail assembly (3). Refer to **RAIL, FUEL, INSTALLATION** .
5. Connect fuel injector electrical harness.

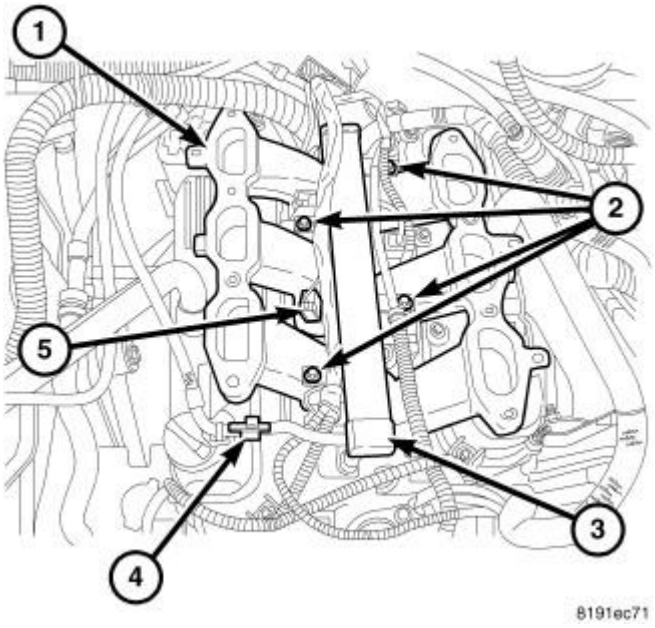

Fig. 217: Fuel Injectors, Line, Rail & Fasteners 3.8L
Courtesy of CHRYSLER GROUP, LLC

6. Connect the engine coolant temperature sensor.
7. Connect the heater supply and radiator upper hoses to manifold.
8. Connect the fuel line (4). Refer to **STANDARD PROCEDURE - QUICK-CONNECT FITTINGS** . .

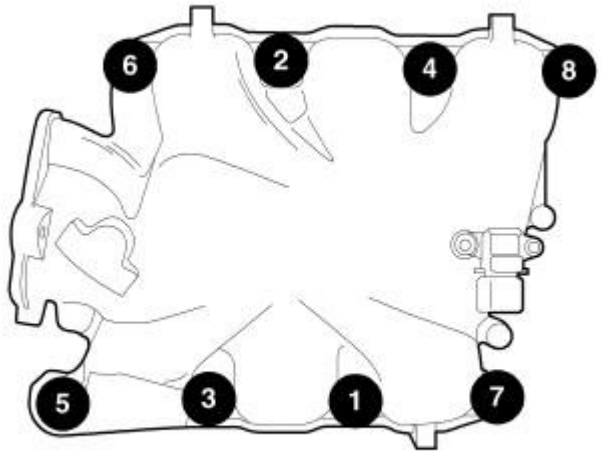

Fig. 218: Intake Manifold Removal/Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

9. Install the upper intake manifold. Refer to **MANIFOLD, INTAKE, INSTALLATION** and **MANIFOLD, INTAKE, LOWER, INSTALLATION**.
10. Connect negative battery cable.
11. Fill the cooling system.
12. Connect the negative battery cable.

VALVE TIMING

STANDARD PROCEDURE

VALVE TIMING VERIFICATION

1. Remove front cylinder head cover and all 6 spark plugs.
2. Rotate engine until the #2 piston is at TDC of the compression stroke.
3. Install a degree wheel on the crankshaft pulley.
4. With proper adaptor, install a dial indicator into #2 spark plug hole. Using the indicator find TDC on the compression stroke.
5. Position the degree wheel to zero.
6. Remove dial indicator from spark plug hole.
7. Place a 5.08 mm (0.200 in.) spacer between the valve stem tip of #2 intake valve and rocker arm pad. Allow tappet to bleed down to give a solid tappet effect.
8. Install a dial indicator so plunger contacts the #2 intake valve spring retainer as nearly perpendicular as possible. Zero the indicator.

9. Rotate the engine clockwise until the intake valve has lifted 0.254 mm (0.010 in.).

CAUTION: Do not turn crankshaft any further clockwise as intake valve might bottom and result in serious damage.

10. Degree wheel should read 6 degrees BTDC to 6 degrees ATDC.

MEASURING TIMING CHAIN WEAR

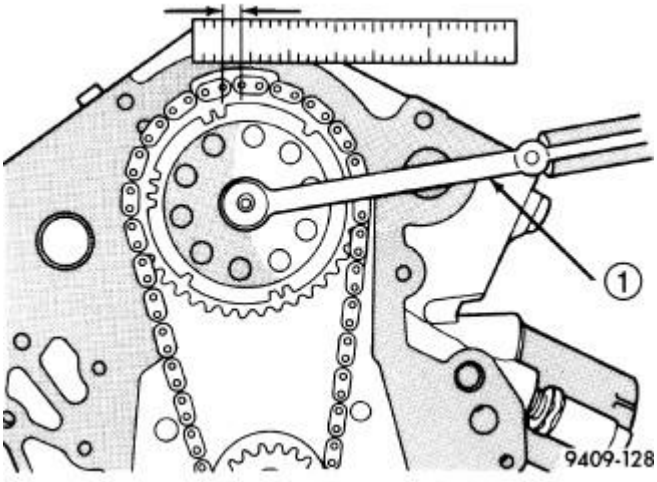

Fig. 219: Measuring Timing Chain Wear
Courtesy of CHRYSLER GROUP, LLC

1 - TORQUE WRENCH

1. Position a scale next to timing chain so that any movement of chain may be measured.
2. Position a torque wrench and socket on the camshaft sprocket attaching bolt. Apply force in the direction of crankshaft rotation to take up slack to the following torque:
   - 41 N.m (30 ft. lb.) with cylinder heads installed
   - 20 N.m (15 ft. lb.) with cylinder heads removed

NOTE: With torque applied to the camshaft sprocket bolt, crankshaft should not be permitted to move. It may be necessary to block crankshaft to prevent rotation.

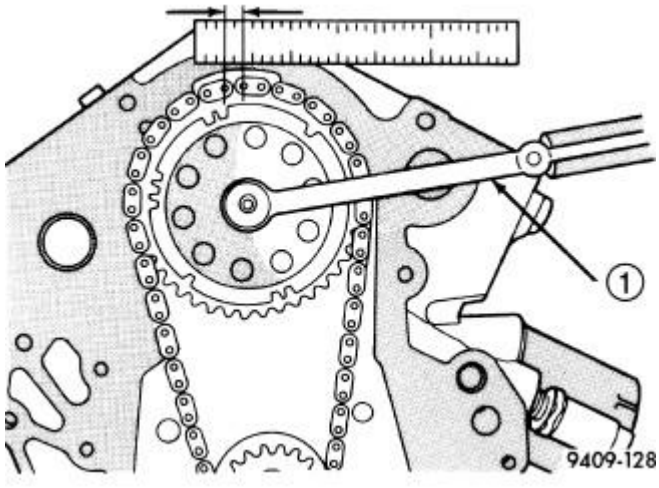

Fig. 220: Measuring Timing Chain Wear
Courtesy of CHRYSLER GROUP, LLC

1 - TORQUE WRENCH

3. Holding a measuring scale along edge of chain links.
4. Apply force in the reverse direction to the following torque:
   - 41 N.m (30 ft. lb.) with cylinder heads installed
   - 20 N.m (15 ft. lb.) with cylinder heads removed
5. Measure amount of sprocket/chain movement.
6. Install a new timing chain and sprockets if movement exceeds 3.175 mm (1/8 in.).

CHAIN AND SPROCKETS, TIMING

REMOVAL

TIMING CHAIN AND CAMSHAFT SPROCKET

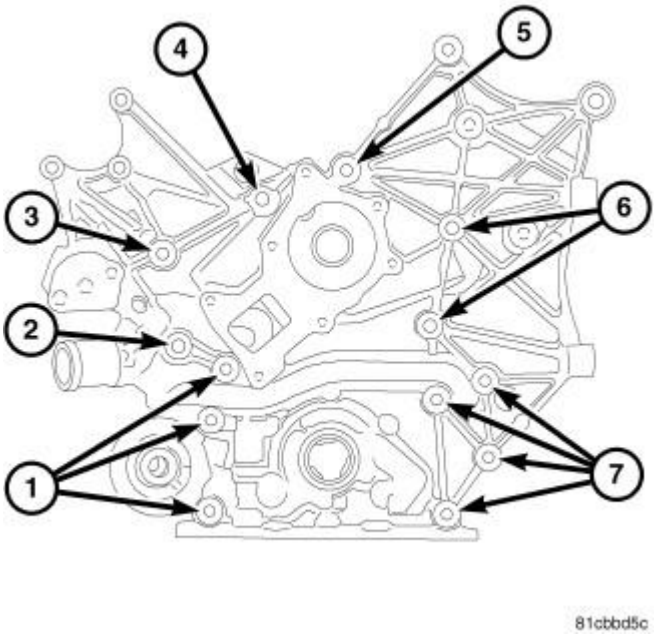

Fig. 221: Timing Cover Bolt Location
Courtesy of CHRYSLER GROUP, LLC

1, 7 - BOLT - M8 x 1.25 x 80	4 - BOLT - M10 x 1.5 x 85
2 - BOLT - M10 x 1.5 x 85	5 - BOLT - M8 x 1.25 x 80
3 - BOLT - M8 x 1.25 x 80	6 - BOLT - M10 x 1.5 x 85

1. Disconnect negative cable from battery.
2. Remove the timing chain cover bolts (1-7), and timing cover. Refer to **COVER(S), ENGINE TIMING, REMOVAL**.

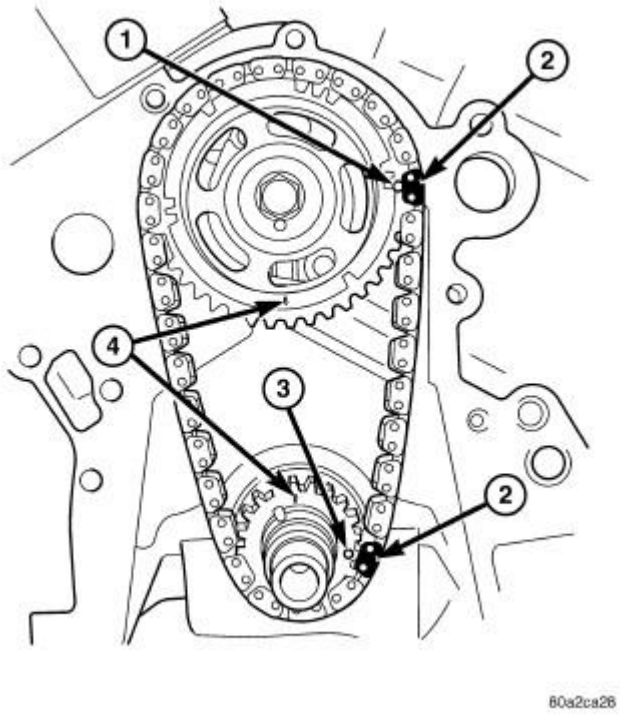

Fig. 222: Timing Marks
Courtesy of CHRYSLER GROUP, LLC

1 - CAMSHAFT SPROCKET TIMING MARK (DOT)
2 - PLATED LINK
3 - CRANKSHAFT SPROCKET TIMING MARK (DOT)
4 - ARROWS

3. Rotate engine by turning crankshaft until the timing marks are aligned as shown in illustration (4).
4. Remove camshaft sprocket attaching bolt.
5. Remove the timing chain with camshaft sprocket.
6. Remove the crankshaft sprocket.

CRANKSHAFT SPROCKET

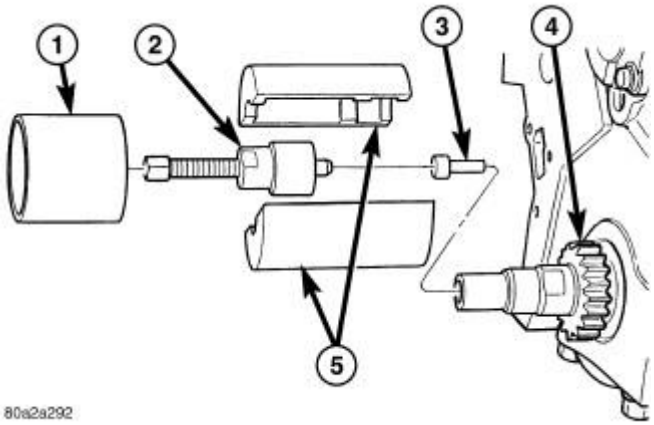

Fig. 223: Crankshaft Sprocket - Removal
Courtesy of CHRYSLER GROUP, LLC

1 - SPECIAL TOOL 5048
2 - SPECIAL TOOL 8452
3 - SPECIAL TOOL 8450
4 - CRANKSHAFT SPROCKET
5 - SPECIAL TOOL 8539

1. Remove the timing chain. Refer to **CHAIN AND SPROCKETS, TIMING, REMOVAL**.

NOTE: Be careful not to damage the crankshaft surface during crankshaft sprocket removal.

2. Using Special Tools (special tool #5048, Puller, Bearing) (1), (special tool #8452, Installer, Crankshaft Sprocket) (2), (special tool #8450, Insert, Crankshaft) (3) and (special tool #8539, Remover, Sprocket) (5) remove the crankshaft sprocket (4) while holding the crankshaft from turning.

INSTALLATION

CRANKSHAFT SPROCKET

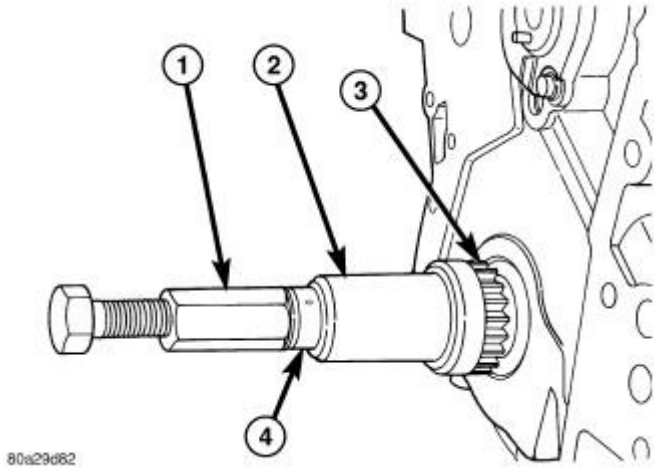

Fig. 224: Crankshaft Sprocket - Installation
Courtesy of CHRYSLER GROUP, LLC

1 - SPECIAL TOOL 8452
2 - SPECIAL TOOL 8452
3 - CRANKSHAFT SPROCKET
4 - THRUST BEARING/WASHER

NOTE: Be careful not to damage the crankshaft surface during crankshaft sprocket installation.

1. Position the sprocket onto the crankshaft (timing mark out) with the timing slot aligned with the timing pin.
2. Using Special Tool (special tool #8452, Installer, Crankshaft Sprocket) (1, 2), install the crankshaft sprocket until it is fully seated onto the crankshaft.
3. Install the timing chain. Refer to **CHAIN AND SPROCKETS, TIMING, INSTALLATION**.

TIMING CHAIN AND CAMSHAFT SPROCKET

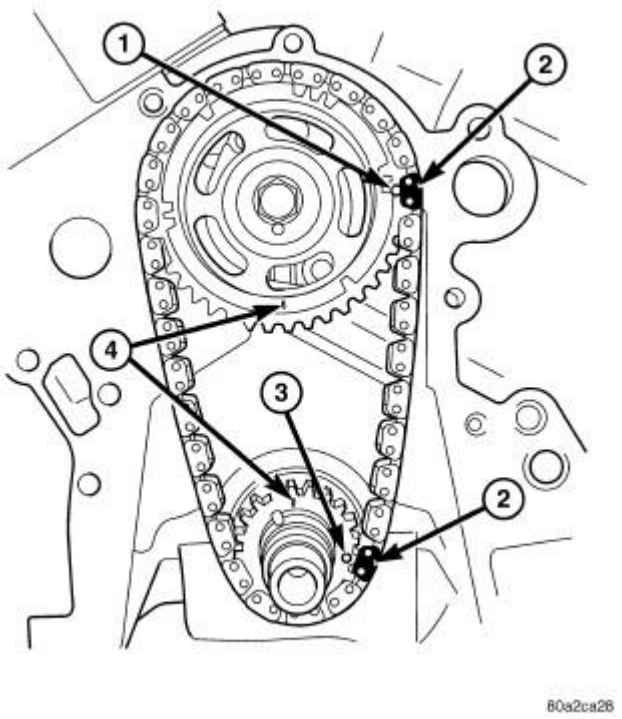

Fig. 225: Timing Marks
Courtesy of CHRYSLER GROUP, LLC

1 - CAMSHAFT SPROCKET TIMING MARK (DOT)
2 - PLATED LINK
3 - CRANKSHAFT SPROCKET TIMING MARK (DOT)
4 - ARROWS

1. Rotate the crankshaft so the timing arrow is to the 12 o'clock position (4).

NOTE: Lubricate the timing chain and sprockets with clean engine oil before installation.

2. While holding the camshaft sprocket and chain in hand, place the timing chain around the sprocket, aligning the plated link (2) with the dot on the sprocket (1). Position the timing arrow (4) to the 6 o'clock position.
3. Place the timing chain around crankshaft sprocket with the plated link (2) lined up with the dot on the sprocket (3). Install the camshaft sprocket into position.
4. Use a straight edge to check alignment of timing marks (4).
5. Install the camshaft sprocket bolt and washer. Tighten the bolt to 54 N.m (40 ft. lbs.).
6. Rotate the crankshaft two revolutions and check the timing mark alignment (4). If timing marks do not line up, remove the camshaft sprocket and realign.

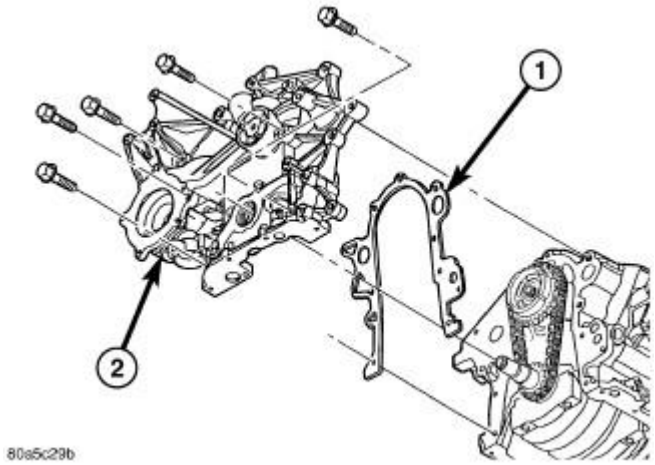

Fig. 226: Timing Chain Cover & Gasket
Courtesy of CHRYSLER GROUP, LLC

1 - GASKET
2 - TIMING CHAIN COVER

7. Install the timing chain cover. Refer to **COVER(S), ENGINE TIMING, INSTALLATION**.
8. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).

NOTE: The Cam/Crank Variation Relearn procedure must be performed anytime there has been a repair/replacement made to a powertrain system, for example: flywheel, valvetrain, camshaft and/or crankshaft sensors or components. Refer to DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard Procedure . .

COVER(S), ENGINE TIMING

REMOVAL

REMOVAL

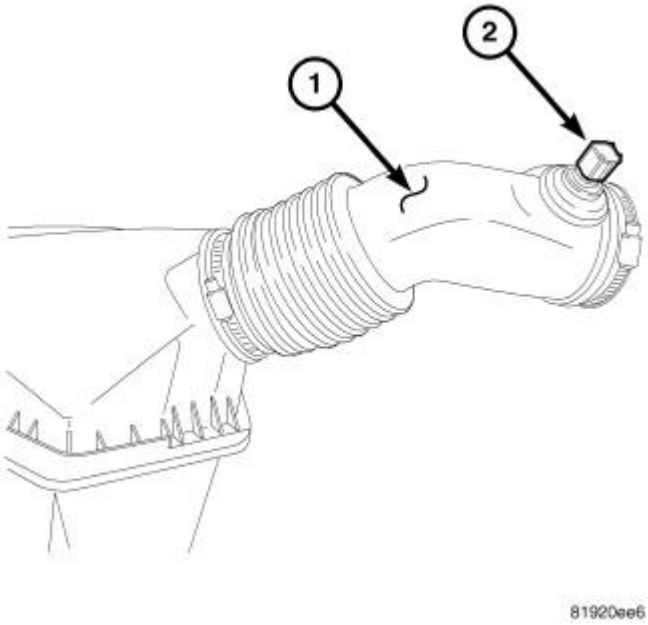

Fig. 227: Rubber Air Intake Tube & Intake Manifold Air Temperature (IAT) Sensor
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect and isolate the negative battery cable.
2. Drain the cooling system. Refer to **STANDARD PROCEDURE** .
3. Remove the air cleaner hose (1) and housing assembly. Refer to **BODY, AIR CLEANER, REMOVAL**.

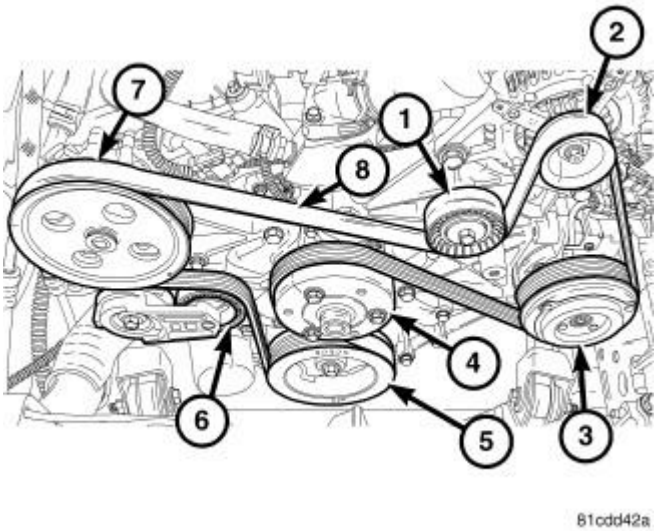

Fig. 228: Accessory Drive Belt Routing, Tensioner & Pulleys
Courtesy of CHRYSLER GROUP, LLC

1 - IDLER PULLEY
2 - GENERATOR PULLEY

3 - A/C COMPRESSOR
4 - WATER PUMP PULLEY
5 - CRANKSHAFT PULLEY
6 - ACCESSORY DRIVE BELT TENSIONER
7 - P/S PUMP PULLEY
8 - ACCESSORY DRIVE BELT

4. Loosen the three mounting bolts at the water pump pulley (4).
5. Remove the accessory drive belt (8) and belt tensioner (6). Refer to **TENSIONER, BELT, REMOVAL** .

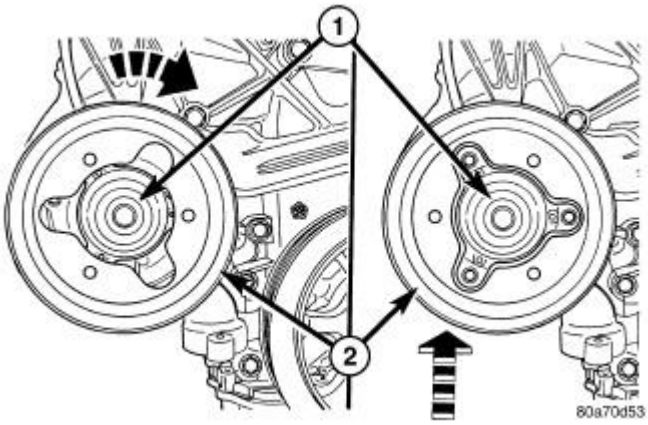

Fig. 229: Water Pump Pulley Positioning
Courtesy of CHRYSLER GROUP, LLC

6. Remove the water pump pulley bolts. Rotate the pulley (2) until the openings in the pulley align with the water pump drive hub spokes (1) and remove the pulley (2).

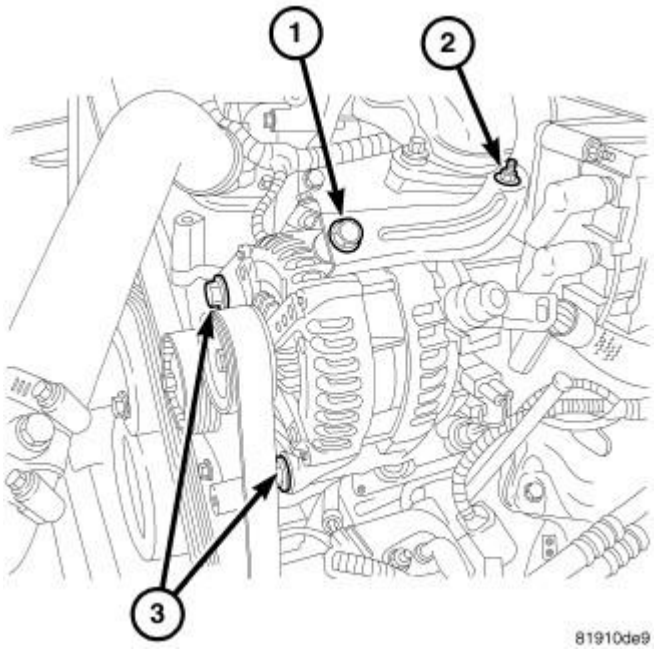

Fig. 230: Generator Mounting 3.8L
Courtesy of CHRYSLER GROUP, LLC

7. Remove the generator (3). Refer to **GENERATOR, REMOVAL** .

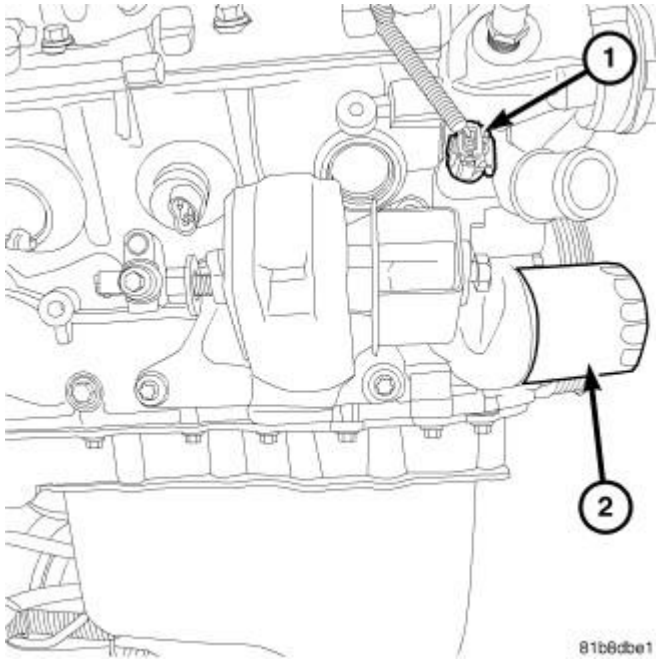

Fig. 231: Oil Pressure Switch & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

8. Raise and support the vehicle on a hoist. Refer to **HOISTING, STANDARD PROCEDURE** .
9. Drain the engine oil and remove the oil filter (2). Refer to **OIL, STANDARD PROCEDURE**.

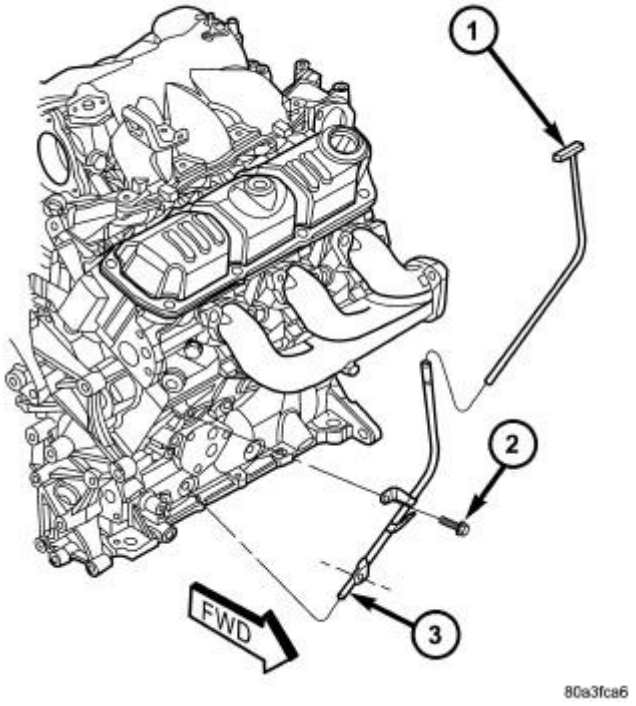

Fig. 232: Oil Level Indicator, Bolt & Tube
Courtesy of CHRYSLER GROUP, LLC

10. Remove the oil level indicator (1) and tube (2).

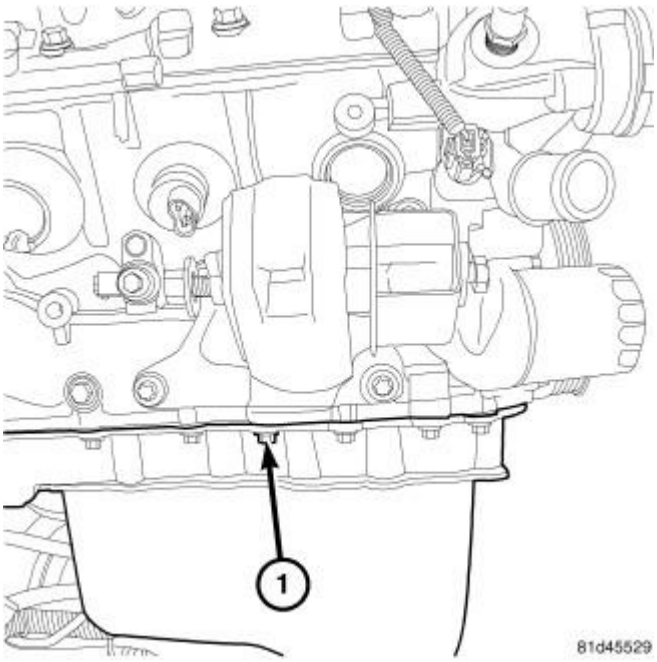

Fig. 233: Oil Pan Fasteners
Courtesy of CHRYSLER GROUP, LLC

11. Remove the structural cover and oil pan. Refer to **PAN, OIL, REMOVAL**.

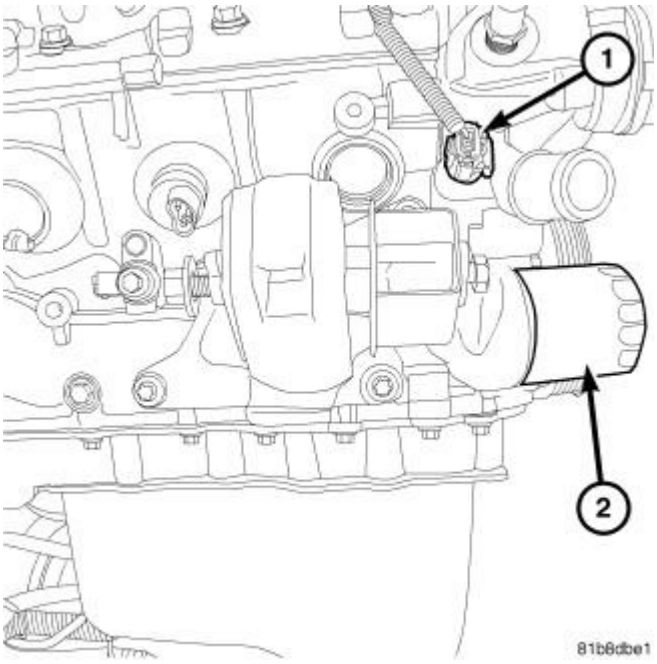

Fig. 234: Oil Pressure Switch & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

12. Disconnect the lower radiator hose.
13. Disconnect the heater hose.
14. Disconnect the oil pressure switch (1).

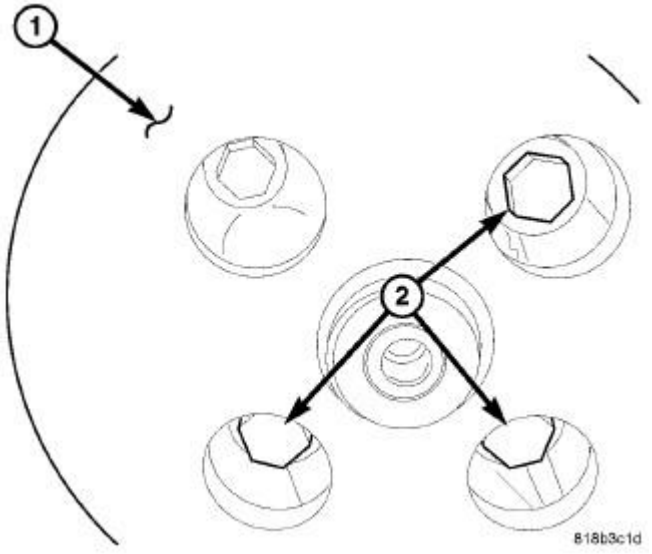

Fig. 235: Power Steering Pump & Mounting Bolts
Courtesy of CHRYSLER GROUP, LLC

15. Remove the power steering pump fasteners (2) and reposition the power steering pump (1).

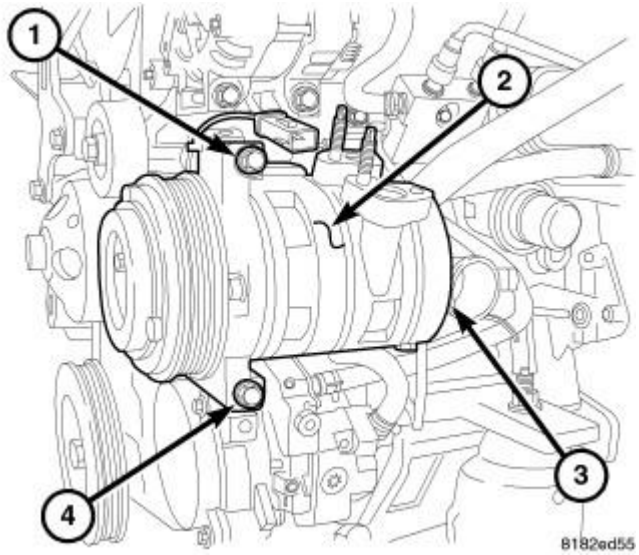

Fig. 236: A/C Compressor & Mounting Bolts
Courtesy of CHRYSLER GROUP, LLC

16. Remove the A/C compressor mounting bolts (1, 3 and 4) and reposition the A/C compressor (2).

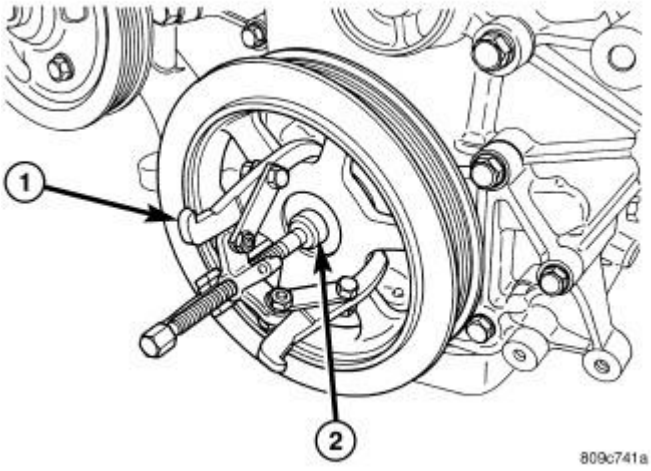

Fig. 237: Vibration Damper - Removal
Courtesy of CHRYSLER GROUP, LLC

17. Remove the crankshaft vibration damper bolt.
18. Place Crankshaft Insert (special tool #8450, Insert, Crankshaft) (2) into the crankshaft nose.
19. Position Puller (special tool #1023, Puller) (1) on the damper. Turn the puller forcing screw until the damper releases from the crankshaft and remove the crankshaft vibration damper.

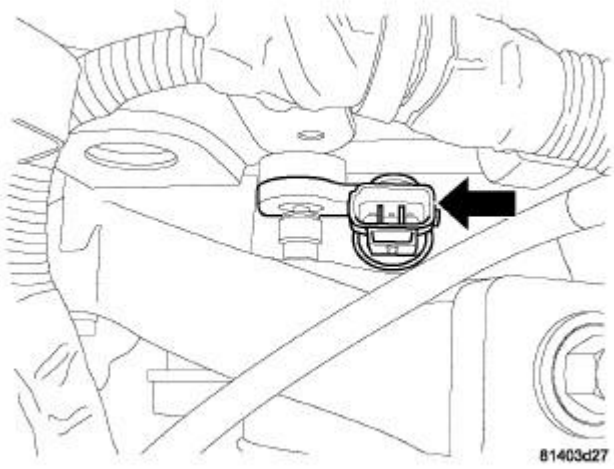

Fig. 238: Camshaft Position Sensor
Courtesy of CHRYSLER GROUP, LLC

20. Remove the camshaft position (CMP) sensor from the timing chain cover. Refer to **SENSOR, CAMSHAFT POSITION, 3.8L, REMOVAL** .

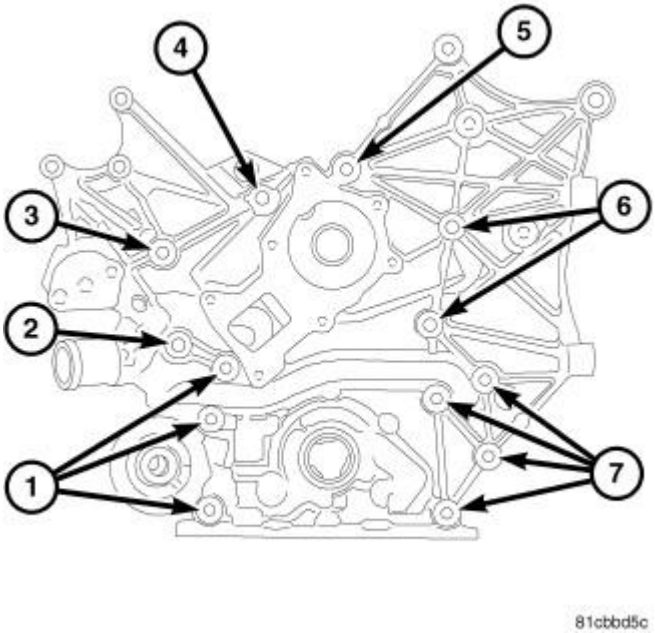

Fig. 239: Timing Cover Bolt Location
Courtesy of CHRYSLER GROUP, LLC

1, 7 - BOLT - M8 x 1.25 x 80	4 - BOLT - M10 x 1.5 x 85
2 - BOLT - M10 x 1.5 x 85	5 - BOLT - M8 x 1.25 x 80
3 - BOLT - M8 x 1.25 x 80	6 - BOLT - M10 x 1.5 x 85

21. Remove the timing chain cover fasteners (1-7) and remove the timing chain cover.

INSTALLATION

INSTALLATION

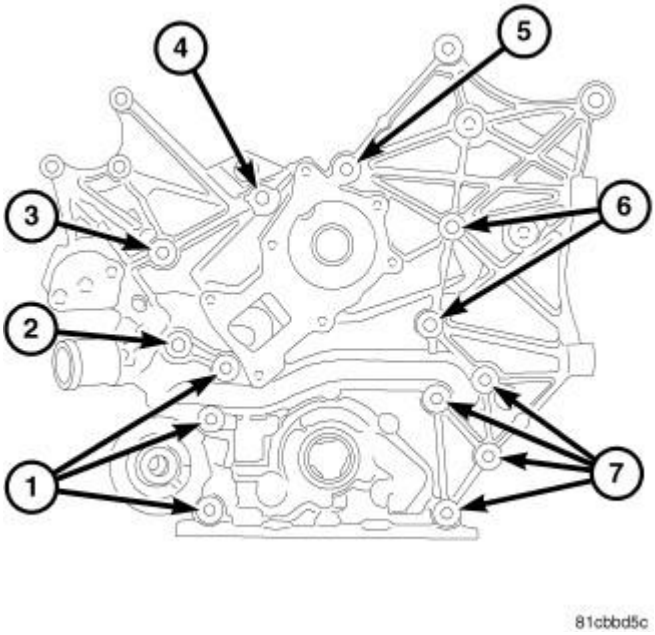

Fig. 240: Timing Cover Bolt Location
Courtesy of CHRYSLER GROUP, LLC

1, 7 - BOLT - M8 x 1.25 x 80	4 - BOLT - M10 x 1.5 x 85
2 - BOLT - M10 x 1.5 x 85	5 - BOLT - M8 x 1.25 x 80
3 - BOLT - M8 x 1.25 x 80	6 - BOLT - M10 x 1.5 x 85

CAUTION: Crankshaft oil seal must be removed to insure correct oil pump engagement.

1. Be sure the mating surfaces of the chain case cover and cylinder block are clean and free from burrs.

NOTE: DO NOT USE SEALER ON THE TIMING COVER GASKET

2. Position the new timing cover gasket on the timing cover. Adhere the new gasket to the chain case cover, making sure that the lower edge of the gasket is 0.5 mm (0.020 in.) beyond the lower edge of the cover.
3. Rotate the crankshaft so that the oil pump drive flats are in the vertical position.
4. Position the oil pump inner rotor so that the mating flats are in the same position as the crankshaft drive flats.

CAUTION: Make sure the oil pump is engaged on the crankshaft correctly or severe damage may result.

5. Install the timing cover.

NOTE: Tighten the M10 bolts (2, 4, 6,) first, then the M8 (1, 3, 5, 7).

6. Install timing chain cover bolts. Tighten the M10 bolts (2, 4, 6) to 54 N.m (40 ft. lbs.) and the M8 bolts (1, 3, 5, 7) to 28 N.m (21 ft. lbs.).

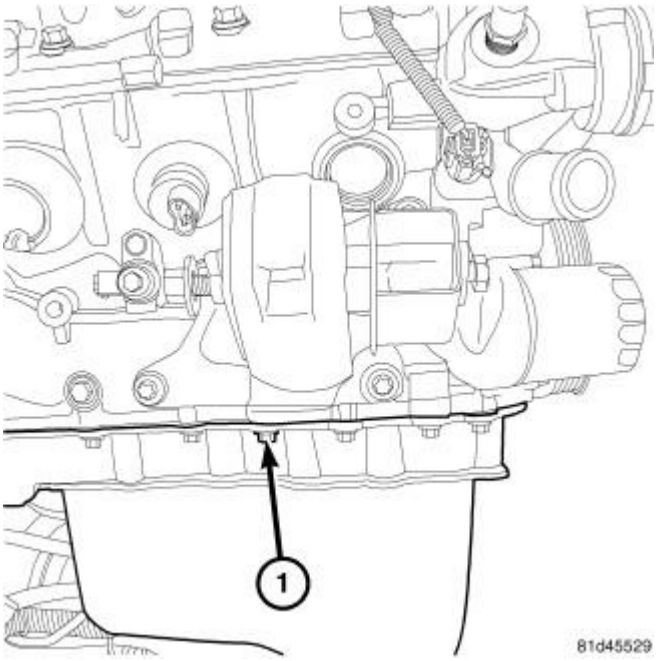

Fig. 241: Oil Pan Fasteners
Courtesy of CHRYSLER GROUP, LLC

7. Raise and support the vehicle on a hoist. Refer to **HOISTING, STANDARD PROCEDURE** .
8. Install the oil pan and structural cover. Refer to **PAN, OIL, INSTALLATION**.

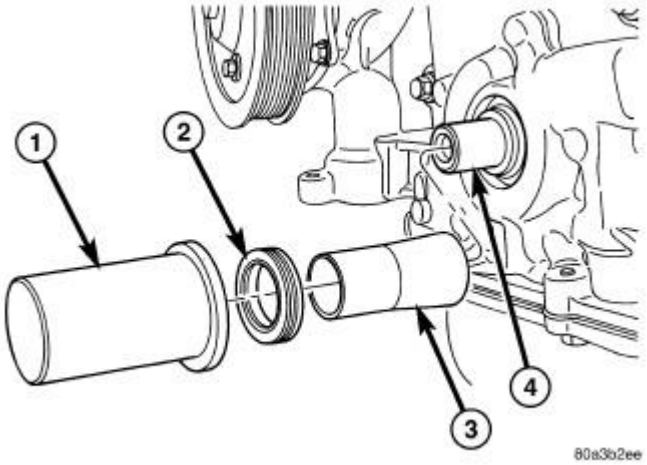

Fig. 242: Crankshaft Front Seal Installation
Courtesy of CHRYSLER GROUP, LLC

1 - SPECIAL TOOL C-4992-1
2 - SEAL
3 - SPECIAL TOOL C-4992-2
4 - CRANKSHAFT

9. Install the front crankshaft oil seal (2). Refer to **SEAL, CRANKSHAFT OIL, FRONT, INSTALLATION**.

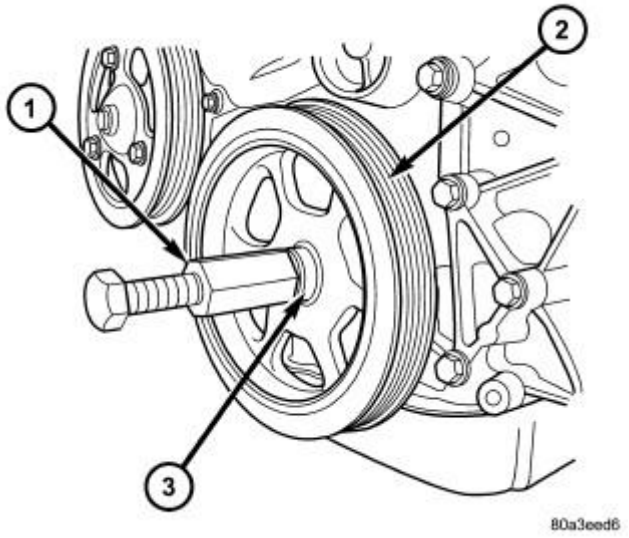

Fig. 243: Vibration Damper - Installation
Courtesy of CHRYSLER GROUP, LLC

1 - FORCING SCREW / NUT FROM SPECIAL TOOL

8452
2 - VIBRATION DAMPER
3 - THRUST BEARING / WASHER

10. Install the crankshaft vibration damper (2). Refer to **DAMPER, VIBRATION, INSTALLATION**.
11. Install the vibration damper bolt. Tighten bolt to 54 N.m (40 ft. lbs.).

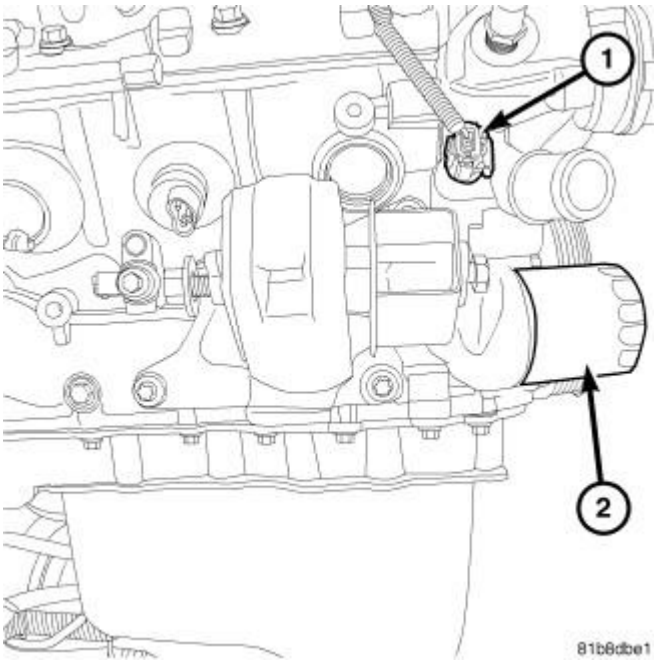

Fig. 244: Oil Pressure Switch & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

12. Connect the oil pressure switch (1).
13. Connect the lower radiator hose.
14. Connect the heater hose.
15. Install a new oil filter (2). Refer to **FILTER, ENGINE OIL, INSTALLATION**.

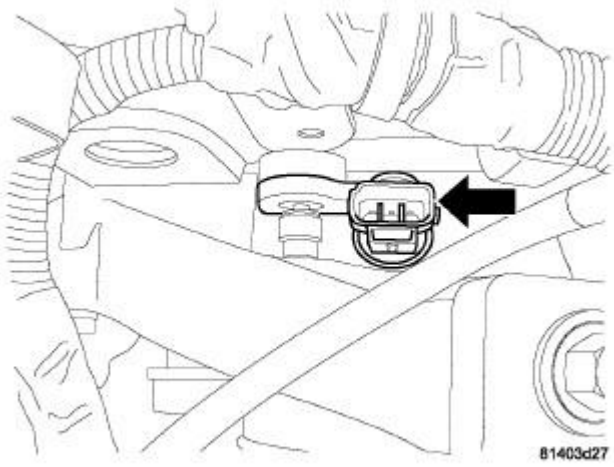

Fig. 245: Camshaft Position Sensor
Courtesy of CHRYSLER GROUP, LLC

16. Install the camshaft position (CMP) sensor. Refer to **SENSOR, CAMSHAFT POSITION, 3.8L, INSTALLATION** .

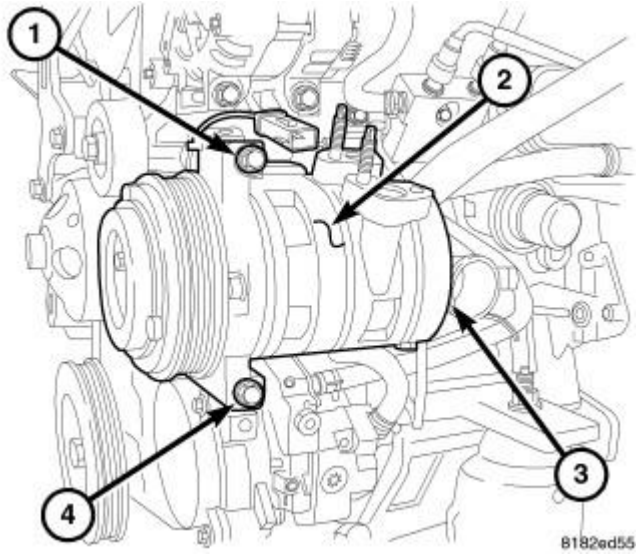

Fig. 246: A/C Compressor & Mounting Bolts
Courtesy of CHRYSLER GROUP, LLC

17. Install the A/C compressor (2) to the engine with three bolts (1, 3 and 4). Tighten the bolts to 28 N.m (21 ft. lbs.) using the following sequence:
    - The upper bolt (1) at the front of the compressor.
    - The lower bolt (4) at the front of the compressor.
    - The bolt (3) at the rear of the compressor.

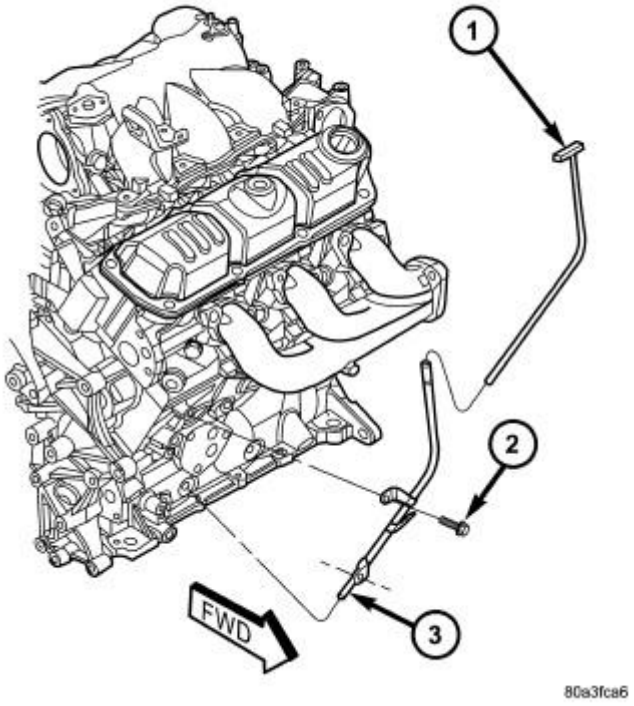

Fig. 247: Oil Level Indicator, Bolt & Tube
Courtesy of CHRYSLER GROUP, LLC

18. Install the oil level indicator tube (3) and indicator (1). Tighten the bolt (2) to 20 N.m (15 ft. lbs.).

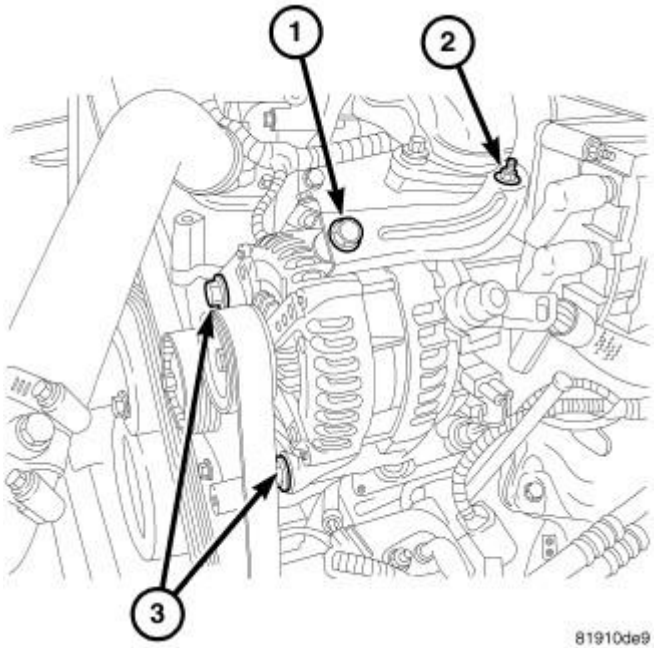

Fig. 248: Generator Mounting 3.8L
Courtesy of CHRYSLER GROUP, LLC

19. Install the generator (3). Refer to **GENERATOR, INSTALLATION** .

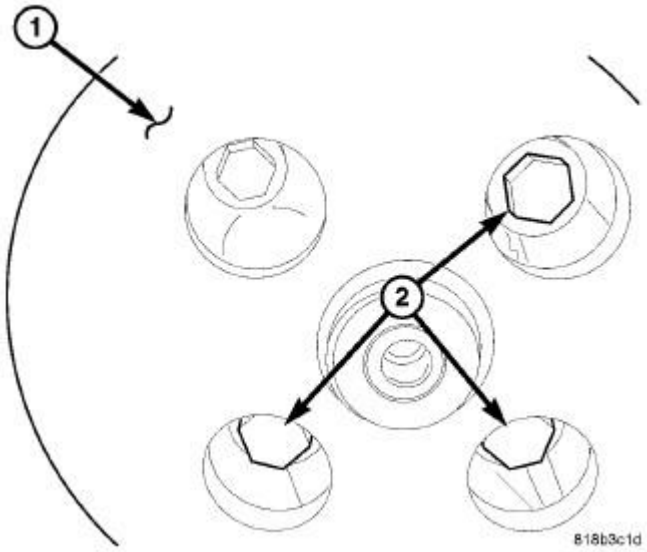

Fig. 249: Power Steering Pump & Mounting Bolts
Courtesy of CHRYSLER GROUP, LLC

20. Install the power steering pump (1). Tighten pump mounting bolts (2) to 26 N.m (19 ft. lbs.).

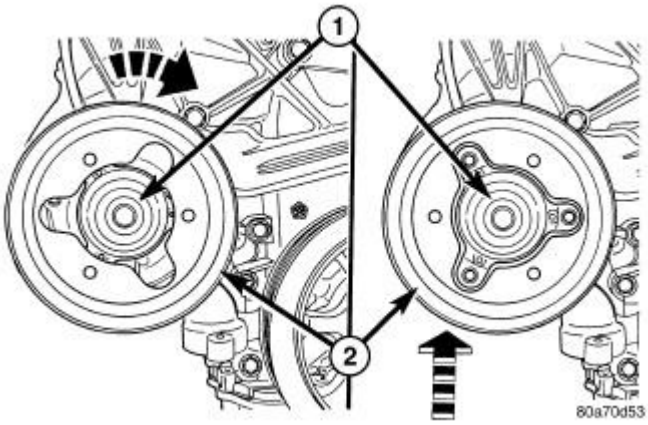

Fig. 250: Water Pump Pulley Positioning
Courtesy of CHRYSLER GROUP, LLC

21. Install the water pump pulley (2) on the water pump hub (1). Install the bolts and tighten to 28 N.m (250 in. lbs.).

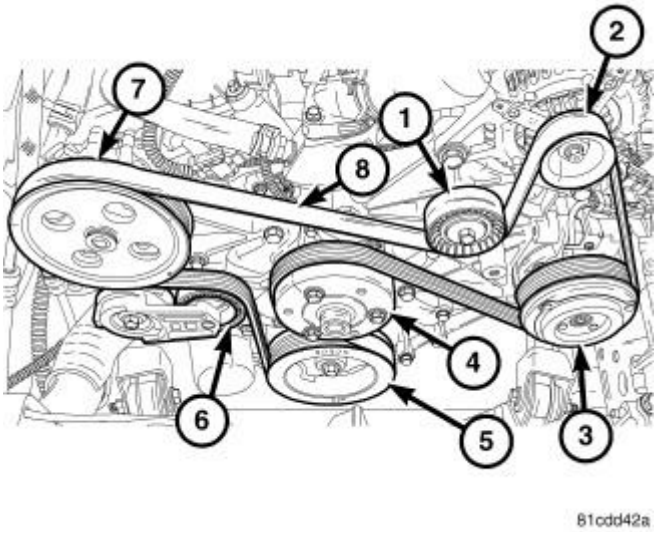

Fig. 251: Accessory Drive Belt Routing, Tensioner & Pulleys
Courtesy of CHRYSLER GROUP, LLC

1 - IDLER PULLEY
2 - GENERATOR PULLEY
3 - A/C COMPRESSOR
4 - WATER PUMP PULLEY
5 - CRANKSHAFT PULLEY
6 - ACCESSORY DRIVE BELT TENSIONER
7 - P/S PUMP PULLEY
8 - ACCESSORY DRIVE BELT

22. Install the belt tensioner (6) and accessory drive belt (8). Refer to **PULLEY, IDLER, INSTALLATION** .

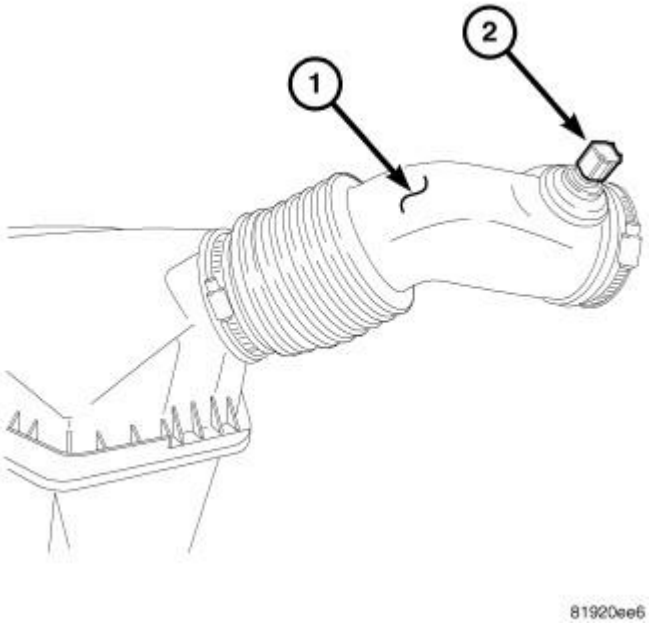

Fig. 252: Rubber Air Intake Tube & Intake Manifold Air Temperature (IAT) Sensor
Courtesy of CHRYSLER GROUP, LLC

23. Install the air cleaner housing assembly and hose (1). Refer to **BODY, AIR CLEANER, INSTALLATION**.
24. Fill the engine crankcase with the proper oil to the correct level. Refer to **OIL, STANDARD PROCEDURE**.
25. Fill the cooling system. Refer to **STANDARD PROCEDURE** .
26. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).

