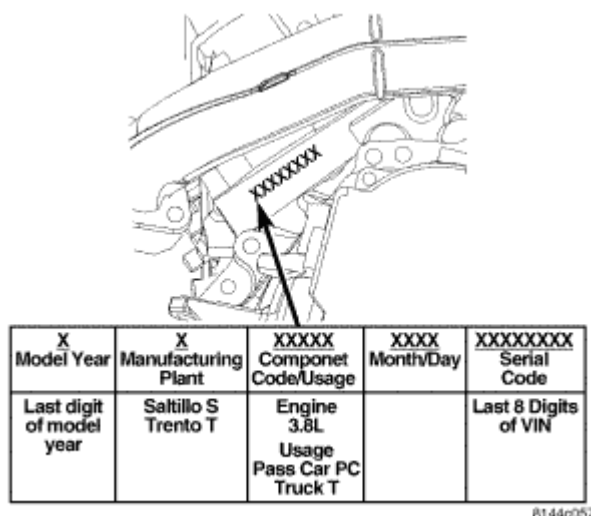


2008 ENGINE

3.8L - Service Information - Wrangler

DESCRIPTION

3.8L ENGINE

**Fig. 1: Engine Identification**

Courtesy of CHRYSLER 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

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.

CYLINDER COMPRESSION PRESSURE TEST

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

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

1. Check engine oil level and add oil if necessary.
2. Drive the vehicle until engine reaches normal operating temperature. Select a route free from traffic and other forms of congestion, observe all traffic laws, and accelerate through the gears several times briskly.
3. Remove all spark plugs from engine. As spark plugs are being removed, check electrodes for abnormal firing indicators fouled, hot, oily, etc. Record cylinder number of spark plug for future reference.
4. Remove the Auto Shutdown (ASD) relay from the PDC.
5. Be sure throttle blade is fully open during the compression check.
6. Insert compression gauge Adapter Special Tool 8116 or the equivalent, into the #1 spark plug hole in cylinder head. Connect the 0-500 psi (Blue) pressure transducer (Special Tool CH7059) with cable Adapters to the DRBIII®. For Special Tool identification, see **SPECIAL TOOLS**.

7. Crank engine until maximum pressure is reached on gauge. Record this pressure as #1 cylinder pressure.
8. Repeat the previous step 7 for all remaining cylinders.
9. Compression should not be less than 689 kPa (100 psi) and not vary more than 25 percent from cylinder to cylinder.
10. If one or more cylinders have abnormally low compression pressures, repeat the compression test.
11. If the same cylinder or cylinders repeat an abnormally low reading on the second compression test, it could indicate the existence of a problem in the cylinder in question. **The recommended compression pressures are to be used only as a guide to diagnosing engine problems. An engine should not be disassembled to determine the cause of low compression unless some malfunction is present.**

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.

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 & 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.
 - Circular spray pattern generally indicates seal leakage or crankshaft damage.
 - Where leakage tends to run straight down, possible causes are a porous block, oil gallery cup plug, bedplate to cylinder block mating surfaces and seal bore. See proper repair procedures for these items.
4. If no leaks are detected, pressurize the crankcase as previously described in 5 under ENGINE OIL LEAK INSPECTION.

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.

INTRODUCTION

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

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

Refer to the **MECHANICAL** and the **PERFORMANCE** diagnostic charts, for possible causes and corrections of malfunctions.

For fuel system diagnosis, refer to **FUEL DELIVERY - 3.8L GAS ENGINE** .

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; refer to **CYLINDER COMPRESSION PRESSURE TEST**.

Cylinder Combustion Pressure Leakage Test; refer to **CYLINDER COMBUSTION PRESSURE LEAKAGE TEST**.

Engine Cylinder Head Gasket Failure Diagnosis; refer to **DIAGNOSIS AND TESTING**.

Intake Manifold Leakage Diagnosis; refer to **DIAGNOSIS AND TESTING**.

Hydraulic Lash Adjuster Noise Diagnosis; refer to **HYDRAULIC LIFTERS DIAGNOSIS - PRELIMINARY STEP**

Engine Oil Leak Inspection; refer to **ENGINE OIL LEAK INSPECTION**

MECHANICAL

| CONDITION | POSSIBLE CAUSES | CORRECTION |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NOISY VALVES | <ol style="list-style-type: none">1. High or low oil level in crankcase.2. Thin or diluted oil.3. Thick oil4. Low oil pressure.5. Dirt in hydraulic lifters/lash adjusters.6. Worn rocker arms.7. Worn hydraulic lifters/lash adjusters.8. Worn valve guides. | <ol style="list-style-type: none">1. Check and correct engine oil level.2. Change oil to correct viscosity.3. (a) Change engine oil and filter. (b) Run engine to operating temperature. (c) Change engine oil and filter again.4. Check and correct engine oil pressure problem.5. Replace hydraulic lifters/lash adjusters.6. Inspect oil supply to rocker arms.7. Replace hydraulic lifters/lash adjusters.8. Replace cylinder head assembly. |

2008 Jeep Wrangler Rubicon

2008 ENGINE 3.8L - Service Information - Wrangler

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| | 9. Excessive runout of valve seats on valve faces. | 9. Grind valve seats and valves. |
| CONNECTING ROD NOISE | <ol style="list-style-type: none"> 1. Insufficient oil supply. 2. Low oil pressure. 3. Thin or diluted oil. 4. Thick oil (b) Run engine to operating temperature. (c) Change engine oil and filter again. 5. Excessive bearing clearance. 6. Connecting rod journal out-of-round. 7. Misaligned connecting rods. | <ol style="list-style-type: none"> 1. Check engine oil level. 2. Check engine oil level. Inspect oil pump relief valve and spring. 3. Change oil to correct viscosity. 4. (a) Change engine oil and filter. 5. Measure bearings for correct clearance. Repair as necessary. 6. Replace crankshaft or grind surface. 7. Replace bent connecting rods. |
| MAIN BEARING NOISE | <ol style="list-style-type: none"> 1. Insufficient oil supply. 2. Low oil pressure. 3. Thin or diluted oil. 4. Thick oil (b) Run engine to operating temperature. (c) Change engine oil and filter again. 5. Excessive bearing clearance. 6. Excessive end play. 7. Crankshaft journal out-of-round or worn. 8. Loose flywheel or torque converter. | <ol style="list-style-type: none"> 1. Check engine oil level. 2. Check engine oil level. Inspect oil pump relief valve and spring. 3. Change oil to correct viscosity. 4. (a) Change engine oil and filter. 5. Measure bearings for correct clearance. Repair as necessary. 6. Check thrust bearing for wear on flanges. 7. Replace crankshaft or grind journals. 8. Tighten to correct torque. |
| OIL PRESSURE DROP | <ol style="list-style-type: none"> 1. Low oil level. 2. Faulty oil pressure sensor/switch. 3. Low oil pressure. 4. Clogged oil filter. 5. Worn parts in oil pump. 6. Thin or diluted oil. 7. Oil pump relief valve stuck. 8. Oil pump suction tube loose. | <ol style="list-style-type: none"> 1. Check engine oil level. 2. Replace oil pressure sensor/switch. 3. Check oil pressure sensor/switch and main bearing oil clearance. 4. Install new oil filter. 5. Replace worn parts or pump. 6. Change oil to correct viscosity. 7. Remove valve and inspect, clean, or replace. 8. Remove oil pan and install new |

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2008 ENGINE 3.8L - Service Information - Wrangler

| | | |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | 9. Oil pump cover warped or cracked. 10. Excessive bearing clearance. | tube or clean, if necessary. 9. Install new oil pump. 10. Measure bearings for correct clearance. |
| OIL LEAKS | 1. Misaligned or deteriorated gaskets. 2. Loose fastener, broken or porous metal part. 3. Misaligned or deteriorated cup or threaded plug. | 1. Replace gasket(s). 2. Tighten, repair or replace the part. 3. Replace as necessary. |
| OIL CONSUMPTION OR SPARK PLUGS FOULED | 1. PCV system malfunction. 2. Worn, scuffed or broken rings. 3. Carbon in oil ring slots. 4. Rings fitted too tightly in grooves. 5. Worn valve guide(s). 6. Valve stem seal(s) worn or damaged. | 1. Check system and repair as necessary. (Refer to <u>VALVE - PCV 3.8L</u>) 2. Hone cylinder bores. Install new rings. 3. Install new rings. 4. Remove rings and check grooves. If groove is not proper width, replace piston. 5. Replace cylinder head assembly. 6. Replace seal(s). |

PERFORMANCE

| CONDITION | POSSIBLE CAUSE | CORRECTION |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ENGINE WILL NOT START | 1. Weak battery. 2. Corroded or loose battery connections. 3. Faulty starter. 4. Faulty coil(s) or control unit. 5. Incorrect spark plug gap. 6. Contamination in fuel system. 7. Faulty fuel pump. | 1. Test battery. Charge or replace as necessary Refer to <u>DIAGNOSIS AND TESTING</u> . 2. Clean and tighten battery connections. Apply a coat of light mineral grease to terminals. 3. Test starting system. Refer to <u>DIAGNOSIS AND TESTING</u> . 4. Test and replace as needed. (Refer to appropriate Diagnostic Service Information) 5. Set gap. Refer to <u>SPECIFICATIONS</u> . 6. Clean system and replace fuel filter. 7. Test fuel pump and replace as |

2008 Jeep Wrangler Rubicon

2008 ENGINE 3.8L - Service Information - Wrangler

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| | 8. Incorrect engine timing. | needed. (Refer to appropriate Diagnostic Service Information) 8. Check for a skipped timing belt/chain. |
| ENGINE STALLS OR IDLES ROUGH | 1. Idle speed too low. 2. Incorrect fuel mixture. 3. Intake manifold leakage. 4. Faulty ignition coil(s). | 1. Test minimum air flow. (Refer to appropriate Diagnostic Service Information) 2. (Refer to appropriate Diagnostic Service Information) 3. Inspect intake manifold, manifold gasket, and vacuum hoses. 4. Test and replace as necessary. (Refer to appropriate Diagnostic Service Information) |
| ENGINE LOSS OF POWER | 1. Dirty or incorrectly gapped plugs. 2. Contamination in fuel system. 3. Faulty fuel pump. 4. Incorrect valve timing. 5. Leaking cylinder head gasket. 6. Low compression. 7. Burned, warped, or pitted valves. 8. Plugged or restricted exhaust system. 9. Faulty ignition coil(s). | 1. Clean plugs and set gap. 2. Clean system and replace fuel filter. 3. Test and replace as necessary. (Refer to appropriate Diagnostic Service Information) 4. Correct valve timing. 5. Replace cylinder head gasket. 6. Test compression of each cylinder. 7. Replace valves. 8. Perform exhaust restriction test. Refer to <u>DIAGNOSIS AND TESTING</u> . Install new parts, as necessary. 9. Test and replace as necessary. (Refer to appropriate Diagnostic Service Information) |
| ENGINE MISSES ON ACCELERATION | 1. Dirty or incorrectly gapped spark plugs. 2. Contamination in Fuel System. 3. Burned, warped, or pitted valves. 4. Faulty ignition coil(s). | 1. Clean spark plugs and set gap. 2. Clean fuel system and replace fuel filter. 3. Replace valves. 4. Test and replace as necessary. (Refer to appropriate Diagnostic Service Information) |
| ENGINE MISSES AT HIGH SPEED | 1. Dirty or incorrect spark plug gap. 2. Faulty ignition coil(s). | 1. Clean spark plugs and set gap. 2. Test and replace as necessary. |

| | | |
|--|----------------------------------|-----------------------------------------------------------------------------------------|
| | | (Refer to appropriate Diagnostic Service Information) |
| | 3. Dirty fuel injector(s). | 3. Test and replace as necessary. (Refer to appropriate Diagnostic Service Information) |
| | 4. Contamination in fuel system. | 4. Clean system and replace fuel filter. |

STANDARD PROCEDURE

ENGINE CORE AND OIL GALLERY PLUGS

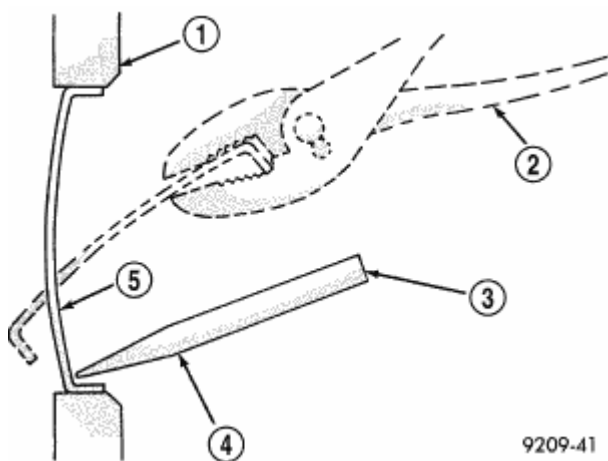


Fig. 2: Core Hole Plug Removal

Courtesy of CHRYSLER 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. See **Fig. 2**.

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.

ENGINE GASKET SURFACE PREPARATION

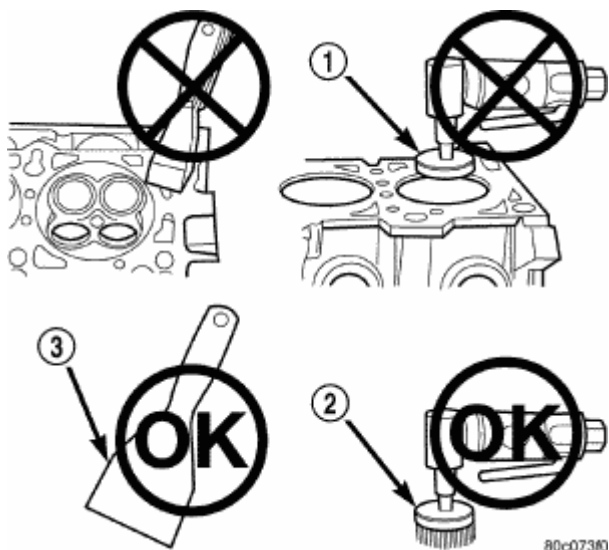


Fig. 3: Proper Tool Usage For Surface Preparation
Courtesy of CHRYSLER LLC

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

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

Never use the following to clean gasket surfaces:

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

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

Only use the following for cleaning gasket surfaces:

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

CAUTION: Excessive pressure or high RPM (beyond the recommended speed), can

damage the sealing surfaces. The mild (white, 120 grit) bristle disc is recommended. If necessary, the medium (yellow, 80 grit) bristle disc may be used on cast iron surfaces with care.

FORM-IN-PLACE GASKETS AND SEALERS

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

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

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

MOPAR® ATF RTV is a specifically designed black silicone rubber RTV that retains adhesion and sealing properties to seal components exposed to automatic transmission fluid, engine coolants, and moisture. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

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

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

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

SEALER APPLICATION

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

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

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

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.

MEASURING BEARING CLEARANCE USING PLASTIGAGE

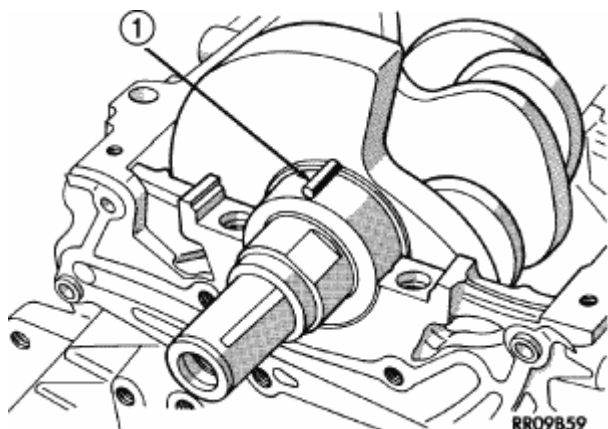


Fig. 4: Locating Plastigage
Courtesy of CHRYSLER LLC

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. See **Fig. 4**. (In addition, suspected areas can be checked by placing the Plastigage in the suspected area). Torque the bearing cap/bed plate bolts of the bearing being checked to the proper specifications.
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 found in the engine specifications table. See **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.

REPAIR OF DAMAGED OR WORN THREADS

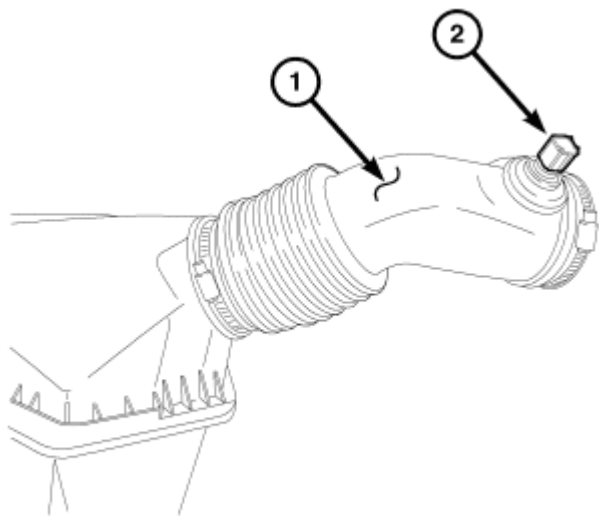
Damaged or worn threads (excluding spark plug and camshaft bearing cap attaching threads) can be repaired. Essentially, this repair consists of drilling out worn or damaged threads, tapping the hole with a special Heli-Coil Tap, (or equivalent) and installing an insert into the tapped hole. This brings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

REMOVAL

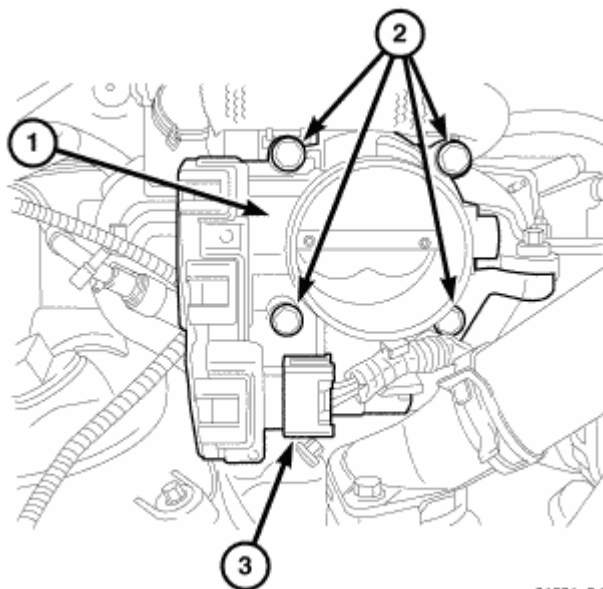
3.8L ENGINE



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Fig. 5: Internal Air Temperature Sensor 3.8L
Courtesy of CHRYSLER LLC

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



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Fig. 6: Throttle Body 3.8L
Courtesy of CHRYSLER LLC

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

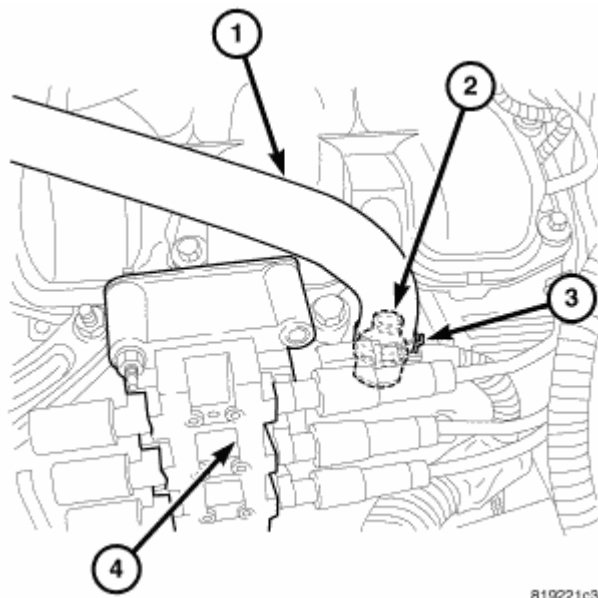


Fig. 7: PCV Valve Location 3.8L
Courtesy of CHRYSLER LLC

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

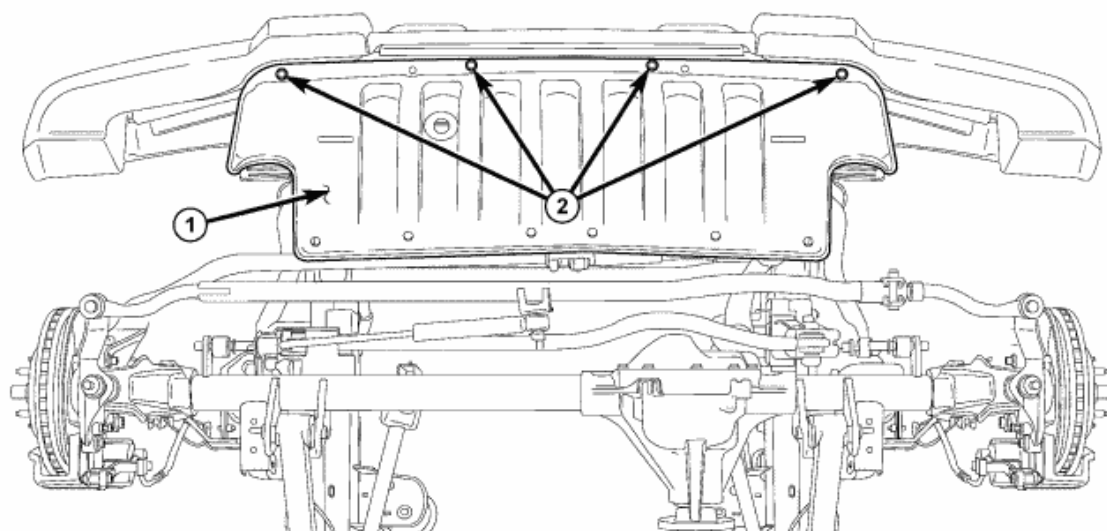
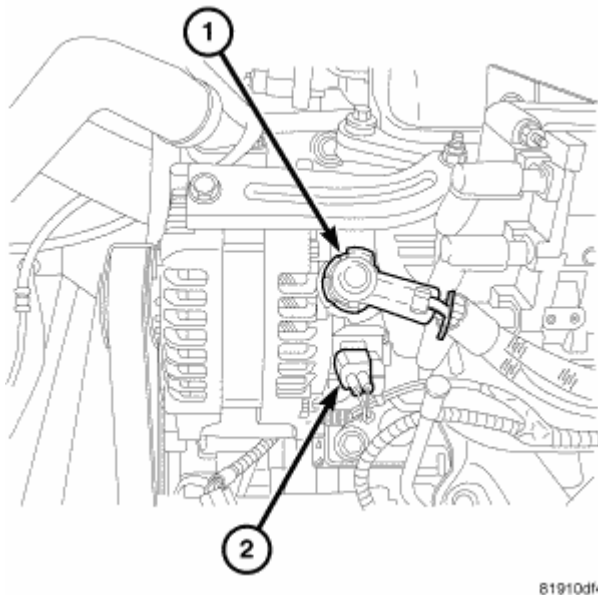


Fig. 8: Front Splash Shield
Courtesy of CHRYSLER LLC

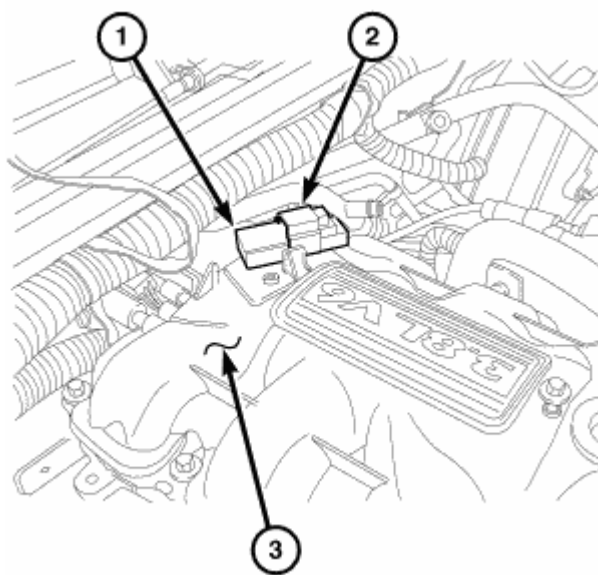
7. Remove the front splash shield (1).
8. Drain the cooling system.
9. Disconnect the upper radiator hose from the thermostat housing and the lower radiator hose from the radiator.
10. Disconnect the heater hoses and coolant reservoir hose.



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Fig. 9: Generator Electrical Connectors 3.8L
Courtesy of CHRYSLER LLC

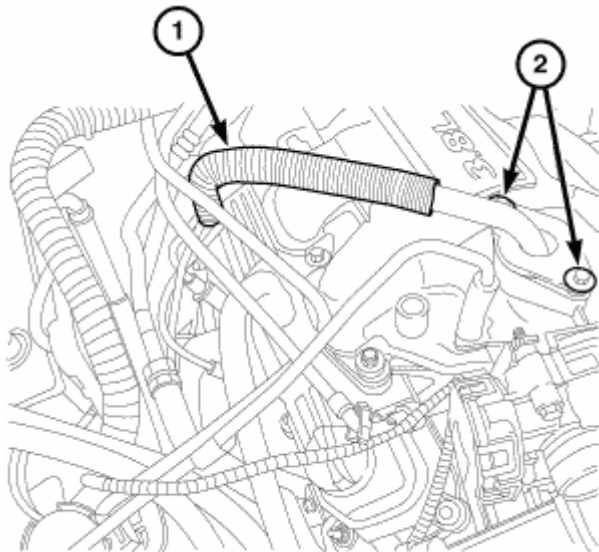
11. Disconnect the generator electrical connectors (1,2).



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Fig. 10: Map Sensor 3.8L
Courtesy of CHRYSLER LLC

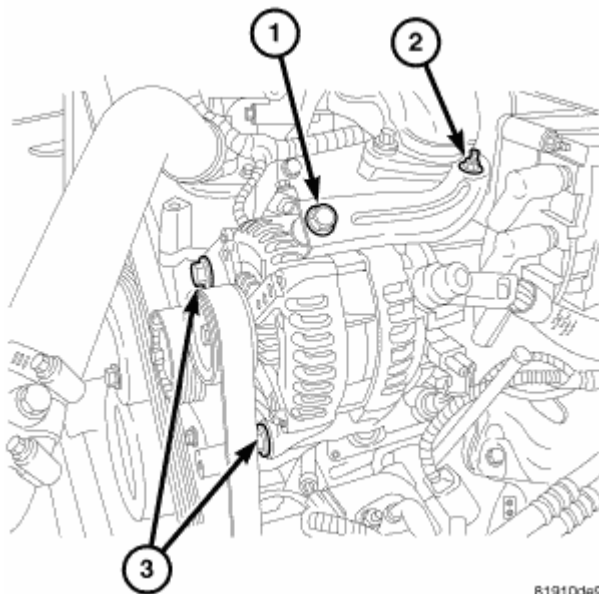
12. Disconnect the throttle position (TP), idle air control (IAC) motor, oxygen (HO₂), cam position (CMP), manifold absolute pressure (MAP) (2) and the two engine wiring harness connectors. Free the harness from the cover studs and set harness aside.
13. Disconnect the purge solenoid harness connector.



819257fe

Fig. 11: EGR Tube Flange
Courtesy of CHRYSLER LLC

14. Disconnect the EVAP hose from the throttle body.
15. Remove the EGR tube (1). Refer to **REMOVAL**.



81910de9

Fig. 12: Generator Mounting 3.8L
Courtesy of CHRYSLER LLC

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

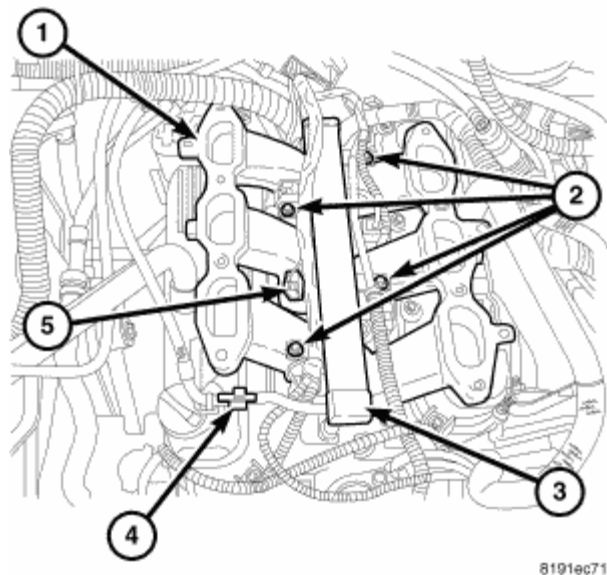


Fig. 13: Fuel Rail 3.8L
Courtesy of CHRYSLER LLC

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.

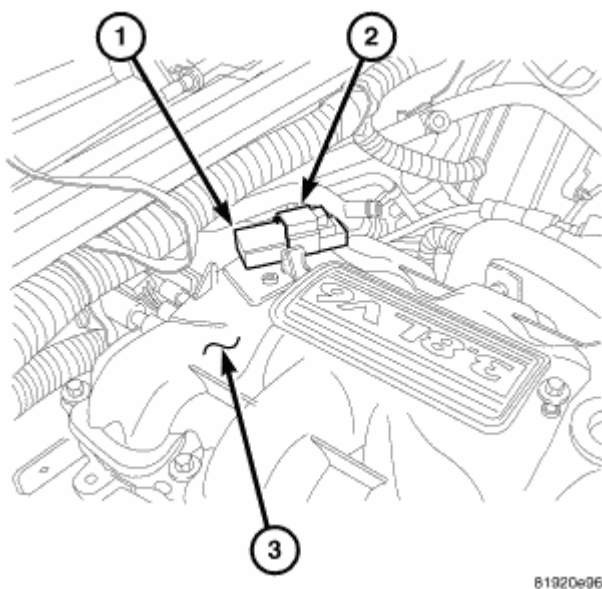


Fig. 14: Map Sensor 3.8L
Courtesy of CHRYSLER LLC

20. Disconnect the knock sensor wiring harness connector.

21. Remove the upper intake manifold (3).

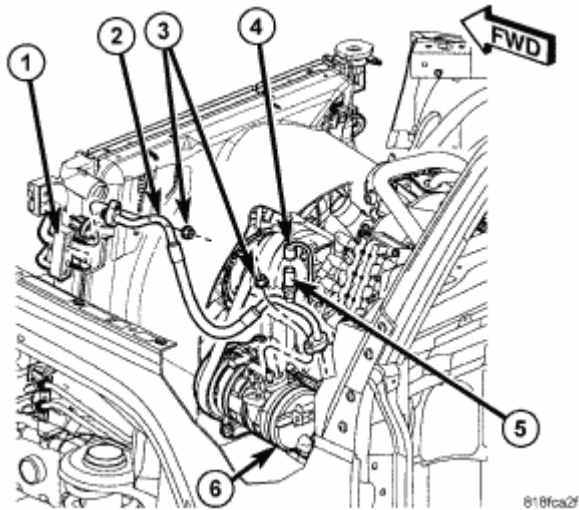


Fig. 15: Removing/Installing A/C Discharge Line
Courtesy of CHRYSLER LLC

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.

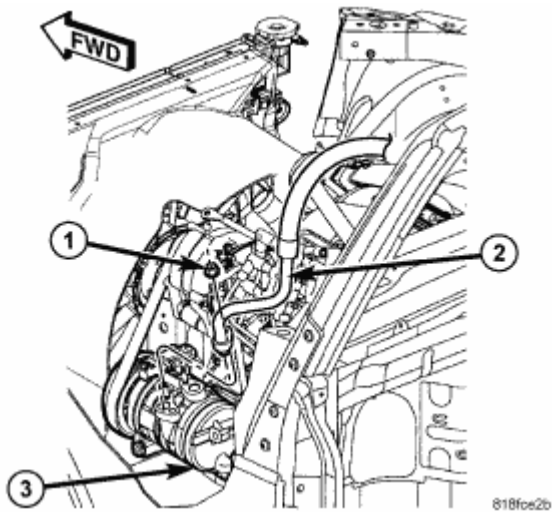
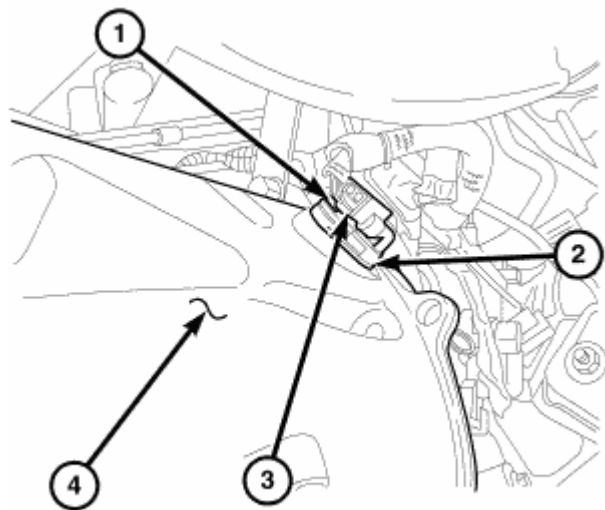


Fig. 16: Removing/Installing A/C Suction Line
Courtesy of CHRYSLER LLC

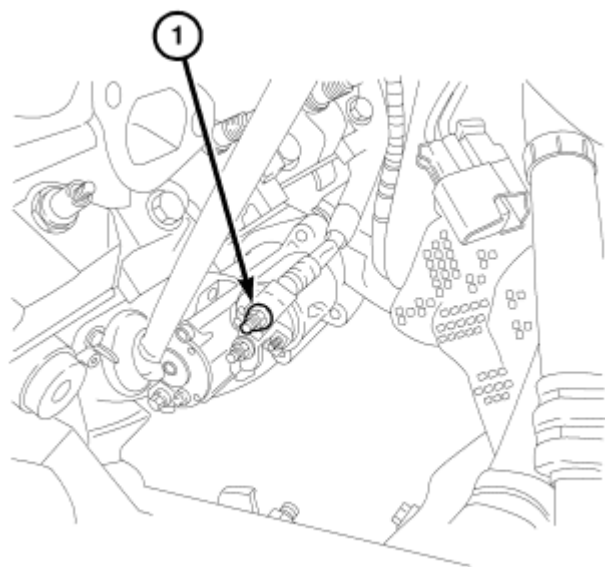
24. Disconnect the A/C suction line (2) from the compressor. Cover and seal all openings of hoses and compressor.



81911cab

Fig. 17: Location Crankshaft Sensor (CKP)
Courtesy of CHRYSLER LLC

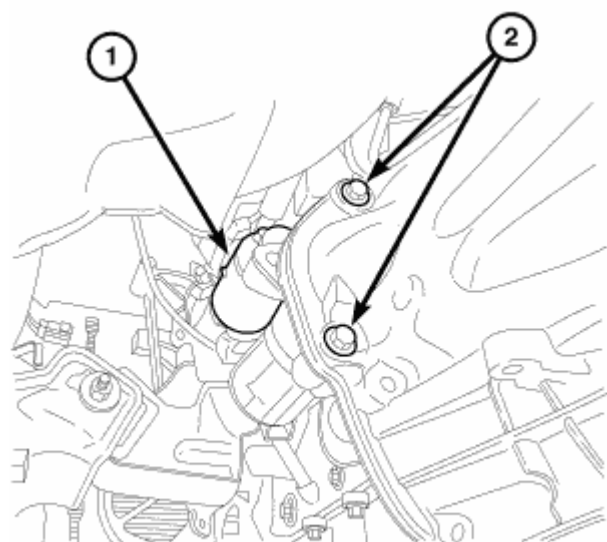
25. Disconnect the oil pressure sending unit (OPS).
26. Disconnect the coolant hose at the engine oil cooler.
27. Remove the crankshaft sensor (2), (CKP).



81911753

Fig. 18: Locating Starter Wiring
Courtesy of CHRYSLER LLC

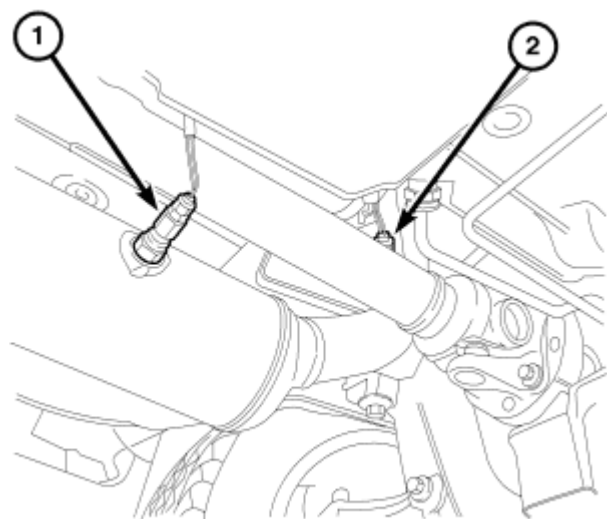
28. Disconnect the in block heater (if equipped).
29. Disconnect the starter wiring (1) and remove starter.



8191173b

Fig. 19: Locating Starter
Courtesy of CHRYSLER LLC

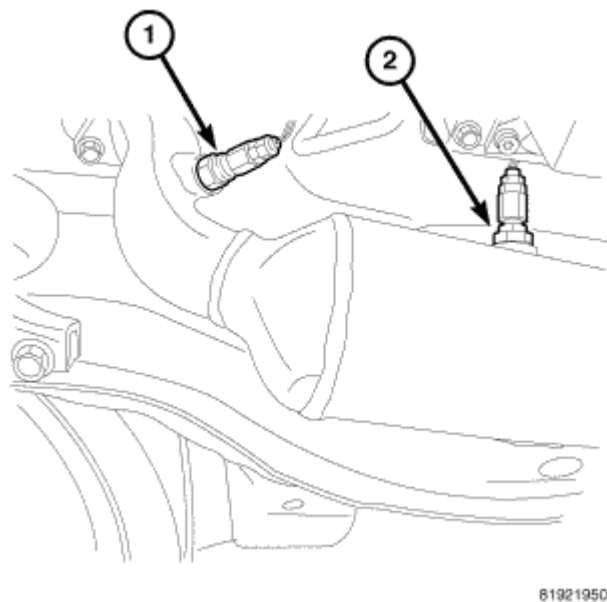
30. Remove the starter (1).
31. Remove the flex plate inspection cover. (If equipped).
32. Rotate the engine at the crankshaft pulley bolt and remove the torque converter bolts. (If equipped).



81921946

Fig. 20: Left Side Oxygen Sensors
Courtesy of CHRYSLER LLC

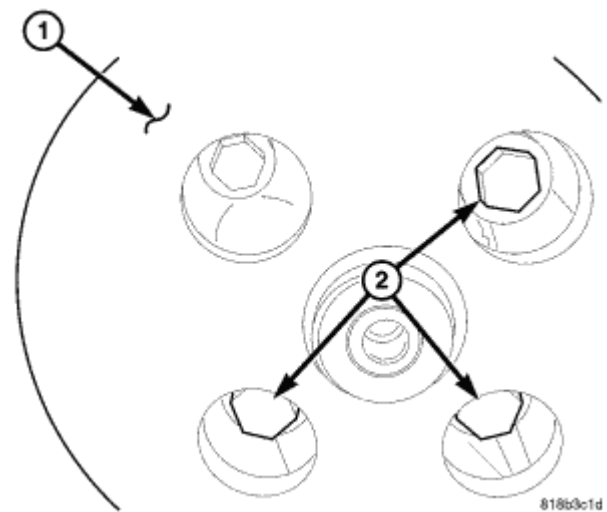
33. Disconnect the left side oxygen sensors (1,2).



81921950

Fig. 21: Right Side Oxygen Sensors
Courtesy of CHRYSLER 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.



81853c1d

Fig. 22: Power Steering Pump Mounting Bolts
Courtesy of CHRYSLER LLC

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

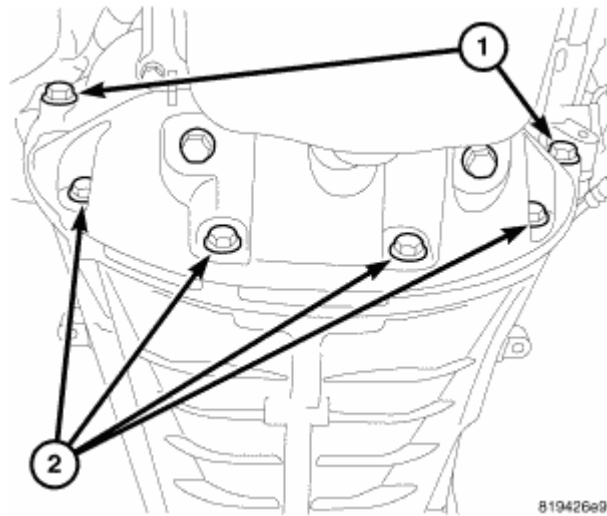


Fig. 23: Structural Cover Mounting Bolts 3.8L
Courtesy of CHRYSLER LLC

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

3.8L ENGINE

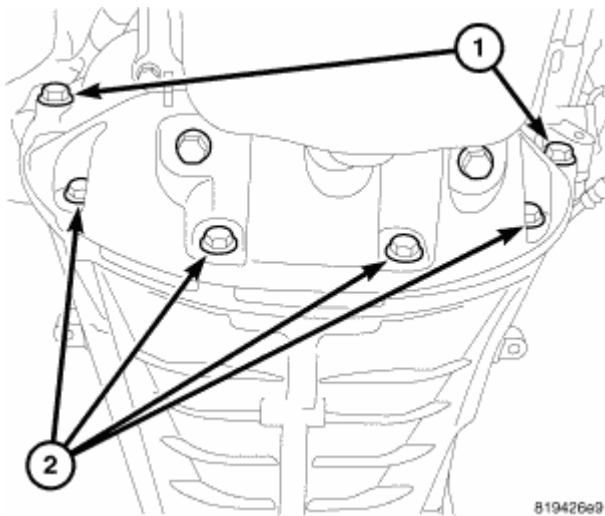
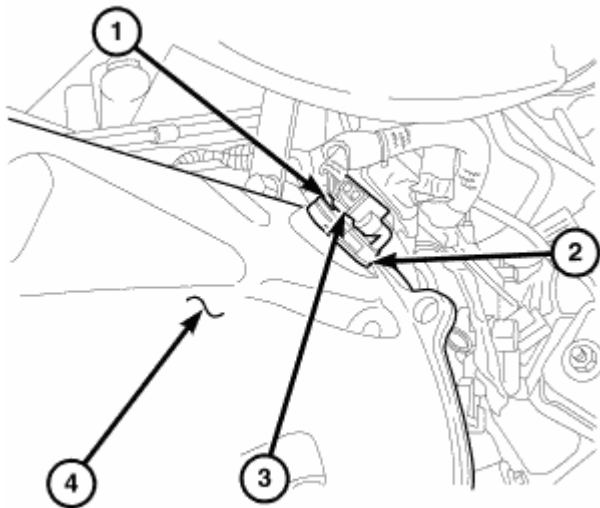


Fig. 24: Structural Cover Mounting Bolts 3.8L
Courtesy of CHRYSLER LLC

1. Position the engine in the vehicle.

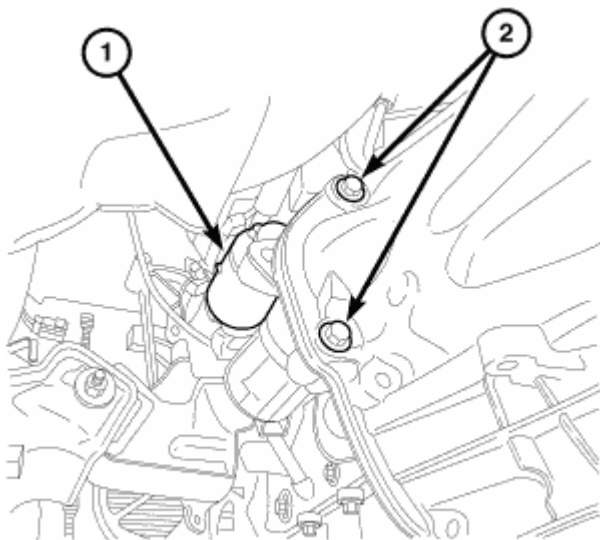
2. Install the transmission bellhousing to engine mounting bolts. Refer to **INSTALLATION** - NSG370. Refer to **INSTALLATION** - 42RLE.
3. Tighten the engine mount thru bolts. See **INSTALLATION**.
4. Install the torque converter bolts. (If equipped). Refer to **INSTALLATION** - 42RLE.
5. Install the structural cover (1). See **INSTALLATION**.



81911cab

Fig. 25: Location Crank Position Sensor (CKP)
Courtesy of CHRYSLER LLC

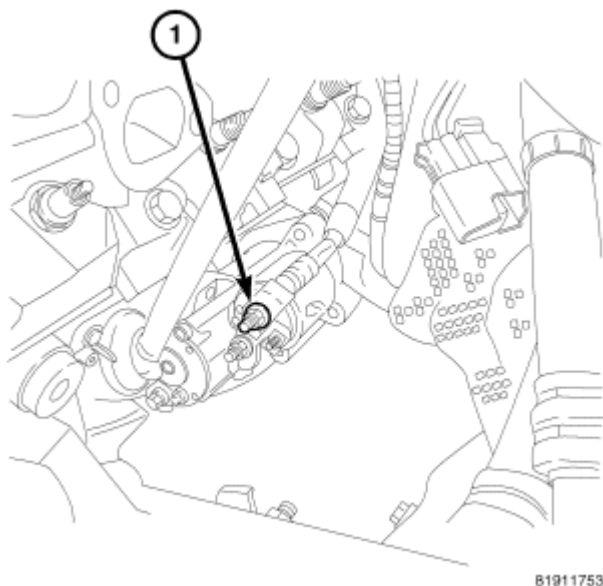
6. Install the crank position sensor (2) (CKP).



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Fig. 26: Locating Starter 3.8L
Courtesy of CHRYSLER LLC

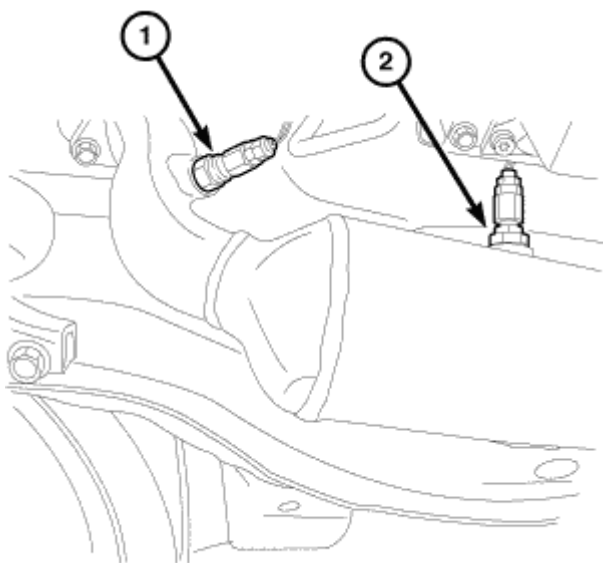
7. Install the starter (1). Refer to **INSTALLATION** .



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Fig. 27: Starter Battery Cable 3.8L
Courtesy of CHRYSLER LLC

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

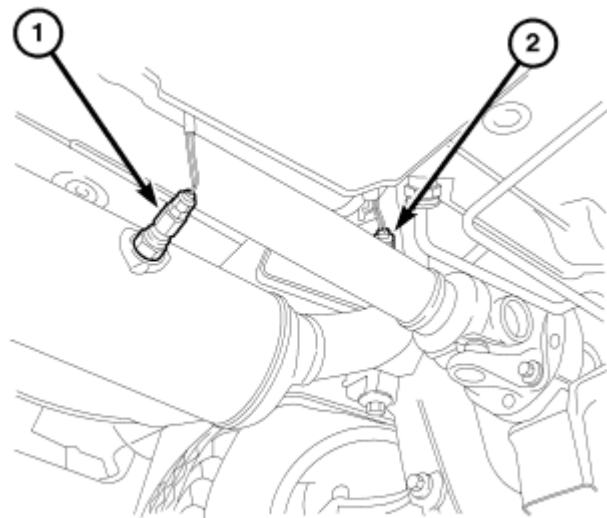


81921950

Fig. 28: Right Side O2 Sensors
Courtesy of CHRYSLER LLC

10. Connect the knock sensor electrical connector.
11. Install the left and right exhaust manifolds.

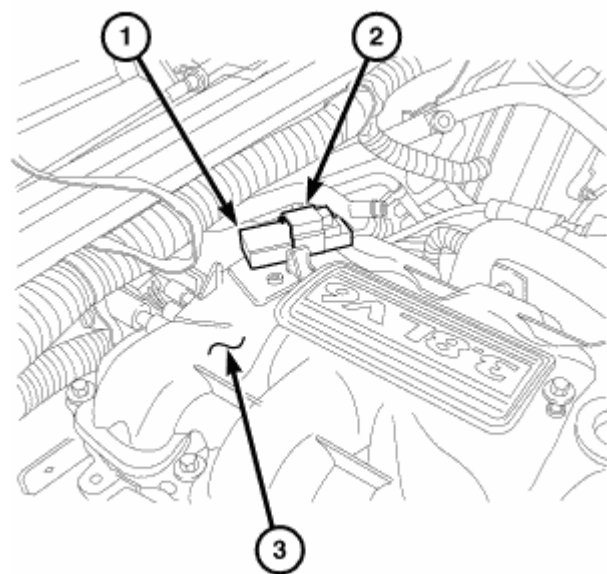
12. Connect the exhaust system and connect the right side O2 sensors (1,2).



81921946

Fig. 29: Left Side O2 Sensors
Courtesy of CHRYSLER 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.

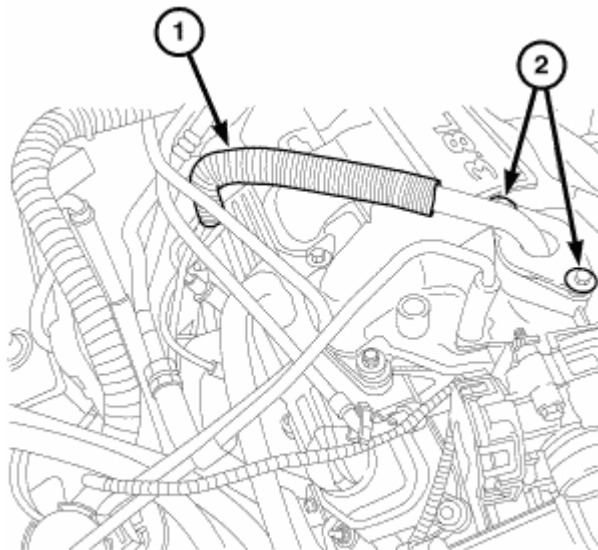


81920e96

Fig. 30: Map Sensor 3.8L
Courtesy of CHRYSLER LLC

16. Connect the oil pressure sending unit (OPS) wiring harness connector.

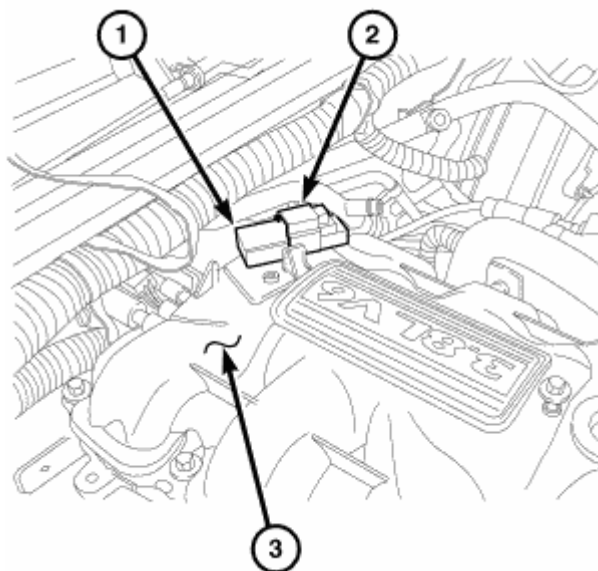
17. Install the upper intake manifold (3). See **INSTALLATION**.



819257fe

Fig. 31: EGR Tube Flange
Courtesy of CHRYSLER LLC

18. Install the EGR tube (1). Refer to **INSTALLATION**.
19. Connect the engine vacuum harnesses.



81920e96

Fig. 32: Map Sensor 3.8L
Courtesy of CHRYSLER 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 (HO2), cam position (CMP),

manifold absolute pressure (MAP) (2), and the engine wiring harness connectors.

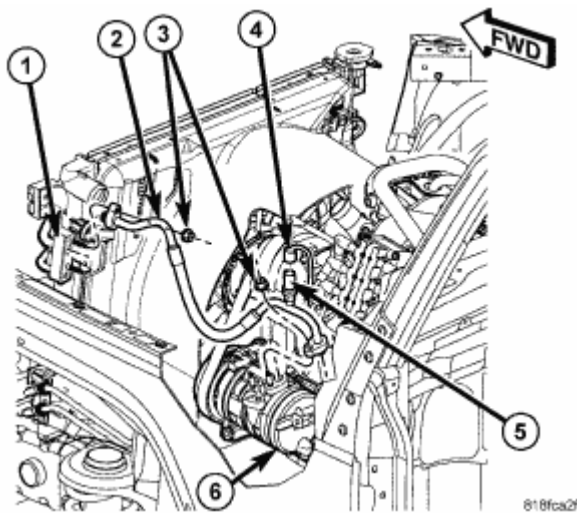


Fig. 33: Removing/Installing A/C Discharge Line
Courtesy of CHRYSLER LLC

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

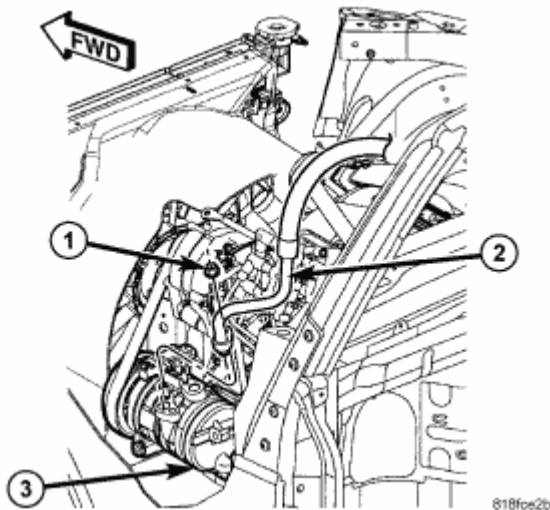


Fig. 34: Disconnecting/Disconnecting A/C Suction Line
Courtesy of CHRYSLER LLC

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

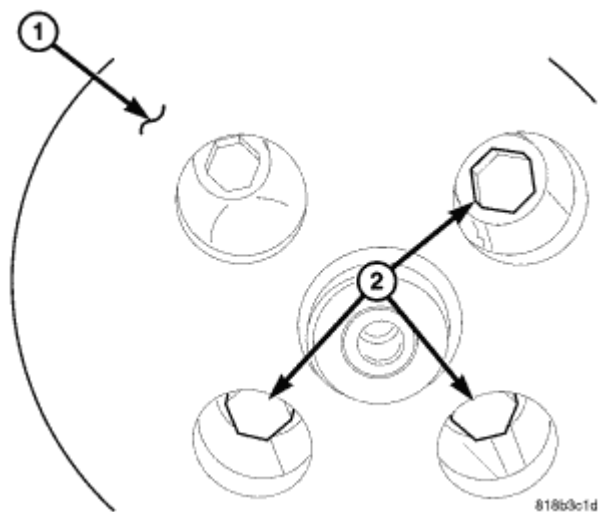


Fig. 35: Power Steering Pump Bolts
Courtesy of CHRYSLER LLC

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

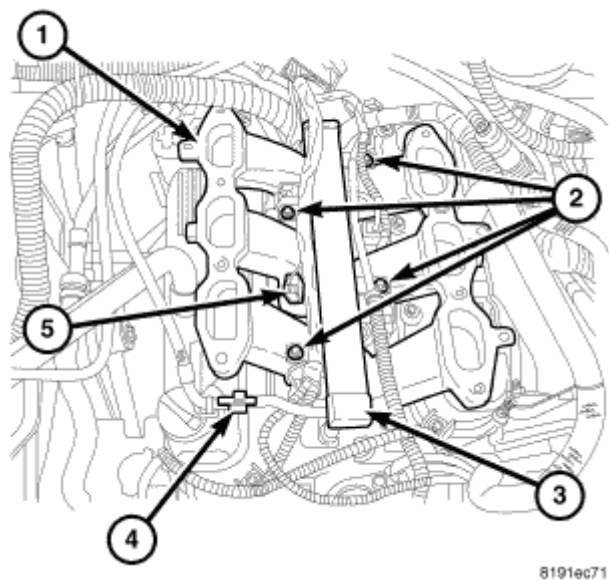
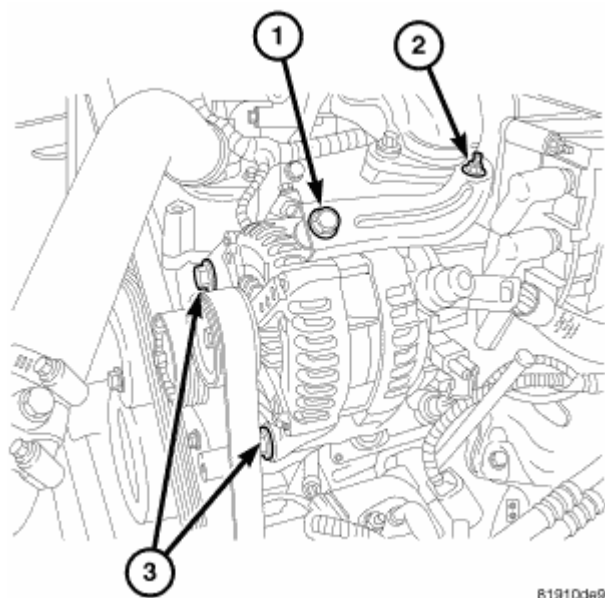


Fig. 36: Fuel Rail 3.8L
Courtesy of CHRYSLER LLC

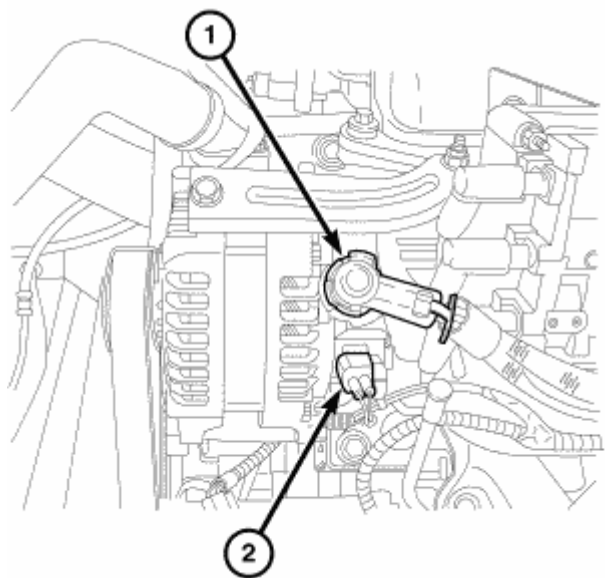
25. Connect the fuel line (4) to the fuel rail.



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Fig. 37: Generator Mounting 3.8L
Courtesy of CHRYSLER LLC

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



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Fig. 38: Generator Electronic Connectors 3.8L
Courtesy of CHRYSLER LLC

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

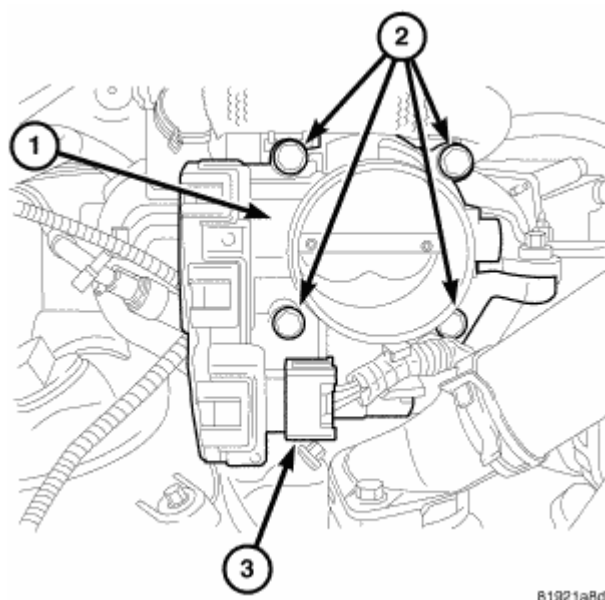


Fig. 39: Throttle Body 3.8L
Courtesy of CHRYSLER LLC

29. Connect the radiator, coolant reservoir and heater hoses.
30. Connect the throttle wiring harness (ETC) (3).

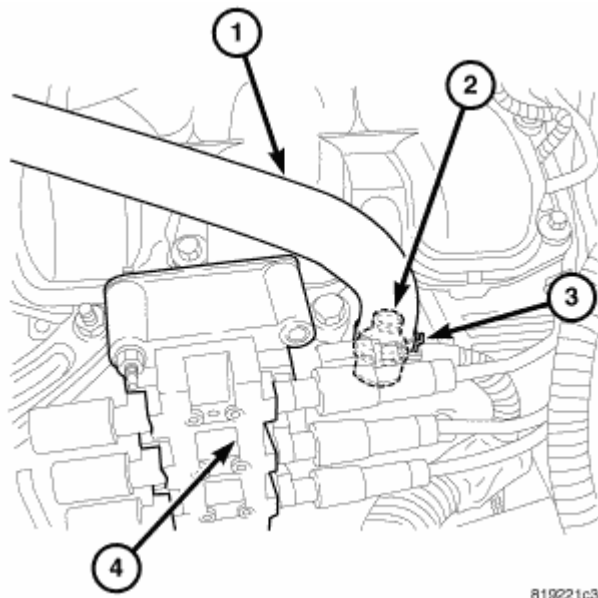
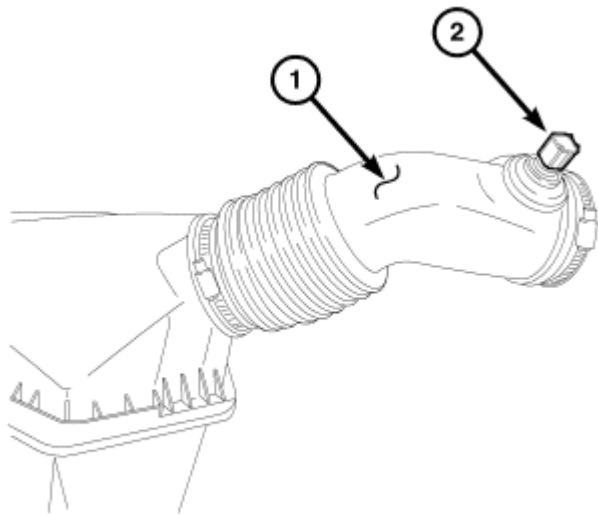


Fig. 40: PCV Valve Location 3.8L
Courtesy of CHRYSLER LLC

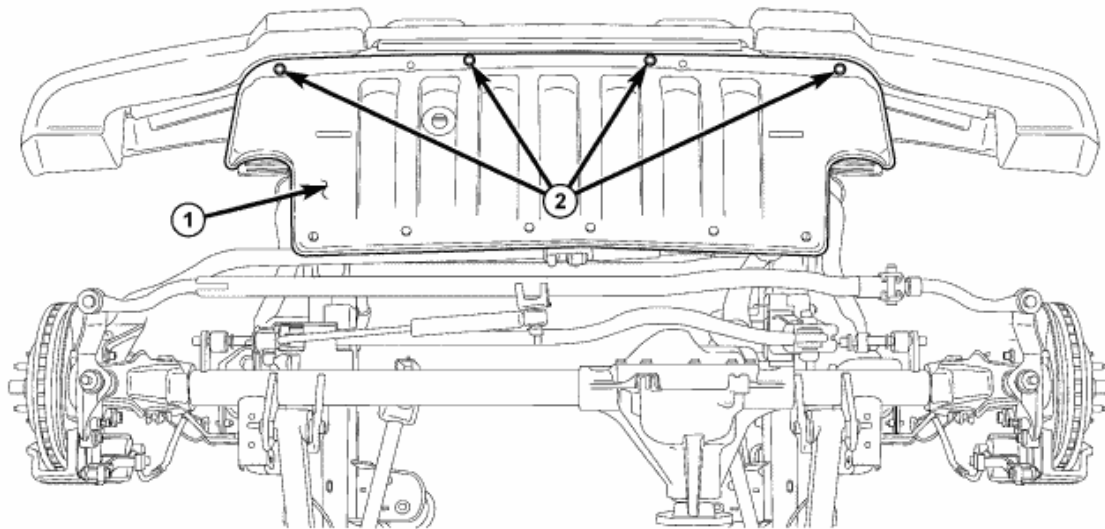
31. Install the PCV hose (1).
32. Fill the cooling system. Refer to **STANDARD PROCEDURE**.



81920ee6

Fig. 41: Inlet Air Temperature Sensor 3.8L
Courtesy of CHRYSLER LLC

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



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Fig. 42: Front Splash Shield
Courtesy of CHRYSLER LLC

36. Install the front splash shield (1).
37. Connect negative cable to battery.

2008 Jeep Wrangler Rubicon

2008 ENGINE 3.8L - Service Information - Wrangler

38. Start engine and run until operating temperature is reached.

SPECIFICATIONS**3.8L ENGINE****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. |

2008 Jeep Wrangler Rubicon

2008 ENGINE 3.8L - Service Information - Wrangler

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. |

2008 Jeep Wrangler Rubicon

2008 ENGINE 3.8L - Service Information - Wrangler

| | | |
|----------------------------------------|----------------|-------------------|
| 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

| | |
|--|--|
| | |
|--|--|

2008 Jeep Wrangler Rubicon

2008 ENGINE 3.8L - Service Information - Wrangler

| 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

| | |
|--|--|
| | |
|--|--|

2008 Jeep Wrangler Rubicon

2008 ENGINE 3.8L - Service Information - Wrangler

| 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) | 34.47 kPa | 5 psi |

2008 Jeep Wrangler Rubicon

2008 ENGINE 3.8L - Service Information - Wrangler

| | | |
|---------------------------------------------------------------------------------------------|-------------|-----------|
| with engine at operating temperature) | | |
| 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 |
| Forged Connecting Rod Cap-Nuts | 54 +1/4 turn | 40 +1/4 turn | - |
| Cracked Connecting Rod Cap-Bolts | See 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 | See 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 |

2008 Jeep Wrangler Rubicon

2008 ENGINE 3.8L - Service Information - Wrangler

| | | | |
|------------------------------|----|----|-----|
| 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 |

SPECIAL TOOLS**3.8L ENGINE**

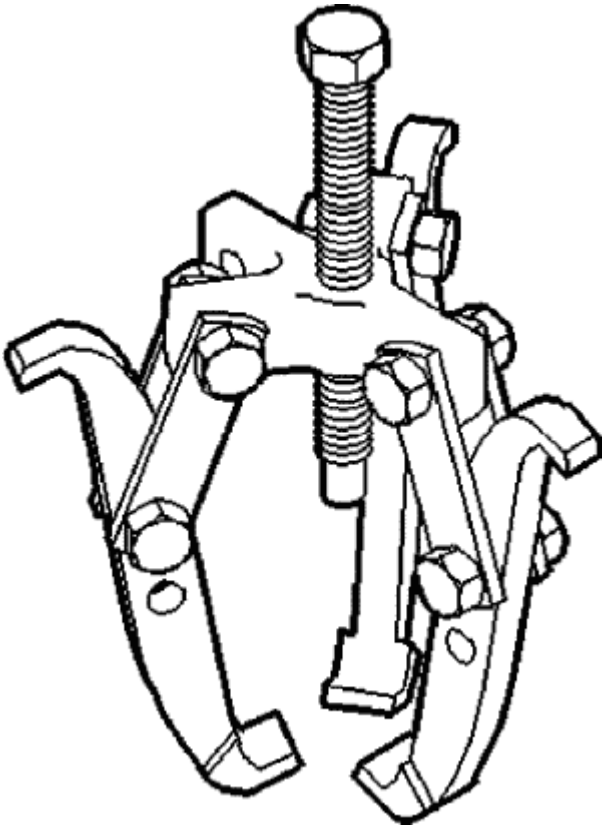


Fig. 43: Puller 1023

Courtesy of CHRYSLER LLC

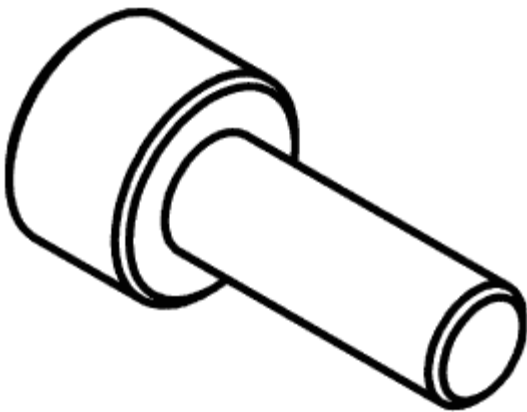


Fig. 44: Insert 8450

Courtesy of CHRYSLER LLC

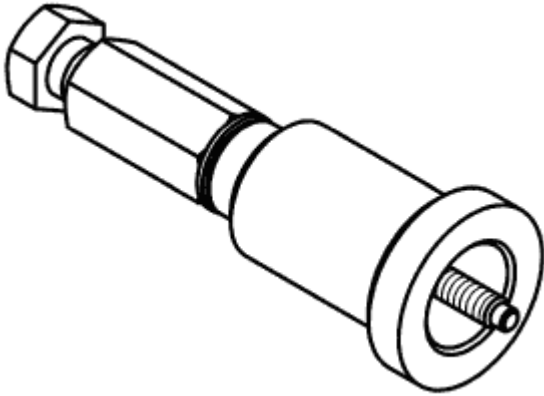
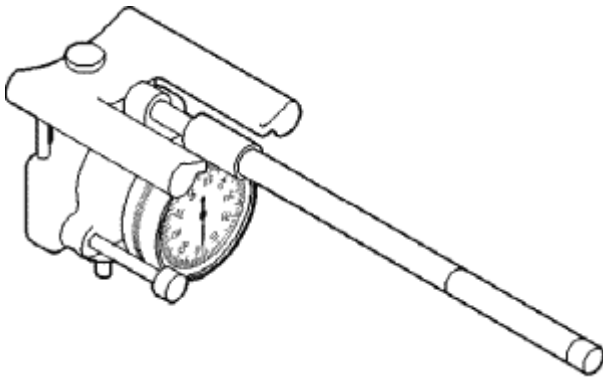
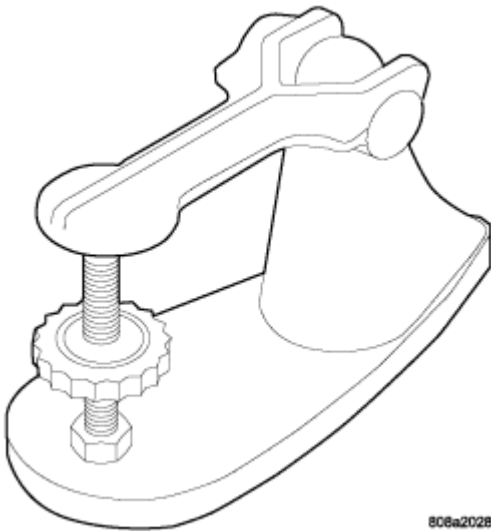


Fig. 45: Crankshaft Damper/Sprocket Installer 8452
Courtesy of CHRYSLER LLC



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Fig. 46: Indicator Cylinder Bore C-119
Courtesy of CHRYSLER LLC



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Fig. 47: Valve Spring Tester C-647

Courtesy of CHRYSLER LLC

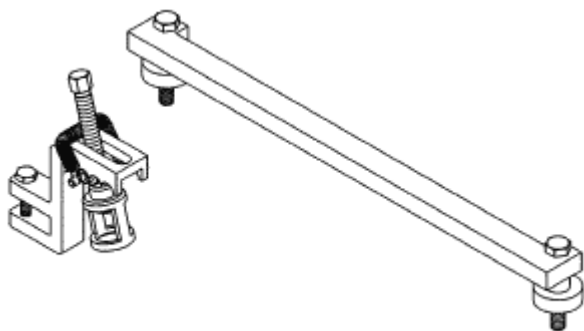


Fig. 48: Compressor, Valve Spring 8453

Courtesy of CHRYSLER LLC

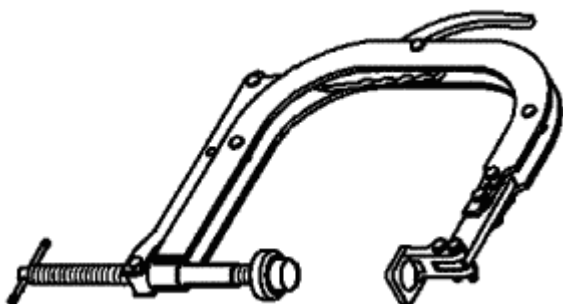


Fig. 49: Valve Spring Compressor C-3422-D

Courtesy of CHRYSLER LLC

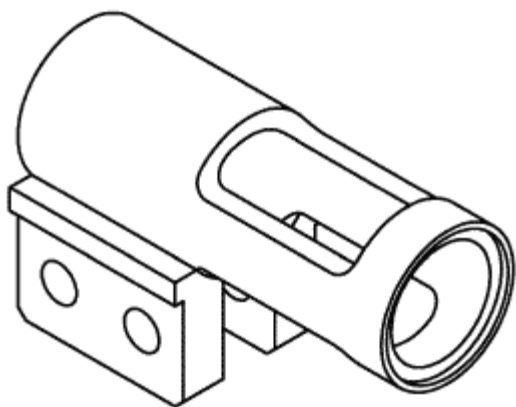


Fig. 50: Adapter, Valve Spring 8464

Courtesy of CHRYSLER LLC

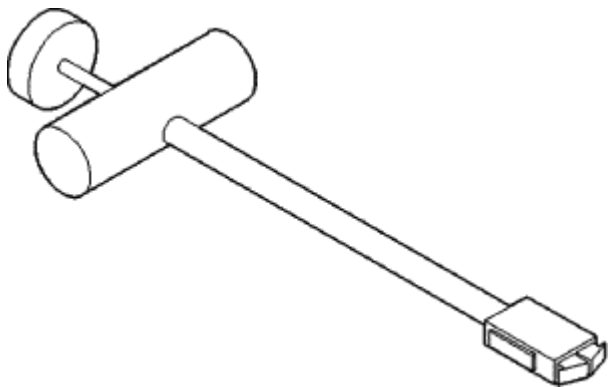


Fig. 51: Valve Tappet
Courtesy of CHRYSLER LLC

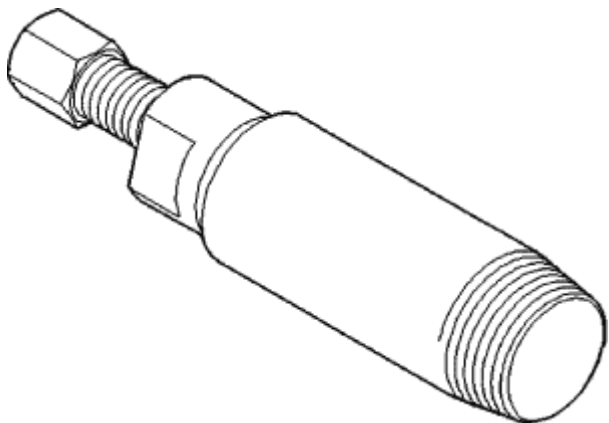
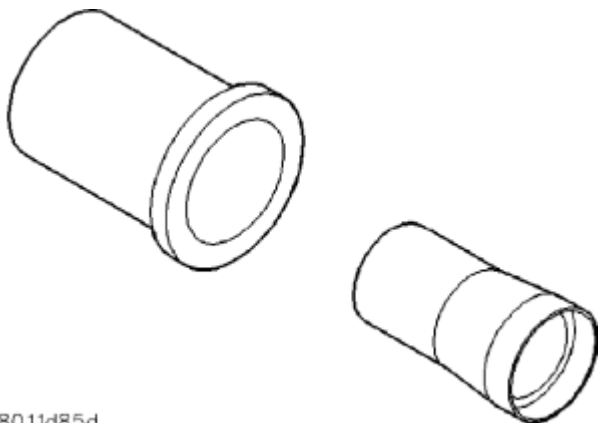


Fig. 52: Front Crankshaft Seal Remover 6341A
Courtesy of CHRYSLER LLC



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Fig. 53: Seal Installer C-4992
Courtesy of CHRYSLER LLC

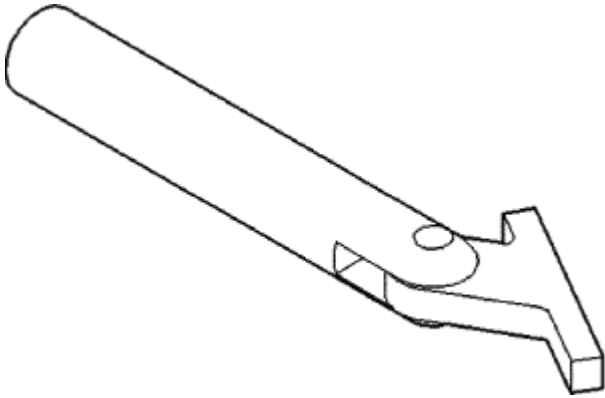


Fig. 54: Crankshaft Main Bearing Remover C-3059
Courtesy of CHRYSLER LLC

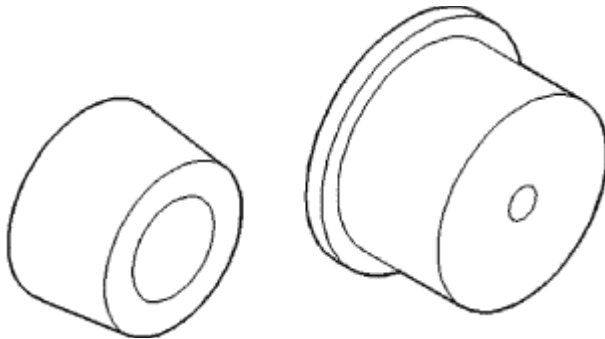


Fig. 55: Rear Crankshaft Oil Seal Installer 6926
Courtesy of CHRYSLER LLC

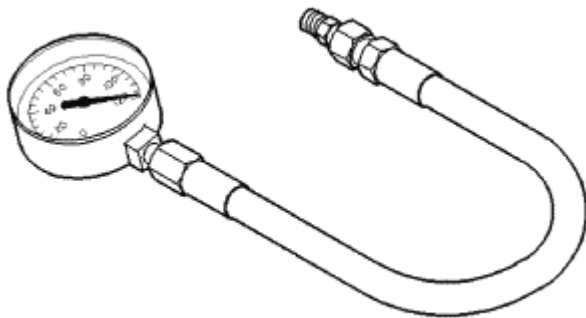


Fig. 56: Oil Pressure Gauge C-3292
Courtesy of CHRYSLER LLC

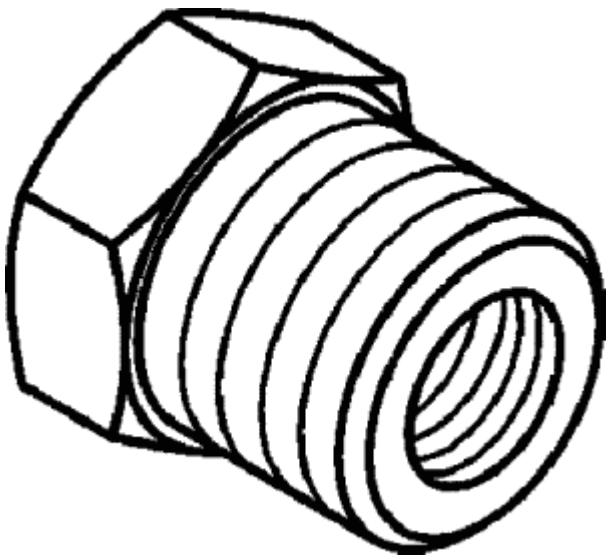


Fig. 57: Adapter 8406
Courtesy of CHRYSLER LLC

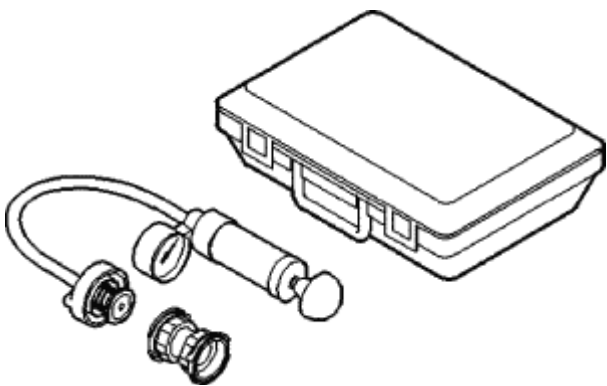


Fig. 58: Pressure Tester Kit 7700
Courtesy of CHRYSLER LLC

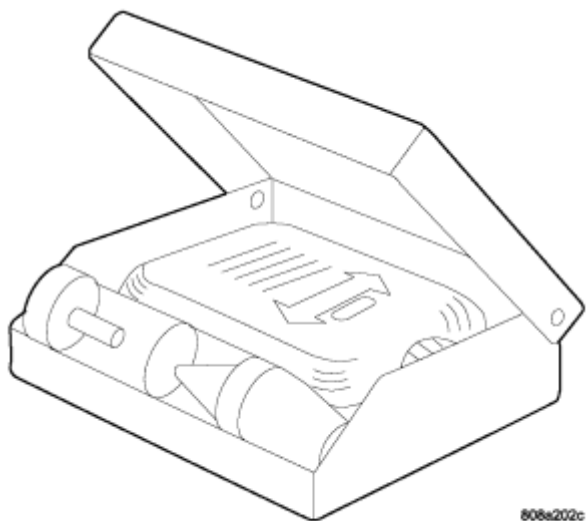


Fig. 59: BLOC-CHEK Kit C-3685
Courtesy of CHRYSLER LLC

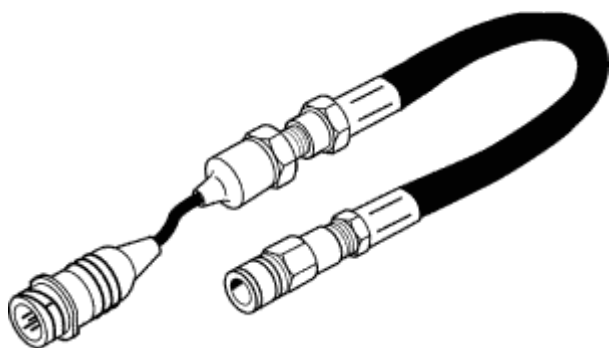


Fig. 60: Pressure Transducer CH7059
Courtesy of CHRYSLER LLC

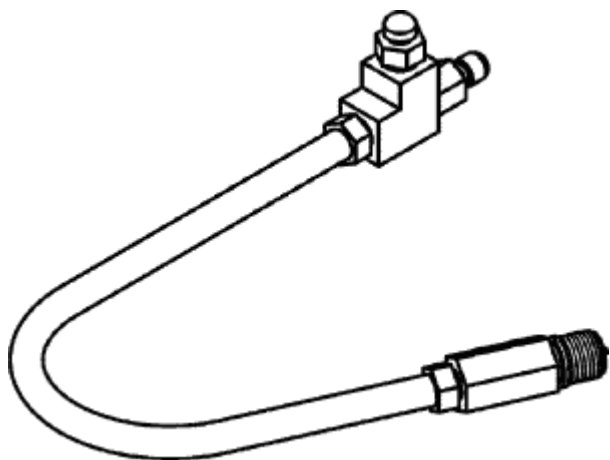


Fig. 61: Cylinder Compression Pressure Adapter 8116
Courtesy of CHRYSLER LLC

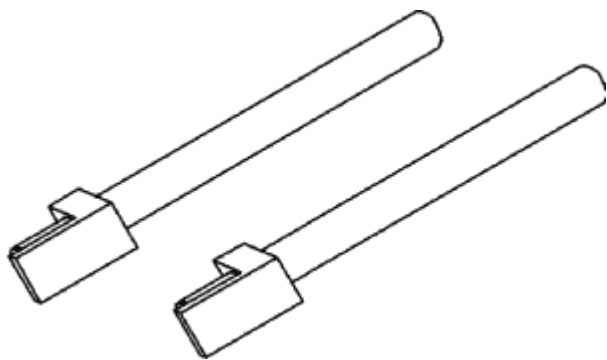


Fig. 62: Connecting Rod Guides 8189

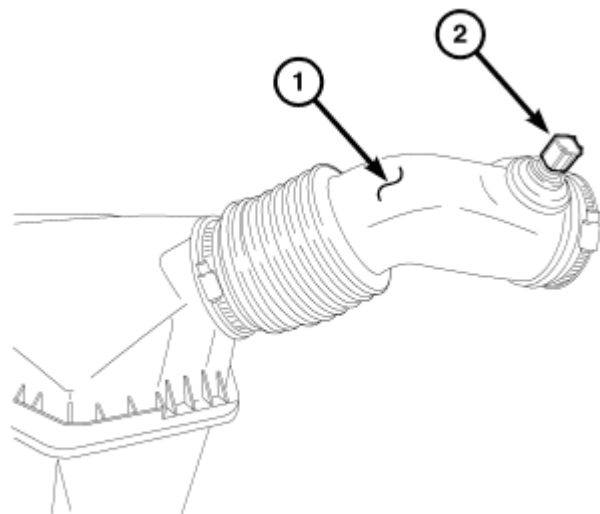
Courtesy of CHRYSLER LLC

AIR INTAKE SYSTEM

ELEMENT-AIR CLEANER

REMOVAL

REMOVAL



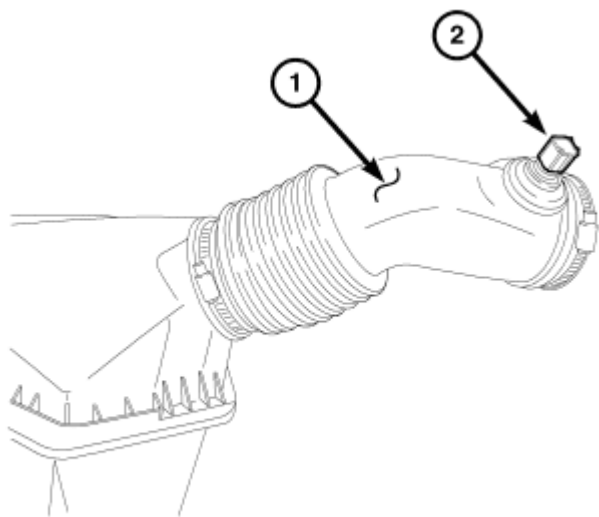
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Fig. 63: Internal Air Temperature Sensor 3.8L

Courtesy of CHRYSLER 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.

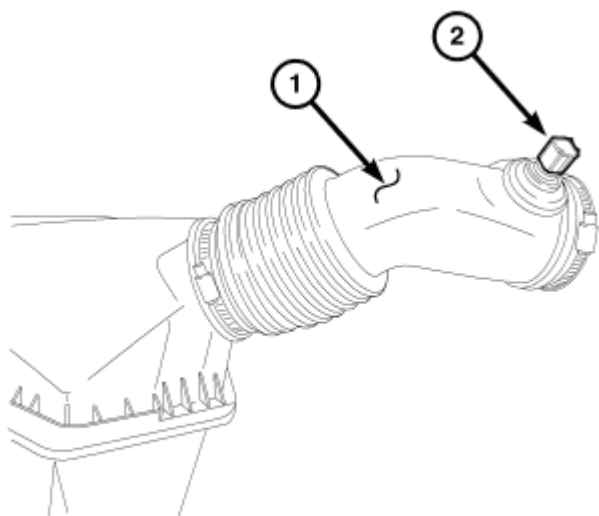
INSTALLATION**INSTALLATION**

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Fig. 64: Internal Air Temperature Sensor 3.8L**Courtesy of CHRYSLER 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.

HOUSING-AIR CLEANER**REMOVAL****REMOVAL**



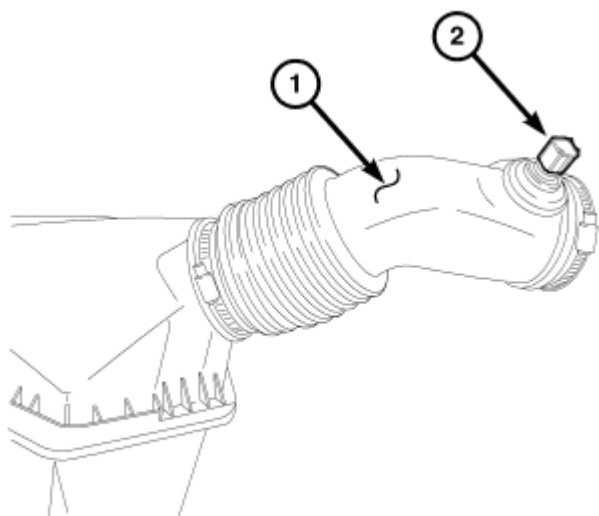
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Fig. 65: Internal Air Temperature Sensor 3.8L
Courtesy of CHRYSLER LLC

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



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Fig. 66: Internal Air Temperature Sensor 3.8L
Courtesy of CHRYSLER 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

CYLINDER HEAD

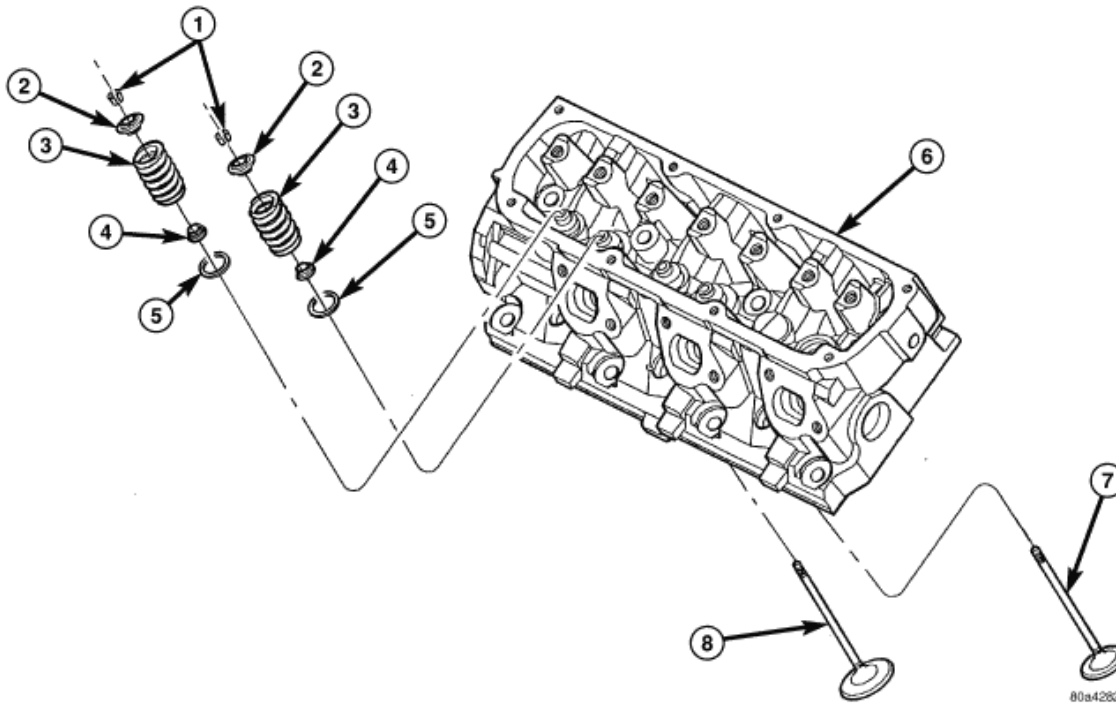


Fig. 67: Cylinder Head Components
Courtesy of CHRYSLER LLC

- | | |
|----------------------|---------------------|
| 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

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. See **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

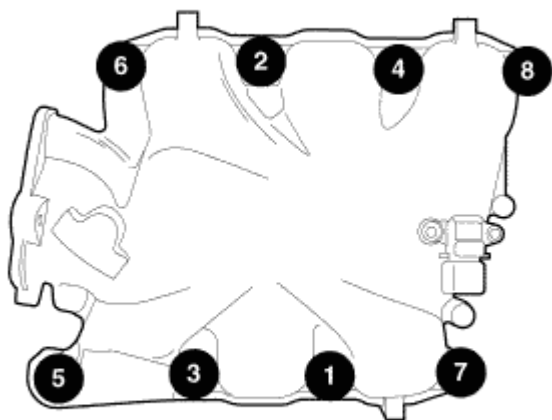
WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

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

CHEMICAL TEST METHOD

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

REMOVAL**CYLINDER HEAD**

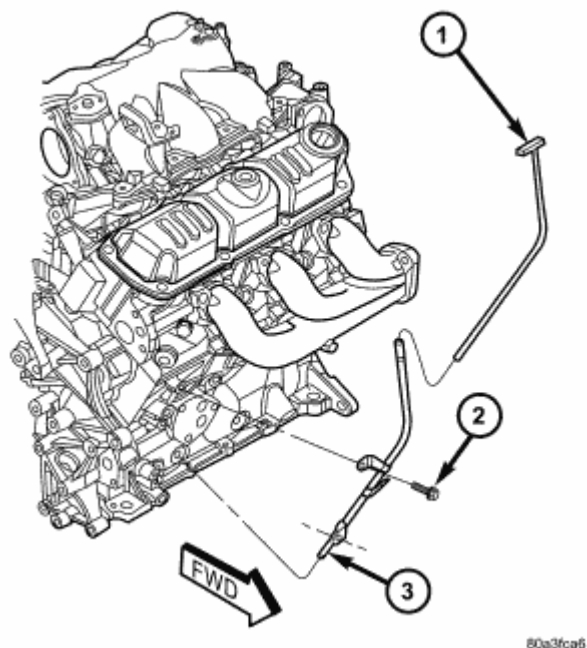


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Fig. 68: Removing/Installing Intake/Exhaust Manifold 3.8L
 Courtesy of CHRYSLER LLC

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.



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Fig. 69: Oil Level Indicator & Tube
Courtesy of CHRYSLER LLC

- 1 - INDICATOR
- 2 - BOLT
- 3 - TUBE

4. Remove the cylinder head covers. See **REMOVAL**.
5. Remove the spark plugs from cylinder head.
6. Remove the oil level indicator and tube.

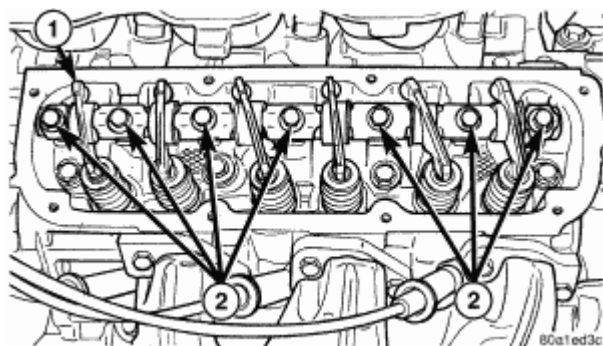


Fig. 70: Rocker Arms And Shaft
Courtesy of CHRYSLER LLC

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

7. Remove exhaust manifold(s). See **REMOVAL**.
8. Remove rocker arm and shaft assemblies (2). See **REMOVAL**. Remove push rods and **mark positions to ensure installation in original locations**.

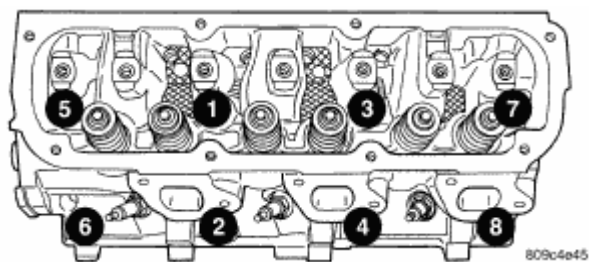


Fig. 71: Removing/Installing Cylinder Head Bolts In Sequence
Courtesy of CHRYSLER LLC

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

CLEANING

CYLINDER HEAD

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. See **STANDARD PROCEDURE**. Be careful not to gouge or scratch the aluminum head sealing surface.

Clean all engine oil passages.

INSPECTION

CYLINDER HEAD

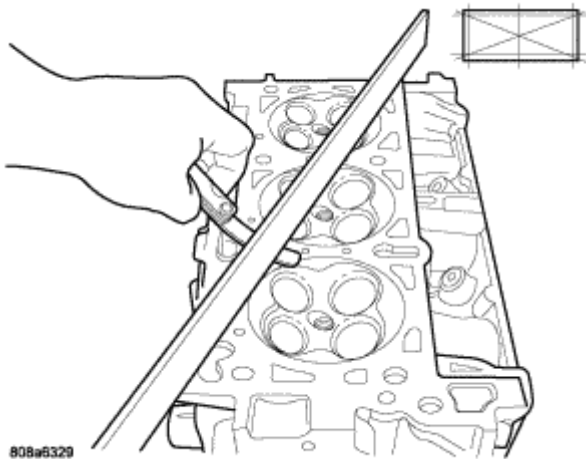


Fig. 72: Checking Cylinder Head For Flatness

Courtesy of CHRYSLER LLC

1. Before cleaning, check for leaks, damage and cracks.
2. Clean cylinder head and oil passages. See **CLEANING**.
3. Check cylinder head for flatness. See **Fig. 72**.
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

CYLINDER HEAD

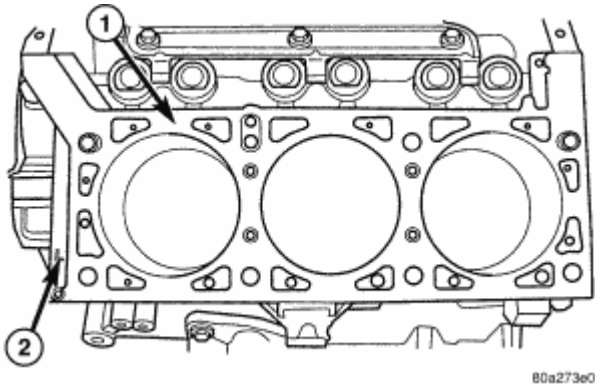


Fig. 73: Cylinder Head Gasket
Courtesy of CHRYSLER LLC

- | |
|----------------------------------------------------------------------------------------------------|
| <p>1 - CYLINDER HEAD GASKET</p> <p>2 - LOCATION IDENTIFICATION (L = LEFT BANK, R = RIGHT BANK)</p> |
|----------------------------------------------------------------------------------------------------|

1. Clean all sealing surfaces of engine block and cylinder heads. See **STANDARD PROCEDURE**.
2. Position new gasket(s) on engine block. 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. See **Fig. 73**.

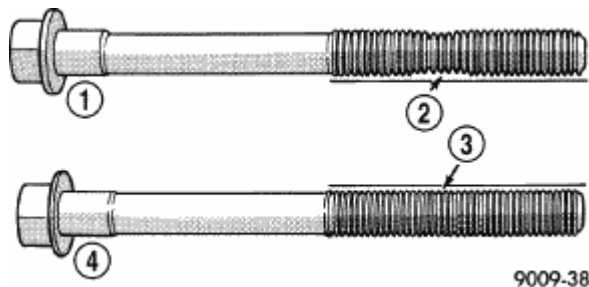


Fig. 74: Check For Stretched Bolts
Courtesy of CHRYSLER LLC

- | |
|-------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1 - STRETCHED BOLT</p> <p>2 - THREADS ARE NOT STRAIGHT ON LINE</p> <p>3 - THREADS ARE STRAIGHT ON LINE</p> <p>4 - UNSTRETCHED BOLT</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------|

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.

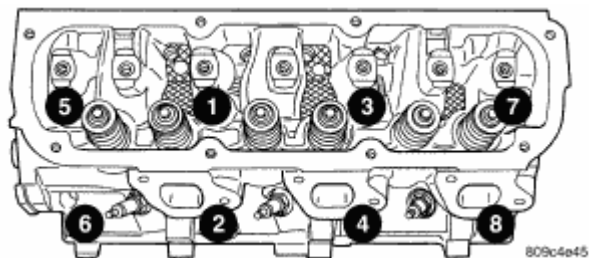


Fig. 75: Removing/Installing Cylinder Head Bolts In Sequence
Courtesy of CHRYSLER LLC

5. Tighten the cylinder head bolts 1-8 in the sequence shown in **Fig. 75**. 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.

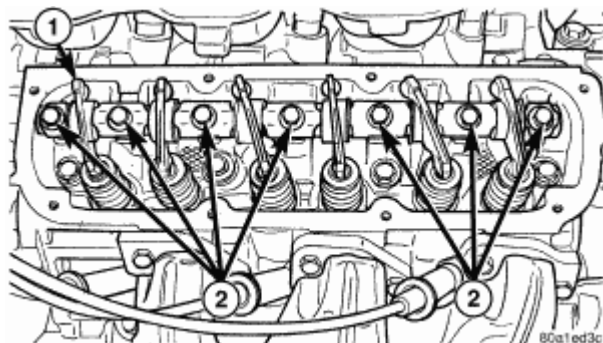
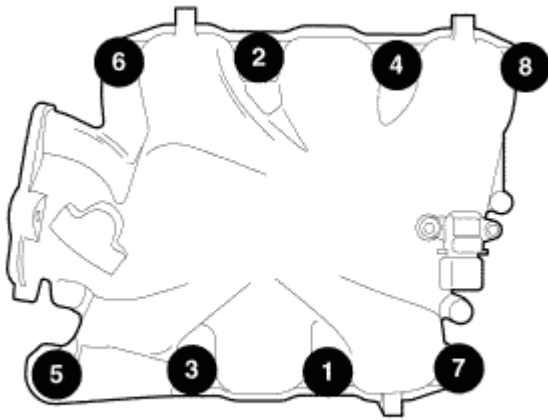


Fig. 76: Rocker Arms And Shaft
Courtesy of CHRYSLER LLC

- | |
|--------------------------------------------------------------|
| 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). See **INSTALLATION**.
9. Install the cylinder head covers. See **INSTALLATION**.



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Fig. 77: Removing/Installing Intake/Exhaust Manifold 3.8L
Courtesy of CHRYSLER LLC

10. Install the exhaust manifolds. See **INSTALLATION**.
11. Install new O-ring on oil level indicator tube. Install oil level indicator tube assembly. See **Fig. 77**.
12. Install upper and lower intake manifolds. See **INSTALLATION**.
13. Fill the cooling system. Refer to **STANDARD PROCEDURE**.
14. Connect negative cable to battery.

COVER(S)-CYLINDER HEAD

DESCRIPTION

CYLINDER HEAD COVER

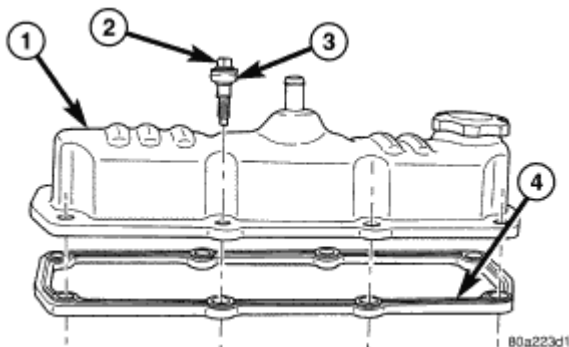


Fig. 78: Cylinder Head Cover Gasket
Courtesy of CHRYSLER LLC

- 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, follow the procedure found in Oil Leak Diagnosis for determining the source of a leak.

COVER-CYLINDER HEAD- RIGHT

REMOVAL

CYLINDER HEAD COVER - RIGHT

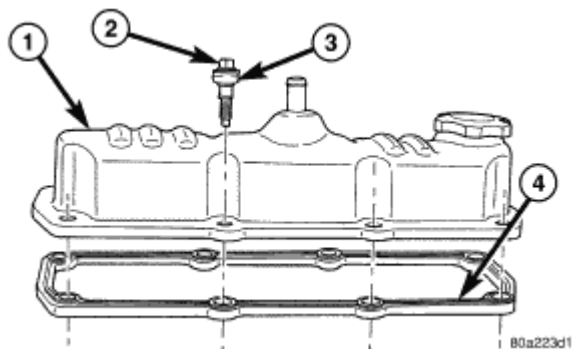


Fig. 79: Cylinder Head Cover Gasket
Courtesy of CHRYSLER LLC

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

CYLINDER HEAD COVER - RIGHT

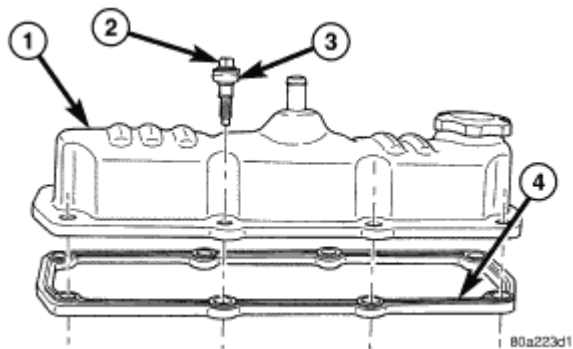


Fig. 80: Cylinder Head Cover Gasket

Courtesy of CHRYSLER 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).

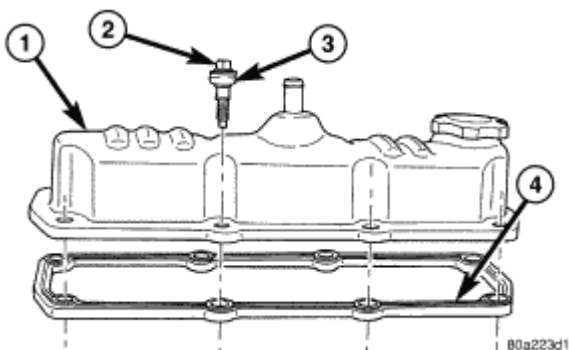


Fig. 81: Cylinder Head Cover Gasket

Courtesy of CHRYSLER 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.

COVER-CYLINDER HEAD-LEFT

REMOVAL

CYLINDER HEAD COVER- LEFT

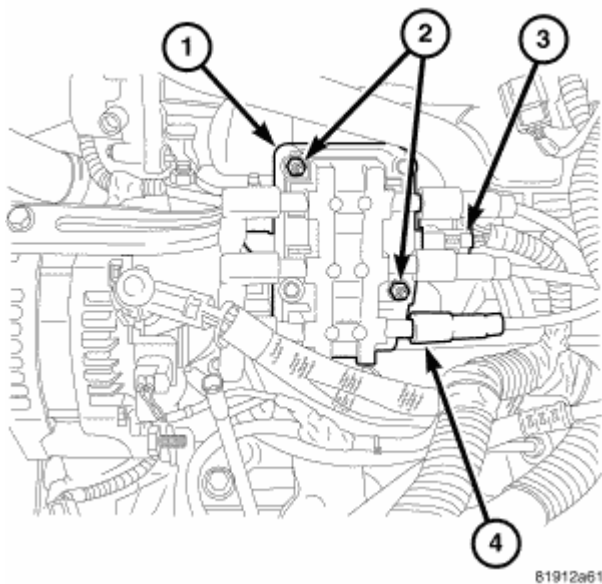


Fig. 82: Ignition Coil Pack 3.8L
Courtesy of CHRYSLER LLC

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

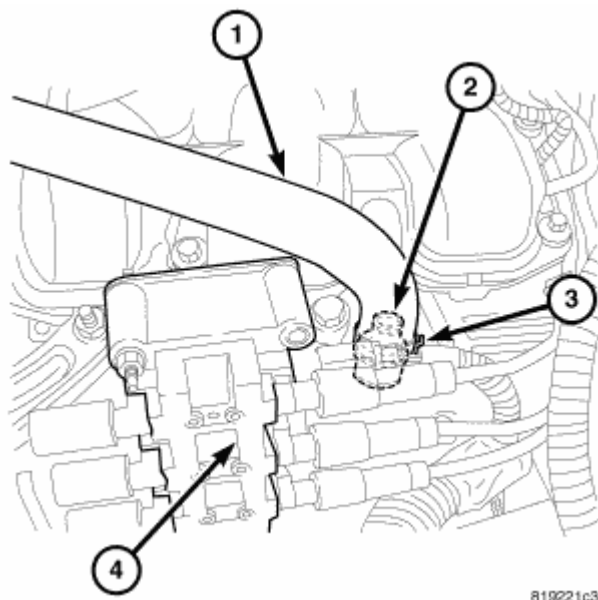


Fig. 83: PCV Valve Location 3.8L
Courtesy of CHRYSLER LLC

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

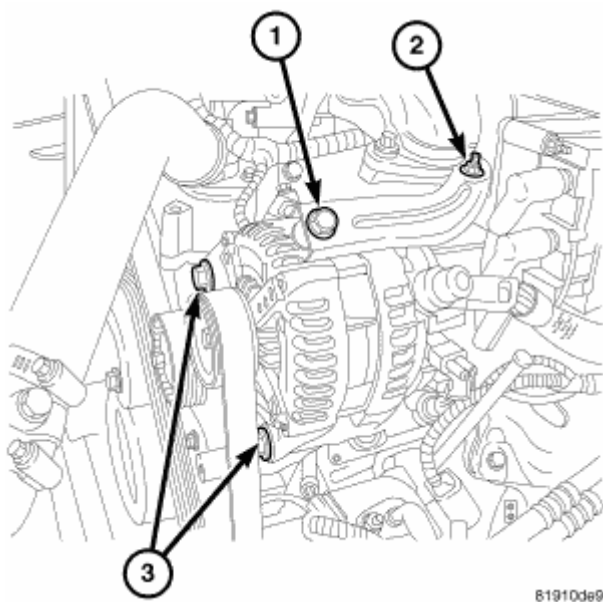
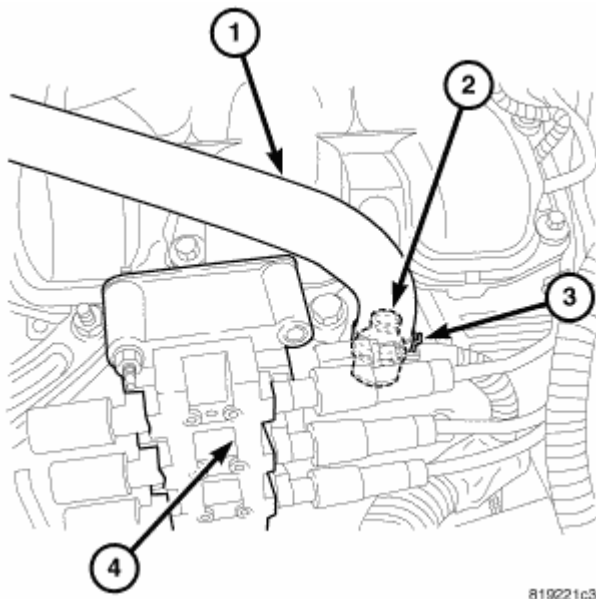


Fig. 84: Generator Support Bracket 3.8L
Courtesy of CHRYSLER LLC

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

INSTALLATION

CYLINDER HEAD COVER - LEFT

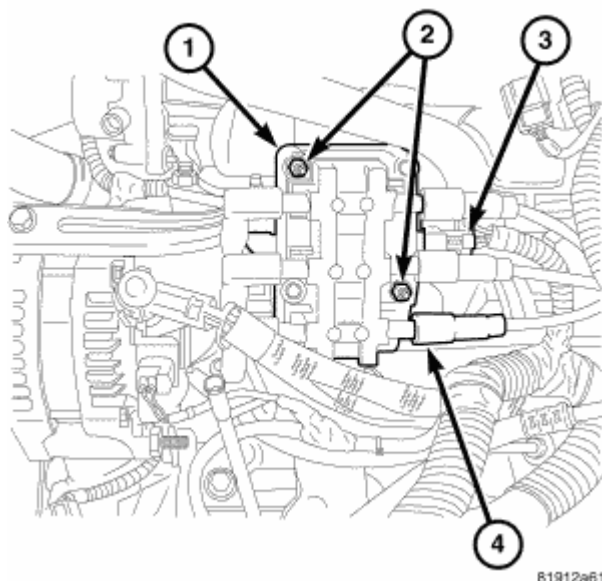


819221c3

Fig. 85: PCV Valve Location 3.8L

Courtesy of CHRYSLER 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).

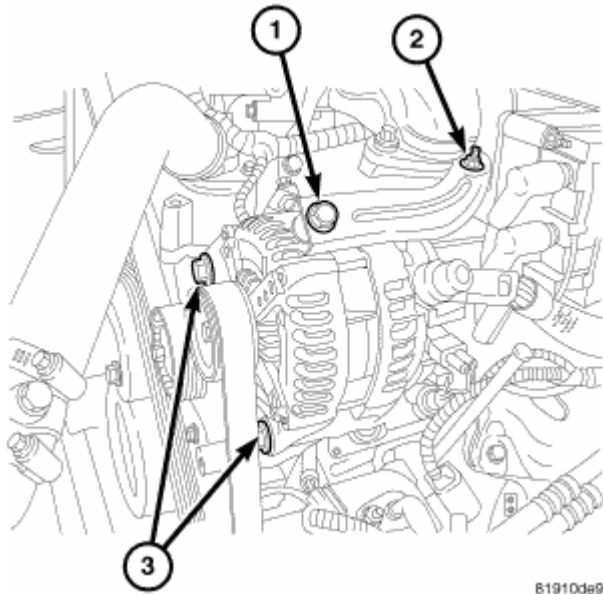


81912a61

Fig. 86: Ignition Coil Pack 3.8L

Courtesy of CHRYSLER LLC

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



81910de9

Fig. 87: Generator Support Bracket 3.8L
Courtesy of CHRYSLER LLC

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

VALVES & SEATS-INTAKE/EXHAUST

DESCRIPTION

VALVES AND VALVE SPRINGS

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

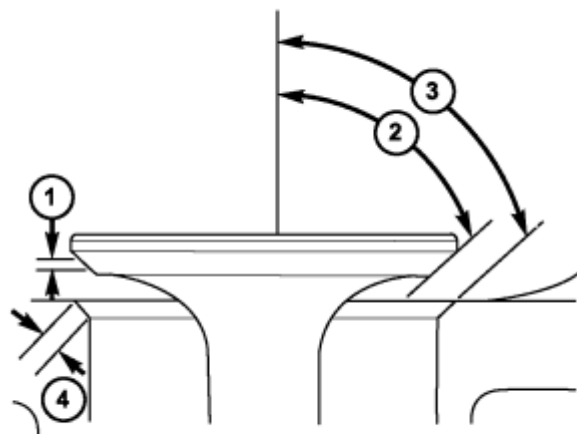
OPERATION

VALVES AND VALVE SPRINGS

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

STANDARD PROCEDURE

REFACING VALVES AND VALVE SEATS



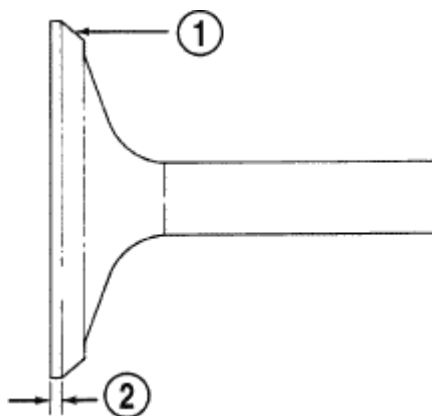
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Fig. 88: Refacing Valves And Valve Seats
Courtesy of CHRYSLER LLC

- 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. See **Fig. 88**.

VALVES



9409-78

Fig. 89: Identifying Valves
Courtesy of CHRYSLER LLC

- 1 - VALVE FACE
- 2 - VALVE MARGIN

1. Inspect the remaining margin after the valves are refaced. See **Fig. 89**. See **SPECIFICATIONS**.

VALVE SEATS

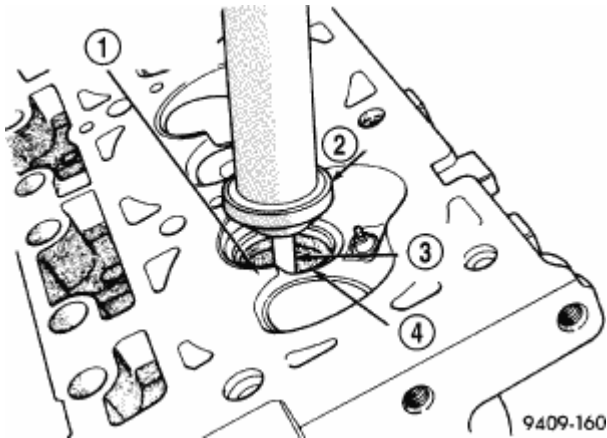


Fig. 90: Identifying Valve Seats
Courtesy of CHRYSLER LLC

- | |
|----------------------------------------------------|
| 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. See **Fig. 90**.

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.

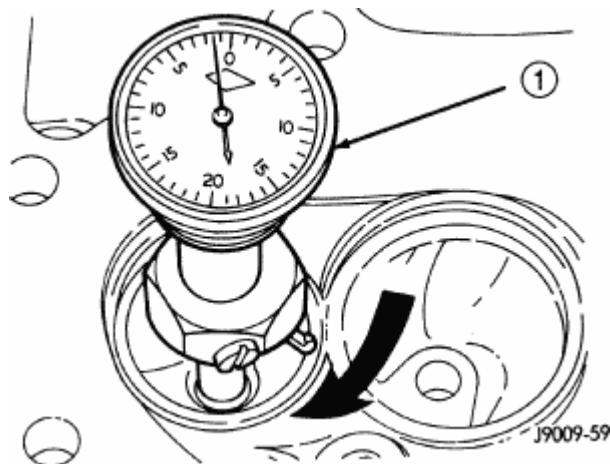


Fig. 91: View Of Dial Indicator
Courtesy of CHRYSLER LLC

1 - DIAL INDICATOR

2. Measure the concentricity of valve seat using dial indicator. See **Fig. 91**. 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.). See **Fig. 88**.

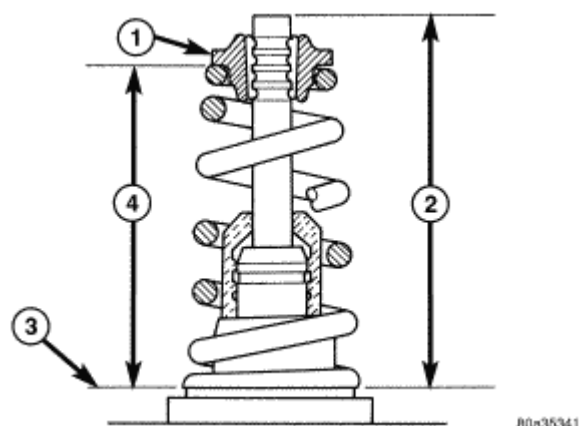


Fig. 92: Identifying Spring Seat
Courtesy of CHRYSLER LLC

- | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>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)</p> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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. See **Fig. 92**. 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. See **Fig. 92**.

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. 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. See [Fig. 92](#).

REMOVAL

VALVES AND VALVE SPRINGS

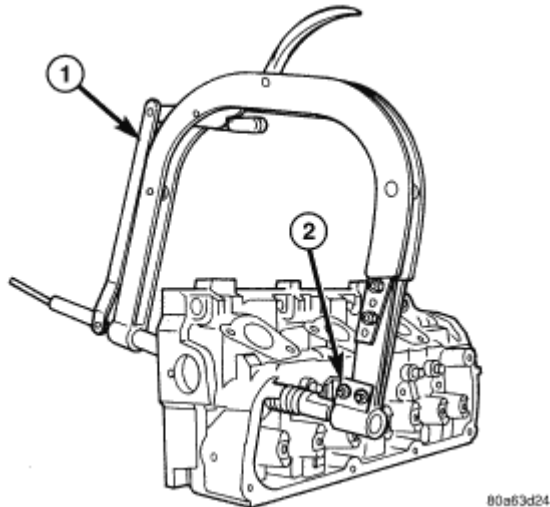


Fig. 93: Identifying Spring Compressor & Adapter
Courtesy of CHRYSLER LLC

- | |
|------------------------------------------------------------------------------|
| 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 C-3422-D with adapter 8464. See [Fig. 93](#).

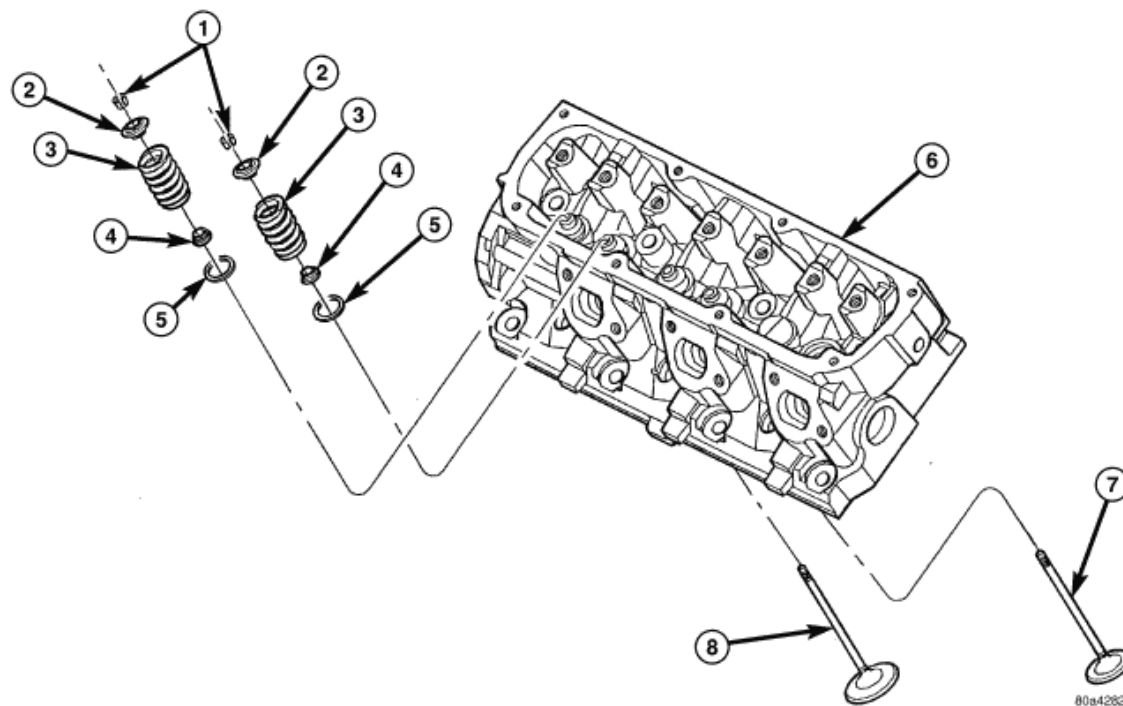


Fig. 94: Exploded View Of Spring Seats & Cylinder Head
 Courtesy of CHRYSLER LLC

| | |
|----------------------|---------------------|
| 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. See **Fig. 94**.
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

VALVE AND VALVE SPRING

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

INSPECTION

VALVE AND GUIDE

VALVES

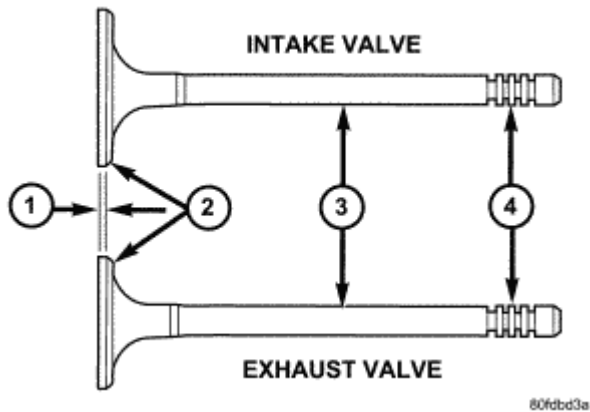


Fig. 95: Identifying Intake & Exhaust Valves
Courtesy of CHRYSLER LLC

- | |
|-------------------------------------------------------------------------------------------------|
| <p>1 - MARGIN</p> <p>2 - FACE</p> <p>3 - STEM</p> <p>4 - VALVE SPRING RETAINER LOCK GROOVES</p> |
|-------------------------------------------------------------------------------------------------|

1. Clean and inspect valves thoroughly. Replace burned, warped and cracked valves.
2. Measure valve stems for wear. See **Fig. 95**. For valve specifications, see **SPECIFICATIONS**.

NOTE: Valve stems are chrome plated and should not be polished. See **Fig. 95**.

VALVE GUIDES

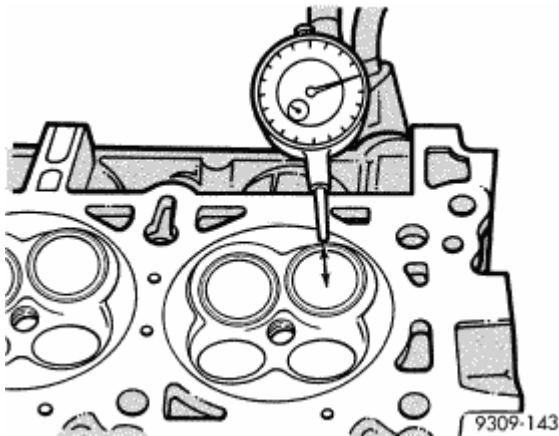


Fig. 96: View Of Valve Guide
Courtesy of CHRYSLER LLC

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 C-3339 to cylinder head and set it at right angle of valve stem being measured. See **Fig. 96**.
5. Move valve to and from the indicator. For clearance specifications, see **SPECIFICATIONS**.

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

INSTALLATION

VALVES AND VALVE SPRINGS

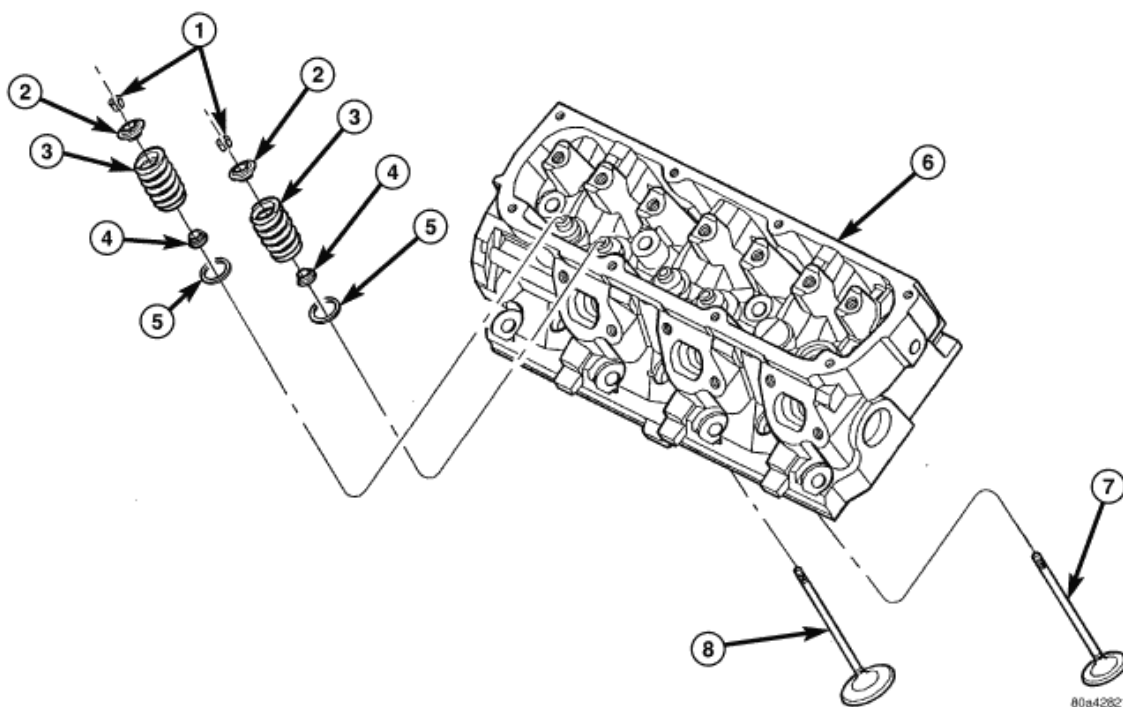


Fig. 97: Exploded View Of Spring Seats & Cylinder Head
Courtesy of CHRYSLER LLC

| | |
|----------------------|---------------------|
| 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. See **Fig. 97**.
2. Install valve spring seat on head. See **Fig. 97**.

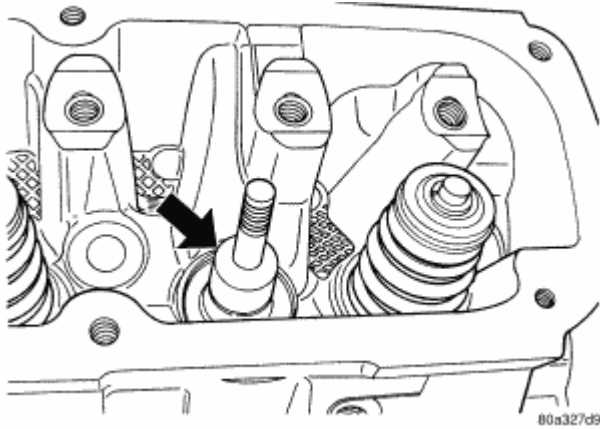


Fig. 98: Identifying New Valve Seal
Courtesy of CHRYSLER LLC

3. Install new seals on all valve stems and over valve guides Install valve springs and valve retainers. See **Fig. 98**
4. Install the valve springs. See **INSTALLATION**.

SPRINGS-VALVE

DESCRIPTION

VALVE SPRINGS

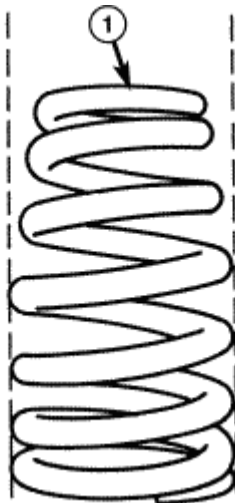


Fig. 99: View Of Valve Spring
Courtesy of CHRYSLER LLC

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. See **Fig. 99**.

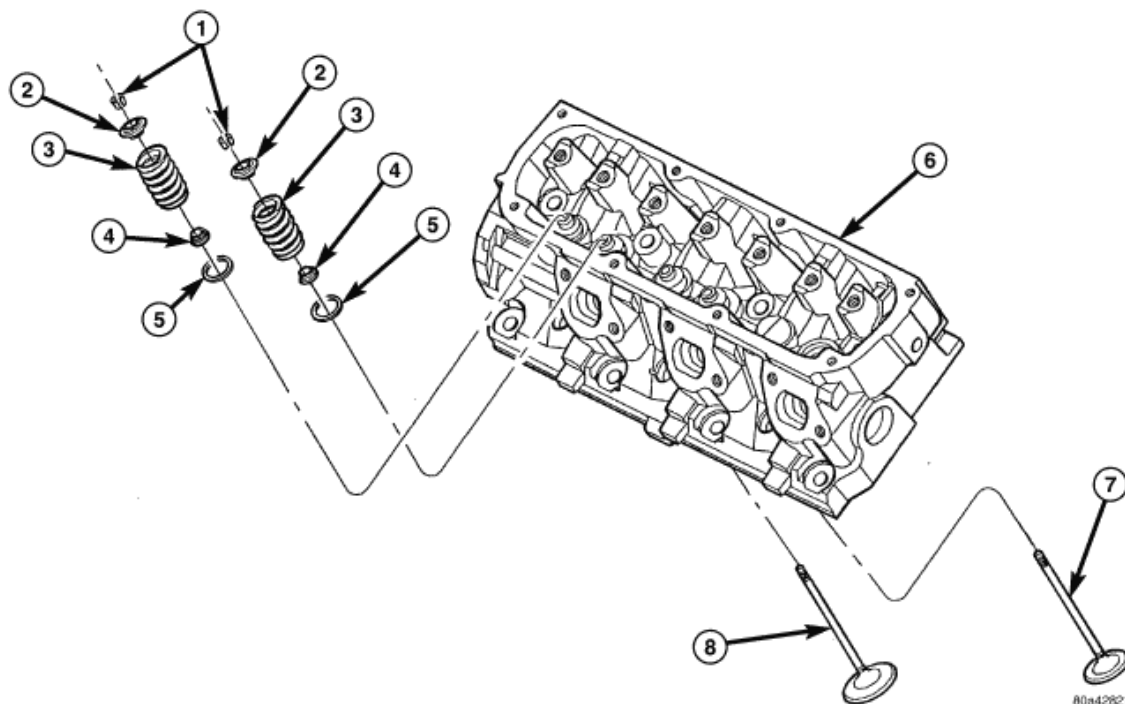


Fig. 100: Exploded View Of Valve Springs & Cylinder Head

Courtesy of CHRYSLER 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. See **Fig. 100**. The springs are installed with the smaller diameter against spring retainer. See **Fig. 99**.

OPERATION

VALVE SPRINGS

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

REMOVAL

VALVE SPRINGS - CYLINDER HEAD OFF

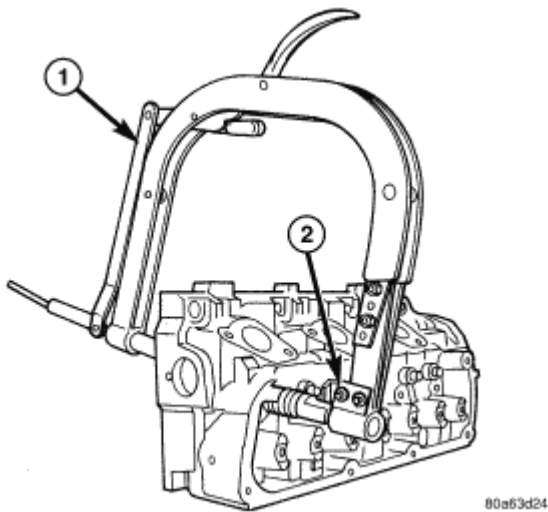


Fig. 101: Identifying Spring Compressor & Adapter
Courtesy of CHRYSLER LLC

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

1. With the cylinder head on a bench, position Special Tool C-3422-D with 8464 Adapter on the valve and spring retainer. See **Fig. 101**.
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. See **REMOVAL**.

VALVE SPRINGS - CYLINDER HEAD ON

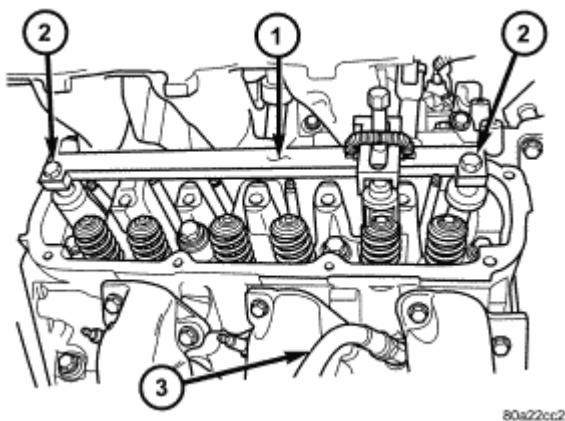


Fig. 102: Spark Plug Adapter
Courtesy of CHRYSLER LLC

- 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). See **REMOVAL**.

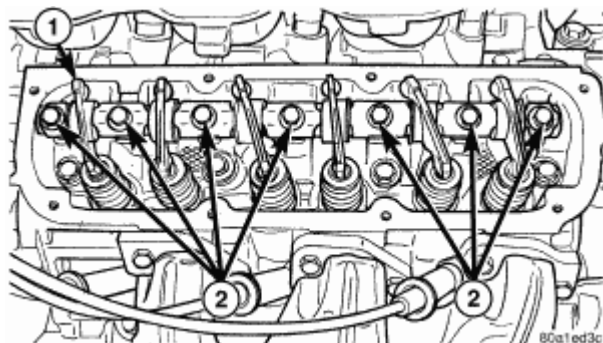


Fig. 103: Rocker Arms & Shaft
Courtesy of CHRYSLER LLC

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

4. Remove rocker arms and shaft (1). See **REMOVAL**.
5. Rotate engine until the piston in the cylinder bore requiring spring removal is at TDC.

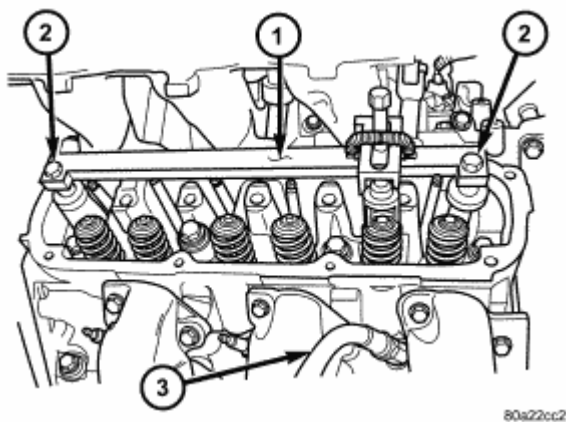


Fig. 104: Spark Plug Adapter
Courtesy of CHRYSLER LLC

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

6. Install Special Tool 8453 (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

VALVE SPRING

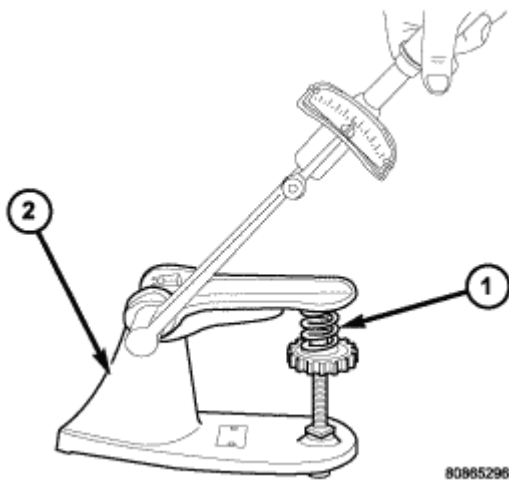


Fig. 105: View Of Special Tool C-647
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL C-647

NOTE: The are two different types of valve springs used that are interchangeable, but have different specifications. See DESCRIPTION.

Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested. See **Fig. 105**. **As an example;** the compression length of a spring to be tested is 38.00 mm (1.496 in.). Turn the table of Tool C-647 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. See SPECIFICATIONS. Replace any springs that do not meet specifications.

INSTALLATION

VALVE SPRINGS - CYLINDER HEAD OFF

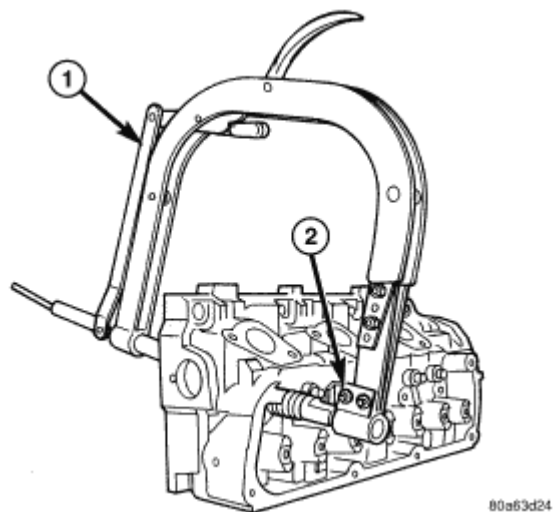


Fig. 106: Identifying Spring Compressor & Adapter
Courtesy of CHRYSLER LLC

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

1. If removed, install a new valve stem seal. See **INSTALLATION**.
2. Position valve spring and retainer on spring seat.
3. Using Special Tool C-3422-D with 8464 Adapter, compress the spring only enough to install the valve retainer locks. Install valve retainer locks. See **Fig. 106**.

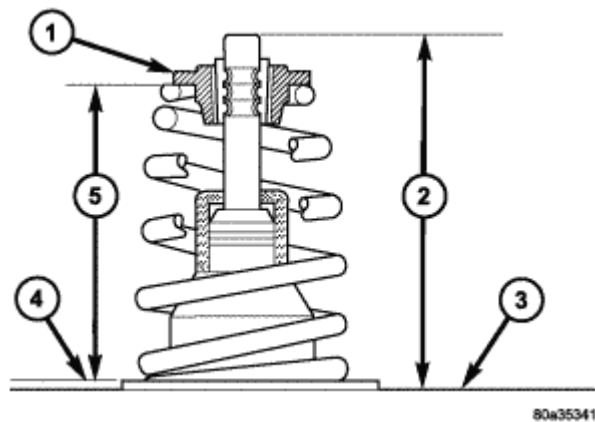


Fig. 107: Identifying Valve Spring Height
Courtesy of CHRYSLER LLC

- 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. See **Fig. 107**.

VALVE SPRINGS OR VALVE STEM SEALS - IN VEHICLE

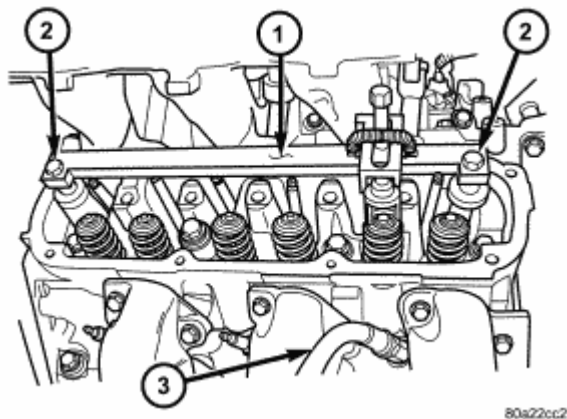


Fig. 108: Spark Plug Adapter Tool
Courtesy of CHRYSLER LLC

- | |
|--------------------------------------------------------------------------------------------|
| 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).

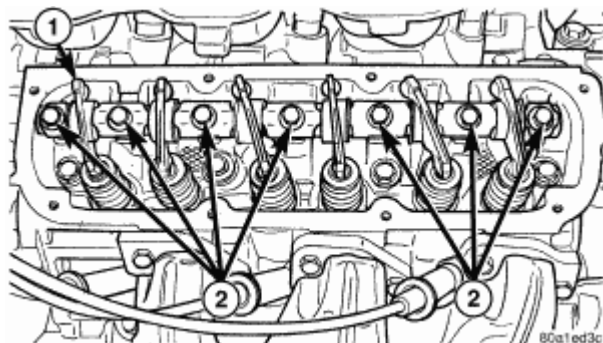


Fig. 109: Rocker Arms & Shaft
Courtesy of CHRYSLER LLC

- | |
|--------------------------------------------------------------|
| 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.

ARMS-ROCKER

DESCRIPTION

DESCRIPTION - 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.

ROCKER ARMS AND SHAFT

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.

OPERATION

OPERATION - 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.

ROCKER ARMS AND SHAFT

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.

REMOVAL

ROCKER ARMS AND SHAFT

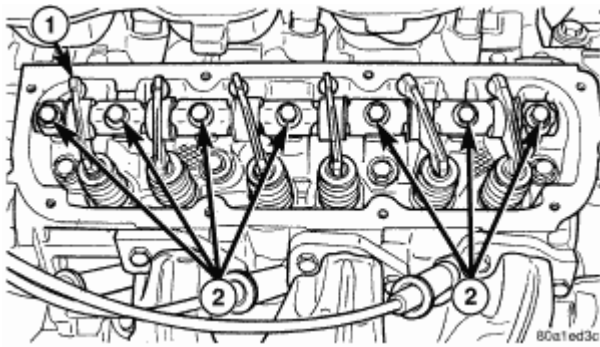


Fig. 110: Rocker Arms & Shaft
Courtesy of CHRYSLER LLC

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

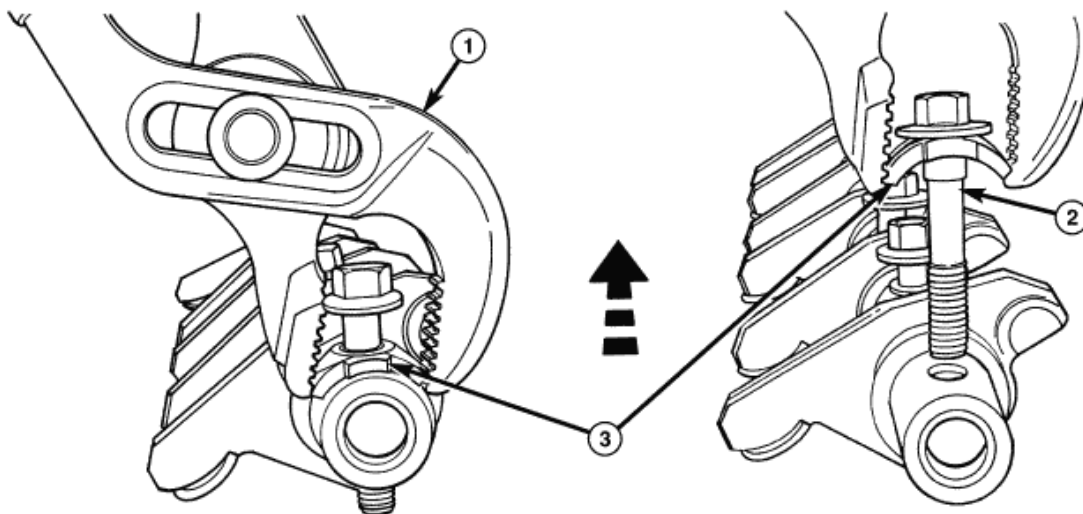
1. Remove the cylinder head cover(s). See **REMOVAL**.

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. See **Fig. 110**.
3. Remove the rocker arms and shaft assembly. See **Fig. 110**.
4. For rocker arm disassembly procedures, see **DISASSEMBLY**.

DISASSEMBLY

ROCKER ARMS AND SHAFT



80a1ec81

Fig. 111: Rocker Arm Retainer - Removal

Courtesy of CHRYSLER 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:
 - Using adjustable pliers, grip the edges of the retainer. See **Fig. 111**.
 - Apply an upward force with a slight rocking motion until the retainer disengages from shaft. See **Fig. 111**.

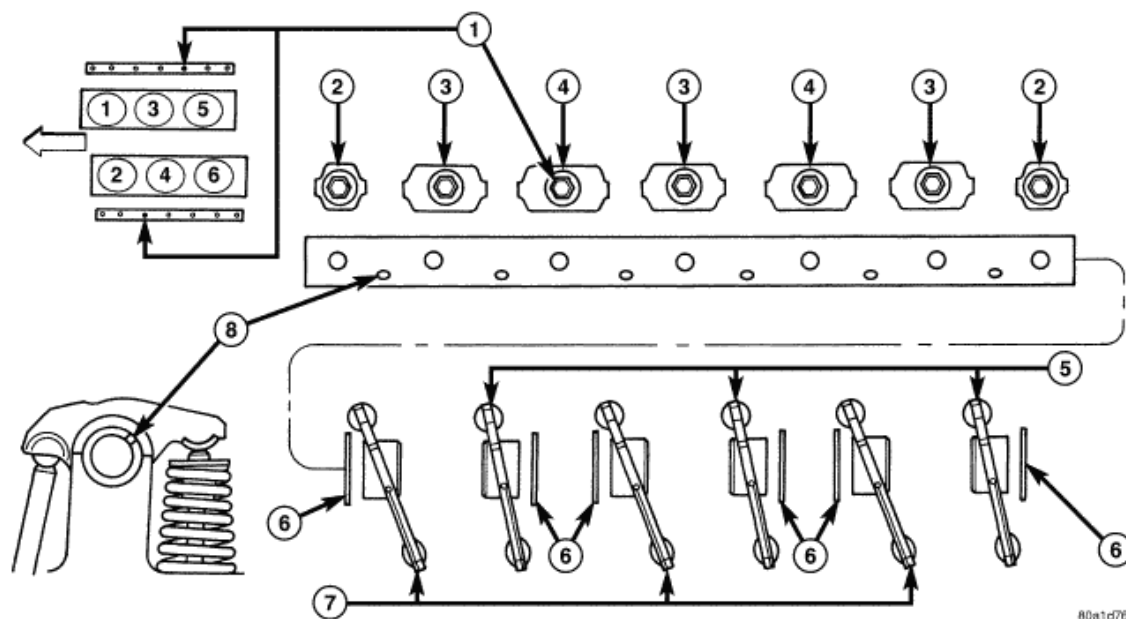


Fig. 112: Rocker Arms & Shaft

Courtesy of CHRYSLER 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 | 8 - ROCKER ARMS LUBRICATION FEED |

mm (1.61 in.)

HOLE (POSITION
UPWARD & TOWARD
VALVE SPRING)

2. Remove rocker arms. See **Fig. 112**. Identify the component locations for reassembly in original locations.

ASSEMBLY

ROCKER ARMS AND SHAFT

1. Install rocker arms on the shaft. Install in the original positions if reused. **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. See **INSTALLATION**.

INSTALLATION

ROCKER ARMS AND SHAFT

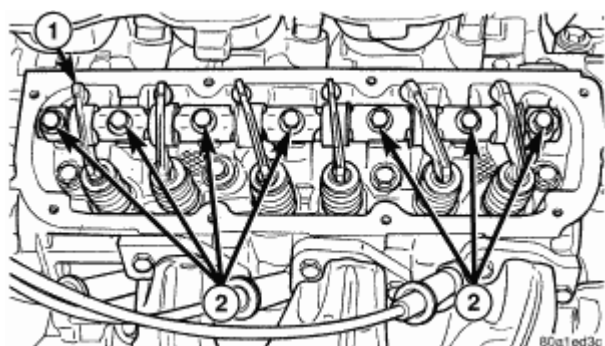


Fig. 113: Rocker Arms & Shaft
Courtesy of CHRYSLER LLC

- | |
|------------------------------------|
| 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. See **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.). See **Fig. 113**.
4. Install the cylinder head cover(s). See **INSTALLATION**.

SEALS-VALVE STEM

DESCRIPTION

VALVE SEALS

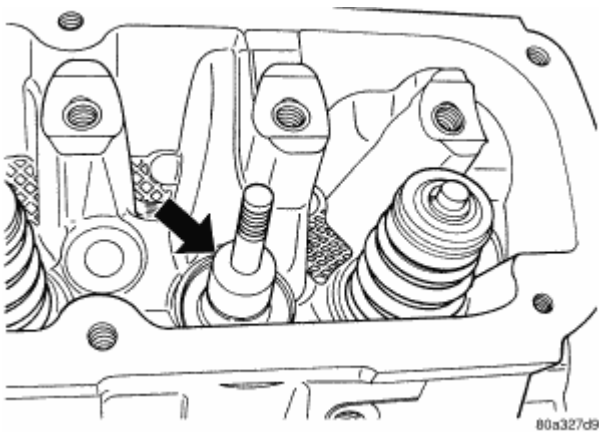


Fig. 114: Identifying Valve Seal
Courtesy of CHRYSLER LLC

The valve stem seals are made of Viton rubber. The seals are positioned over the valve stem and seated on the valve guide. See **Fig. 114**.

REMOVAL

VALVE STEM SEALS

1. Remove the valve springs. See **REMOVAL**.
2. Remove the valve stem seal.

INSTALLATION

VALVE STEM SEALS

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. See **INSTALLATION**.

ENGINE BLOCK

DESCRIPTION

CYLINDER BLOCK

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

STANDARD PROCEDURE

CYLINDER BORE HONING

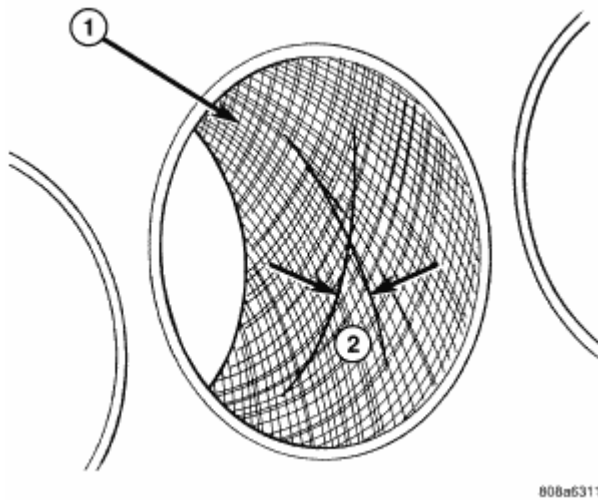


Fig. 115: Cylinder Bore Cross-Hatch Pattern
Courtesy of CHRYSLER LLC

1 - CROSS-HATCH PATTERN

2 - 40°-60°

1. Used carefully, the cylinder bore resizing hone, recommended tool C-823 or equivalent, equipped with 220 grit stones, is the best tool for this honing procedure. In addition to deglazing, it will reduce taper and out-of-round as well as removing light scuffing, scoring or scratches. Usually a few strokes will clean up a bore and maintain the required limits.
2. Deglazing of the cylinder walls may be done using a cylinder surfacing hone, recommended tool C-3501 or equivalent, equipped with 280 grit stones, if the cylinder bore is straight and round. 20-60 strokes depending on the bore condition, will be sufficient to provide a satisfactory surface. Use a light honing oil. **Do not use engine or transmission oil, mineral spirits or kerosene.** Inspect cylinder walls after each 20 strokes.
3. Honing should be done by moving the hone up and down fast enough to get a cross-hatch pattern. When hone marks **intersect** at 40-60 degrees (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.

CLEANING

ENGINE BLOCK

Clean cylinder block thoroughly using a suitable cleaning solvent.

INSPECTION

ENGINE BLOCK

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, see **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).

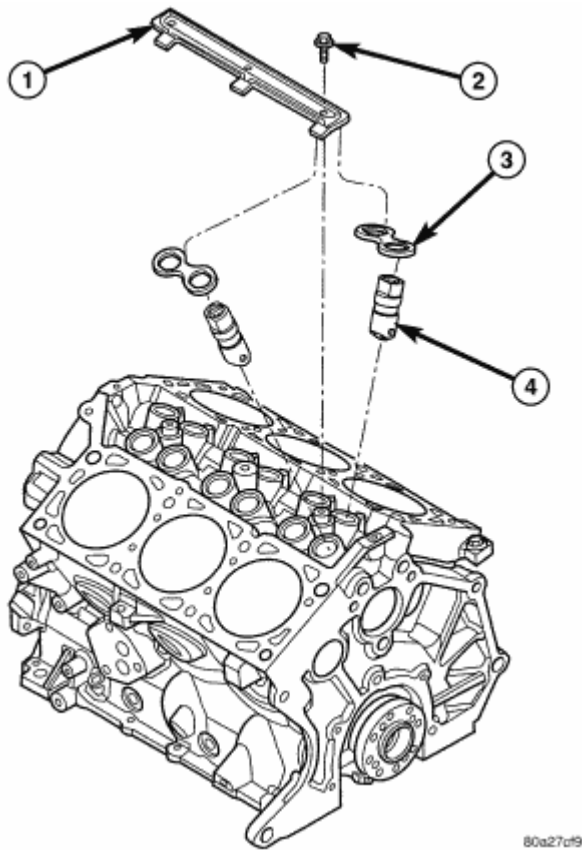
The cylinder walls should be checked for out-of-round and taper with Tool C119 or equivalent. See **SPECIFICATIONS**. If the cylinder walls are badly scuffed or scored, the cylinder block should be replaced, and new pistons and rings fitted.

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. See **SPECIFICATIONS**.

TAPPETS-HYDRAULIC-(CAM IN BLOCK)

DESCRIPTION

HYDRAULIC LIFTERS



80a27r9

Fig. 116: Hydraulic Lifters

Courtesy of CHRYSLER 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

HYDRAULIC LIFTERS

HYDRAULIC LIFTERS DIAGNOSIS - PRELIMINARY STEP

Before disassembling any part of the engine to correct lifter noise, check the engine oil pressure. See **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

HYDRAULIC LIFTERS

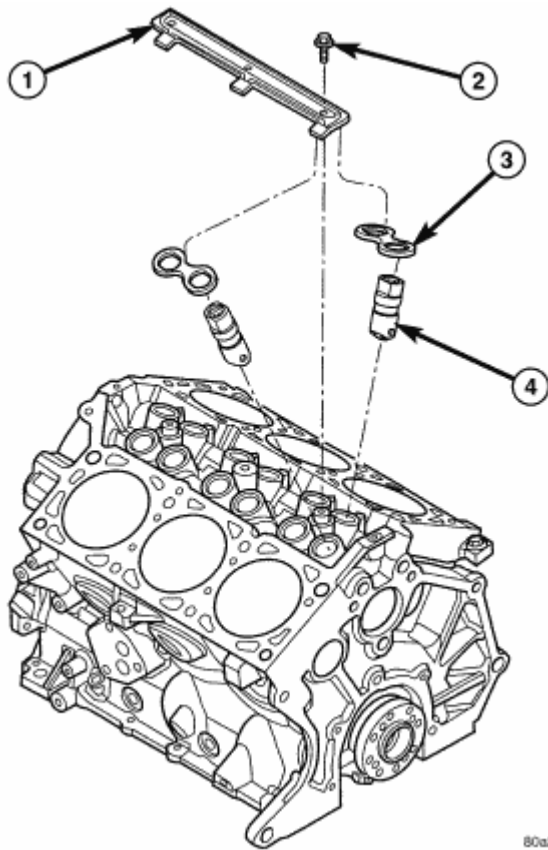


Fig. 117: Hydraulic Lifters
Courtesy of CHRYSLER LLC

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

1. Remove the cylinder head(s). See **REMOVAL**.
2. Remove the yoke retainer (1) and aligning yokes (3).
3. Remove the hydraulic lifters. If necessary use Special Tool C-4129, or equivalent to remove lifters from bores. If lifters are to be reused, identify each lifter to ensure installation in original location.

INSTALLATION

HYDRAULIC LIFTERS

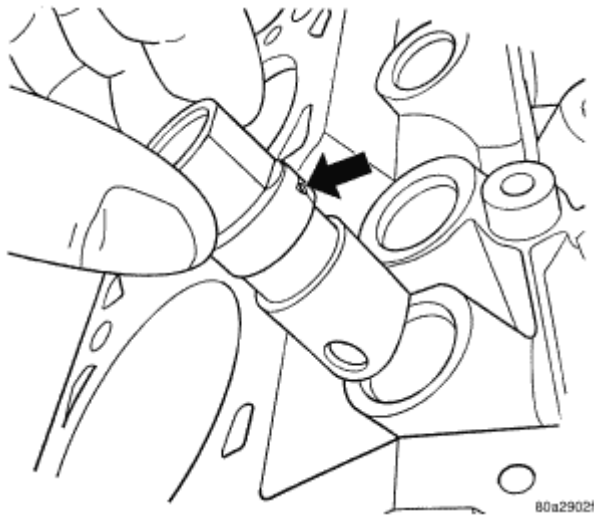


Fig. 118: Lifter Lubrication Hole
Courtesy of CHRYSLER LLC

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.

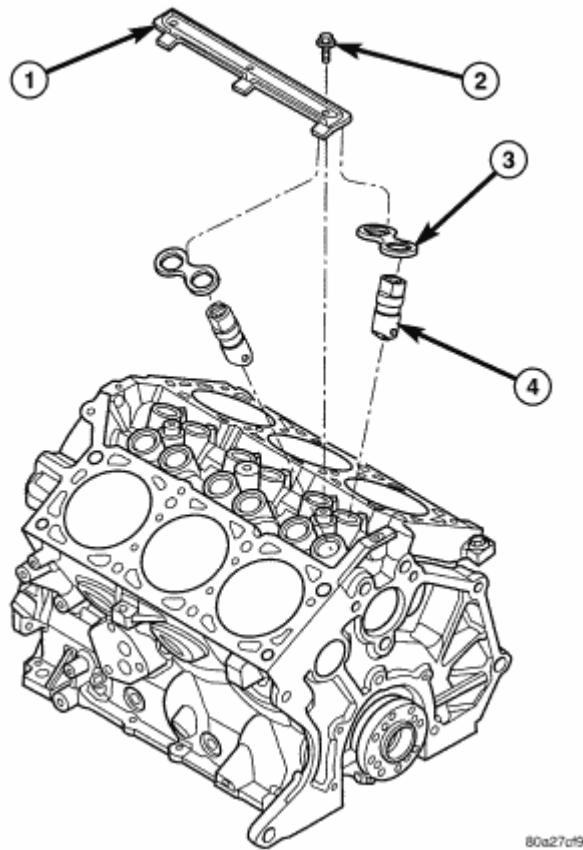


Fig. 119: Hydraulic Lifters
Courtesy of CHRYSLER LLC

- | |
|--------------------------------------------------------------------------------------------|
| 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. See **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.

CAMSHAFT & BEARINGS (IN BLOCK)

DESCRIPTION

CAMSHAFT

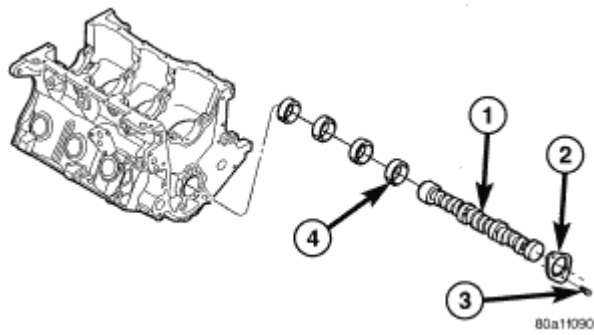


Fig. 120: Camshaft & Bearings
Courtesy of CHRYSLER LLC

- | |
|-------------------------------------------------------------------------------------------------------|
| <p>1 - CAMSHAFT 2 - THRUST PLATE 3 - BOLT 4 - CAMSHAFT BEARINGS (SERVICED WITH BLOCK)</p> |
|-------------------------------------------------------------------------------------------------------|

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

CAMSHAFT

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

CAMSHAFT

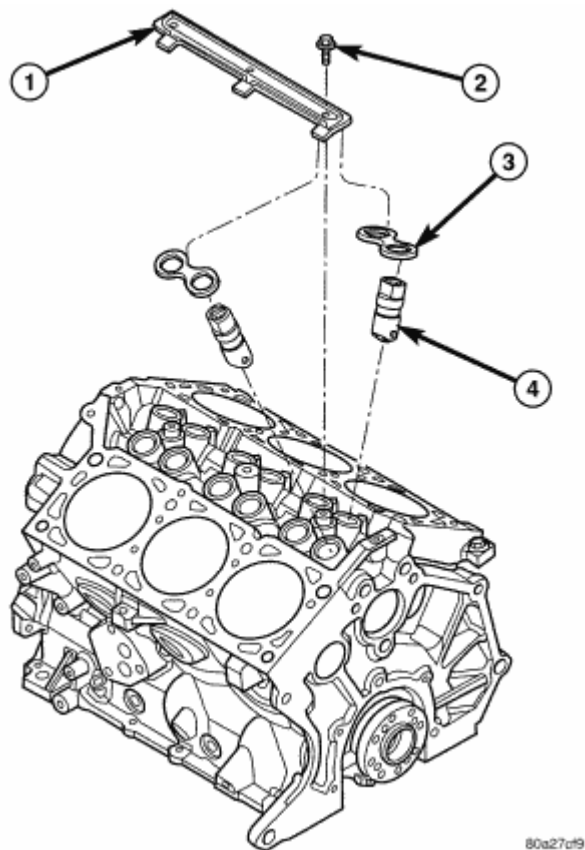


Fig. 121: Hydraulic Lifters

Courtesy of CHRYSLER 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. See **REMOVAL**.
3. Remove the timing chain and camshaft sprocket. See **REMOVAL**.
4. Remove the yoke retainer (1).
5. Remove the hydraulic lifters (4). See **REMOVAL**. Identify each tappet for reinstallation in original location.

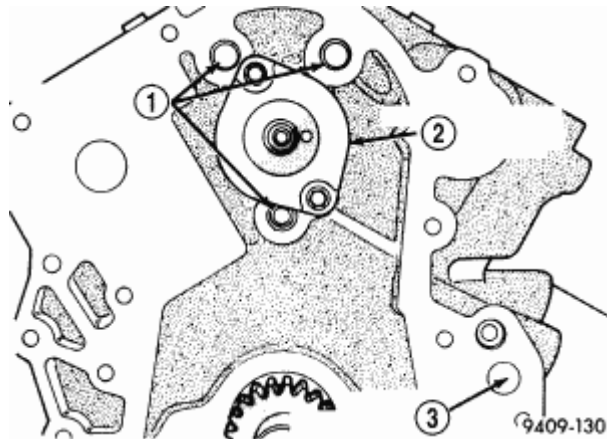


Fig. 122: Camshaft Thrust Plate
Courtesy of CHRYSLER LLC

- | |
|---------------------------------------------------------------------------------------------------|
| <p>1 - OIL GALLERY CUP PLUGS 2 - CAMSHAFT THRUST PLATE 3 - OIL FEED GALLERY FROM PUMP</p> |
|---------------------------------------------------------------------------------------------------|

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

CAMSHAFT

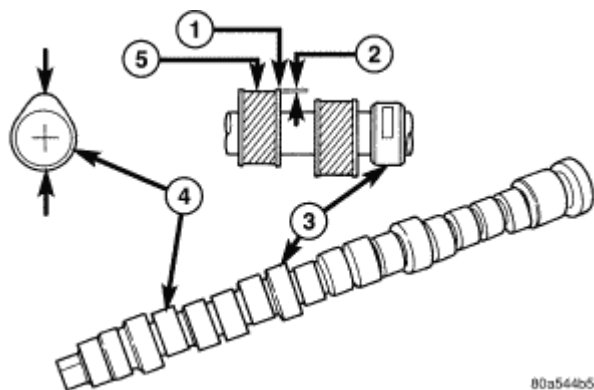


Fig. 123: Camshaft - Inspection
Courtesy of CHRYSLER LLC

- 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

CAMSHAFT

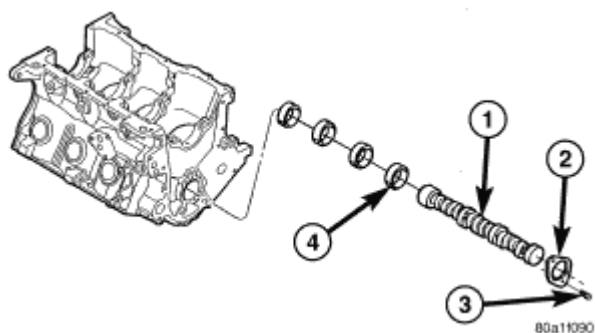


Fig. 124: Camshaft & Bearings
Courtesy of CHRYSLER LLC

- 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. See **SPECIFICATIONS**. If not within specifications, replace thrust plate.
6. Install the timing chain and sprockets. See **INSTALLATION**.

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

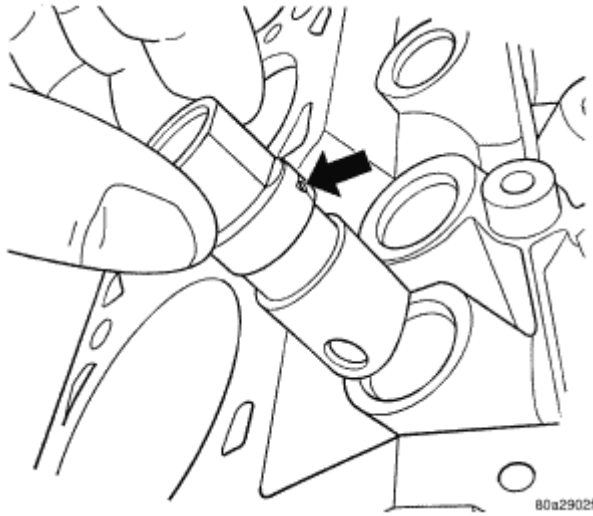


Fig. 125: Lifter Lubrication Hole
Courtesy of CHRYSLER LLC

7. Install the hydraulic lifters with lubrication hole in the upward position. See INSTALLATION.
8. Install the timing chain cover. See INSTALLATION.
9. Install the cylinder heads. See INSTALLATION.
10. Install the cylinder head covers. See INSTALLATION.
11. Install the lower and upper intake manifolds. See INSTALLATION.
12. Install the radiator and cooling fan.

ROD-CONNECTING-PISTON

DESCRIPTION

PISTON AND CONNECTING ROD

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

NOTE: The 3.8L may have any combination of forged or cracked cap connecting rods. The cracked cap design is easily identified by the connecting rod cap bolts rather than the traditional forged connecting rod cap nuts. The cracked cap design also has a different tightening procedure and specification. The connecting rod caps must be paint marked or scribed to identify the accompanying connecting rod. All 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 connecting rods have either the standard forged caps or forged cracked cap design. Both the cracked cap and forged cap connecting rod designs are interchangeable and may be found in any combination when mounted to the crankshaft. The difference between the two different rod caps, aside from design, is the tightening procedure and specification.

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

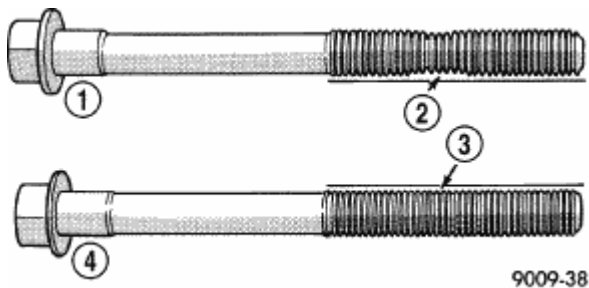


Fig. 126: Check For Stretched Bolts

Courtesy of CHRYSLER 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.

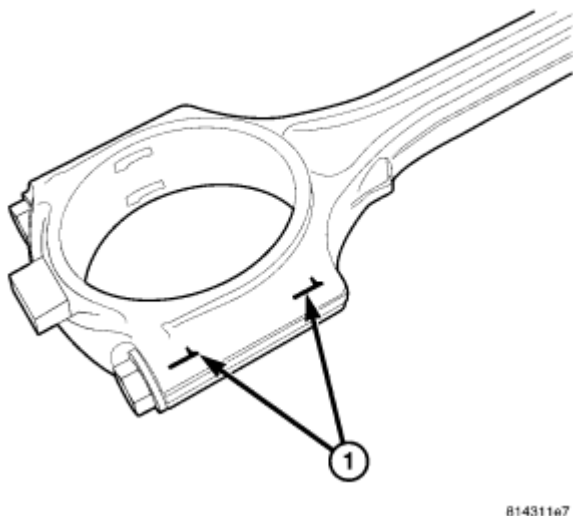


Fig. 127: Connecting Rod To Cylinder Identification

Courtesy of CHRYSLER 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. See **STANDARD PROCEDURE**. Fit all connecting rods on one bank until complete.

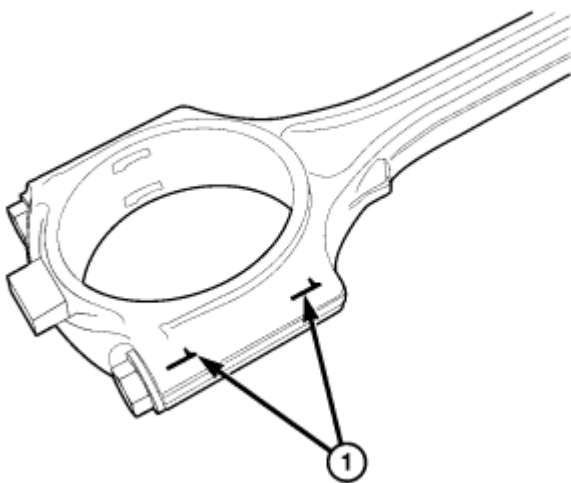
1. Before installing the bolts, the threads should be oiled with engine oil.
2. Install bolts finger tight then alternately torque each bolt to assemble the cap properly.
3. Tighten the cracked cap bolts to 28 N.m PLUS 90 degrees (20 ft. lbs.) plus 90 degrees.
4. Using a feeler gauge, check connecting rod side clearance. Refer to **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 **SPECIFICATIONS**. **Pistons and cylinder bores should be measured at normal room temperature, 21°C (70°F).**

REMOVAL**PISTON AND CONNECTING ROD**

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Fig. 128: Connecting Rod To Cylinder Identification

Courtesy of CHRYSLER LLC

1 - PAINT MARK OR SCRIBE

NOTE: Refer to the connecting rod Description before beginning repair. See **DESCRIPTION**.

1. Disconnect negative cable from battery.
2. Remove the cylinder heads. See **REMOVAL**.
3. Remove the oil pan. See **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 (1), if necessary.

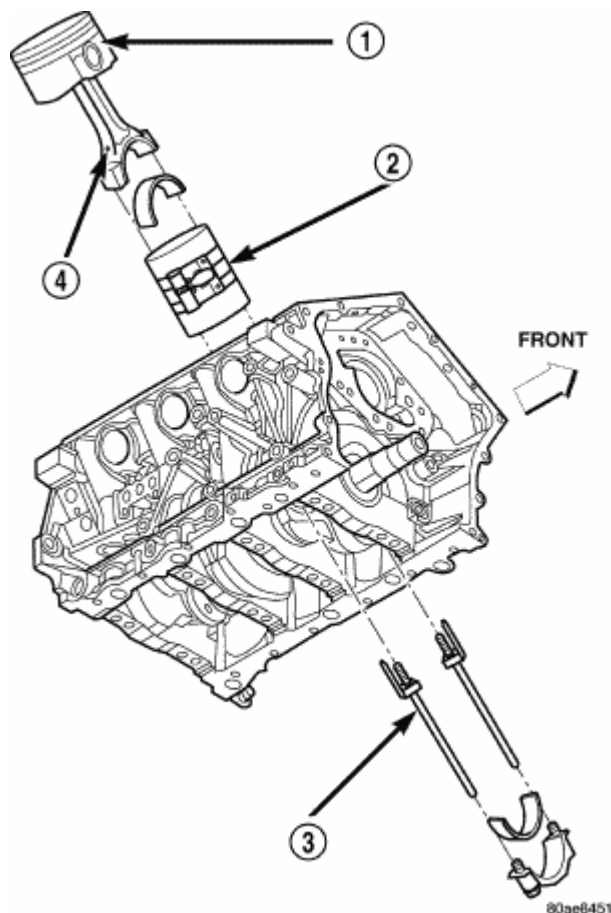


Fig. 129: Piston & Connecting Rod
Courtesy of CHRYSLER LLC

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

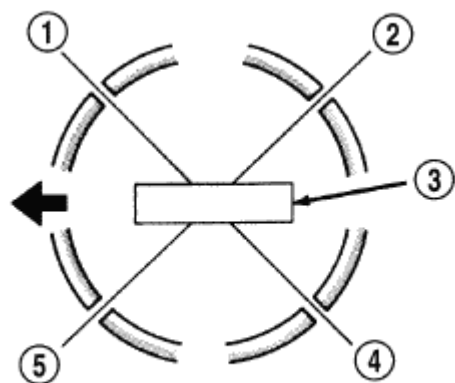
6. Remove connecting rod cap. Install connecting rod bolt protectors special tool #8189 (3) on connecting rod to guide cracked connecting rod (4).
7. Remove each piston (1) and connecting rod assembly (4) out of the cylinder bore.

NOTE: Be careful not to nick crankshaft journals.

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

INSTALLATION

PISTON AND CONNECTING ROD



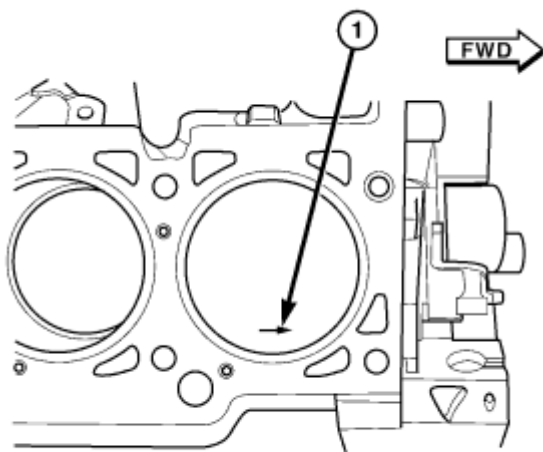
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Fig. 130: Piston Ring End Gap Position
Courtesy of CHRYSLER LLC

- 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. See 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).



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Fig. 131: Identifying Arrow Faces Front Of Engine
Courtesy of CHRYSLER LLC

1 - ARROW FACES FRONT OF ENGINE

2. Before installing pistons and connecting rod assemblies into the bore, ensure that the arrow (1) on top of the piston is facing the front of the engine, if equipped.

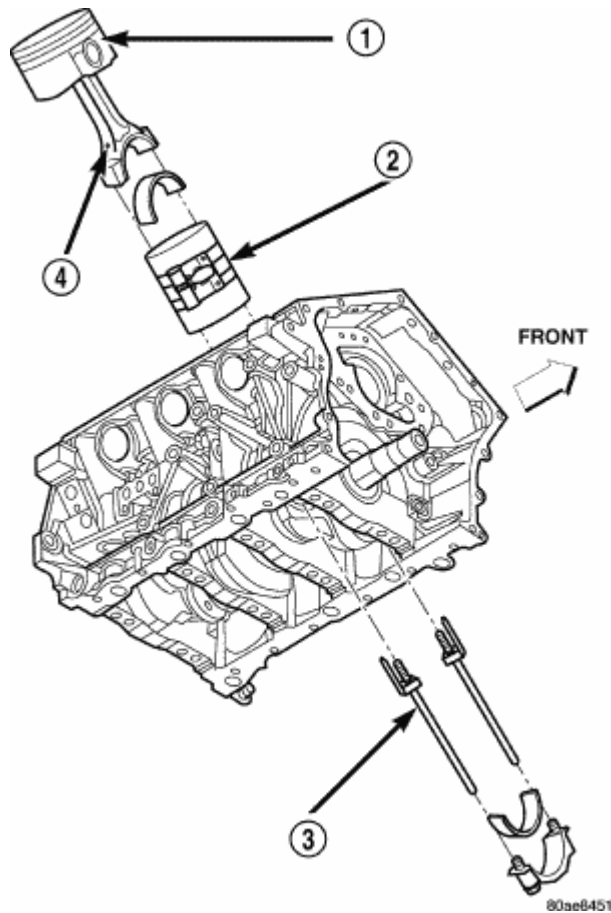
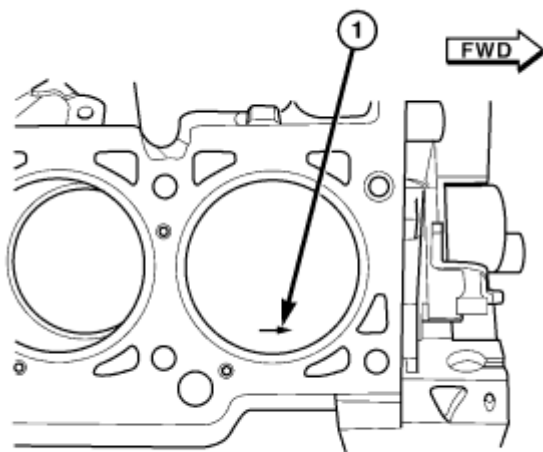


Fig. 132: Piston & Connecting Rod

Courtesy of CHRYSLER LLC

- | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1 - "F" TOWARD FRONT OF ENGINE 2 - RING COMPRESSOR 3 - SPECIAL TOOL 8189 4 - OIL SQUIRT HOLE</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|

3. 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.**
4. Position upper bearing onto connecting rod. Lubricate bearing with oil.
5. Install connecting rod protectors special tool #8189 (3) on the connecting rod,



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Fig. 133: Identifying Arrow Faces Front Of Engine
Courtesy of CHRYSLER LLC

1 - ARROW FACES FRONT OF ENGINE

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

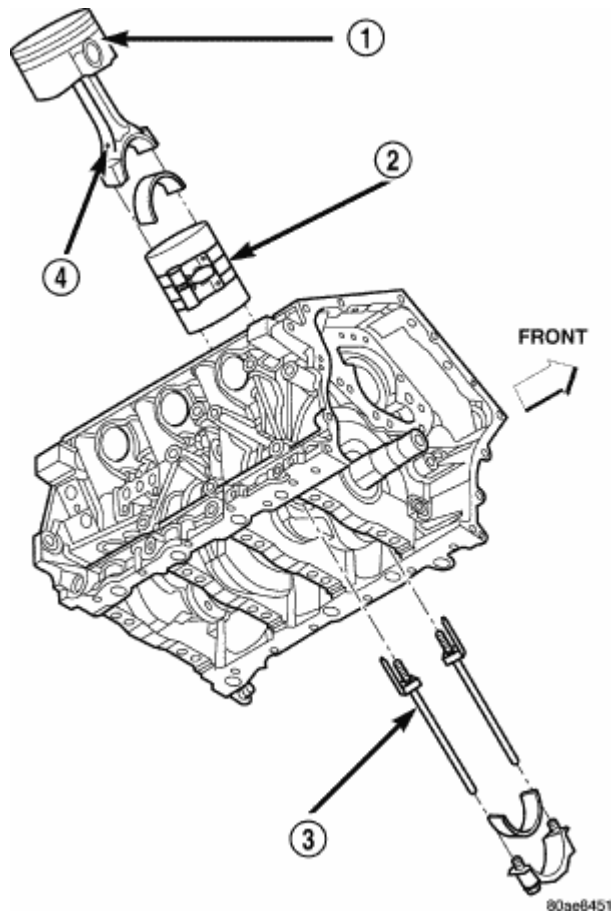


Fig. 134: Piston & Connecting Rod
Courtesy of CHRYSLER LLC

- | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1 - "F" TOWARD FRONT OF ENGINE 2 - RING COMPRESSOR 3 - SPECIAL TOOL 8189 4 - OIL SQUIRT HOLE</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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 connecting rod bolts and tighten to 7 N.m (5 ft. lbs) initially. Tighten the bolts an additional 21 N.m (15 ft. lbs.) and then turn each bolt 90° to final clamping load.
10. Repeat procedure for each piston and connecting rod installation.
11. Install the cylinder heads. See **INSTALLATION**.
12. Install the oil pan. See **INSTALLATION**.
13. Fill engine crankcase with proper oil to correct level.
14. Connect negative cable to battery.

BEARINGS-CONNECTING ROD

STANDARD PROCEDURE

MEASURING CONNECTING ROD BEARING CLEARANCE

The bearing caps are not interchangeable and should be marked 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.

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. Refer to **SPECIFICATIONS**. **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.**

RINGS-PISTON

STANDARD PROCEDURE

PISTON RING FITTING

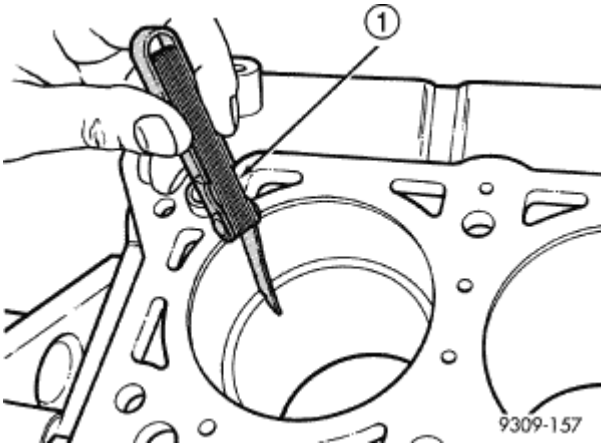


Fig. 135: Checking Ring Gap Using Feeler Gauge
Courtesy of CHRYSLER LLC

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, see **SPECIFICATIONS**.

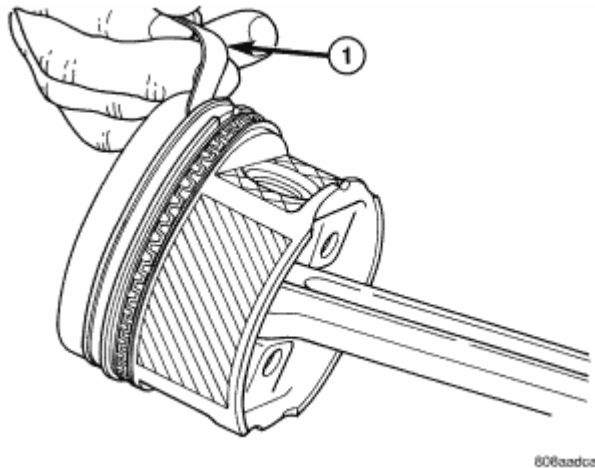


Fig. 136: Piston Ring Side Clearance
Courtesy of CHRYSLER LLC

1 - FEELER GAUGE

2. Check piston ring to groove side clearance (1). For clearance specification, see **SPECIFICATIONS**.

REMOVAL

PISTON RINGS

1. Remove piston and connecting rod. See **REMOVAL**.

2. Remove No. 1 and No. 2 piston rings from piston using a ring expander tool.
3. Remove upper oil ring side rail.
4. Remove lower oil ring side rail.
5. Remove oil ring expander.

INSTALLATION

PISTON RINGS

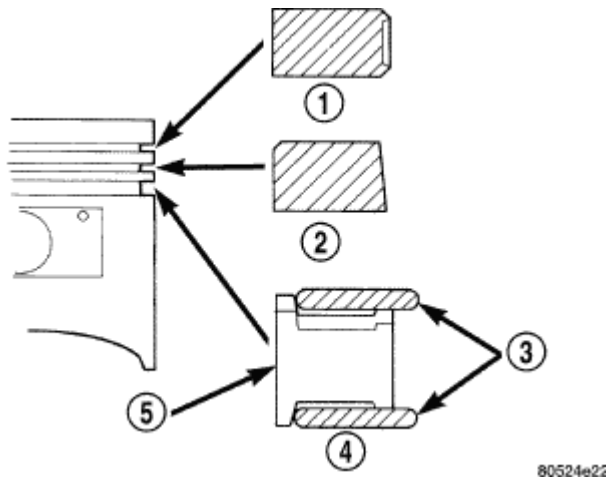


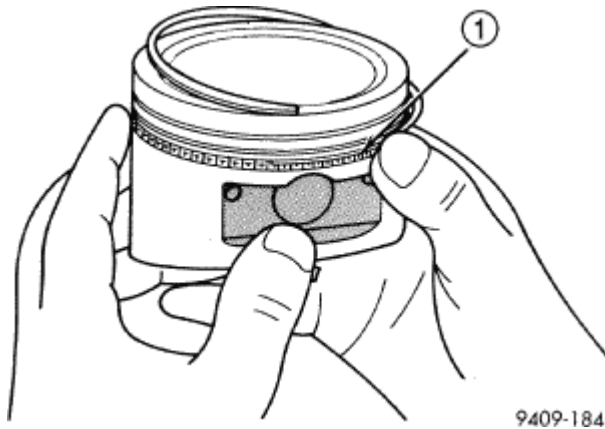
Fig. 137: Piston Ring Installation
Courtesy of CHRYSLER LLC

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

1. Install rings with manufacturers I.D. mark (if present) facing up, to the top of the piston.

CAUTION: Install piston rings in the following order:

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

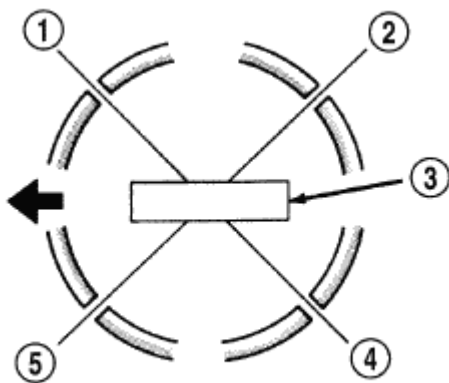


9409-184

Fig. 138: Installing Side Rail
Courtesy of CHRYSLER LLC

1 - SIDE RAIL END

2. Install the side rail by placing one end between the piston ring groove and the expander. Hold end firmly and press down the portion to be installed until side rail is in position. **Do not use a piston ring expander.**
3. Install lower side rail first and then the upper (1) side rail.
4. Install No. 2 piston ring and then No. 1 piston ring.



RR09B48

Fig. 139: Piston Ring End Gap Position
Courtesy of CHRYSLER 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

5. Position piston ring end gaps.

6. Position oil ring expander gap (5) at least 45° from the side rail gaps (1,4) but **not** on the piston pin (3) center or on the thrust direction. Staggering ring gap is important for oil control.

BEARINGS-CRANKSHAFT MAIN

STANDARD PROCEDURE

MAIN BEARING FITTING

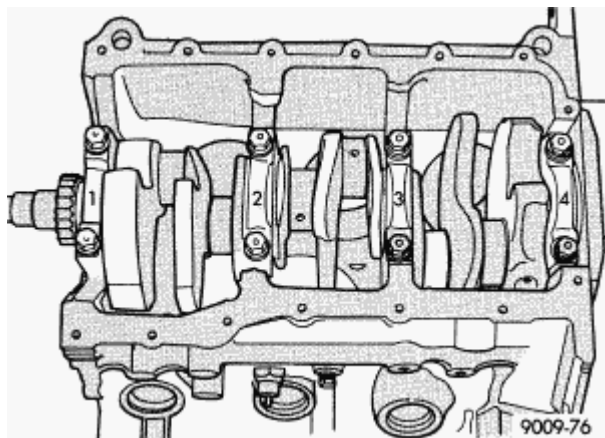


Fig. 140: Main Bearing Cap Identification
Courtesy of CHRYSLER LLC

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.

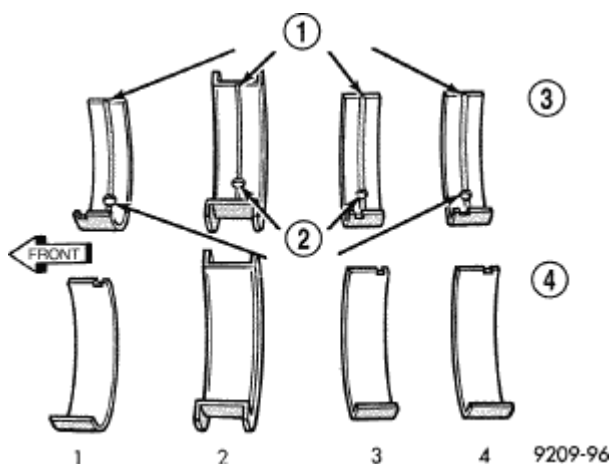


Fig. 141: Main Bearing Identification
Courtesy of CHRYSLER LLC

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.

CRANKSHAFT BEARING OIL CLEARANCE

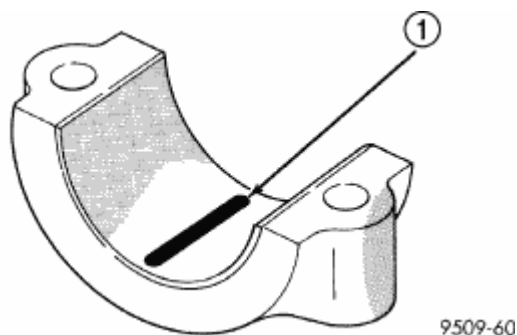


Fig. 142: Plastigage
Courtesy of CHRYSLER LLC

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.

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:

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.).

When checking #1 main bearing shim #2 main bearing.

When checking #2 main bearing shim #1 & #3 main bearing.

When checking #3 main bearing shim #2 & #4 main bearing.

When checking #4 main bearing shim #3 main bearing.

NOTE: Remove all shims before reassembling engine.

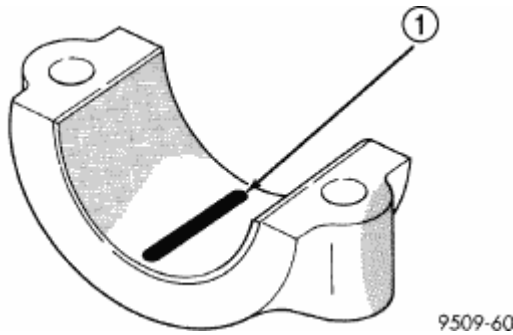


Fig. 143: Plastigage
Courtesy of CHRYSLER LLC

2. Alternative Method:

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. See **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.

PLASTIGAGE METHOD-ENGINE OUT-OF-VEHICLE

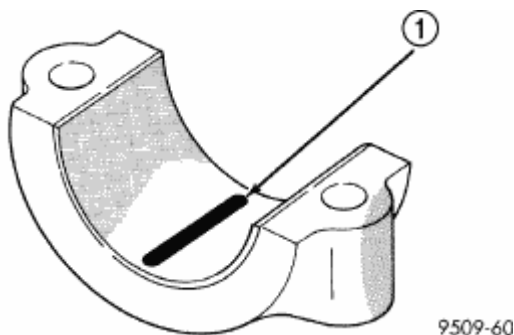


Fig. 144: Plastigage
Courtesy of CHRYSLER LLC

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. See **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. See **SPECIFICATIONS**. 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.

REMOVAL

CRANKSHAFT MAIN BEARINGS

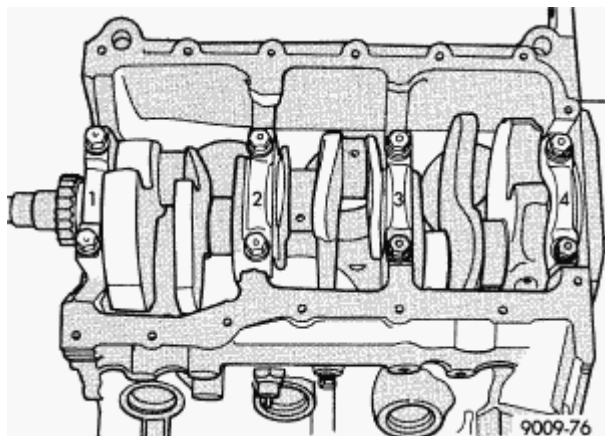


Fig. 145: Main Bearing Cap Identification
Courtesy of CHRYSLER LLC

1. Remove the oil pan. See **REMOVAL**.
2. Identify main bearing caps before removal.
3. Remove bearing caps one at a time. Remove upper half of bearing by inserting Special Main Bearing Tool C-3059 into the oil hole of crankshaft.
4. Slowly rotate crankshaft clockwise, forcing out upper half of bearing shell.

INSTALLATION

CRANKSHAFT MAIN BEARINGS

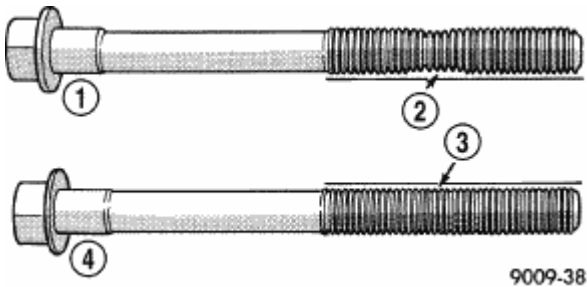


Fig. 146: Check For Stretched Bolts
Courtesy of CHRYSLER LLC

- 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, see **STANDARD PROCEDURE**.
2. Start bearing in place, and insert Main Bearing Tool C-3059 into oil hole of crankshaft.
3. Slowly rotate crankshaft counterclockwise sliding the bearing into position. Remove Special Main Bearing Tool C-3059.
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.

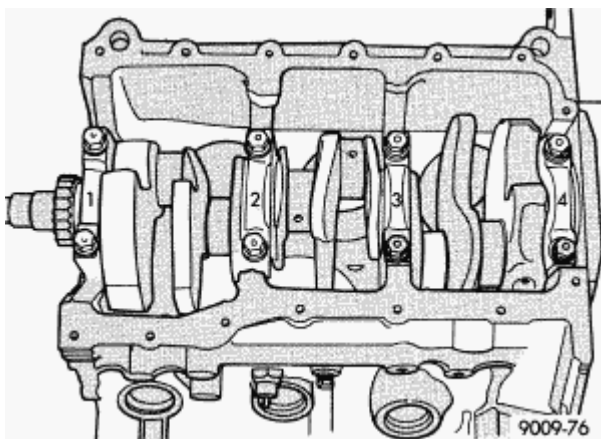


Fig. 147: Main Bearing Cap Identification
Courtesy of CHRYSLER LLC

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:
 Move crankshaft all the way to the rear of its travel.
 Then, move crankshaft all the way to the front of its travel.
 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.
 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. See **INSTALLATION**.
10. Fill engine crankcase with proper oil to correct level.

CRANKSHAFT

DESCRIPTION

CRANKSHAFT - 3.8L

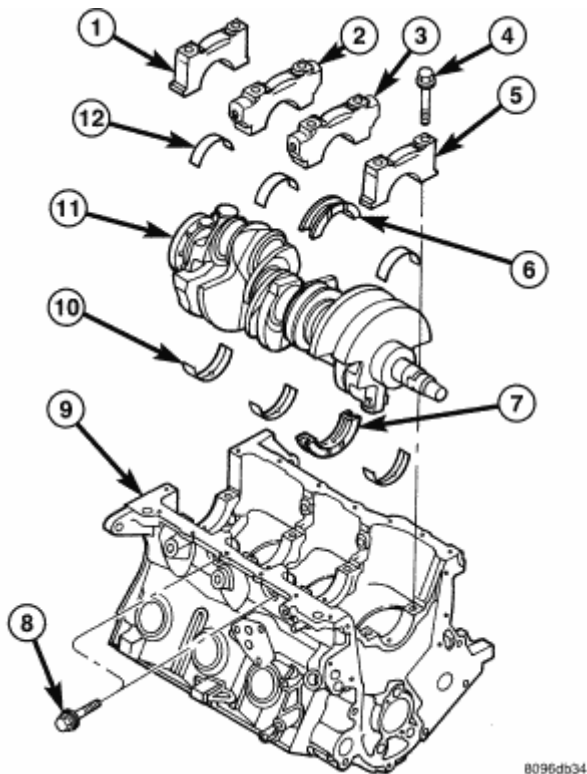


Fig. 148: Crankshaft & Block - 3.8L
 Courtesy of CHRYSLER LLC

- 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

MEASURING CRANKSHAFT END PLAY

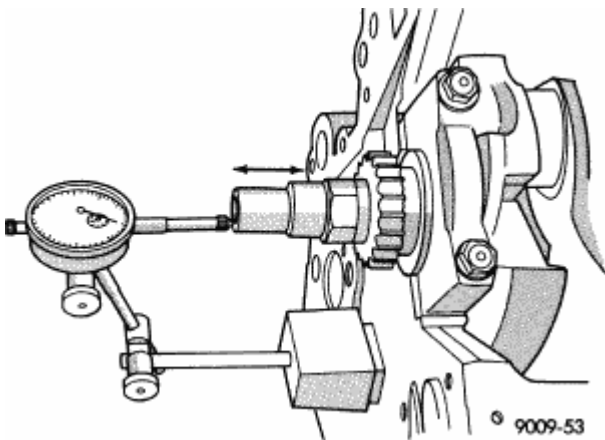


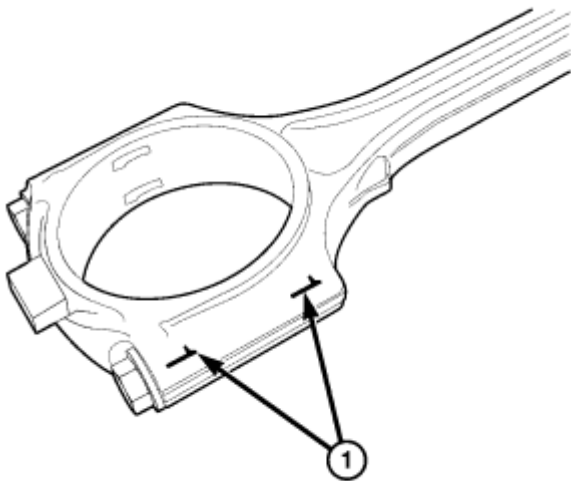
Fig. 149: Crankshaft End Play Typical

Courtesy of CHRYSLER 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. See **SPECIFICATIONS** for end play specification.

REMOVAL

CRANKSHAFT



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Fig. 150: Connecting Rod To Cylinder Identification
Courtesy of CHRYSLER LLC

1 - PAINT MARK OR SCRIBE

1. Remove the engine assembly. See **REMOVAL**.
2. Mount engine on an engine stand.
3. Remove the oil filter.
4. Remove the oil pan and oil pick-up tube. See **REMOVAL**.
5. Remove the timing chain cover. See **REMOVAL**.
6. Remove timing chain and sprockets. See **REMOVAL**.
7. Remove crankshaft rear oil seal and retainer. See **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.

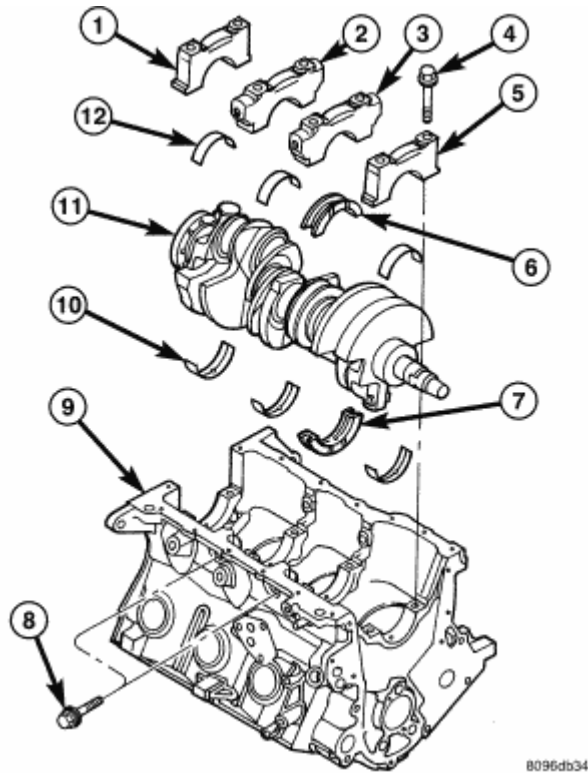


Fig. 151: Crankshaft & Block - 3.8L
Courtesy of CHRYSLER LLC

- 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

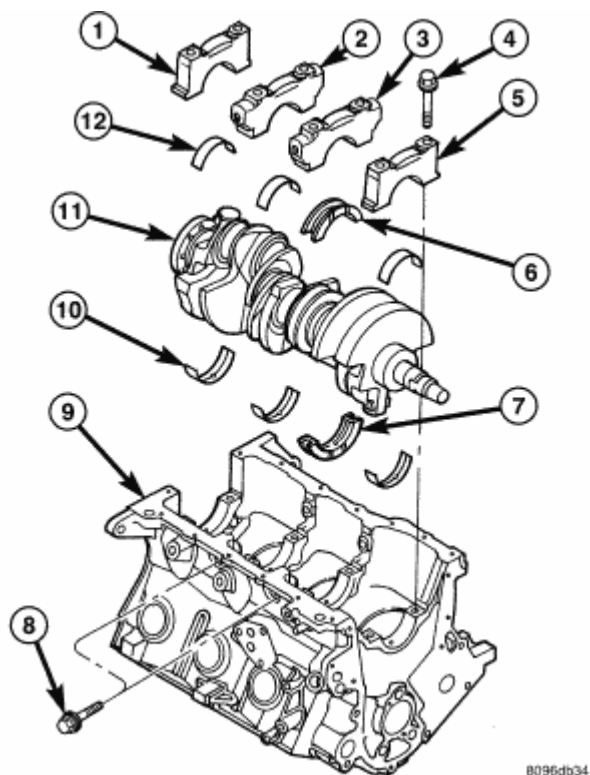
12. Remove and discard the main bearing cross bolts and washers (8).

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

CRANKSHAFT

**Fig. 152: Crankshaft & Block - 3.8L**

Courtesy of CHRYSLER 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. See **STANDARD PROCEDURE**.

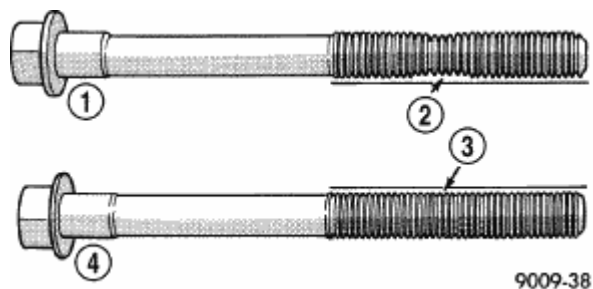


Fig. 153: Check For Stretched Bolts

Courtesy of CHRYSLER 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.

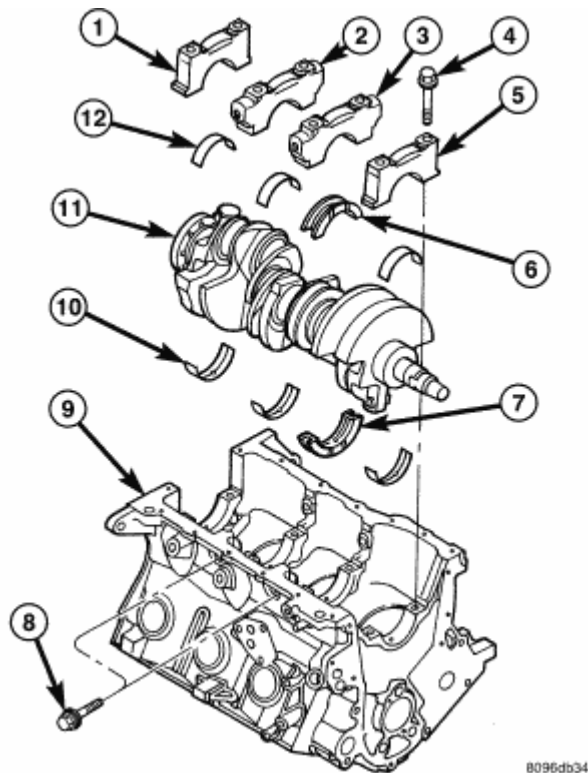


Fig. 154: Crankshaft & Block - 3.8L

Courtesy of CHRYSLER 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. See **STANDARD PROCEDURE**.
8. Install the crankshaft rear oil seal. See **INSTALLATION**.
9. Install the crankshaft sprocket. See **INSTALLATION**.
10. Install the timing chain and camshaft sprocket. See **INSTALLATION**.
11. Install the timing chain cover. See **INSTALLATION**.
12. Install the oil pick-up tube and oil pan. See **INSTALLATION**.
13. Install the engine assembly. See **INSTALLATION**.

OIL SEAL-CRANKSHAFT-FRONT

REMOVAL

CRANKSHAFT OIL SEAL - FRONT

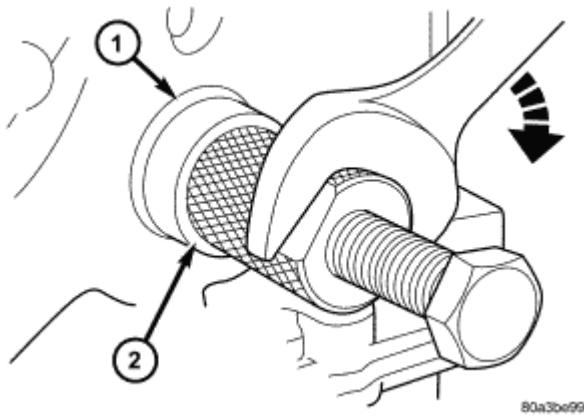


Fig. 155: Special Tool 6341A
 Courtesy of CHRYSLER LLC

1 - SEAL
 2 - SPECIAL TOOL 6341A

1. Disconnect negative cable from battery.
2. Remove accessory drive belt. Refer to **REMOVAL**.
3. Remove crankshaft damper. See **REMOVAL**.
4. Position Special Tool 6341A (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

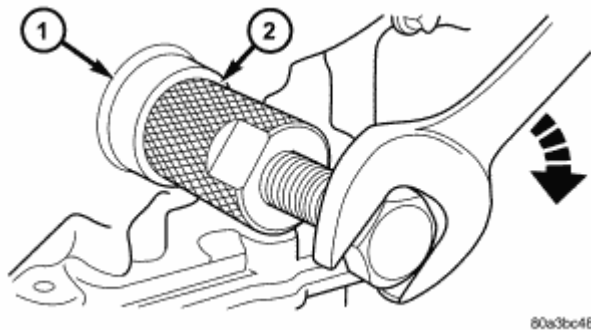


Fig. 156: Removing/Installing Oil Seal
 Courtesy of CHRYSLER LLC

1 - SEAL
 2 - SPECIAL TOOL 6341A

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

INSTALLATION

CRANKSHAFT OIL SEAL - FRONT

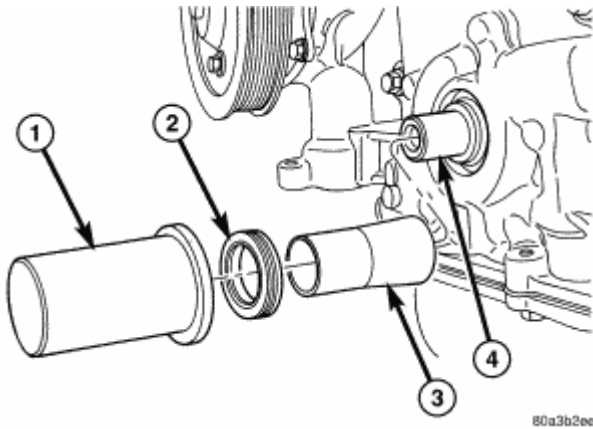


Fig. 157: Front Crankshaft Oil Seal
Courtesy of CHRYSLER LLC

- | |
|------------------------------------------------------------------------------------------------|
| <p>1 - SPECIAL TOOL C-4992-1 2 - SEAL 3 - SPECIAL TOOL C-4992-2 4 - CRANKSHAFT</p> |
|------------------------------------------------------------------------------------------------|

1. Position Special Tool C-4992-2 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 C-4992-1 (1) until seal is flush with cover.
4. Install crankshaft damper. See **INSTALLATION**.
5. Install accessory drive belt. Refer to **INSTALLATION** .
6. Lower vehicle and connect negative cable to battery.

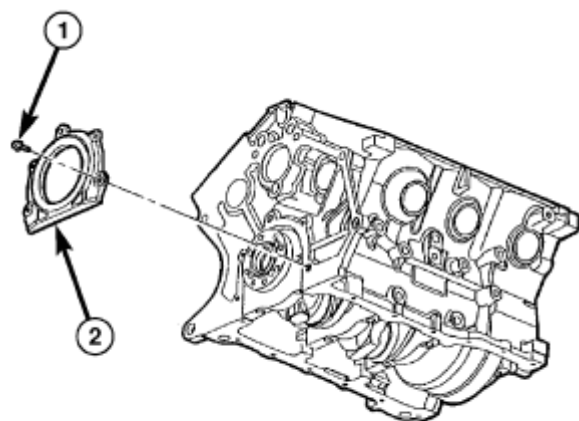
RETAINER-OIL SEAL-CRANK REAR

REMOVAL

CRANKSHAFT OIL SEAL RETAINER - REAR

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

1. Remove the transmission. Refer to **REMOVAL** for manual, or **REMOVAL** for automatic.
2. Remove the flex plate or for vehicles equipped with a manual transmission and flywheel, refer to **REMOVAL** . See **REMOVAL** for flex plate



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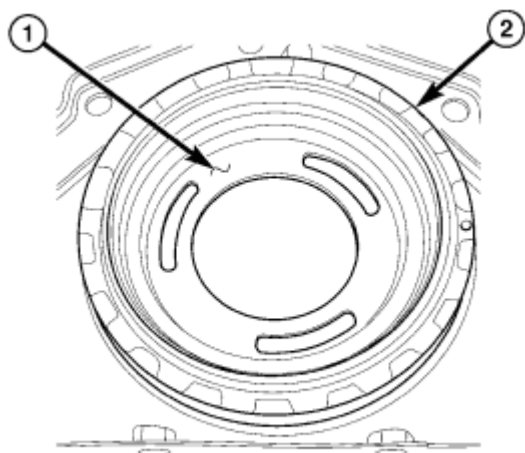
Fig. 158: Rear Crankshaft Oil Seal Retainer
Courtesy of CHRYSLER LLC

- | |
|-------------------------|
| 1 - OIL SEAL |
| 2 - BOLT |
| 3 - RETAINER - OIL SEAL |
| 4 - GASKET |

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

CRANKSHAFT OIL SEAL RETAINER - REAR



81d999e3

Fig. 159: Rear Crankshaft Oil Seal Retainer
Courtesy of CHRYSLER LLC

- 1 - OIL SEAL
- 2 - BOLT
- 3 - RETAINER - OIL SEAL
- 4 - GASKET

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 a bead (approximately 1/4 in. diameter) of Mopar® Engine RTV GEN II around the inside edge of the rear crankshaft oil seal retainer assembly recess in the engine block.
4. Place the rear crankshaft oil seal assembly over the rear crankshaft flange. Do not press seal assembly over the rear crankshaft flange at this time.
5. Using both hands, one on each side of the rear crankshaft flange, press the rear crankshaft oil seal over the rear crankshaft flange.
6. Ensure that the extruded dowels in the rear crankshaft oil seal are seated in the locating holes in the rear of the engine block.
7. Install the five rear crankshaft oil seal fasteners. Do not tighten at this time.
8. Remove and discard the plastic installation sleeve.
9. Tighten the five rear crankshaft oil seal fasteners to 11.8 Nm (105 in-lbs).
10. Install the flex plate or flywheel. See **INSTALLATION** for flex plate. Refer to **INSTALLATION** for flywheel.
11. Install the transmission. Refer to **INSTALLATION** for automatic, or **INSTALLATION** for manual.

COVER-STRUCTURAL

REMOVAL

STRUCTURAL COVER

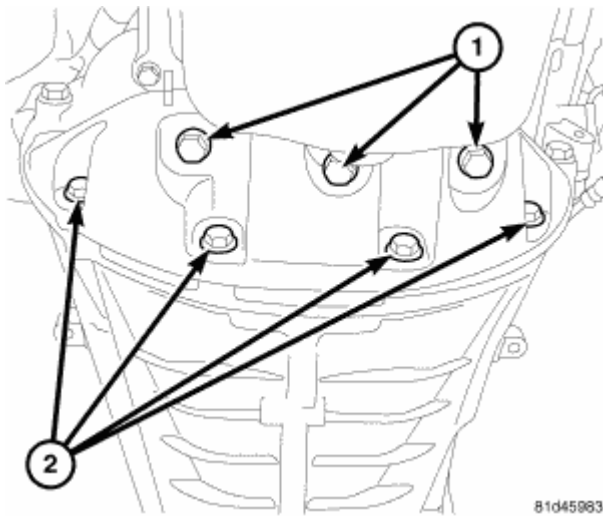


Fig. 160: 3.8L Structural Cover
Courtesy of CHRYSLER LLC

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

STRUCTURAL COVER

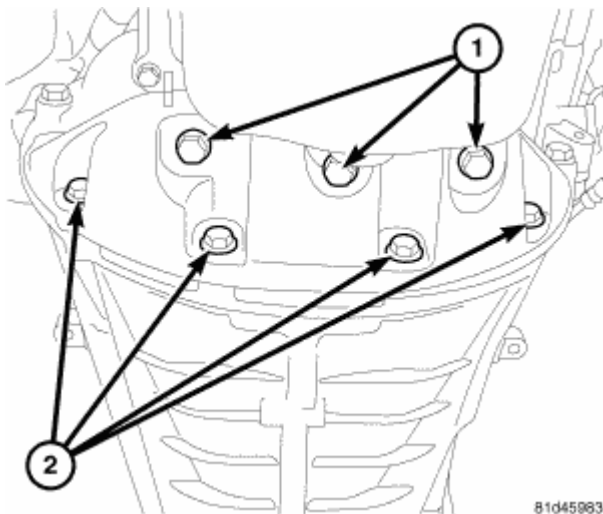


Fig. 161: 3.8L Structural Cover
Courtesy of CHRYSLER LLC

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 cover must be held tightly against both the engine and the transmission bell housing during tightening sequence. Failure to do so may cause 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.).

DAMPER-VIBRATION

REMOVAL

VIBRATION DAMPER

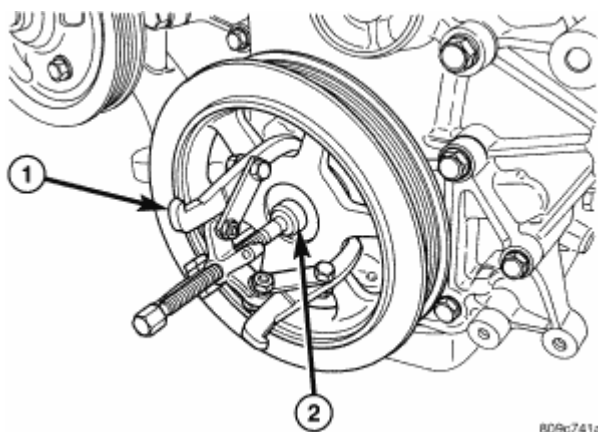


Fig. 162: Vibration Damper - Removal
Courtesy of CHRYSLER LLC

- | |
|------------------------------------------------------------------------|
| 1 - SPECIAL TOOL 8450 - INSERT 2 - SPECIAL TOOL 1026 - 3 JAW PULLER |
|------------------------------------------------------------------------|

1. Disconnect negative cable from battery.
2. Raise vehicle on hoist.
3. Remove the accessory drive belt. Refer to **REMOVAL**.
4. Remove vibration damper bolt.
5. Insert Special Tool 8450 (2) into crankshaft nose.
6. Position 3-jaw puller Special Tool 1026 (2) on damper. Turn puller forcing screw until damper releases from crankshaft.

7. Remove the crankshaft vibration damper.

INSTALLATION

VIBRATION DAMPER

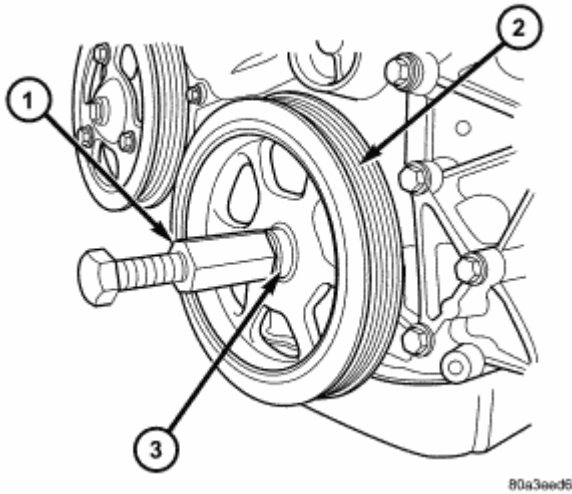


Fig. 163: Crankshaft Damper

Courtesy of CHRYSLER 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 8452 (1).

NOTE: To minimize friction and prolong tool life, lubricate the threads on the forcing screw of Special Tool 8452.

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

FLEXPLATE

REMOVAL

FLEX PLATE

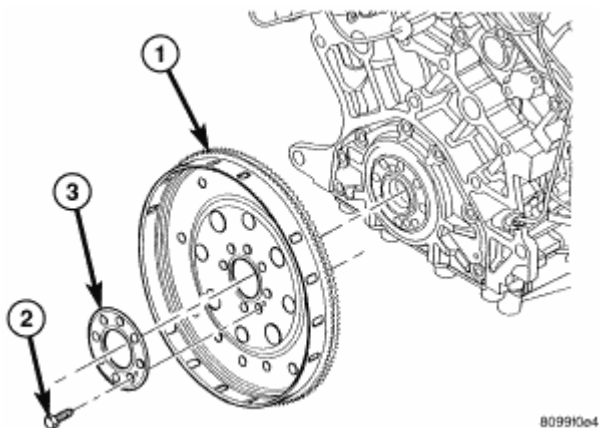


Fig. 164: Flex Plate

Courtesy of CHRYSLER 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

FLEX PLATE

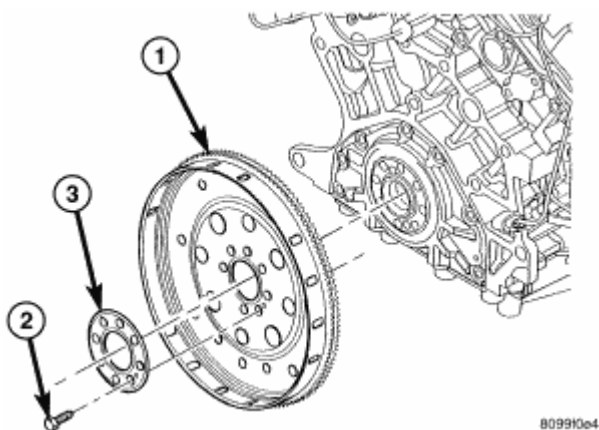


Fig. 165: Flex Plate

Courtesy of CHRYSLER LLC

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

3 - BACKING PLATE

1. Position flex plate (1) with backing plate on the crankshaft.
2. Apply Mopar® Lock & Seal Adhesive to the flex plate bolts.
3. Install flex plate bolts. Tighten bolts to 95 N.m (70 ft. lbs.).
4. Install the transmission.

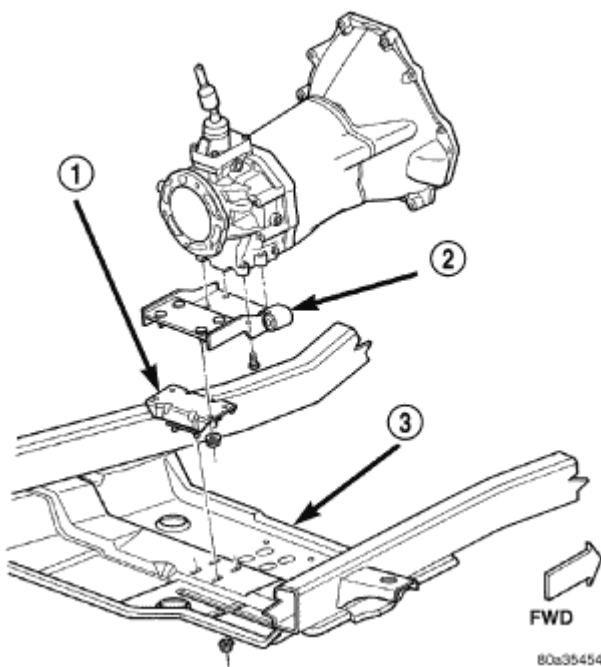
ENGINE MOUNTING**MOUNT-FRONT****REMOVAL****REMOVAL FRONT ENGINE MOUNT**

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 FRONT ENGINE MOUNT**

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.).

MOUNT-REAR**REMOVAL****REAR MOUNT****MANUAL TRANSMISSIONS**

**Fig. 166: Rear Mount (Manual Transmission)**

Courtesy of CHRYSLER 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). See **Fig. 167**.
6. Remove bolts holding transmission support bracket to transmission.
7. Remove the transmission support bracket.

AUTOMATIC TRANSMISSIONS

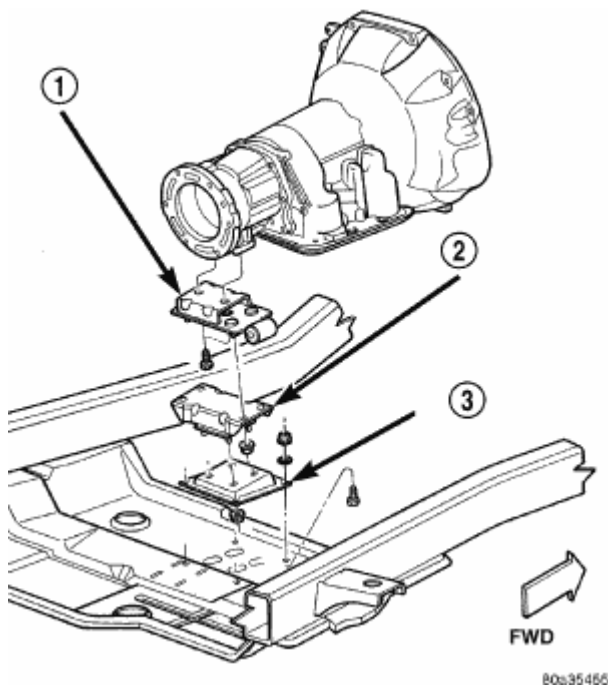


Fig. 167: Rear Mount (Automatic Transmission)

Courtesy of CHRYSLER LLC

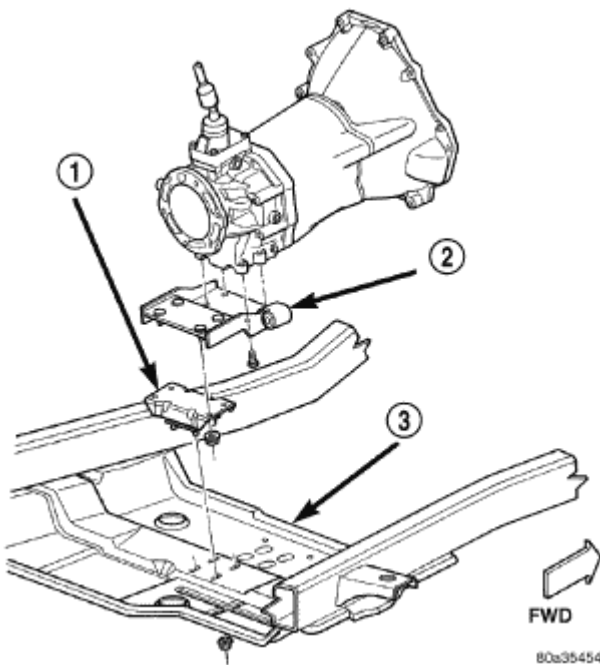
- | |
|-------------|
| 1 - BRACKET |
| 2 - CUSHION |
| 3 - BRACKET |

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). See **Fig. 167**.
5. Remove the bolts holding the transmission support bracket to transmission.
6. Remove the transmission support bracket.

INSTALLATION

REAR MOUNT

MANUAL TRANSMISSION

**Fig. 168: Rear Mount (Manual Transmission)**

Courtesy of CHRYSLER 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. See **Fig. 168**.

AUTOMATIC TRANSMISSION

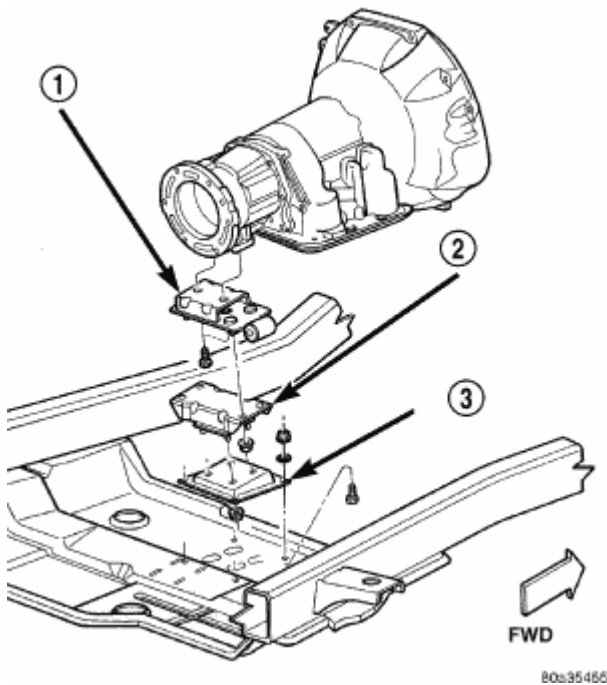


Fig. 169: Rear Mount (Automatic Transmission)

Courtesy of CHRYSLER 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. Tighten the nuts to 41 N.m (30 ft. lbs.) torque. See **Fig. 169**.
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

ENGINE LUBRICATION SYSTEM

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

ENGINE LUBRICATION SYSTEM

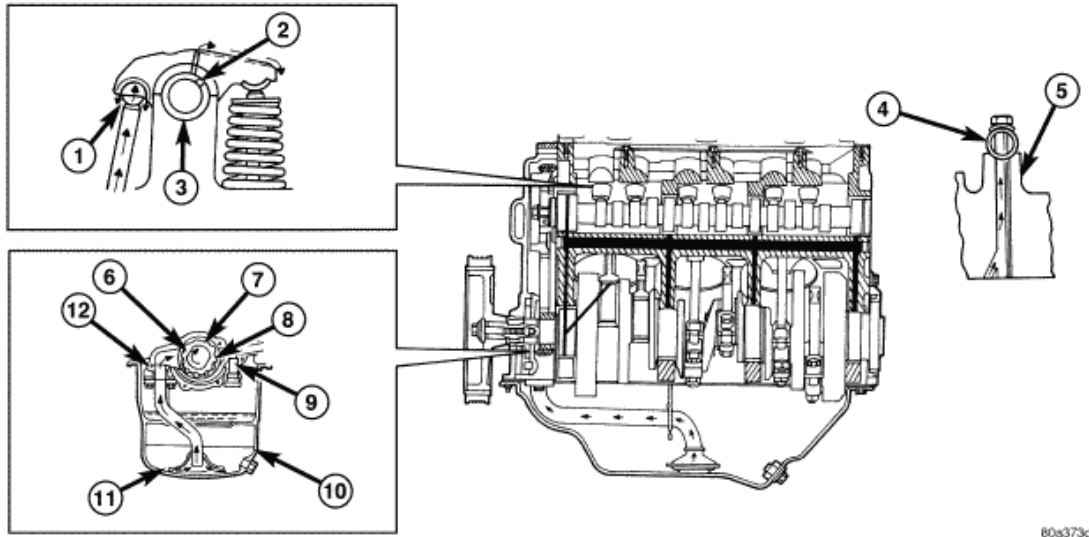


Fig. 170: Identifying Engine Lubrication System
Courtesy of CHRYSLER LLC

| | |
|---------------------------------------------------------------------------------------------------------------|--------------------|
| 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 PEDESTAL 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. See **Fig. 170**.

DIAGNOSIS AND TESTING

ENGINE OIL PRESSURE

1. Disconnect and remove oil pressure switch. See **REMOVAL**.

2. Install Special Tools C-3292 Gauge with 8406 Adapter. For Special Tool identification, see **SPECIAL TOOLS**.
3. Start engine and record oil pressure. Refer to Oil Pressure in Engine Specifications for the correct pressure. See **SPECIFICATIONS**.

OIL

STANDARD PROCEDURE

ENGINE OIL AND FILTER CHANGE

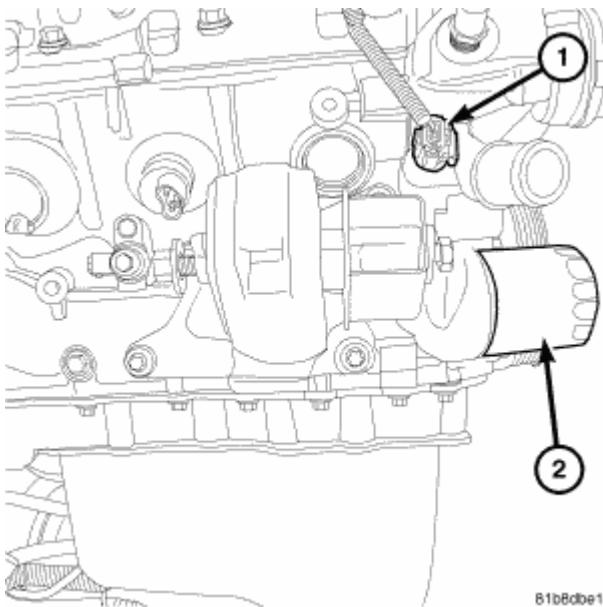


Fig. 171: 3.8L Oil Pressure Switch
Courtesy of CHRYSLER LLC

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

ENGINE OIL LEVEL CHECK

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

Checking the oil while the vehicle is on level ground will improve the accuracy of the oil level reading. Add engine oil only when the level is at or below the ADD mark on the indicator.

FILTER-OIL

REMOVAL

OIL FILTER

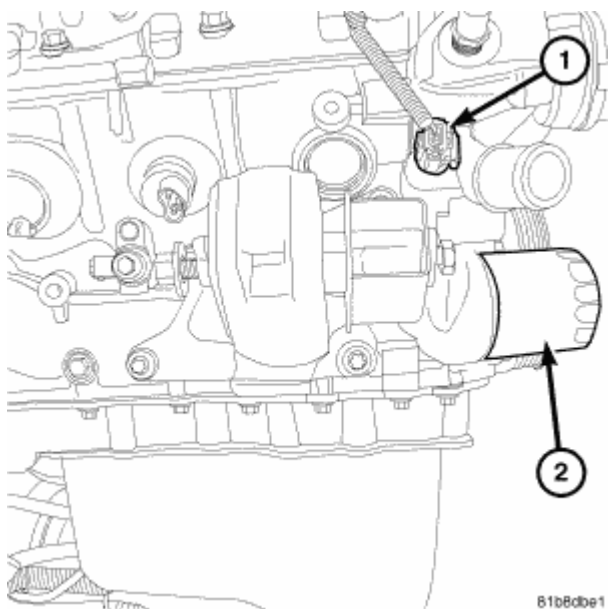


Fig. 172: 3.8L Oil Pressure Switch

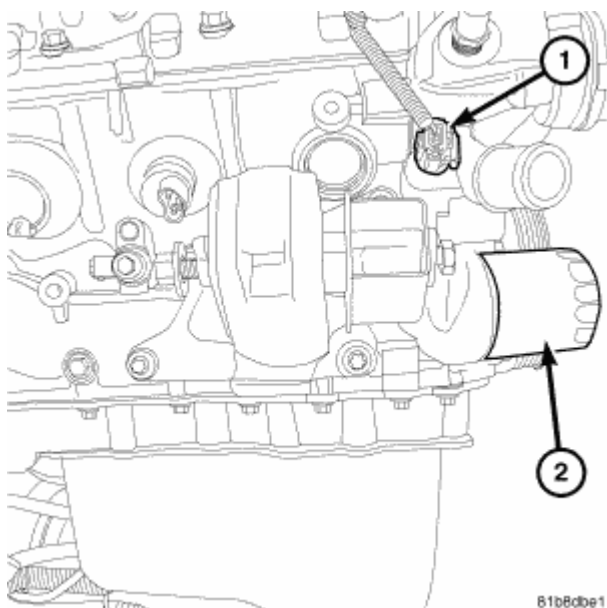
Courtesy of CHRYSLER LLC

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

OIL FILTER

**Fig. 173: 3.8L Oil Pressure Switch**

Courtesy of CHRYSLER 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.

PAN-OIL

REMOVAL

REMOVAL

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

2. Remove engine oil level indicator tube.

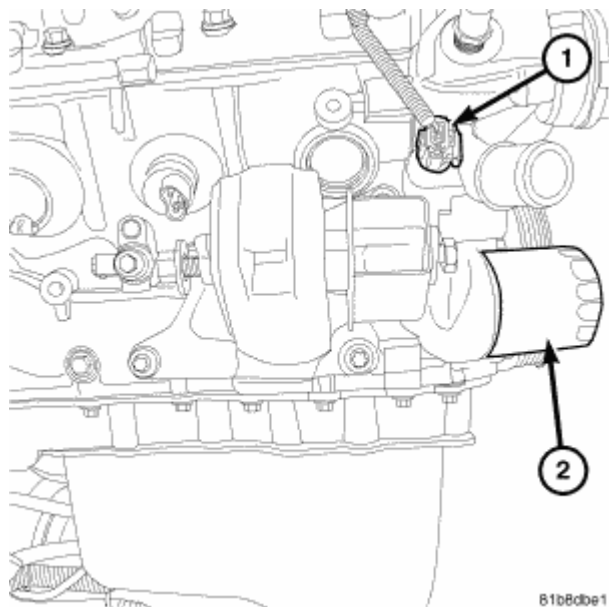


Fig. 174: 3.8L Oil Pressure Switch
Courtesy of CHRYSLER LLC

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

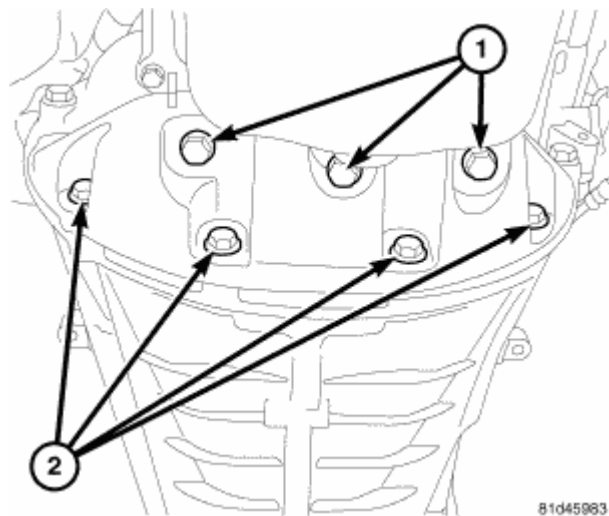


Fig. 175: 3.8L Structural Cover
Courtesy of CHRYSLER LLC

4. Remove the structural cover fasteners (1,2) and structural cover. See **REMOVAL**.

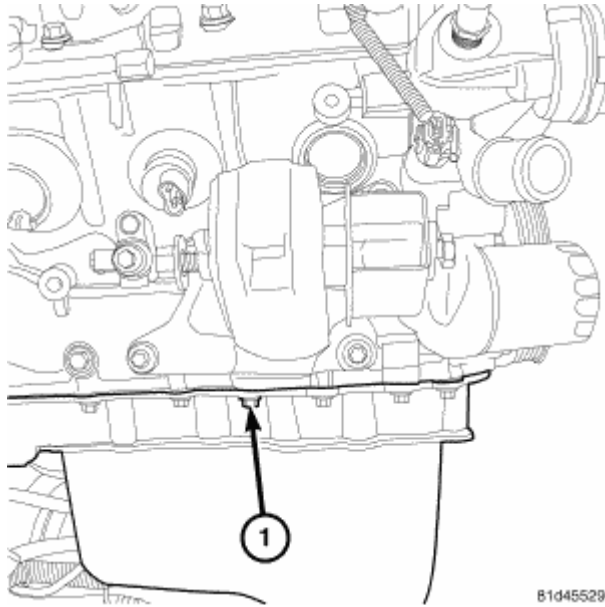


Fig. 176: 3.8L Oil Pressure Switch
Courtesy of CHRYSLER LLC

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

OIL PAN

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

OIL PAN

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

OIL PAN

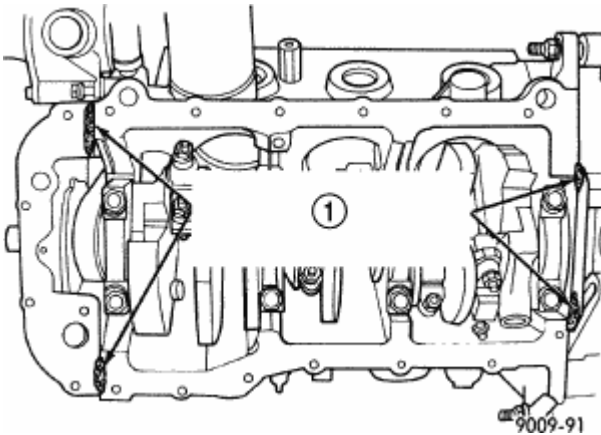


Fig. 177: Locating Sealer

Courtesy of CHRYSLER 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.

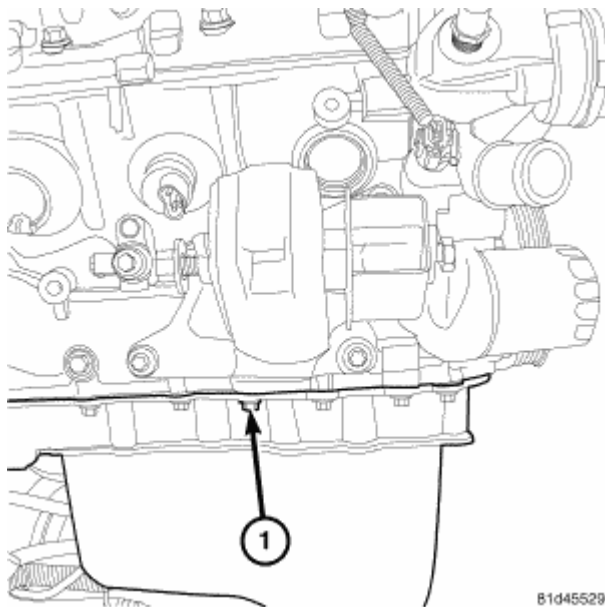


Fig. 178: 3.8L Oil Pressure Switch

Courtesy of CHRYSLER LLC

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

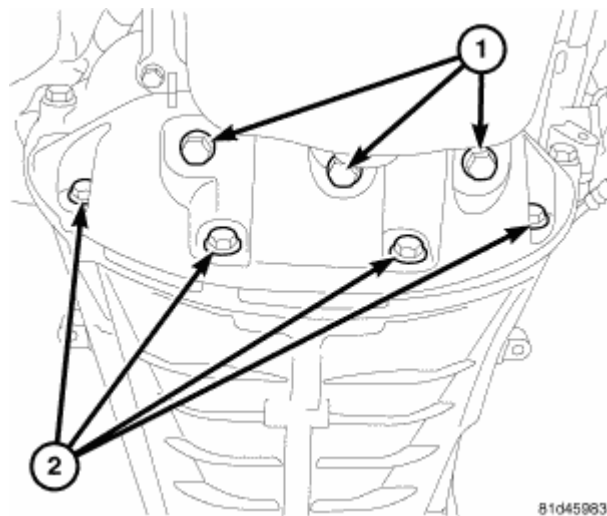


Fig. 179: 3.8L Structural Cover
Courtesy of CHRYSLER LLC

4. Install the structural cover and tighten fasteners (1,2). See **INSTALLATION**.
5. Lower vehicle and install oil level indicator.

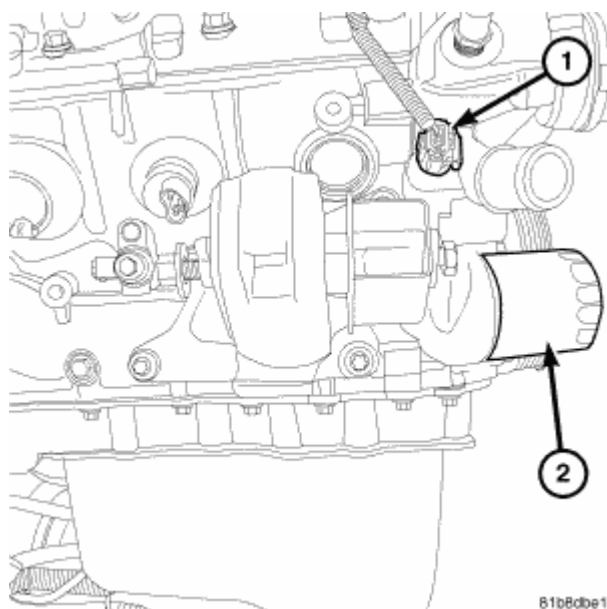


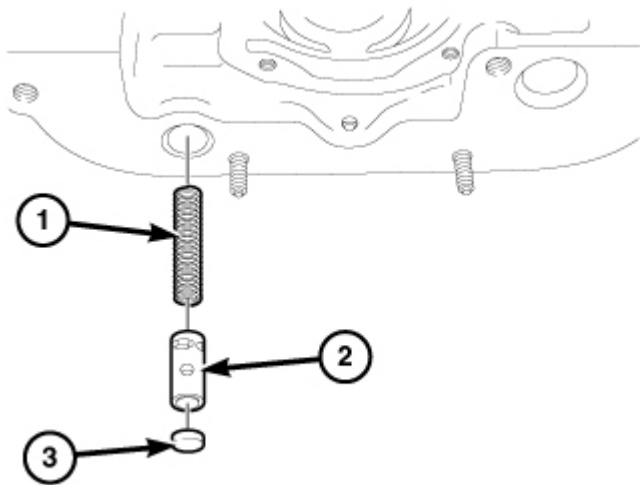
Fig. 180: 3.8L Oil Pressure Switch
Courtesy of CHRYSLER LLC

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

RELIEF VALVE-OIL PRESSURE

REMOVAL

OIL PRESSURE RELIEF VALVE



362939

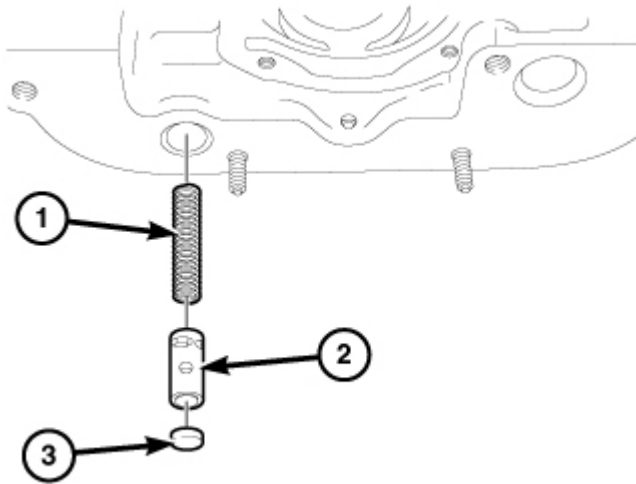
Fig. 181: Oil Pressure Relief Valve
Courtesy of CHRYSLER LLC

- | |
|----------------------------------------------------|
| 1 - SPRING 2 - RELIEF VALVE 3 - RETAINER CAP |
|----------------------------------------------------|

1. Remove oil pan. See **REMOVAL**.
2. Drill a 3.175 mm (1/8 in.) hole in the center of the retainer cap. See **Fig. 181**. Insert a self-threading sheet metal screw into the cap.
3. Using suitable pliers, remove cap and discard.
4. Remove spring and relief valve. See **Fig. 181**.

INSTALLATION

OIL PRESSURE RELIEF VALVE



362939

Fig. 182: 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 relief valve, spring and bore.

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

2. Install the spring (1) into 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 oil pan.
6. Fill crankcase with proper oil to correct level.

SWITCH-OIL PRESSURE

DESCRIPTION

OIL PRESSURE SWITCH

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**OIL PRESSURE SWITCH**

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 an open circuit to the low pressure indicator light. For wiring circuits and diagnostic information, (Refer to Appropriate Wiring/Diagnostic Information).

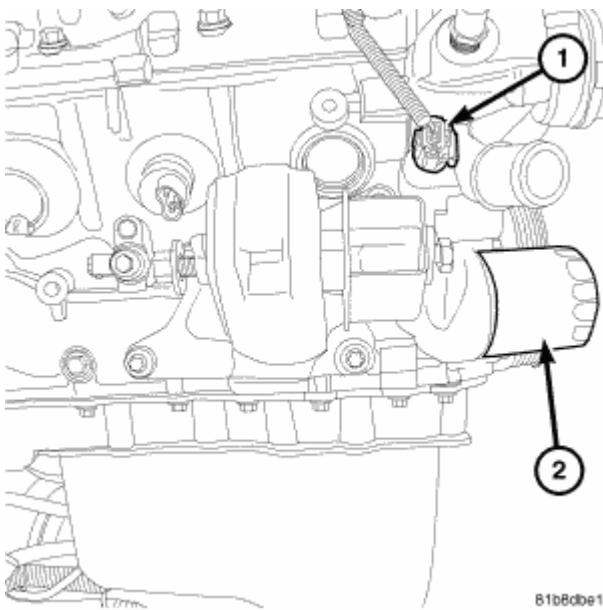
REMOVAL**OIL PRESSURE SWITCH**

Fig. 183: 3.8L Oil Pressure Switch
Courtesy of CHRYSLER LLC

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

INSTALLATION**OIL PRESSURE SWITCH**

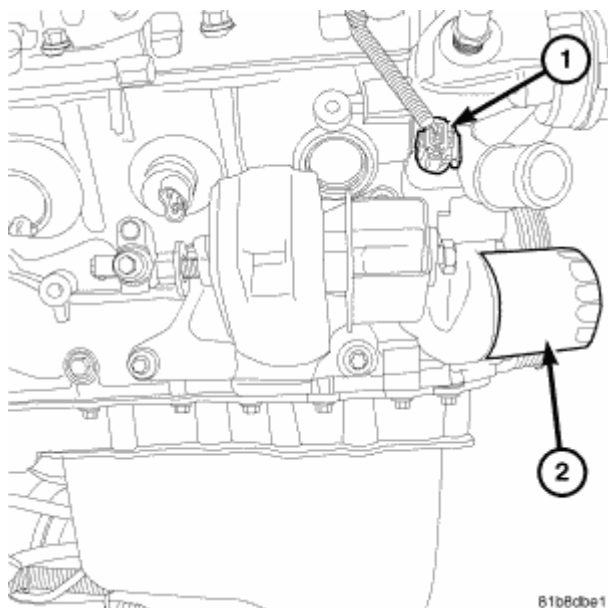


Fig. 184: 3.8L Oil Pressure Switch
Courtesy of CHRYSLER LLC

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.

PUMP-OIL

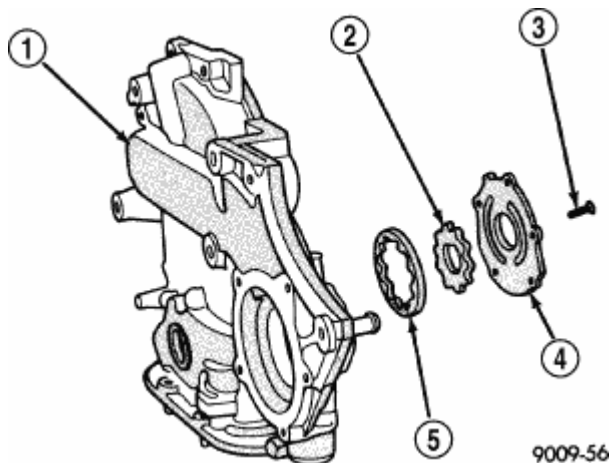
DESCRIPTION

OIL PUMP

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

REMOVAL

OIL PUMP

**Fig. 185: Oil Pump**

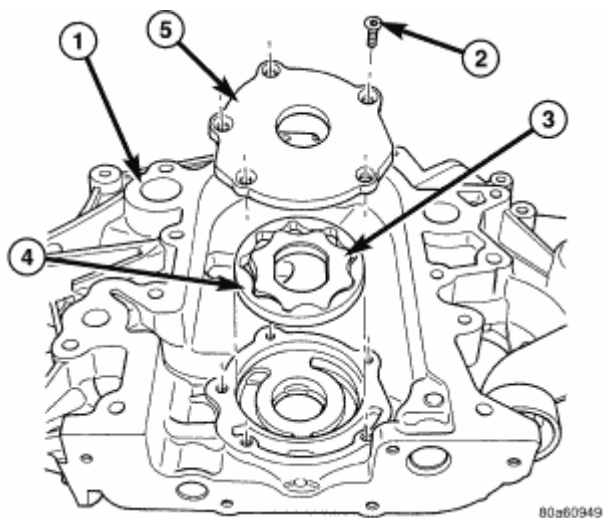
Courtesy of CHRYSLER LLC

- | |
|-----------------------------------------------------------------------------------------------------------------|
| 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**OIL PUMP**

**Fig. 186: Oil Pump**

Courtesy of CHRYSLER LLC

- | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none">1 - TIMING CHAIN COVER2 - SCREWS3 - INNER ROTOR4 - OUTER ROTOR5 - 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.

CLEANING**OIL PUMP - CLEANING**

1. Clean all parts thoroughly in a suitable solvent.

INSPECTION**OIL PUMP**

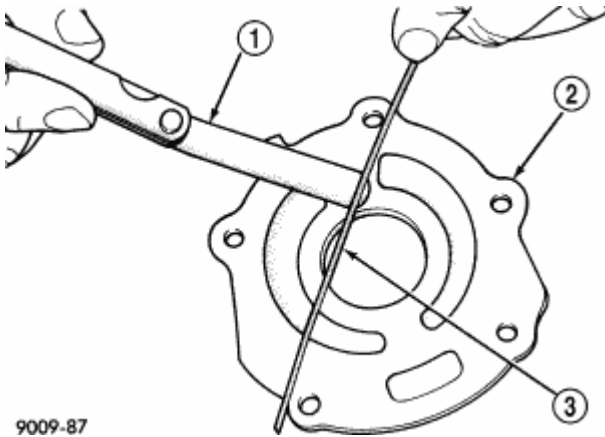


Fig. 187: Identifying Oil Pump Cover

Courtesy of CHRYSLER 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. See **Fig. 187**. If a 0.025 mm (0.001 in.) feeler gauge can be inserted between cover and straight edge, cover should be replaced.

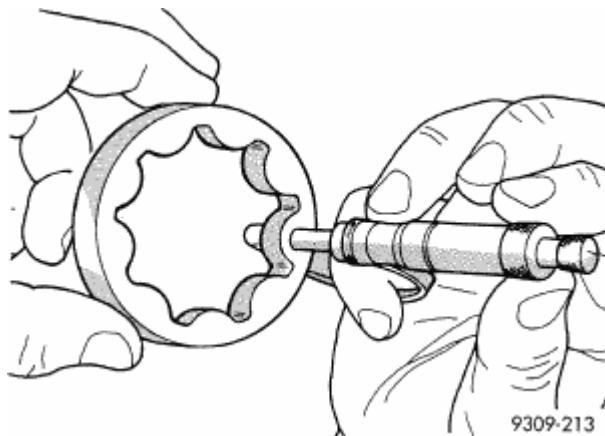


Fig. 188: Measuring Thickness & Diameter Of Outer Rotor

Courtesy of CHRYSLER 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. See **Fig. 188**.

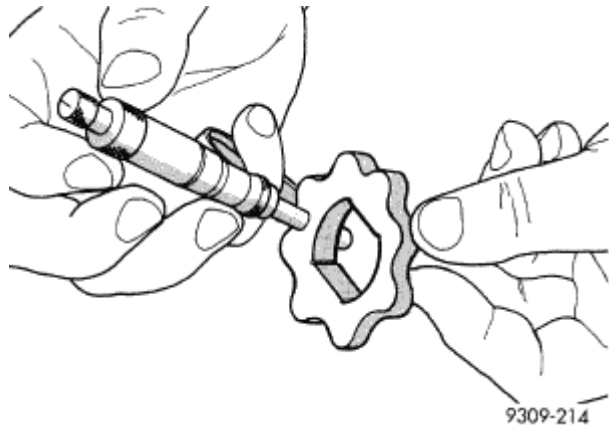


Fig. 189: Identifying Inner Rotor Thickness
Courtesy of CHRYSLER LLC

4. If inner rotor thickness measures 7.64 mm (0.301 in.) or less, replace inner rotor. See **Fig. 189**.

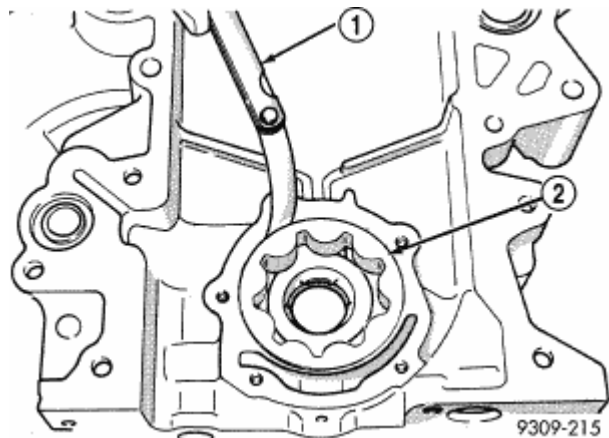


Fig. 190: Identifying Feeler Gauge & Outer Rotor
Courtesy of CHRYSLER LLC

- | |
|-------------------------------------|
| 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. See **Fig. 190**. If measurement is 0.39 mm (0.015 in.) or more, replace chain case cover, only if outer rotor is in specification.

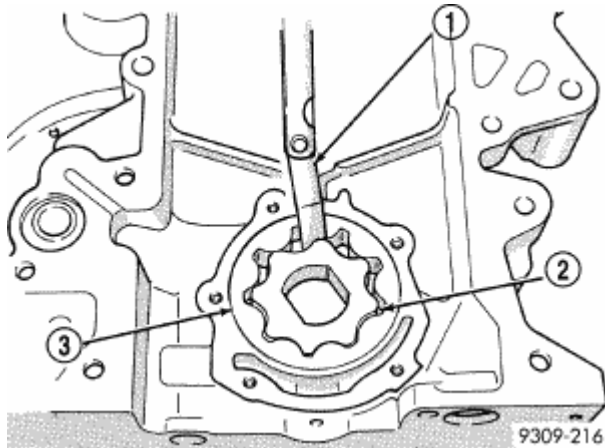


Fig. 191: Identifying Feeler Gauge, Inner & Outer Rotor
Courtesy of CHRYSLER LLC

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. See **Fig. 191**.

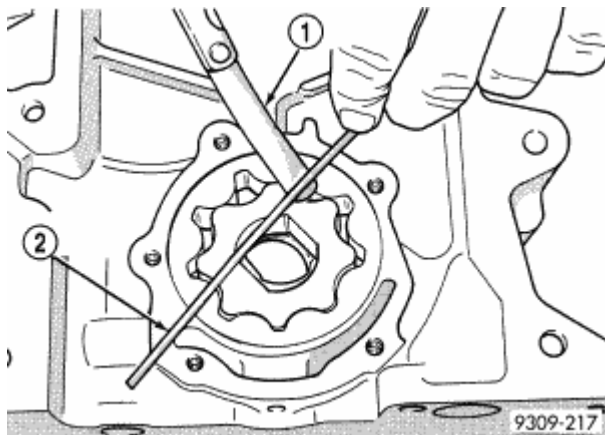


Fig. 192: Identifying Feeler Gauge & Straight Edge
Courtesy of CHRYSLER LLC

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. See **Fig. 192**. **ONLY** if rotors are in specs.

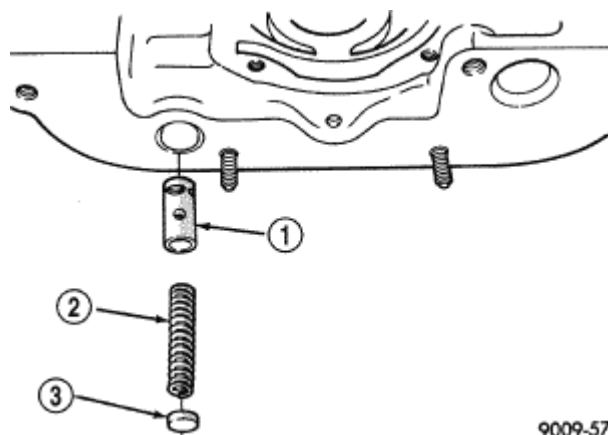


Fig. 193: Identifying Relief Valve, Spring & Retainer Cap
Courtesy of CHRYSLER LLC

- | |
|------------------|
| 1 - RELIEF VALVE |
| 2 - SPRING |
| 3 - RETAINER CAP |

8. Remove oil pressure relief valve. See **REMOVAL**.
9. Inspect oil pressure relief valve and bore. Inspect for scoring, pitting and free valve operation in bore. See **Fig. 193**. 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

OIL PUMP

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. See **INSTALLATION**.

INSTALLATION

OIL PUMP

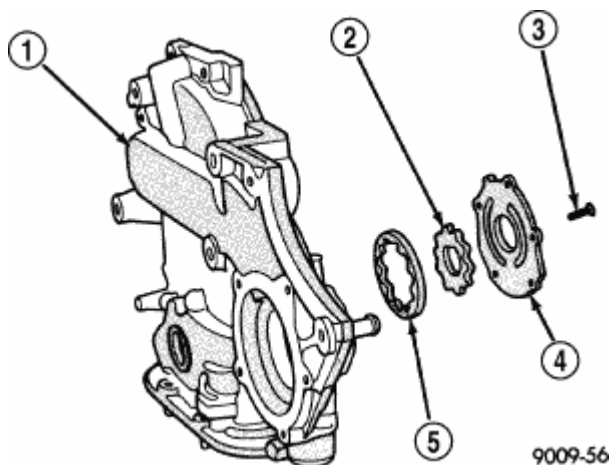


Fig. 194: Oil Pump

Courtesy of CHRYSLER LLC

- | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1 - CHAIN CASE COVER 2 - OIL PUMP INNER ROTOR 3 - SCREW 4 - OIL PUMP COVER 5 - OIL PUMP OUTER ROTOR</p> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

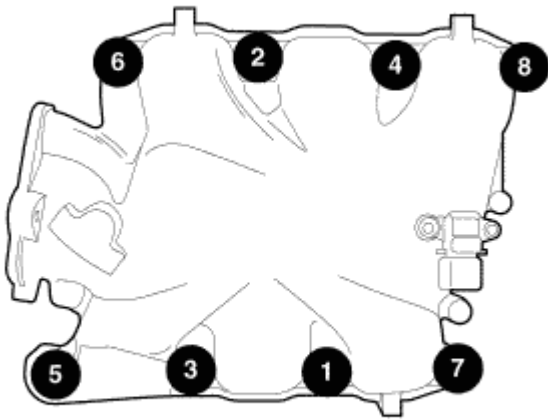
1. Install oil pump assembly (2,4,5).
2. Install timing chain cover.

MANIFOLDS

MANIFOLD-INTAKE

DESCRIPTION

INTAKE MANIFOLD



81b19156

Fig. 195: Removing/Installing Intake/Exhaust Manifold 3.8L
Courtesy of CHRYSLER 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

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.

MANIFOLD-INTAKE

STANDARD PROCEDURE

INTAKE MANIFOLD VACUUM PORT REPAIR

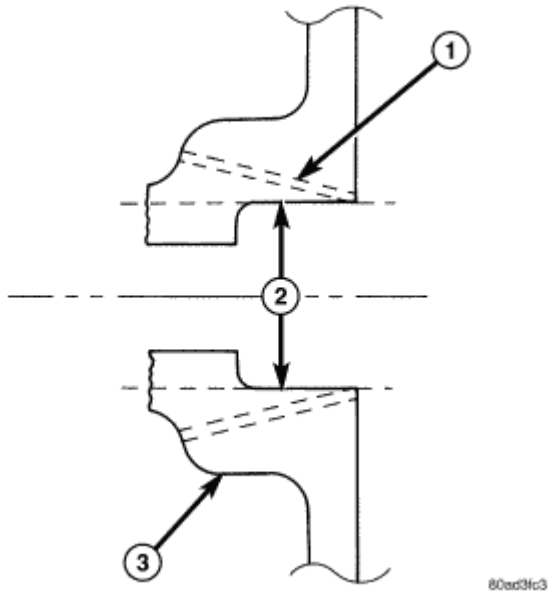


Fig. 196: Intake Manifold Vacuum Port Repair
Courtesy of CHRYSLER LLC

- 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" |

2008 Jeep Wrangler Rubicon

2008 ENGINE 3.8L - Service Information - Wrangler

| | |
|------------------------------------------------------------------|-----------------------------------------------------------------------|
| | . 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).

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

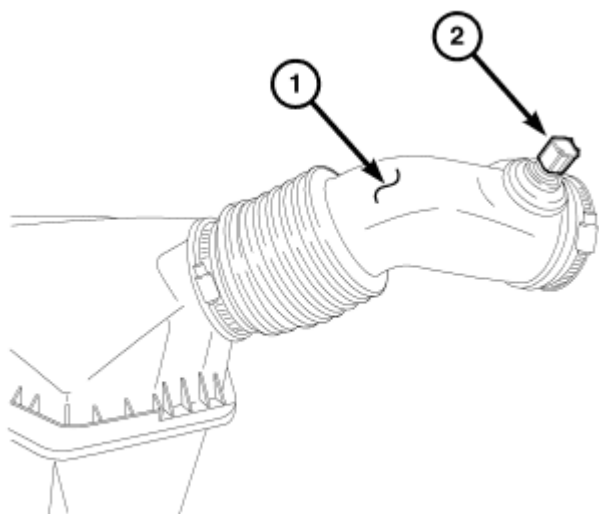
Throttle cable bracket

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 | |

REMOVAL

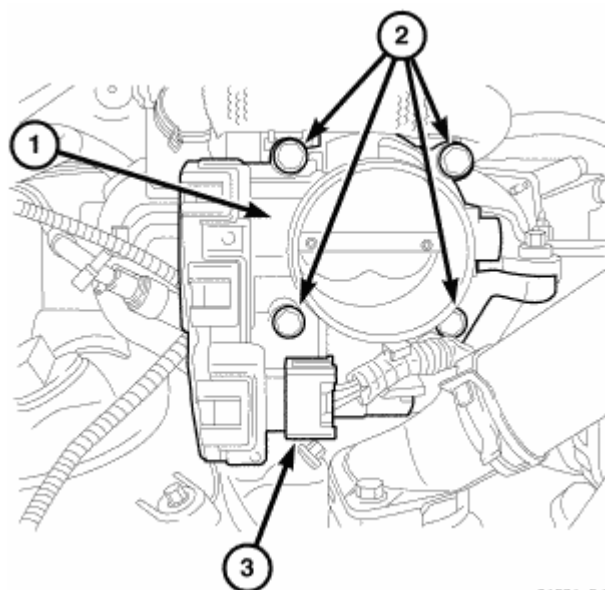
INTAKE MANIFOLD - UPPER



81920ee6

Fig. 197: Inlet Air Temperature Sensor 3.8L
Courtesy of CHRYSLER LLC

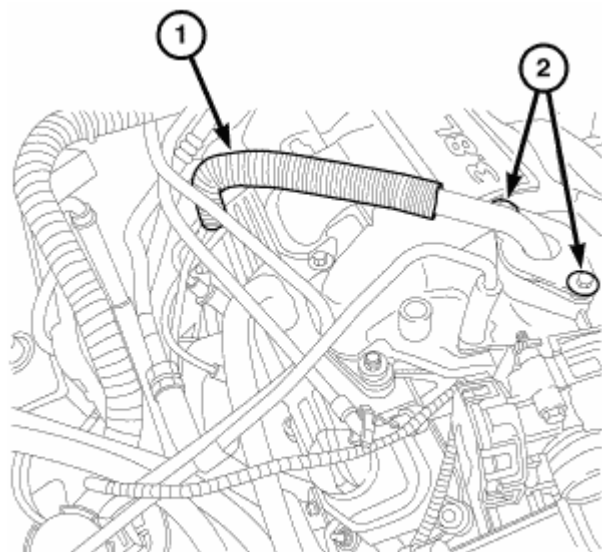
1. Disconnect battery negative cable.
2. Disconnect inlet air temperature (IAT) sensor electrical connector (2).
3. Remove air inlet resonator to throttle body hose assembly (1).



81921a8d

Fig. 198: Throttle Body 3.8L
Courtesy of CHRYSLER LLC

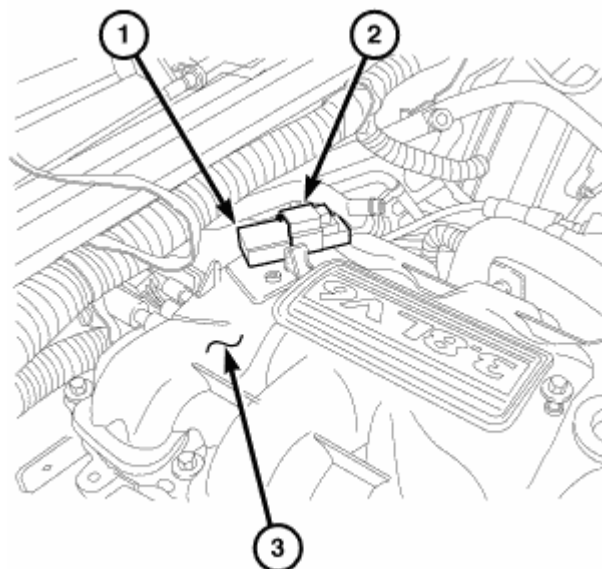
4. Disconnect the throttle connectors (ETC) (3) from the throttle body.
5. Disconnect the EVAP hose at the throttle.



819257fe

Fig. 199: EGR Tube Flange
Courtesy of CHRYSLER LLC

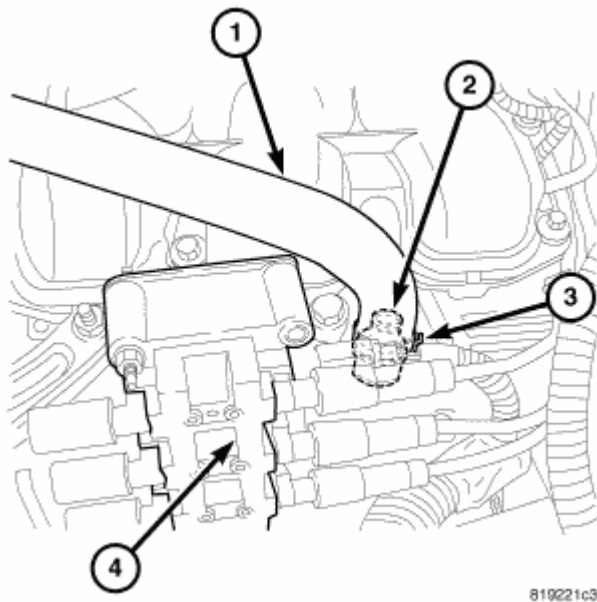
6. Remove the EGR tube (1).
7. Disconnect the idle air control (IAC) motor and throttle position sensor (TPS) wiring.



81920e96

Fig. 200: Map Sensor 3.8L
Courtesy of CHRYSLER LLC

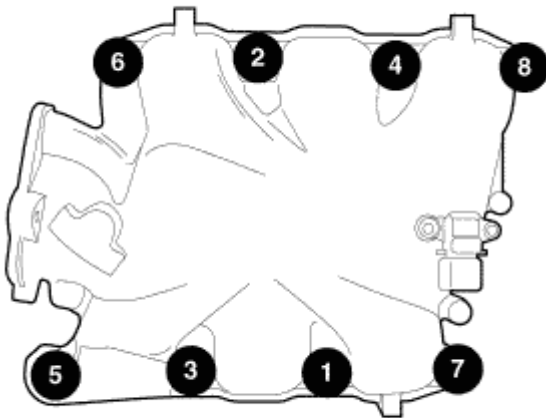
8. Disconnect the manifold absolute pressure (MAP) sensor electrical connector (2).



819221c3

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

9. Disconnect the PCV hose (1).



81b19156

Fig. 202: Removing/Installing Intake/Exhaust Manifold 3.8L
Courtesy of CHRYSLER LLC

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

CLEANING

INTAKE MANIFOLD

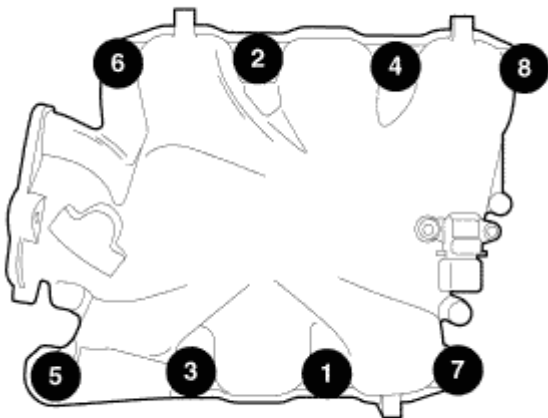
1. Discard gasket(s).
2. Clean all sealing surfaces.

INSPECTION**INTAKE MANIFOLD**

Check manifold for:

Damage and cracks.

Mounting surface distortion by using a straightedge and thickness gauge.

INSTALLATION**INTAKE MANIFOLD - UPPER**

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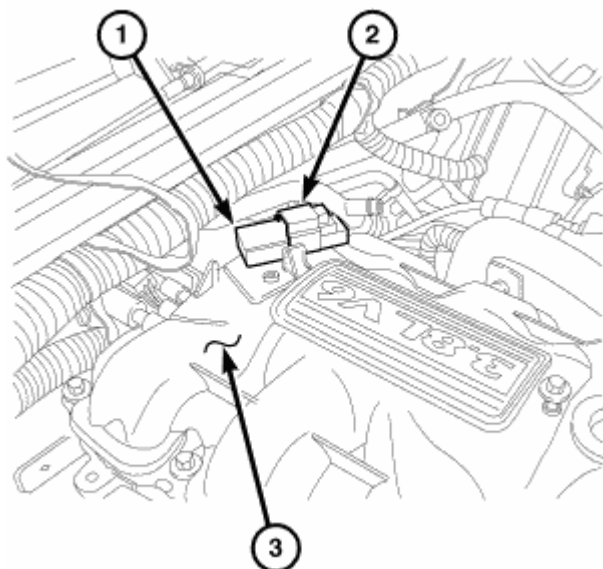
Fig. 203: Removing/Installing Intake/Exhaust Manifold 3.8L

Courtesy of CHRYSLER LLC

1. Remove covering on lower intake manifold and clean surfaces.
2. Inspect manifold gasket condition. Gaskets can be reused, if not damaged. Position new gasket in seal channel and press lightly in-place. Repeat procedure for each gasket position.
3. Position upper manifold on lower manifold.
4. Apply Mopar® Lock & Seal Adhesive (Medium Strength Threadlocker) to each upper intake manifold bolt. Install and tighten bolts to 12 N.m (105 in. lbs.) using torque sequence.

CAUTION: The special screws used for the composite manifold attached components must be installed slowly using hand tools only. This

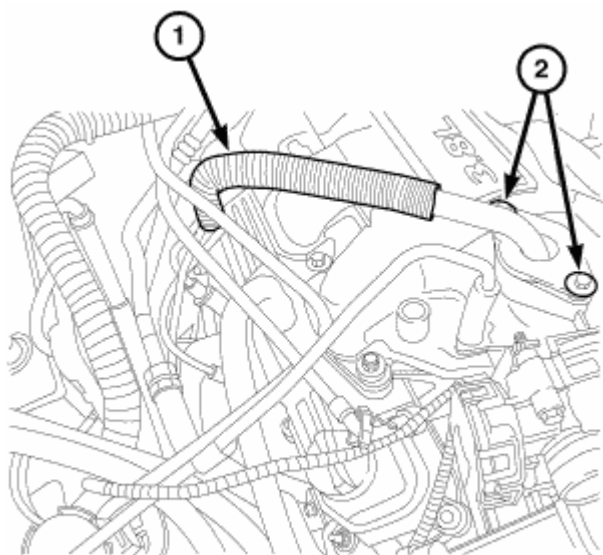
requirement is to prevent the melting of material that causes stripped threads. If threads become stripped, an oversize repair screw is available.



81920e96

Fig. 204: MAP Sensor 3.8L
Courtesy of CHRYSLER LLC

5. Install the MAP sensor (1), and torque fasteners to 1.7 N.m (15 in. lbs.).
6. Connect the MAP sensor electrical connector (2).

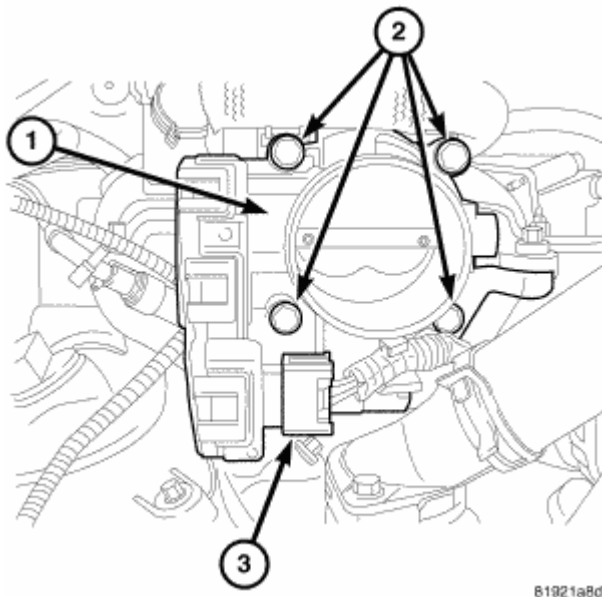


819257fe

Fig. 205: EGR Tube Flange
Courtesy of CHRYSLER 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.

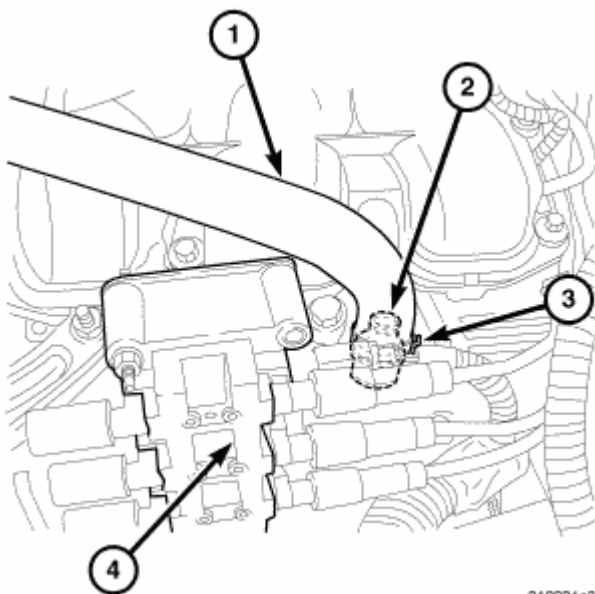
7. Install the EGR tube (1).



81921a8d

Fig. 206: Throttle Body 3.8L
Courtesy of CHRYSLER LLC

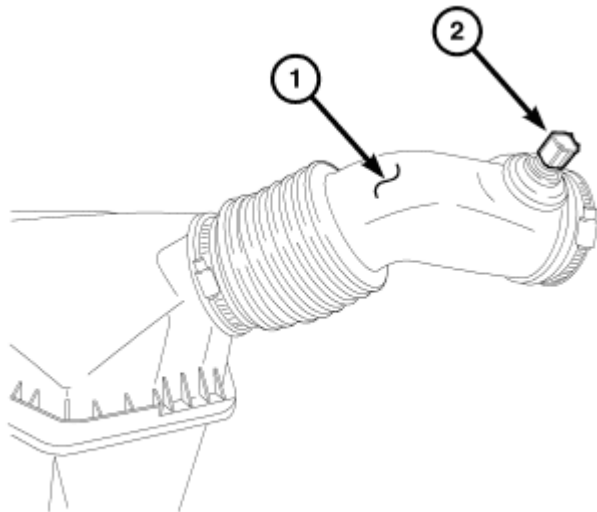
8. Connect the throttle (ETC) (3) connector to throttle body
9. Connect the EVAP hose to the throttle body.



819221c3

Fig. 207: PCV Valve Location 3.8L**Courtesy of CHRYSLER LLC**

10. Connect the wiring connectors to the throttle position sensor (TPS) and idle air control (IAC) motor.
11. Connect the PCV hose (1).



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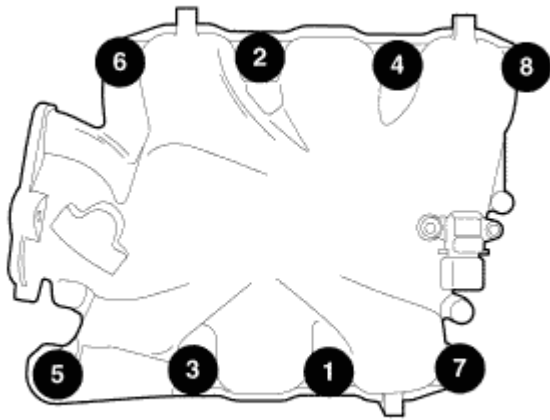
Fig. 208: Inlet Air Temperature Sensor 3.8L**Courtesy of CHRYSLER LLC**

12. Install air cleaner and air inlet hose assembly (1).
13. Connect the inlet air temperature (IAT) sensor electrical connector (2).
14. Connect battery negative cable.

INTAKE MANIFOLD - LOWER

REMOVAL

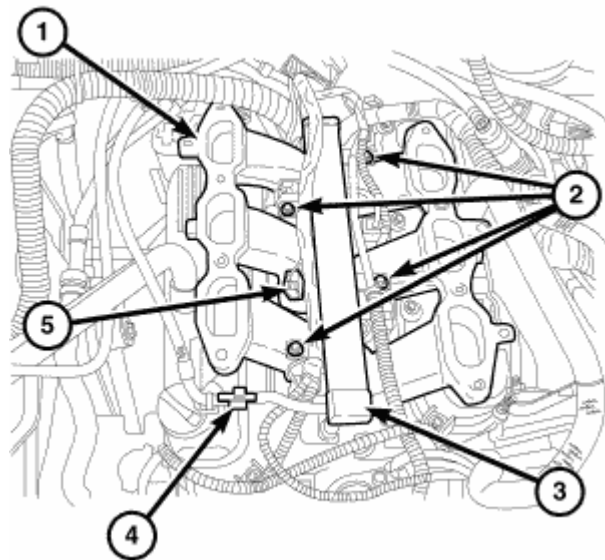
INTAKE MANIFOLD - LOWER



81b19156

Fig. 209: Removing/Installing Intake/Exhaust Manifold 3.8L
Courtesy of CHRYSLER LLC

1. Perform fuel system pressure release procedure. Refer to **STANDARD PROCEDURE** .
2. Drain the cooling system.
3. Remove the upper intake manifold. See **REMOVAL**.



8191ec71

Fig. 210: Fuel Rail 3.8L
Courtesy of CHRYSLER LLC

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

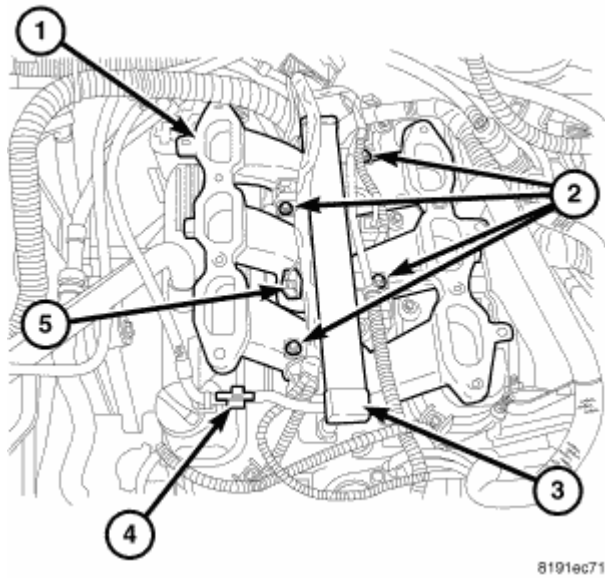


Fig. 211: Fuel Rail 3.8L
Courtesy of CHRYSLER LLC

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

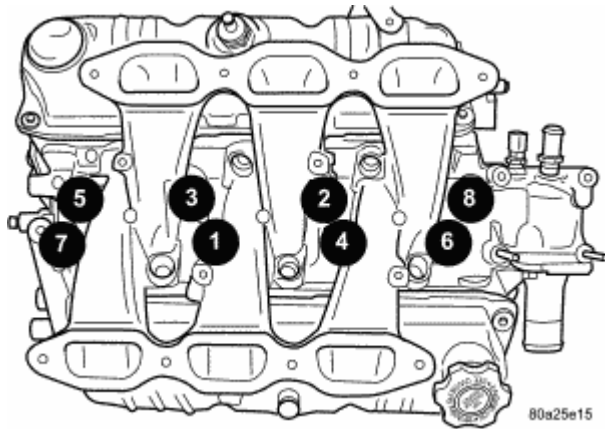


Fig. 212: Lower Manifold Tightening Sequence
Courtesy of CHRYSLER LLC

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**INTAKE MANIFOLD**

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

INSPECTION**INTAKE MANIFOLD**

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. See

INSPECTION.

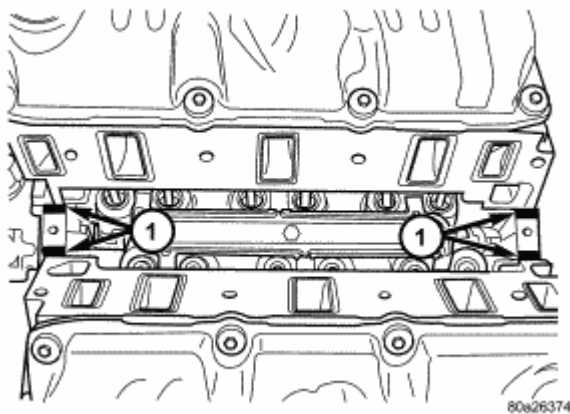
INSTALLATION**INTAKE MANIFOLD - LOWER**

Fig. 213: Sealer Locations

Courtesy of CHRYSLER 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.).

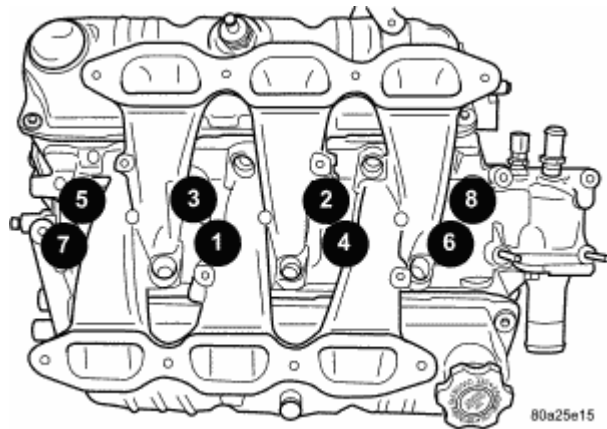


Fig. 214: Lower Manifold Tightening Sequence
Courtesy of CHRYSLER LLC

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.**

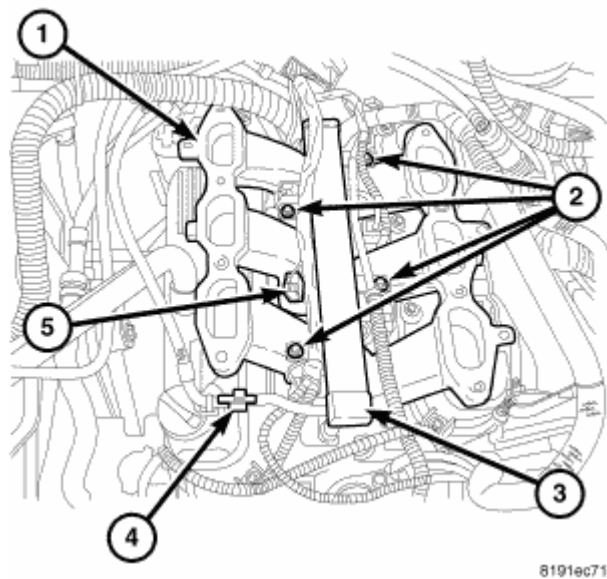


Fig. 215: Fuel Rail 3.8L
Courtesy of CHRYSLER LLC

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

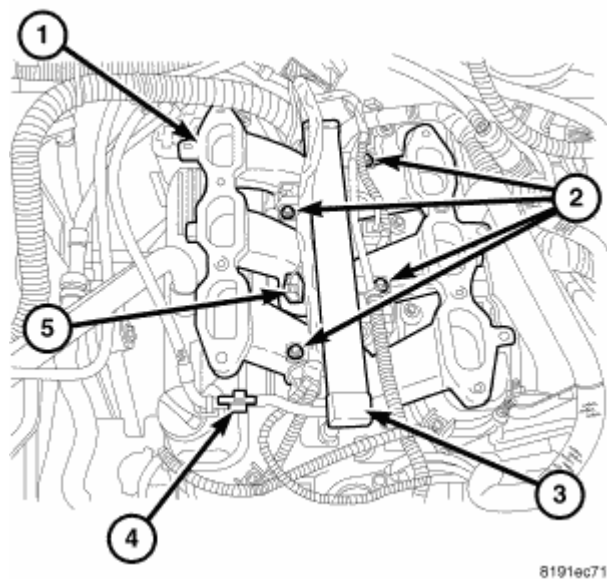


Fig. 216: Fuel Rail 3.8L
Courtesy of CHRYSLER LLC

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** .

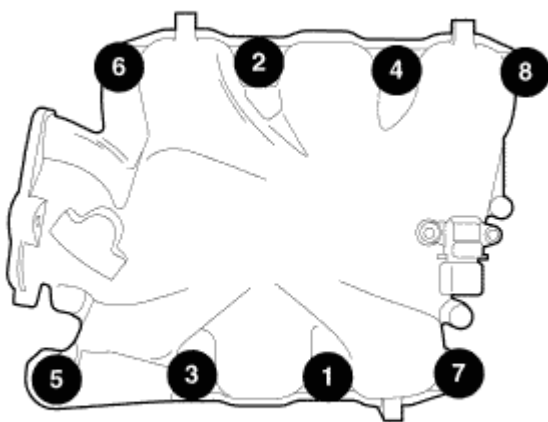
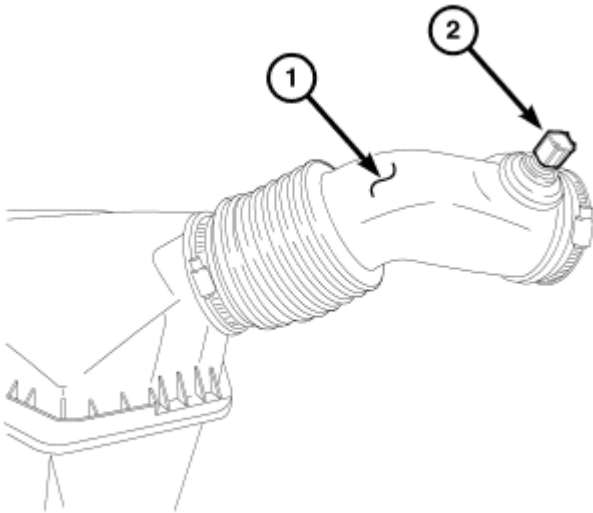


Fig. 217: Removing/Installing Intake/Exhaust Manifold 3.8L
Courtesy of CHRYSLER LLC

9. Install the upper intake manifold. See **INSTALLATION**.
10. Connect negative battery cable.
11. Fill the cooling system.

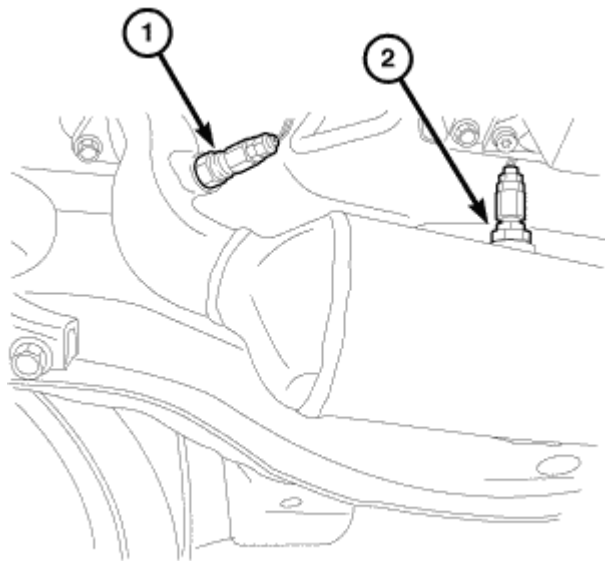
12. Connect the negative battery cable.

MANIFOLD-EXHAUST-RIGHT**REMOVAL****EXHAUST MANIFOLD - RIGHT**

81920ee6

Fig. 218: Inlet Air Temperature Sensor 3.8L
Courtesy of CHRYSLER LLC

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



81921950

Fig. 219: Oxygen Sensors
Courtesy of CHRYSLER 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

EXHAUST MANIFOLD

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

INSPECTION

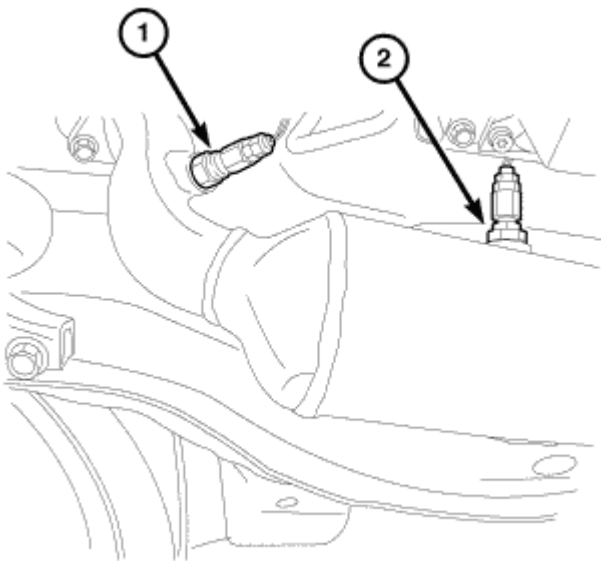
EXHAUST MANIFOLD

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

EXHAUST MANIFOLD - RIGHT

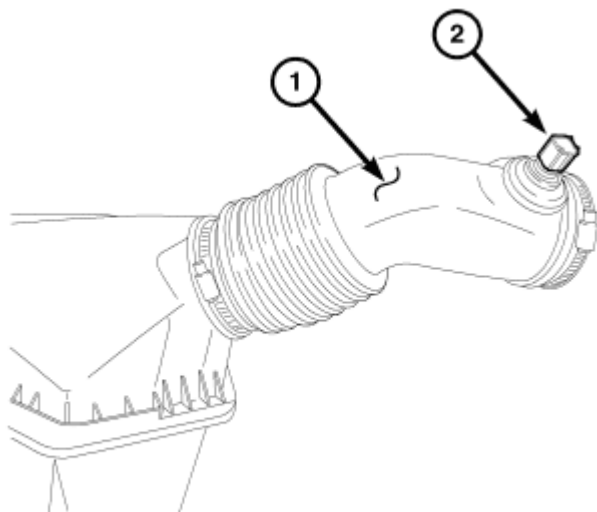


81921950

Fig. 220: Oxygen Sensors

Courtesy of CHRYSLER 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.



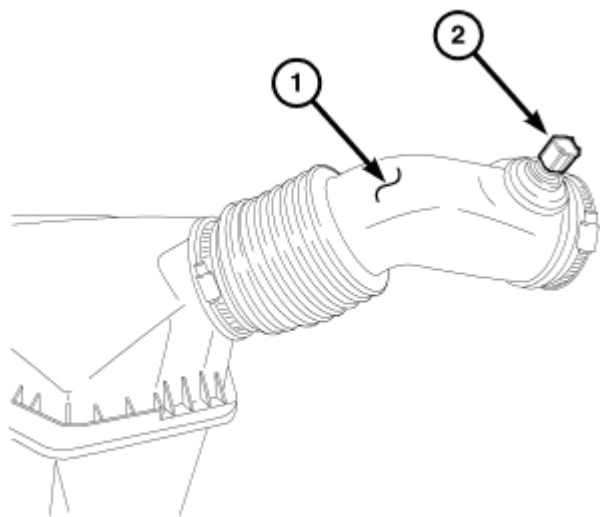
81920ee6

Fig. 221: Inlet Air Temperature Sensor 3.8L

Courtesy of CHRYSLER 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-EXHAUST-LEFT**REMOVAL****EXHAUST MANIFOLD - LEFT**

81920ee6

Fig. 222: Inlet Air Temperature Sensor 3.8L
Courtesy of CHRYSLER LLC

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

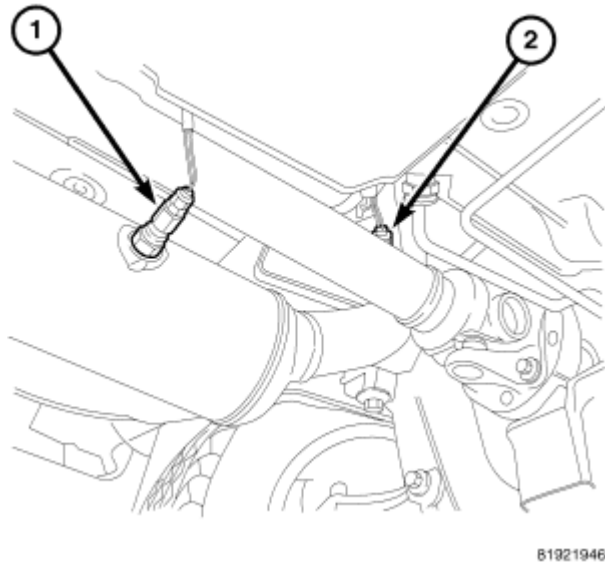


Fig. 223: Left Side Oxygen Sensors
Courtesy of CHRYSLER LLC

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

EXHAUST MANIFOLD

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

INSPECTION

EXHAUST MANIFOLD

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

EXHAUST MANIFOLD

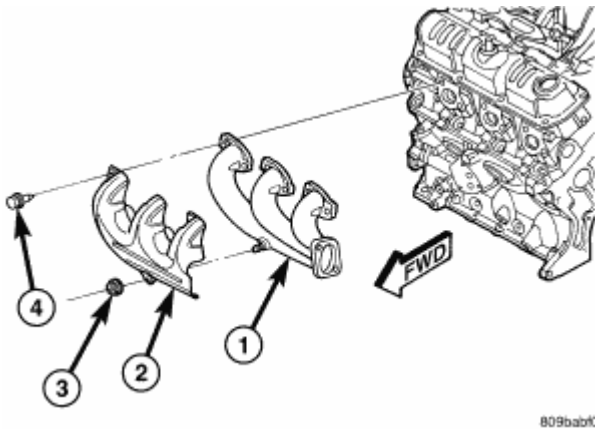


Fig. 224: Exhaust Manifold - Left
Courtesy of CHRYSLER LLC

- | |
|-------------------------------------------------------------------------------------------------------------|
| 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.).

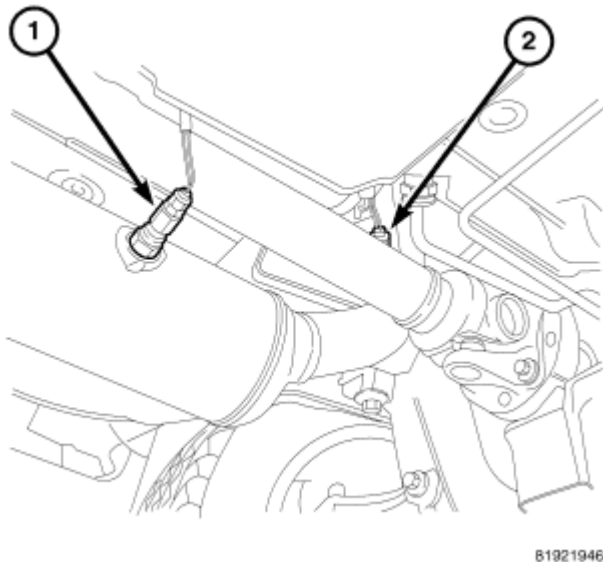


Fig. 225: Left Side Oxygen Sensors
Courtesy of CHRYSLER LLC

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.

VALVE TIMING

STANDARD PROCEDURE

MEASURING TIMING CHAIN WEAR

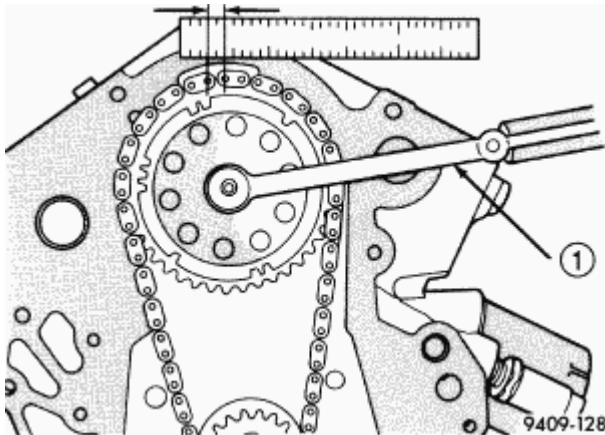


Fig. 226: Measuring Timing Chain Wear
Courtesy of CHRYSLER LLC

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.

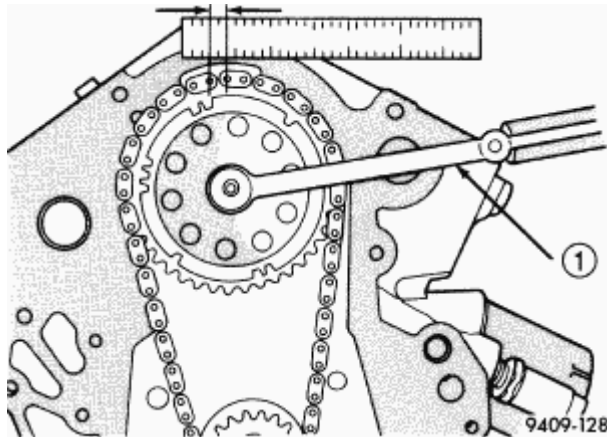


Fig. 227: Measuring Timing Chain Wear
Courtesy of CHRYSLER LLC

1 - TORQUE WRENCH

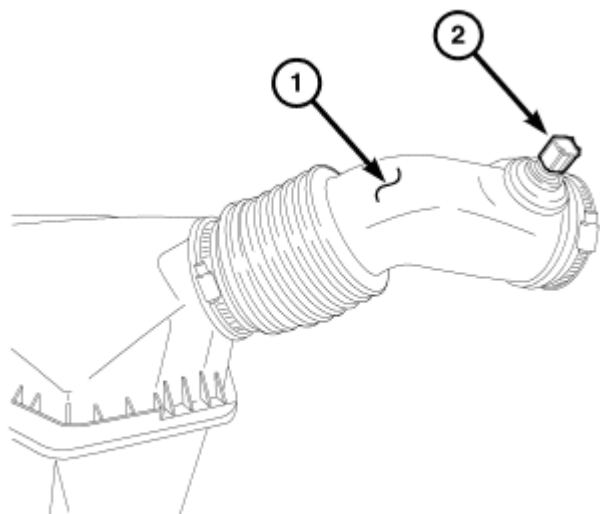
3. Holding a measuring scale along edge of chain links.
4. Apply force in the reverse direction to the following torque:
 - 41 N.m (30 ft. lb.) with cylinder heads installed
 - 20 N.m (15 ft. lb.) with cylinder heads removed
5. Measure amount of sprocket/chain movement.
6. Install a new timing chain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

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 Adapter, 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 .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.

COVER-TIMING CHAIN**REMOVAL****TIMING CHAIN COVER**

81920ee6

Fig. 228: Inlet Air Temperature Sensor 3.8L
Courtesy of CHRYSLER LLC

1. Perform the fuel pressure relief procedure. Refer to **STANDARD PROCEDURE** .
2. Disconnect negative cable from battery.
3. Drain cooling system.
4. Remove the air cleaner hose (1) and housing assembly.

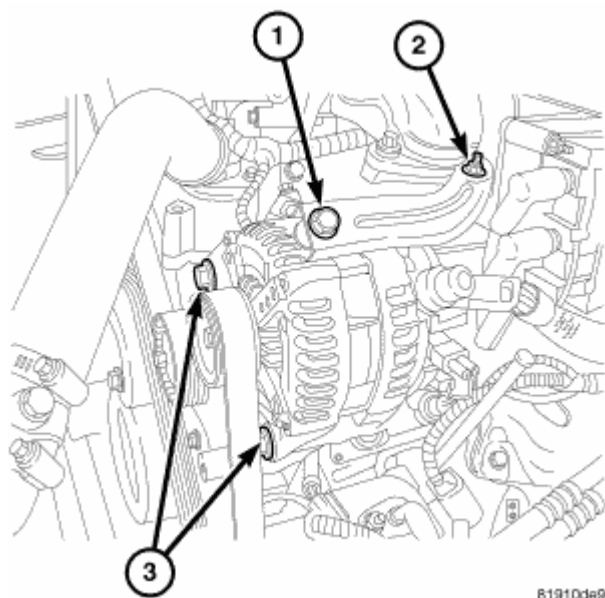


Fig. 229: Generator 3.8L
Courtesy of CHRYSLER LLC

5. Remove the accessory drive belt and belt tensioner.
6. Remove the generator (3).
7. Remove the oil level indicator tube.
8. Drain engine oil.

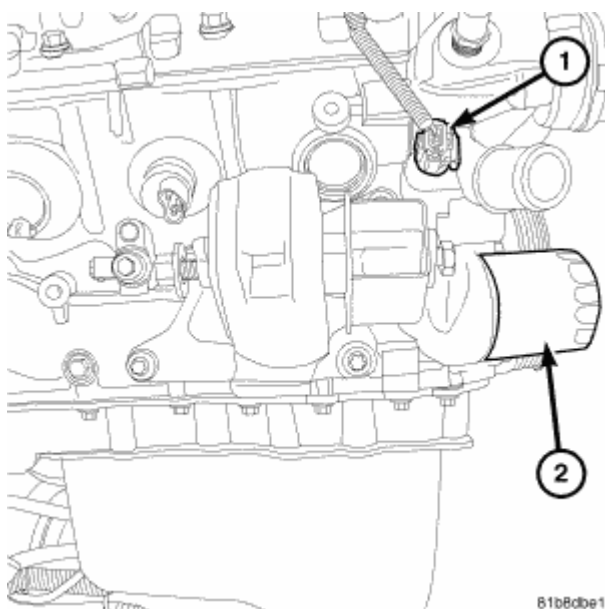


Fig. 230: 3.8L Oil Pressure Switch
Courtesy of CHRYSLER LLC

9. Remove oil pan. See **REMOVAL**.
10. Remove the oil filter (2).

11. Disconnect the oil pressure switch (1).

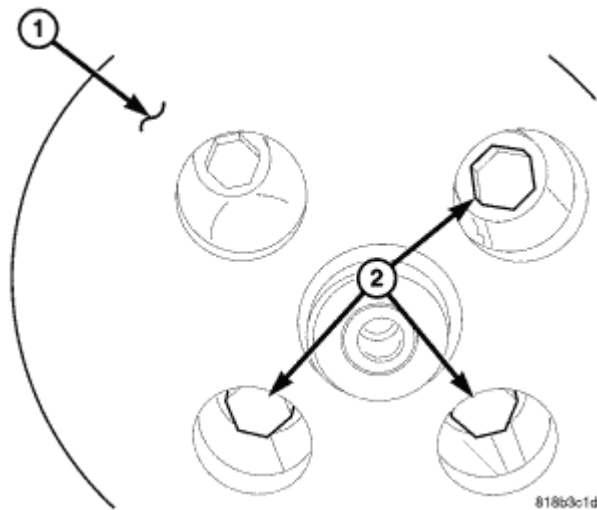


Fig. 231: Mounting Bolts
Courtesy of CHRYSLER LLC

12. Remove power steering pump fasteners (2) and set pump (1) aside.
13. Disconnect the lower radiator hose.
14. Separate the air conditioning compressor from the engine and set aside.

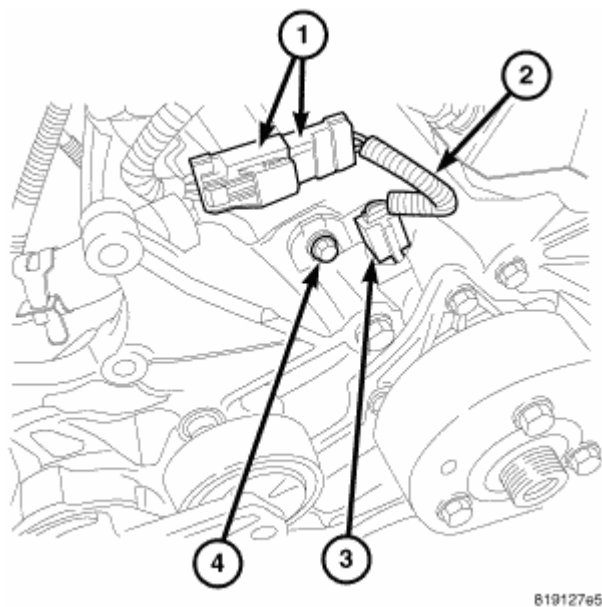
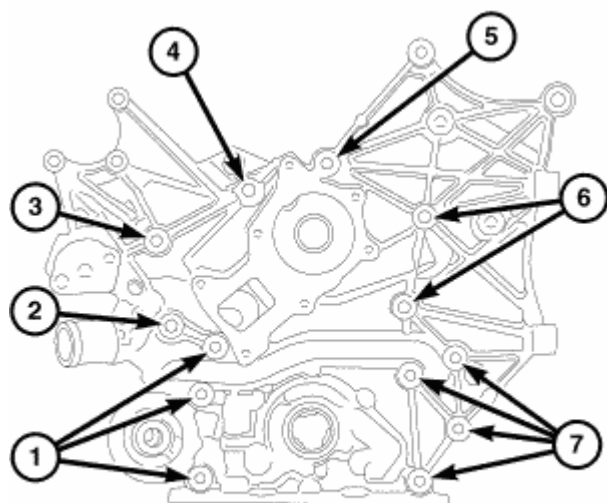


Fig. 232: Camshaft Position Sensor 3.8L
Courtesy of CHRYSLER LLC

15. Remove crankshaft vibration damper using special tool #8454 and insert #8450. See **REMOVAL**.
16. Remove camshaft position sensor (CMP) (4) from timing chain cover. Refer to **REMOVAL**.



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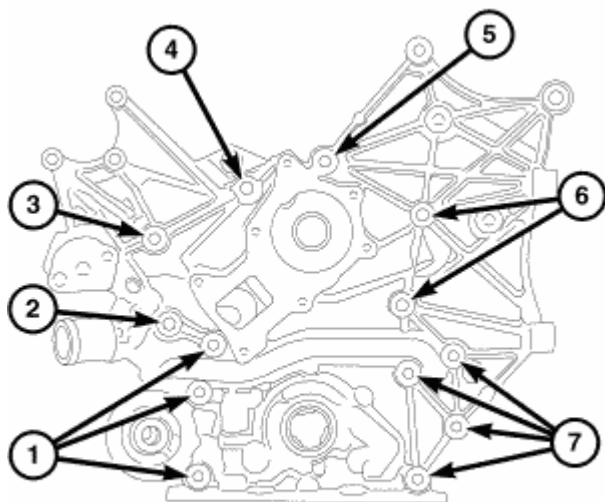
Fig. 233: Timing Cover Bolt Location
Courtesy of CHRYSLER LLC

| | |
|-----------------------------|---------------------------|
| 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 |

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

INSTALLATION

TIMING CHAIN COVER



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Fig. 234: Timing Cover Bolt Location

Courtesy of CHRYSLER 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 mating surfaces of chain case cover and cylinder block are clean and free from burrs.

NOTE: DO NOT USE SEALER ON COVER GASKET

2. Position new gasket on timing cover. Adhere new gasket to 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 crankshaft so that the oil pump drive flats are in the vertical position.
4. Position oil pump inner rotor so 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 timing cover.

NOTE: Torque 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 M8 bolts (1,3,5,7) to 28 N.m (21 ft. lbs.).

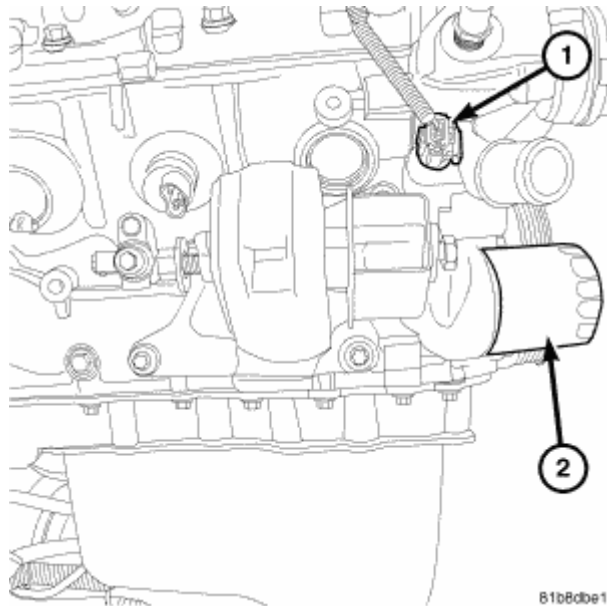


Fig. 235: 3.8L Oil Pressure Switch
Courtesy of CHRYSLER LLC

7. Install the oil pan. See **INSTALLATION**.
8. Install crankshaft front oil seal. See **INSTALLATION**.
9. Install crankshaft vibration damper. See **INSTALLATION**.
10. Install a new oil filter (2) and connect the oil pressure switch (1).

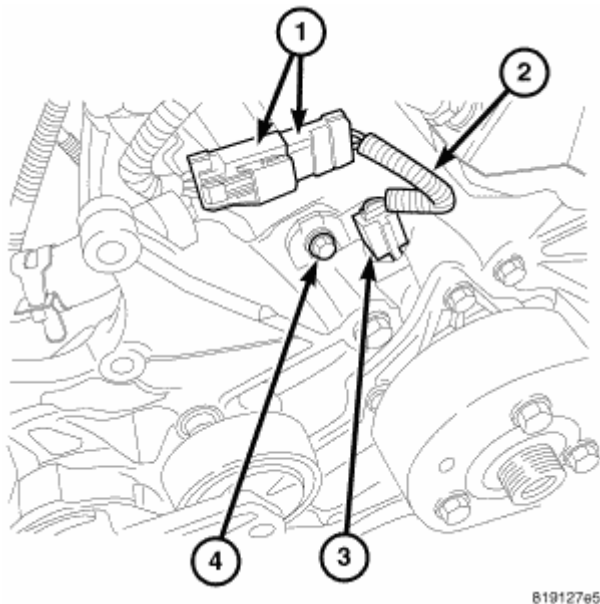


Fig. 236: Camshaft Position Sensor 3.8L
Courtesy of CHRYSLER LLC

11. Connect the coolant hoses.
12. Install camshaft position sensor (CMP).

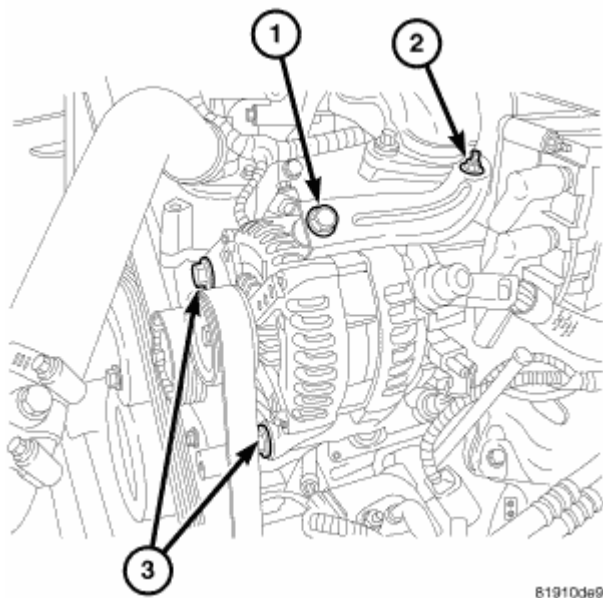


Fig. 237: Generator 3.8L
Courtesy of CHRYSLER LLC

13. Install A/C compressor.
14. Install the oil level indicator tube.
15. Install the generator (3).

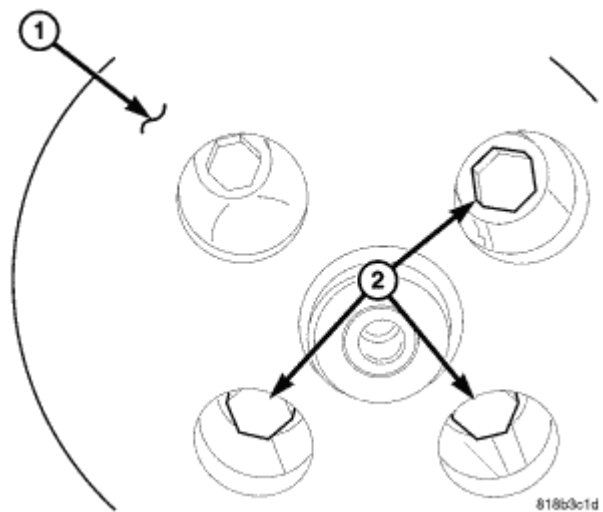
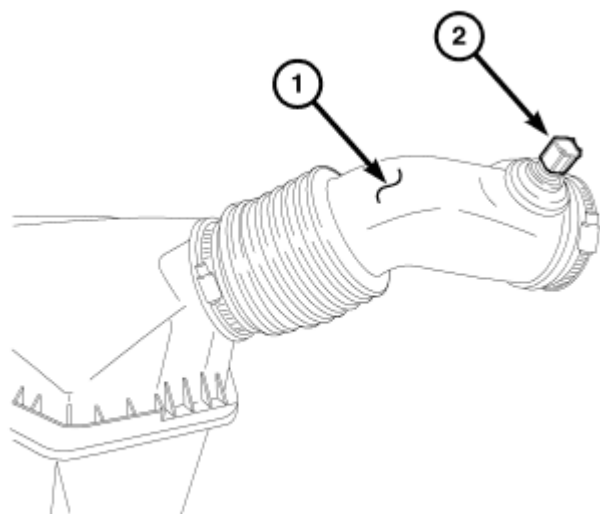


Fig. 238: Power Steering Pump Bolts
Courtesy of CHRYSLER LLC

16. Install the power steering pump (1).
17. Install the accessory drive belt and idler pulley.
18. Fill crankcase with engine oil to proper level.



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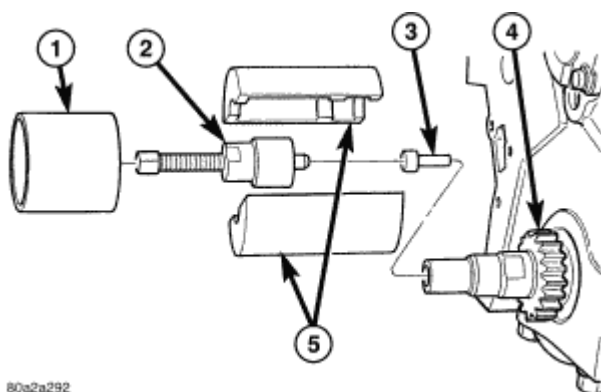
Fig. 239: Inlet Air Temperature Sensor 3.8L
Courtesy of CHRYSLER LLC

19. Install the Air cleaner housing and hose (1).
20. Fill cooling system.
21. Connect negative cable to battery.

CHAIN & SPROCKETS-TIMING

REMOVAL

CRANKSHAFT SPROCKET



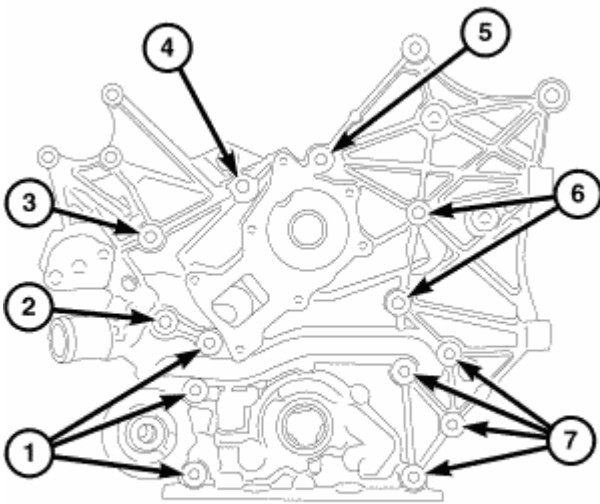
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Fig. 240: Crankshaft Sprocket Components
Courtesy of CHRYSLER LLC

- 1 - SPECIAL TOOL 5048-6
- 2 - SPECIAL TOOL 5048-1
- 3 - SPECIAL TOOL 8450

4 - CRANKSHAFT SPROCKET**5 - SPECIAL TOOL 8539**

1. Remove the timing chain.
2. Using Special Tools 8539 (5), 5048-6 (1), and 5048-1, remove the crankshaft sprocket while holding the crankshaft from turning. Be careful not to damage the crankshaft surfaces.

TIMING CHAIN AND CAMSHAFT SPROCKET

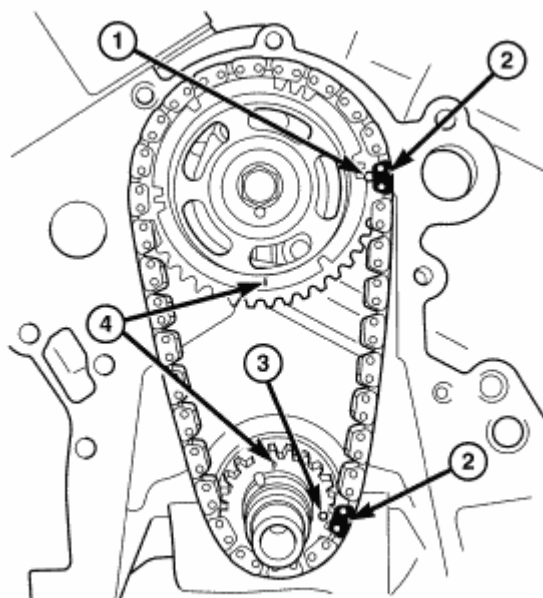
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Fig. 241: Timing Cover Bolt Location

Courtesy of CHRYSLER 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. See **REMOVAL**.



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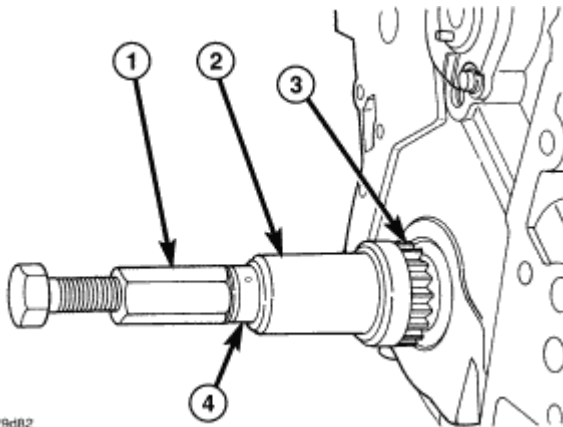
Fig. 242: Timing Marks
Courtesy of CHRYSLER LLC

- | |
|------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1 - CAMSHAFT SPROCKET TIMING MARK (DOT)</p> <p>2 - PLATED LINK</p> <p>3 - CRANKSHAFT SPROCKET TIMING MARK (DOT)</p> <p>4 - ARROWS</p> |
|------------------------------------------------------------------------------------------------------------------------------------------|

3. Rotate engine by turning crankshaft until the timing marks are aligned as shown (4), see **Fig. 242**.
4. Remove camshaft sprocket attaching bolt.
5. Remove the timing chain with camshaft sprocket.
6. Remove the crankshaft sprocket.

INSTALLATION

CRANKSHAFT SPROCKET



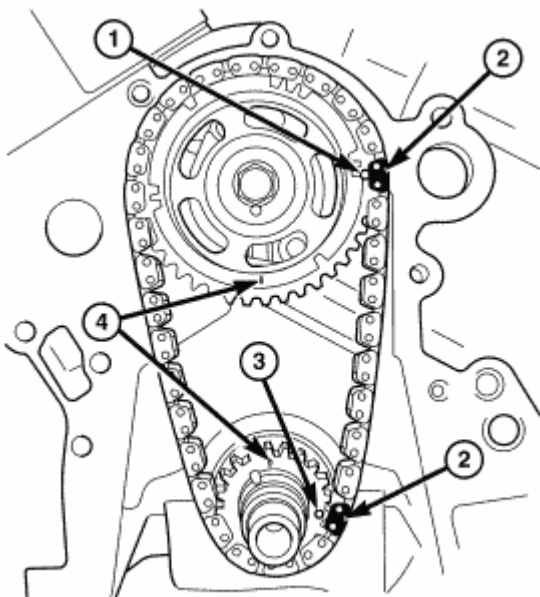
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Fig. 243: Crankshaft Sprocket Components
Courtesy of CHRYSLER LLC

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

1. Position the sprocket on the crankshaft (timing mark out) with the timing slot aligned with the timing pin.
2. Install sprocket using Special Tool 8452 (1,2). Install sprocket until it is fully seats on the crankshaft.
3. Install the timing chain and camshaft sprocket.

TIMING CHAIN AND CAMSHAFT SPROCKET



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Fig. 244: Timing Marks

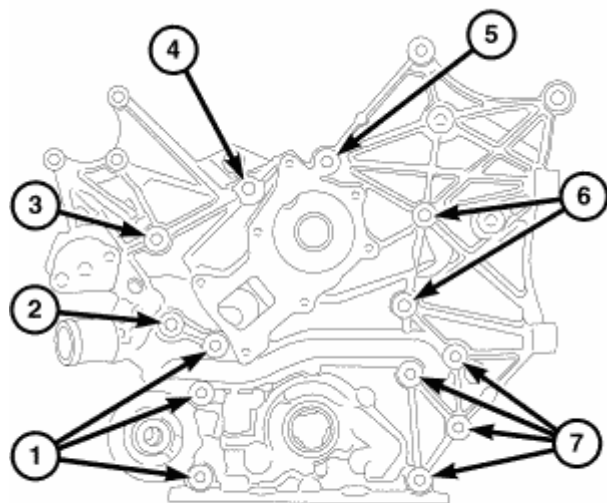
Courtesy of CHRYSLER LLC

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

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

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

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



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Fig. 245: Timing Cover Bolt Location
Courtesy of CHRYSLER 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 |

2008 Jeep Wrangler Rubicon

2008 ENGINE 3.8L - Service Information - Wrangler

7. Install the timing chain cover, and bolts (1-7). See **INSTALLATION**.
8. Connect negative cable to battery.