

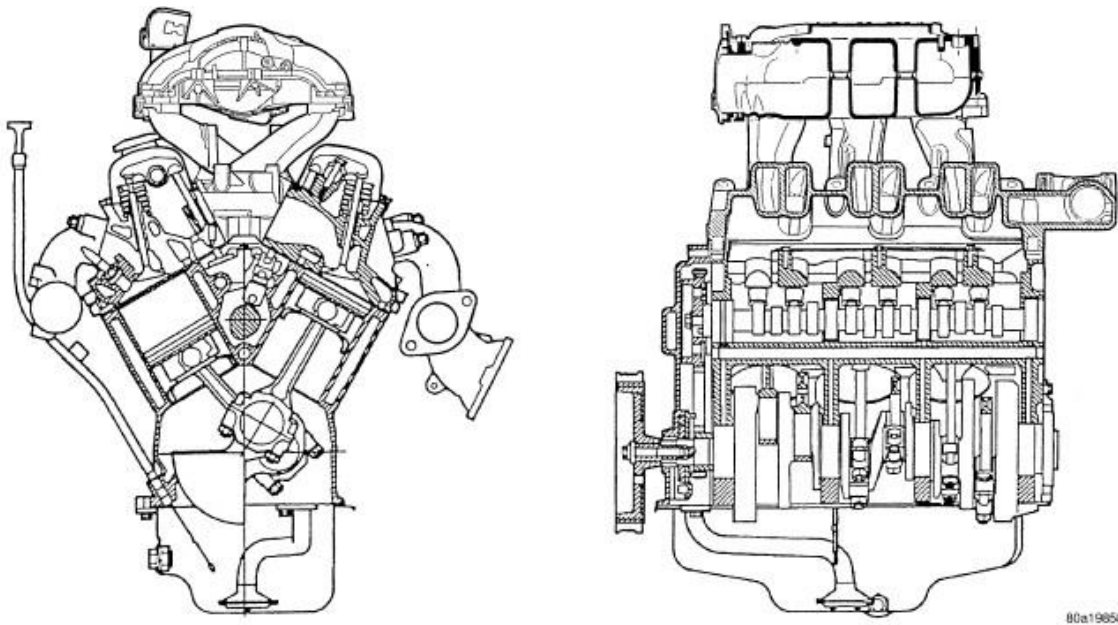
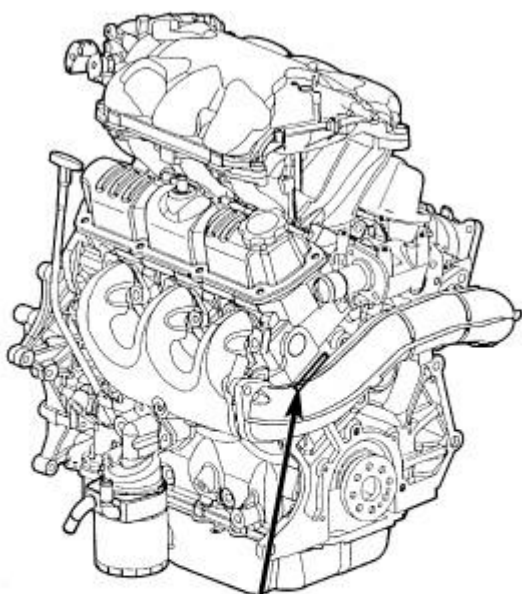
2010 ENGINE**3.3L/3.8L - Service Information - Grand Caravan, Town & Country****DESCRIPTION****DESCRIPTION**

Fig. 1: 3.3/3.8L V-6 Engines
Courtesy of CHRYSLER LLC

The 3.3 Liter (201 cu. in.) and 3.8 Liter (231 cu. in.) engines are 60° V-6 engines with cast iron cylinder blocks and aluminum cylinder heads. The engine uses a single, block mounted camshaft with pushrods to actuate the valves. These engines do not have provisions for a free wheeling valve train.

The firing order is 1-2-3-4-5-6. The cylinders are numbered from the front of the engine to the rear. The front cylinder bank is numbered 2, 4, and 6. The rear cylinder bank is numbered 1, 3, and 5.



X Model Year	X Manufacturing Plant	XXXXX Component Code/Usage	XXXX Month/Day	XXXXXXXX Serial Code
Last digit of model year	Saltillo S Trenton T	Engine 2.4L 3.3/3.8L Usage Pass Car PC Truck T		Last 8 Digits of VIN

80sc274f

Fig. 2: Engine Identification
Courtesy of CHRYSLER LLC

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

DIAGNOSIS AND TESTING

INTRODUCTION

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

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

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

For fuel system diagnosis, refer to **Fuel System/Fuel Delivery - Diagnosis and Testing** .

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

within the following:

- Cylinder Compression Pressure Test: 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 **CYLINDER HEAD GASKET**.
- Intake Manifold Leakage Diagnosis: Refer to **INTAKE MANIFOLD LEAKS**.
- Hydraulic Lash Adjuster Noise Diagnosis: Refer to **HYDRAULIC LIFTERS**.
- Engine Oil Leak Inspection: Refer to **ENGINE OIL LEAK INSPECTION**.

PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	<ol style="list-style-type: none"> 1. Weak battery. 2. Corroded or loose battery connections. 3. Faulty starter. 4. Faulty coil(s) or control unit. 5. Incorrect spark plug gap. 6. Contamination in fuel system. 7. Faulty fuel pump. 8. Incorrect engine timing. 	<ol style="list-style-type: none"> 1. Test battery. Charge or replace as necessary. Refer to <u>Electrical/Battery System - 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>Electrical/Starting - Diagnosis and Testing</u>. 4. Test and replace as needed. (Refer to Appropriate Diagnostic Information) 5. Set gap. Refer to <u>Electrical/Ignition Control - Specifications</u>. 6. Clean system and replace fuel filter. 7. Test fuel pump and replace as needed. (Refer to Appropriate Diagnostic Information) 8. Check for a skipped timing belt/chain.
ENGINE STALLS OR IDLES ROUGH	<ol style="list-style-type: none"> 1. Idle speed too low. 2. Incorrect fuel mixture. 3. Intake manifold leakage. 4. Faulty ignition coil(s). 	<ol style="list-style-type: none"> 1. Test minimum air flow. (Refer to Appropriate Diagnostic Information) 2. (Refer to Appropriate Diagnostic Information) 3. Inspect intake manifold, manifold gasket, and vacuum hoses. 4. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
ENGINE LOSS OF POWER	<ol style="list-style-type: none"> 1. Dirty or incorrectly gapped plugs. 2. Contamination in fuel system. 3. Faulty fuel pump. 	<ol style="list-style-type: none"> 1. Clean plugs and set gap. 2. Clean system and replace fuel filter. 3. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)

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- - - - - -	<p>4. Incorrect valve timing.</p> <p>5. Leaking cylinder head gasket.</p> <p>6. Low compression.</p> <p>7. Burned, warped, or pitted valves.</p> <p>8. Plugged or restricted exhaust system.</p> <p>9. Faulty ignition coil (s).</p>	<p>4. Correct valve timing.</p> <p>5. Replace cylinder head gasket.</p> <p>6. Test compression of each cylinder.</p> <p>7. Replace valves.</p> <p>8. Perform exhaust restriction test. Refer to <u>Exhaust System - Diagnosis and Testing</u> . Install new parts, as necessary.</p> <p>9. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)</p>
ENGINE MISSES ON ACCELERATION - - -	<p>1. Dirty or incorrectly gapped spark plugs.</p> <p>2. Contamination in Fuel System.</p> <p>3. Burned, warped, or pitted valves.</p> <p>4. Faulty ignition coil (s).</p>	<p>1. Clean spark plugs and set gap.</p> <p>2. Clean fuel system and replace fuel filter.</p> <p>3. Replace valves.</p> <p>4. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)</p>
ENGINE MISSES AT HIGH SPEED - - -	<p>1. Dirty or incorrect spark plug gap.</p> <p>2. Faulty ignition coil (s).</p> <p>3. Dirty fuel injector(s).</p> <p>4. Contamination in fuel system.</p>	<p>1. Clean spark plugs and set gap.</p> <p>2. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)</p> <p>3. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)</p> <p>4. Clean system and replace fuel filter.</p>

MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES	<p>1. High or low oil level in crankcase.</p> <p>2. Thin or diluted oil.</p> <p>3. Thick oil</p> <p>4. Low oil pressure.</p> <p>5. Dirt in hydraulic lifters/lash adjusters.</p> <p>6. Worn rocker arms.</p>	<p>1. Check and correct engine oil level.</p> <p>2. Change oil to correct viscosity.</p> <p>3. (a) Change engine oil and filter. (b) Run engine to operating temperature. (c) Change engine oil and filter again.</p> <p>4. Check and correct engine oil pressure problem.</p> <p>5. Replace hydraulic lifters/lash adjusters.</p> <p>6. Inspect oil supply to rocker arms.</p>

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	<ul style="list-style-type: none"> 7. Worn hydraulic lifters/lash adjusters. 8. Worn valve guides. 9. Excessive runout of valve seats on valve faces. 	<ul style="list-style-type: none"> 7. Replace hydraulic lifters/lash adjusters. 8. Replace cylinder head assembly. 9. Grind valve seats and valves.
CONNECTING ROD NOISE	<ul 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. 	<ul 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	<ul 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. 	<ul 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	<ul 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. 	<ul 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,

	8. Oil pump suction tube loose. 9. Oil pump cover warped or cracked. 10. Excessive bearing clearance.	or replace. 8. Remove oil pan and install new tube or clean, if necessary. 9. Install new oil pump. 10. Measure bearings for correct clearance.
OIL LEAKS	1. Misaligned or deteriorated gaskets. 2. Loose fastener, broken or porous metal part. 3. Misaligned or deteriorated cup or threaded plug.	1. Replace gasket(s). 2. Tighten, repair or replace the part. 3. Replace as necessary.
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>Emissions Control/Evaporative Emissions/VALVE, Positive Crankcase Ventilation (PCV) - Diagnosis and Testing</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).

ENGINE OIL LEAK INSPECTION

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

1. Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.
2. Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.
3. Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair as necessary.
4. If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.
5. **If the oil leak source is not positively identified at this time** , proceed with the AIR LEAK DETECTION TEST METHOD as follows:

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

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

- Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provides the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service information procedures.
 - If the leakage occurs at the crankshaft rear oil seal area, refer to **INSPECTION FOR REAR SEAL AREA LEAKS**.
6. If no leaks are detected, turn off the air supply. Remove the air hose, all plugs, and caps. Install the PCV valve and fresh air hose (make-up air). Proceed to next step.
 7. Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

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

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

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.

INSPECTION FOR REAR SEAL AREA LEAKS

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

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

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak. If a leak is present in this area, remove transmission for further

inspection.

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

CYLINDER COMPRESSION PRESSURE TEST

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

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

1. Check engine oil level and add oil if necessary.
2. Drive the vehicle until engine reaches normal operating temperature. Select a route free from traffic and other forms of congestion, observe all traffic laws, and accelerate through the gears several times briskly.
3. Remove all spark plugs from engine. As spark plugs are being removed, check electrodes for abnormal firing indicators such as fouled, hot, oily, etc. Record cylinder number of spark plug for future reference.
4. Remove the Auto Shutdown (ASD) relay from the power distribution center.
5. Insert compression gauge adaptor Special Tool 8116 or the equivalent, into the #1 spark plug hole in cylinder head. Connect the 0-500 psi (Blue) pressure transducer (Special Tool CH7059) with cable adaptors to the DRBIII®. For Special Tool identification, see **Engine - Special Tools**.
6. Crank engine until maximum pressure is reached on gauge. Record this pressure as #1 cylinder pressure.
7. Repeat the previous step for all remaining cylinders.
8. Compression should not be less than 689 kPa (100 psi) and not vary more than 25 percent from cylinder to cylinder.

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

CYLINDER COMBUSTION PRESSURE LEAKAGE TEST

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

Combustion pressure leakage testing will detect:

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

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

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

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

Clean spark plug recesses with compressed air.

Remove the spark plugs.

Remove the oil filler cap.

Remove the air cleaner.

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

Perform the test procedures on each cylinder according to the tester manufacturer's instructions. While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the coolant.

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

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

STANDARD PROCEDURE

ENGINE GASKET SURFACE PREPARATION

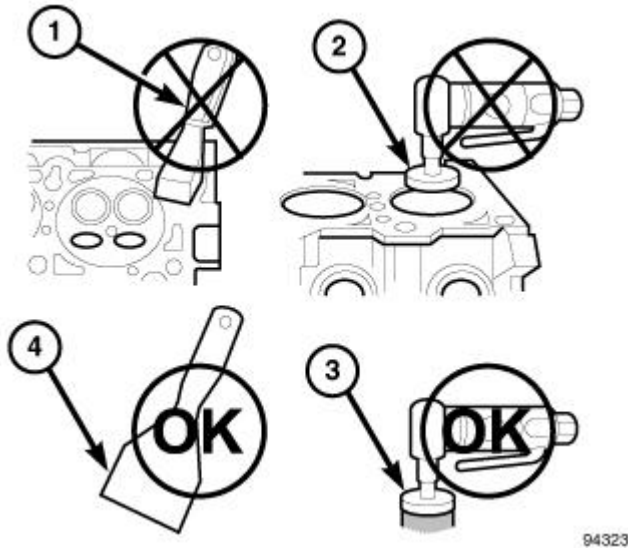


Fig. 3: PROPER TOOL USAGE FOR SURFACE PREPARATION
Courtesy of CHRYSLER LLC

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

Never use the following to clean gasket surfaces:

- Metal scraper (1).
- Abrasive pad or paper to clean cylinder block and head.
- High speed power tool with an abrasive pad or a wire brush (2,3).

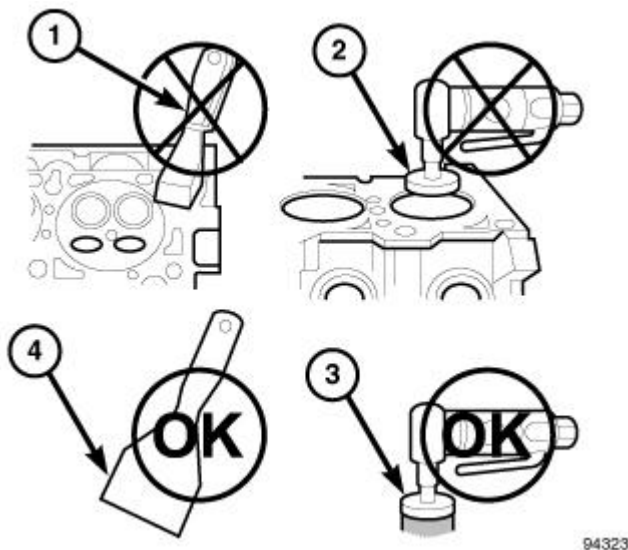


Fig. 4: PROPER TOOL USAGE FOR SURFACE PREPARATION
Courtesy of CHRYSLER LLC

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

Only use the following for cleaning gasket surfaces:

- Solvent or a commercially available gasket remover
- Plastic or wood scraper (4).

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

MEASURING BEARING CLEARANCE USING PLASTIGAGE

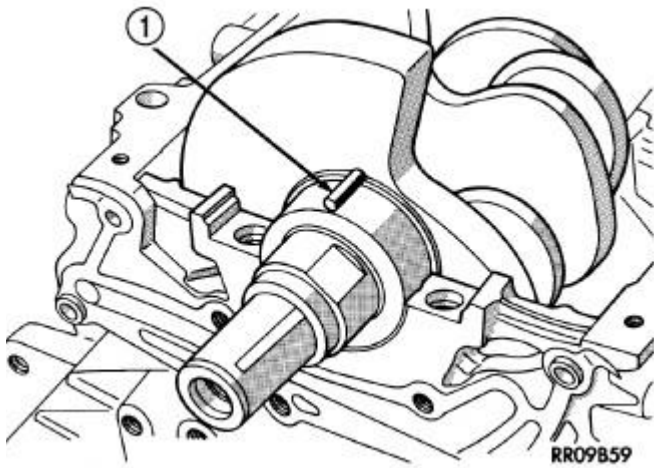


Fig. 5: Placing Plastigage Across Bearing Shell
Courtesy of CHRYSLER LLC

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 (1) 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/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 **Engine - Specifications**. **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.**

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

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

FORM-IN-PLACE GASKETS AND SEALERS

NOTE: All of the sealants mentioned below are not used on every engine, they are listed as general reference guide. See service information for specific sealer usage.

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.

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.

HYDROSTATIC LOCKED ENGINE

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

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

1. Inspect air cleaner, induction system and intake manifold to insure system is dry and clear of foreign material.
2. Remove negative battery cable.
3. Place a shop towel around the spark plugs when removing them from the engine. This will catch any fluid that may possibly be in the cylinder under pressure.
4. With all spark plugs removed, rotate engine crankshaft using a breaker bar and socket.
5. Identify the fluid in the cylinder(s) (i.e., coolant, fuel, oil or other).
6. Make sure all fluid has been removed from the cylinders. Inspect engine for damage (i.e., connecting rods, pistons, valves, etc.)
7. Repair engine or components as necessary to prevent this problem from re-occurring.

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

8. Install new spark plugs.
9. Drain engine oil and remove oil filter.
10. Install a new oil filter.
11. Fill engine with specified amount of approved oil.
12. Connect negative battery cable.
13. Start engine and check for any leaks.

REPAIR OF DAMAGED OR WORN THREADS

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

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

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

ENGINE CORE AND OIL GALLERY PLUGS

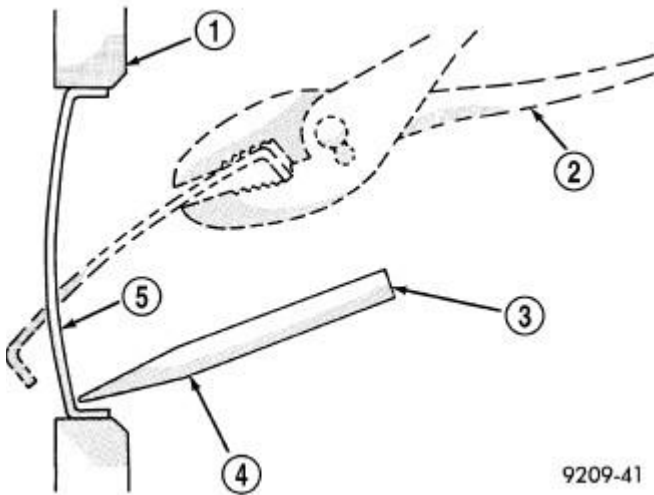


Fig. 6: Core Hole Plug Removal
Courtesy of CHRYSLER LLC

- 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.

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

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

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

REMOVAL

REMOVAL

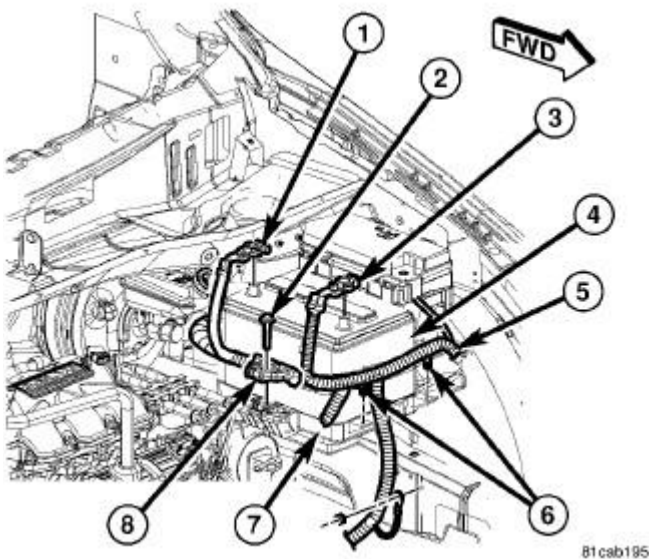


Fig. 7: CONVENTIONAL BATTERY REMOVAL
Courtesy of CHRYSLER LLC

1. Perform fuel pressure release procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .
2. Disconnect negative battery cable (3).
3. Remove air cleaner and hoses.

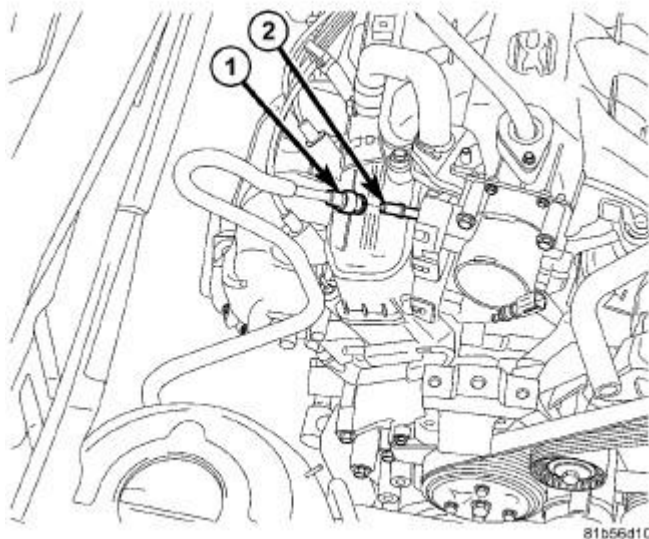


Fig. 8: Disconnecting Fuel Line From Fuel Rail
Courtesy of CHRYSLER LLC

4. Disconnect the fuel line (1) from fuel rail. Refer to **Fuel System/Fuel Delivery/FITTING, Quick**

Connect - Standard Procedure .

5. Remove the wiper module. Refer to **Electrical/Wipers/Washers/LINKAGE, Wiper Arm - Removal** .

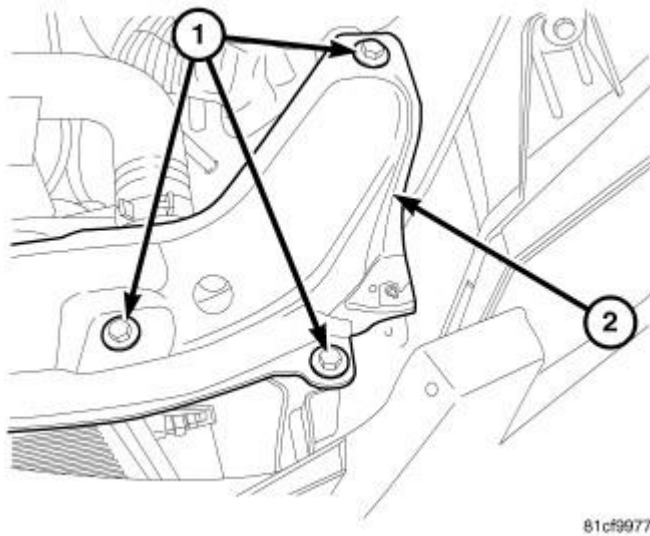


Fig. 9: CROSSMEMBER BOLTS

Courtesy of CHRYSLER LLC

6. Block off heater hoses to the rear heater system using pinch-off pliers (if equipped).
7. Drain the cooling system. Refer to **Cooling - Standard Procedure** .
8. Disconnect the heater hoses.
9. Remove the radiator upper support crossmember (2). Refer to **Body/Exterior/CROSSMEMBER, Radiator - Removal** .

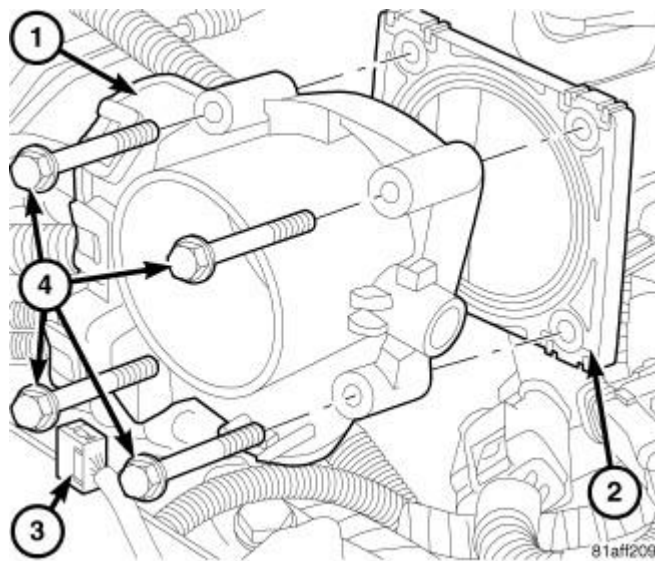


Fig. 10: THROTTLE BODY

Courtesy of CHRYSLER LLC

10. Remove the radiator fans. Refer to **Cooling/Engine/FAN, Cooling - Removal**.
11. Disconnect the ETC connector (3) from the throttle body.
12. Disconnect the MAP, IAC, and TPS electrical connectors.
13. Disconnect the EGR transducer electrical connector (if equipped).
14. Disconnect the vacuum hoses from throttle body.

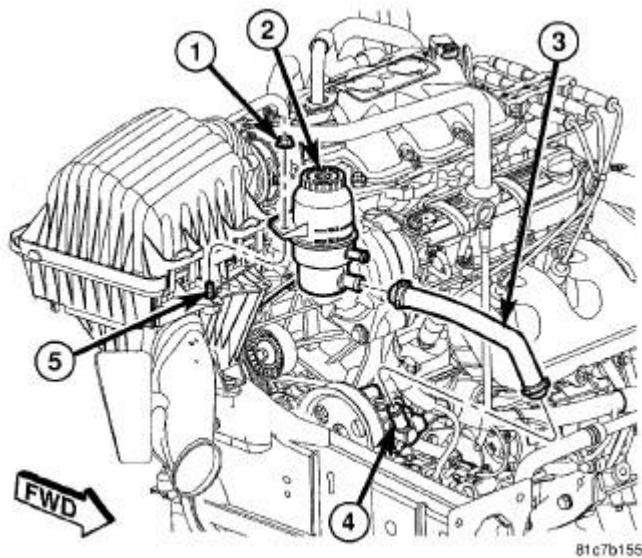


Fig. 11: SUPPLY HOSE AND RESERVOIR MOUNTING
Courtesy of CHRYSLER LLC

15. Disconnect the brake booster and speed control vacuum hoses.
16. Disengage wire harness clip from the right side engine mount.
17. Remove the power steering reservoir (2) from mounting position and set aside.
18. Disconnect ground strap from rear of cylinder head.

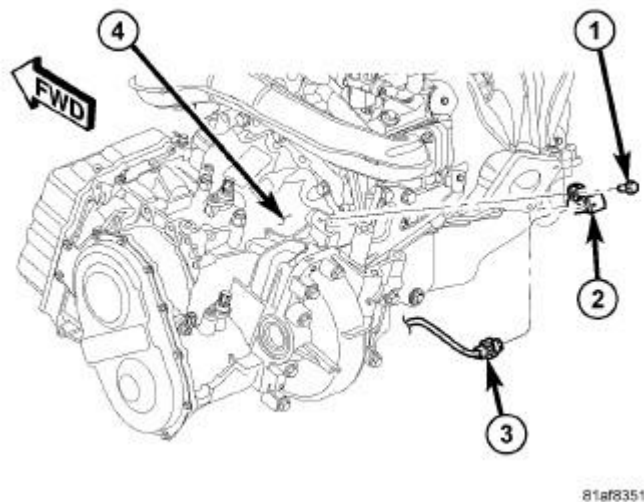


Fig. 12: Identifying Camshaft/Crankshaft Position Sensor Connectors
Courtesy of CHRYSLER LLC

19. Disconnect engine coolant temperature (ECT) sensor and ignition coil electrical connectors.
20. Disconnect the fuel injector electrical harness connector and disengage clip from support bracket.
21. Disconnect camshaft and crankshaft (2) position sensor electrical connectors.

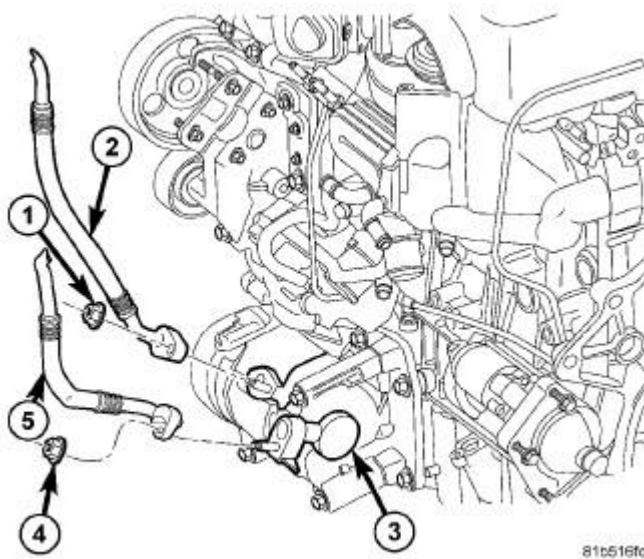


Fig. 13: Identifying A/C Refrigerant Lines
Courtesy of CHRYSLER LLC

22. Evacuate air conditioning system. Refer to **STANDARD PROCEDURE** .
23. Disconnect A/C compressor electrical connector.
24. Disconnect the A/C lines (2, 5) from compressor. Cover and seal all openings of hoses and compressor.

25. Remove the radiator upper hose.
26. Disengage electrical harness clip at transaxle dipstick tube.
27. Remove transaxle dipstick tube. Seal opening using a suitable plug.
28. Remove transaxle cooler lines
29. Disconnect transaxle shift linkage and electrical connectors.

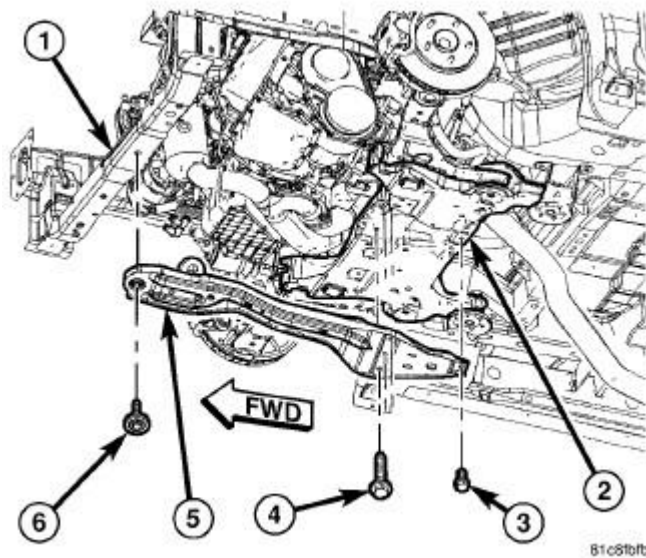


Fig. 14: Identifying Fore-Aft Crossmember
Courtesy of CHRYSLER LLC

30. Raise vehicle on hoist and drain the engine oil.
31. Remove the axle shafts. Refer to **Differential and Driveline/Half Shaft - Removal** .
32. Remove the fore/aft crossmember (5).

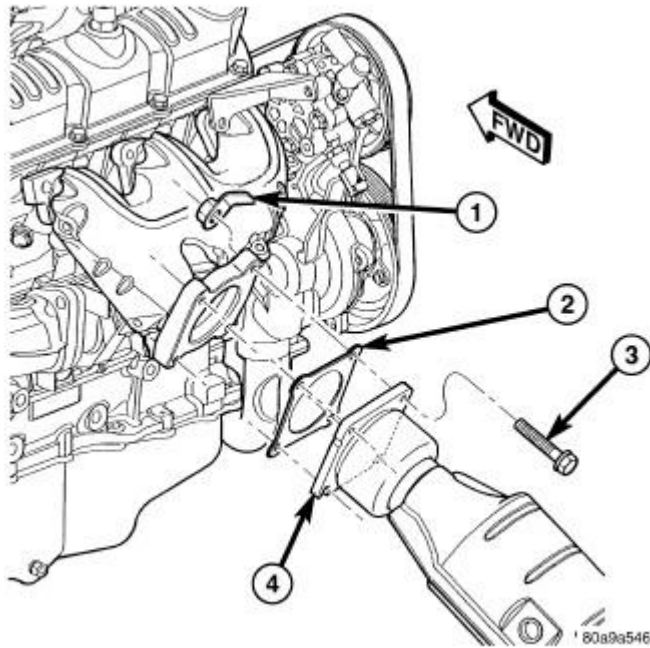


Fig. 15: Catalytic Converter to Exhaust Manifold
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - FLAG NUT
2 - GASKET
3 - BOLT
4 - CATALYTIC CONVERTER</p> |
|---|

33. Disconnect exhaust pipe (4) from the manifold.
34. Remove front engine mount bracket.
35. Remove the engine rear mount bracket.
36. Remove transaxle case cover.
37. Remove flex plate to torque converter bolts. Mark torque converter to flex plate for orientation for reassembly.
38. Remove the power steering pressure hose support clip attaching bolt.
39. Disconnect the knock sensor electrical connector (3.8L only).
40. Disconnect the engine block heater electrical connector (if equipped).
41. Remove the accessory belt splash shield.
42. Remove accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal**.
43. Disconnect the radiator lower hose.
44. Remove air conditioning compressor from engine.
45. Remove the generator. Refer to **Electrical/Charging/GENERATOR - Removal**.
46. Remove the water pump pulley attaching bolts and position pulley between pump hub and housing.

47. Disconnect the oil pressure switch electrical connector.
48. Disconnect wiring harness support clip from engine oil dipstick tube.
49. Install Special Tools 6912 and 8444 Adapters on the right side (rear) of engine block .

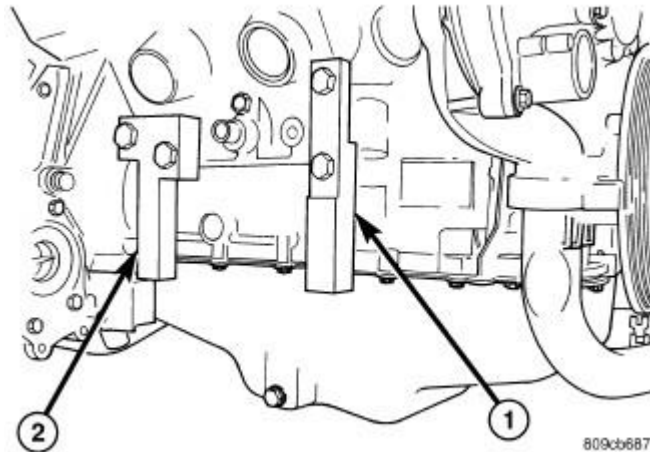


Fig. 16: Identifying Adapter Tools Mounted On Block
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - SPECIAL TOOL 6912
2 - SPECIAL TOOL 8444</p> |
|--|

50. Lower the vehicle.
51. Remove the power steering pump and set aside.
52. Raise vehicle enough to allow engine dolly Special Tool 6135 and cradle Special Tool 6710A with post Special Tool 6848 and adaptor Special Tool 6909A to be installed under vehicle .
53. Loosen cradle/post mounts to allow movement for positioning posts into locating holes on the engine and . Slowly lower vehicle and position cradle/post mounts until the engine is resting on posts. Tighten all cradle/post mounts to cradle frame. This will keep mounts from moving when removing or installing engine and transmission.

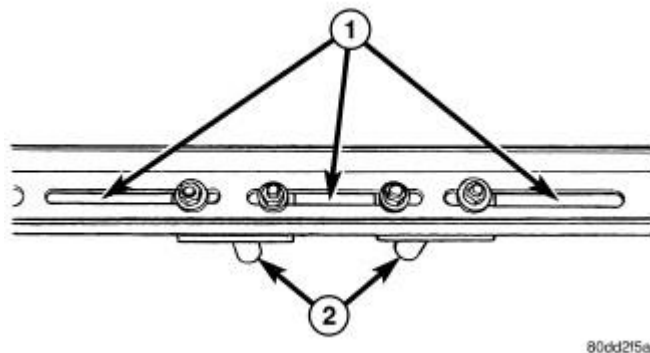


Fig. 17: Identifying Special Tools 6848 & Slots

Courtesy of CHRYSLER LLC

- 1 - SLOTS
- 2 - SPECIAL TOOLS 6848

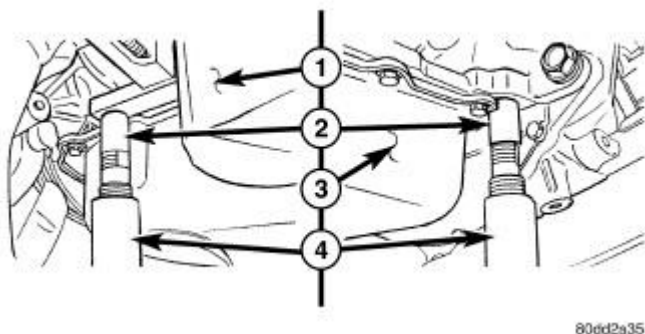


Fig. 18: Identifying Oil Pan, Oil Filter, & Special Tools 6848 & 6909A
Courtesy of CHRYSLER LLC

- 1 - OIL FILTER
- 2 - SPECIAL TOOLS 6909A
- 3 - OIL PAN
- 4 - SPECIAL TOOLS 6848

- 54. Lower vehicle so the weight of **ONLY THE ENGINE AND TRANSMISSION** is on the cradle.
- 55. Install and secure the safety straps to the cradle fixture and around the engine .
- 56. Remove the engine right side mount to engine attaching bolts.
- 57. Remove the left mount through bolt.
- 58. Raise vehicle slowly. It is necessary to move the engine/transmission assembly with the dolly to allow for removal around body flanges.

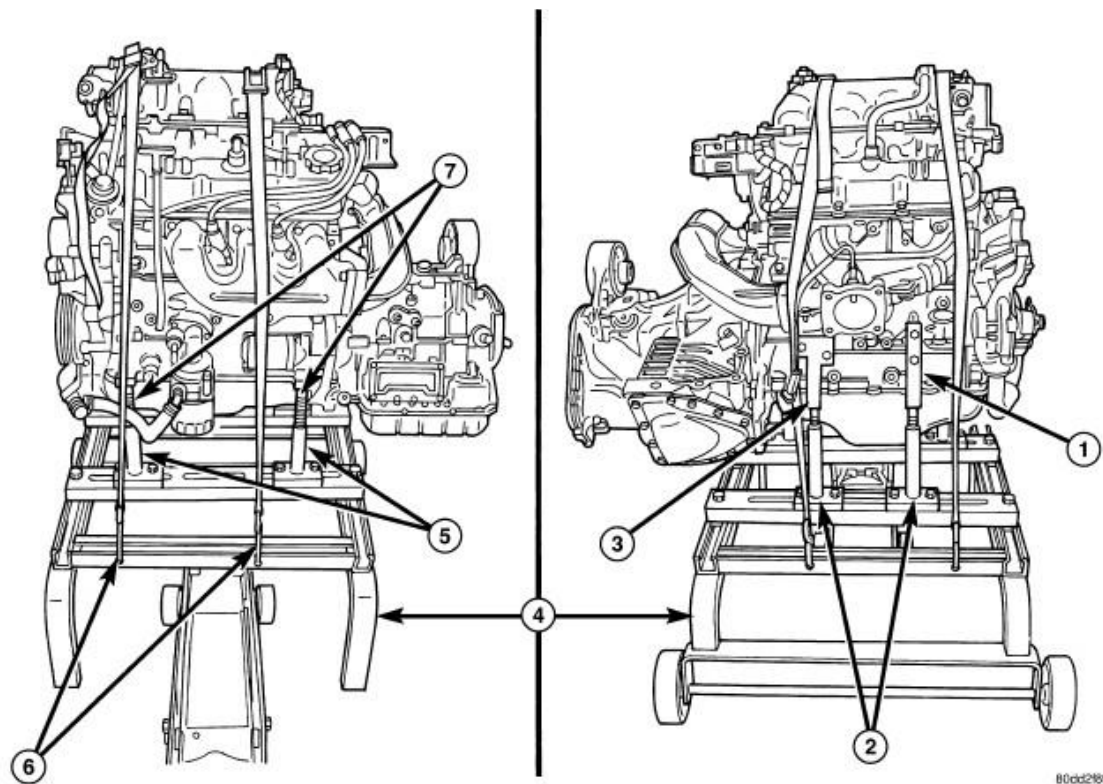


Fig. 19: Positioning Engine Cradle Support Post Mounts
Courtesy of CHRYSLER LLC

- 1 - SPECIAL TOOL 8444
- 2 - SPECIAL TOOLS 6848
- 3 - SPECIAL TOOL 6912
- 4 - SPECIAL TOOLS 6135 AND 6710A
- 5 - SPECIAL TOOLS 6848
- 6 - SAFETY STRAPS
- 7 - SPECIAL TOOLS 6909A

INSTALLATION

INSTALLATION

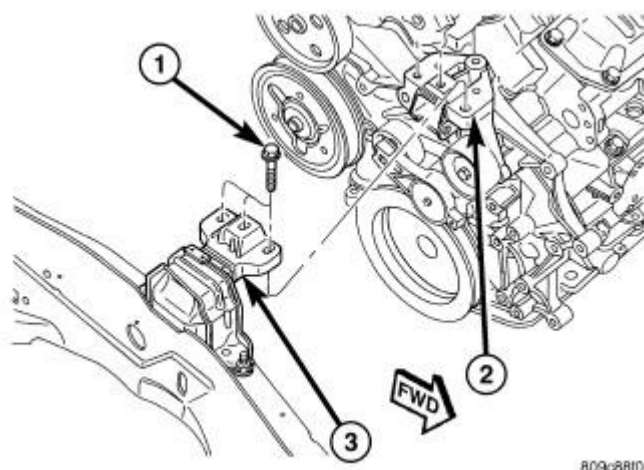


Fig. 20: Right Mount to Engine
Courtesy of CHRYSLER LLC

1. Position engine and transmission assembly under vehicle. Slowly lower the vehicle down over the engine and transmission. It is necessary to move the engine/transmission assembly with the dolly for clearance around body flanges.
2. Align engine and transmission mounts to attaching points. Install mounting bolts at the right engine mount (3).

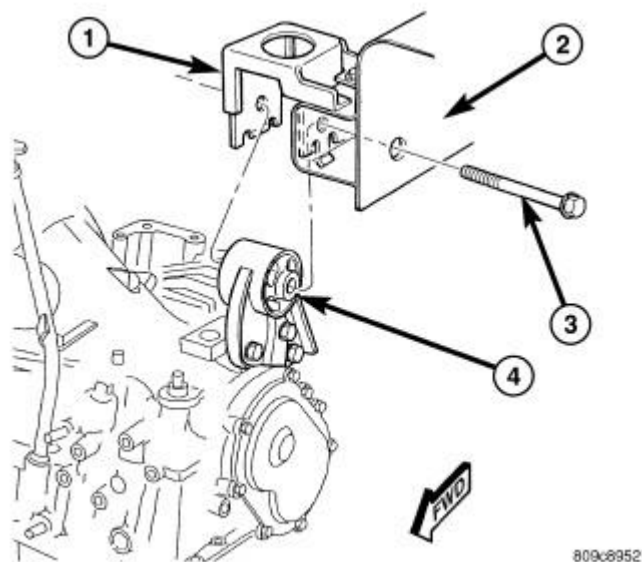


Fig. 21: LEFT MOUNT TO FRAME BRACKET
Courtesy of CHRYSLER LLC

3. Align engine and transmission mounts to attaching points. Install left transmission mount (4)/
4. Remove the safety straps from around engine.
5. Slowly raise vehicle enough to remove the engine dolly and cradle Special Tools 6135, 6710A, 6848 and

6909A.

6. Remove Special Tools 6912 and 8444.
7. Lower the vehicle.
8. Install power steering pump and pressure line support.
9. Install the generator and wiring harness. Refer to **Electrical/Charging/GENERATOR - Installation**.
10. Raise vehicle.
11. Attach wiring harness support clip to the engine oil dipstick tube.
12. Connect oil pressure switch electrical connector.
13. Install the A/C compressor.
14. Install the water pump pulley.
15. Connect the radiator lower hose.
16. Install the accessory drive belt and splash shield. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation**.
17. Connect the engine block heater electrical connector (if equipped).
18. Connect the knock sensor electrical connector (3.8L only).
19. Install the torque converter to flex plate bolts.
20. Install the transaxle case cover.

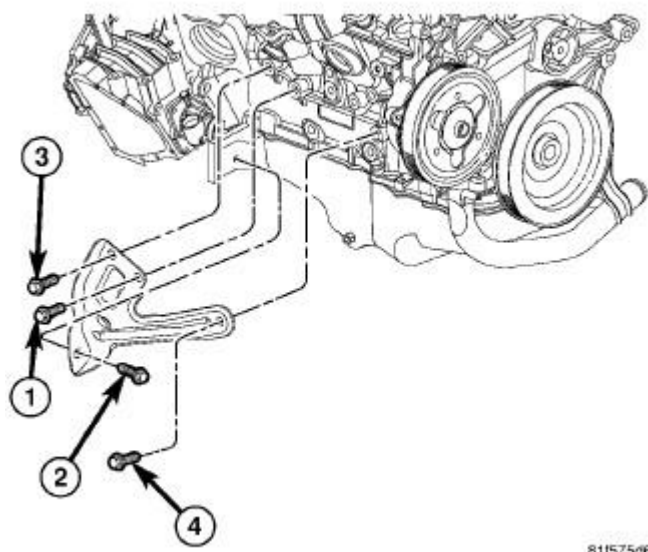


Fig. 22: Identifying Powertrain Strut Torque Sequence
Courtesy of CHRYSLER LLC

1 - Bolt (Torque 1st)
2 - Bolt (Torque 2nd)
3 - Bolt (Torque 3rd)
4 - Bolt (Torque last)

21. Install the powertrain struts. On 3.3L, tighten the bolts in the sequence shown in illustration.
22. Install the engine rear mount bracket.
23. Install the engine front mount and bracket assembly.
24. Install the axle shafts. Refer to **Differential and Driveline/Half Shaft - Installation** .
25. Connect exhaust pipe to manifold.
26. Install crossmember cradle plate.
27. Lower vehicle.
28. Connect transaxle shift linkage.
29. Connect transaxle electrical connectors.
30. Remove plugs from transmission cooler hoses and install transaxle oil cooler line service splice kit. Refer to instructions included with kit.
31. Install transaxle dipstick tube and attach electrical harness clip.
32. Connect the A/C lines to compressor.
33. Connect the A/C compressor electrical connector.
34. Evacuate and recharge A/C system.
35. Connect crankshaft and camshaft position sensors.
36. Connect the fuel injector electrical harness connector and engage clip to support bracket.
37. Connect engine coolant temperature (ECT) sensor and ignition coil electrical connectors.
38. Connect the ground strap to rear of cylinder head.
39. Install power steering reservoir.
40. Engage wire harness clip to engine right side mount.
41. Connect the brake booster and speed control vacuum hoses.
42. Connect the vacuum hoses to the throttle body.
43. Connect the EGR transducer electrical connector (if equipped).
44. Connect the TPS, IAC, and MAP sensor electrical connectors.
45. Connect throttle cables to throttle body.
46. Install the radiator fans. Refer to **Cooling/Engine/FAN, Cooling - Installation** .
47. Connect the radiator upper hose.
48. Connect the heater hoses. Remove pinch-off pliers from the rear heater hoses (if equipped).
49. Install the radiator upper support crossmember. Refer to **Body/Exterior/CROSSMEMBER, Radiator - Installation** .
50. Install the wiper module. Refer to **Electrical/Wipers/Washers/LINKAGE, Wiper Arm - Installation** .
51. Connect the fuel line to fuel rail. Refer to **Fuel System/Fuel Delivery/FITTING, Quick Connect - Standard Procedure** .
52. Install the air cleaner and hoses.
53. Install new oil filter. Fill engine crankcase with proper oil to correct level.

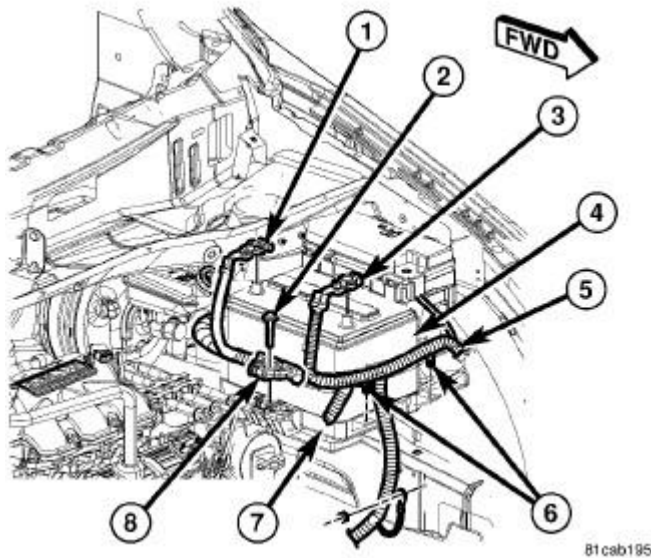


Fig. 23: CONVENTIONAL BATTERY REMOVAL
Courtesy of CHRYSLER LLC

54. Connect negative cable (3) to battery.
55. Fill the cooling system. Refer to **Cooling - Standard Procedure**.
56. Start engine and run until operating temperature is reached.

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

SPECIFICATIONS

SPECIFICATIONS

GENERAL DESCRIPTION

DESCRIPTION	SPECIFICATION	
	Metric	Standard
-		
Engine Type	60° V-6 Engine	
Number of Cylinders	6	
Displacement 3.3L	3.3 Liters	201 cu. in.
Displacement 3.8L	3.8 Liters	231 cu. in.
Bore 3.3L	93.0 mm	3.661 in.
Bore 3.8L	96.0 mm	3.779 in.
Stroke	87 mm	3.425 in.
Compression Ratio 3.3L	-	9.35:1

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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) 3.3L	92.993-93.007 mm	3.661-3.6617 in.
Cylinder Bore Diameter (Standard) 3.8L	95.993-96.007 mm	3.7792-3.780 in.
Out of Round (Service Limits)	0.076 mm	0.003 in.
Taper (Service Limits)	0.051 mm	0.002 in.
Lifter Bore Diameter (early)	22.980-23.010 mm	0.905-0.906 in.
Lifter Bore Diameter (late)	21.42-21.45 mm	0.843-0.844 in.
Deck Surface Flatness (Max.)	0.1 mm	0.004 in.

CRANKSHAFT

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

CONNECTING RODS

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

PISTONS

DESCRIPTION	SPECIFICATION	

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2010 ENGINE 3.3L/3.8L - Service Information - Grand Caravan, Town & Country

-	Metric	Standard
Piston Diameter 3.3L-Measured 39.8 mm (1.567 in) From Piston Top	92.968-92.998 mm.	3.660-3.661 in.
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 3.3L	362 ± 5 grams	12.77 ± 0.1764 oz.
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 3.3L	67.25-67.75 mm	2.648-2.667 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	0.18-0.38 mm	0.007-0.015 in.
Second Compression Ring	0.28-0.57 mm	0.011-0.022 in.
Oil Control (Steel Rails)	0.23-0.78 mm	0.009-0.030 in.
Wear Limit-Compression Rings	1.0 mm	0.039 in.
Wear Limit-Oil Control Steel Rails	1.88 mm	0.074 in.
Ring Side Clearance	-	-
Top Compression Ring 3.3L	0.030-0.080 mm	0.0012-0.0031 in.
Top Compression Ring 3.8L	0.030-0.069 mm	0.0012-0.0027 in.
Second Compression Ring 3.3L	0.030-0.095 mm	0.0012-0.0037 in.
Second Compression Ring 3.8L	0.041-0.085 mm	0.0016-0.0033 in.
Oil Ring (Steel Ring)	0.039-0.200 mm	0.0015-0.0078 in.
Wear Limit- Top Ring	0.10 mm	0.004 in.
Wear Limit-2nd Ring	0.13 mm	0.005
Wear Limit Oil Ring Pack	0.266 mm	0.009
Ring Width-Top Compression Ring 3.3L	1.46-1.49 mm	0.0575-0.058 in.

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Ring Width-Top Compression Ring 3.8L	1.175-1.190 mm	0.0462-0.0468
Ring Width-2nd Compression Ring 3.3L and 3.8L	1.46-1.49 mm	0.0575-0.058 in.
Ring Width-Oil Ring (Steel Rails) 3.3L	0.435-0.490 mm	-.017-0.019 in.
Ring Width-Oil Ring (Steel Rails) 3.8L	0.435-0.510 mm	0.017-0.020

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-3.3L (ATDC)	-	14°
Closes-3.8L (ATDC)	-	18°
Opens-3.3L (BBDC)	-	50°
Opens-3.8L (BBDC)	-	46°
Duration-3.3L	-	244°
Duration-3.8L	-	244°
Intake Valve Timing	-	
Closes-3.3L (ABDC)	-	42°
Closes-3.8L (ABDC)	-	63°
Opens-3.3L (ATDC)	-	2°
Opens-3.8L (ATDC)	-	1°
Duration-3.3L	-	224°
Duration-3.8L	-	242°
Valve Overlap-3.3L	-	16°
Valve Overlap-3.8L	-	17°

HYDRAULIC LIFTER

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

CYLINDER HEAD

DESCRIPTION	SPECIFICATION	
-	Metric	Standard
Gasket Thickness (Compressed)	0.65-0.75 mm	0.0026-0.0030 in.

VALVES

DESCRIPTION	SPECIFICATION	
-	Metric	Standard
Face Angle-Intake	-	45-45.5°
Face Angle-Exhaust	-	45-45.5°
Head Diameter-Intake	47.87-48.13 mm	1.88-1.89 in.
Head Diameter-Exhaust	35.37-35.63 mm	1.39-1.40 in.
Valve Lift (Zero Lash)-Intake-3.3L	10.5 mm	0.413 in.
Valve Lift (Zero Lash)-Exhaust-3.3L	11.0 mm	0.433 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

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

VALVE MARGIN

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

VALVE STEM DIAMETER

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

VALVE STEM TO GUIDE CLEARANCE

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

PUSH RODS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Length	135.438 mm	5.33 in.

VALVE SPRING

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

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LUBRICATION

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

OIL PUMP

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

TORQUE

TORQUE SPECIFICATIONS

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Camshaft Sprocket-Bolt	54	40	-
Camshaft Thrust Plate-Bolts	12	-	105
Cracked Connecting Rod Cap- Bolts	See <u>Engine/Engine Block/ROD, Piston and Connecting - Installation.</u>		
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 <u>Engine/Cylinder Head - Installation.</u>		
Cylinder Head Cover-Bolts	12	-	105
Flex Plate to Crankshaft	95	70	-

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Engine Mounting	Refer to ENGINE MOUNTING.		
Exhaust Manifold-Bolts	23	-	200
Exhaust Crossover Pipe-Bolts	54	40	-
Intake Manifold - Lower-Bolts	23	-	200
Intake Manifold - Lower Gasket Retainer-Bolts	12	-	105
Intake Manifold Upper-Bolts	12	-	105
Lifter Yoke Retainer-Bolts	12	-	105
Oil Filter Attaching Fitting	54	40	-
Oil Cooler Attaching Fitting	27	20	-
Oil Filter	20	15	-
Oil Filter Adapter-Bolts	28	-	250
Oil Gallery Plug	27	20	-
Oil Pan-Bolts	12	-	105
Oil Pan Drain-Plug	27	20	-
Oil Pressure Switch	23	-	200
Oil Pump Cover Plate-Screws	12	-	105
Oil Pump Pick-up Tube-Bolt	28	-	250
Oil Dipstick Housing-Bolts	48	35	-
Rocker Arm Shaft-Bolts	23	-	200
Spark Plug	16	12	-
Thermostat Housing	12	-	105
Timing Chain Case Cover	-	-	-
-M8 Bolt	27	20	-
-M10 Bolt	54	40	-
Water Pump-Bolts	12	-	105
Water Pump Pulley-Bolts	28	-	250

SPECIAL TOOLS

SPECIAL TOOLS

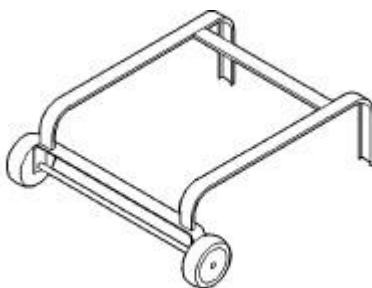


Fig. 24: DOLLY, POWER TRAIN - 6135
 Courtesy of CHRYSLER LLC

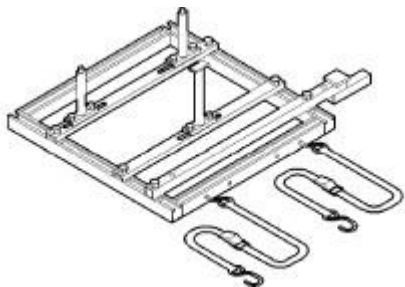


Fig. 25: CRADLE, ENGINE SUPPORT - 6710A
Courtesy of CHRYSLER LLC

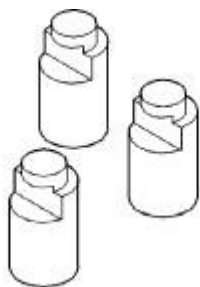


Fig. 26: ADAPTER, PINS - 6909A
Courtesy of CHRYSLER LLC

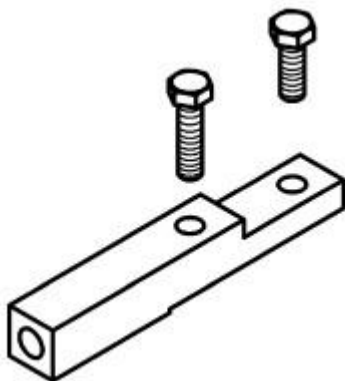


Fig. 27: SUPPORT - 8444
Courtesy of CHRYSLER LLC

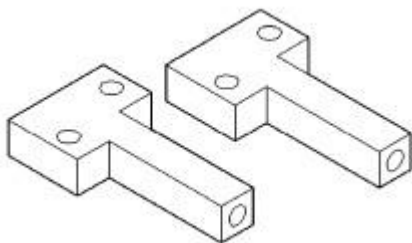


Fig. 28: SUPPORT - 6912
Courtesy of CHRYSLER LLC

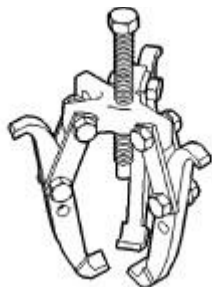


Fig. 29: PULLER - 1026

Courtesy of CHRYSLER LLC

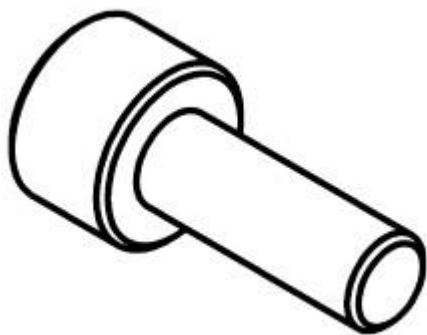


Fig. 30: INSERT, CRANKSHAFT - 8450

Courtesy of CHRYSLER LLC

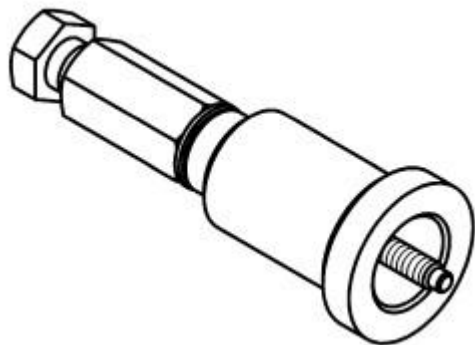
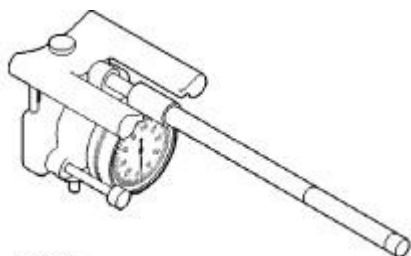


Fig. 31: INSTALLER, CRANKSHAFT SPROCKET - 8452

Courtesy of CHRYSLER LLC



8011c9fa

Fig. 32: CYLINDER INDICATOR - C-119

Courtesy of CHRYSLER LLC

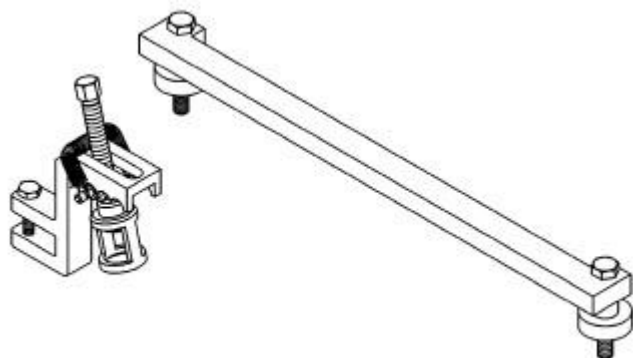


Fig. 33: COMPRESSOR, VALVE SPRING - 8453

Courtesy of CHRYSLER LLC



Fig. 34: COMPRESSOR, VALVE SPRING - C-3422-D

Courtesy of CHRYSLER LLC

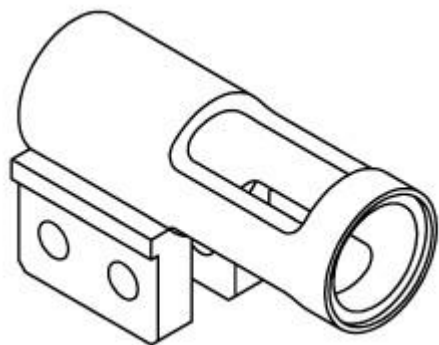


Fig. 35: ADAPTER, VALVE SPRING - 8464

Courtesy of CHRYSLER LLC

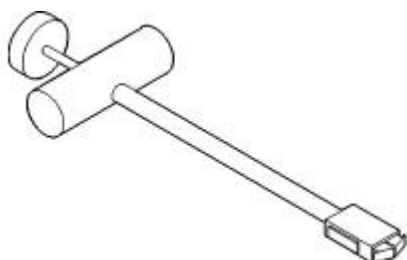


Fig. 36: REMOVER & INSTALLER - C-4129-A
Courtesy of CHRYSLER LLC

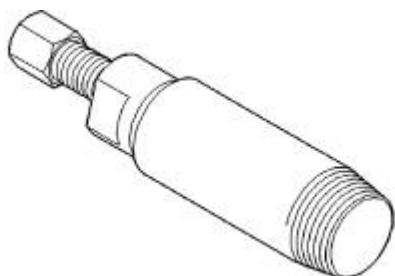
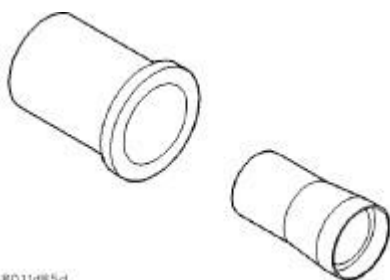


Fig. 37: REMOVER, SEAL - 6341A
Courtesy of CHRYSLER LLC



8011d85d

Fig. 38: INSTALLER/PROTECTOR - C-4992
Courtesy of CHRYSLER LLC

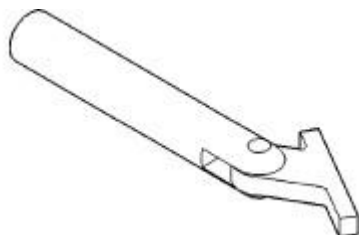


Fig. 39: REMOVER/INSTALLER - C-3059A
Courtesy of CHRYSLER LLC

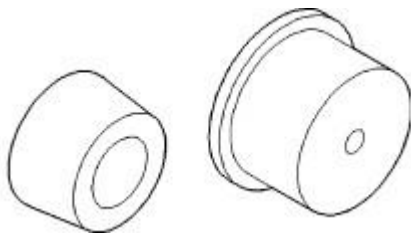


Fig. 40: INSTALLER, SEAL - 6926
Courtesy of CHRYSLER LLC

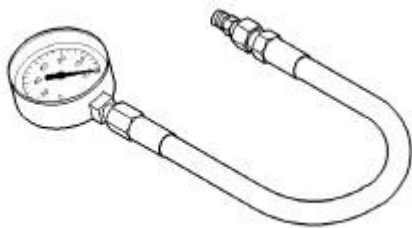


Fig. 41: GAUGE, PRESSURE - C-3292A

Courtesy of CHRYSLER LLC



Fig. 42: ADAPTER, OIL PRESSURE - 8406

Courtesy of CHRYSLER LLC

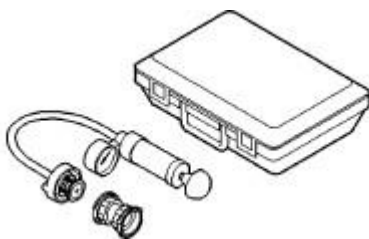
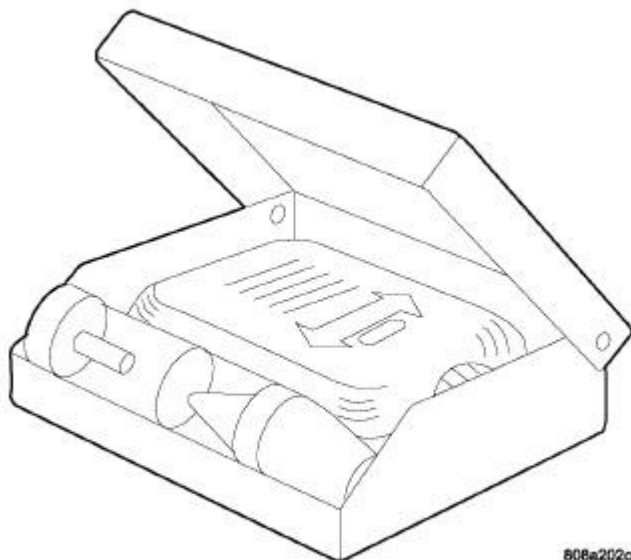


Fig. 43: TESTER, COOLING SYSTEM - 7700-A

Courtesy of CHRYSLER LLC



808a202c

Fig. 44: BLOC-CHEK-KIT - C-3685-A

Courtesy of CHRYSLER LLC

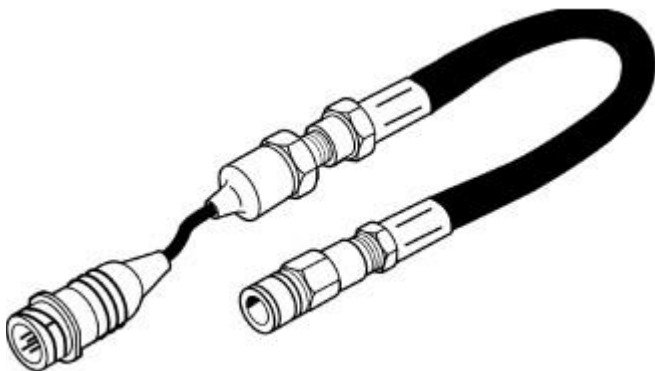


Fig. 45: PRESSURE TRANSDUCER, RPL - CH7059

Courtesy of CHRYSLER LLC

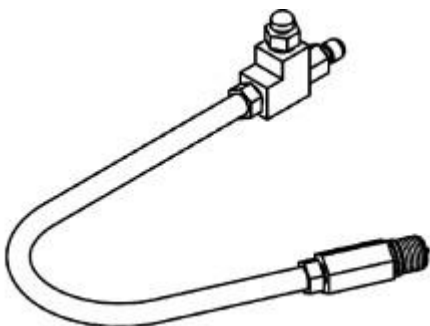


Fig. 46: ADAPTER, PRESSURE PEP - 8116

Courtesy of CHRYSLER LLC



Fig. 47: DRBIII® Economy Kit - CH6020A

Courtesy of CHRYSLER LLC

AIR INTAKE SYSTEM

AIR CLEANER

Removal

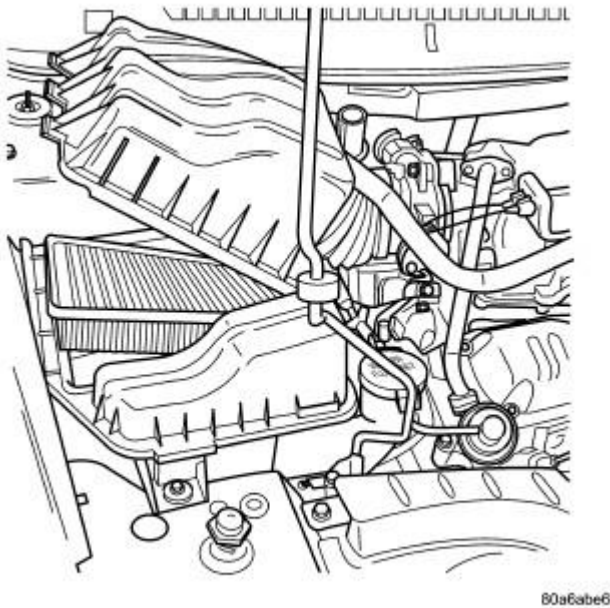
REMOVAL

Fig. 48: Air Cleaner Element and Housing Cover
Courtesy of CHRYSLER LLC

1. Disengage the two retaining clamps that secure the air cleaner housing cover to air cleaner housing.
2. Lift and pull the air cleaner housing cover toward the engine to disengage the cover from the locating tabs on the air cleaner housing and position the cover out of the way.
3. Remove the air cleaner element from the inside of the air cleaner housing.

Installation**INSTALLATION**

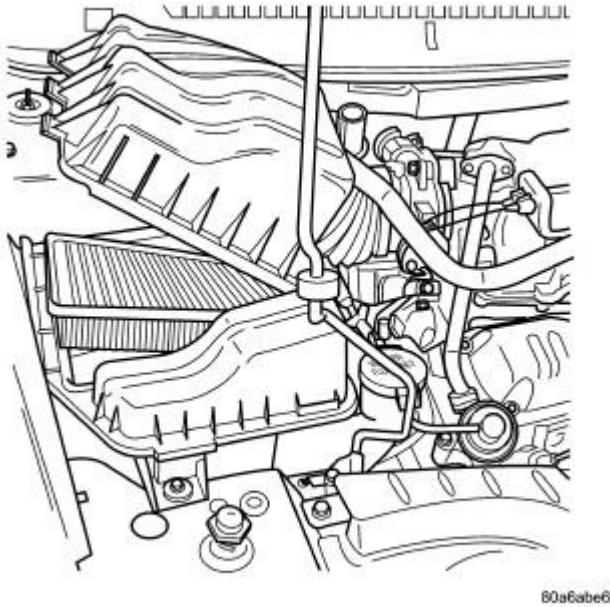


Fig. 49: Air Cleaner Element and Housing Cover
Courtesy of CHRYSLER LLC

1. Clean any dirt or foreign matter from the inside of the air cleaner housing.
2. Install the air cleaner element into air cleaner housing. Make sure the element is properly seated in the housing.
3. Engage the air cleaner housing cover to the locating tabs on the air cleaner housing. Make sure the cover is properly positioned.
4. Fully install the air cleaner housing cover to the air cleaner housing and engage the two retaining clamps. Make sure the clamps are fully engaged.

BODY, AIR CLEANER

Removal

REMOVAL

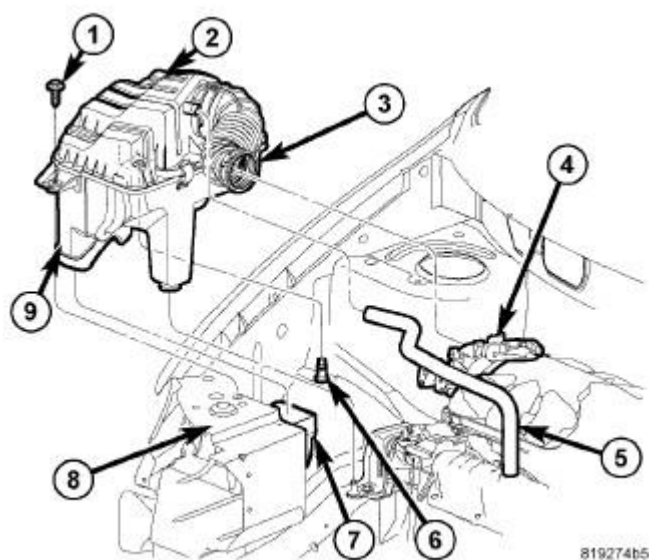


Fig. 50: Removing/Installing Air Cleaner Housing
 Courtesy of CHRYSLER LLC

- 1 - BOLT
- 2 - AIR CLEANER HOUSING COVER
- 3 - AIR INLET HOSE
- 4 - THROTTLE BODY
- 5 - PCV FRESH AIR HOSE
- 6 - MOUNTING STUD
- 7 - FRESH AIR DUCT
- 8 - UPPER RADIATOR SUPPORT
- 9 - AIR CLEANER HOUSING

1. Disconnect and isolate the negative battery cable.
2. Disconnect the engine wire harness connector from the inlet air temperature sensor located on the air inlet hose (3).
3. Disconnect the PCV fresh air hose (5) from the air cleaner housing cover.
4. Loosen the clamp and disconnect the air inlet hose from the throttle body.
5. Remove the bolt that secures the air cleaner housing to upper radiator cross member.
6. Pull the air cleaner housing straight upward to disengage the housing from the mounting stud and the fresh air duct and remove the housing from the engine compartment.

Installation

INSTALLATION

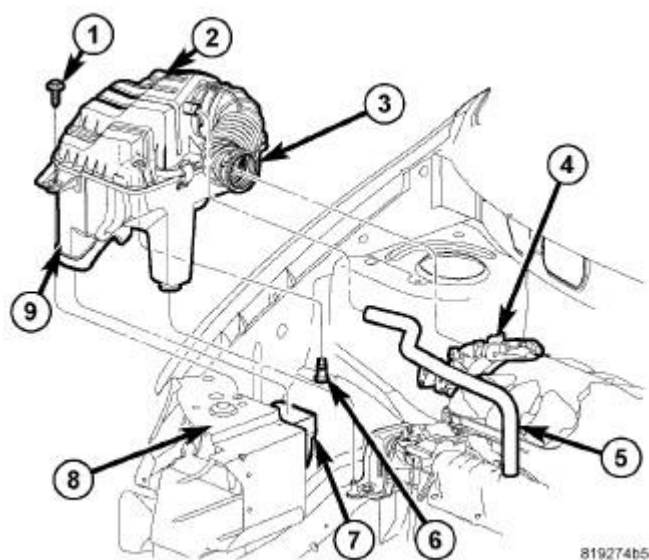


Fig. 51: Removing/Installing Air Cleaner Housing
Courtesy of CHRYSLER LLC

- 1 - BOLT
- 2 - AIR CLEANER HOUSING COVER
- 3 - AIR INLET HOSE
- 4 - THROTTLE BODY
- 5 - PCV FRESH AIR HOSE
- 6 - MOUNTING STUD
- 7 - FRESH AIR DUCT
- 8 - UPPER RADIATOR SUPPORT
- 9 - AIR CLEANER HOUSING

1. Position the air cleaner housing (9) into the engine compartment and engage the housing to the fresh air duct and the mounting stud. Make sure the housing is properly engaged to the duct and stud.
2. Install the bolt that secures the air cleaner housing to the upper radiator support. Tighten the bolt securely.
3. Connect the air inlet hose to the throttle body and tighten the hose clamp. Make sure the hose is fully installed to the throttle body and that the clamp is tight.
4. Connect the PCV fresh air hose (5) to the air cleaner housing cover.
5. Connect the engine wire harness connector to the inlet air temperature sensor.
6. Reconnect the negative battery cable.

CYLINDER HEAD

DESCRIPTION

DESCRIPTION

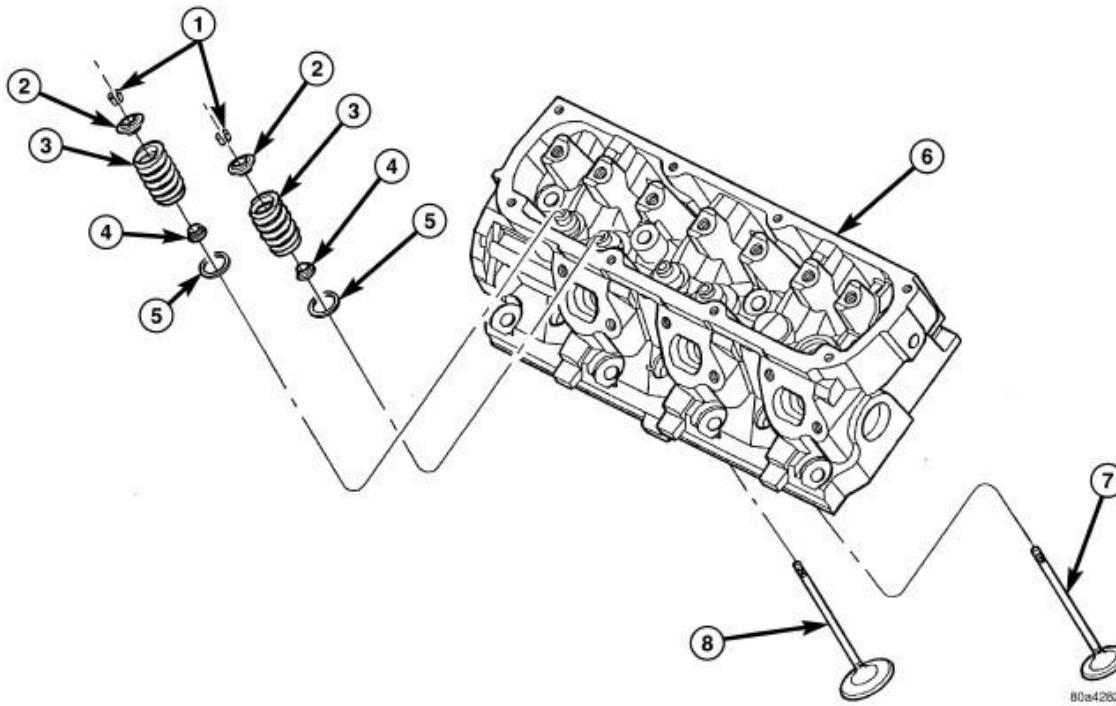


Fig. 52: Identifying Cylinder Head Components
Courtesy of CHRYSLER LLC

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**REMOVAL**

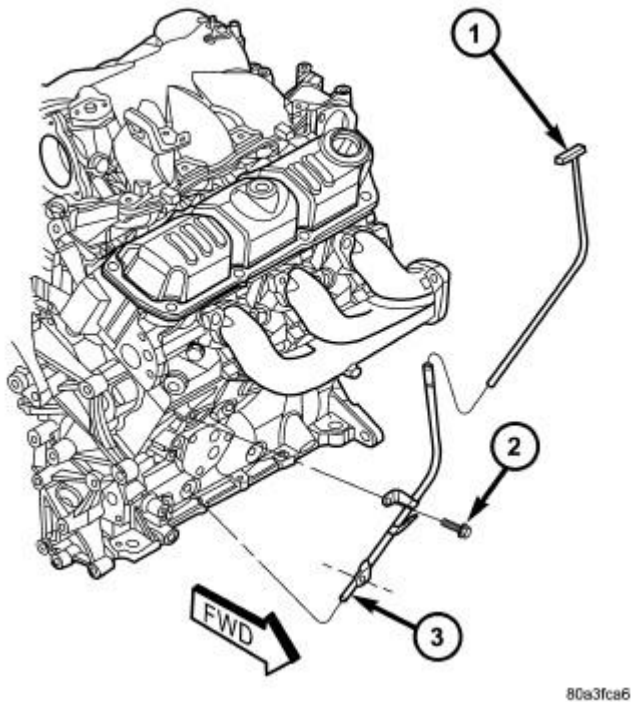


Fig. 53: DIPSTICK AND TUBE
Courtesy of CHRYSLER LLC

- 1 - DIPSTICK
- 2 - BOLT
- 3 - TUBE

1. Drain the cooling system. Refer to Cooling - Standard Procedure.
2. Disconnect negative cable from battery.
3. Remove upper and lower intake manifolds. See Engine/Manifolds/MANIFOLD, Intake - Removal.

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

4. Remove the cylinder head covers. See Engine/Cylinder Head/COVER(S), Cylinder Head - Removal.
5. Remove the spark plugs from cylinder head.
6. Remove the dipstick and tube (1).
7. Remove exhaust manifold(s). See Engine/Manifolds/MANIFOLD, Exhaust - Removal.
8. Remove rocker arm and shaft assemblies. See Engine/Cylinder Head/ROCKER ARM, Valve - Removal. Remove push rods and **mark positions to ensure installation in original locations**.
9. Remove the eight head bolts from each cylinder head and remove cylinder heads.

CLEANING

CLEANING

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

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

Remove all gasket material from cylinder head and block. See Engine - Standard Procedure. Be careful not to gouge or scratch the aluminum head sealing surface.

Clean all engine oil passages.

INSPECTION

INSPECTION

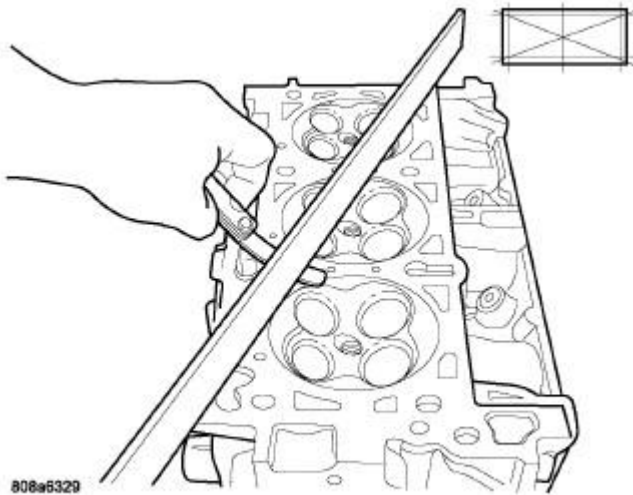


Fig. 54: Checking Cylinder Head Flatness-Typical
Courtesy of CHRYSLER LLC

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

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.

- 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.

INSTALLATION

INSTALLATION

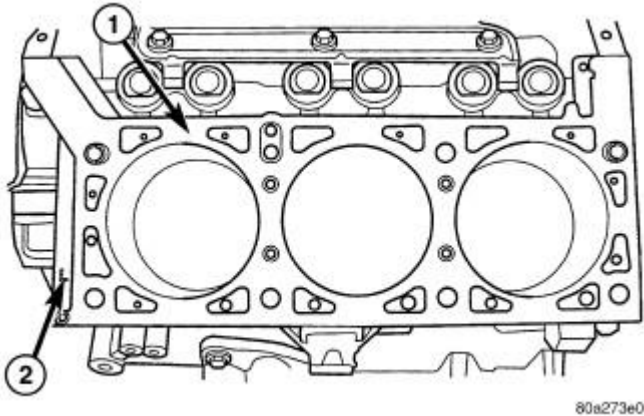


Fig. 55: Head Gasket Installation
Courtesy of CHRYSLER LLC

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

1. Clean all sealing surfaces of engine block and cylinder heads. See **Engine - Standard Procedure**.
2. Position new gasket (1) on engine block. The left bank gasket is identified with the "L" stamped in the exposed area of the gasket located at front of engine. 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 (2).

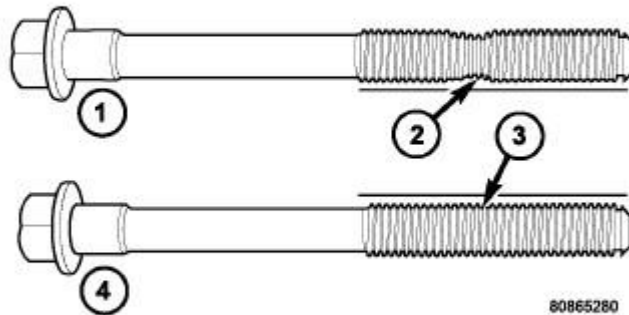


Fig. 56: Checking Bolts for Stretching (Necking)
Courtesy of CHRYSLER LLC

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

3. The cylinder head bolts should be examined **BEFORE** reuse. If the threads are necked down, the bolts must be replaced.
4. Necking can be checked by holding a scale or straight edge (2) against the threads. If all the threads do not contact the scale (2) the bolt should be replaced.

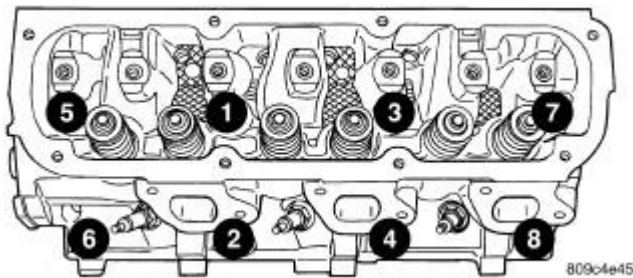


Fig. 57: CYLINDER HEAD TIGHTENING SEQUENCE
Courtesy of CHRYSLER LLC

5. Tighten the cylinder head bolts 1-8 in the following sequence. Using the 4 step torque turn method, tighten according to the following values:

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

- 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.)**
6. Inspect push rods and replace worn or bent rods.
 7. Install the push rods.
 8. Install the rocker arm and shaft assemblies. See Engine/Cylinder Head/ROCKER ARM, Valve - Installation.
 9. Install the cylinder head covers. See Engine/Cylinder Head/COVER(S), Cylinder Head - Installation.
 10. Install the exhaust manifolds. See Engine/Manifolds/MANIFOLD, Exhaust - Installation.
 11. Install new O-ring on dipstick tube. Install dipstick tube assembly.
 12. Install the spark plugs.
 13. Install upper and lower intake manifolds. See Engine/Manifolds/MANIFOLD, Intake - Installation.
 14. Fill the cooling system. Refer to Cooling - Standard Procedure.
 15. Connect negative cable to battery.

COVER(S), CYLINDER HEAD

Description

DESCRIPTION

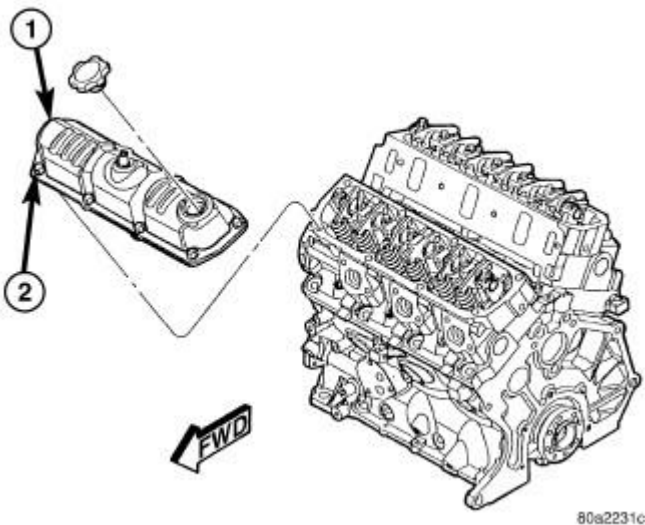


Fig. 58: CYLINDER HEAD COVER

Courtesy of CHRYSLER LLC

- | |
|-------------------------|
| 1 - CYLINDER HEAD COVER |
| 2 - BOLT |

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 (2) 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. See ENGINE OIL LEAK INSPECTION for determining the source of a leak.

COVER(S), CYLINDER HEAD, LEFT

Removal

REMOVAL

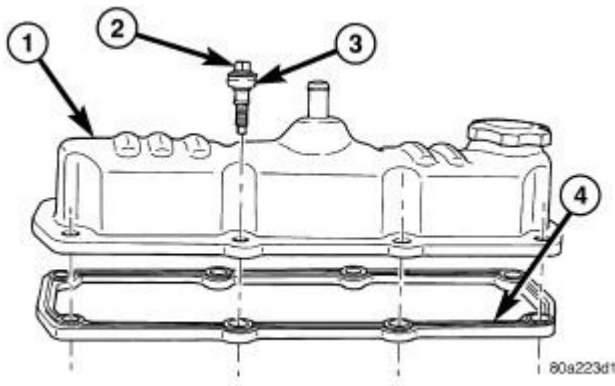


Fig. 59: CYLINDER HEAD COVER GASKET
Courtesy of CHRYSLER LLC

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

1. Disconnect spark plug wires from spark plugs.
2. Disconnect crankcase vent hose from cylinder head cover.
3. Remove cylinder head cover bolts (2).
4. Remove cylinder head cover and gasket.

Installation

INSTALLATION

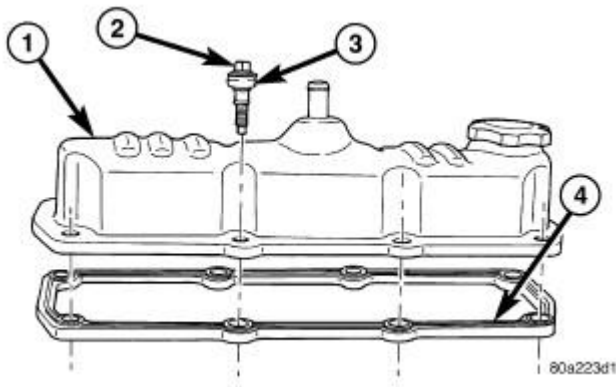


Fig. 60: CYLINDER HEAD COVER GASKET
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - CYLINDER HEAD COVER
2 - BOLT
3 - SEAL (SERVICED WITH BOLT)
4 - GASKET</p> |
|--|

1. Clean cylinder head and 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 (2) to 12 N.m (105 in. lbs.).
5. Connect crankcase vent hose.
6. Connect spark plug wires to spark plugs.

COVER(S), CYLINDER HEAD, RIGHT

Removal

REMOVAL

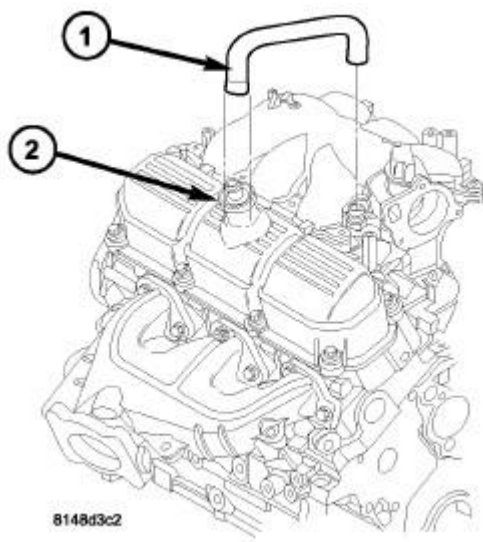


Fig. 61: PCV HOSE

Courtesy of CHRYSLER LLC

1 - HOSE

2 - PCV VALVE

1. Disconnect negative cable from battery.
2. Remove the wiper module. Refer to **Electrical/Wipers/Washers/LINKAGE, Wiper Arm - Removal** .
3. Disconnect spark plug wires from plugs.
4. Disconnect PCV hose from cylinder head cover (1).
5. Remove cylinder head cover bolts.
6. Remove cylinder head cover and gasket.

Installation

INSTALLATION

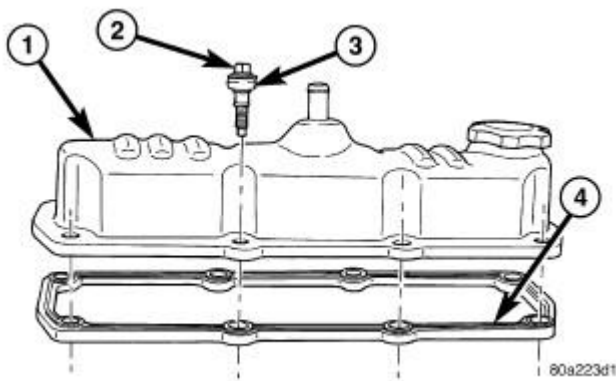


Fig. 62: CYLINDER HEAD COVER GASKET

Courtesy of CHRYSLER LLC

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

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

NOTE: The cylinder head cover bolts contain a torque limiter sleeve and a seal (3). The seal and torque sleeve is replaced with the bolt.

4. Assemble gasket to cylinder cover by inserting the bolt assemblies (2) through each bolt hole on the cover and gasket.
5. Install cylinder head cover and bolts.
6. Tighten cylinder head cover bolts (2) to 12 N.m (105 in. lbs.).

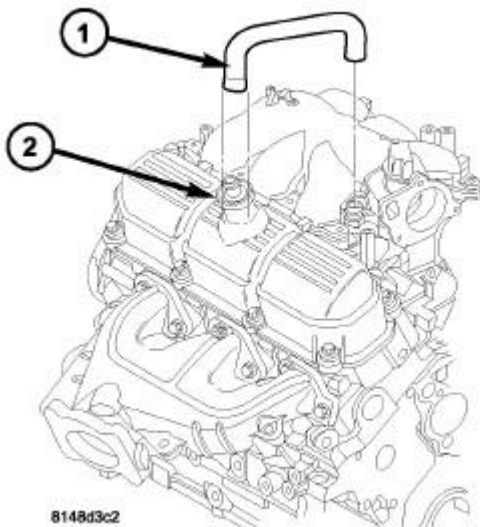


Fig. 63: PCV HOSE

Courtesy of CHRYSLER LLC

- 1 - HOSE
- 2 - PCV VALVE

NOTE: Be sure that the PVC valve is properly seated inside the cylinder head cover protrusion and the PCV valve hose completely covers the protrusion

of the PCV valve housing.

7. Connect PCV hose (1) to cylinder head cover.
8. Connect spark plug wires to spark plugs.
9. Install wiper module. Refer to **Electrical/Wipers/Washers/LINKAGE, Wiper Arm - Installation** .
10. Connect negative cable to battery.

ROCKER ARM, VALVE**Description****ROCKER ARMS**

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

PUSHRODS

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

Operation**ROCKER ARMS**

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

PUSHRODS

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

Removal**REMOVAL**

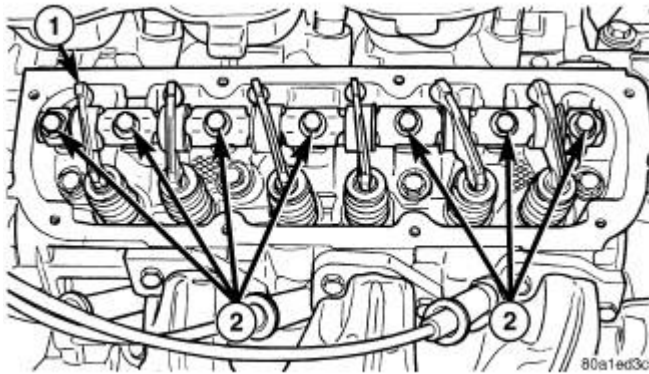


Fig. 64: ROCKER ARMS AND SHAFT

Courtesy of CHRYSLER LLC

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

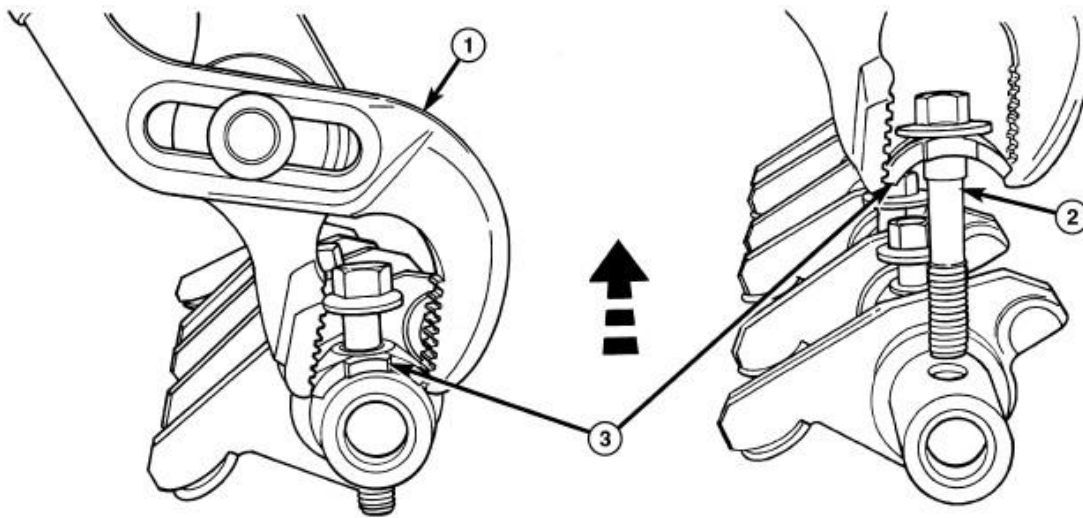
1. Remove the cylinder head cover(s). See Engine/Cylinder Head/COVER(S), Cylinder Head - Removal.

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

2. Loosen the rocker shaft bolts (2) , rotating one turn each, until all valve spring pressure is relieved.
3. Remove the rocker arms and shaft assembly (1).
4. For rocker arm disassembly procedures, see Engine/Cylinder Head/ROCKER ARM, Valve - Disassembly.

Disassembly

ROCKER ARMS AND SHAFT



80a1ec81

Fig. 65: 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:
 - a. Using adjustable pliers, grip the edges of the retainer (3).
 - b. Apply an upward force with a slight rocking motion until the retainer (3) disengages from shaft.

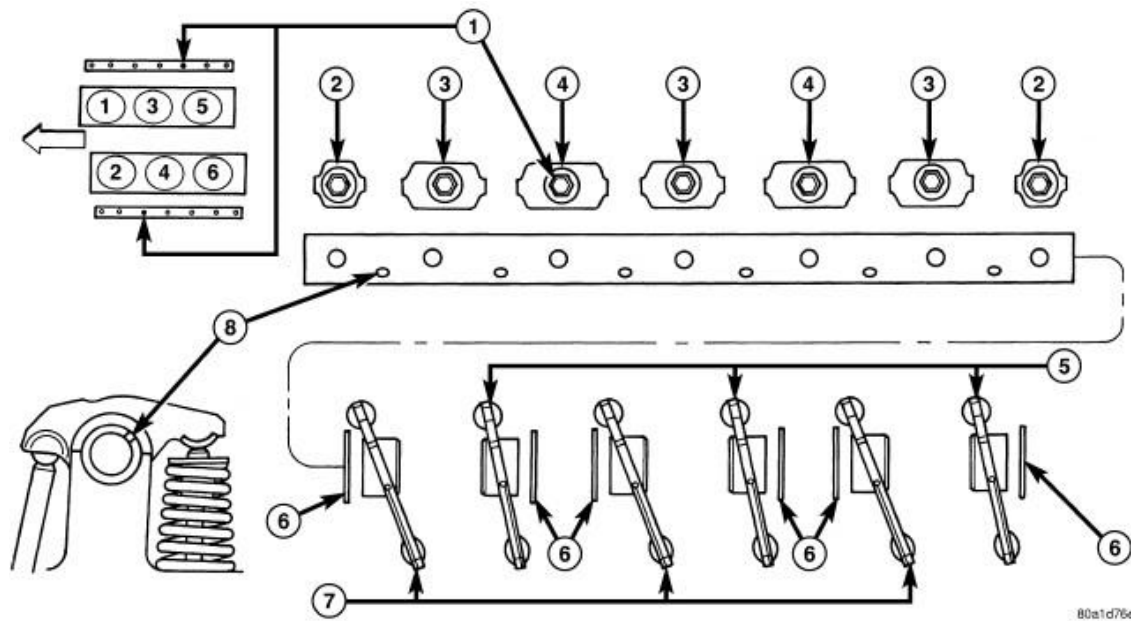


Fig. 66: ROCKER ARMS AND SHAFT
Courtesy of CHRYSLER LLC

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 mm (1.61 in.)	8 - ROCKER ARMS LUBRICATION FEED HOLE (POSITION UPWARD AND TOWARD VALVE SPRING)

2. Remove rocker arms (7). 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 **Engine/Cylinder Head/ROCKER ARM, Valve - Installation.**

Installation

ROCKER ARMS AND SHAFT

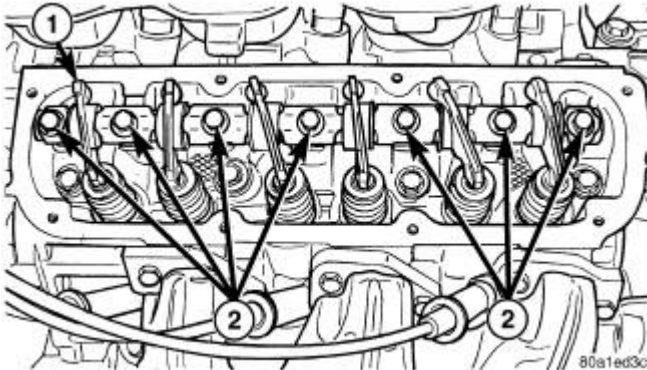


Fig. 67: ROCKER ARMS AND SHAFT

Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - ROCKER ARMS AND SHAFT ASSEMBLY
2 - ROCKER SHAFT BOLTS</p> |
|--|

CAUTION: Ensure the longer shaft retaining bolt is installed in the proper location on the rocker shaft. See Engine/Cylinder Head/ROCKER ARM, Valve - Assembly.

1. Position the rocker arm (1) 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 (2) evenly until shaft is seated. Tighten bolts to 23 N.m (200 in. lbs.).
4. Install the cylinder head cover(s). See Engine/Cylinder Head/COVER(S), Cylinder Head - Installation.

SEAL(S), VALVE GUIDE

Description

DESCRIPTION

The valve stem seals are made of Viton rubber. The seals are positioned over the valve stem and seated on the

valve guide .

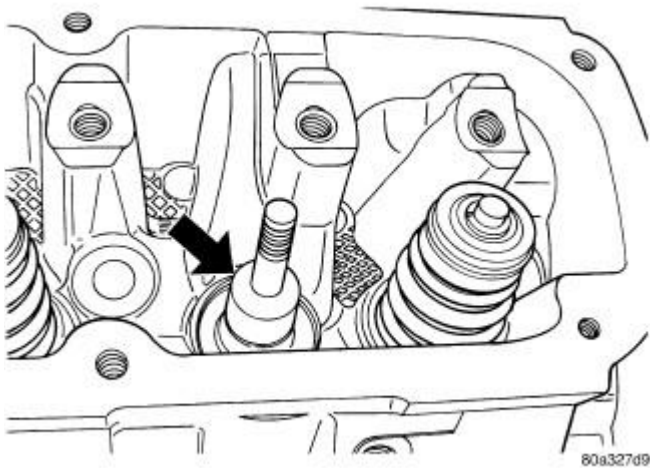


Fig. 68: Valve Stem Seal

Courtesy of CHRYSLER LLC

Removal

REMOVAL

1. Remove the valve springs. See **Engine/Cylinder Head/SPRING(S), Valve - Removal**.
2. Remove the valve stem seal .

Installation

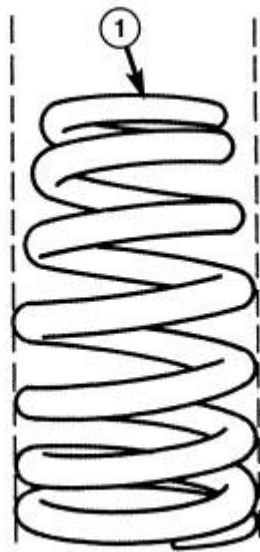
INSTALLATION

1. Install the valve stem seal squarely over the valve guide, using the valve stem as a guide . Do not force the seal against top of the valve guide.
2. Install the valve spring. See **Engine/Cylinder Head/SPRING(S), Valve - Installation**.

SPRING(S), VALVE

Description

DESCRIPTION

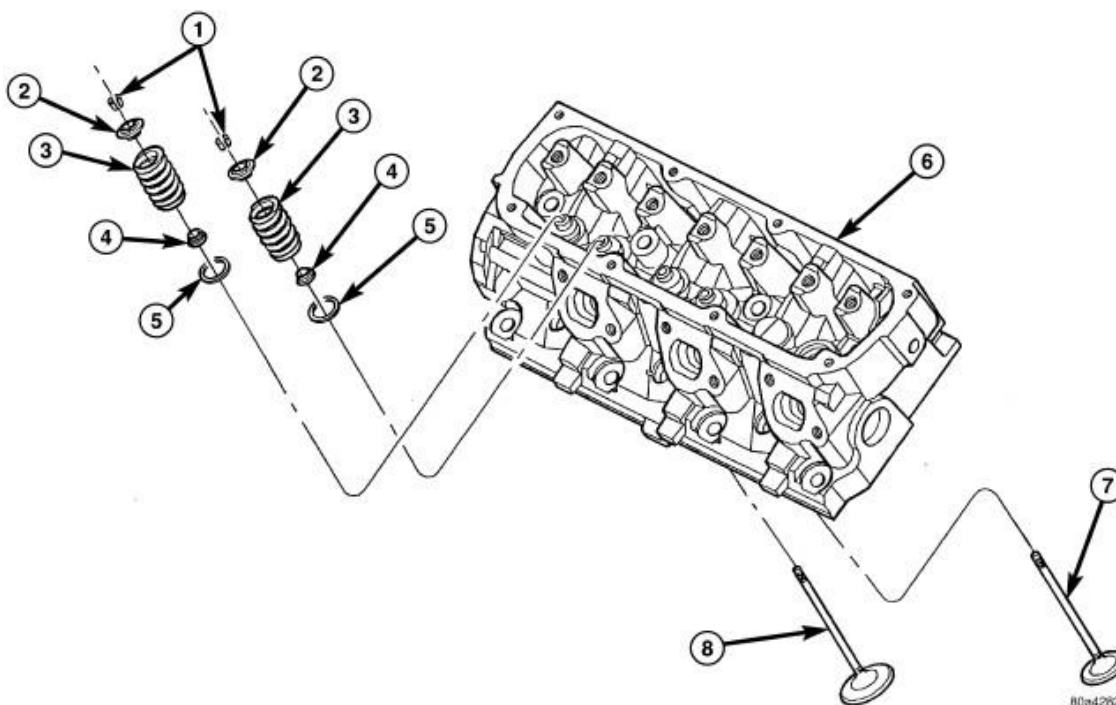


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Fig. 69: Valve Spring - Type A
Courtesy of CHRYSLER LLC

1 - VALVE SPRING (TOP - SMALLER DIAMETER)

There are two interchangeable, floating (spring rotates during operation), valve spring designs. Type A (1) 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.



80s42621

Fig. 70: VALVE 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 springs are seated on a steel washer (5) on the cylinder head with retainers and locks retaining the springs. The springs are installed with the smaller diameter against spring retainer.

Operation

OPERATION

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

Removal

CYLINDER HEAD OFF

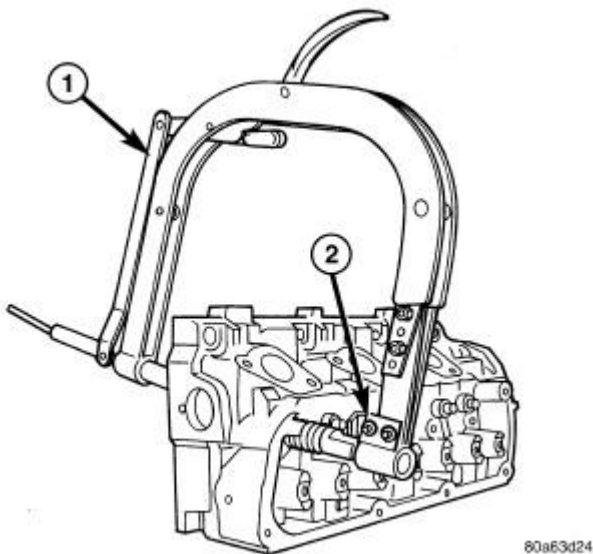


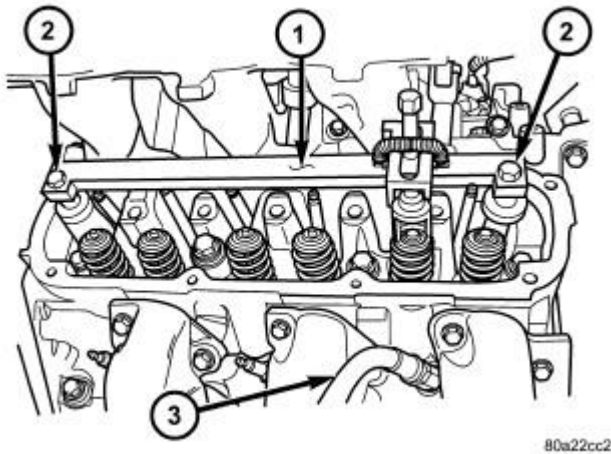
Fig. 71: VALVE SPRING - REMOVE/INSTALL

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 (1) with 8464 Adapter (2) on the valve and spring retainer.
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 **Engine/Cylinder Head/SEAL(S), Valve Guide - Removal.**

CYLINDER HEAD ON**Fig. 72: VALVE SPRING - REMOVE/INSTALL (HEAD ON)****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 **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal.**
4. Remove rocker arms and shaft. See **Engine/Cylinder Head/ROCKER ARM, Valve - Removal.**
5. Rotate engine until the piston in the cylinder bore requiring spring removal is at TDC.
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 in the spark plug hole. Connect air hose that can supply 620.5-689 kPa (90-100 psi) of air pressure to adapter. This is to hold valves in place while servicing components.
8. Locate the forcing screw and spring retainer adapter assembly over the spring requiring removal.
9. Slowly turn the forcing screw clockwise (compressing the valve spring) until the valve keepers can be removed.
10. Turn forcing screw counterclockwise to relieve spring tension. Remove retainer and valve spring.
11. Repeat procedure for each cylinder requiring valve spring removal.

Inspection**INSPECTION**

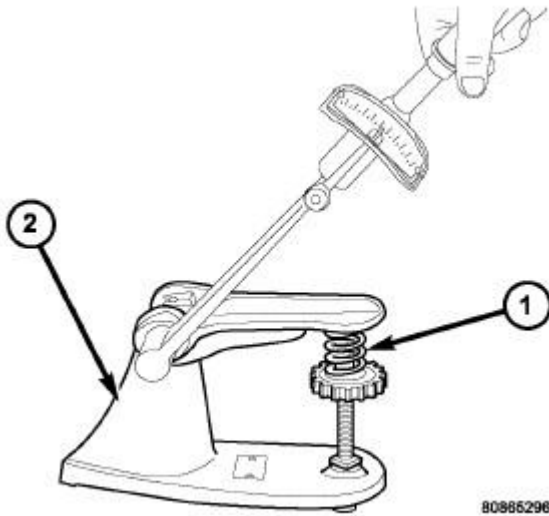


Fig. 73: TESTING VALVE SPRING
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL C-647

NOTE: There are two different types of valve springs used that are interchangeable, but have different specifications. See Engine/Cylinder Head/SPRING(S), Valve - Description.

Whenever valves have been removed for inspection, reconditioning or replacement, valve springs (1) should be tested. **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 Engine - Specifications. Replace any springs that do not meet specifications.

Installation

CYLINDER HEAD OFF

1. If removed, install a new valve stem seal. See Engine/Cylinder Head/SEAL(S), Valve Guide - 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.
4. Slowly release the spring tension. Ensure the retainer locks are seated properly.

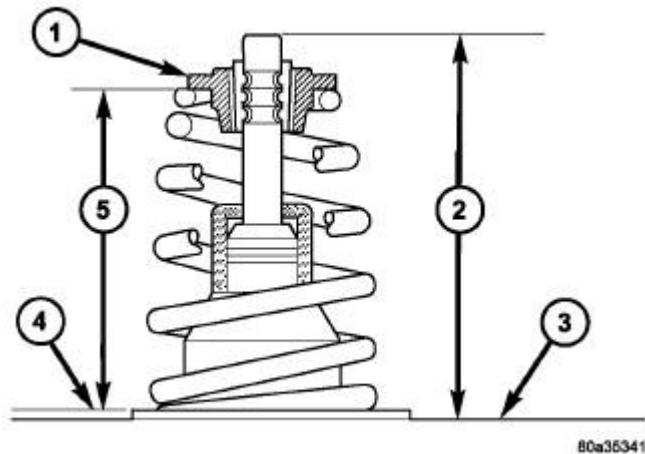


Fig. 74: VALVE SPRING INSTALLED
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - VALVE SPRING RETAINER
 2 - VALVE INSTALLED HEIGHT
 3 - CYLINDER HEAD SURFACE
 4 - VALVE SPRING SEAT SURFACE
 5 - VALVE SPRING INSTALLED HEIGHT</p> |
|---|

CYLINDER HEAD ON

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.
4. Install rocker arms and shaft assembly. See Engine/Cylinder Head/ROCKER ARM, Valve - Installation.
5. Install cylinder head covers. See Engine/Cylinder Head/COVER(S), Cylinder Head - Installation.
6. Install spark plugs and connect wires.
7. Connect negative cable to battery.

VALVES, INTAKE AND EXHAUST

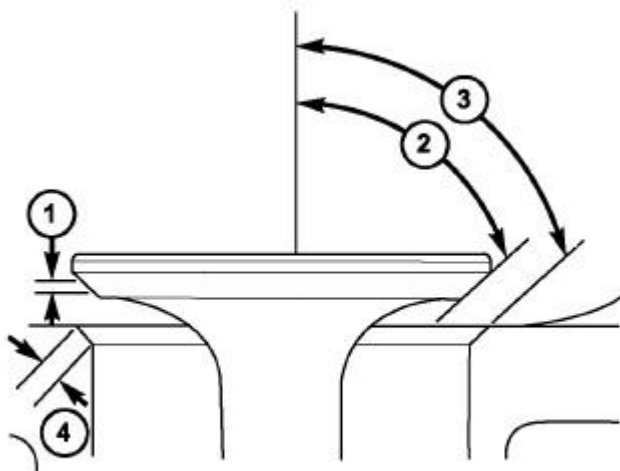
Description

DESCRIPTION

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

Operation**OPERATION**

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

Standard Procedure**REFACING VALVES AND VALVE SEATS**

811d191e

Fig. 75: VALVE FACE AND SEAT
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 .

VALVES

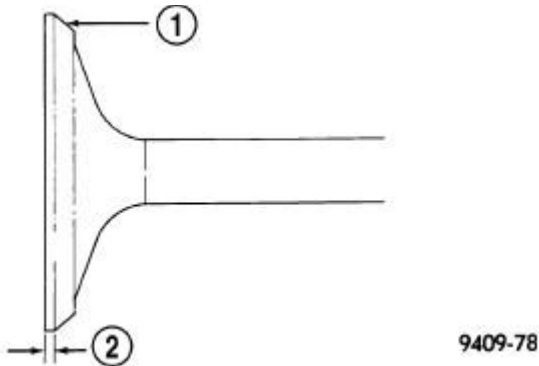


Fig. 76: Intake and Exhaust Valve Refacing
Courtesy of CHRYSLER LLC

- 1 - VALVE FACE
- 2 - VALVE MARGIN

1. Inspect the remaining margin after the valves are refaced . See Engine - Specifications.

VALVE SEATS

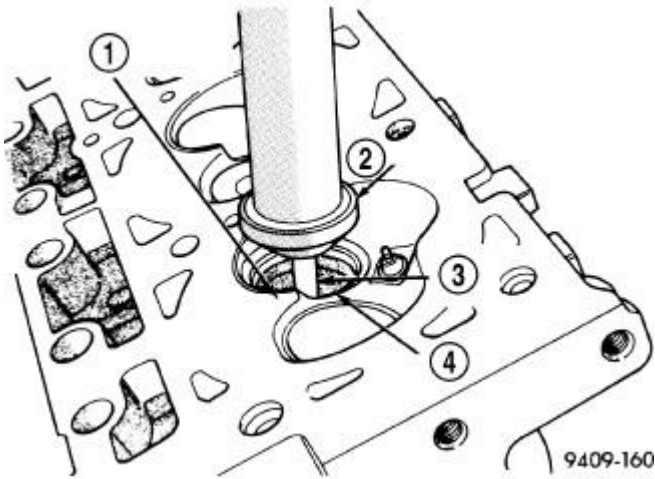


Fig. 77: Refacing Valve Seats
Courtesy of CHRYSLER LLC

- 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 .

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.

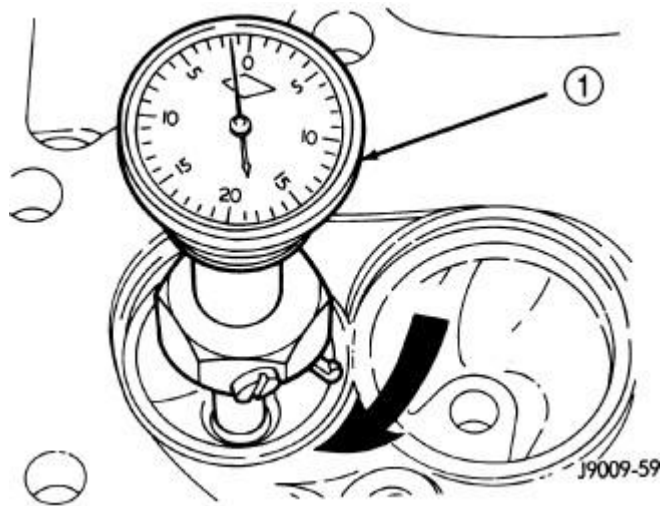


Fig. 78: Measurement of Valve Seat Runout
Courtesy of CHRYSLER LLC

1 - DIAL INDICATOR

2. Measure the concentricity of valve seat using dial indicator . 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.) .

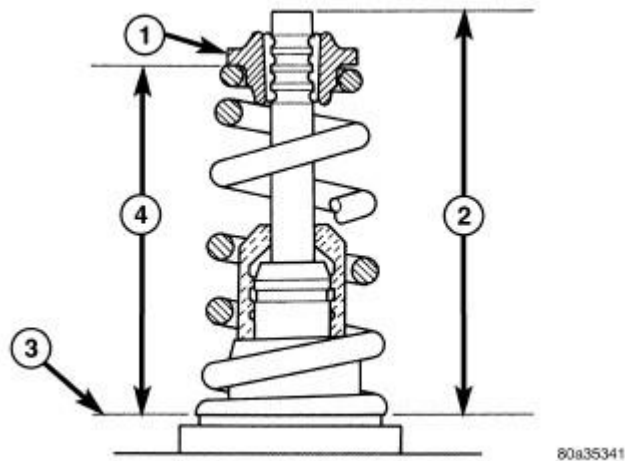


Fig. 79: VALVE INSTALLED HEIGHT
Courtesy of CHRYSLER LLC

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

- 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 . 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.
- Check the valve spring installed height after refacing the valve and seat .

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.

Removal

REMOVAL

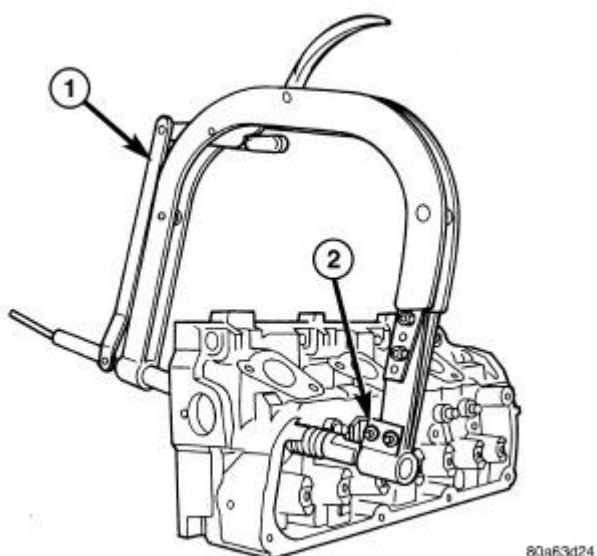


Fig. 80: VALVE SPRING - REMOVE/INSTALL
Courtesy of CHRYSLER LLC

- 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 (2).

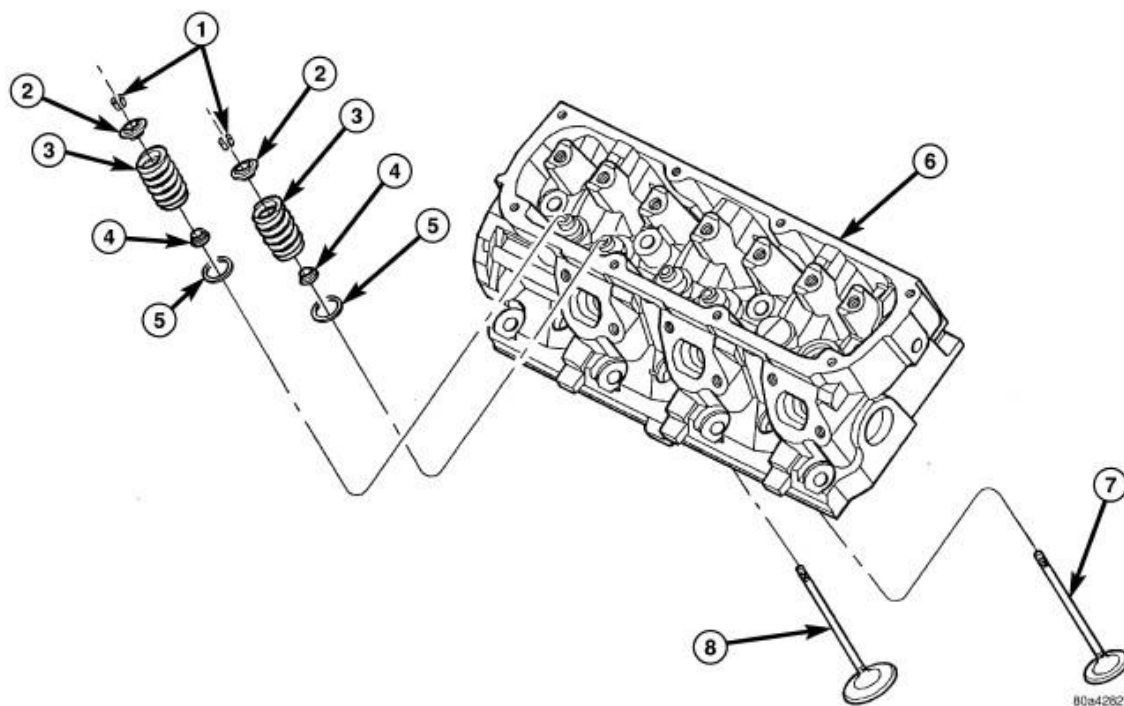


Fig. 81: VALVE COMPONENTS

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

2. Remove valve retaining locks (1).
3. Slowly release valve spring compressor. Remove valve spring retainer, valve spring, and valve stem seal.
4. Before removing valves, **remove any burrs from valve stem lock grooves to prevent damage to the valve guides.** Identify valves to insure installation in original location.

Cleaning

CLEANING

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

Inspection

INSPECTION

VALVES

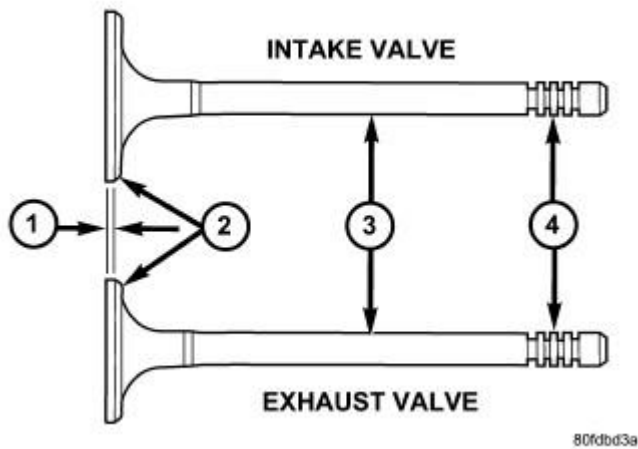


Fig. 82: Intake and Exhaust Valves
Courtesy of CHRYSLER LLC

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

1. Clean and inspect valves thoroughly. Replace burned, warped and cracked valves.
2. Measure valve stems for wear (3). For valve specifications, see **Engine - Specifications**.

NOTE: Valve stems are chrome plated and should not be polished (3).

VALVE GUIDES

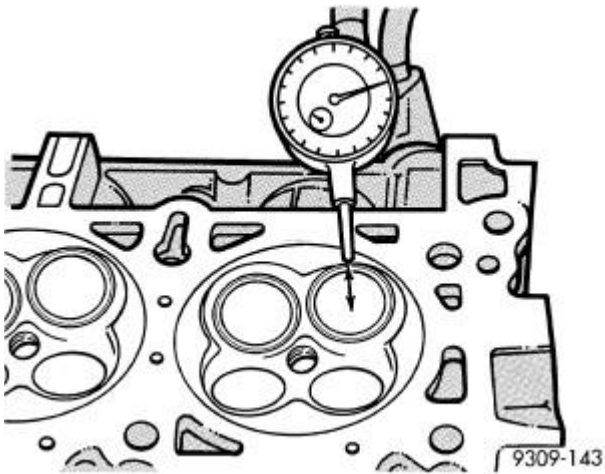


Fig. 83: Measuring Valve Guide Wear
Courtesy of CHRYSLER LLC

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-3339A to cylinder head and set it at right angle of valve stem being measured.
5. Move valve to and from the indicator. For clearance specifications, see **Engine - Specifications**.

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

Installation

INSTALLATION

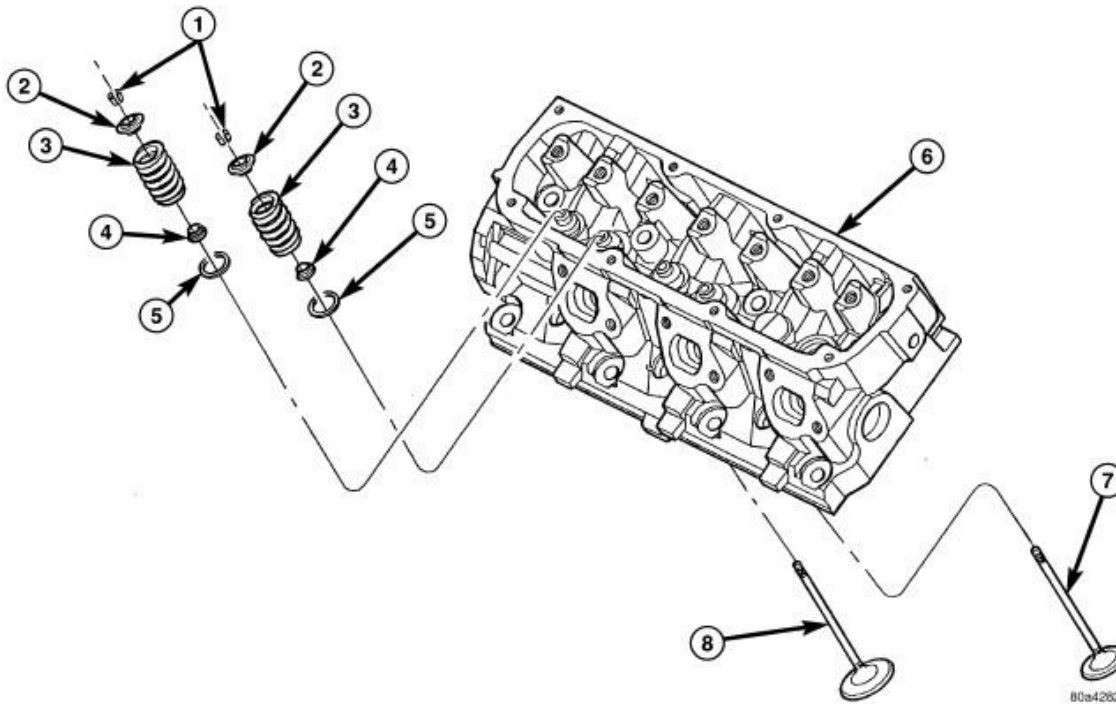


Fig. 84: VALVE COMPONENTS
Courtesy of CHRYSLER LLC

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

1. Coat valve stems (7) with clean engine oil and insert them in cylinder head.
2. Install valve spring seat (5) on head.

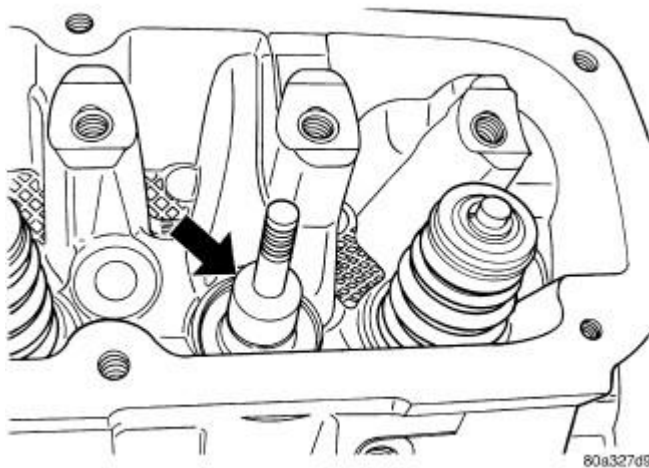


Fig. 85: VALVE STEM SEAL
Courtesy of CHRYSLER LLC

3. Install new seals on all valve stems and over valve guides Install valve springs and valve retainers.
4. Install the valve springs. See **Engine/Cylinder Head/SPRING(S), Valve - Installation.**

ENGINE BLOCK

DESCRIPTION

DESCRIPTION

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

STANDARD PROCEDURE

CYLINDER BORE HONING

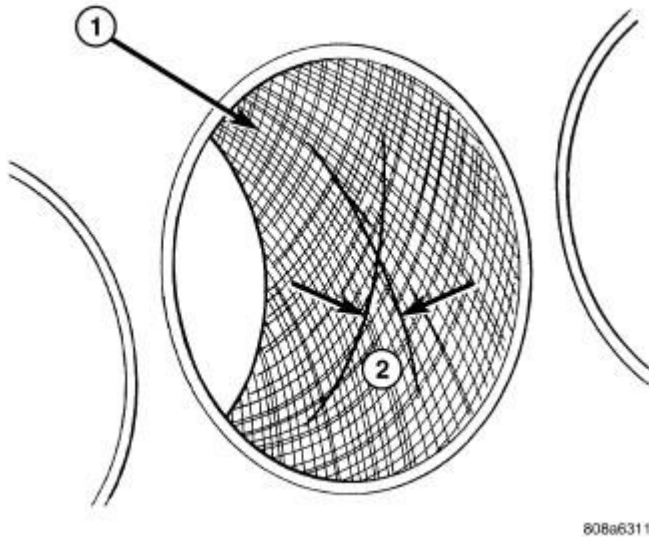


Fig. 86: CYLINDER BORE CROSS-HATCH PATTERN
Courtesy of CHRYSLER LLC

- | |
|--|
| 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

CLEANING

Clean cylinder block thoroughly using a suitable cleaning solvent.

INSPECTION

INSPECTION

ENGINE BLOCK

1. Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.
2. If new core plugs are to be installed, see Engine - Standard Procedure.
3. Examine block and cylinder bores for cracks or fractures.
4. Check block deck surfaces for flatness. Deck surface must be within service limit of 0.1 mm (0.004 in.).

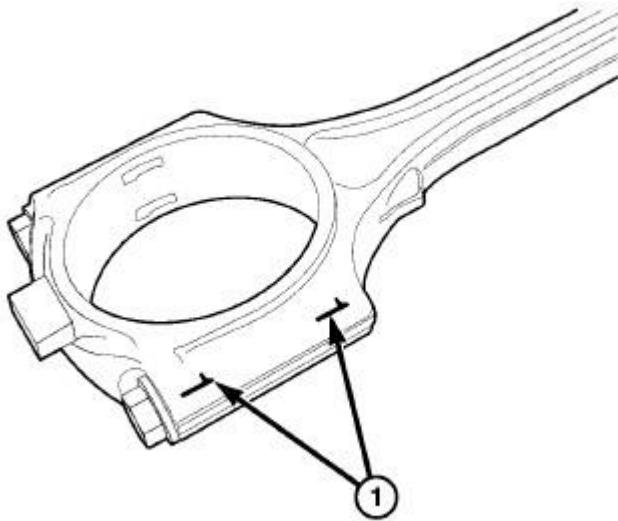
CYLINDER BORE

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

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

Measure the cylinder bore at three levels in directions A and B. Top measurement should be 10 mm (3/8 in.) down and bottom measurement should be 10 mm (3/8 in.) up from bottom of bore. See Engine - Specifications.

BEARING(S), CONNECTING ROD

Standard Procedure**MEASURING CONNECTING ROD BEARING CLEARANCE**

814311e7

Fig. 87: Connecting Rod To Cylinder Identification
Courtesy of CHRYSLER LLC

1 - PAINT MARK OR SCRIBE

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

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

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

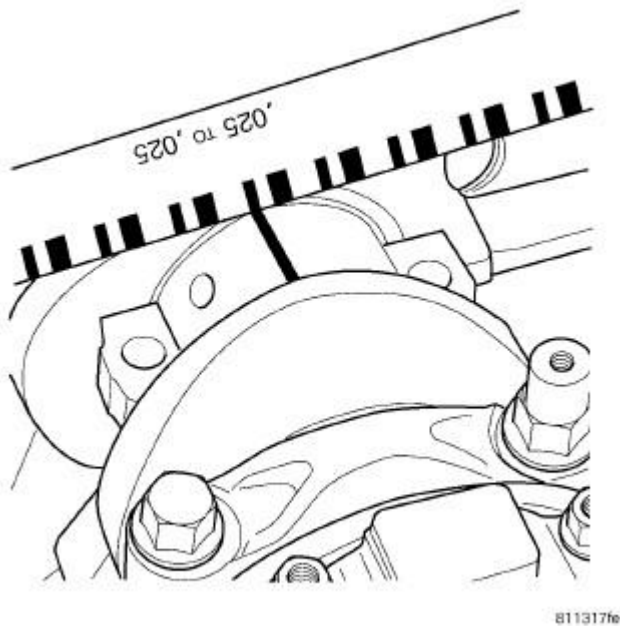


Fig. 88: CONNECTING ROD BEARING CLEARANCE
Courtesy of CHRYSLER LLC

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

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

BEARING(S), CRANKSHAFT, MAIN

Standard Procedure

MAIN BEARING FITTING

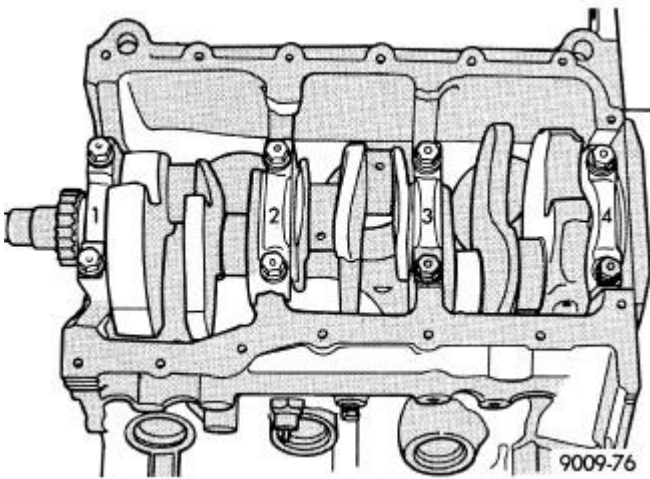


Fig. 89: Main Bearing Cap Identification
Courtesy of CHRYSLER LLC

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.

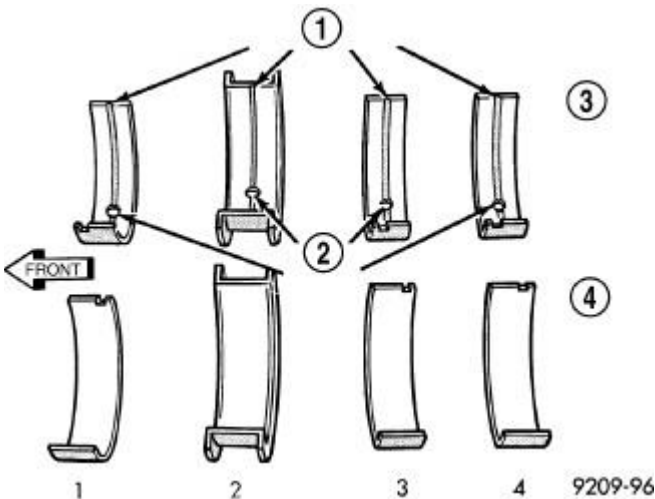


Fig. 90: Main Bearing Identification
Courtesy of CHRYSLER LLC

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

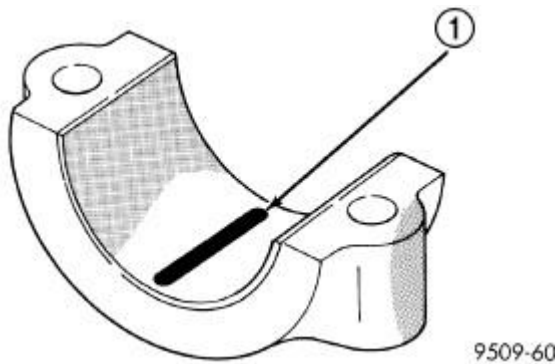


Fig. 91: Plastigage Placed in Lower Shell
Courtesy of CHRYSLER LLC

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:

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

NOTE: Remove all shims before reassembling engine.

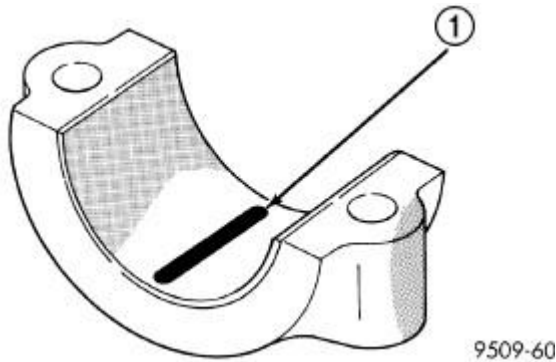


Fig. 92: Plastigage Placed in Lower Shell
Courtesy of CHRYSLER LLC

2. Alternative Method:
 - a. Support the weight of the crankshaft with a jack under the counterweight adjacent to the bearing being checked.
3. Remove oil film from surface to be checked. Plastigage is soluble in oil.
4. Place a piece of Plastigage (1) across the entire width of the bearing shell in the cap approximately 6.35 mm (1/4 in.) off center and away from the oil holes. (In addition, suspected areas can be checked by placing the Plastigage in the suspected area). Torque the bearing cap bolts of the bearing being checked to the proper specifications.
5. Remove the bearing cap and compare the width of the flattened Plastigage (1) with the scale provided on the package. Locate the band closest to the same width. This band shows the amount of clearance in thousandths. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. See **Engine - Specifications**. Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.

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

PLASTIGAGE METHOD-ENGINE OUT-OF-VEHICLE

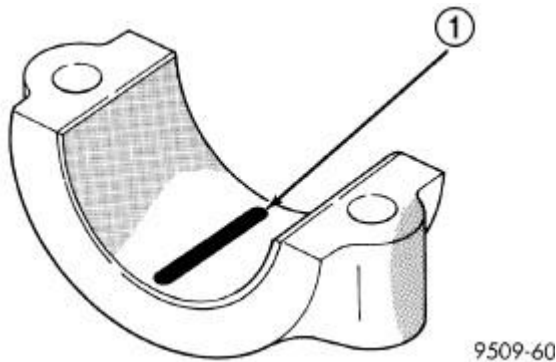


Fig. 93: Plastigage Placed in Lower Shell
Courtesy of CHRYSLER LLC

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 **Engine - Specifications**.

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

5. Carefully remove the bearing cap and measure the width of the Plastigage (1) at the widest part using the scale on the Plastigage package. Refer to Engine Specifications for proper clearances. See **Engine - 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

REMOVAL

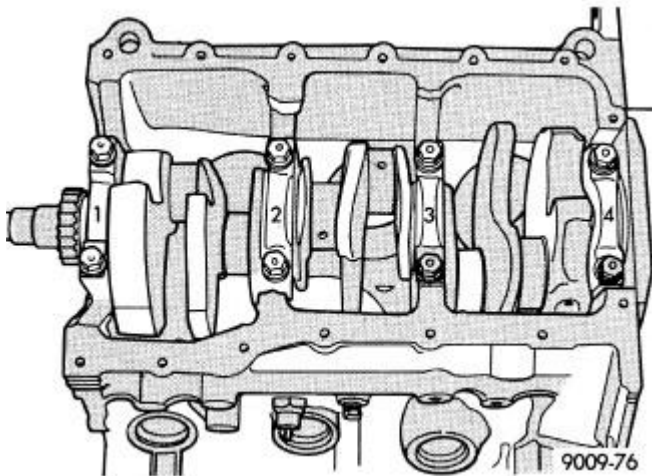


Fig. 94: Main Bearing Cap Identification

Courtesy of CHRYSLER LLC

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

Installation

INSTALLATION

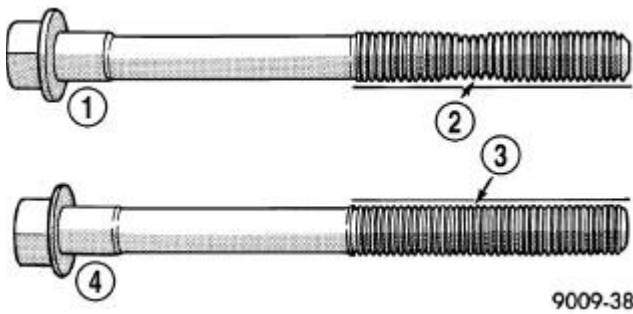


Fig. 95: Check for Stretched Bolts
Courtesy of CHRYSLER LLC

- 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 Engine/Engine Block/BEARING(S), Crankshaft - Standard Procedure.
2. Start bearing in place, and insert Main Bearing Tool C-3059A into oil hole of crankshaft.
3. Slowly rotate crankshaft counterclockwise sliding the bearing into position. Remove Special Main Bearing Tool C-3059A.
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.

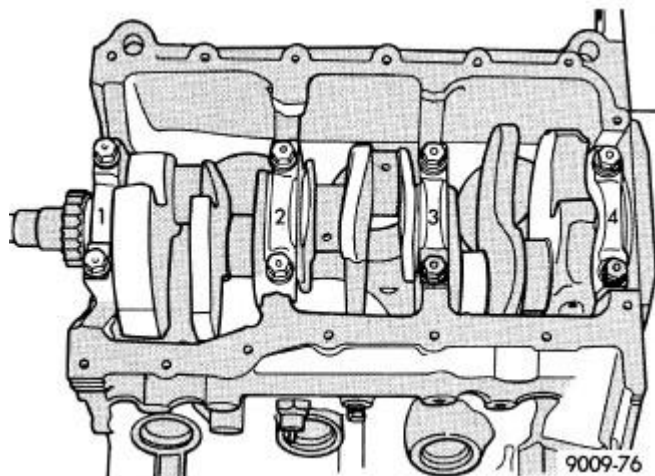


Fig. 96: Main Bearing Cap Identification
Courtesy of CHRYSLER LLC

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:
 - a. Move crankshaft all the way to the rear of its travel.
 - b. Then, move crankshaft all the way to the front of its travel.
 - c. Wedge an appropriate tool between the rear of the cylinder block and rear crankshaft counterweight. This will hold the crankshaft in it's most forward position.
 - d. Tighten the #2 Thrust Bearing cap bolts to 41 N.m + 1/4 Turn (30 ft. lbs.+ 1/4 Turn). Remove the holding tool.
9. Install oil pan. See **Engine/Lubrication/PAN, Oil - Installation.**
10. Fill engine crankcase with proper oil to correct level.

CAMSHAFT, ENGINE

Description

DESCRIPTION

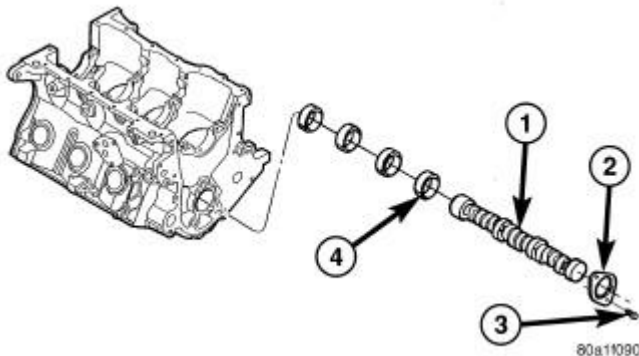


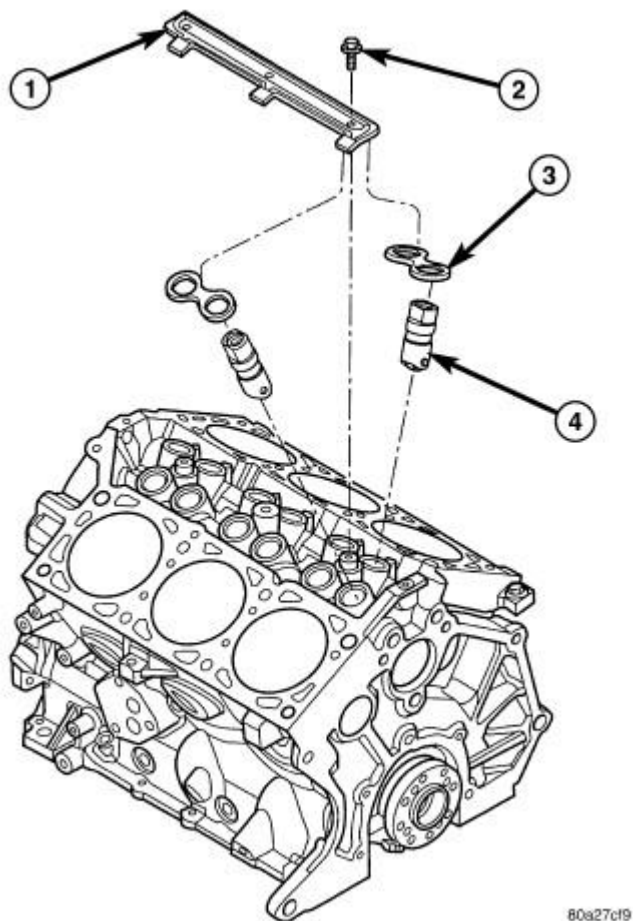
Fig. 97: CAMSHAFT AND BEARINGS
Courtesy of CHRYSLER LLC

- | |
|---|
| <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**OPERATION**

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

Removal**REMOVAL**

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Fig. 98: 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 **Engine/Cylinder Head - Removal**.
3. Remove the timing chain and camshaft sprocket. Refer to **CHAIN and SPROCKETS, Timing**.
4. Remove the yoke retainer (1).
5. Remove the hydraulic lifters (4). See **Engine/Engine Block/LIFTER(S), Hydraulic - Removal**. Identify each tappet for reinstallation in original location.

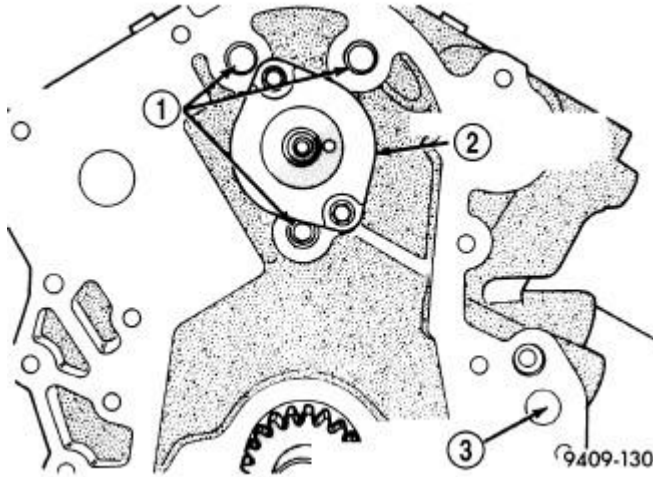


Fig. 99: Camshaft Thrust Plate
Courtesy of CHRYSLER LLC

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

6. Remove camshaft thrust plate (2).

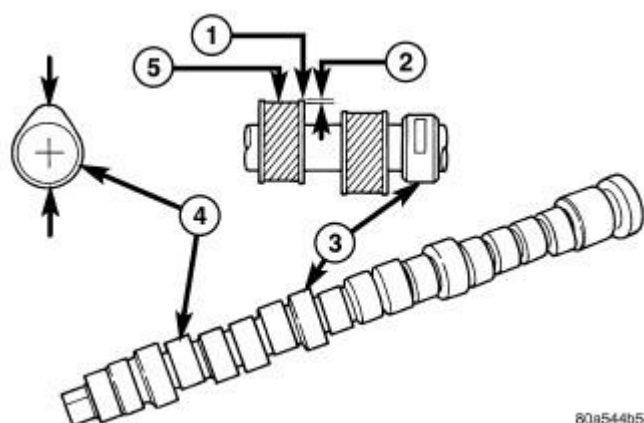
NOTE: **Slowly remove the camshaft from the engine taking precautions not to damage the camshaft bearings.**

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

INSPECTION



80a544b5

Fig. 100: CAMSHAFT - INSPECTION
Courtesy of CHRYSLER LLC

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

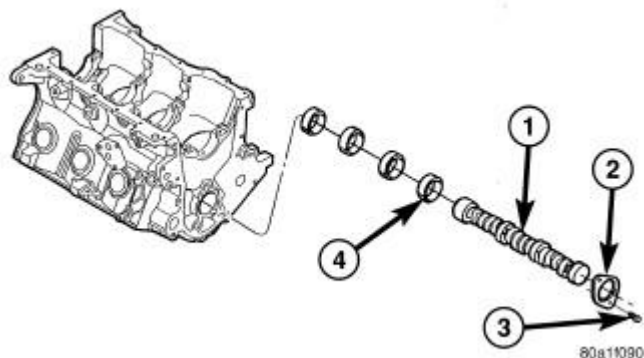
1. Check the cam lobes (4) and bearing surfaces (3) for abnormal wear and damage. Replace camshaft as required.

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

INSTALLATION



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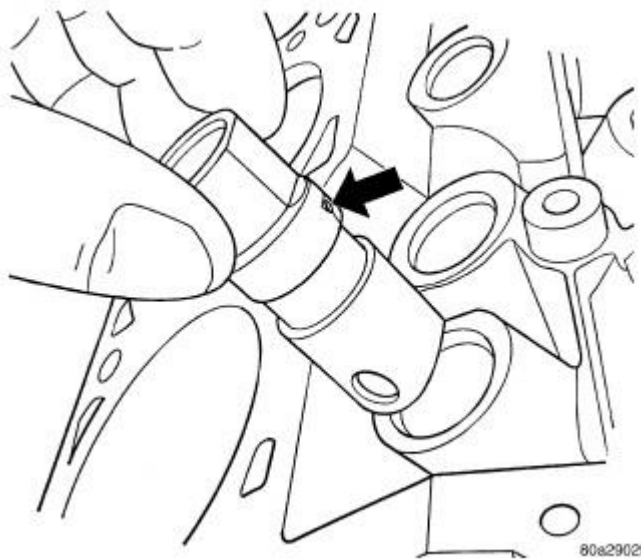
Fig. 101: CAMSHAFT AND BEARINGS

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 **Engine - Specifications**. If not within specifications, replace thrust plate.
6. Install the timing chain and sprockets. Refer to **CHAIN and SPROCKETS, Timing**.

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

**Fig. 102: LIFTER LUBRICATION HOLE**

Courtesy of CHRYSLER LLC

7. Install the hydraulic lifters with lubrication hole in the upward position. See **Engine/Engine Block/LIFTER(S), Hydraulic - Installation**.
8. Install the timing chain cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Installation**.
9. Install the cylinder heads. See **Engine/Cylinder Head - Installation**.
10. Install the cylinder head covers. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.
11. Install the lower and upper intake manifolds. See **Engine/Manifolds/MANIFOLD, Intake - Installation**.

12. Install the radiator and cooling fan.

COVER, STRUCTURAL DUST

Removal

REMOVAL

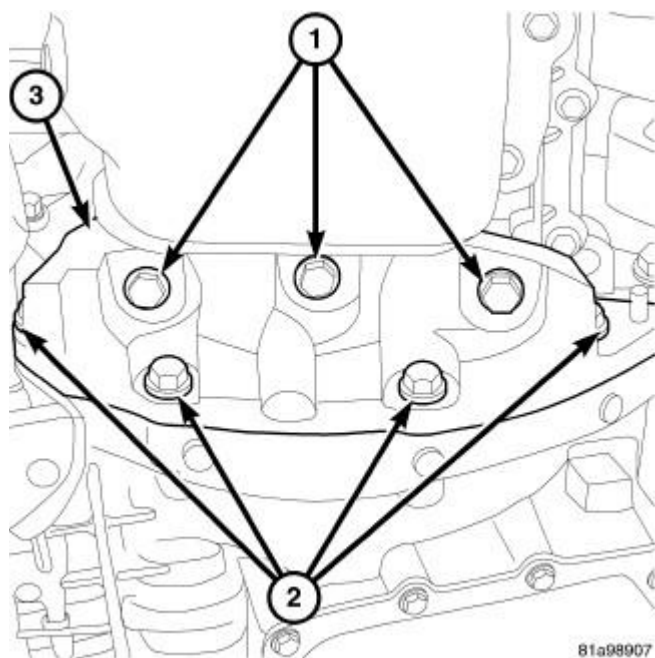


Fig. 103: Removing/Installing Structural Dust Cover
Courtesy of CHRYSLER LLC

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

INSTALLATION

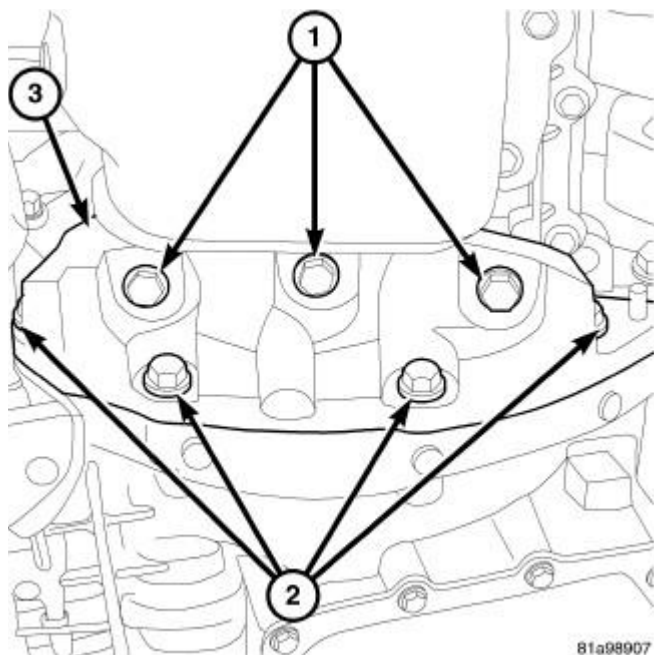


Fig. 104: Removing/Installing Structural Dust Cover
Courtesy of CHRYSLER LLC

CAUTION: The structural dust cover must be installed as described in the following steps. Failure to do so may cause severe damage to the cover.

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

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

4. Starting with the cover-to-engine bolts, tighten bolts to 54 N.m (40 ft. lbs.), then tighten bolts (1) and (2) to 54 N.m (40 ft. lbs.).

CRANKSHAFT

Description

DESCRIPTION

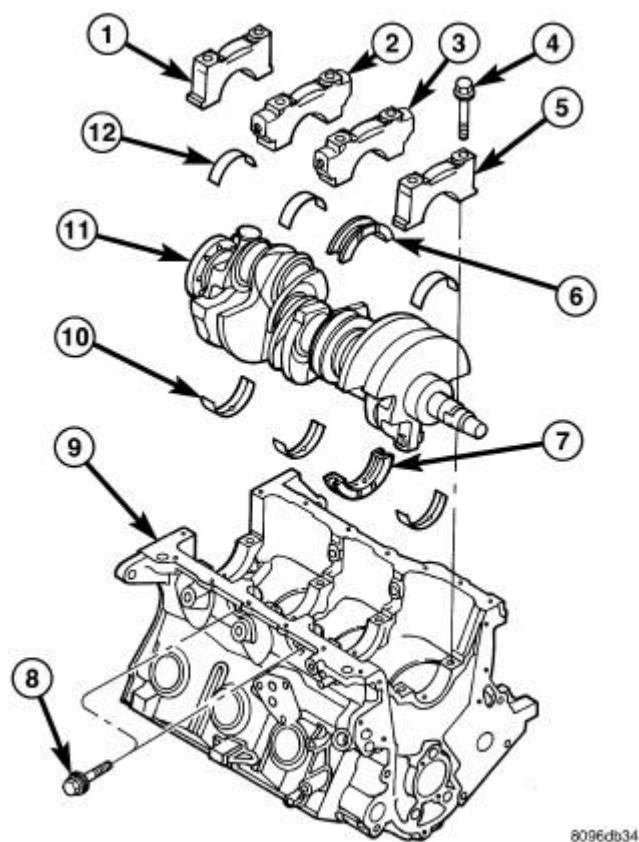


Fig. 105: Identifying Crankshaft & Main Bearings
 Courtesy of CHRYSLER LLC

- 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.

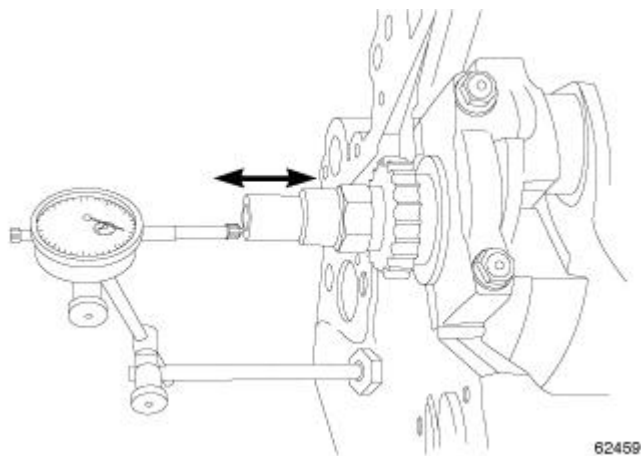
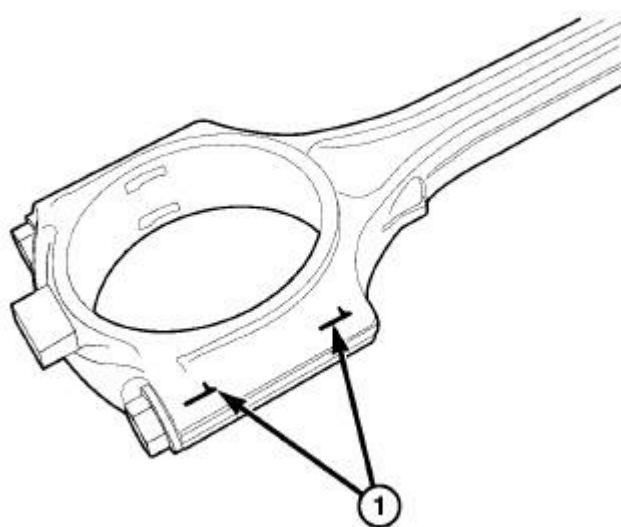
Standard Procedure**MEASURING CRANKSHAFT END PLAY**

Fig. 106: Measuring Crankshaft End Play
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. Crankshaft end play must be within specification. See **Engine - Specifications**.

Removal**REMOVAL**



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Fig. 107: Connecting Rod To Cylinder Identification

Courtesy of CHRYSLER LLC

1 - PAINT MARK OR SCRIBE

1. Remove the engine assembly. See **Engine - Removal**.
2. Mount engine on an engine stand.
3. Remove the oil filter.
4. Remove the oil pan and oil pick-up tube. See **Engine/Lubrication/PAN, Oil - Removal**.
5. Remove the timing chain cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.
6. Remove timing chain and sprockets. Refer to **CHAIN and SPROCKETS, Timing**.
7. Remove crankshaft rear oil seal and retainer. See **Engine/Engine Block/RETAINER, Crankshaft Rear Oil Seal - Removal**.
8. Rotate the crankshaft until connecting rod cap is accessible.
9. Paint mark or scribe the connecting rod cap position (1).
10. Remove connecting rod bearing cap. Use care to prevent damage to the crankshaft bearing surfaces.
11. Repeat removal procedure for each connecting rod cap.

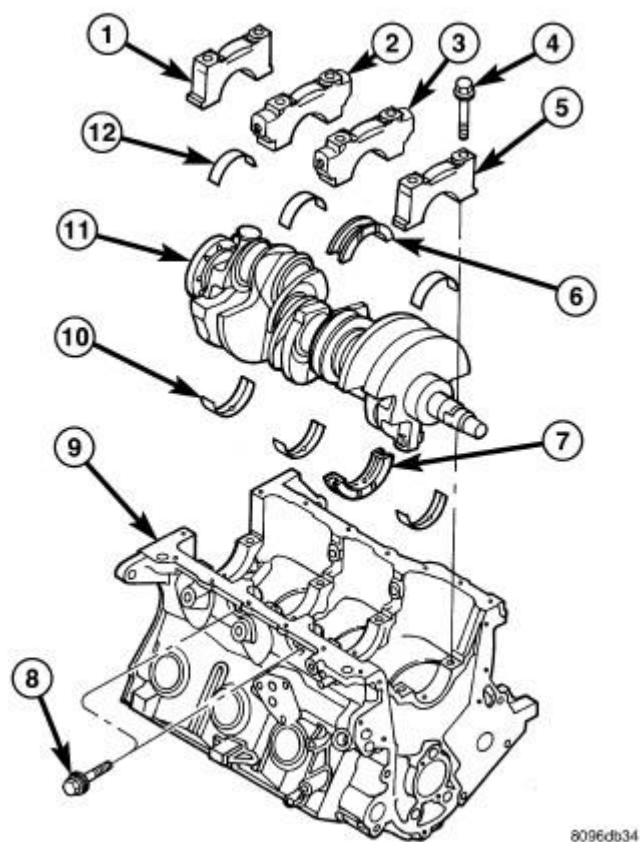


Fig. 108: Identifying Crankshaft & Main Bearing Caps
Courtesy of CHRYSLER LLC

- 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

INSTALLATION

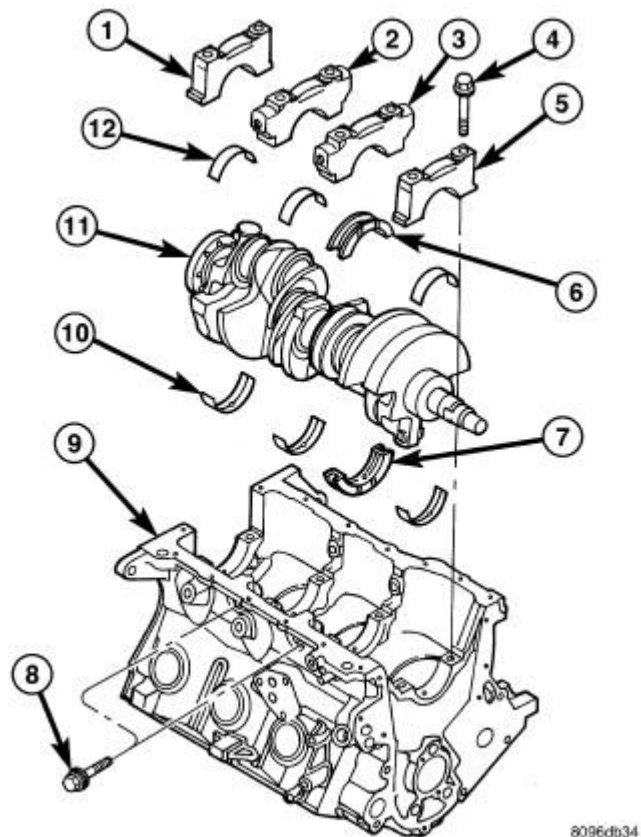


Fig. 109: Identifying Crankshaft & Main Bearing Caps
Courtesy of CHRYSLER LLC

- 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 **Engine/Engine Block/BEARING(S), Crankshaft - Standard Procedure**.

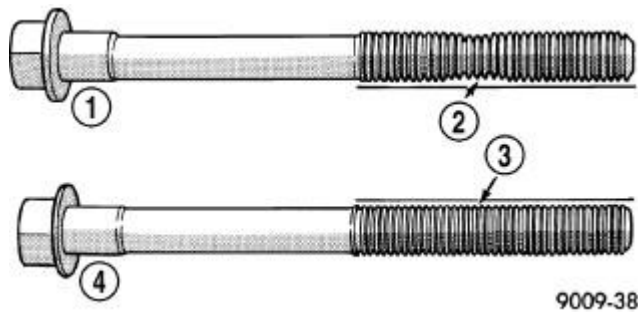


Fig. 110: Check for Stretched Bolts
Courtesy of CHRYSLER LLC

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.

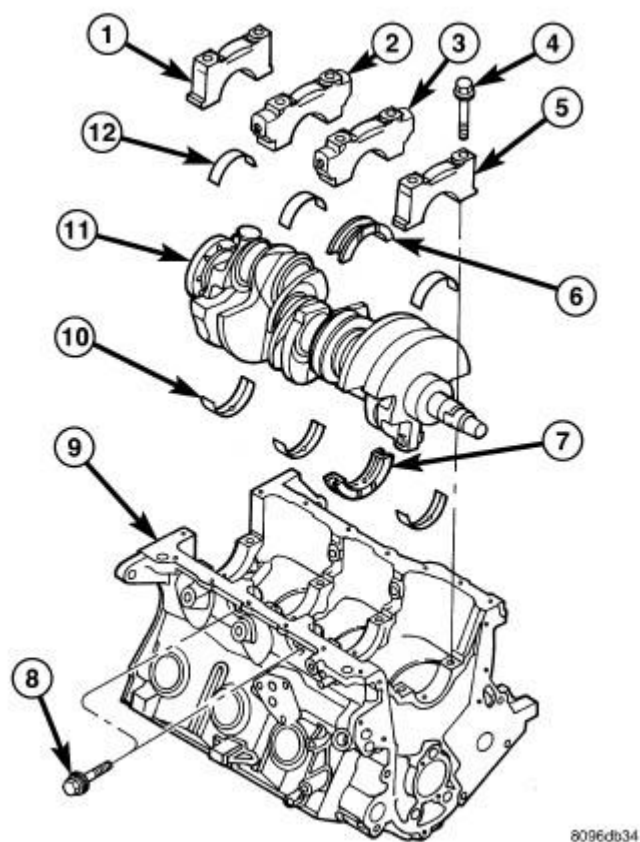


Fig. 111: Identifying Crankshaft & Main Bearing Caps
Courtesy of CHRYSLER LLC

- 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 **Engine/Engine Block/BEARING(S), Connecting Rod - Standard Procedure.**
8. Install the crankshaft rear oil seal. See **Engine/Engine Block/RETAINER, Crankshaft Rear Oil Seal - Installation.**
9. Install the crankshaft sprocket. Refer to **CHAIN and SPROCKETS, Timing.**
10. Install the timing chain and camshaft sprocket. Refer to **CHAIN and SPROCKETS, Timing.**
11. Install the timing chain cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Installation.**
12. Install the oil pick-up tube and oil pan. See **Engine/Lubrication/PAN, Oil - Installation.**
13. Install the engine assembly. See **Engine - Installation.**

DAMPER, VIBRATION

Removal

REMOVAL

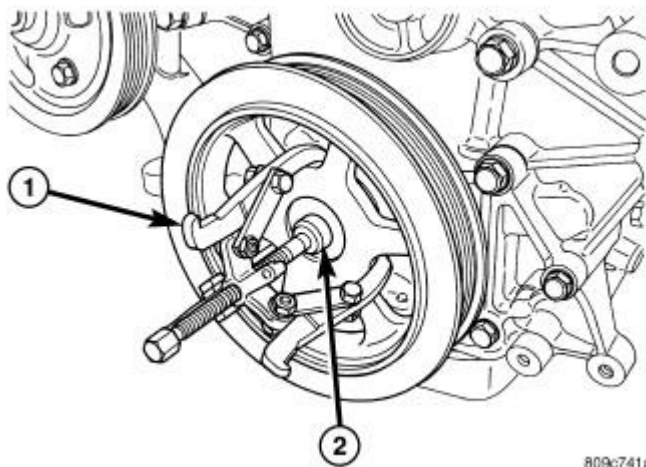


Fig. 112: VIBRATION DAMPER - REMOVAL

Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - SPECIAL TOOL 8450 - INSERT</p> <p>2 - SPECIAL TOOL 1026 - 3 JAW PULLER</p> |
|---|

1. Disconnect negative cable from battery.
2. Raise vehicle on hoist.
3. Remove the accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - 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

INSTALLATION

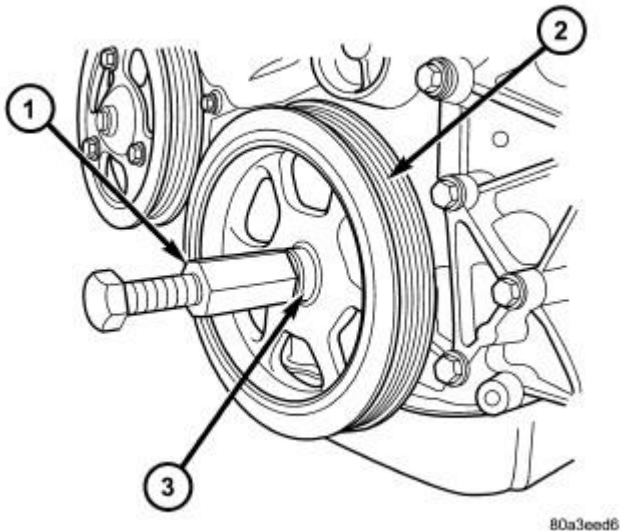


Fig. 113: CRANKSHAFT DAMPER

Courtesy of CHRYSLER LLC

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

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 Cooling/Accessory Drive/BELT, Serpentine - Installation.
7. Connect negative cable to battery.

FLEXPLATE

Removal

REMOVAL

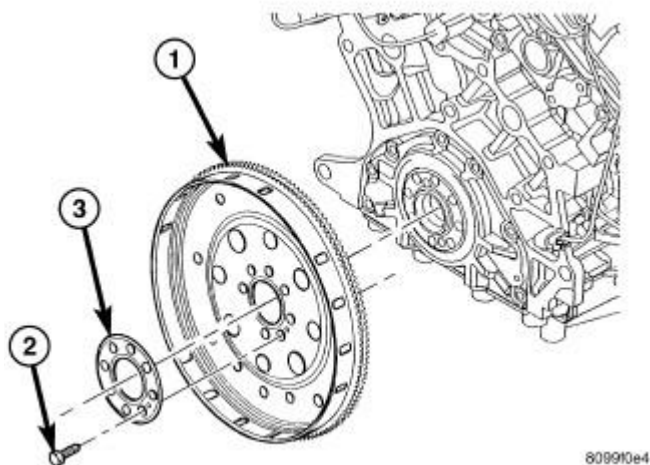


Fig. 114: FLEX PLATE

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

INSTALLATION

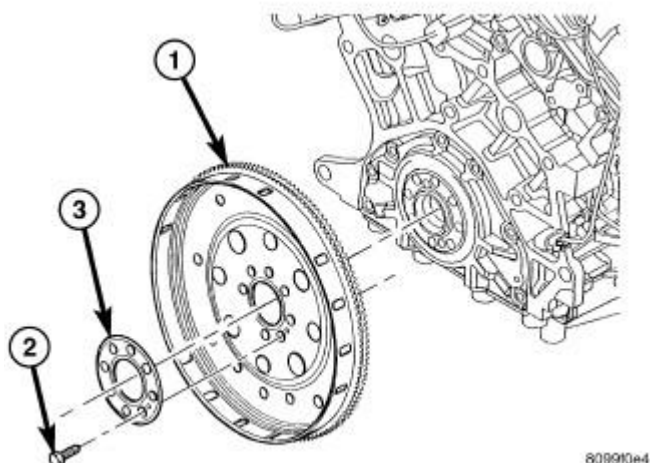


Fig. 115: FLEX PLATE

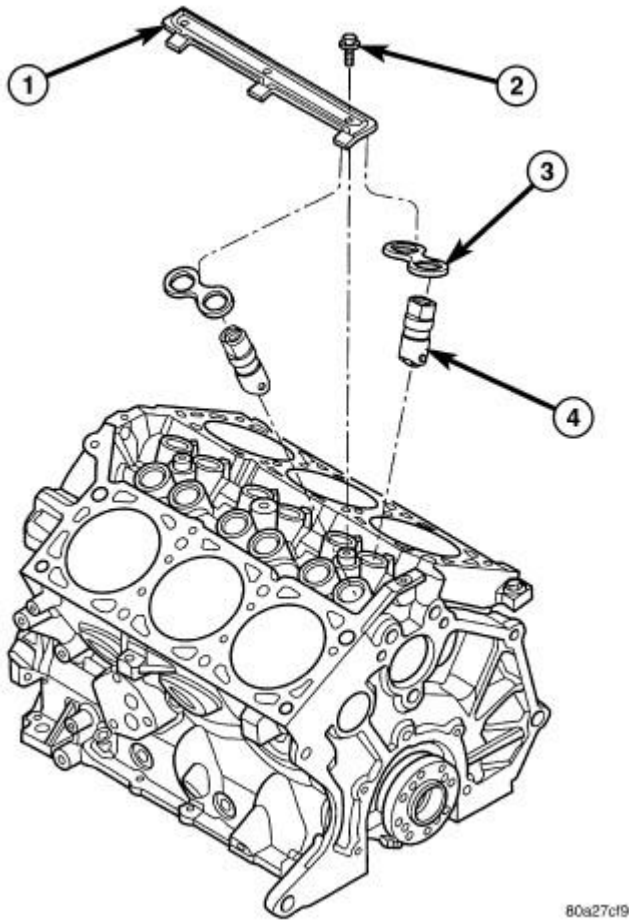
Courtesy of CHRYSLER LLC

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

1. Position the flex plate (1) with backing plate (3) on the crankshaft.
2. Apply Mopar® Lock AND Seal Adhesive to the eight flex plate bolts (2).
3. Install the flex plate bolts (2). Tighten the bolts to 95 N.m (70 ft. lbs.).
4. Install the transaxle. Refer to Transmission and Transfer Case/Automatic - 41TE - Installation or Transmission and Transfer Case/Automatic - 62TE - Installation .

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

LIFTER(S), HYDRAULIC**Description****DESCRIPTION**



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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 **Engine/Lubrication - Diagnosis and Testing**.

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

OIL LEVEL TOO HIGH

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

OIL LEVEL TOO LOW

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

VALVE TRAIN NOISE

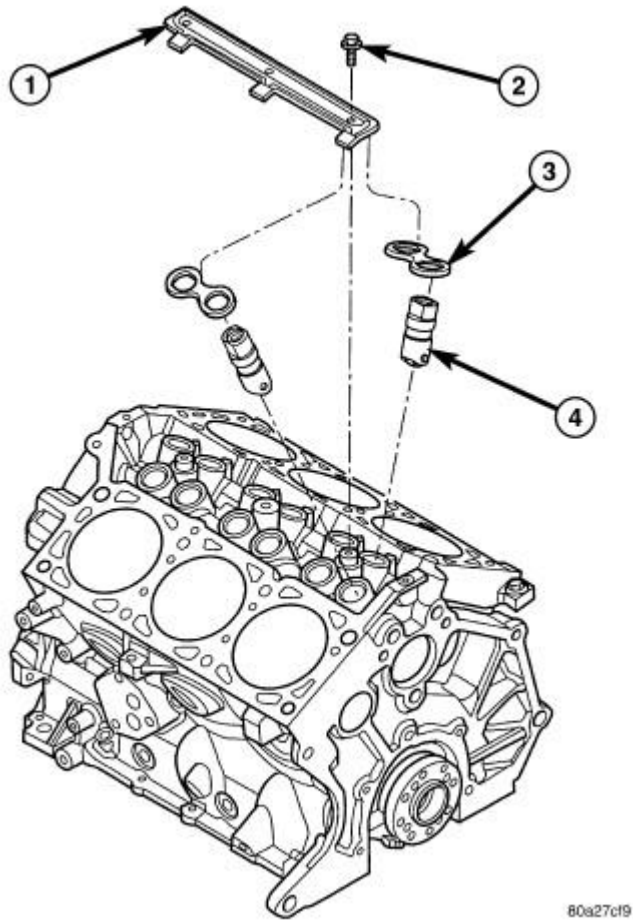
To determine source of valve train noise, operate engine at idle with cylinder head covers removed and listen for source of the noise.

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

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

Removal

REMOVAL



80a27cf9

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 **Engine/Cylinder Head - Removal**.
2. Remove the yoke retainer (1) and aligning yokes (3).
3. Remove the hydraulic lifters. If lifters are to be reused, identify each lifter to ensure installation in original location.

Installation

INSTALLATION

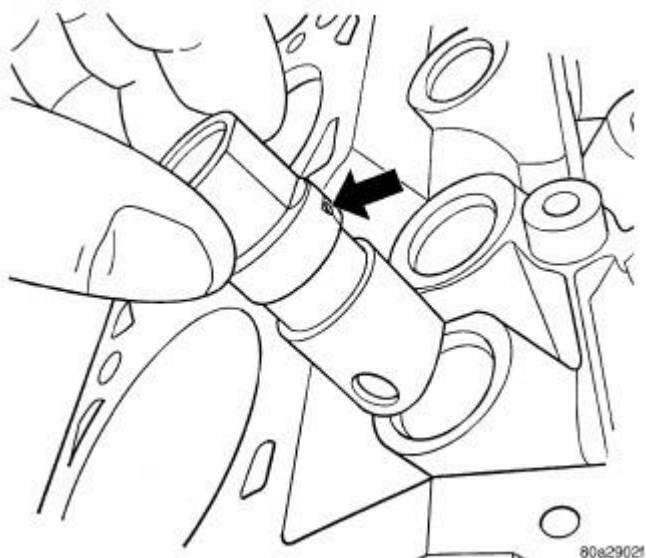


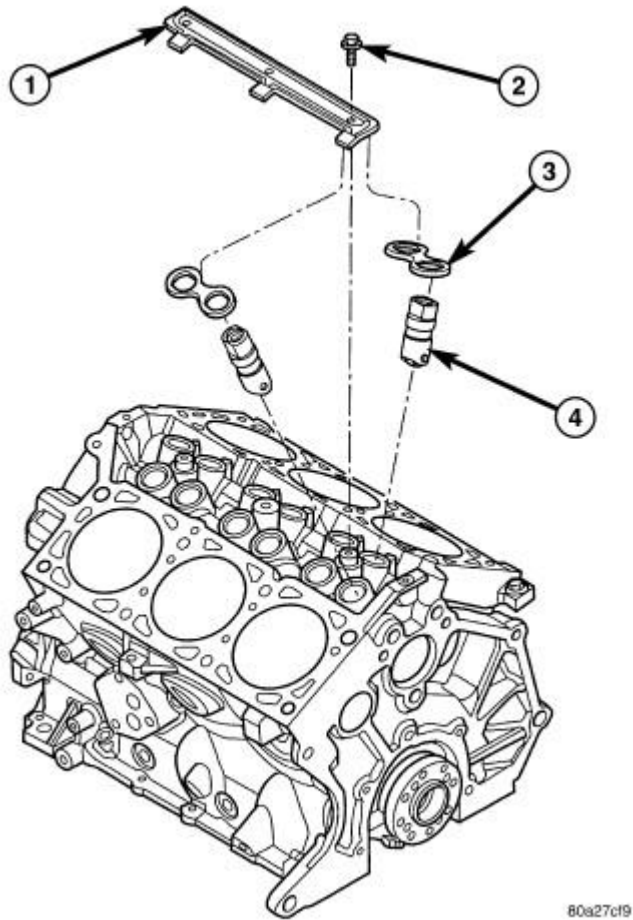
Fig. 118: LIFTER LUBRICATION HOLE

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.



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Fig. 119: HYDRAULIC LIFTERS

Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - YOKE RETAINER
 2 - BOLT - YOKE RETAINER
 3 - ALIGNING YOKE
 4 - HYDRAULIC LIFTER</p> |
|---|

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 **Engine/Cylinder Head - Installation**.
6. Start and operate engine. Warm up to normal operating temperature.

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

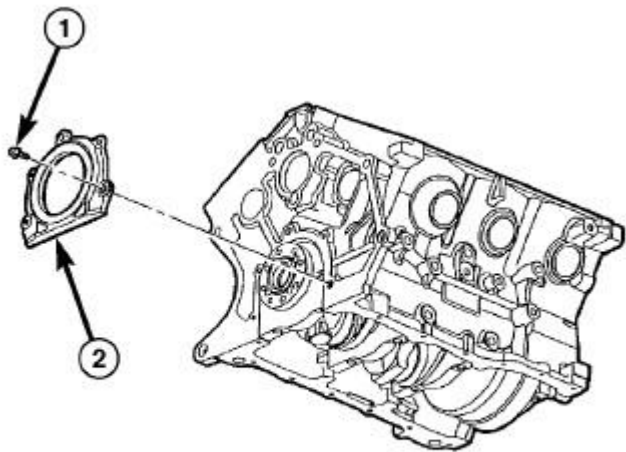
RETAINER, CRANKSHAFT REAR OIL SEAL

Removal

REMOVAL

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

1. Remove the transmission. Refer to Transmission and Transfer Case/Automatic - 41TE - Removal or Transmission and Transfer Case/Automatic - 62TE - Removal.
2. Remove the flex plate. See Engine/Engine Block/FLEXPLATE - Removal.



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Fig. 120: Removing/Installing Crankshaft Rear Oil Seal
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - OIL SEAL
2 - BOLT
3 - RETAINER - OIL SEAL
4 - GASKET</p> |
|---|

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

Installation

INSTALLATION

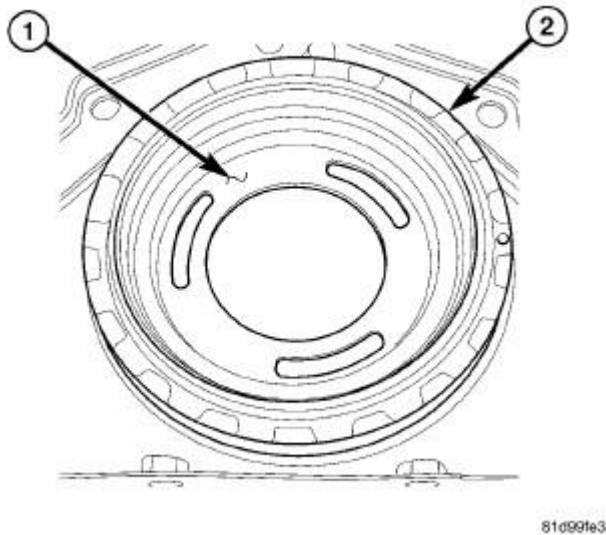


Fig. 121: Identifying Installation Sleeve
Courtesy of CHRYSLER LLC

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

1. Remove any original sealer, oil, or debris from the rear oil seal retainer assembly mounting area.
2. Place a bead (approximately 1/4 in. diameter) of Mopar® Engine RTV GEN II in the lower corners of the rear crankshaft oil seal retainer mounting surface, where the seal retainer meets the oil pan (the T-Joint).
3. Place the rear crankshaft oil seal assembly over the rear crankshaft flange. Do not press the seal assembly over the rear crankshaft flange at this time.
4. Using both hands, one on each side of the rear crankshaft flange, press the rear crankshaft oil seal over the rear crankshaft flange.
5. Ensure that the extruded dowels in the rear of the crankshaft oil seal retainer are seated in the locating holes in the rear of the engine block.
6. Install the five rear crankshaft oil seal retainer fasteners. Do not tighten at this time.
7. Remove and discard the plastic installation sleeve (1).
8. Tighten the five rear crankshaft oil seal retainer fasteners to 11.8 N.m (105 in. lbs.).
9. Install the flex plate. See **Engine/Engine Block/FLEXPLATE - Installation**.
10. Install the transmission. Refer to **Transmission and Transfer Case/Automatic - 41TE - Installation** or **Transmission and Transfer Case/Automatic - 62TE - Installation**.

RING(S), PISTON

Standard Procedure

PISTON RING FITTING

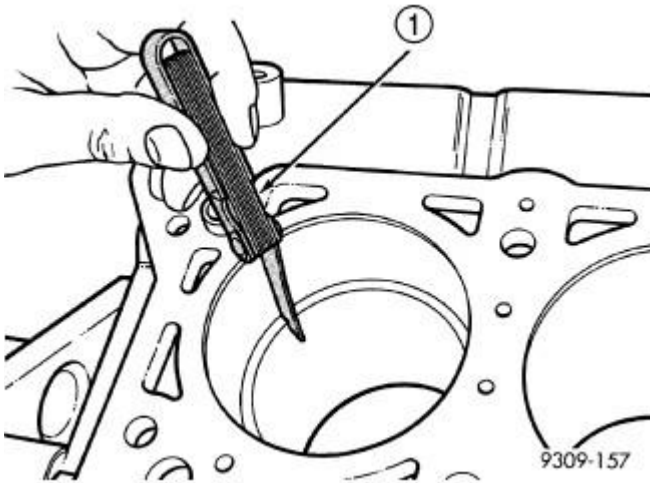


Fig. 122: Check Gap on Piston Rings
Courtesy of CHRYSLER LLC

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 **Engine - Specifications**.

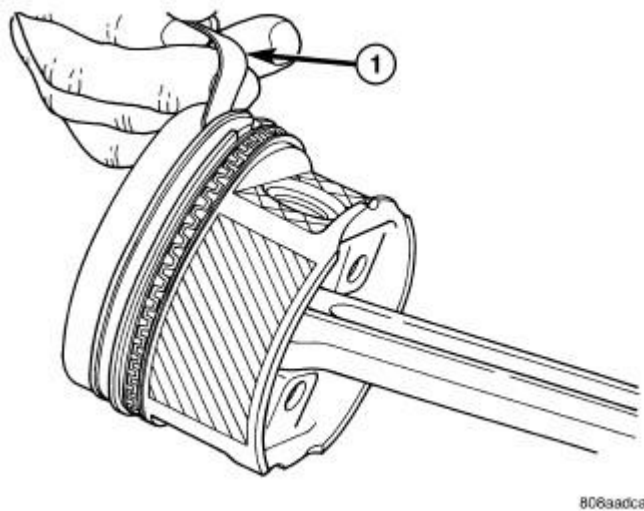


Fig. 123: Piston Ring Side Clearance
Courtesy of CHRYSLER LLC

1 - FEELER GAUGE

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

Removal

REMOVAL

1. Remove piston and connecting rod. See Engine/Engine Block/ROD, Piston and Connecting - 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

INSTALLATION

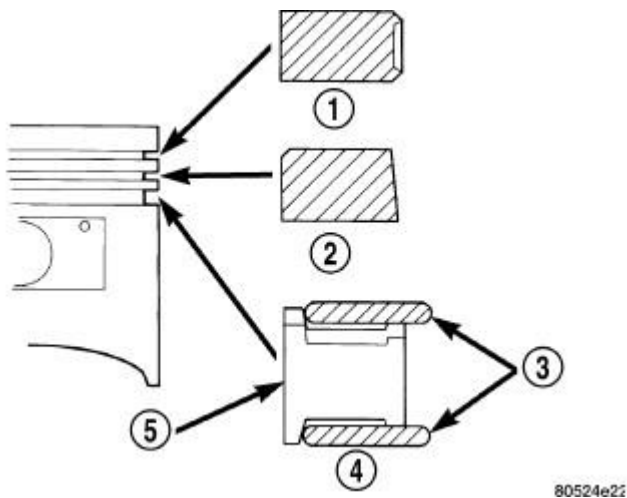


Fig. 124: Piston Ring Installation
Courtesy of CHRYSLER LLC

- 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:

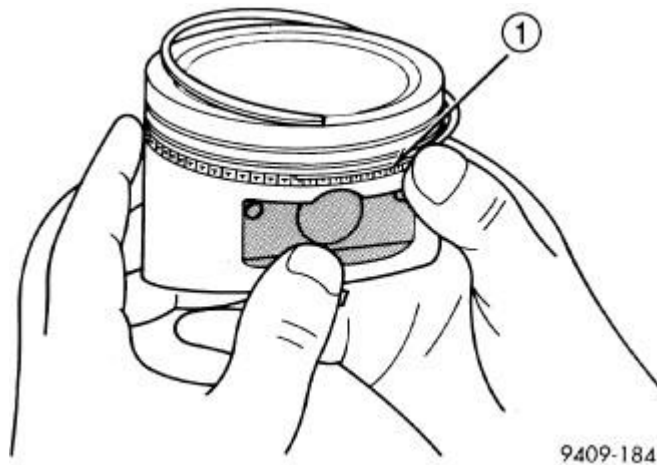
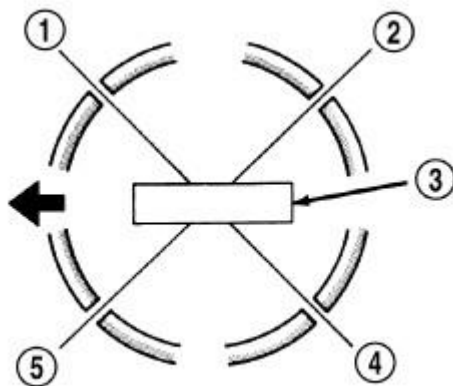


Fig. 125: Installing Side Rail
Courtesy of CHRYSLER LLC

1 - SIDE RAIL END

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



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Fig. 126: 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.

ROD, PISTON AND CONNECTING

Description

DESCRIPTION

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

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

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

Standard Procedure

FITTING CONNECTING RODS

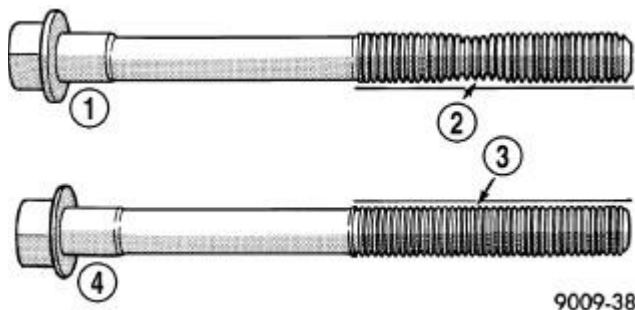
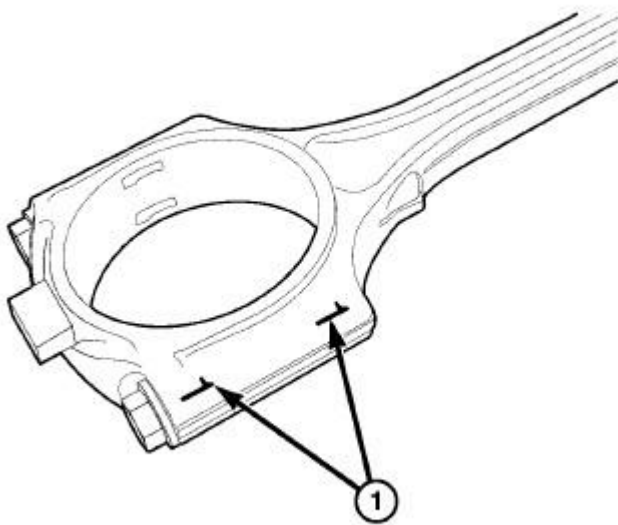


Fig. 127: Checking Cylinder Head Bolts
Courtesy of CHRYSLER LLC

- 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.



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Fig. 128: 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 **Engine/Engine Block/BEARING(S), Connecting Rod - Standard Procedure**. Fit all connecting rods on one bank until complete.

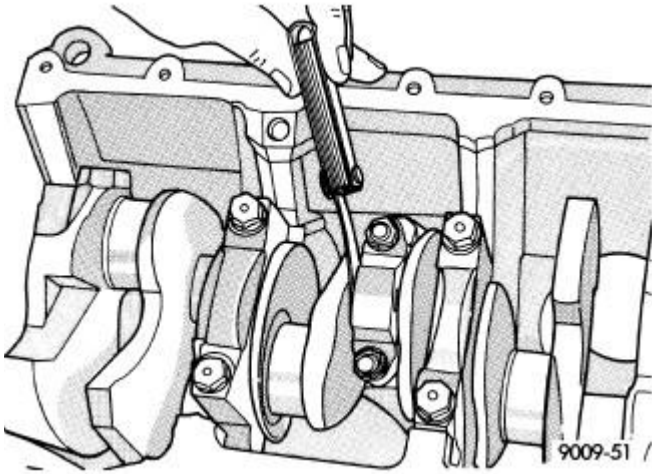


Fig. 129: Checking Connecting Rod To Crankshaft Journal Flange Clearance

Courtesy of CHRYSLER LLC

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

FITTING PISTONS

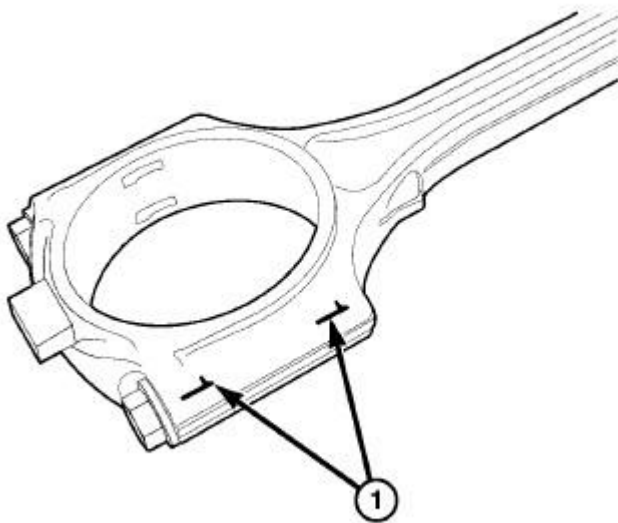
NOTE: **Pistons and connecting rods are machined to tight weight tolerances and need not be sorted in any way.**

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

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

Removal

REMOVAL



814311e7

Fig. 130: 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 Engine/Engine Block/ROD, Piston and Connecting - Description.

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

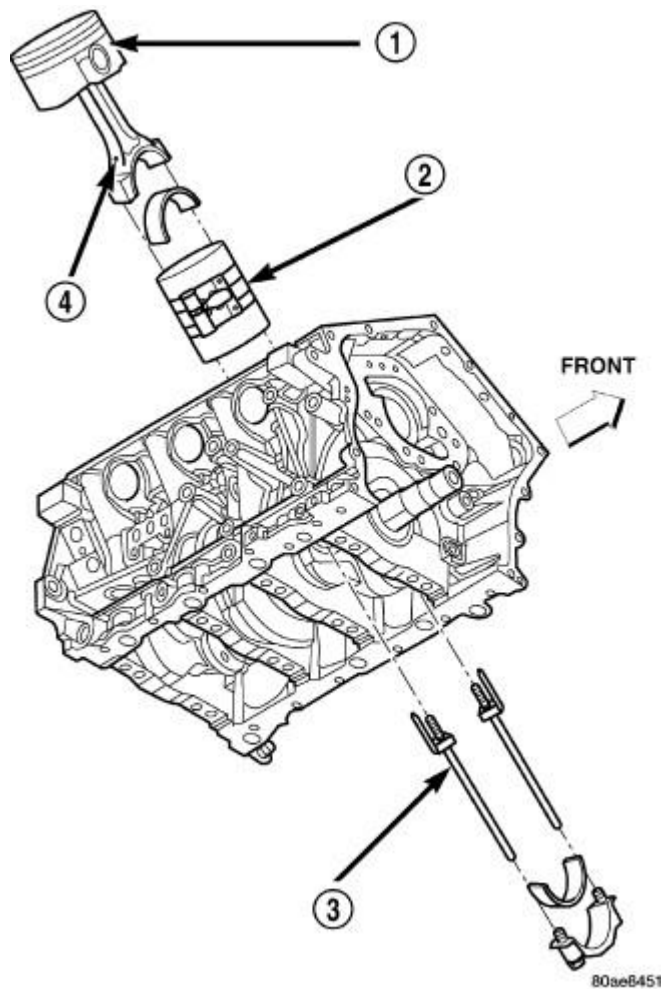


Fig. 131: PISTON AND CONNECTING ROD
Courtesy of CHRYSLER LLC

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

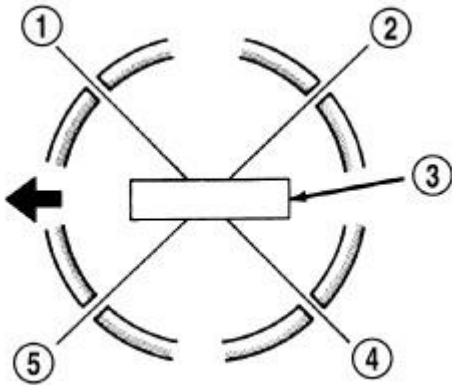
6. Remove connecting rod cap. Install Guide Pins 8189 (3) on connecting rod to guide cracked connecting rod (4).
7. Remove each piston (1) and connecting rod assembly (4) out of the cylinder bore.

NOTE: Be careful not to nick crankshaft journals.

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

Installation

INSTALLATION



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Fig. 132: 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 Engine/Engine Block/ROD, Piston and Connecting - Description.

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

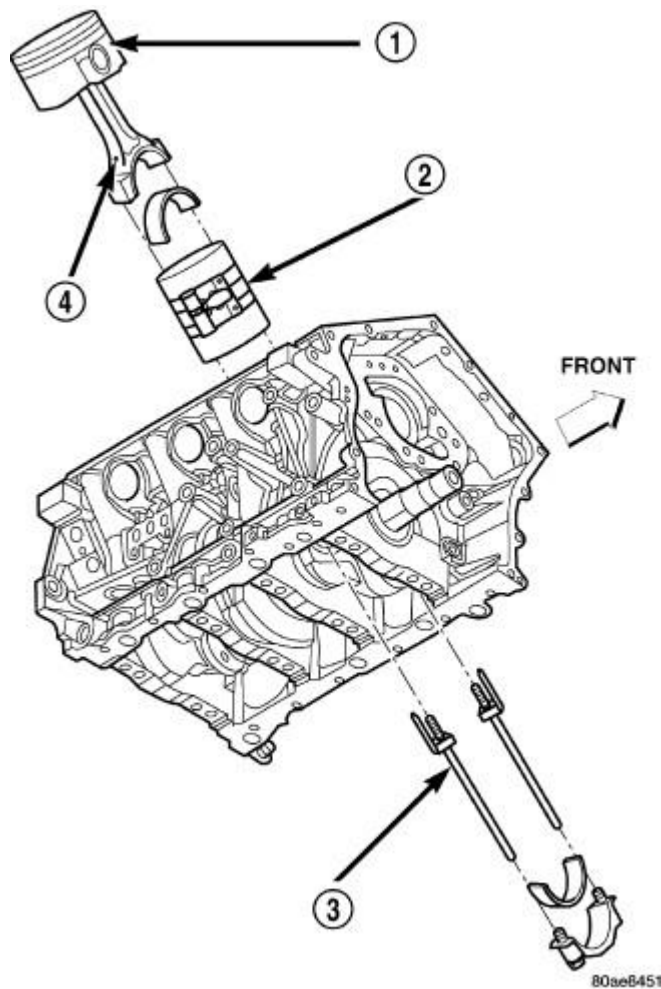
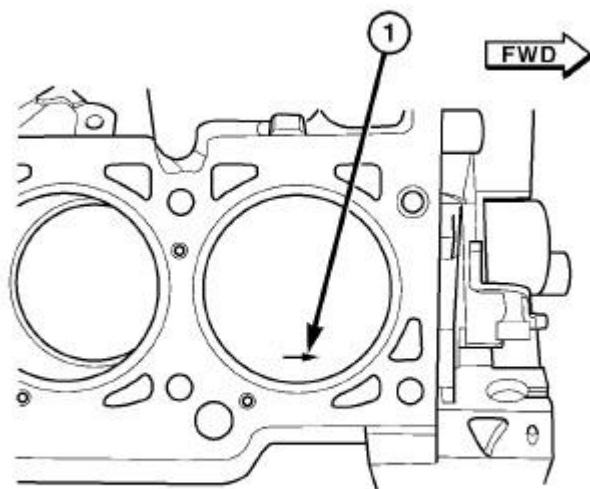


Fig. 133: PISTON AND CONNECTING ROD
 Courtesy of CHRYSLER LLC

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

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



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Fig. 134: Identifying Proper Piston Orientation
Courtesy of CHRYSLER LLC

1 - ARROW FACES FRONT OF ENGINE

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

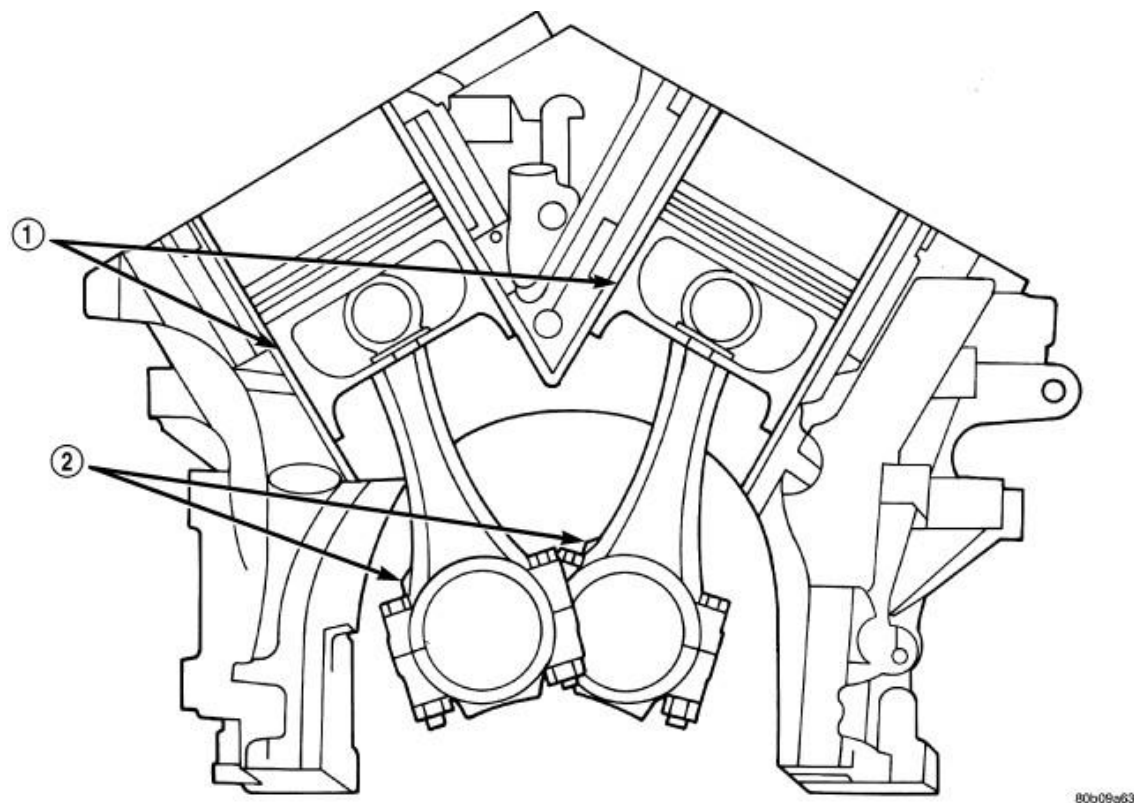


Fig. 135: Piston and Connecting Rod Positioning
Courtesy of CHRYSLER LLC

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

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

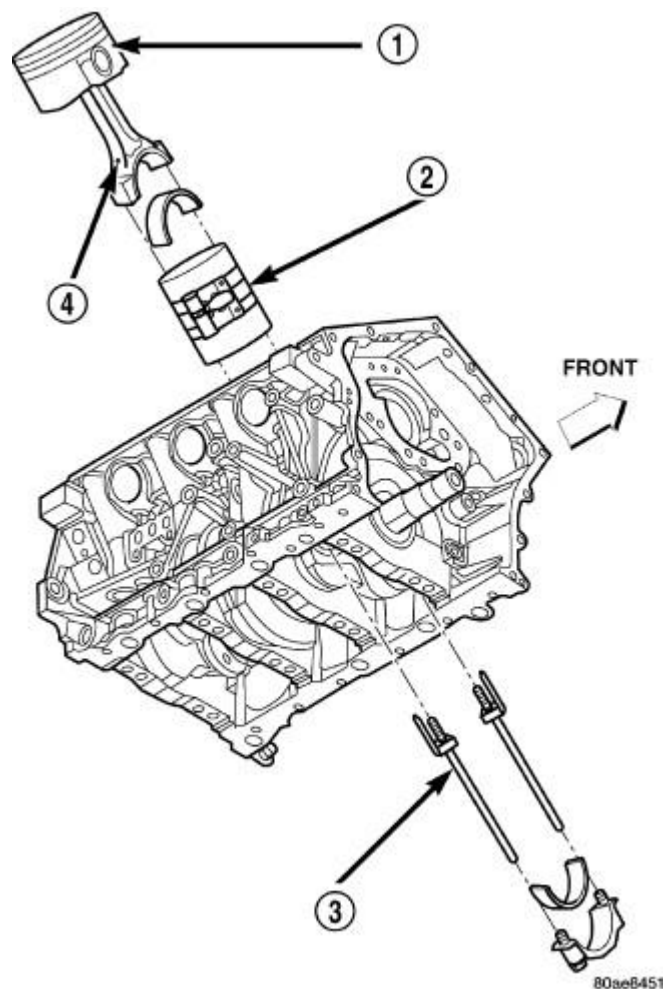


Fig. 136: PISTON AND CONNECTING ROD
Courtesy of CHRYSLER LLC

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

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

11. Install the cylinder heads. See [Engine/Cylinder Head - Installation](#).
12. Install the oil pan. See [Engine/Lubrication/PAN, Oil - Installation](#).
13. Fill engine crankcase with proper oil to correct level. See [Engine/Lubrication/OIL - Standard Procedure](#).
14. Connect negative cable to battery.

SEAL, CRANKSHAFT OIL, FRONT

Removal

REMOVAL

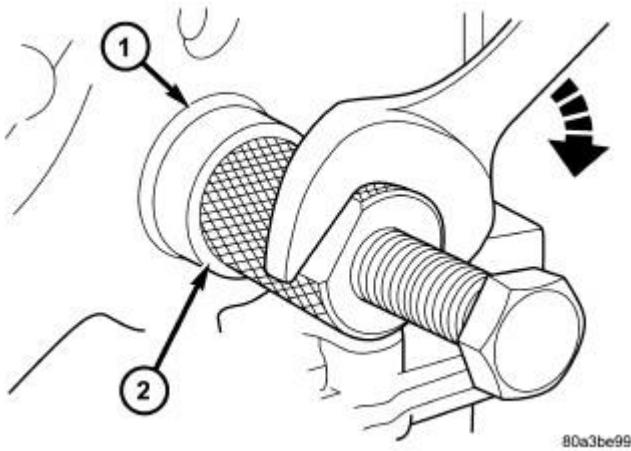


Fig. 137: Engaging Special Tool 6341A Into Front Crankshaft Oil Seal
 Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - SEAL</p> <p>2 - SPECIAL TOOL 6341A</p> |
|---|

1. Disconnect negative cable from battery.
2. Remove accessory drive belt. Refer to [Cooling/Accessory Drive/BELT, Serpentine - Removal](#).
3. Remove crankshaft damper. See [Engine/Engine Block/DAMPER, Vibration - 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

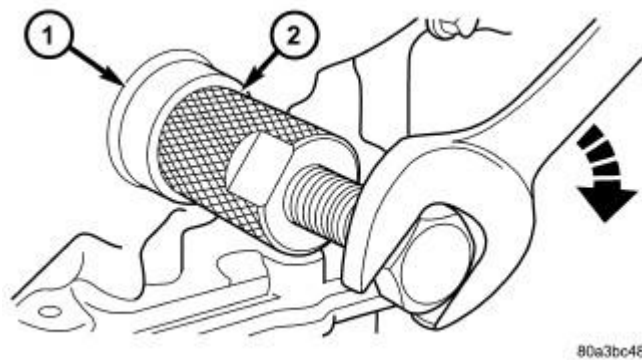


Fig. 138: CRANKSHAFT FRONT SEAL REMOVAL
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - SEAL
2 - SPECIAL TOOL 6341A</p> |
|--|

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

Installation

INSTALLATION

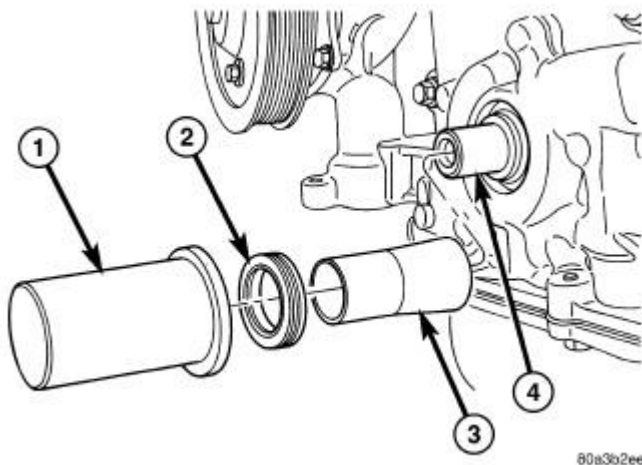


Fig. 139: CRANKSHAFT FRONT SEAL INSTALLATION
Courtesy of CHRYSLER LLC

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

- 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 **Engine/Engine Block/DAMPER, Vibration - Installation**.
5. Install accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation**.
6. Lower vehicle and connect negative cable to battery.

ENGINE MOUNTING

DESCRIPTION

DESCRIPTION

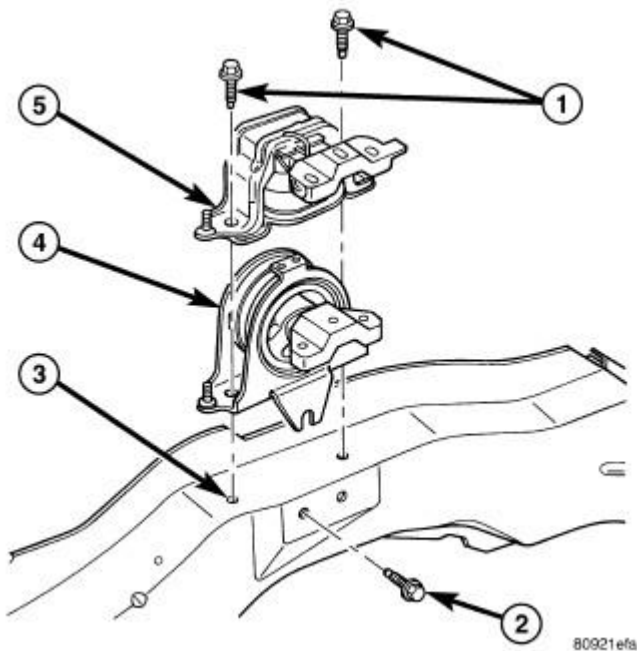
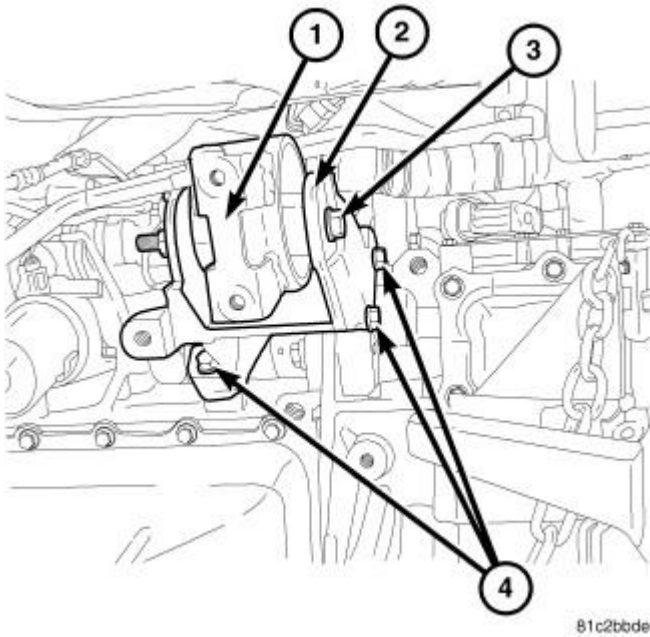


Fig. 140: Engine Hydro-type Mount - Right Side
Courtesy of CHRYSLER LLC

- | |
|-----------------------------------|
| 1 - BOLT |
| 2 - BOLT |
| 3 - FRAME RAIL |
| 4 - RIGHT MOUNT - 2.4L ENGINE |
| 5 - RIGHT MOUNT - 3.3/3.8L ENGINE |

The engine mounting system consist of four mounts; right and a left side support the powertrain, and a front and a rear mount control powertrain torque. The right side mount is a hydro-type (5), all others are of molded rubber material.

INSULATOR, ENGINE MOUNT, FRONT**Removal****REMOVAL****Fig. 141: Identifying Front Engine Mount****Courtesy of CHRYSLER LLC**

1. Support the engine and transmission assembly with a floor jack so it will not rotate.
2. Remove the front engine mount thru bolt (3) from the insulator and front crossmember mounting bracket (2).
3. Remove the air dam to allow access to the front mount screws.
4. Remove the front engine mount bolts and remove the insulator assembly (1).
5. Remove the front mounting bracket, if necessary.

Installation**INSTALLATION**

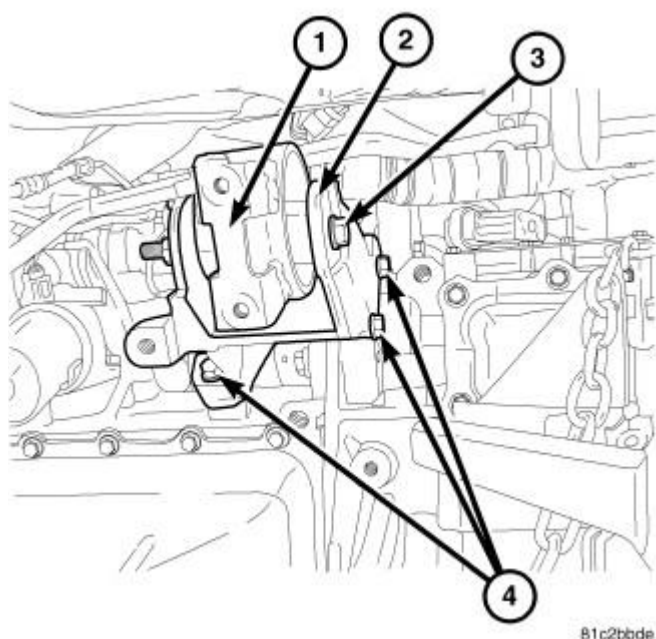


Fig. 142: Identifying Front Engine Mount
Courtesy of CHRYSLER LLC

1. Install the front mounting bracket (2), if removed.
2. Install the front engine mount thru bolt (3) thru the insulator and front crossmember mounting bracket (2).
3. Install the insulator assembly and mounting bolts.

INSULATOR, ENGINE MOUNT, LEFT

Removal

REMOVAL

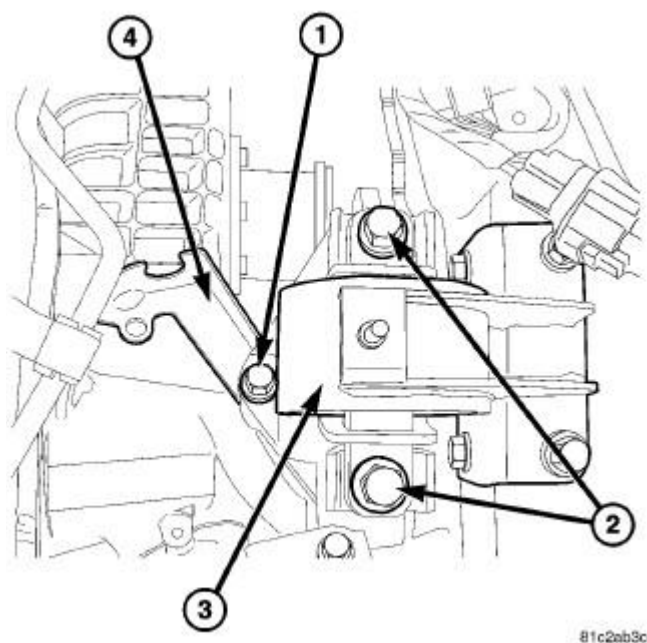


Fig. 143: Removing Left Engine Mount Insulator
Courtesy of CHRYSLER LLC

1. Raise the vehicle on hoist.
2. Remove the left front wheel.
3. Remove the left mount thru bolt access cover.
4. Support the transaxle with a suitable jack.
5. Remove the engine front mount thru bolt to allow left mount removal clearance.
6. Remove the left mount thru frame rail bolt (2).
7. Lower transaxle for access to horizontal bolts.
8. Remove the horizontal bolts (2) from the mount (1) to the transaxle (3).

NOTE: To remove mount, additional lowering of transaxle may be required.

9. Remove left mount.

Installation

INSTALLATION

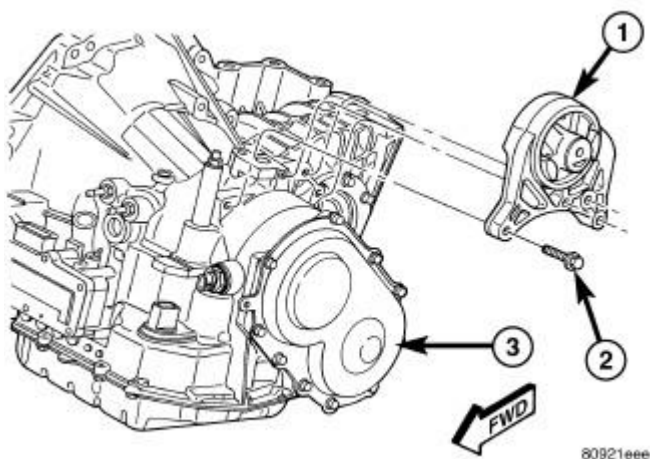


Fig. 144: Installing Left Engine Mount Insulator (1 Of 2)
Courtesy of CHRYSLER LLC

- 1 - LEFT MOUNT ASSEMBLY
- 2 - BOLT - 54 N.m (40 ft. lbs.)
- 3 - TRANSAXLE - 41TE

1. Install left mount (1) on transaxle (3).
2. Raise transaxle (3) with jack until left mount is in position.

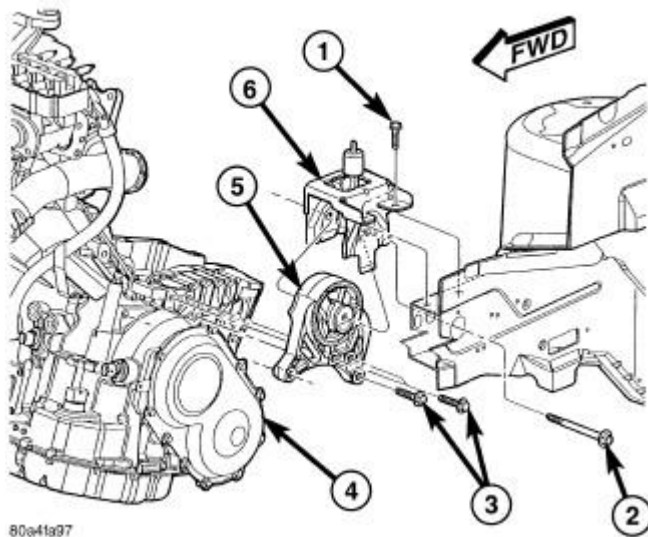


Fig. 145: Installing Left Engine Mount Insulator (2 Of 2)
Courtesy of CHRYSLER LLC

- 1 - BOLT - BRACKET TO FRAME RAIL
- 2 - BOLT - MOUNT TO RAIL THRU

- 3 - BOLT - LEFT MOUNT TO TRANSAXLE
- 4 - TRANSAXLE
- 5 - MOUNT - LEFT
- 6 - BRACKET - LEFT MOUNT

3. Install left mount thru bolt (2).
4. Install left mount through bolt access cover.
5. Install front mount through bolt.
6. Install left front wheel.
7. Lower vehicle.

INSULATOR, ENGINE MOUNT, REAR

Removal

REMOVAL

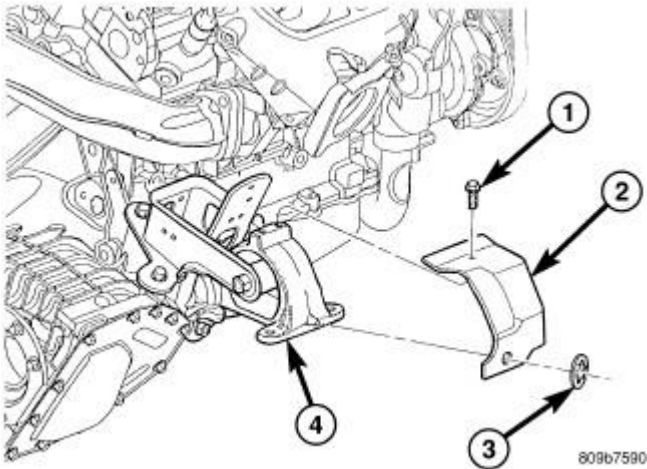


Fig. 146: Rear Mount Heat Shield
Courtesy of CHRYSLER LLC

- 1 - BOLT - HEAT SHIELD 11 N.m (100 in. lbs.)
- 2 - HEAT SHIELD
- 3 - CLIP
- 4 - REAR MOUNT

1. Raise vehicle on hoist.
2. Remove the rear mount heat shield (2).

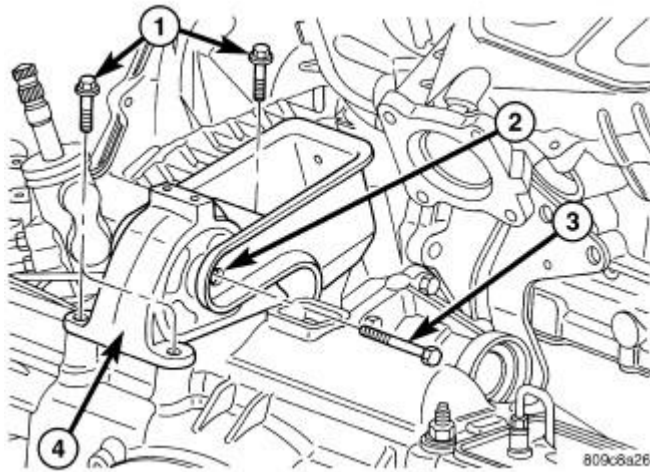


Fig. 147: Removing/Installing Rear Engine Mount
Courtesy of CHRYSLER LLC

- 1 - BOLT 54 N.m (40 ft. lbs.)
- 2 - REAR MOUNT BRACKET
- 3 - THRU-BOLT 54 N.m (40 ft. lbs.)
- 4 - REAR MOUNT

3. Remove the thru bolt (3) from the mount (4) and rear mount bracket (2).
4. Remove the mount bolts (1).
5. Remove the rear mount (4).

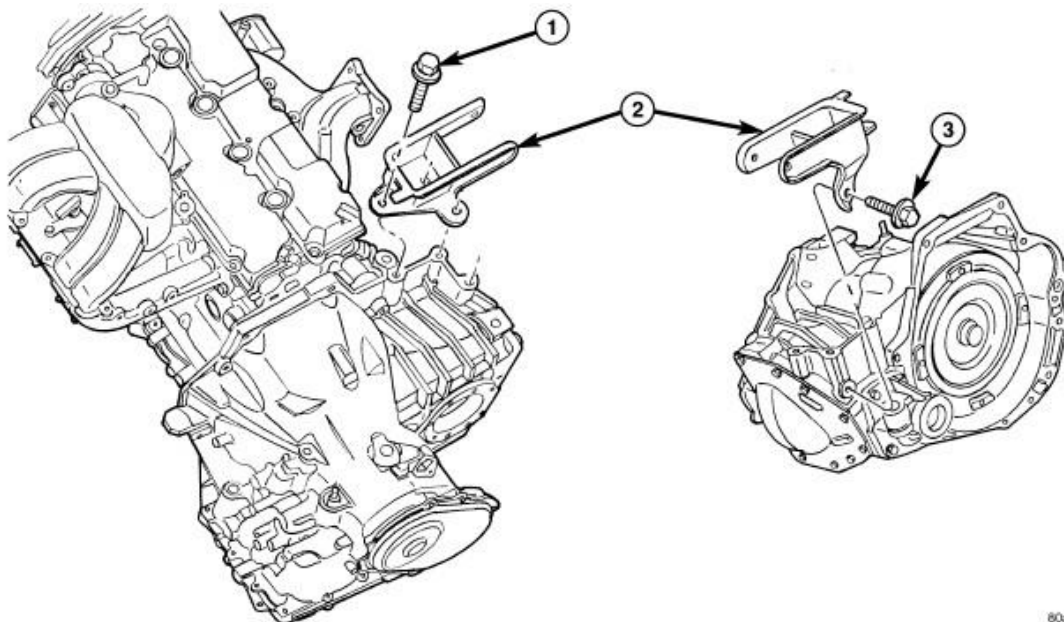


Fig. 148: Removing/Installing Rear Mount Bracket
Courtesy of CHRYSLER LLC

- 1 - BOLT - VERTICAL 102 N.m (75 ft. lbs.)
- 2 - BRACKET - REAR MOUNT
- 3 - BOLT - HORIZONTAL 102 N.m (75 ft. lbs.)

6. For rear mount bracket removal, remove the bolts (1,3) attaching bracket (2) to transaxle.
7. Remove rear mount bracket.

Installation

INSTALLATION

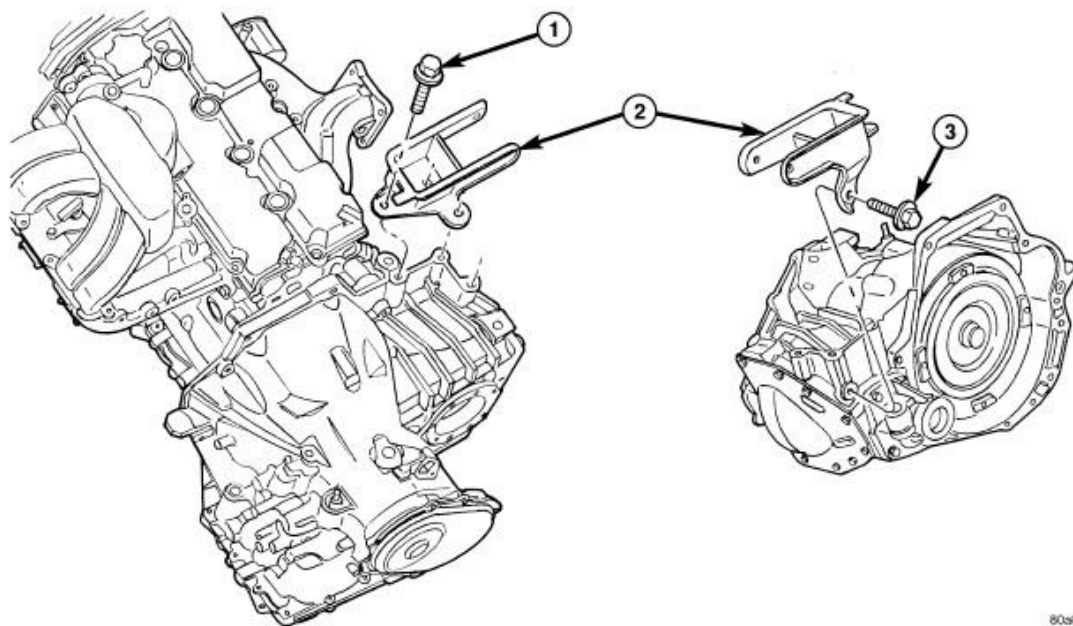


Fig. 149: Removing/Installing Rear Mount Bracket
Courtesy of CHRYSLER LLC

- 1 - BOLT - VERTICAL 102 N.m (75 ft. lbs.)
- 2 - BRACKET - REAR MOUNT
- 3 - BOLT - HORIZONTAL 102 N.m (75 ft. lbs.)

1. Install rear mount bracket (2), if removed.

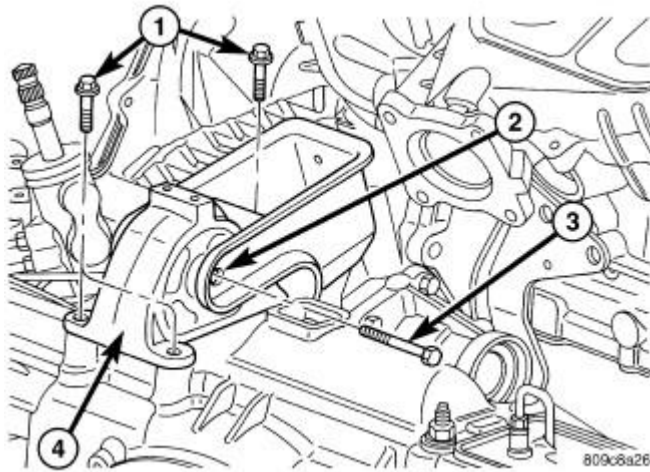


Fig. 150: Removing/Installing Rear Engine Mount
Courtesy of CHRYSLER LLC

- 1 - BOLT 54 N.m (40 ft. lbs.)
- 2 - REAR MOUNT BRACKET
- 3 - THRU-BOLT 54 N.m (40 ft. lbs.)
- 4 - REAR MOUNT

2. Install the rear mount (4) and bolts (1). Tighten bolts to 54 N.m (40 ft. lbs.).
3. Install the mount thru bolt (3) to the mount and bracket (2). Tighten through bolt (3) to 54 N.m (40 ft. lbs.).

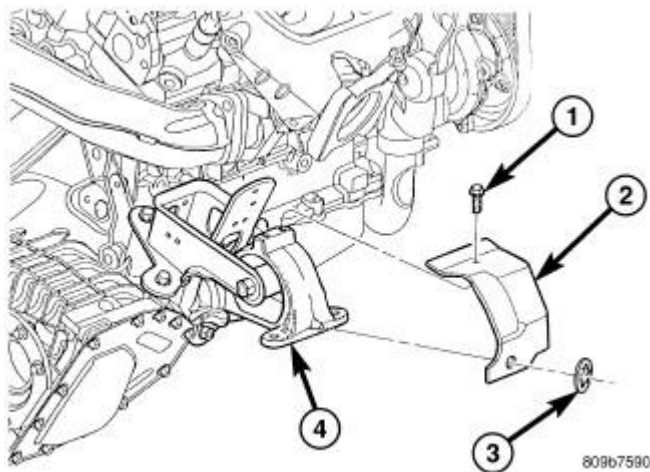


Fig. 151: Rear Mount Heat Shield
Courtesy of CHRYSLER LLC

- 1 - BOLT - HEAT SHIELD 11 N.m (100 in. lbs.)
- 2 - HEAT SHIELD
- 3 - CLIP

4 - REAR MOUNT

4. Install the rear mount heat shield (2).
5. Lower vehicle on hoist.

INSULATOR, ENGINE MOUNT, RIGHT

Removal

REMOVAL

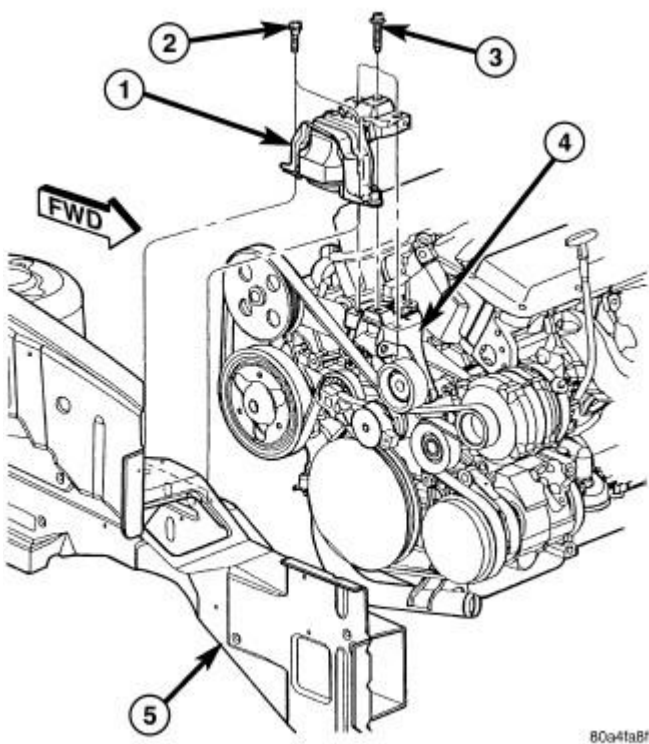
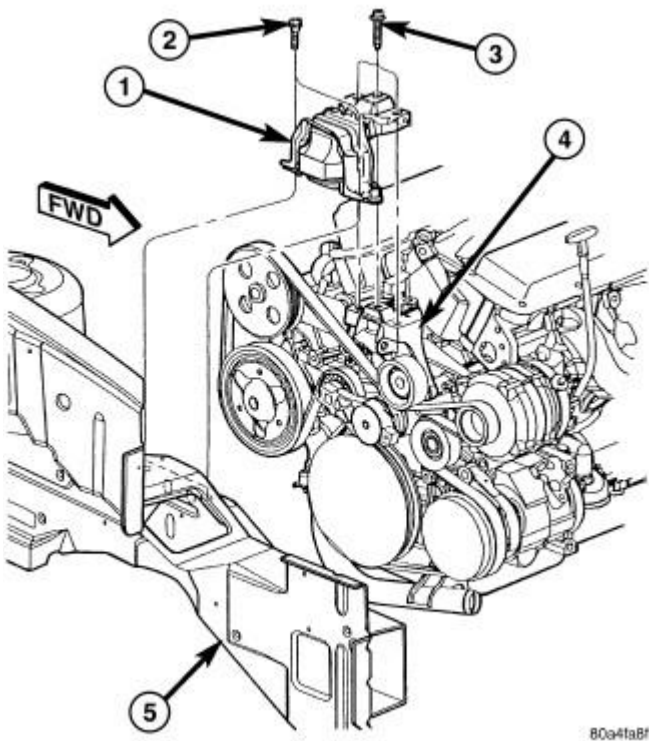


Fig. 152: Right Engine Mount
Courtesy of CHRYSLER LLC

- 1 - RIGHT ENGINE MOUNT
- 2 - BOLT - MOUNT TO FRAME RAIL
- 3 - BOLT - MOUNT TO ENGINE
- 4 - ENGINE MOUNT BRACKET
- 5 - RIGHT FRAME RAIL

1. Remove air cleaner housing lid and clean air hose from throttle body.
2. Remove air cleaner element and housing.
3. Disconnect make-up air hose from cylinder head cover.

4. Remove the load on the right engine mount (1) by carefully supporting the engine assembly with a floor jack.
5. Disconnect electrical harness support clips from engine mount bracket.
6. Remove the bolts (2,3) attaching the engine mount (1) to the frame rail.
7. Remove the three bolts attaching the engine mount to the engine bracket (4).
8. Remove the right engine mount (1).

Installation**INSTALLATION****Fig. 153: Right Engine Mount****Courtesy of CHRYSLER LLC**

- | |
|--|
| 1 - RIGHT ENGINE MOUNT
2 - BOLT - MOUNT TO FRAME RAIL
3 - BOLT - MOUNT TO ENGINE
4 - ENGINE MOUNT BRACKET
5 - RIGHT FRAME RAIL |
|--|

1. Install engine bracket (4) (if removed). Tighten bolts to 33 N.m (24 ft. lbs.).
2. Position right engine mount (1) and install frame rail to mount bolts (2). Tighten bolts to 68 N.m (50 ft. lbs.).

3. Install the mount to engine bracket bolts (3) and tighten to 54 N.m (40 ft. lbs.).
4. Connect electrical harness support clips to engine mount bracket.
5. Remove jack from under engine.
6. Connect make-up air hose to cylinder head cover.
7. Install air cleaner housing and element.
8. Install air cleaner housing lid and clean air tube to throttle body.

LUBRICATION

DESCRIPTION

DESCRIPTION

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

OPERATION

OPERATION

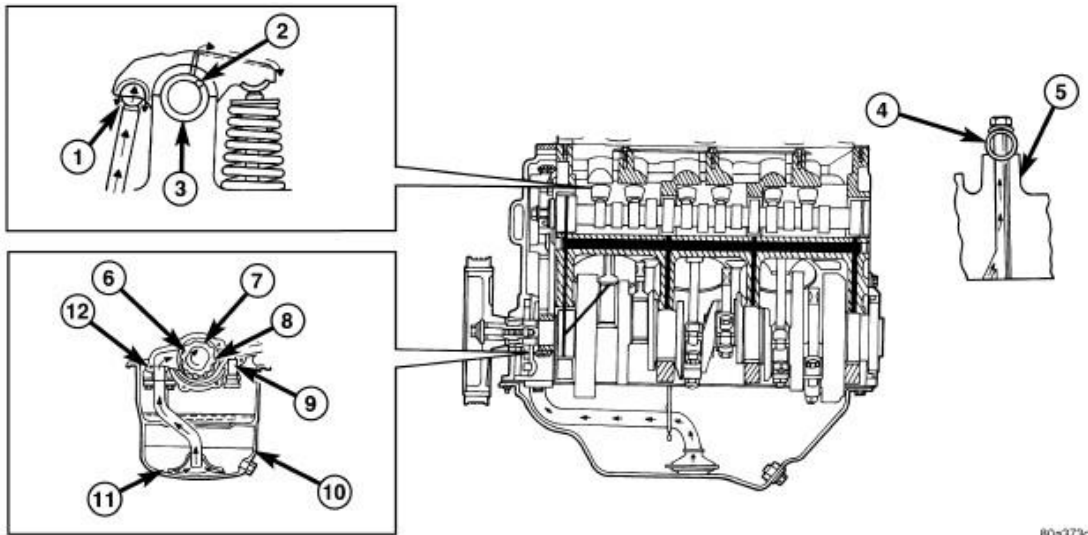


Fig. 154: Engine Oiling System
Courtesy of CHRYSLER LLC

- | | |
|---|------------------|
| 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 | 10 - OIL PAN |

HEAD, THIRD FROM FRONT ON LEFT HEAD

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.

DIAGNOSIS AND TESTING

ENGINE OIL PRESSURE

1. Disconnect and remove oil pressure switch. See Engine/Lubrication/SWITCH, Oil Pressure - Removal.
2. Install Special Tools C-3292A Gauge with 8406 Adaptor. For Special Tool identification, see Engine - Special Tools.
3. Start engine and record oil pressure. Refer to Oil Pressure in Engine Specifications for the correct pressure. See Engine - Specifications.

ADAPTER, OIL FILTER

Removal

REMOVAL

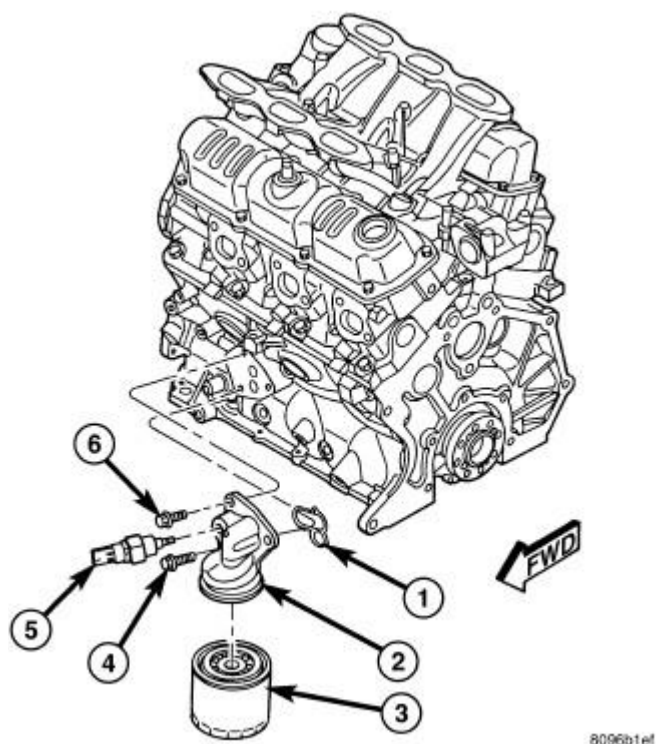


Fig. 155: Removing/Installing Oil Filter Adapter
Courtesy of CHRYSLER LLC

- 1 - SEAL
- 2 - OIL FILTER ADAPTER
- 3 - OIL FILTER
- 4 - BOLT
- 5 - OIL PRESSURE SWITCH
- 6 - BOLT

1. Raise vehicle on hoist.
2. Remove the oil filter.
3. Disconnect oil pressure switch electrical connector.
4. Remove oil filter adapter attaching bolts.
5. Remove oil filter adapter (2) and seal.

Installation

INSTALLATION

1. Clean oil filter adapter and install new seal.
2. Position adapter on engine block and install bolts.
3. Tighten adapter bolts to 28 N.m (250 in. lbs.).

4. Connect oil pressure switch electrical connector.
5. Install the oil filter.
6. Lower vehicle on hoist.
7. Start engine and allow to run approximately 2 minutes.
8. Turn off engine and check oil level. Adjust oil level as necessary.

COOLER AND LINES, OIL

Description

DESCRIPTION

An engine oil cooler is used on 3.3/3.8L engines (Heavy Duty Cooling Only). The cooler is a coolant-to-oil type and mounted between the oil filter and engine block.

Operation

OPERATION

Engine oil travels from the oil filter and into the oil cooler. Engine oil then exits the cooler into the main gallery. Engine coolant flows into the cooler from the heater return tube and exits into the water pump inlet.

Removal

REMOVAL

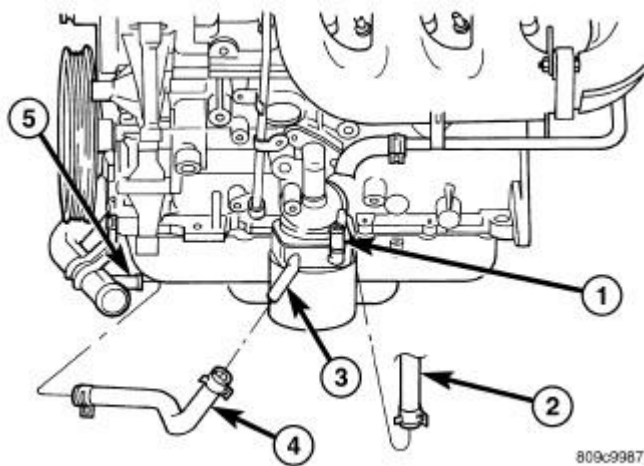


Fig. 156: Engine Oil Cooler Hoses
Courtesy of CHRYSLER LLC

- | |
|----------------------------|
| 1 - OIL COOLER INLET TUBE |
| 2 - INLET HOSE |
| 3 - OIL COOLER OUTLET TUBE |

4 - OUTLET HOSE

5 - WATER PUMP INLET TUBE

1. Drain cooling system. Refer to Cooling - Standard Procedure .
2. Disconnect oil cooler inlet and outlet hoses (2,4).

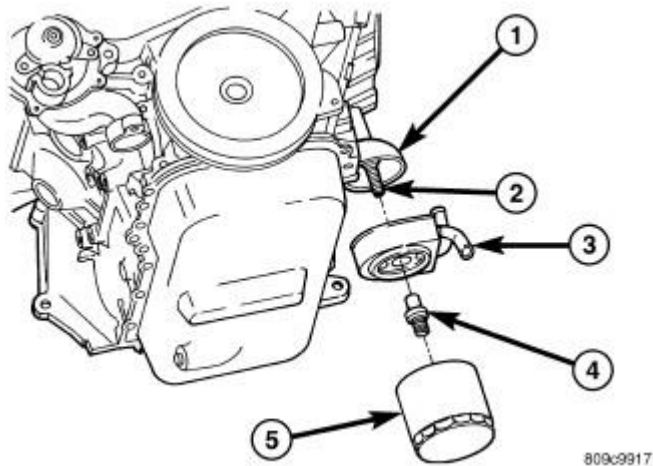


Fig. 157: Engine Oil Cooler - 3.3/3.8L (Heavy Duty Cooling)
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - OIL FILTER ADAPTER
 2 - CONNECTOR
 3 - ENGINE OIL COOLER
 4 - OIL COOLER ATTACHMENT FITTING
 5 - OIL FILTER</p> |
|--|

3. Remove oil filter (5).
4. Remove oil cooler attachment fitting (4).
5. Remove oil cooler (3).

Installation

INSTALLATION

1. Lubricate seal and position oil cooler to connector fitting on oil filter adapter.

NOTE: Position the flat side of oil cooler parallel to oil pan rail.

2. Install oil cooler attachment fitting and tighten to 27 N.m (20 ft. lbs.).
3. Install oil filter.
4. Connect oil cooler inlet and outlet hoses.

5. Fill cooling system. Refer to **Cooling - Standard Procedure**.

FILTER, ENGINE OIL

Removal

REMOVAL

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

1. Using suitable oil filter wrench, turn filter counterclockwise to remove from oil filter adapter. Properly discard used oil filter.

Installation

INSTALLATION

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 until gasket contacts base. Tighten filter 1 turn or 20 N.m (15 ft. lbs.). Use filter wrench if necessary.
4. Start engine and check for leaks.

OIL

Standard Procedure

ENGINE OIL AND FILTER CHANGE

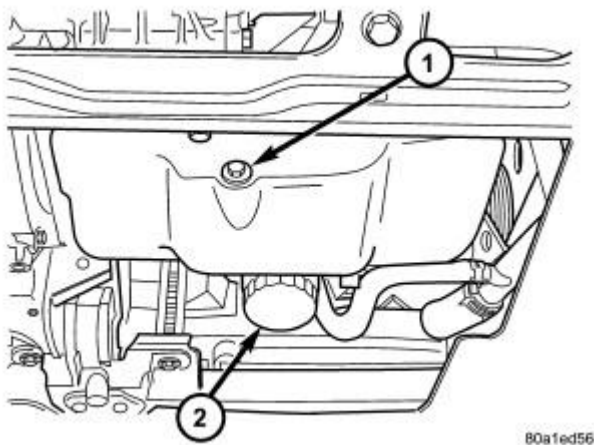


Fig. 158: Engine Oil Drain Plug and Oil Filter
Courtesy of CHRYSLER LLC

1 - DRAIN PLUG**2 - OIL FILTER**

Change engine oil at mileage and time intervals described in the Maintenance Schedule. Refer to **Vehicle Quick Reference/Maintenance Schedules - Description** .

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

Run engine until achieving normal operating temperature.

1. Position the vehicle on a level surface and turn engine off.
2. Open hood, remove oil fill cap.
3. Hoist and support vehicle on safety stands. Refer to Hoisting and Jacking Recommendations. Refer to **Vehicle Quick Reference/Hoisting - Standard Procedure** .
4. Place a suitable drain pan under crankcase drain.
5. Remove drain plug (1) from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug and gasket if damaged.
6. Remove oil filter (2). See **Engine/Lubrication/FILTER, Engine Oil - Removal**.
7. Install and tighten drain plug in crankcase.
8. Install new oil filter. See **Engine/Lubrication/FILTER, Engine Oil - Installation**.
9. Lower vehicle and fill crankcase with specified type and amount of engine oil. Refer to **Vehicle Quick Reference/Capacities and Recommended Fluids - Description** .
10. Install oil fill cap.
11. Start engine and inspect for leaks.
12. Stop engine and inspect oil level.

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

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 only when the level is at or below the ADD mark.

PAN, OIL

Removal

REMOVAL

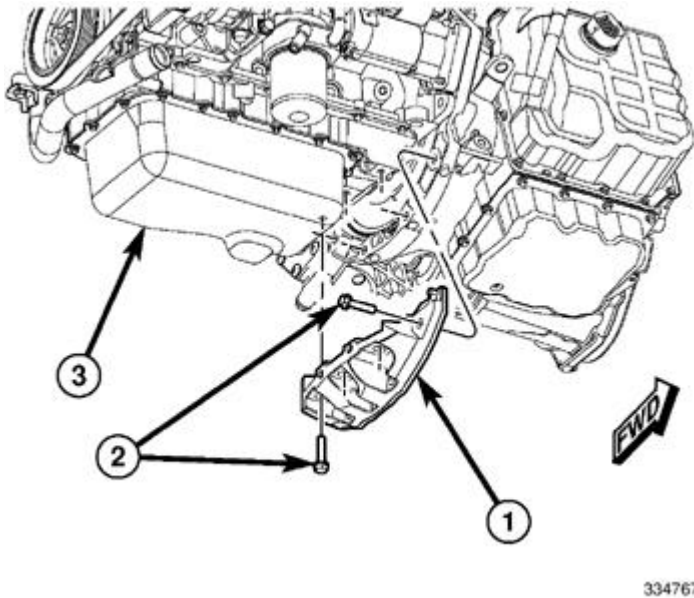


Fig. 159: Removing/Installing Oil Pan
Courtesy of CHRYSLER LLC

NOTE: This engine uses a two-piece oil pan. RTV is used between the upper and lower pans. The lower pan should not be separated from the upper pan unless this junction is leaking.

1. Disconnect and isolate the negative battery cable.
2. Remove the engine oil dipstick.
3. Raise and support the vehicle.
4. Drain engine oil.
5. Remove drive belt splash shield.
6. Remove the seven structural collar bolts (2) and structural collar (1).
7. Remove the upper oil pan bolts (4), oil pan (3) and gasket.

Cleaning

CLEANING

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

Inspection**INSPECTION**

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

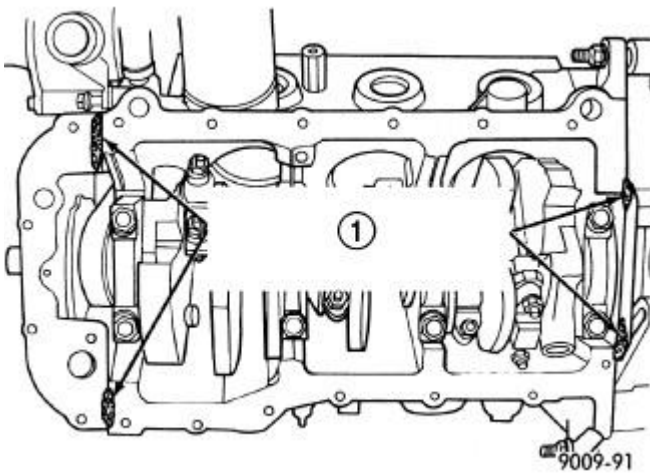
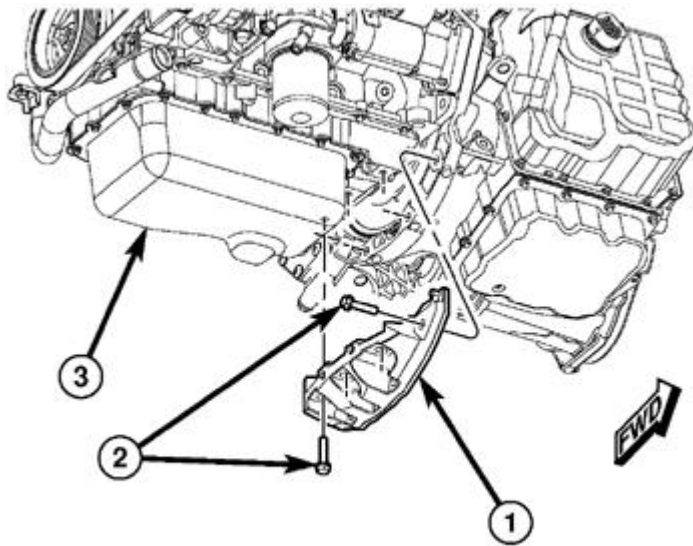
Installation**INSTALLATION**

Fig. 160: Oil Pan Sealing
Courtesy of CHRYSLER LLC

1 - SEALER LOCATIONS

NOTE: This engine uses a two-piece oil pan. RTV is used between the upper and lower pans. The lower pan should not be separated from the upper pan unless this junction is leaking.

1. Clean sealing surfaces and apply a 1/8 inch bead of Mopar® Engine RTV GEN II at the parting line (1) of the chain case cover and the rear seal retainer (1).



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Fig. 161: Removing/Installing Oil Pan
Courtesy of CHRYSLER LLC

2. Position a new pan gasket on oil pan.
3. Install oil pan (3) and tighten bolts (4) to 12 N.m (105 in. lbs.).
4. Install structural collar (1) and tighten bolts (2) to 75 N.m (55 ft. lbs.).
5. Install the drive belt splash shield.
6. Lower vehicle and install oil dipstick.
7. Connect negative cable to battery.
8. Fill crankcase with oil to proper level.

PUMP, ENGINE OIL

Description

DESCRIPTION

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

Removal

REMOVAL

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

1. Remove oil pan. See **Engine/Lubrication/PAN, Oil - Removal.**
2. Remove the timing chain cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal.**
3. Disassemble oil pump from timing chain cover. See **Engine/Lubrication/PUMP, Engine Oil - Disassembly.**

4. Clean and inspect oil pump components. See Engine/Lubrication/PUMP, Engine Oil - Cleaning. See Engine/Lubrication/PUMP, Engine Oil - Inspection.

Disassembly

DISASSEMBLY

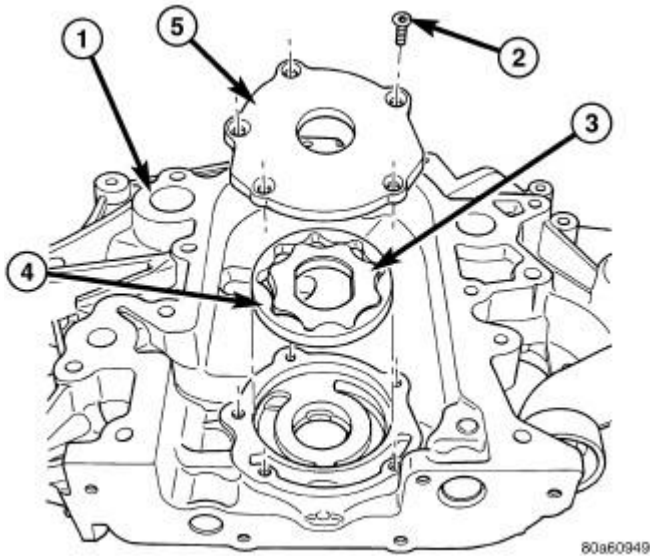


Fig. 162: OIL PUMP

Courtesy of CHRYSLER LLC

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

1. Remove oil pump cover screws, and lift off cover .
2. Remove oil pump rotors .
3. Clean and inspect oil pump components. See Engine/Lubrication/PUMP, Engine Oil - Cleaning. See Engine/Lubrication/PUMP, Engine Oil - Inspection.

Cleaning

CLEANING

1. Clean all parts thoroughly in a suitable solvent.

Inspection

INSPECTION

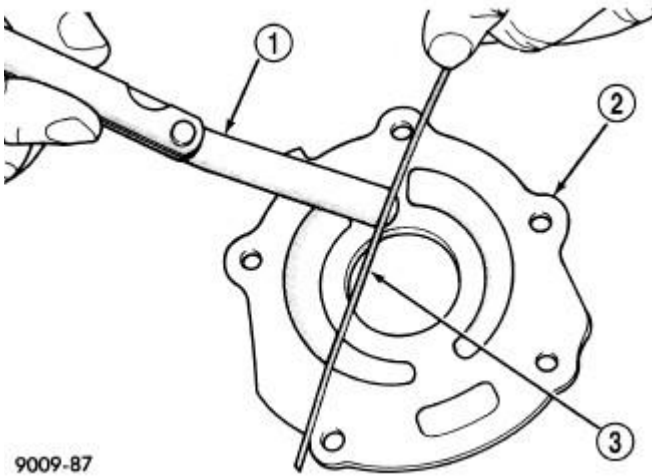


Fig. 163: Checking Oil Pump Cover Flatness
Courtesy of CHRYSLER LLC

- 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 . If a 0.025 mm (0.001 in.) feeler gauge can be inserted between cover and straight edge, cover should be replaced.

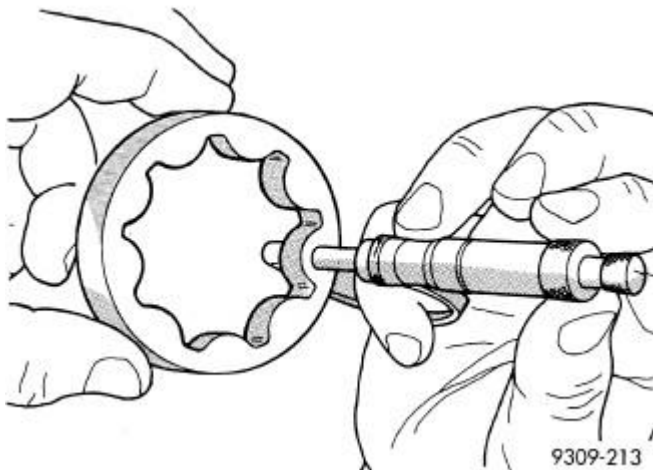


Fig. 164: Measuring Outer Rotor Thickness
Courtesy of CHRYSLER LLC

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.

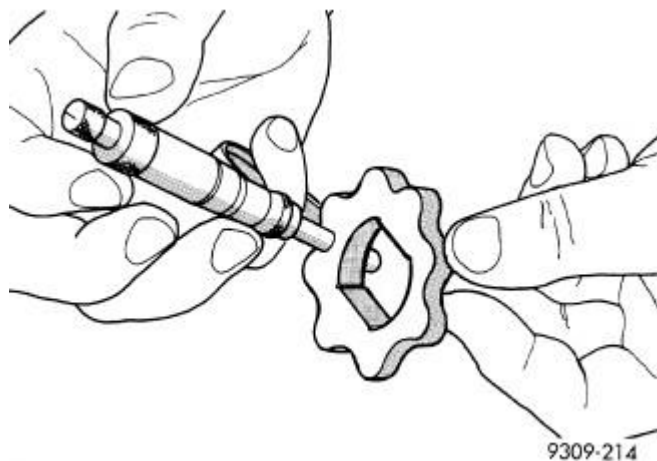


Fig. 165: Measuring Inner Rotor Thickness
Courtesy of CHRYSLER LLC

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

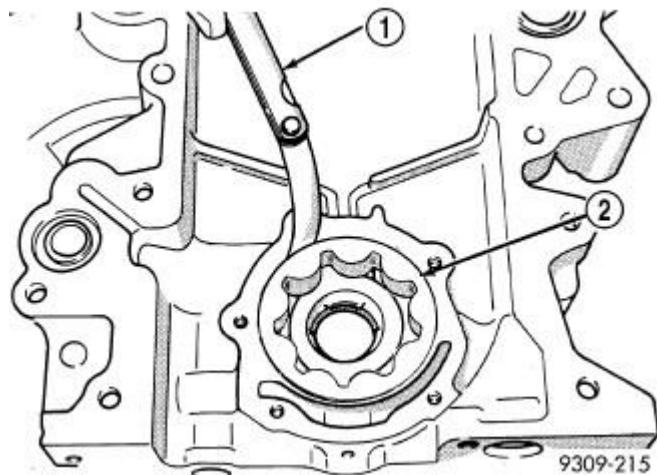


Fig. 166: Measuring Outer Rotor Clearance in Housing
Courtesy of CHRYSLER LLC

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 . If measurement is 0.39 mm (0.015 in.) or more, replace chain case cover, only if outer rotor is in specification.

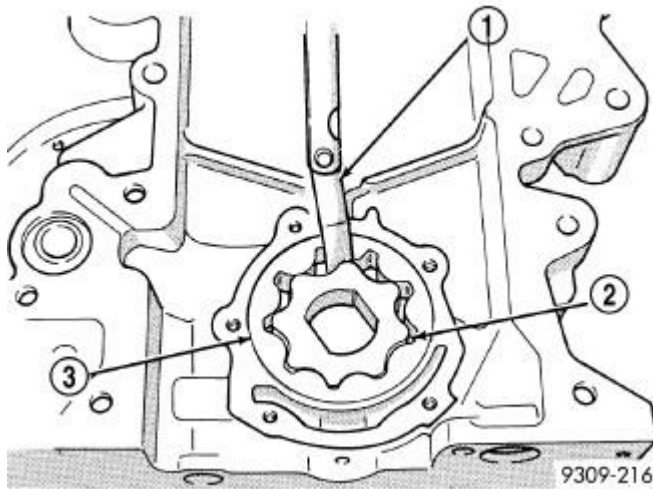


Fig. 167: Measuring Clearance Between Rotors
Courtesy of CHRYSLER LLC

- 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.

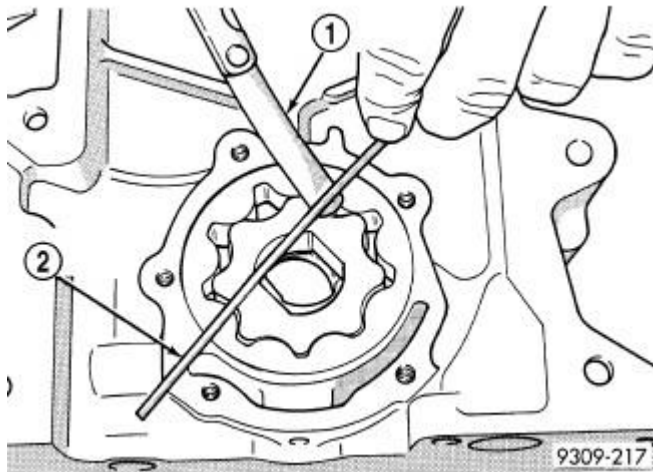


Fig. 168: Measuring Clearance Over Rotors
Courtesy of CHRYSLER LLC

- 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 .

ONLY if rotors are in specs.

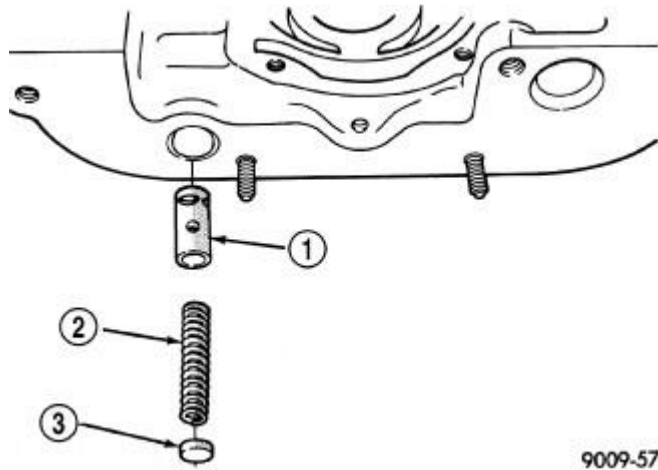


Fig. 169: Oil Pressure Relief Valve
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - RELIEF VALVE
2 - SPRING
3 - RETAINER CAP</p> |
|---|

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

Assembly

ASSEMBLY

1. Assemble pump, using new parts as required. **Install the inner rotor with chamfer facing the cast iron oil pump cover.**
2. Prime oil pump before installation by filling rotor cavity with engine oil.
3. Install cover and tighten screws to 12 N.m (105 in. lbs.).
4. If removed, install the oil pressure relief valve. See **Engine/Lubrication/VALVE, Oil Pressure Relief - Installation.**

Installation

INSTALLATION

1. Install oil pump. See **Engine/Lubrication/PUMP, Engine Oil - Assembly.**
2. Install timing chain cover and oil pan. See **Engine/Valve Timing/COVER(S), Engine Timing - Installation.**

SWITCH, OIL PRESSURE

Description

DESCRIPTION

The engine oil pressure switch is located on the lower left front side of the engine. It screws into the oil filter adapter. The normally closed switch provides an input through a single wire to the low pressure indicator light on the instrument cluster.

Operation

OPERATION

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

Removal

REMOVAL

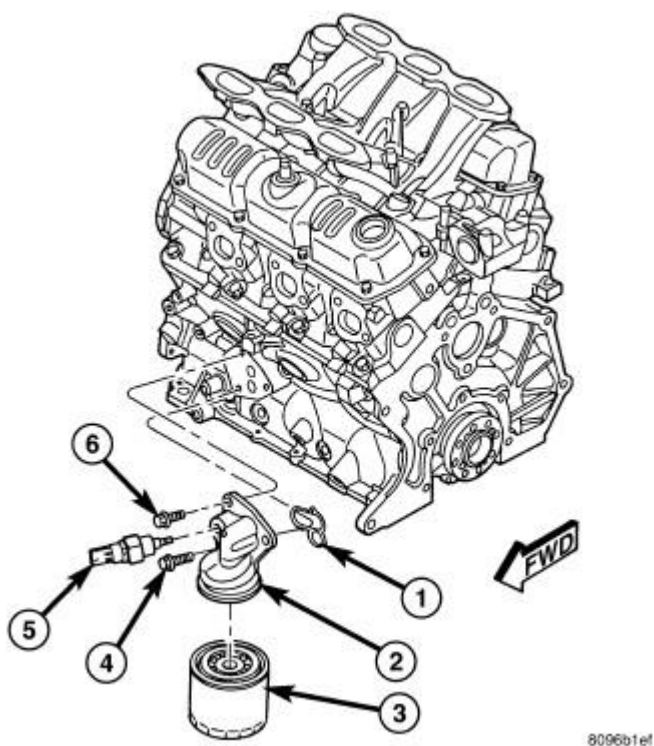


Fig. 170: Removing/Installing Oil Filter Adapter
Courtesy of CHRYSLER LLC

- 1 - SEAL
- 2 - OIL FILTER ADAPTER
- 3 - OIL FILTER
- 4 - BOLT
- 5 - OIL PRESSURE SWITCH
- 6 - BOLT

1. Raise vehicle on hoist.
2. Disconnect electrical connector from switch.
3. Remove oil pressure switch (5).

Installation

INSTALLATION

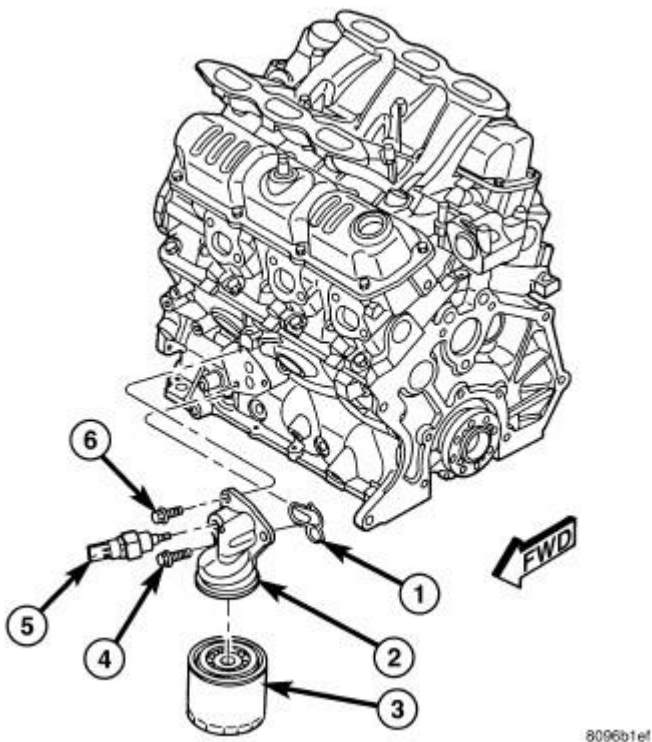


Fig. 171: Removing/Installing Oil Filter Adapter
Courtesy of CHRYSLER LLC

- 1 - SEAL
- 2 - OIL FILTER ADAPTER
- 3 - OIL FILTER
- 4 - BOLT
- 5 - OIL PRESSURE SWITCH
- 6 - BOLT

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

VALVE, OIL PRESSURE RELIEF

Removal

REMOVAL

1. Remove oil pan. See [Engine/Lubrication/PAN, Oil - Removal](#).

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

Installation

INSTALLATION

1. Clean relief valve, spring and bore.

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

2. Install relief valve and spring into housing.
3. Install new retainer cap until flush with sealing surface.
4. Install oil pan. See Engine/Lubrication/PAN, Oil - Installation.
5. Fill crankcase with proper oil to correct level.

MANIFOLDS

MANIFOLD, EXHAUST, LEFT

Removal

REMOVAL

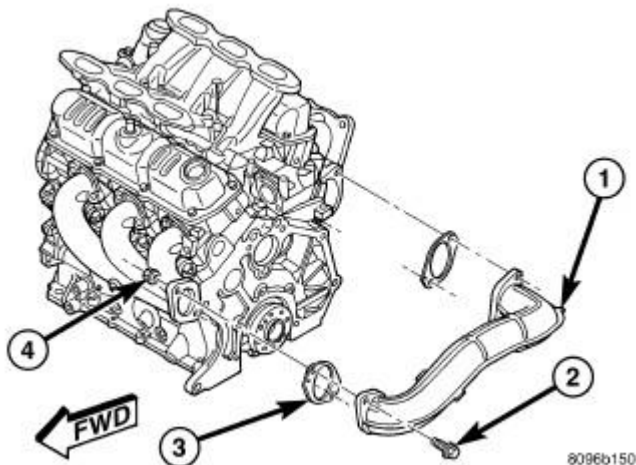


Fig. 172: CROSS-OVER PIPE
Courtesy of CHRYSLER LLC

- 1 - CROSS-OVER PIPE
- 2 - BOLT

- 3 - GASKET
- 4 - FLAG NUT

1. Disconnect battery negative cable.
2. Remove bolts attaching crossover pipe (1) to exhaust manifold.
3. Disconnect left cylinder bank spark plug wires.

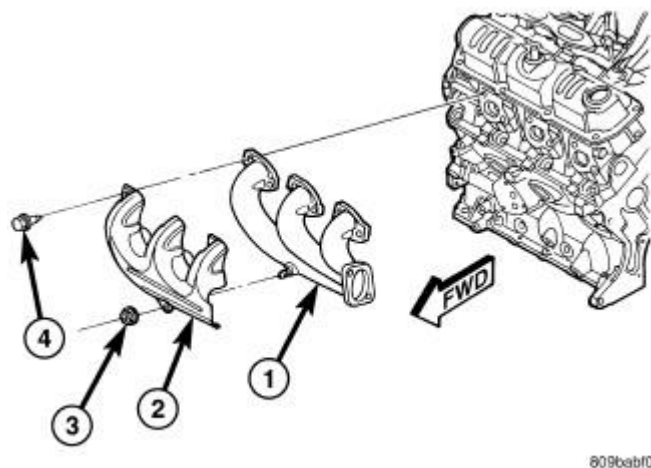


Fig. 173: EXHAUST MANIFOLD - LEFT
Courtesy of CHRYSLER LLC

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

4. Remove heat shield (2) attaching bolts.
5. Remove bolts attaching exhaust manifold (1) to cylinder head.
6. Remove the exhaust manifold (1).
7. Inspect and clean manifold. See **Engine/Manifolds/MANIFOLD, Exhaust - Inspection**. See **Engine/Manifolds/MANIFOLD, Exhaust - Cleaning**.

Cleaning

CLEANING

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

Inspection

INSPECTION

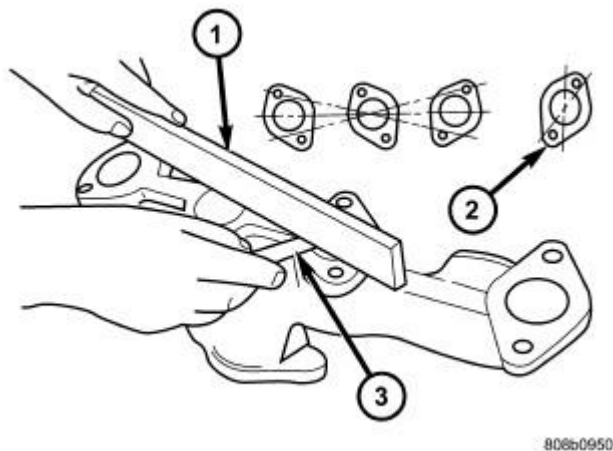


Fig. 174: Checking Surface Flatness Of Exhaust Manifold
Courtesy of CHRYSLER LLC

- 1 - STRAIGHT EDGE
- 2 - CROSSOVER PIPE MOUNTING SURFACE
- 3 - FEELER GAUGE

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 (1).

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

Installation

INSTALLATION

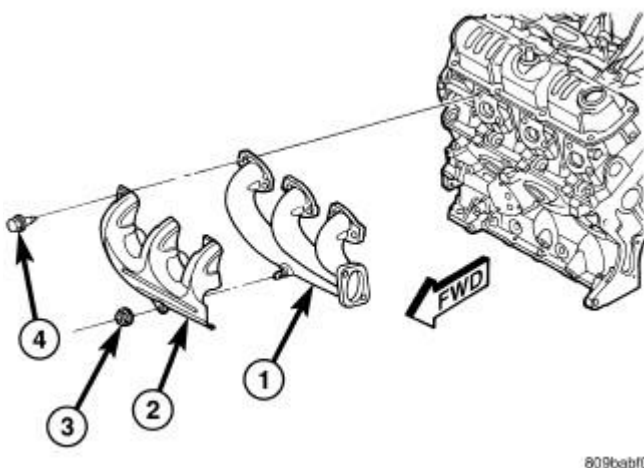


Fig. 175: EXHAUST MANIFOLD - LEFT
Courtesy of CHRYSLER LLC

- 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.).

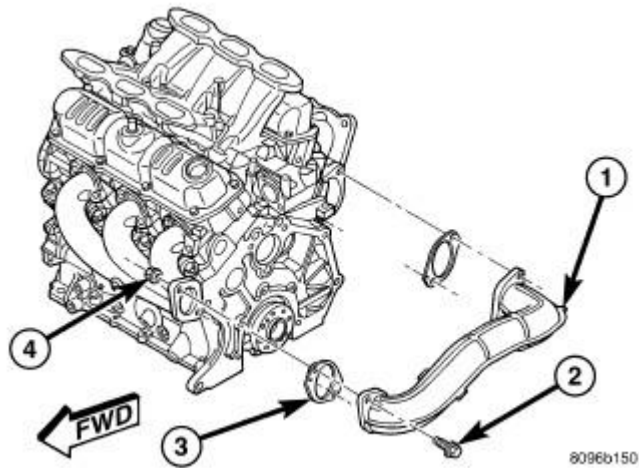


Fig. 176: CROSS-OVER PIPE
Courtesy of CHRYSLER LLC

- 1 - CROSS-OVER PIPE
- 2 - BOLT
- 3 - GASKET
- 4 - FLAG NUT

2. Using a new gasket, attach crossover pipe (1) to exhaust manifold and tighten bolts to 41 N.m (30 ft. lbs.).

NOTE: Inspect crossover pipe fasteners for damage from heat and corrosion. The cross-over bolts are made of a special stainless steel alloy. If replacement is required, OEM bolts are highly recommended.

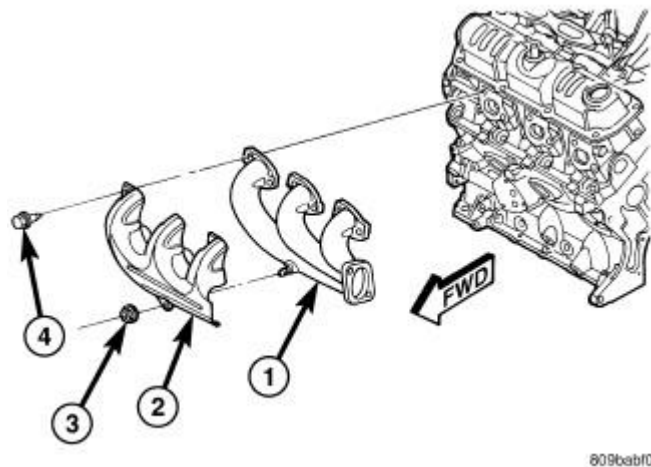


Fig. 177: EXHAUST MANIFOLD - LEFT
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - EXHAUST MANIFOLD - LEFT BANK
 2 - HEAT SHIELD
 3 - NUT - HEAT SHIELD
 4 - BOLT - EXHAUST MANIFOLD</p> |
|--|

3. Position heat shield (2) on manifold.
4. Install the remaining manifold attaching bolts (4). Tighten all bolts to 23 N.m (200 in. lbs.).
5. Install and tighten heat shield attaching nut (3) to 12 N.m (105 in. lbs.).
6. Connect battery negative cable.

MANIFOLD, EXHAUST, RIGHT

Removal

REMOVAL

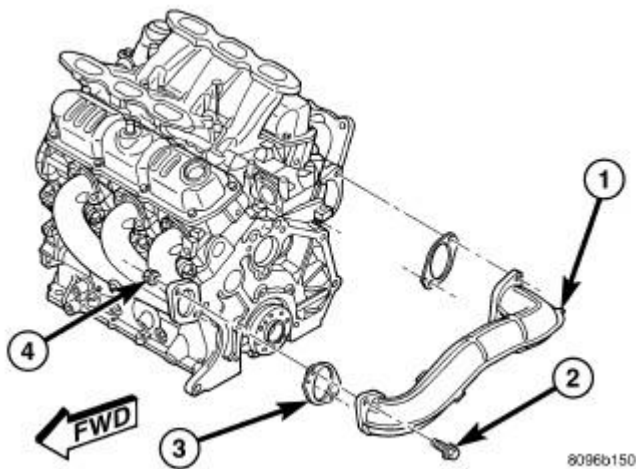


Fig. 178: CROSS-OVER PIPE
Courtesy of CHRYSLER LLC

- 1 - CROSS-OVER PIPE
- 2 - BOLT
- 3 - GASKET
- 4 - FLAG NUT

1. Disconnect battery negative cable.
2. Remove the wiper module. Refer to **Electrical/Wipers/Washers/LINKAGE, Wiper Arm - Removal**.
3. Disconnect spark plug wires.
4. Remove bolts (2) fastening crossover pipe (1) to exhaust manifold.
5. Disconnect and remove the upstream oxygen sensor.
6. Remove the heat shield attaching screws.
7. Remove the upper heat shield.
8. Raise vehicle on hoist and remove drive belt shield.
9. Disconnect downstream oxygen sensor connector.

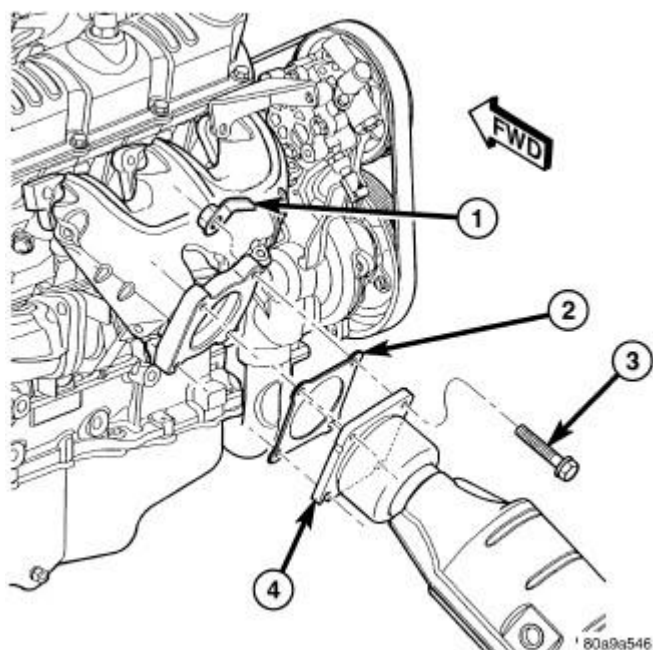


Fig. 179: Catalytic Converter to Exhaust Manifold
Courtesy of CHRYSLER LLC

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

10. Disconnect catalytic converter pipe (4) from exhaust manifold.

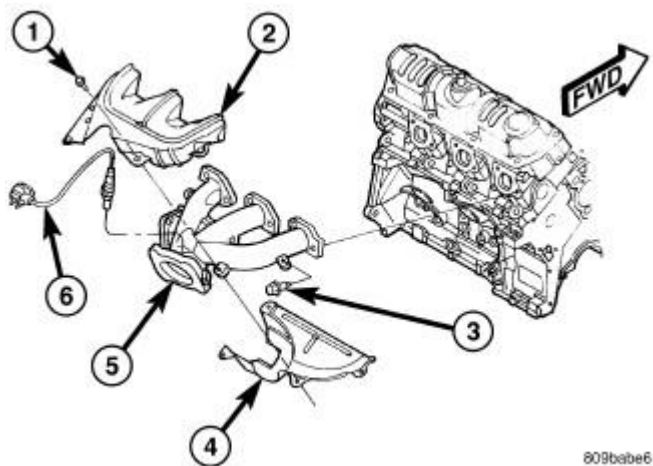


Fig. 180: EXHAUST MANIFOLD - RIGHT
Courtesy of CHRYSLER LLC

- 1 - SCREW - HEAT SHIELD
- 2 - HEAT SHIELD - UPPER
- 3 - BOLT - EXHAUST MANIFOLD
- 4 - HEAT SHIELD - LOWER
- 5 - EXHAUST MANIFOLD - RIGHT
- 6 - OXYGEN SENSOR - UPSTREAM

11. Remove bolts attaching exhaust manifold (5) to cylinder head and remove manifold.
12. Inspect and clean manifold. See **Engine/Manifolds/MANIFOLD, Exhaust - Cleaning**. See **Engine/Manifolds/MANIFOLD, Exhaust - Inspection**.

Cleaning

CLEANING

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

Inspection

INSPECTION

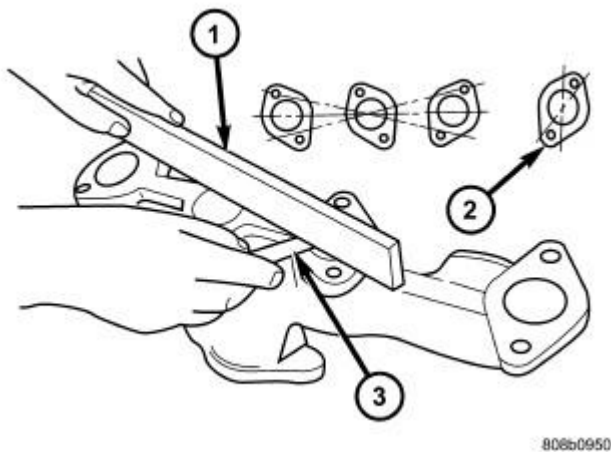


Fig. 181: Checking Surface Flatness Of Exhaust Manifold
 Courtesy of CHRYSLER LLC

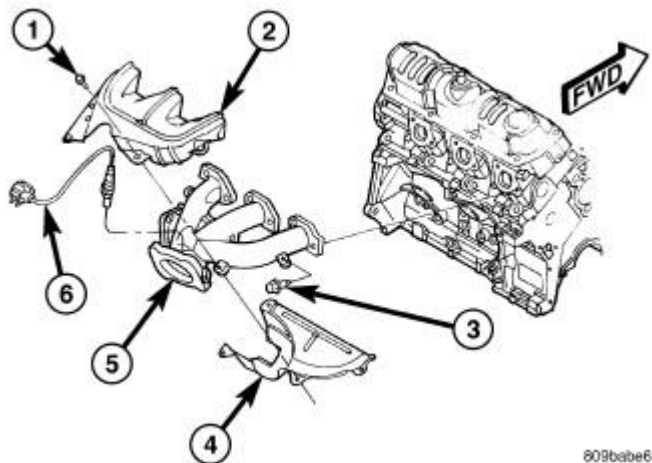
- 1 - STRAIGHT EDGE
- 2 - CROSSOVER PIPE MOUNTING SURFACE
- 3 - FEELER GAUGE

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 (1).

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

Installation

INSTALLATION



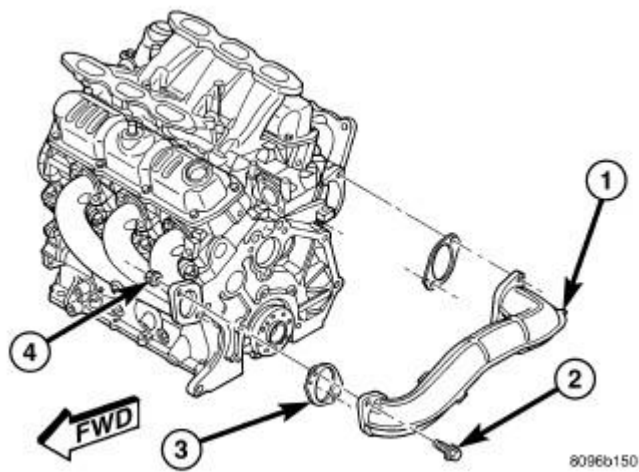
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Fig. 182: EXHAUST MANIFOLD - RIGHT

Courtesy of CHRYSLER LLC

- 1 - SCREW - HEAT SHIELD
- 2 - HEAT SHIELD - UPPER
- 3 - BOLT - EXHAUST MANIFOLD
- 4 - HEAT SHIELD - LOWER
- 5 - EXHAUST MANIFOLD - RIGHT
- 6 - OXYGEN SENSOR - UPSTREAM

1. Position exhaust manifold (5) on cylinder head and install bolts to center runner (cylinder #3) and initial tighten to 2.8 N.m (25 in. lbs.).



8096b150

Fig. 183: CROSS-OVER PIPE

Courtesy of CHRYSLER LLC

- 1 - CROSS-OVER PIPE
- 2 - BOLT
- 3 - GASKET
- 4 - FLAG NUT

2. Using a new gasket, attach crossover pipe (1) to exhaust manifold and tighten bolts to 41 N.m (30 ft. lbs.).

NOTE: Inspect crossover pipe fasteners for damage from heat and corrosion. The cross-over bolts are made of a special stainless steel alloy. If replacement is required, OEM bolts are highly recommended.

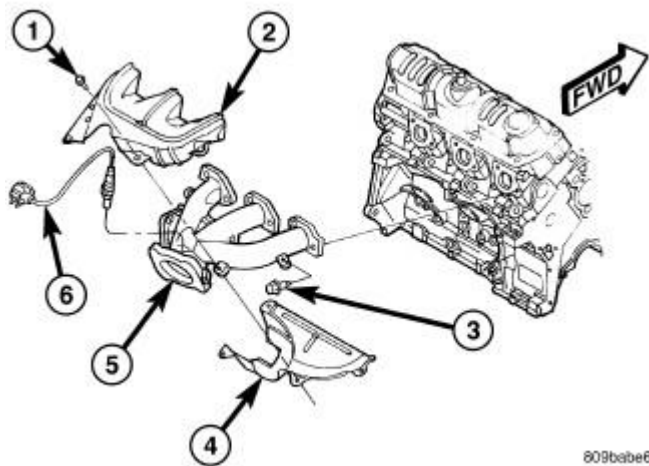


Fig. 184: EXHAUST MANIFOLD - RIGHT
Courtesy of CHRYSLER LLC

- 1 - SCREW - HEAT SHIELD
- 2 - HEAT SHIELD - UPPER
- 3 - BOLT - EXHAUST MANIFOLD
- 4 - HEAT SHIELD - LOWER
- 5 - EXHAUST MANIFOLD - RIGHT
- 6 - OXYGEN SENSOR - UPSTREAM

3. Install the remaining manifold attaching bolts. Tighten all bolts to 23 N.m (200 in. lbs.).
4. Install heat shield (2,4) and attaching screws.
5. Install and connect upstream oxygen sensor.
6. Raise the vehicle.

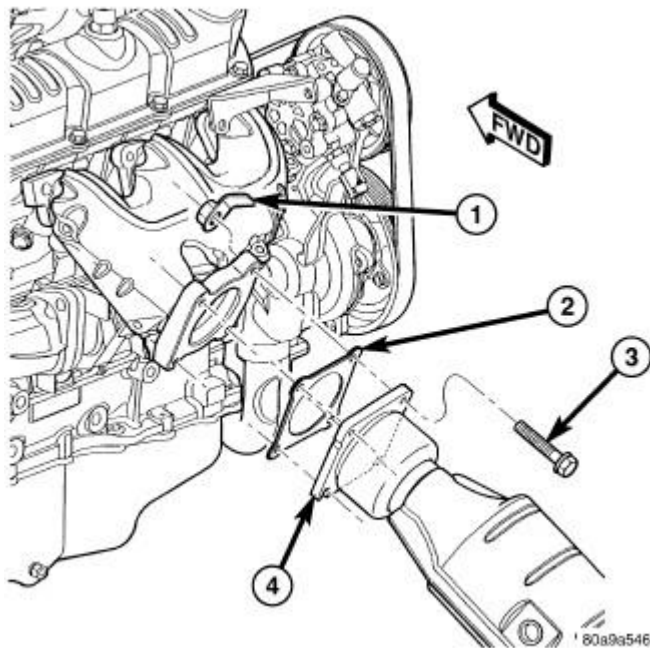


Fig. 185: Catalytic Converter to Exhaust Manifold
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - FLAG NUT
2 - GASKET
3 - BOLT
4 - CATALYTIC CONVERTER</p> |
|---|

7. Attach catalytic converter pipe (4) to exhaust manifold using new gasket and tighten bolts to 37 N.m (27 ft. lbs.).
8. Connect downstream oxygen sensor connector.
9. Install the belt splash shield and lower the vehicle.
10. Install the wiper module. Refer to **Electrical/Wipers/Washers/LINKAGE, Wiper Arm - Installation** .
11. Connect battery negative cable.

MANIFOLD, INTAKE

Description

DESCRIPTION

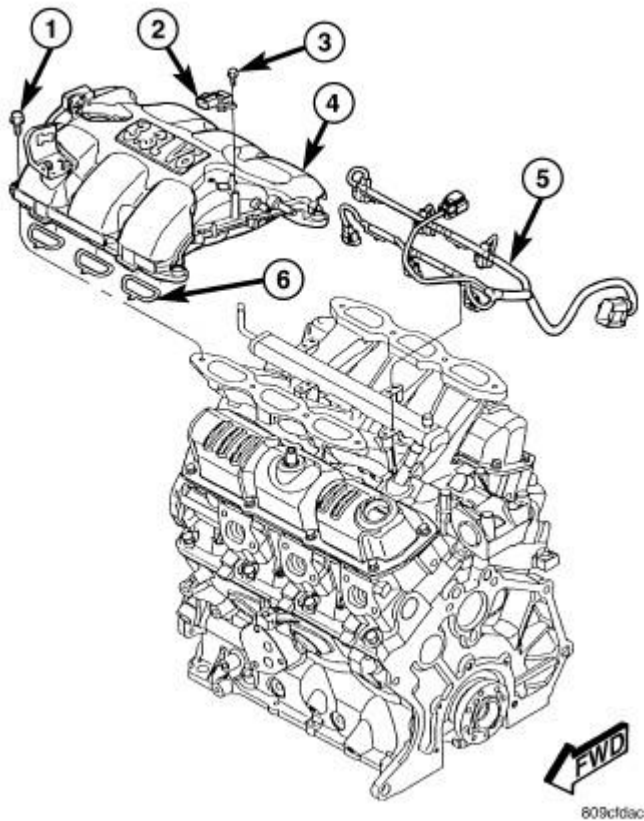


Fig. 186: Identifying Upper Intake Manifold
Courtesy of CHRYSLER LLC

- 1 - BOLT
- 2 - MAP SENSOR
- 3 - SCREW
- 4 - MANIFOLD - UPPER
- 5 - WIRE HARNESS
- 6 - GASKET (3 PER CYL. BANK)

The intake system is made up of an upper (4) and lower intake manifold. The upper intake manifold (4) 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. For more information and procedure, see **Engine/Manifolds/MANIFOLD, Intake - Standard Procedure**. 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. For more information and procedure, see **Engine/Manifolds/MANIFOLD, Intake - Standard Procedure**.

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, LOWER**Removal****REMOVAL**

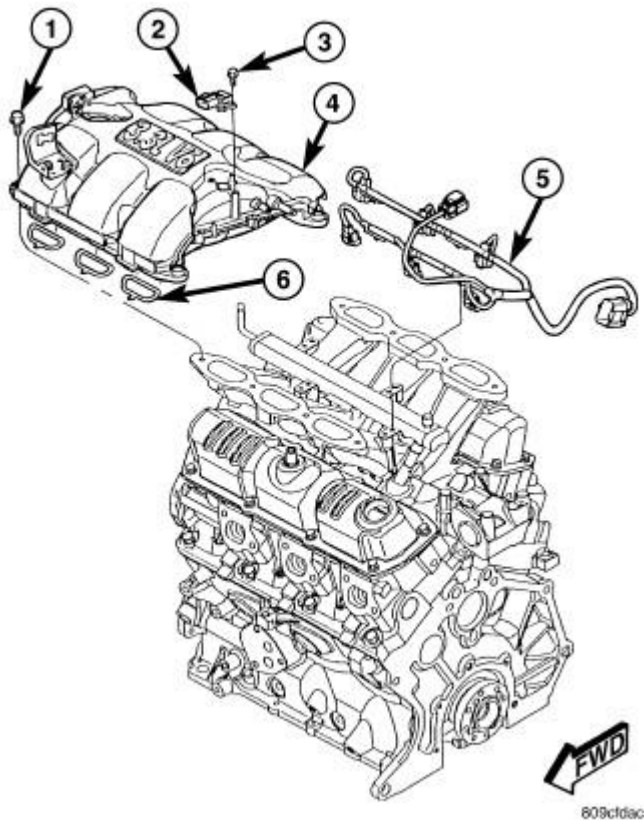


Fig. 187: Identifying Upper Intake Manifold
Courtesy of CHRYSLER LLC

- 1 - BOLT
- 2 - MAP SENSOR
- 3 - SCREW
- 4 - MANIFOLD - UPPER
- 5 - WIRE HARNESS
- 6 - GASKET (3 PER CYL. BANK)

WARNING: The fuel system is under constant pressure even with engine off. Before servicing fuel rail, fuel system pressure must be released.

1. Perform the fuel pressure release procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .
2. Disconnect and isolate the negative battery cable.
3. Drain the cooling system. Refer to **Cooling - Standard Procedure** .
4. Remove the EGR tube and upper intake manifold (4). See **Engine/Manifolds/MANIFOLD, Intake - Removal**.

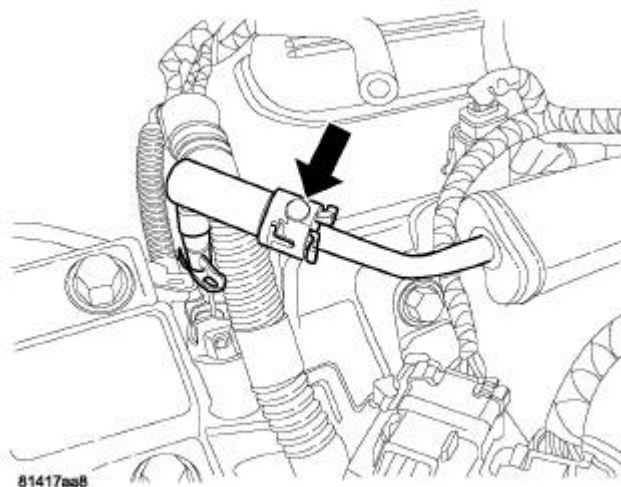


Fig. 188: FUEL LINE DISCONNECT FITTING

Courtesy of CHRYSLER LLC

5. Disconnect the fuel supply hose from the fuel rail. Refer to **Fuel System/Fuel Delivery/FITTING, Quick Connect - Standard Procedure**.

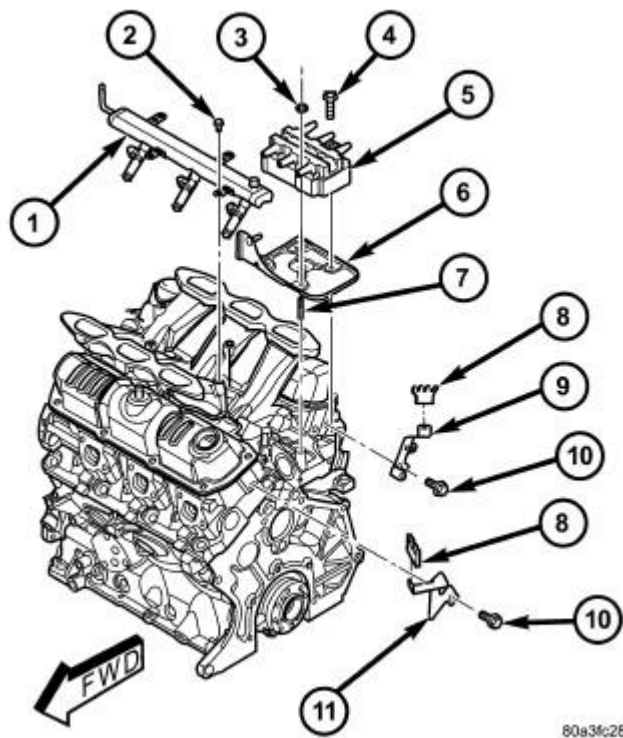


Fig. 189: Removing/Installing Ignition Coil & Bracket

Courtesy of CHRYSLER LLC

- 1 - FUEL RAIL
- 2 - BOLT - FUEL RAIL
- 3 - NUT - IGNITION COIL
- 4 - BOLT - IGNITION COIL
- 5 - IGNITION COIL
- 6 - BRACKET - IGNITION COIL
- 7 - STUD - IGNITION COIL
- 8 - SEPARATOR - SPARK PLUG CABLE
- 9 - BRACKET - SPARK PLUG CABLE SEPARATOR
- 10 - BOLT - SEPARATOR BRACKET
- 11 - BRACKET - SPARK PLUG CABLE SEPARATOR

6. Remove the ignition coil (5) and bracket (6).

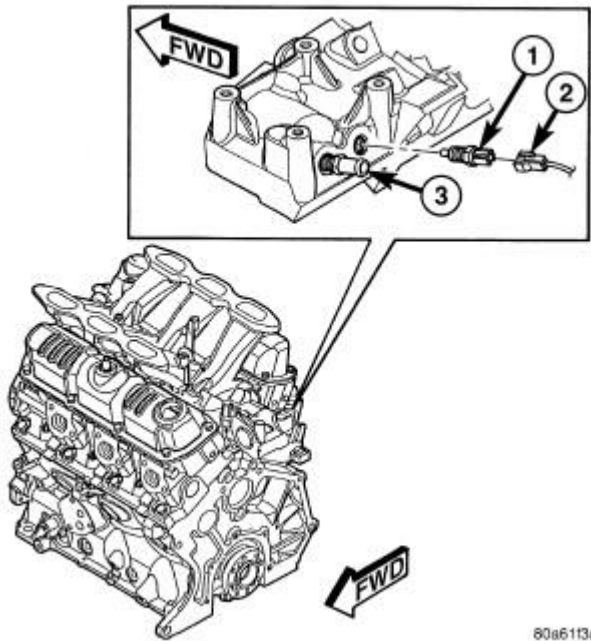


Fig. 190: Identifying Heater Supply Hose, Engine Coolant Temperature (ECT) Sensor, & ECT Electrical Connector

Courtesy of CHRYSLER LLC

- 1 - ENGINE COOLANT TEMPERATURE SENSOR
- 2 - CONNECTOR - ENGINE COOLANT SENSOR
- 3 - FITTING - HEATER SUPPLY

7. Disconnect the heater supply hose and the Engine Coolant Temperature (ECT) sensor electrical connector (2).

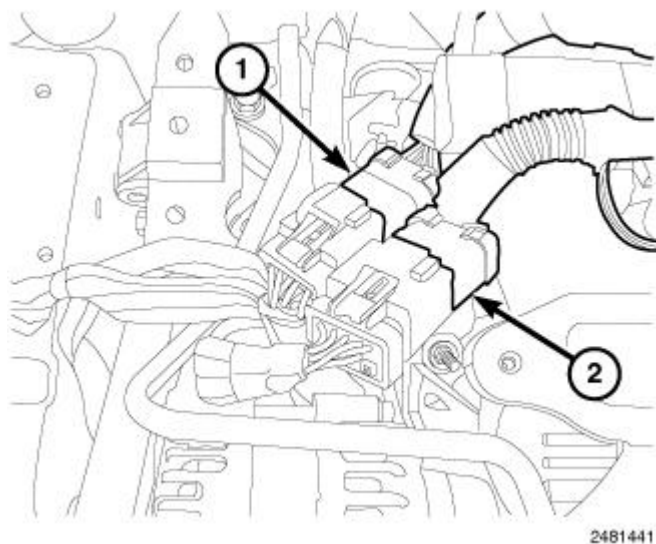


Fig. 191: Identifying Fuel Injector Electrical Connectors
Courtesy of CHRYSLER LLC

8. Disconnect the fuel injector electrical connectors (1) and (2).

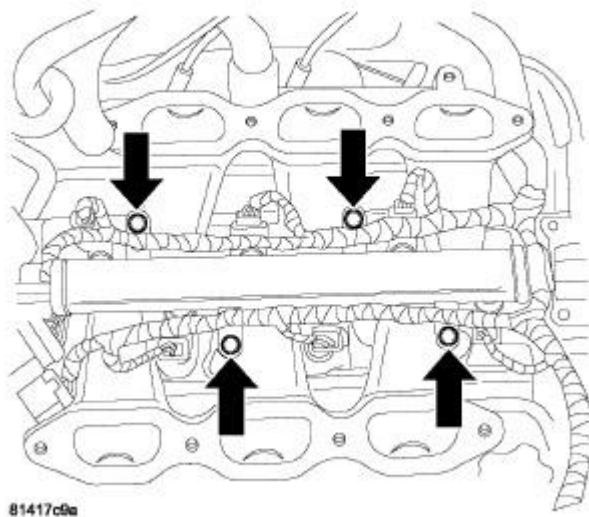


Fig. 192: FUEL RAIL BOLTS LOCATIONS
Courtesy of CHRYSLER LLC

NOTE: Mark the fuel injector electrical harness connectors with the correct corresponding cylinder numbers.

9. Remove the fuel rail mounting bolts from the fuel rail.

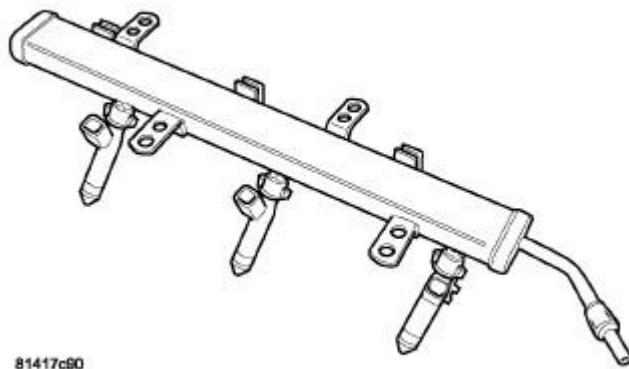


Fig. 193: FUEL RAIL ASSEMBLY
Courtesy of CHRYSLER LLC

10. Lift the fuel rail straight up off of the lower intake manifold.

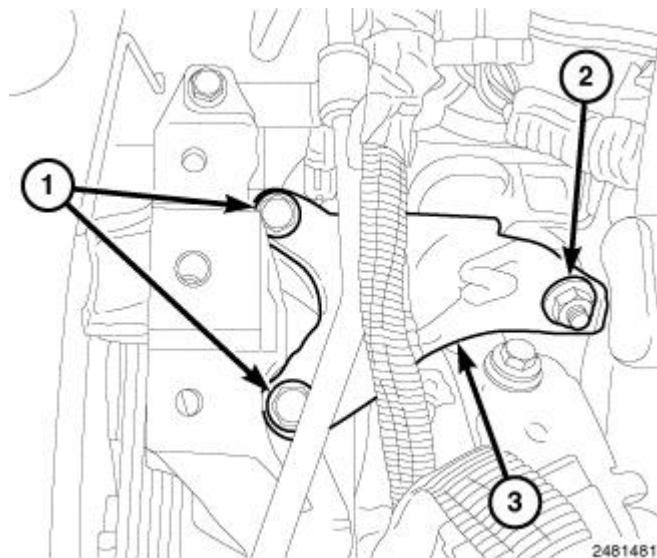


Fig. 194: Identifying Bolts, Nut, & Lower Intake Manifold Bracket
Courtesy of CHRYSLER LLC

11. Remove the upper radiator hose.
12. Remove two bolts (1), nut (2) and bracket (3).

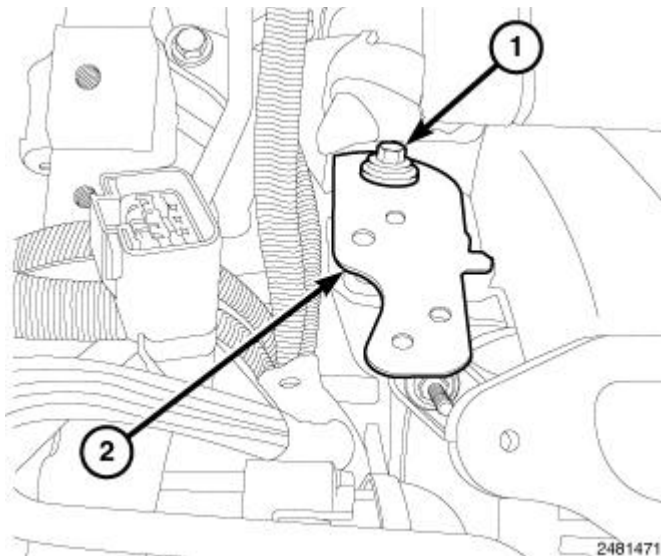


Fig. 195: Identifying Injector Harness Connector Support Bracket & Bolt
Courtesy of CHRYSLER LLC

13. Remove the bolt (1) and the injector harness connector support bracket (2).

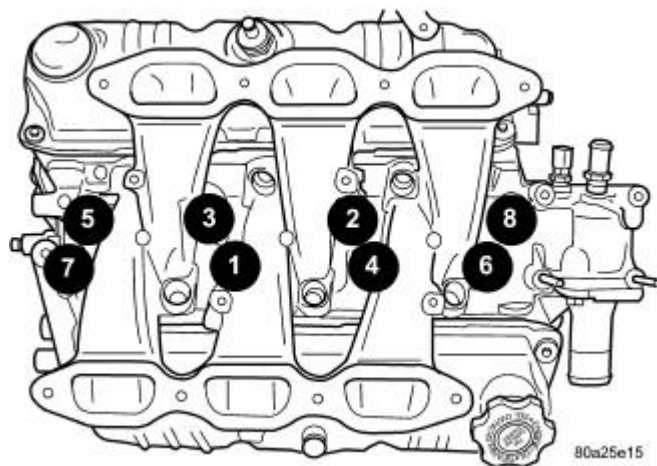


Fig. 196: LOWER MANIFOLD TIGHTENING SEQUENCE
Courtesy of CHRYSLER LLC

14. Remove the rest of the lower intake manifold bolts.

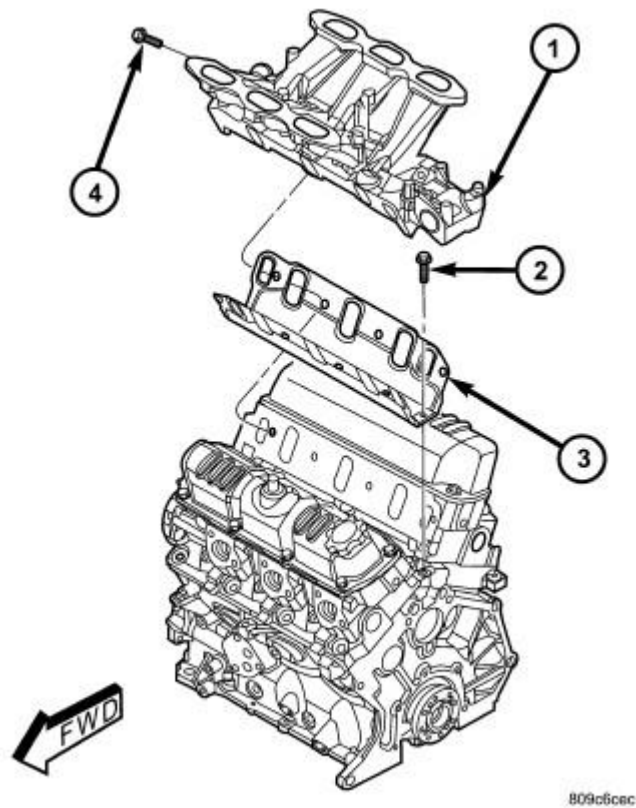


Fig. 197: INTAKE MANIFOLD - LOWER
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - INTAKE MANIFOLD - LOWER
 2 - BOLT - GASKET END SEAL RETAINER
 3 - GASKET
 4 - BOLT - LOWER INTAKE MANIFOLD</p> |
|---|

WARNING: Intake manifold gasket is made of very thin metal and may cause personal injury, handle with care.

15. Remove the lower intake manifold (1).
16. Remove the intake manifold end seal retainer bolts (2) and remove the intake manifold gasket (3).
17. Inspect and clean the manifold.

Cleaning

CLEANING

1. Discard gasket(s).

2. Clean all sealing surfaces.

Inspection**INSPECTION**

Check for:

- Damage and cracks of each section.
- Check for cylinder head mounting surface distortion using a straightedge and thickness gauge. See **Engine/Cylinder Head - Inspection.**

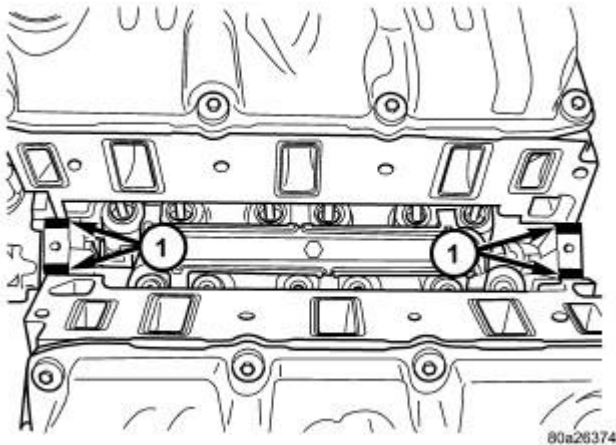
Installation**INSTALLATION**

Fig. 198: 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).

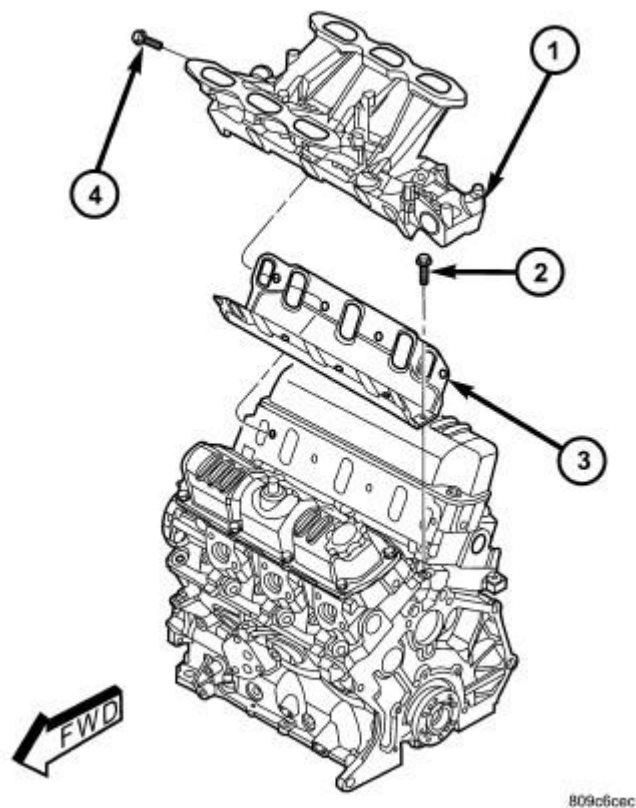


Fig. 199: INTAKE MANIFOLD - LOWER
Courtesy of CHRYSLER LLC

- | |
|-------------------------------------|
| 1 - INTAKE MANIFOLD - LOWER |
| 2 - BOLT - GASKET END SEAL RETAINER |
| 3 - GASKET |
| 4 - BOLT - LOWER INTAKE MANIFOLD |

- Carefully install the new intake manifold gasket (3). Tighten the end seal retainer bolts (2) to 12 N.m (105 in. lbs.).
- Position the lower intake manifold (1) on the gasket (3).

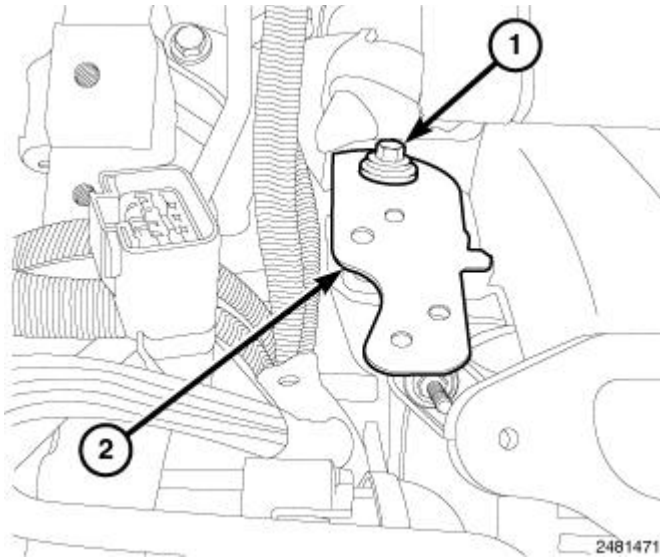


Fig. 200: Identifying Injector Harness Connector Support Bracket & Bolt
 Courtesy of CHRYSLER LLC

4. Install the injector harness connector support bracket (2) and bolt (1). The bolt will be tightened in the next step.

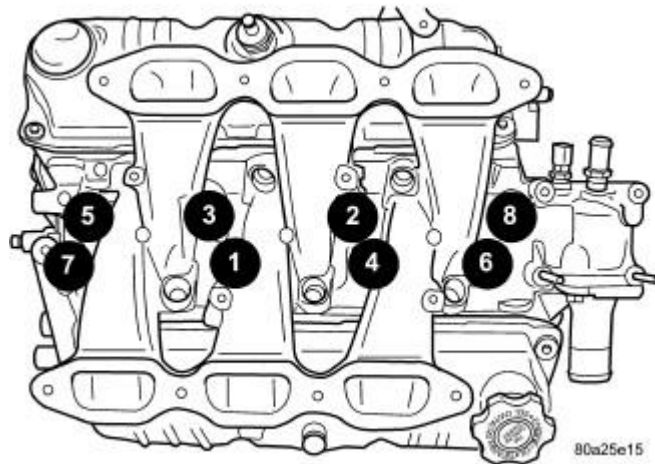


Fig. 201: LOWER MANIFOLD TIGHTENING SEQUENCE
 Courtesy of CHRYSLER LLC

5. Install the rest of the intake manifold bolts. Initially tighten all bolts to 1 N.m (10 in lbs.). Finish tightening the bolts in two steps, first to 22 N.m (200 in. lbs.) in the sequence shown in illustration, then again to 22 N.m (200 in. lbs.) in the sequence shown in illustration. After the intake manifold is in place, **inspect to make sure seals are in place.**

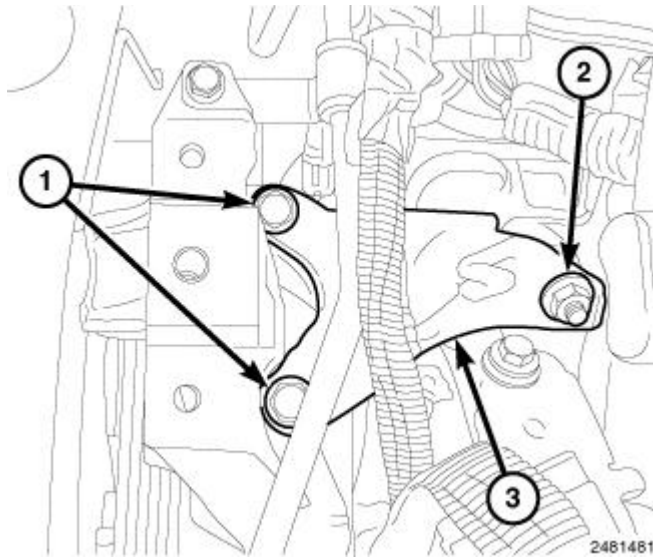


Fig. 202: Identifying Bolts, Nut, & Lower Intake Manifold Bracket
Courtesy of CHRYSLER LLC

6. Install the front cover support bracket (3) with two bolts (1) and nut (2). Tighten the nut to 22 N.m (200 in. lbs.). Tighten the bolts to 25 N.m (18 ft. lbs.).
7. Install the upper radiator hose.

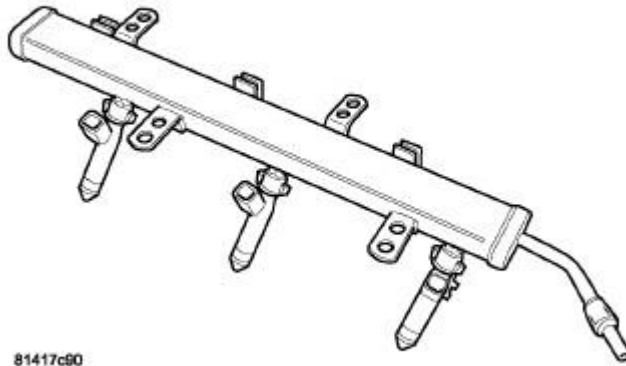


Fig. 203: FUEL RAIL ASSEMBLY
Courtesy of CHRYSLER LLC

8. Apply a light coating of clean engine oil to the O-ring on the nozzle end of each of the injectors.

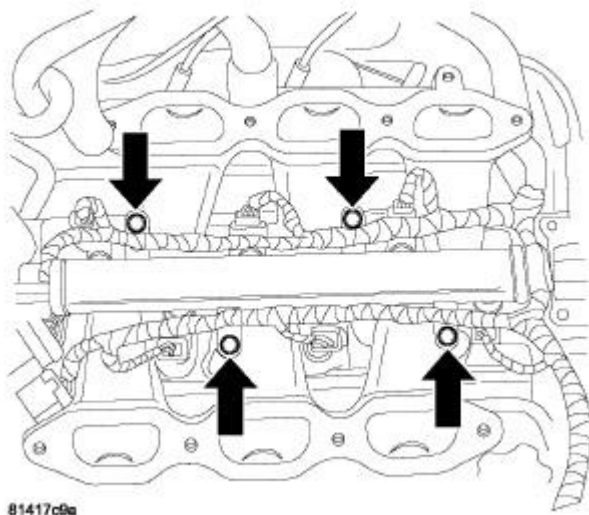


Fig. 204: FUEL RAIL BOLTS LOCATIONS
Courtesy of CHRYSLER LLC

9. Insert the fuel injector nozzles into the openings in the lower intake manifold. Seat the injectors in place. Install the fuel rail bolts and tighten bolts to 12 N.m (106 in. lbs.).

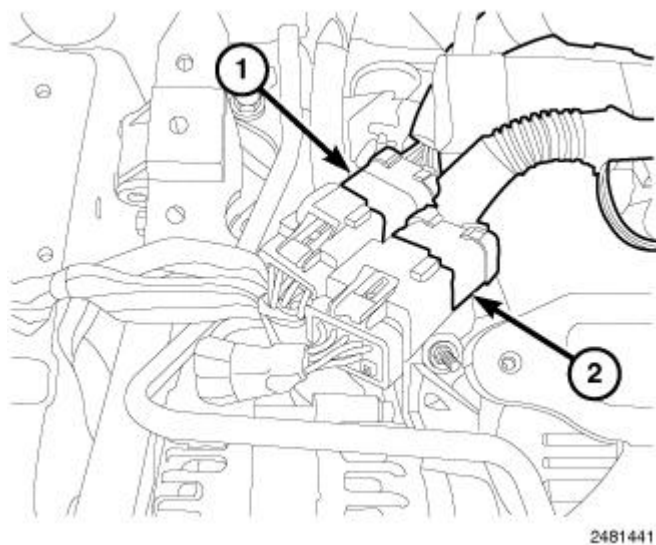
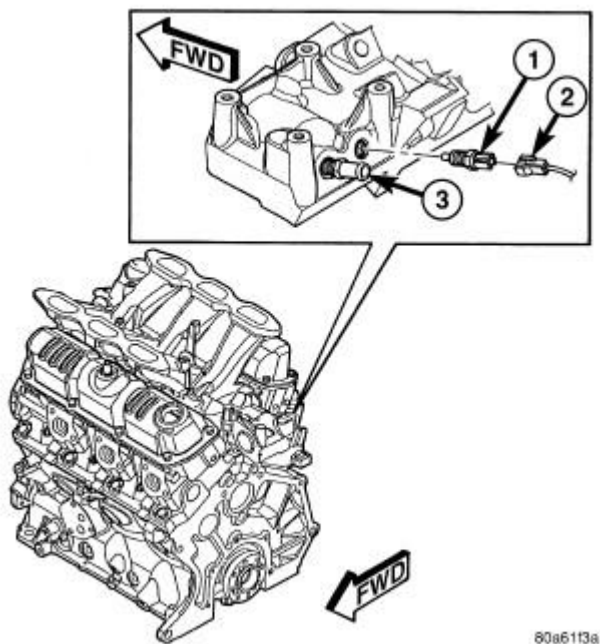


Fig. 205: Identifying Fuel Injector Electrical Connectors
Courtesy of CHRYSLER LLC

10. Correctly position and connect the fuel injector electrical harness connectors to the fuel injectors.
11. Connect the fuel injector electrical harness connectors (1) and (2).



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Fig. 206: Identifying Heater Supply Hose, Engine Coolant Temperature (ECT) Sensor, & ECT Electrical Connector

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - ENGINE COOLANT TEMPERATURE SENSOR
2 - CONNECTOR - ENGINE COOLANT SENSOR
3 - FITTING - HEATER SUPPLY |
|---|

12. Connect the heater supply hose and the Engine Coolant Temperature (ECT) sensor electrical connector (2).

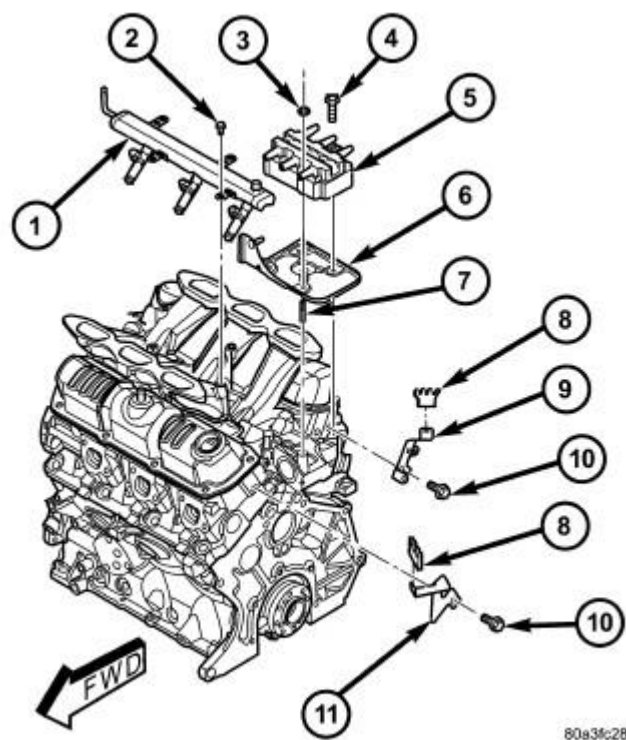


Fig. 207: Removing/Installing Ignition Coil & Bracket
Courtesy of CHRYSLER LLC

- 1 - FUEL RAIL
- 2 - BOLT - FUEL RAIL
- 3 - NUT - IGNITION COIL
- 4 - BOLT - IGNITION COIL
- 5 - IGNITION COIL
- 6 - BRACKET - IGNITION COIL
- 7 - STUD - IGNITION COIL
- 8 - SEPARATOR - SPARK PLUG CABLE
- 9 - BRACKET - SPARK PLUG CABLE SEPARATOR
- 10 - BOLT - SEPARATOR BRACKET
- 11 - BRACKET - SPARK PLUG CABLE SEPARATOR

13. Install the ignition coil (5) and bracket (6).

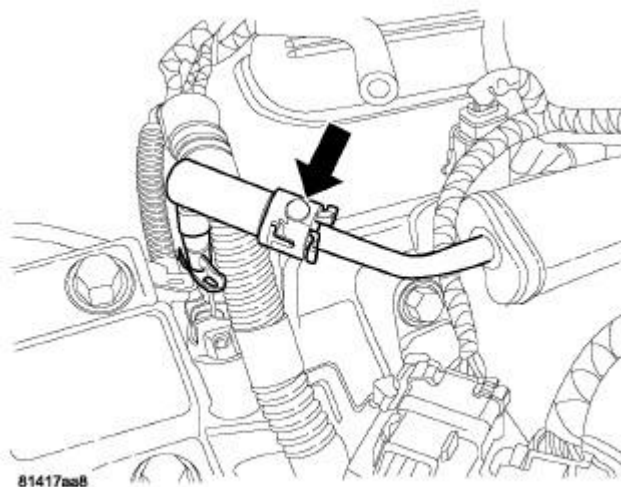


Fig. 208: FUEL LINE DISCONNECT FITTING

Courtesy of CHRYSLER LLC

14. Connect the fuel supply hose to the fuel rail. Refer to **Fuel System/Fuel Delivery/FITTING, Quick Connect - Standard Procedure** .

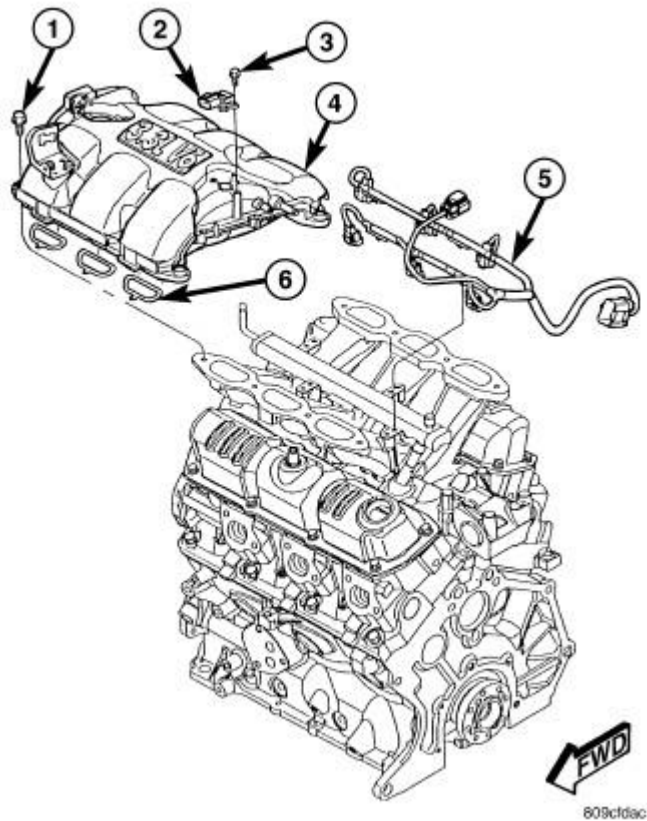


Fig. 209: INTAKE MANIFOLD - UPPER

Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - BOLT
 2 - MAP SENSOR
 3 - SCREW
 4 - MANIFOLD - UPPER
 5 - WIRE HARNESS
 6 - GASKET (3 PER CYL. BANK)</p> |
|--|

15. Install the upper intake manifold (4) and EGR tube. See **Engine/Manifolds/MANIFOLD, Intake - Installation**.
16. Fill the cooling system. Refer to **Cooling - Standard Procedure**.
17. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
18. Use the scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

MANIFOLD, INTAKE, UPPER

Standard Procedure

MANIFOLD STRIPPED THREAD REPAIR

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

- MAP sensor
- Power steering reservoir
- EGR tube

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.)
EGR Tube Attaching Repair Screw	9 N.m (80 in. lbs.)
*Install Slowly Using Hand Tools Only	

INTAKE MANIFOLD VACUUM PORT REPAIR

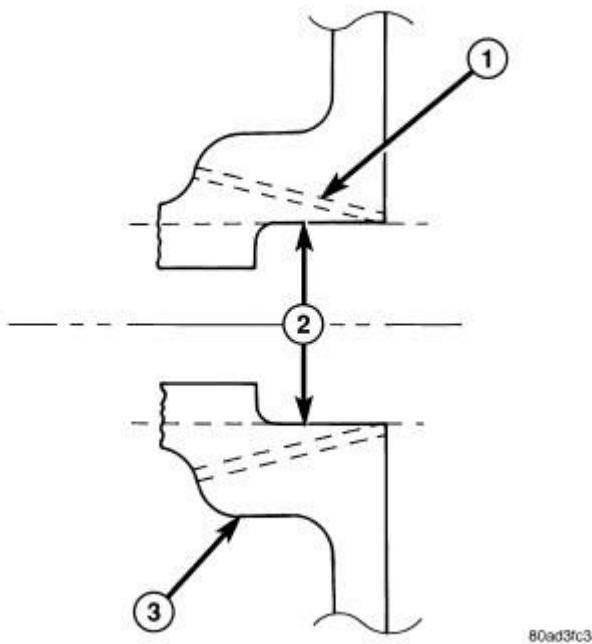


Fig. 210: Manifold Port (Nipple) Repair
Courtesy of CHRYSLER LLC

- 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

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

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

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

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

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 (2).
3. Using a 1/4"-18 NPT (brake booster port) or 1/8"-18 NPT (LDP/speed control port) pipe tap, cut internal threads. Use caution to start tap in a axis same as original port.
4. Apply Mopar® Thread Sealant to threads of repair port (s).
5. Install repair port (s). Do not over torque repair port (s).

Removal

REMOVAL

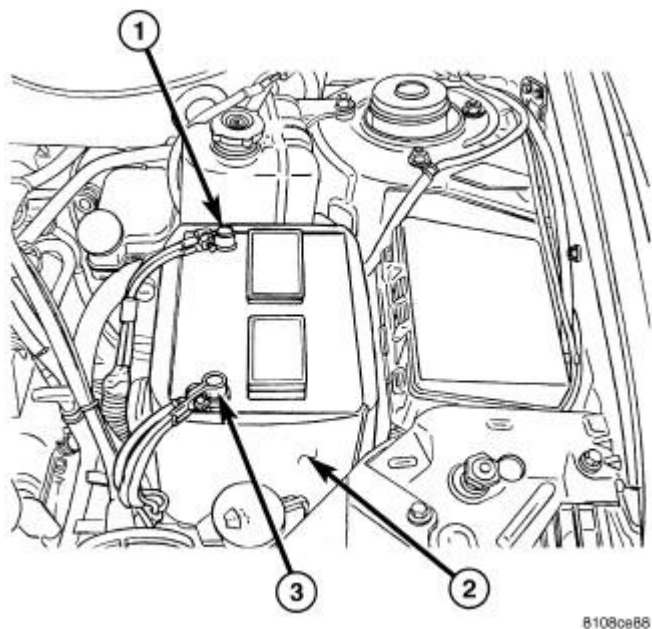


Fig. 211: Battery

Courtesy of CHRYSLER LLC

- 1 - BATTERY POSITIVE CABLE
- 2 - THERMO-WRAP
- 3 - BATTERY NEGATIVE CABLE

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

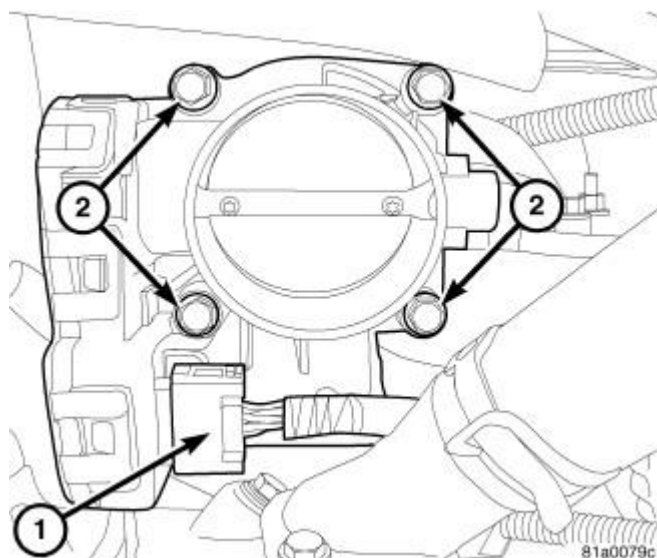


Fig. 212: THROTTLE BODY
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - ETC Connector
2 - Throttle Body Bolts |
|--|

4. Disconnect the EVAP hose at the throttle body.
5. Disconnect the ETC wiring connector (1) from the throttle body.

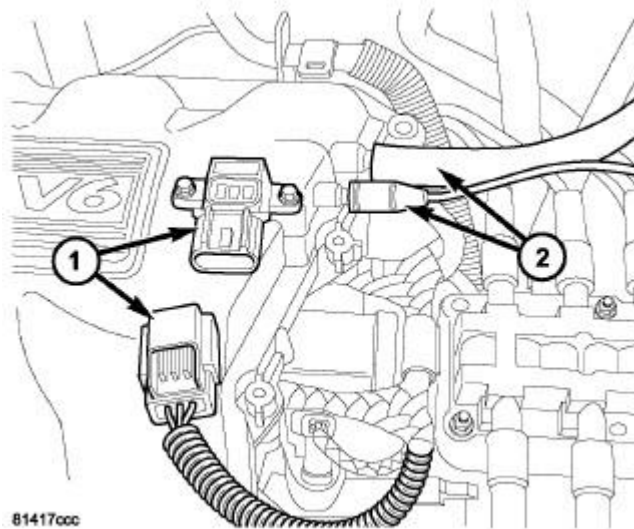


Fig. 213: MAP SENSOR
Courtesy of CHRYSLER LLC

- | |
|------------------------------------|
| 1 - MAP Sensor
2 - Vacuum Lines |
|------------------------------------|

6. Disconnect the brake booster hose from the intake manifold.
7. Disconnect the Manifold Absolute Pressure (MAP) sensor electrical connector (1).
8. Disconnect the PCV hose.

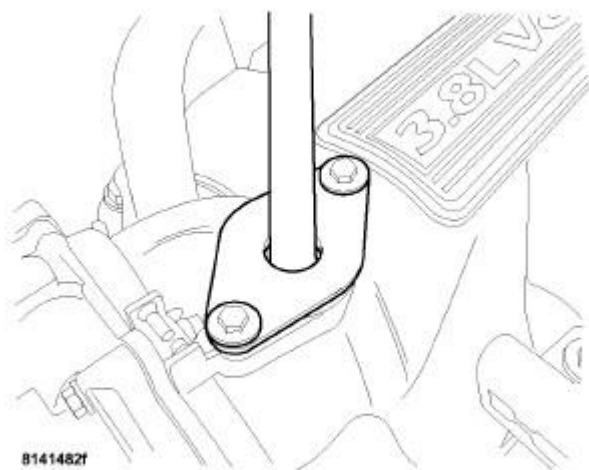


Fig. 214: EGR TUBE AT INTAKE

Courtesy of CHRYSLER LLC

9. Remove the EGR tube. Refer to **Emissions Control/Exhaust Gas Recirculation/TUBE, Exhaust Gas Recirculation (EGR) - Removal** .

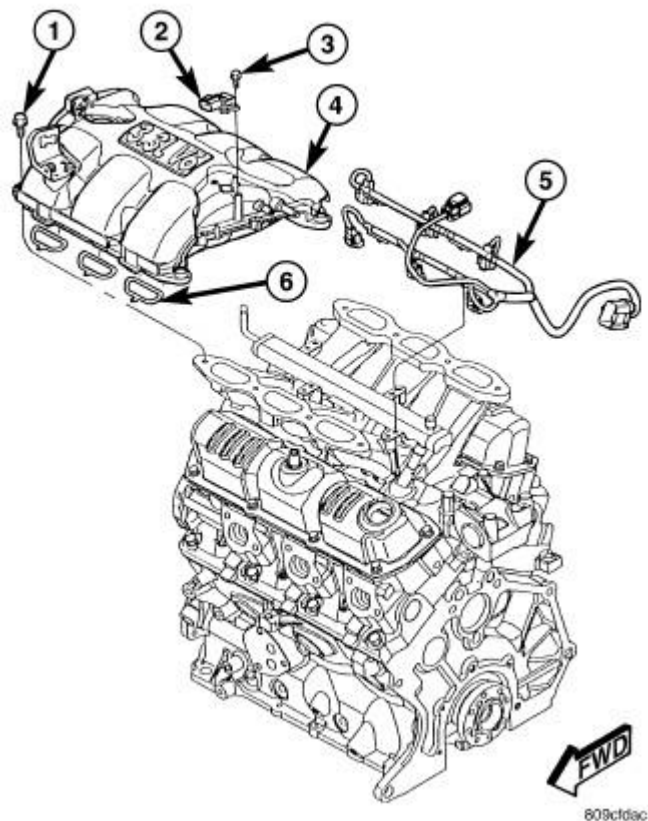


Fig. 215: INTAKE MANIFOLD - UPPER

Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - BOLT
 2 - MAP SENSOR
 3 - SCREW
 4 - MANIFOLD - UPPER
 5 - WIRE HARNESS
 6 - GASKET (3 PER CYL. BANK)</p> |
|--|

10. Remove the intake manifold bolts (1) and remove the manifold (4).
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

CLEANING

1. Clean all sealing surfaces.

Inspection

INSPECTION

Check manifold for:

- Damage and cracks.

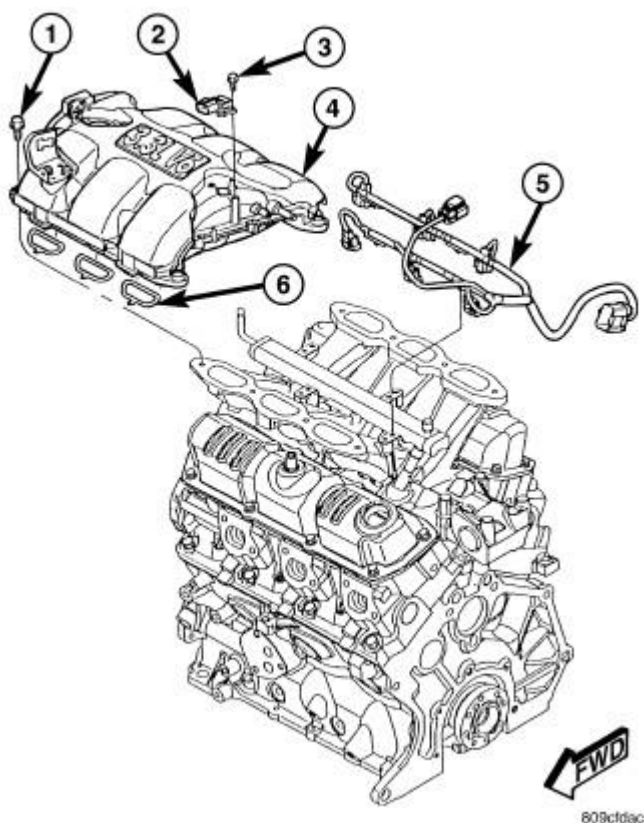
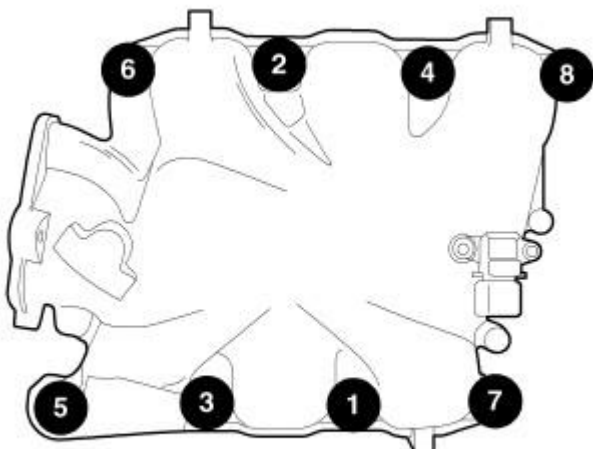
Installation**INSTALLATION**

Fig. 216: INTAKE MANIFOLD - UPPER
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - BOLT
2 - MAP SENSOR
3 - SCREW
4 - MANIFOLD - UPPER
5 - WIRE HARNESS
6 - GASKET (3 PER CYL. BANK) |
|---|

1. Remove covering from the lower intake manifold and clean the gasket surfaces.

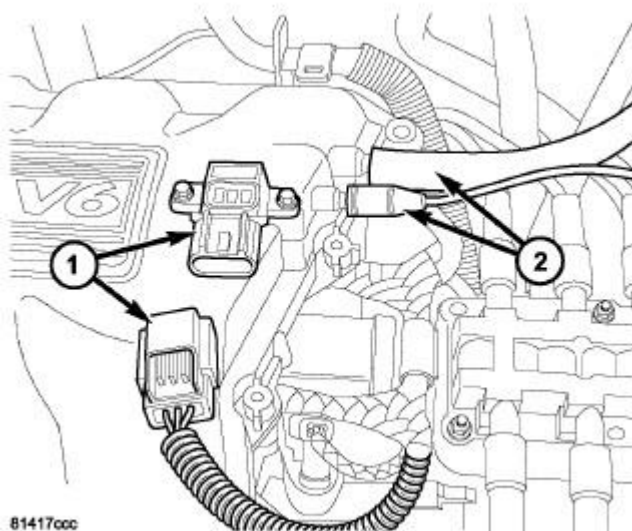
2. Inspect manifold gasket condition. Gaskets can be reused, if not damaged. Position gasket (6) in the seal channel and press lightly into place. Repeat procedure for each gasket position.
3. Position the upper manifold (4) on the lower manifold.



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Fig. 217: INTAKE TORQUE SEQUENCE 3.8L
Courtesy of CHRYSLER LLC

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



81417ccc

Fig. 218: MAP SENSOR
Courtesy of CHRYSLER LLC

- 1 - MAP Sensor
- 2 - Vacuum Lines

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.

5. Install the Manifold Absolute Pressure (MAP) sensor (1) and torque fasteners to 1.7 N.m (15 in. lbs.).
6. Connect the MAP sensor electrical connector (1).
7. Connect the brake booster hose to intake manifold.

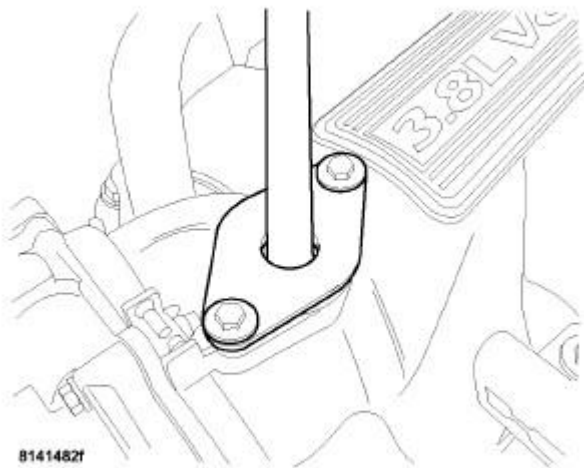


Fig. 219: EGR TUBE AT INTAKE

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.

8. Install the EGR tube. Refer to **Emissions Control/Exhaust Gas Recirculation/TUBE, Exhaust Gas Recirculation (EGR) - Installation** .

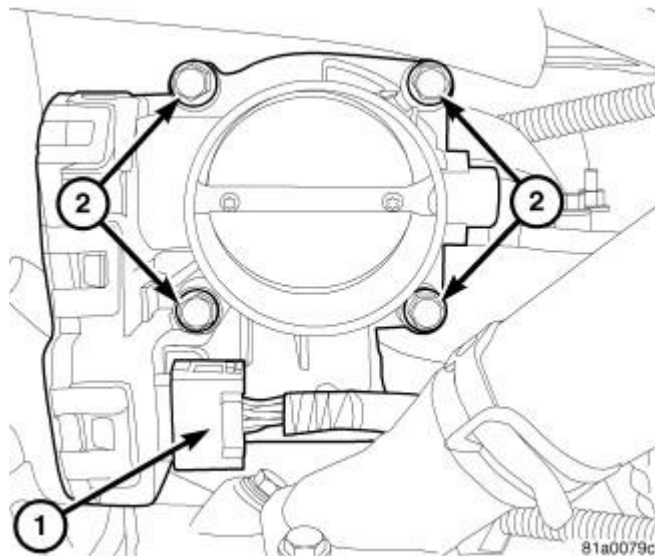


Fig. 220: THROTTLE BODY
Courtesy of CHRYSLER LLC

- 1 - Purge Line
- 2 - Throttle Position Sensor
- 3 - Idle Air Control Motor

9. Connect the ETC connector (1) to the throttle body.
10. Connect the EVAP hose to the throttle body.

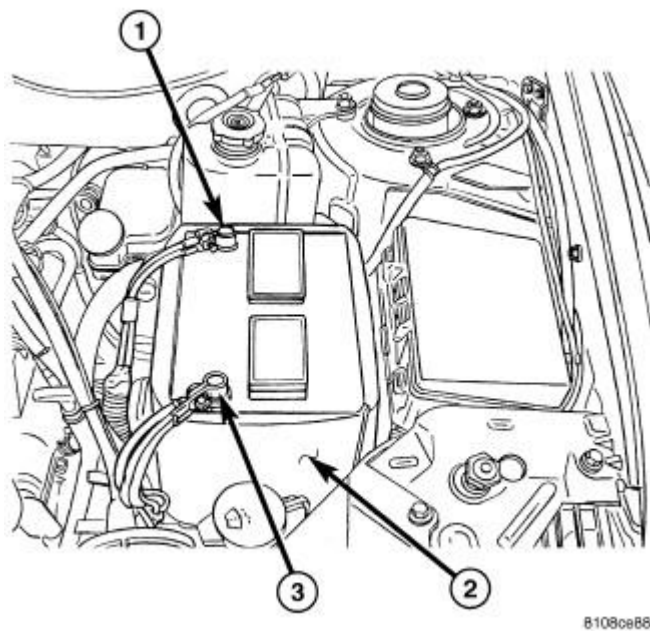


Fig. 221: Battery

Courtesy of CHRYSLER LLC

1 - BATTERY POSITIVE CABLE 2 - THERMO-WRAP 3 - BATTERY NEGATIVE CABLE

11. Install the air cleaner and air inlet hose assembly.
12. Connect the Inlet Air Temperature (IAT) sensor electrical connector.
13. Connect the battery negative cable (3) and tighten nut to 5 N.m (45 in. lbs.).

VALVE TIMING**STANDARD PROCEDURE****VALVE TIMING VERIFICATION**

1. Remove front cylinder head cover and all 6 spark plugs.
2. Rotate engine until the #2 piston is at TDC of the compression stroke.
3. Install a degree wheel on the crankshaft pulley.
4. With proper adaptor, install a dial indicator into #2 spark plug hole. Using the indicator find TDC on the compression stroke.
5. Position the degree wheel to zero.
6. Remove dial indicator from spark plug hole.
7. Place a 5.08 mm (0.200 in.) spacer between the valve stem tip of #2 intake valve and rocker arm pad. Allow tappet to bleed down to give a solid tappet effect.
8. Install a dial indicator so plunger contacts the #2 intake valve spring retainer as nearly perpendicular as possible. Zero the indicator.
9. Rotate the engine clockwise until the intake valve has lifted .254 mm (0.010 in.).

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

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

MEASURING TIMING CHAIN WEAR

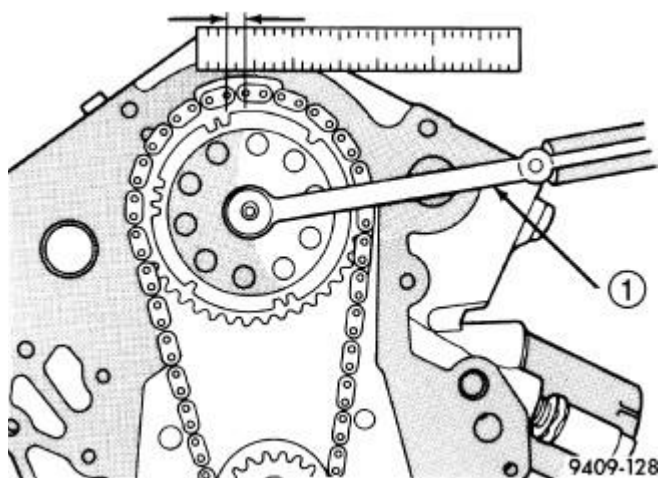


Fig. 222: Measuring Timing Chain Wear

Courtesy of CHRYSLER LLC

1 - TORQUE WRENCH

NOTE: This procedure must be performed with the timing chain cover removed. See Engine/Valve Timing/COVER(S), Engine Timing - Removal.

1. Position a scale next to timing chain so that any movement of chain may be measured.
2. Position a torque wrench (1) and socket on the camshaft sprocket attaching bolt. Apply force in the direction of crankshaft rotation to take up slack to the following torque:

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.

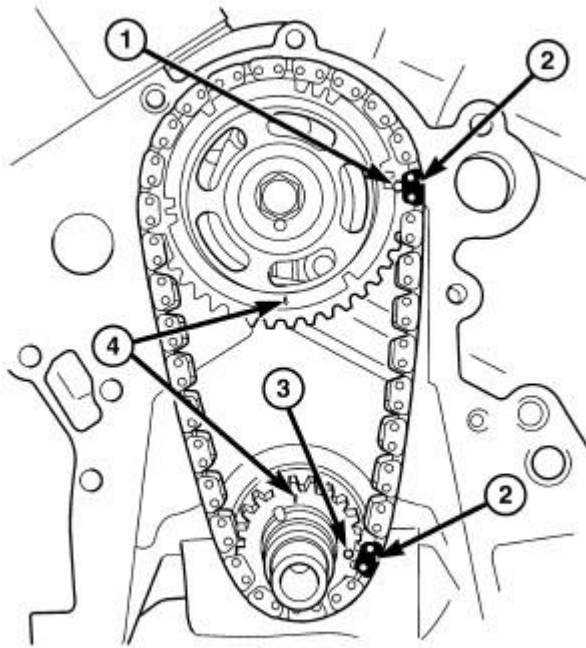
- 41 N.m (30 ft. lb.) with cylinder heads installed
 - 20 N.m (15 ft. lb.) with cylinder heads removed
3. Holding a measuring scale along edge of chain links.
 4. Apply force in the reverse direction to the following torque:
 - 41 N.m (30 ft. lb.) with cylinder heads installed
 - 20 N.m (15 ft. lb.) 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.). Refer to CHAIN and SPROCKETS, Timing.

CHAIN AND SPROCKETS, TIMING

Removal

TIMING CHAIN AND CAMSHAFT SPROCKET

1. Disconnect negative cable from battery.



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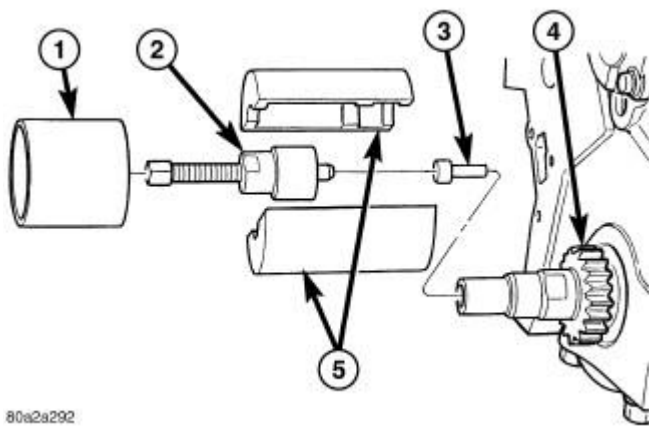
Fig. 223: Timing Mark Alignment

Courtesy of CHRYSLER LLC

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

2. Remove the timing chain cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.
3. Rotate engine by turning crankshaft until the timing marks are aligned (4).
4. Remove camshaft sprocket attaching bolt.
5. Remove the timing chain with camshaft sprocket.
6. Remove the crankshaft sprocket. Refer to **CHAIN and SPROCKETS, Timing**.

CRANKSHAFT SPROCKET



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Fig. 224: CRANKSHAFT SPROCKET - REMOVAL

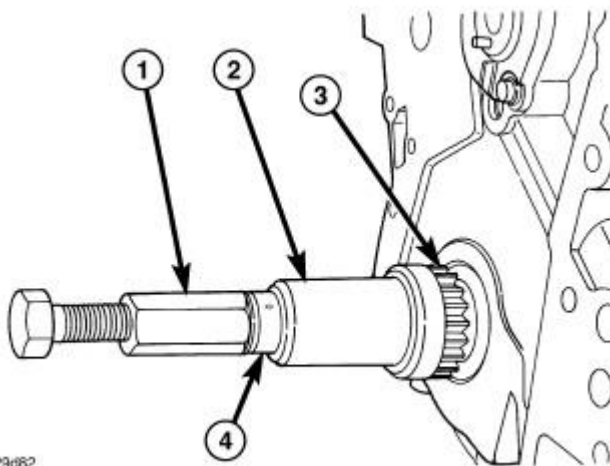
Courtesy of CHRYSLER LLC

- 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. Refer to **CHAIN and SPROCKETS, Timing**.
2. Using Special Tools 8539, 5048-6, and 5048-1, remove the crankshaft sprocket (4) while holding the crankshaft from turning. Be careful not to damage the crankshaft surfaces.

Installation

CRANKSHAFT SPROCKET



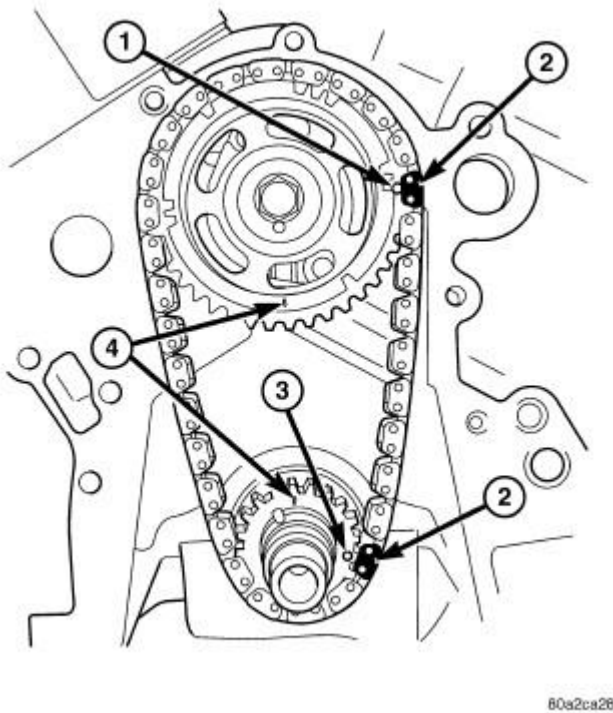
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Fig. 225: CRANKSHAFT SPROCKET - INSTALLATION

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). Install sprocket (3) until it is fully seats on the crankshaft.
3. Install the timing chain and camshaft sprocket. Refer to **CHAIN and SPROCKETS, Timing.**

TIMING CHAIN AND CAMSHAFT SPROCKET**Fig. 226: TIMING MARKS**

Courtesy of CHRYSLER LLC

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

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

2. While holding the camshaft sprocket and chain in hand, place the timing chain around the sprocket, aligning the plated link (2) with the dot on the sprocket (1). Position the timing arrow (4) to the 6 o'clock position.
3. Place the timing chain around crankshaft sprocket with the plated link (2) lined up with the dot on the

sprocket (3). Install the camshaft sprocket into position.

4. Use a straight edge to check alignment of timing marks (4).
5. Install the camshaft sprocket bolt and washer. Tighten the bolt to 54 N.m (40 ft. lbs.).
6. Rotate the crankshaft two revolutions and check the timing mark alignment (4). If timing marks do not line up, remove the camshaft sprocket and realign.

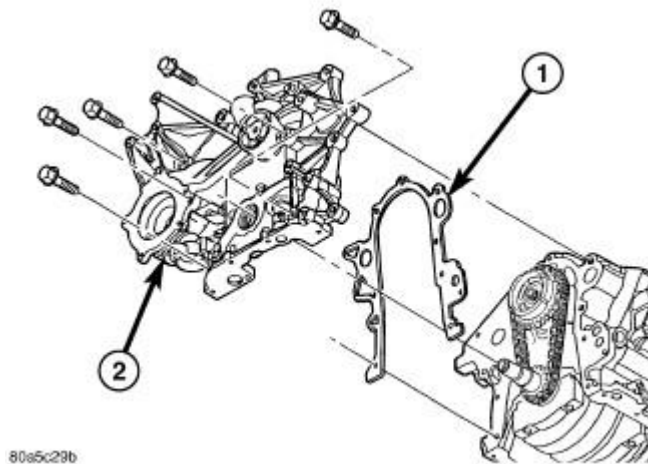


Fig. 227: TIMING CHAIN COVER AND GASKET

Courtesy of CHRYSLER LLC

7. Install the timing chain cover. See Engine/Valve Timing/COVER(S), Engine Timing - Installation.
8. Connect the negative battery cable.

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

COVER(S), ENGINE TIMING

Removal

REMOVAL

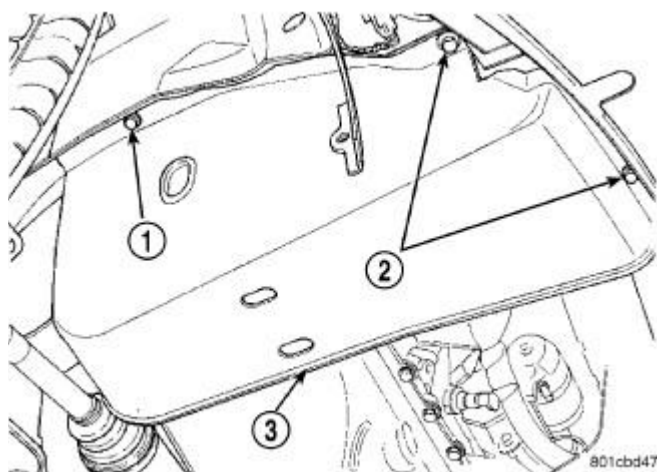


Fig. 228: Accessory Drive Belt Splash Shield
Courtesy of CHRYSLER LLC

- 1 - ATTACHING SCREW
- 2 - ATTACHING SCREWS
- 3 - SPLASH SHIELD

1. Disconnect and isolate the negative battery cable.
2. Drain the cooling system. Refer to **Cooling - Standard Procedure** .
3. Raise and secure the vehicle on hoist. Refer to **Vehicle Quick Reference/Hoisting - Standard Procedure** .
4. Drain the engine oil. See **Engine/Lubrication/OIL - Standard Procedure**.
5. Remove the right front tire and wheel assembly. Refer to **Tires and Wheels - Removal** .
6. Remove the right front inner splash shield (3).

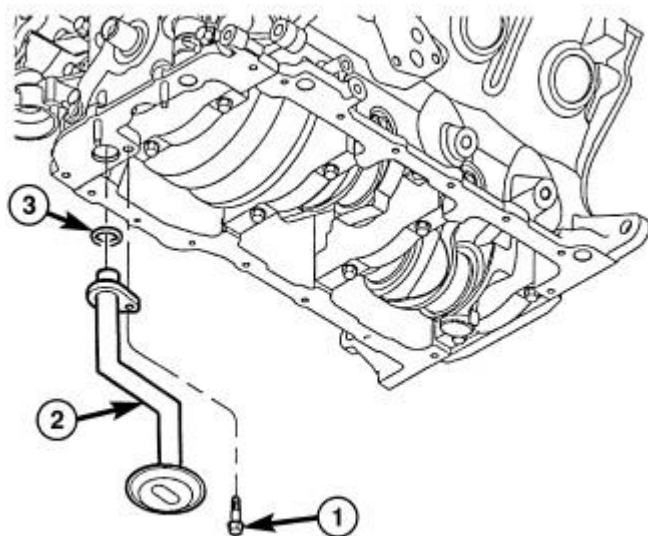


Fig. 229: OIL PICKUP TUBE
Courtesy of CHRYSLER LLC

- 1 - BOLT
- 2 - OIL PICK-UP TUBE
- 3 - O-RING

7. Remove the oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.
8. Remove the oil pick-up tube (2).

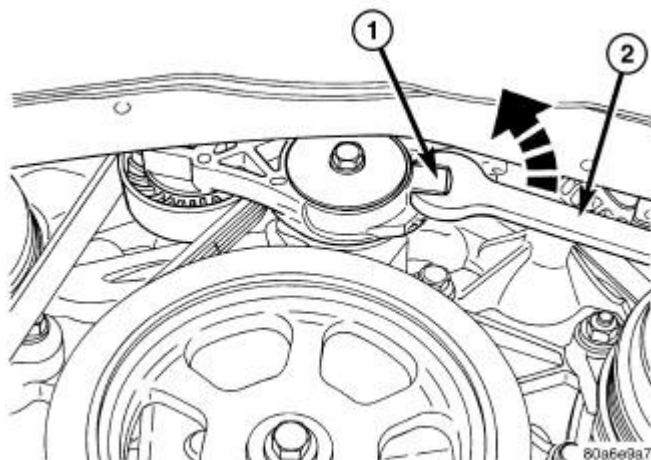


Fig. 230: DRIVE BELT TENSION RELEASE
Courtesy of CHRYSLER LLC

- 1 - BELT TENSIONER LUG
- 2 - WRENCH

9. Remove the accessory drive belt (1). Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal**.

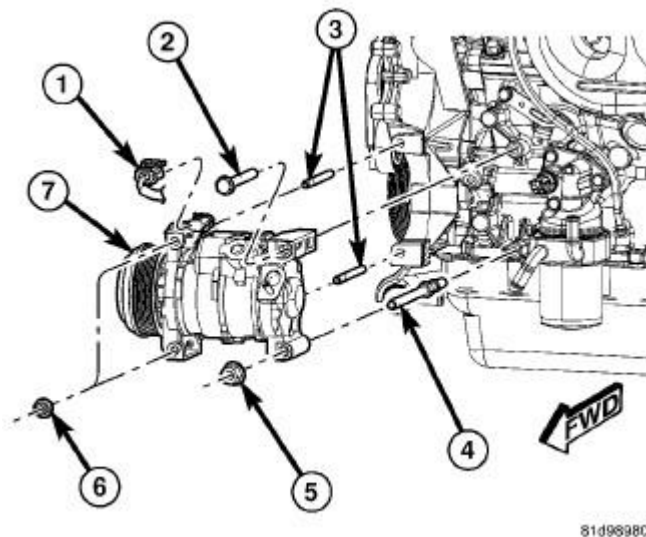


Fig. 231: Removing/Installing AC Compressor
Courtesy of CHRYSLER LLC

10. Remove the one bolt (2), three nuts (5 and 6) and reposition the A/C compressor (7).

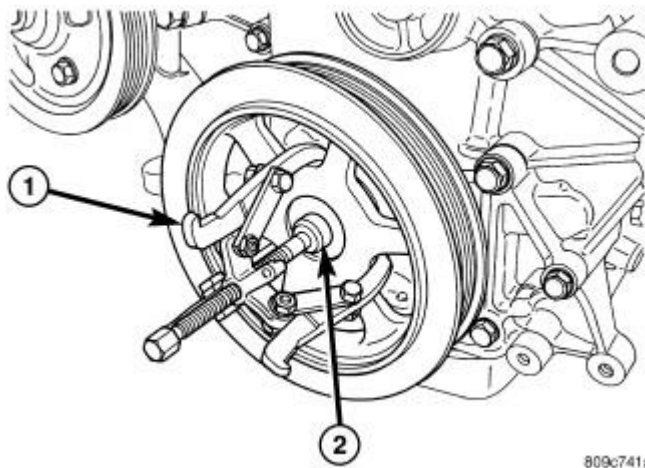


Fig. 232: VIBRATION DAMPER - REMOVAL
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - SPECIAL TOOL 8450 - INSERT
2 - SPECIAL TOOL 1026 - 3 JAW PULLER</p> |
|--|

11. Remove the crankshaft vibration damper. See **Engine/Engine Block/DAMPER, Vibration - Removal**.

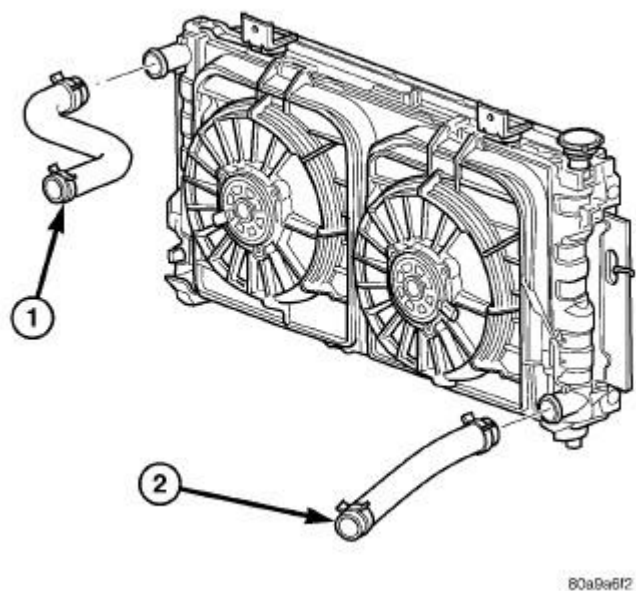


Fig. 233: Radiator Hoses to Radiator - 3.3/3.8L
Courtesy of CHRYSLER LLC

1 - UPPER HOSE
2 - LOWER HOSE

12. Remove the heater return hose from the timing chain cover housing or water pump inlet tube (if equipped with an engine oil cooler).
13. Remove the lower radiator hose (2).

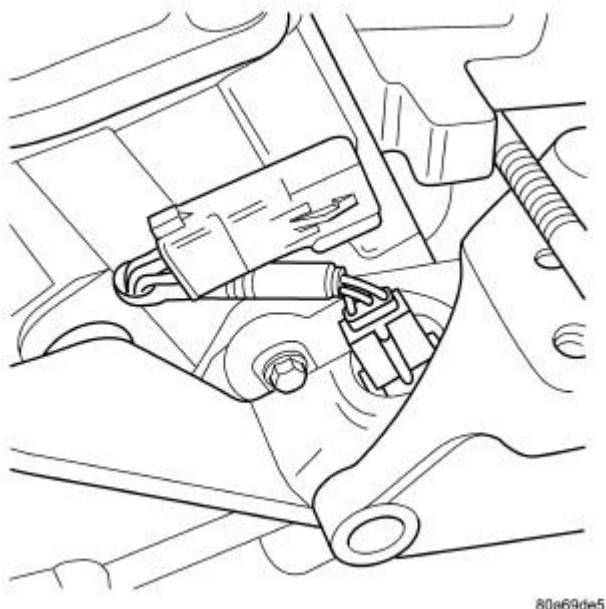


Fig. 234: Removing/Installing Camshaft Position Sensor
Courtesy of CHRYSLER LLC

14. Remove the camshaft position sensor from the timing chain cover. Refer to **Electrical/Ignition Control/SENSOR, Camshaft Position - Removal** .

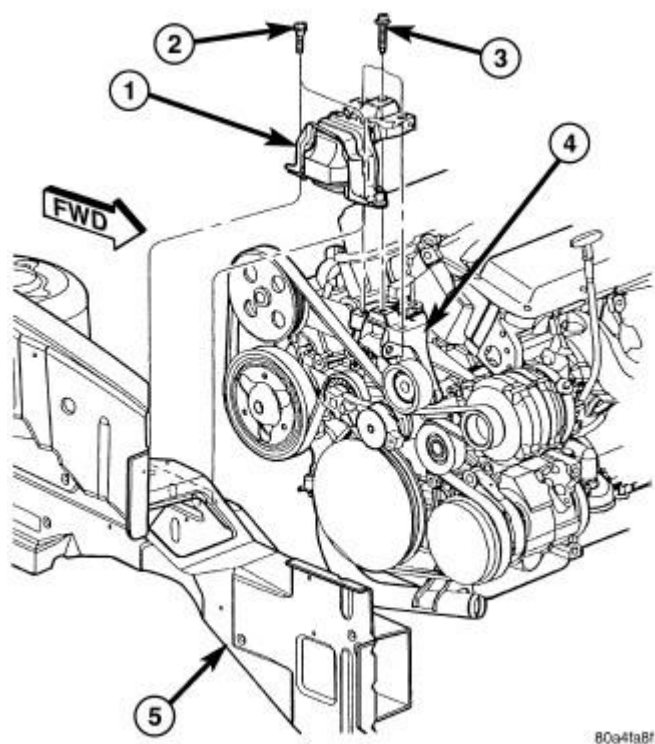


Fig. 235: Right Engine Mount
Courtesy of CHRYSLER LLC

- | |
|--|
| <ul style="list-style-type: none">1 - RIGHT ENGINE MOUNT2 - BOLT - MOUNT TO FRAME RAIL3 - BOLT - MOUNT TO ENGINE4 - ENGINE MOUNT BRACKET5 - RIGHT FRAME RAIL |
|--|

15. Remove the right side engine mount (1). See **Engine/Engine Mounting/INSULATOR, Engine Mount - Removal**.

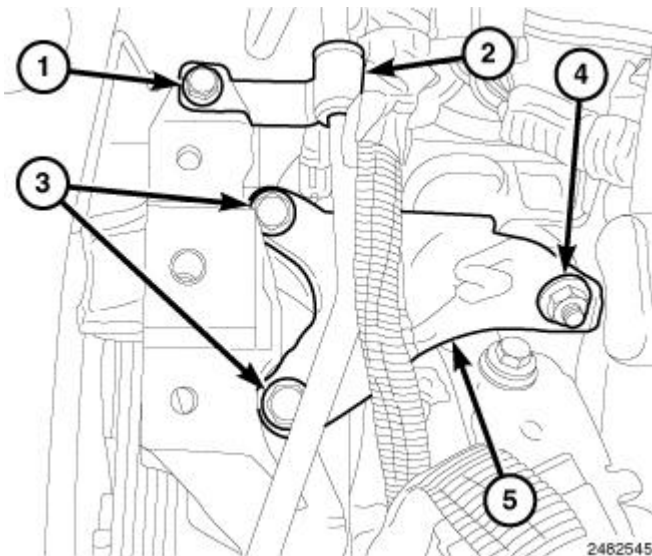


Fig. 236: Identifying Power Steering Line Support Bracket, Bolts, & Nut
Courtesy of CHRYSLER LLC

16. Remove the bolt (1) from the power steering line support bracket (2).
17. Remove two bolts (3), nut (4) and bracket (5).

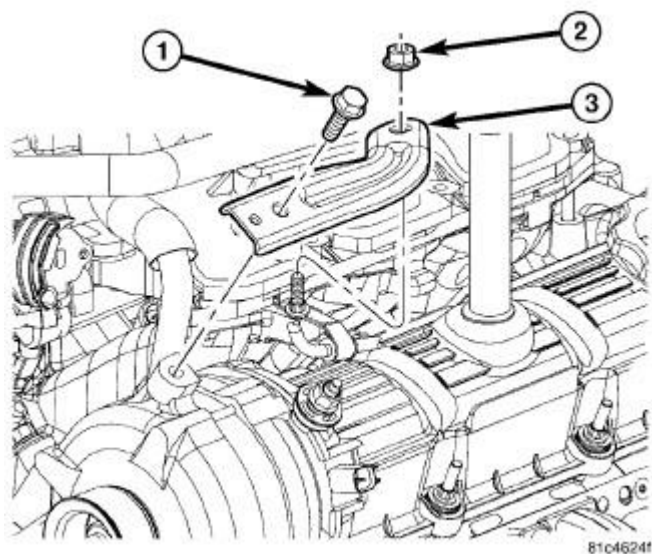


Fig. 237: Removing/Installing Alternator Bracket
Courtesy of CHRYSLER LLC

18. Remove the bolt (1), nut (2) and bracket (3).

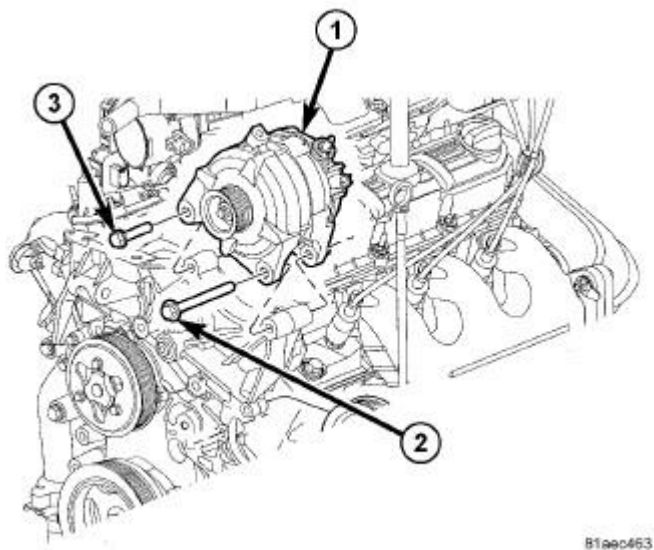


Fig. 238: Removing/Installing Generator
Courtesy of CHRYSLER LLC

19. Remove mounting bolts (2 and 3) and reposition the generator (1).

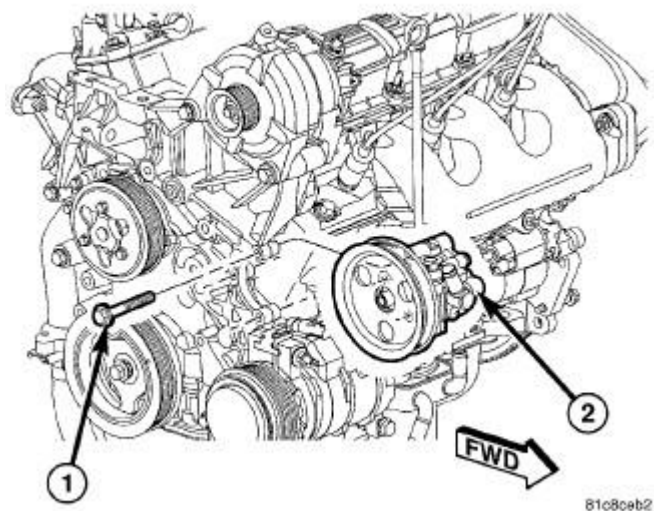


Fig. 239: Removing/Installing Power Steering Pump
Courtesy of CHRYSLER LLC

20. Remove three mounting bolts (1) through pump pulley and reposition power steering pump (2).

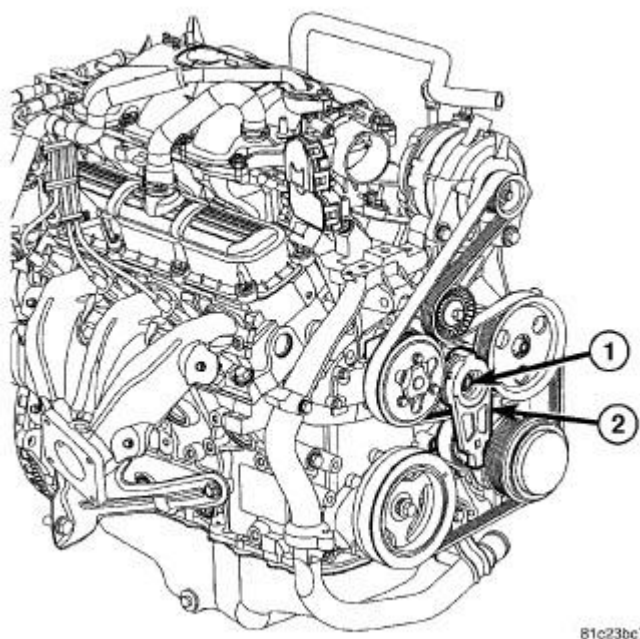


Fig. 240: Removing/Installing Accessory Drive Belt Tensioner
Courtesy of CHRYSLER LLC

1 - BOLT

2 - ACCESSORY DRIVE BELT TENSIONER

21. Remove the bolt (1) and the accessory drive belt tensioner (2).

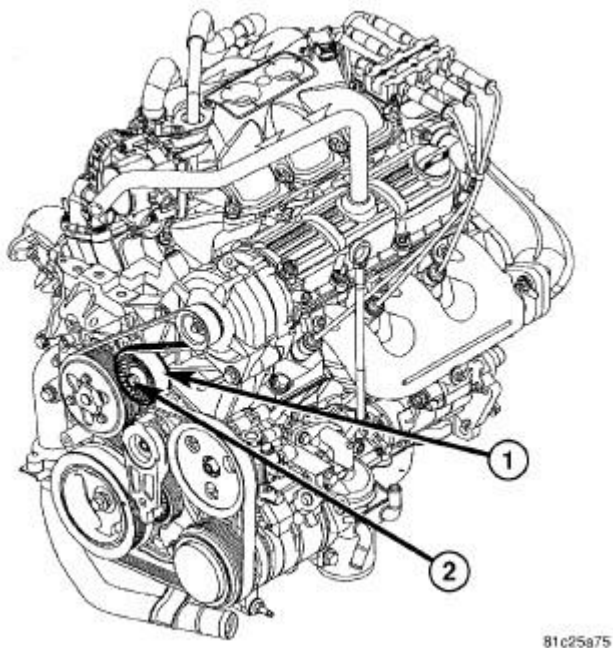


Fig. 241: Removing/Installing Idler Pulley

Courtesy of CHRYSLER LLC

1 - IDLER PULLEY
2 - BOLT

22. Remove the bolt (2) and the accessory drive belt idler pulley (1).

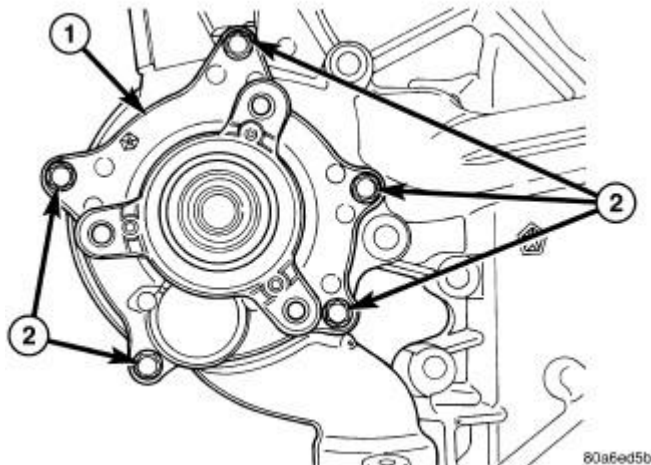


Fig. 242: Removing/Installing Water Pump

Courtesy of CHRYSLER LLC

1 - WATER PUMP
2 - BOLTS

23. Remove the water pump (1) for timing cover removal clearance. Refer to **Cooling/Engine/PUMP, Water - Removal**.

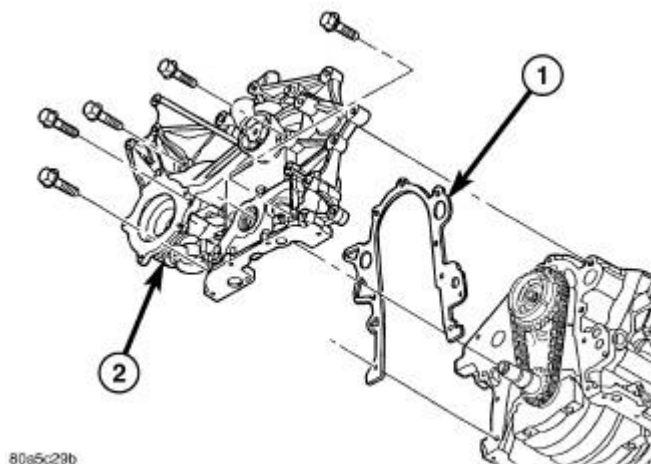


Fig. 243: TIMING CHAIN COVER AND GASKET

Courtesy of CHRYSLER LLC

- 1 - GASKET
- 2 - TIMING CHAIN COVER

24. Remove the timing chain cover fasteners and remove timing chain cover (2).

Installation

INSTALLATION

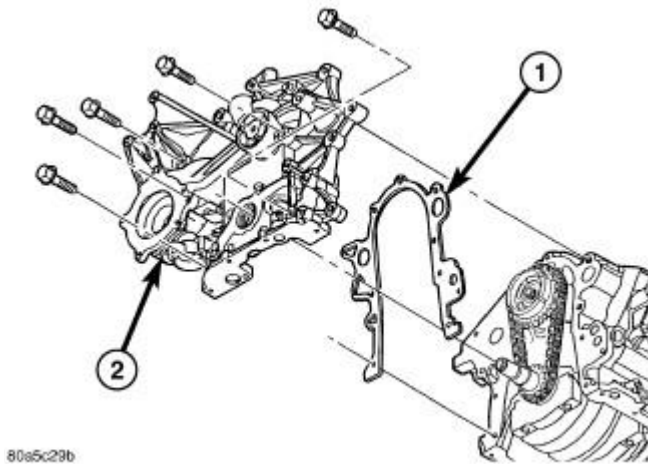


Fig. 244: TIMING CHAIN COVER AND GASKET
Courtesy of CHRYSLER LLC

- 1 - GASKET
- 2 - TIMING CHAIN COVER

1. Be sure the mating surfaces of the chain case cover and cylinder block are clean and free from burrs. The crankshaft oil seal must be removed to insure correct oil pump engagement.

NOTE: DO NOT USE SEALER ON COVER GASKET

2. Position a new gasket (1) on the timing cover (2). Adhere the new gasket to the chain case cover, making sure that the lower edge of the gasket is flush to 0.5 mm (0.020 in.) passed the lower edge of the cover.
3. Rotate the crankshaft so that the oil pump drive flats are in the vertical position.
4. Position the oil pump inner rotor so the mating flats are in the same position as the crankshaft drive flats.

CAUTION: Make sure the oil pump is engaged on the crankshaft correctly or severe damage may result.

5. Install the timing cover and timing chain cover bolts. Tighten M8 bolts to 27 N.m (20 ft. lbs.) and M10

bolts to 54 N.m (40 ft. lbs.).

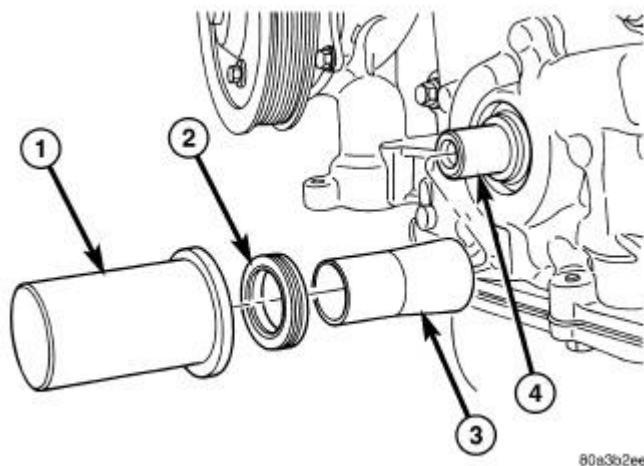


Fig. 245: CRANKSHAFT FRONT SEAL INSTALLATION
Courtesy of CHRYSLER LLC

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

6. Install the crankshaft front oil seal (2). See **Engine/Engine Block/SEAL, Crankshaft Oil - Installation.**

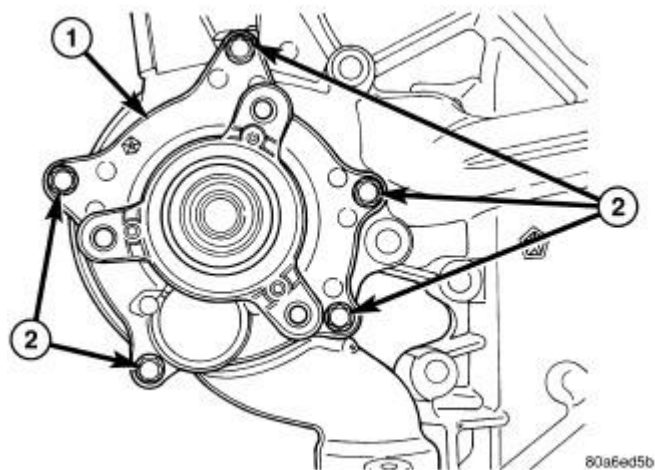


Fig. 246: Removing/Installing Water Pump
Courtesy of CHRYSLER LLC

- | |
|----------------|
| 1 - WATER PUMP |
| 2 - BOLTS |

7. Install the water pump and pulley. Refer to Cooling/Engine/PUMP, Water - Installation .

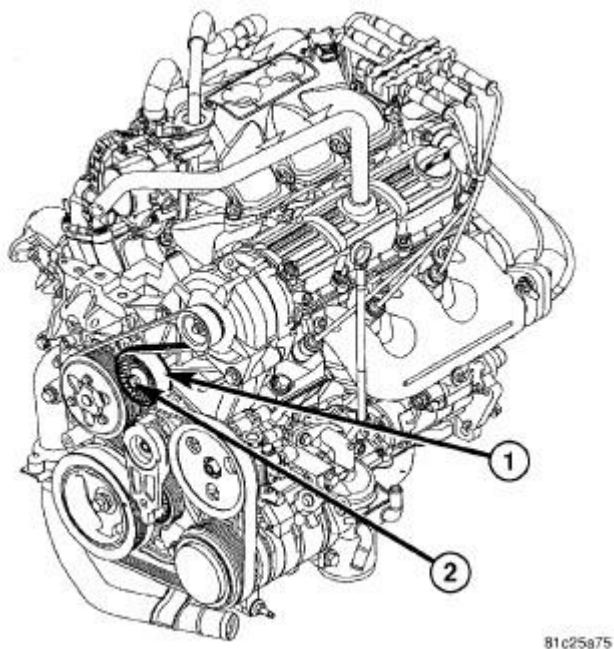


Fig. 247: Removing/Installing Idler Pulley
Courtesy of CHRYSLER LLC

1 - IDLER PULLEY
2 - BOLT

8. Install the accessory drive belt idler pulley (1). Tighten the bolt (2) to 28 N.m (250 in. lbs.).

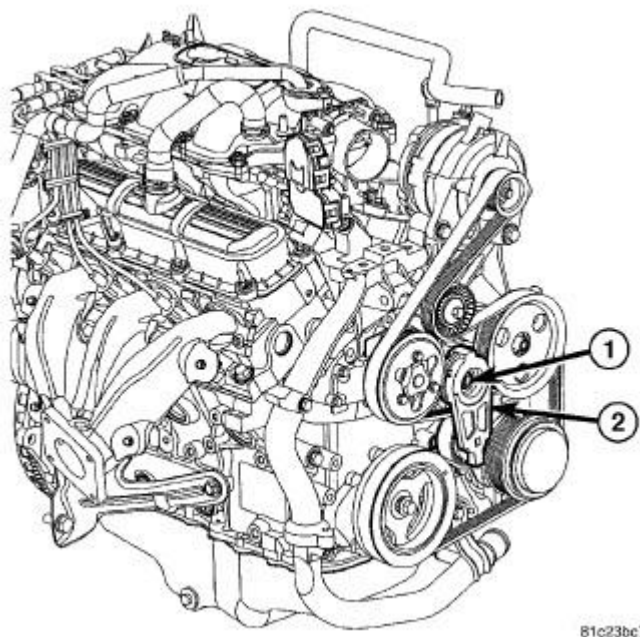


Fig. 248: Removing/Installing Accessory Drive Belt Tensioner
Courtesy of CHRYSLER LLC

1 - BOLT

2 - ACCESSORY DRIVE BELT TENSIONER

9. Install the accessory drive belt tensioner (2). Tighten the bolt (1) to 28 N.m (250 in. lbs.).

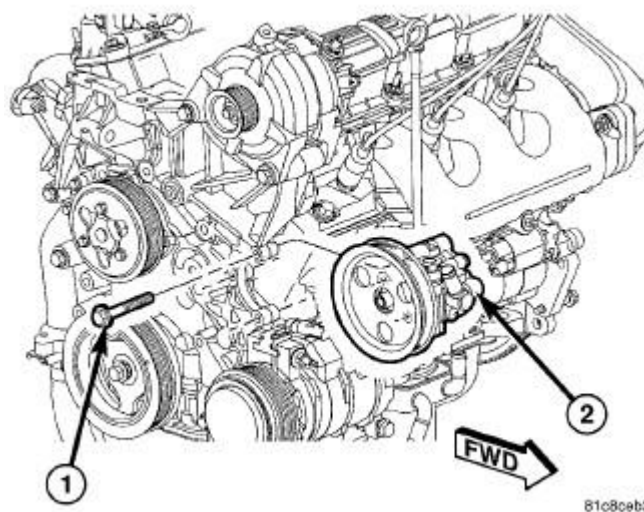


Fig. 249: Removing/Installing Power Steering Pump
Courtesy of CHRYSLER LLC

10. Position the power steering pump (2) on the engine.
11. Install three power steering pump mounting bolts (1) through openings in the pulley. Tighten pump mounting bolts to 23 N.m (17 ft. lbs.).

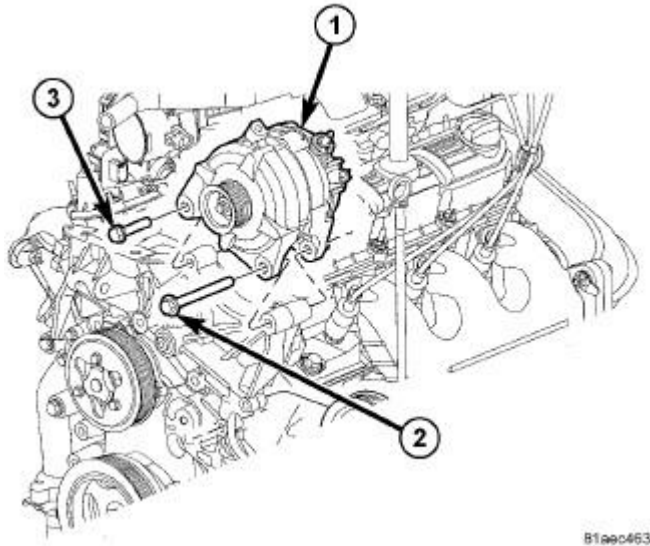


Fig. 250: Removing/Installing Generator
Courtesy of CHRYSLER LLC

12. Position the generator (1) on the engine and install two mounting bolts (2) and (3). Tighten both bolts to 54 N.m (40 ft. lbs.).

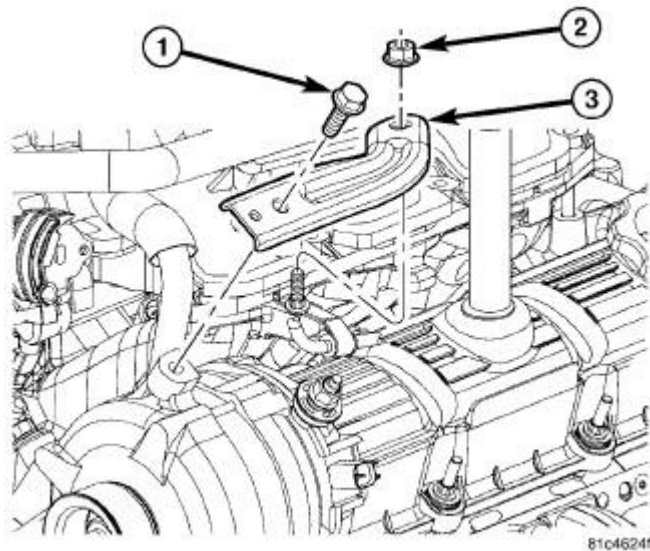


Fig. 251: Removing/Installing Alternator Bracket
Courtesy of CHRYSLER LLC

13. Install the bracket (3) to the generator and stud. Tighten the bolt (1) and nut (2) to 28 N.m (21 ft. lbs.).

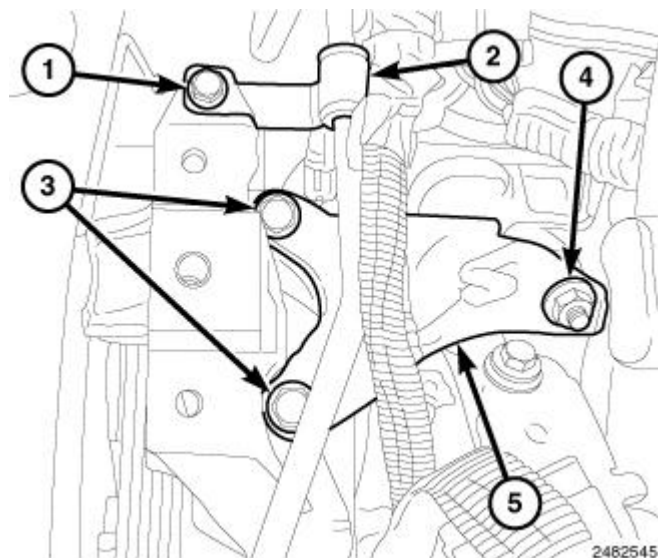


Fig. 252: Identifying Power Steering Line Support Bracket, Bolts, & Nut
Courtesy of CHRYSLER LLC

14. Install the front cover support bracket (5) with two bolts (3) and nut (4). Tighten the nut (4) to 22 N.m (200 in. lbs.). Tighten the bolts (3) to 25 N.m (18 ft. lbs.).
15. Position the power steering line support bracket (2) and install the mounting bolt (1). Tighten the bolt to 10 N.m (89 in. lbs.).

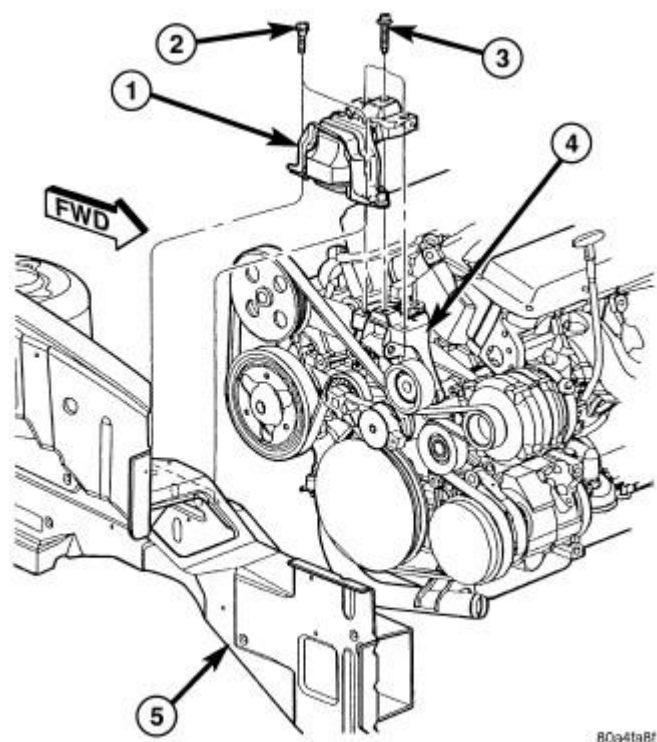


Fig. 253: Right Engine Mount
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - RIGHT ENGINE MOUNT
 2 - BOLT - MOUNT TO FRAME RAIL
 3 - BOLT - MOUNT TO ENGINE
 4 - ENGINE MOUNT BRACKET
 5 - RIGHT FRAME RAIL</p> |
|---|

16. Install the right side engine mount. See **Engine/Engine Mounting/INSULATOR, Engine Mount - Installation.**

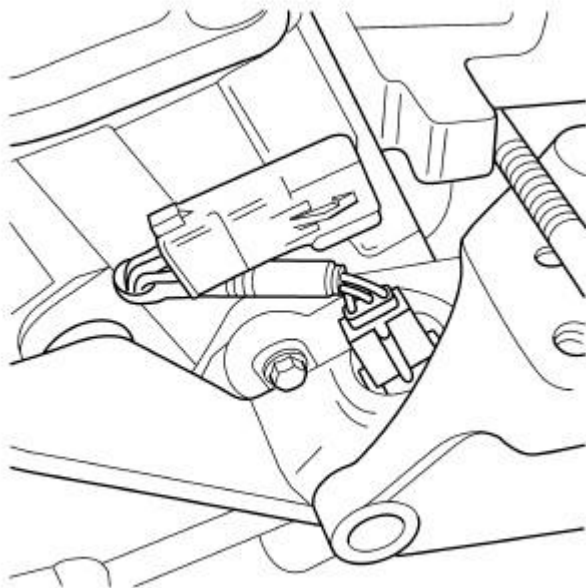


Fig. 254: Removing/Installing Camshaft Position Sensor
Courtesy of CHRYSLER LLC

17. Install the camshaft position sensor to the timing chain cover. Refer to **Electrical/Ignition Control/SENSOR, Camshaft Position - Installation** .

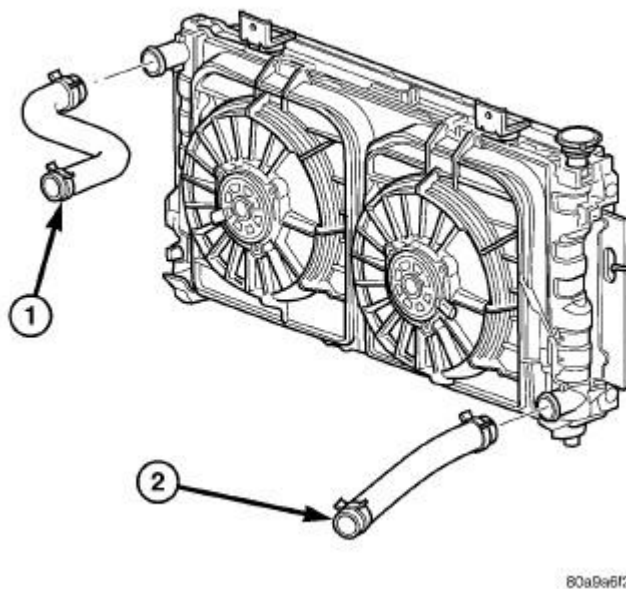


Fig. 255: Radiator Hoses to Radiator - 3.3/3.8L
Courtesy of CHRYSLER LLC

- 1 - UPPER HOSE
- 2 - LOWER HOSE

18. Connect the heater return hose to the timing chain cover housing or water pump inlet tube (if equipped with an engine oil cooler).
19. Connect the lower radiator hose (2).

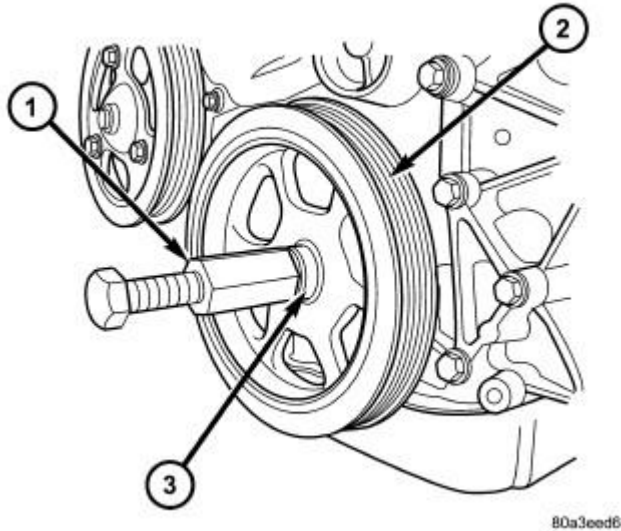


Fig. 256: CRANKSHAFT DAMPER
Courtesy of CHRYSLER LLC

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

20. Install the crankshaft vibration damper (2). See **Engine/Engine Block/DAMPER, Vibration - Installation**.

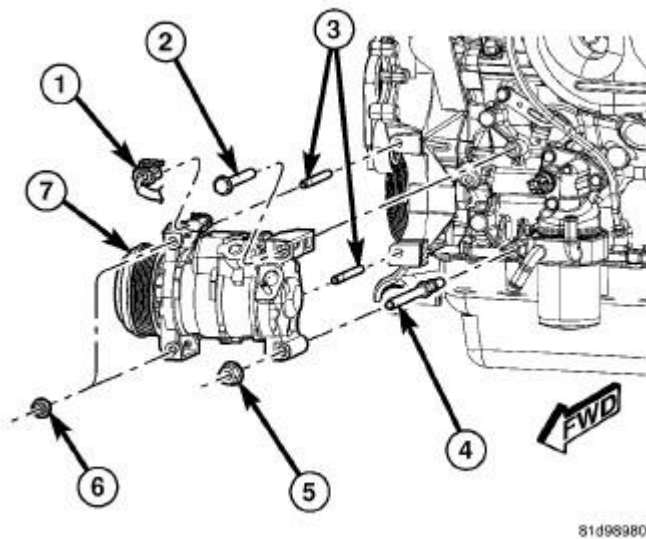


Fig. 257: Removing/Installing AC Compressor
Courtesy of CHRYSLER LLC

21. Position the A/C compressor (7) onto the engine and tighten the nuts (5 and 6) and bolt (2) in the following sequence:

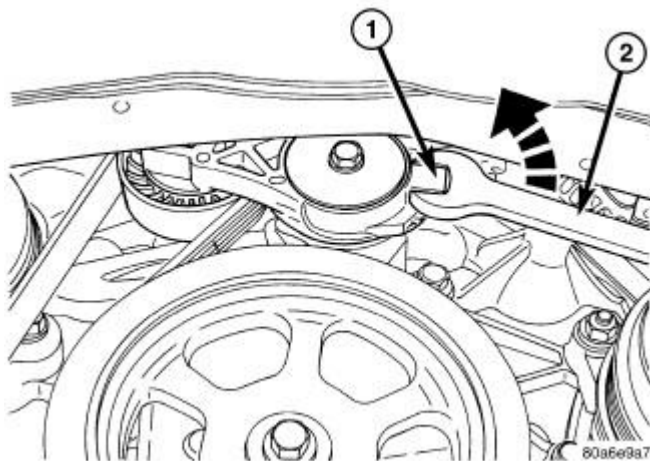
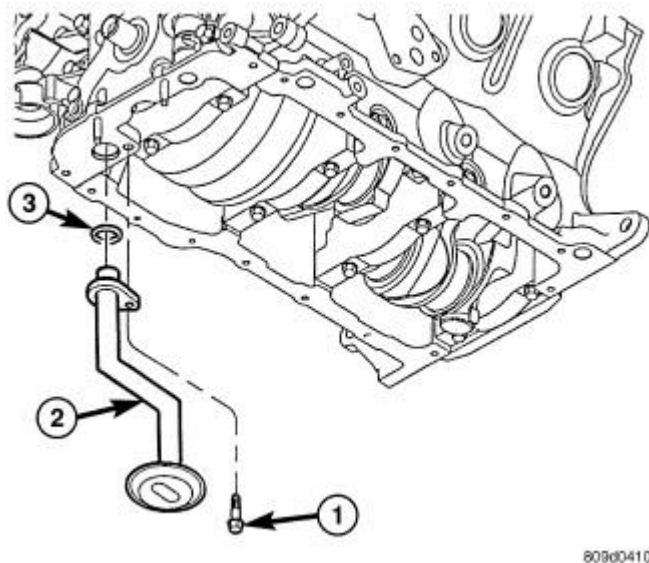


Fig. 258: Removing/Installing Accessory Drive Belt
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - BELT TENSIONER LUG
2 - WRENCH</p> |
|--|

- Install the bolt (2) and hand tighten.
- Install the nuts (5 and 6) and hand tighten.
- Tighten front 8 mm nuts (6) to 23 N.m (17 ft. lbs.).

- Tighten rear upper 10 mm bolt (2) to 40 N.m (30 ft. lbs.).
 - Tighten rear lower 10 mm nut (5) onto the stud with spacer (4) to 40 N.m (30 ft. lbs.).
22. Install accessory drive belt (1). Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation**.

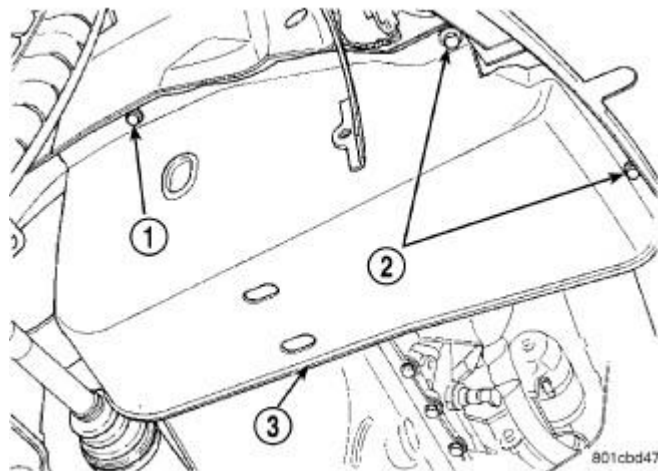


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Fig. 259: OIL PICKUP TUBE
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - BOLT
2 - OIL PICK-UP TUBE
3 - O-RING</p> |
|---|

23. Install the oil pump pick-up tube (2) with new O-ring (3). Tighten the attaching bolt (1) to 28 N.m (250 in. lbs.).
24. Install the oil pan. See **Engine/Lubrication/PAN, Oil - Installation**.



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Fig. 260: Accessory Drive Belt Splash Shield
Courtesy of CHRYSLER LLC

1 - ATTACHING SCREW 2 - ATTACHING SCREWS 3 - SPLASH SHIELD
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25. Install the right front inner splash shield (3).
26. Install the right front tire and wheel assembly. Refer to **Tires and Wheels - Installation** .
27. Fill the crankcase with engine oil to proper level. See **Engine/Lubrication/OIL - Standard Procedure**.
28. Fill cooling system. Refer to **Cooling - Standard Procedure** .
29. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).