2009 ENGINE

3.5L - Service Information - Journey

DESCRIPTION

DESCRIPTION

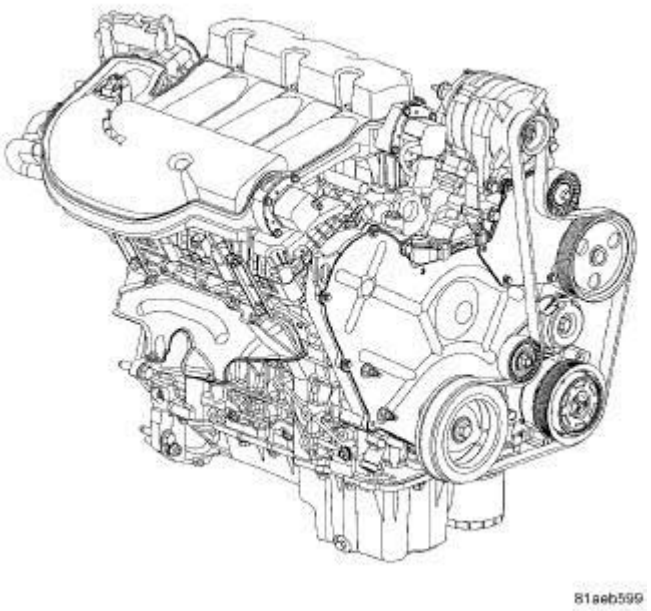

Fig. 1: View Of 3.5L Engine
Courtesy of CHRYSLER LLC

The 3.5 Liter 60 degree V-6 engine is a single overhead camshaft design with hydraulic lifters and four valves per cylinder. The engine does not have provisions for a free wheeling valve train.

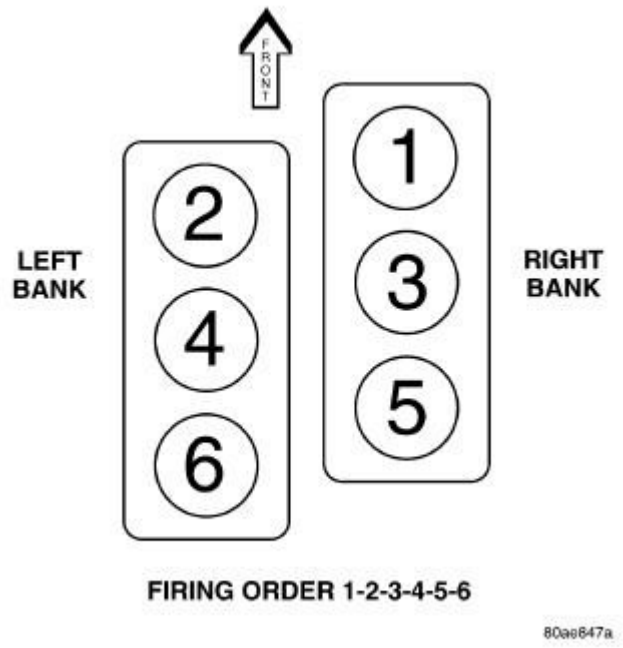

Fig. 2: Cylinder Numbering & Firing Order
Courtesy of CHRYSLER LLC

The cylinders are numbered from front to rear, with the right bank odd numbered, and the left bank even numbered. The firing order is 1-2-3-4-5-6.

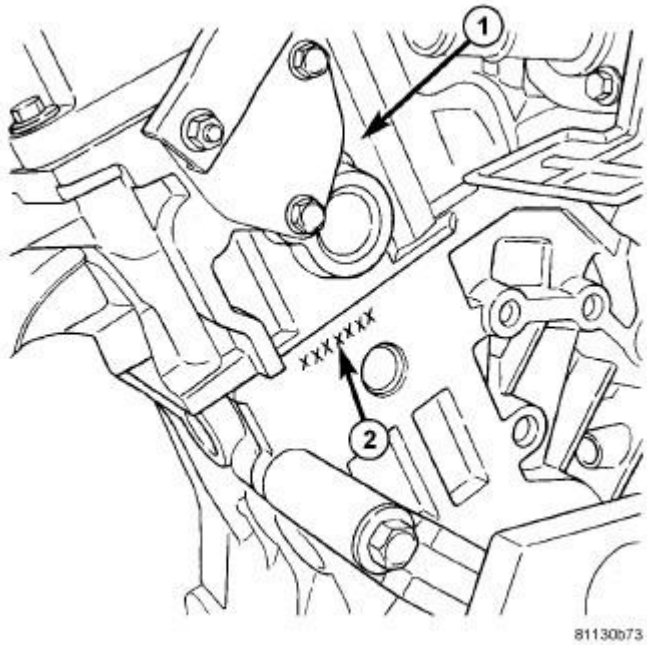

Fig. 3: ENGINE IDENTIFICATION
Courtesy of CHRYSLER LLC

1 - REAR OF LEFT CYLINDER HEAD 2 - ENGINE IDENTIFICATION NUMBER

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

DIAGNOSIS AND TESTING

INTRODUCTION

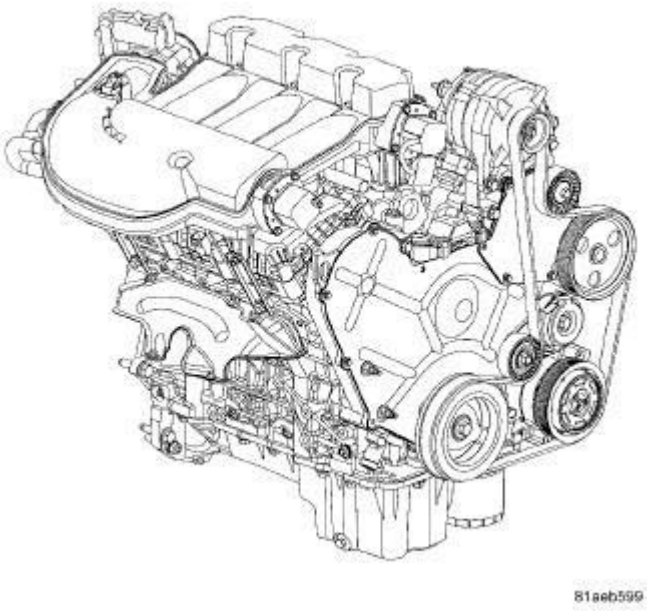

Fig. 4: View Of 3.5L Engine
Courtesy of CHRYSLER LLC

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).

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

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.

- Cylinder Head Gasket Failure Diagnosis: Refer to **CYLINDER HEAD GASKET**.
- Intake Manifold Leakage Diagnosis: Refer to **MANIFOLD, Intake**.
- Lash Adjuster (Tappet) Noise Diagnosis: Refer to **LASH ADJUSTER (TAPPET) NOISE DIAGNOSIS**.
- Engine Oil Leak Inspection: Refer to **ENGINE OIL LEAK INSPECTION**.

ENGINE PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery.	1. Test battery. Charge or replace as necessary. Refer to **Electrical - Engine Systems/Battery System/BATTERY - Description** .
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Apply a coat of light mineral grease to terminals.
	3. Faulty starter.	3. Test starting system. Refer to **Electrical - Engine Systems/Starting - Diagnosis and Testing** .
	4. Faulty coil(s) or control unit.	4. Test and replace as needed. (Refer to Appropriate Diagnostic Information)
	5. Incorrect spark plug gap.	5. Check and adjust gap as needed.
	6. Contamination in fuel system.	6. Clean system and replace fuel filter.
	7. Faulty fuel pump.	7. Test fuel pump and replace as needed. (Refer to Appropriate Diagnostic Information)
	8. Incorrect engine timing.	8. Check for a skipped timing belt or a loose camshaft sprocket.
ENGINE STALLS OR IDLES ROUGH	1. Idle speed too low.	1. Test minimum air flow. (Refer to Appropriate Diagnostic Information)
	2. Incorrect fuel mixture.	2. (Refer to Appropriate Diagnostic Information)
	3. Intake manifold leakage.	3. Inspect intake manifold gasket, manifold, and vacuum hoses.
	4. Faulty coil(s).	4. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped plugs.	1. Set gap as needed or replace plug(s).

	2. Contamination in fuel system.	2. Clean system and replace fuel filter.
	3. Faulty fuel pump.	3. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
	4. Incorrect valve timing.	4. Correct valve timing as needed.
	5. Leaking cylinder head gasket.	5. Replace cylinder head gasket.
	6. Low compression.	6. Test compression of each cylinder.
	7. Burned, warped, or pitted valves.	7. Replace valves.
	8. Plugged or restricted exhaust system.	8. Check exhaust system restriction. Replace parts, as necessary.
	9. Faulty coil(s).	9. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
ENGINE MISSES ON ACCELERATION	1. Dirty or incorrectly gapped spark plugs.	1. Set gap as needed or replace plug(s).
	2. Contamination in Fuel System.	2. Clean fuel system and replace fuel filter.
	3. Burned, warped, or pitted valves.	3. Replace valves.
	4. Faulty coil(s).	4. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
ENGINE MISSES AT HIGH SPEED	1. Dirty or incorrect spark plug gap.	1. Set gap as needed or replace plug(s).
	2. Faulty coil(s).	2. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
	3. Dirty fuel injector(s).	Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
	4. Contamination in fuel system.	4. Clean system and replace fuel filter.

MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES	1. High or low oil level in crankcase.	1. Check and correct engine oil level.
	2. Thin or diluted oil.	2. Change oil to correct viscosity.
	3. Thick oil	3. (a.) Change oil and filter. (b.) Run engine to operating

		temperature. (c.) Change oil and filter again.
	4. Low oil pressure.	4. Check and correct engine oil level.
	5. Dirt in tappets/lash adjusters.	5. Replace rocker arm/hydraulic lash adjuster assembly.
	6. Worn rocker arms.	6. Inspect oil supply to rocker arms.
	7. Worn tappets/lash adjusters.	7. Install new rocker arm/hydraulic lash adjuster assembly.
	8. Worn valve guides.	8. Replace cylinder head(s).
	9. Excessive runout of valve seats on valve faces.	9. Grind valve seats and valves.
	10. Missing adjuster pivot.	10. Replace rocker arm/hydraulic lash adjuster assembly.
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. Check engine oil level.
	2. Low oil pressure.	2. Check engine oil level. Inspect oil pump relief valve and spring.
	3. Thick/Thin or diluted oil.	3. Change oil to correct viscosity. (a.) Change oil and filter. (b.) Run engine to operating temperature. (c.) Change oil and filter again.
	4. Excessive bearing clearance.	4. Measure bearings for correct clearance. Repair as necessary.
	5. Connecting rod journal out-of-round.	5. Replace crankshaft or grind surface.
	6. Misaligned connecting rods.	6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply.	1. Check engine oil level.
	2. Low oil pressure.	2. Check engine oil level. Inspect oil pump relief valve and spring.
	3. Thick/Thin or diluted oil.	3. Change oil to correct viscosity. (a.) Change oil and filter. (b.) Run engine to operating temperature. (c.) Change oil and filter again.
	4. Excessive bearing clearance.	4. Measure bearings for correct clearance. Repair as necessary.
	5. Excessive end play.	5. Check thrust bearing for wear on flanges.
	6. Crankshaft journal out-of-round or worn.	6. Replace crankshaft or grind journals.
	7. Loose flywheel or torque	7. Tighten to correct torque.

	converter.	
OIL PRESSURE DROP	1. Low oil level. 2. Faulty oil pressure sending unit. 3. Low oil pressure. 4. Clogged oil filter. 5. Worn parts in oil pump. 6. Thin or diluted oil. 7. Oil pump relief valve stuck. 8. Oil pump suction tube loose. 9. Oil pump cover warped or cracked. 10. Excessive bearing clearance.	1. Check engine oil level. 2. Install new sending unit. 3. Check sending unit and main bearing oil clearance. 4. Install new oil filter. 5. Replace worn parts or pump. 6. Change oil to correct viscosity. 7. Remove valve and inspect, clean, or replace. 8. Remove oil pan and install new tube or clean, if necessary. 9. Install new oil pump. 10. Measure bearings for correct clearance.
OIL LEAKS	1. Misaligned or deteriorated gaskets. 2. Loose fastener, broken or porous metal part. 3. Misaligned or deteriorated cup or threaded plug.	1. Replace gasket(s). 2. Tighten, repair or replace the part. 3. Replace as necessary.
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 Appropriate Diagnostic Information) 2. Hone cylinder bores. Install new rings. 3. Clean pistons and install new rings. 4. Remove rings and check grooves. If groove is not proper width, replace piston. 5. Replace cylinder head(s). 6. Replace seal(s).

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 TIPM.
5. Install a suitable compression test gauge into the number 1 spark plug hole in cylinder head.
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.

ENGINE OIL LEAK INSPECTION

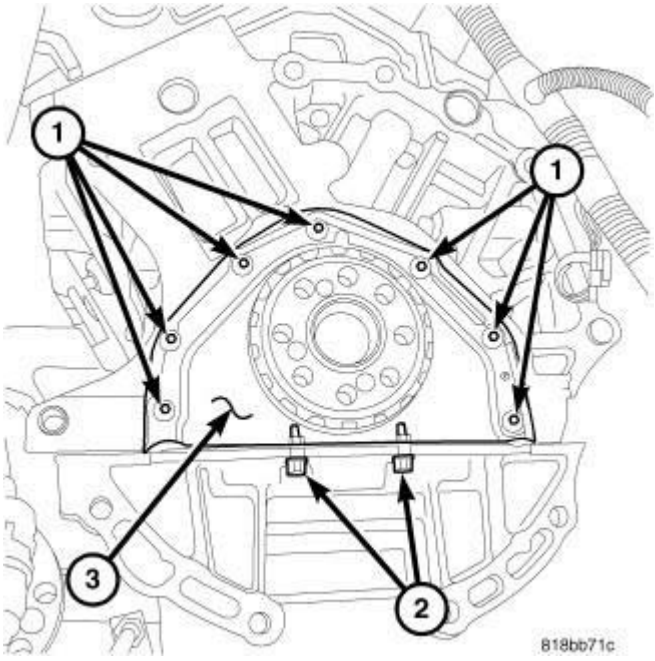

Fig. 5: REAR MAIN
Courtesy of CHRYSLER LLC

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

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

- Disconnect the fresh air hose (make-up air) at the cylinder head cover and plug or cap the nipple on the cover.
- Remove the PCV valve hose from the cylinder head cover. Cap or plug the PCV valve nipple on the cover.
- Attach an air hose with pressure gauge and regulator to the dipstick tube.

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

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

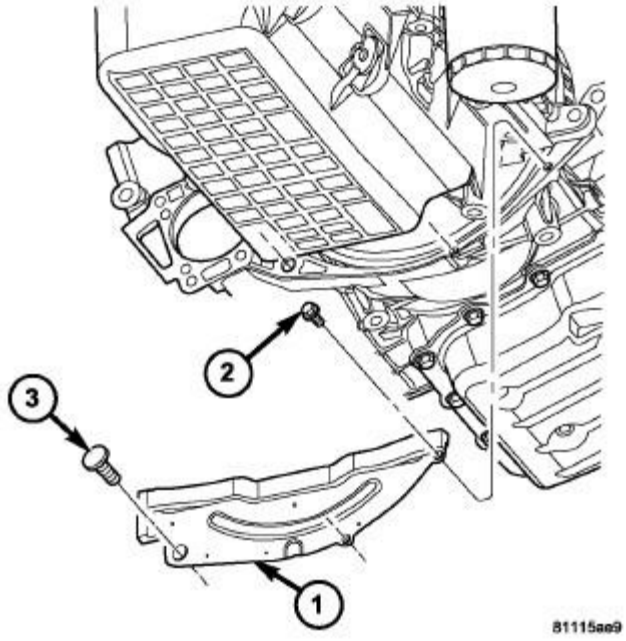

Fig. 6: Torque Converter Dust Shield
Courtesy of CHRYSLER LLC

1 - DUST SHIELD 2 - BOLT (2) 3 - RETAINER

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

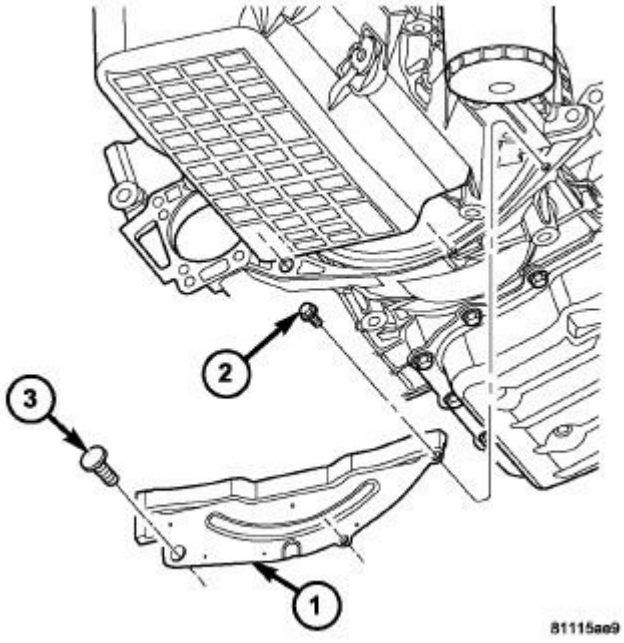

Fig. 7: Torque Converter Dust Shield
Courtesy of CHRYSLER LLC

1 - DUST SHIELD 2 - BOLT (2) 3 - RETAINER

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.

STANDARD PROCEDURE

ENGINE GASKET SURFACE PREPARATION

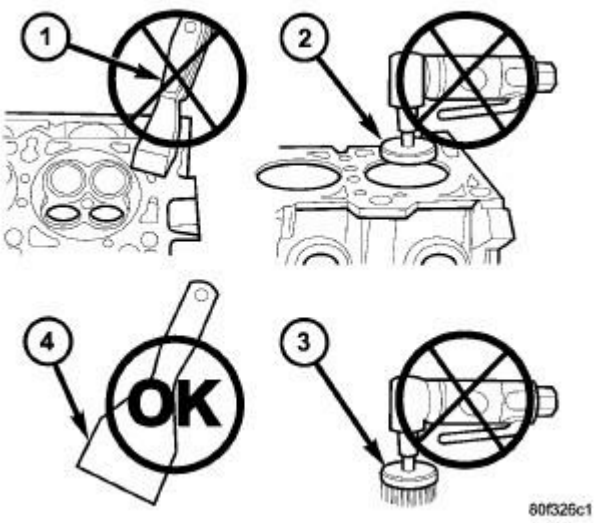

Fig. 8: PROPER TOOL USAGE FOR SURFACE PREPARATION
Courtesy of CHRYSLER LLC

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).

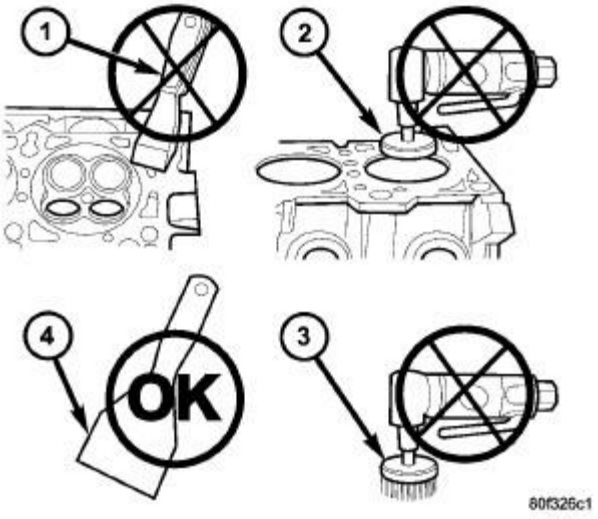

Fig. 9: PROPER TOOL USAGE FOR SURFACE PREPARATION

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).

FORM-IN-PLACE GASKETS AND SEALERS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket. **All sealing surfaces that use form-in-place gaskets must be free of grease or oil.** Surfaces should be cleaned with Mopar® brake parts cleaner prior to sealer application. After the sealer is applied, the parts should be assembled within 10 minutes.

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 bedplate and cylinder block without disturbing the bearing clearance or alignment of these components. The material cures slowly in the absence of air when torqued between two metallic surfaces, and will rapidly cure when heat is applied.

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

SEALER APPLICATION

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

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

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

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.

HYDROSTATIC LOCKED ENGINE

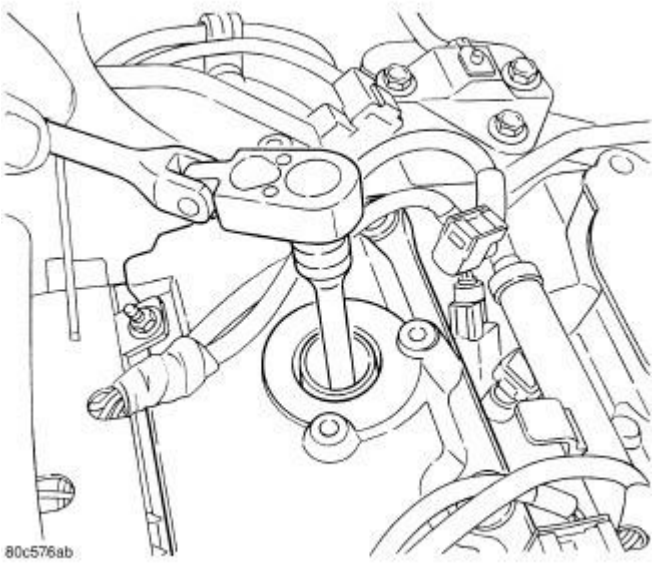

Fig. 10: SPARK PLUG REMOVAL/INSTALLATION
Courtesy of CHRYSLER LLC

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 reoccurring.

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.

ENGINE CORE AND OIL GALLERY PLUGS

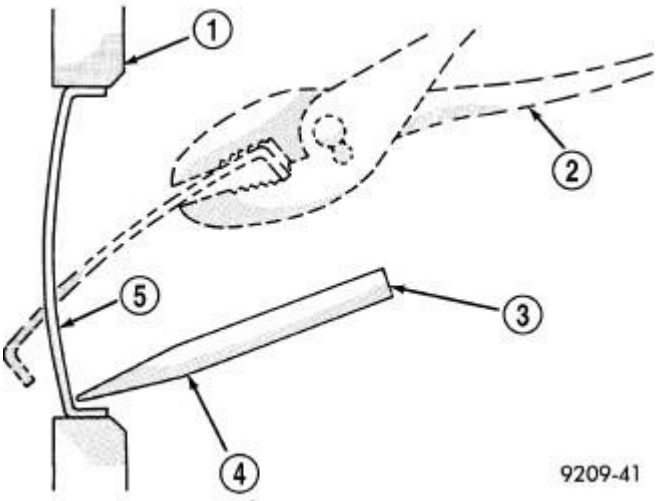

Fig. 11: Core Hole Plug Removal
Courtesy of CHRYSLER LLC

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

NOTE: Capture and store any residual fluid drainage, or leakage from disconnected components or systems in appropriately marked containers. Dispose of residual fluid in accordance with all applicable environmental regulations.

1. Remove the engine cover.

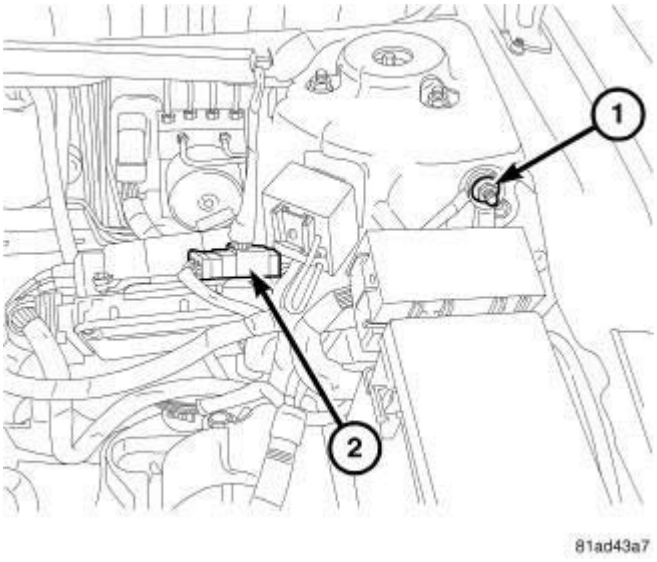

Fig. 12: BATTERY CABLE
Courtesy of CHRYSLER LLC

2. Disconnect and isolate the negative battery cable (1).
3. Drain the cooling system. Refer to **Cooling - Standard Procedure** .
4. Evacuate and recover the air conditioning system. Refer to **Heating and Air Conditioning/Plumbing - Standard Procedure** .
5. Perform the fuel pressure release procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .

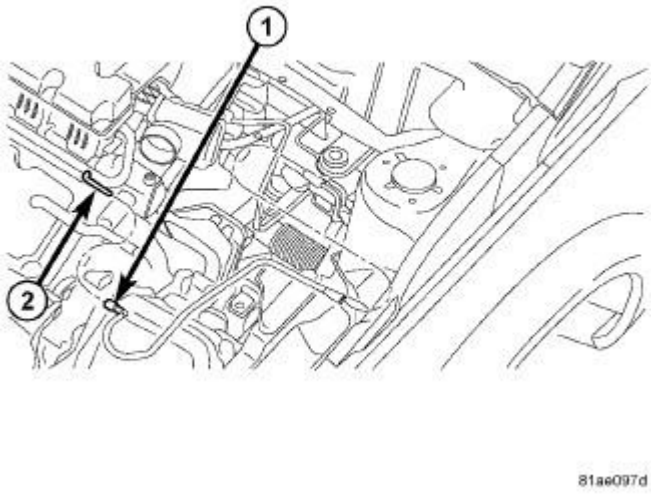

Fig. 13: Fuel Line From Fuel Rail Inlet
Courtesy of CHRYSLER LLC

6. Disconnect fuel line (1) from the fuel rail inlet (2) and position aside.

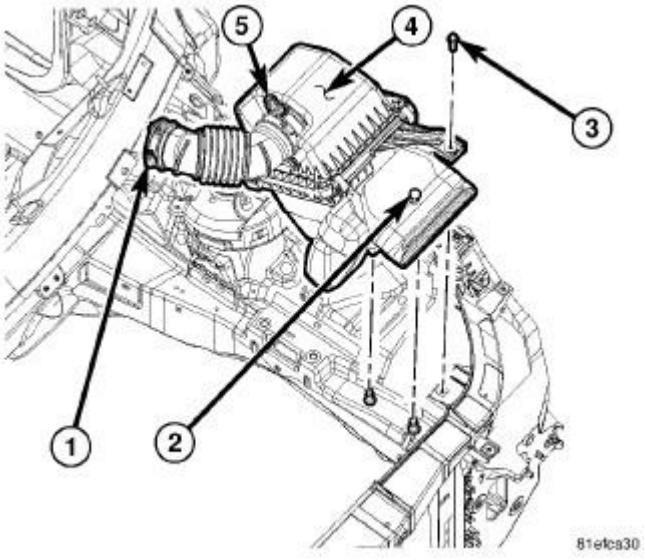

Fig. 14: HOUSING - AIR CLEANER
Courtesy of CHRYSLER LLC

7. Remove the Air Cleaner Housing (4). See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.

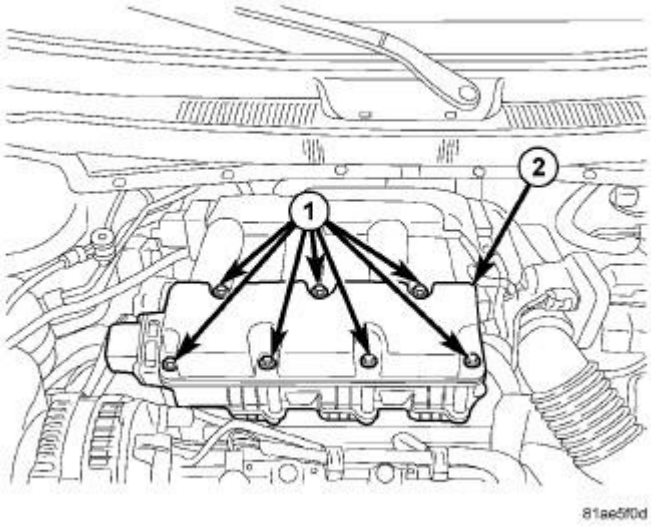

Fig. 15: Upper Intake Manifold
Courtesy of CHRYSLER LLC

8. Remove the Upper Intake Manifold (2). See **Engine/Manifolds/MANIFOLD, Intake - Removal**.

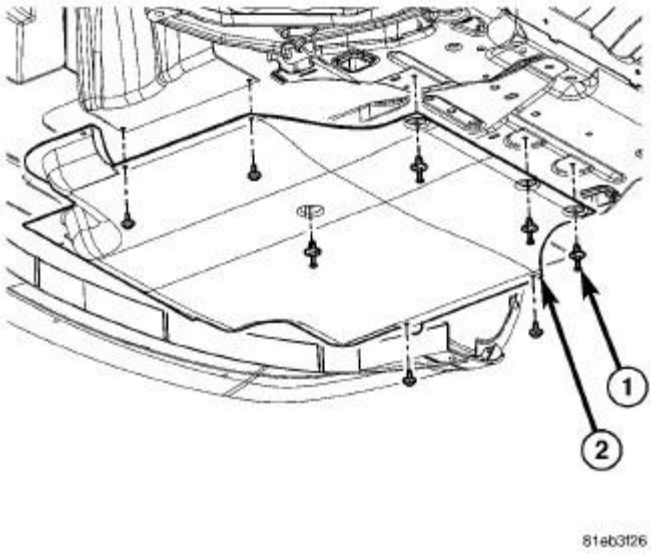

Fig. 16: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

9. Raise the vehicle.
10. Remove the 12 belly pan fasteners (1) and remove the belly pan (2).

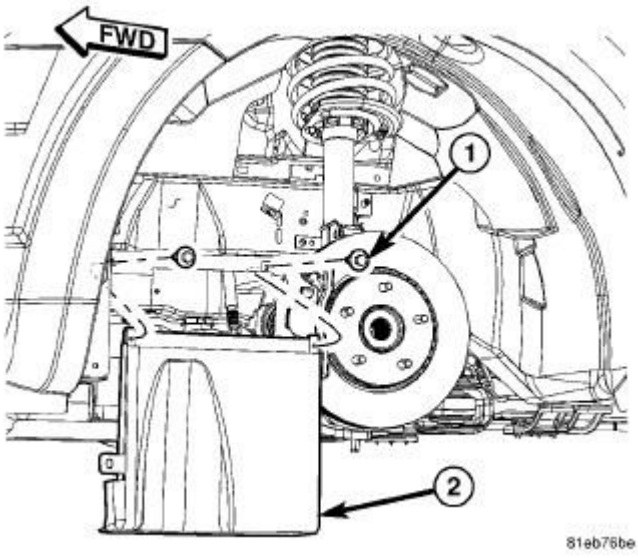

Fig. 17: Right Forward Splash Shield
Courtesy of CHRYSLER LLC

11. Remove the Right Forward Splash Shield (2). Refer to **Body/Exterior/SHIELD, Splash - Removal** .

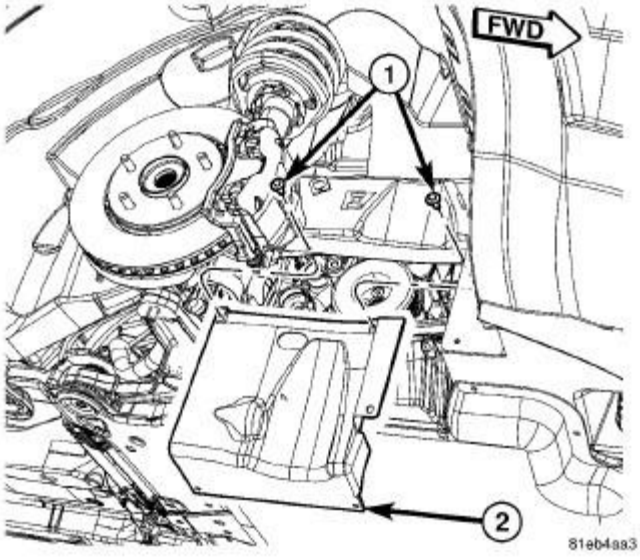

Fig. 18: Left Forward Splash Shield
Courtesy of CHRYSLER LLC

12. Remove the Left Forward Splash Shield (2). Refer to **Body/Exterior/SHIELD, Splash - Removal** .

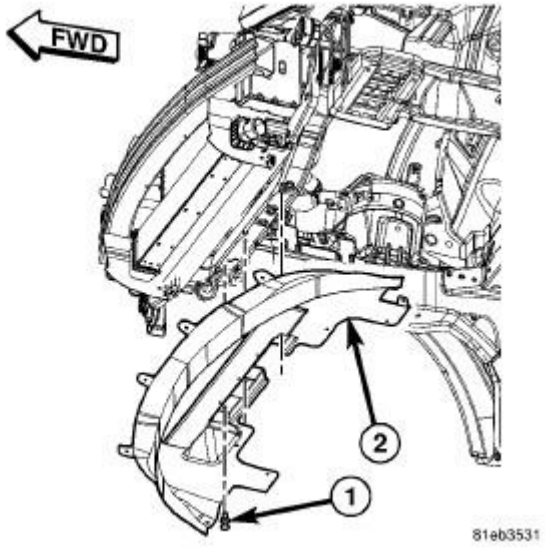

Fig. 19: Front Closeout Panel
Courtesy of CHRYSLER LLC

13. Remove the Front Closeout Panel (2). Refer to **Frame and Bumpers/Bumpers/FASCIA, Front Lower - Removal** .

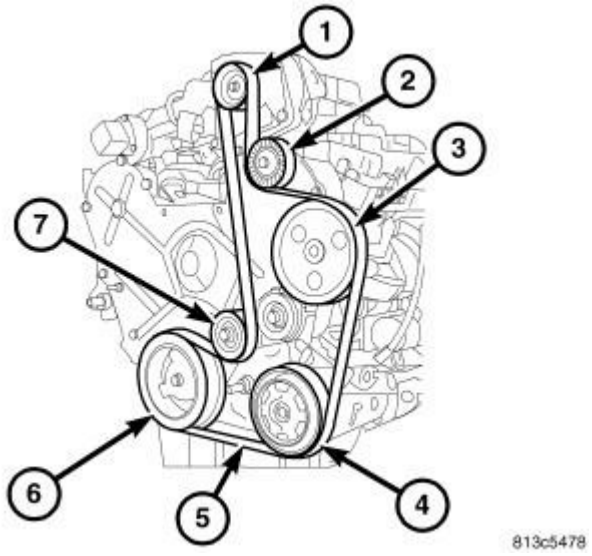

Fig. 20: 3.5L ENGINE ACCESSORY DRIVE BELT INSTALLATION
Courtesy of CHRYSLER LLC

1 - IDLER PULLEY
2 - P/S PUMP
3 - A/C COMPRESSOR
4 - CRANKSHAFT
5 - TENSIONER

6 - GENERATOR

14. Remove the accessory drive belt (6). Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal** .

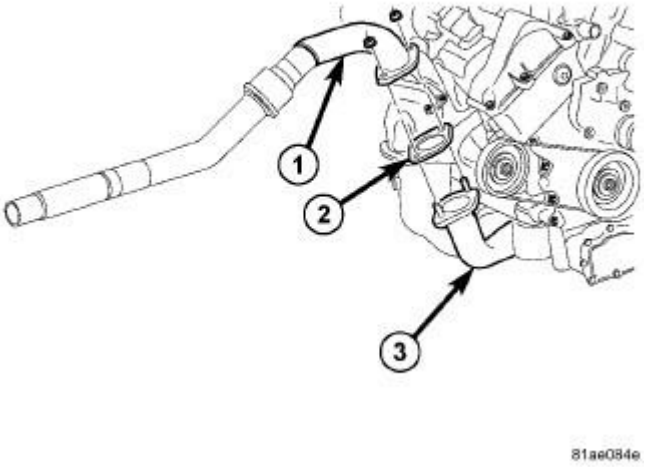

Fig. 21: Exhaust Extension Pipe & Gasket
Courtesy of CHRYSLER LLC

15. Disconnect the Exhaust Extension Pipe (1) and gasket (2) from the Crossunder pipe (3).
16. Remove the Cross Under Pipe (3). Refer to **Exhaust System/PIPE, Exhaust Crossunder - Removal** .

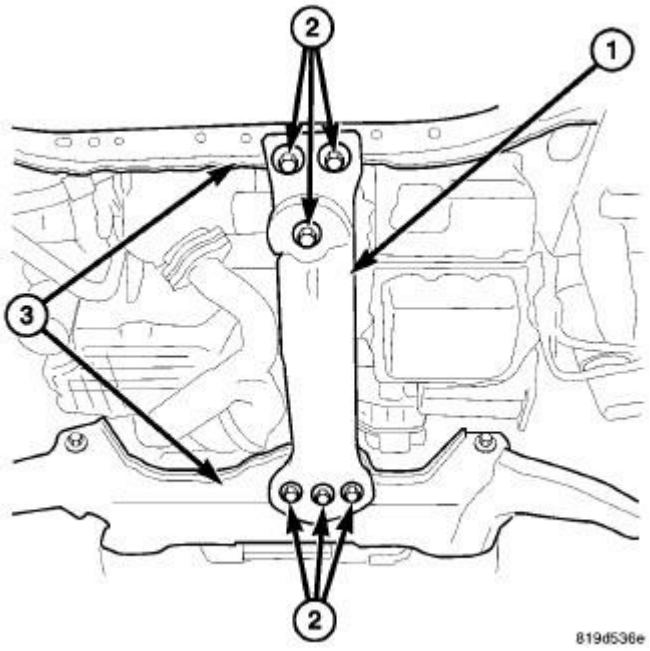

Fig. 22: FORE-AFT Crossmember
Courtesy of CHRYSLER LLC

17. Remove the fore-aft crossmember (1). Refer to **Frame and Bumpers/Frame/CROSSMEMBER - Removal** .

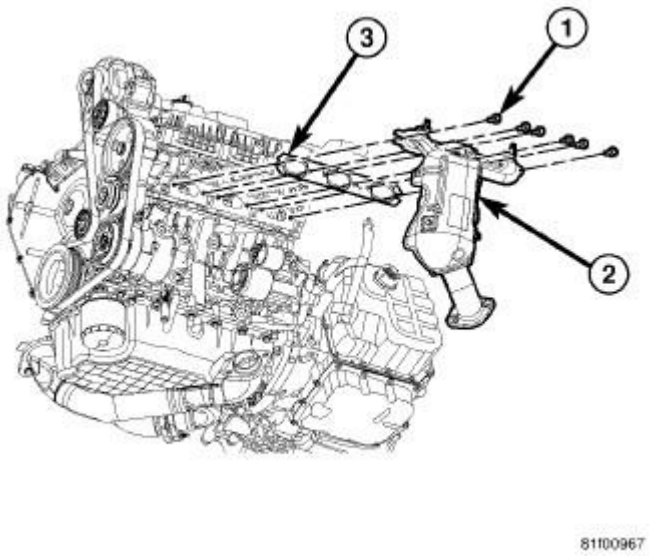

Fig. 23: Right Front Half Shaft Assembly
Courtesy of CHRYSLER LLC

18. Remove the Right Front Half Shaft assembly. Refer to **Differential and Driveline/Half Shaft - Removal** .
19. Remove the Right Maniverter. See **Engine/Manifolds/MANIFOLD, Exhaust - Removal**.

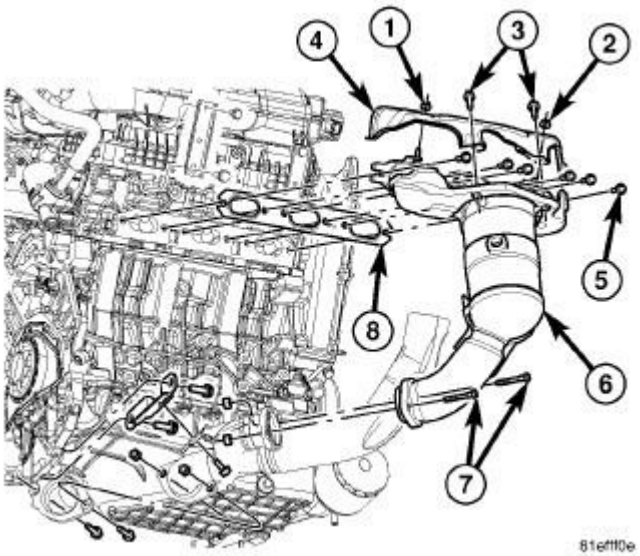

Fig. 24: Maniverter Retaining Bolts
Courtesy of CHRYSLER LLC

20. Remove the Left Maniverter (6). See **Engine/Manifolds/MANIFOLD, Exhaust - Removal**.

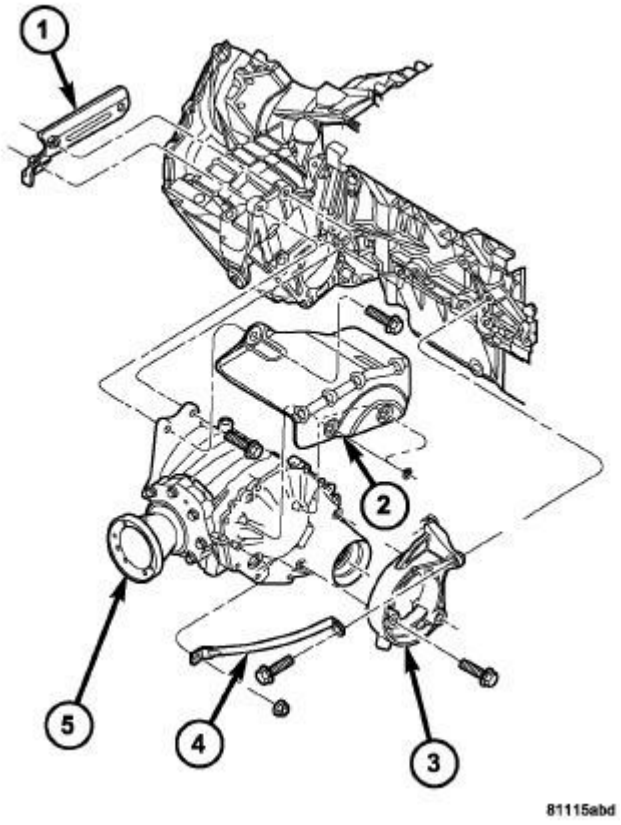

Fig. 25: Power Transfer Unit Mounting
Courtesy of CHRYSLER LLC

1 - BRACKET
2 - HEAT SHIELD
3 - BRACKET
4 - BRACE
5 - POWER TRANSFER UNIT

21. If equipped, remove the PTU (5). Refer to **Transmission and Transfer Case/Power Transfer Unit - Removal** .

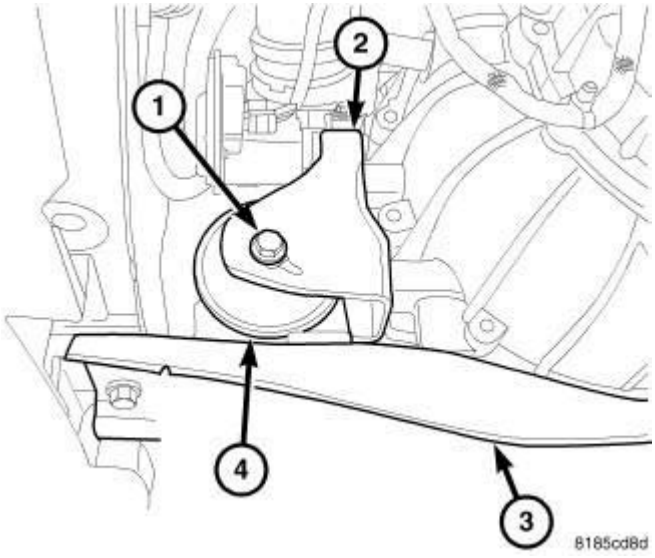

Fig. 26: Removing/Installing Front Mount
Courtesy of CHRYSLER LLC

22. Remove the Front Engine Mount Bracket (2). See **Engine/Engine Mounting/INSULATOR, Engine Mount - Removal**.

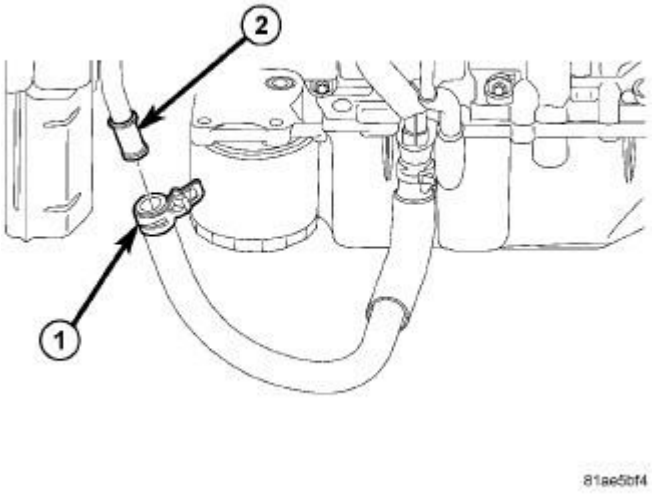

Fig. 27: Lower Coolant Hose From Return Tube
Courtesy of CHRYSLER LLC

23. Disconnect the Lower Coolant Hose (1) from the return tube (2).
24. Remove the Left Front Half Shaft. Refer to **Differential and Driveline/Half Shaft - Removal** .
25. Lower Vehicle.

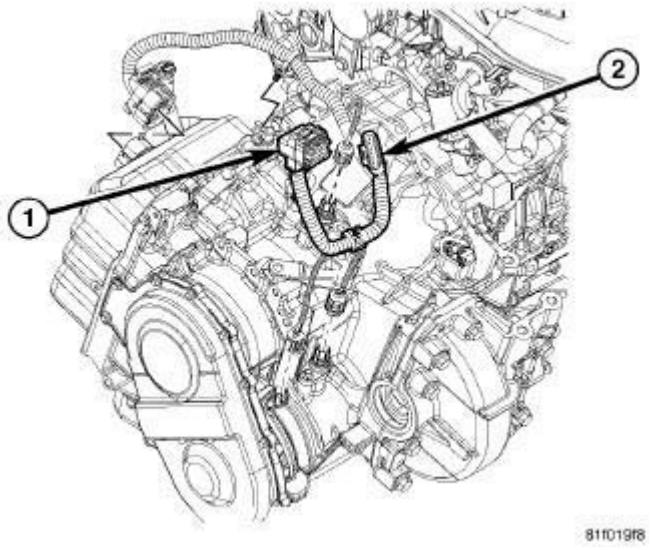

Fig. 28: Engine Harness Connectors
Courtesy of CHRYSLER LLC

26. Disconnect the engine harness PCM (1), 12-way (2), ground (3), 8-way (4) connectors.

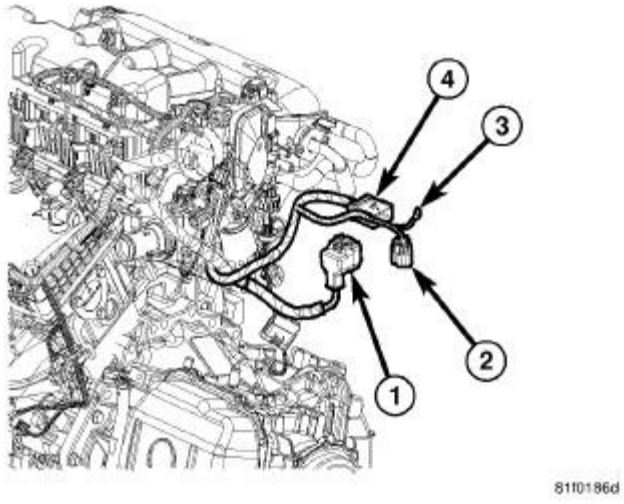

Fig. 29: Transaxle Harness Connectors
Courtesy of CHRYSLER LLC

27. Disconnect the transaxle harness PCM (1), and 6-way (2) connectors.

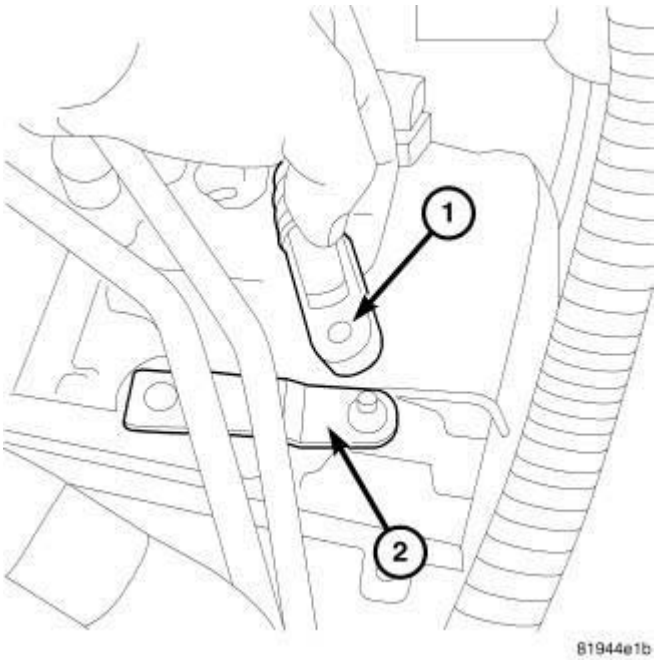

Fig. 30: Transaxle Shifter Cable
Courtesy of CHRYSLER LLC

28. Disconnect the transaxle shifter cable (1).

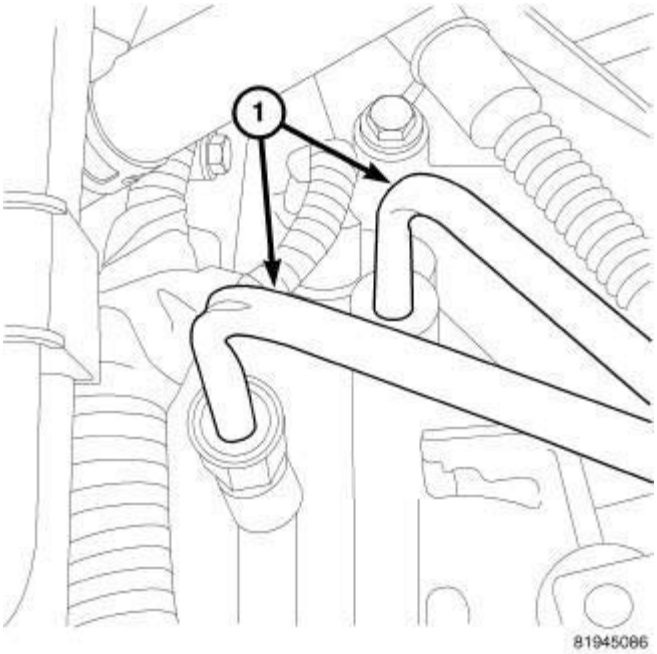

Fig. 31: Transaxle Cooler Lines
Courtesy of CHRYSLER LLC

29. Disconnect the transaxle cooler lines (1).

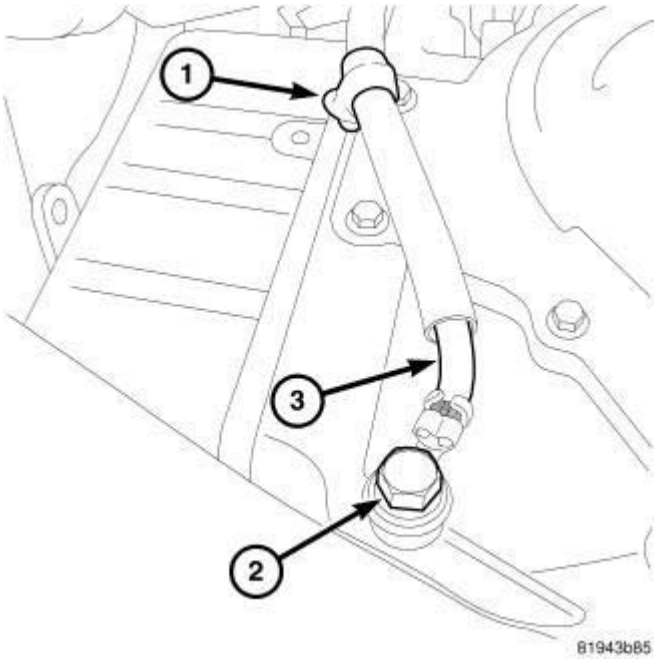

Fig. 32: GROUND CABLE
Courtesy of CHRYSLER LLC

30. Disconnect the ground (3) from the side of the transaxle.

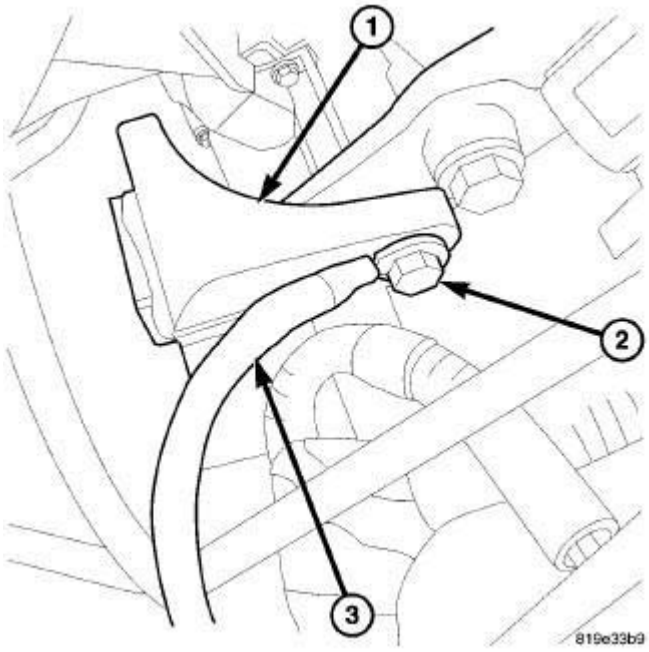

Fig. 33: GROUND CABLE AT FRONT MOUNT
Courtesy of CHRYSLER LLC

31. Disconnect the ground (3) from the front of the transaxle.

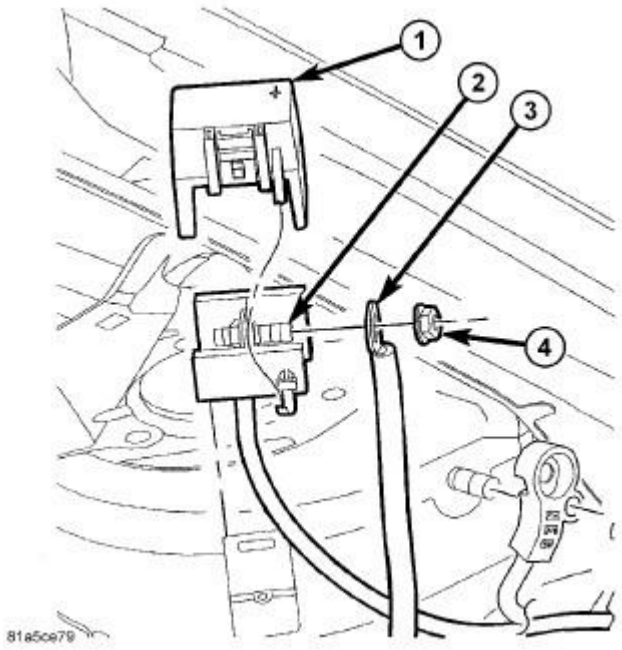

Fig. 34: Positive Auxiliary Battery Post Cable
Courtesy of CHRYSLER LLC

32. Disconnect the positive auxiliary battery post cable (2) and the negative battery cable from the left shock tower and position aside.

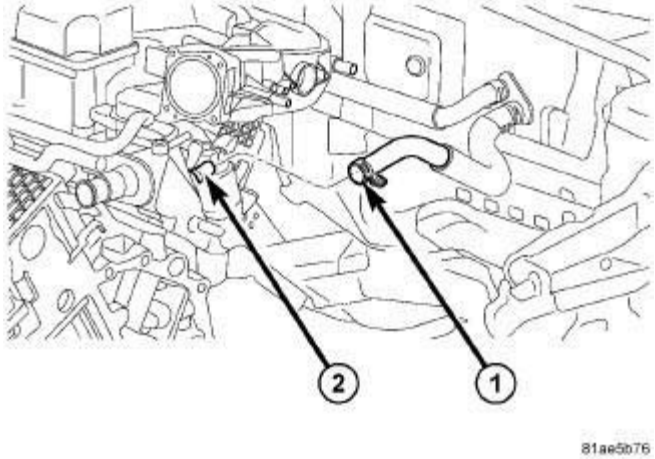

Fig. 35: Heater Core Supply Hose
Courtesy of CHRYSLER LLC

33. Disconnect the heater core supply hose (1) from the intake manifold outlet (2).

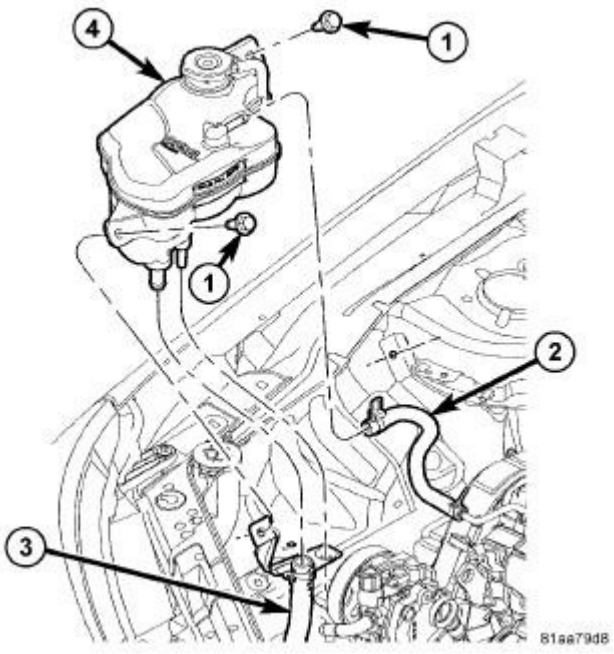

Fig. 36: COOLANT RECOVERY CONTAINER - PRESSURE SYSTEM
Courtesy of CHRYSLER LLC

34. Disconnect the coolant reservoir overflow hose (2) from the coolant bottle (4) and position aside.

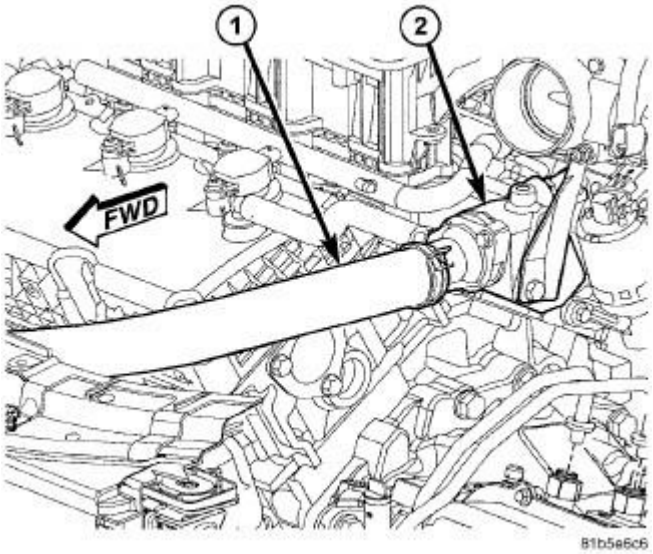

Fig. 37: Upper Radiator Hose From Thermostat Housing
Courtesy of CHRYSLER LLC

35. Disconnect the Upper Radiator hose (1) from the thermostat housing (2) and position aside.

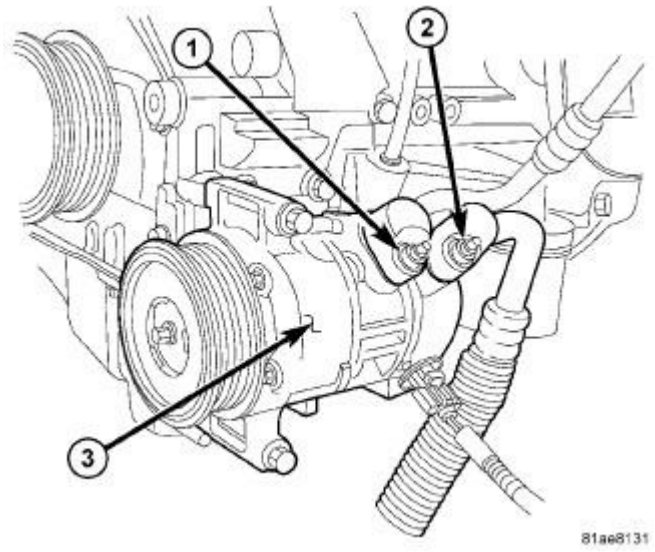

Fig. 38: A/C Discharge Line-Compressor
Courtesy of CHRYSLER LLC

36. Disconnect both A/C lines (1) and (2) and the harness connector from the A/C compressor (3).
37. Remove the A/C compressor (3). Refer to **Heating and Air Conditioning/Plumbing/COMPRESSOR, A/C - Removal** .

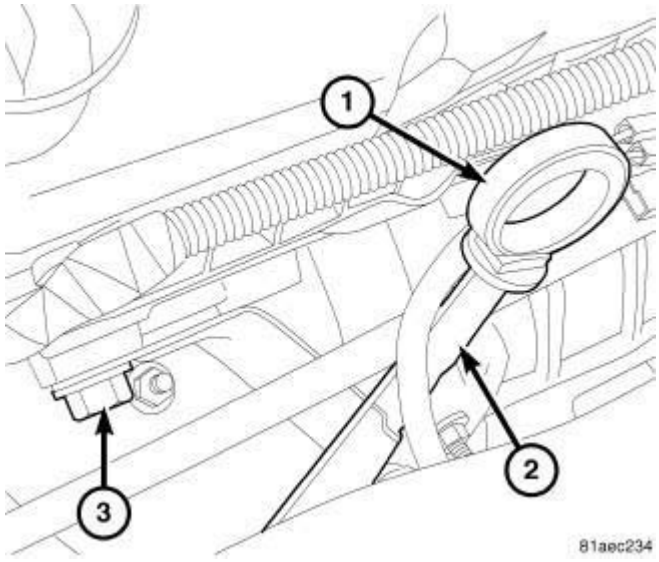

Fig. 39: Engine Oil Dipstick Tube
Courtesy of CHRYSLER LLC

38. Remove the Fan Module. Refer to **Cooling/Engine/FAN, Cooling - Removal** .
39. Remove the bolt, and the engine oil dipstick tube (2).

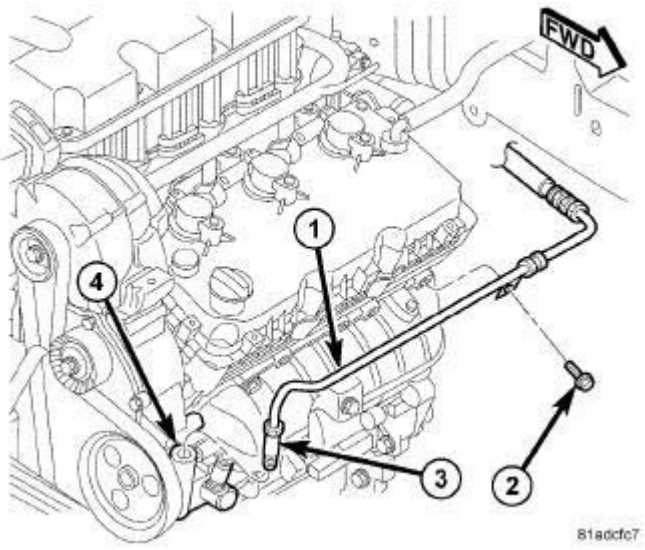

Fig. 40: Power Steering Line Retainer Bolt
Courtesy of CHRYSLER LLC

40. Remove the power steering line retainer bolt (2).

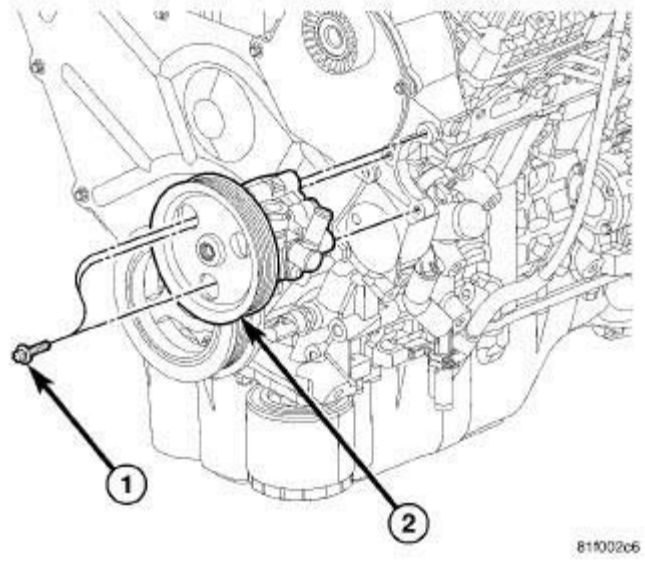

Fig. 41: Power Steering Pump & Reservoir
Courtesy of CHRYSLER LLC

41. Position the power steering pump (2) and reservoir aside in the engine compartment. Avoid opening the power steering system by leaving the power steering lines connected.

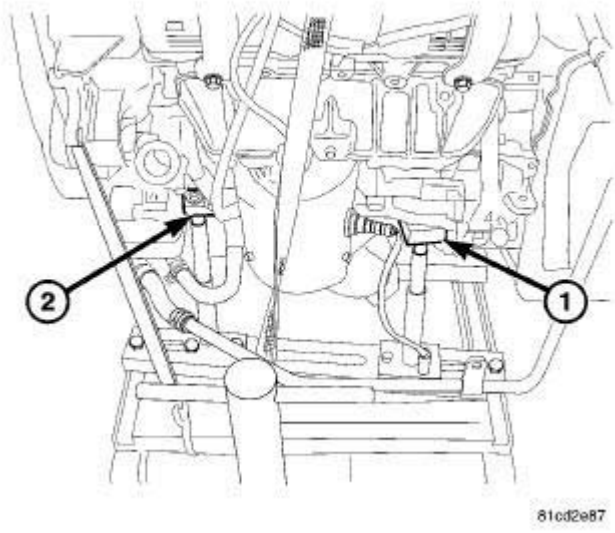

Fig. 42: Front Engine Fixture Brackets
Courtesy of CHRYSLER LLC

1 - 8130 ADAPTER 2 - ENGINE CRADLE POST

42. Position vehicle height to allow engine dolly 6135 and cradle 6710A with posts 6848 to be installed under vehicle.
43. Align the front right engine cradle post (2) with the Lift Point Hole in the Engine Block.
44. Align the front left engine cradle post and 8130 support bracket (1) with the lift point hole in the engine block.

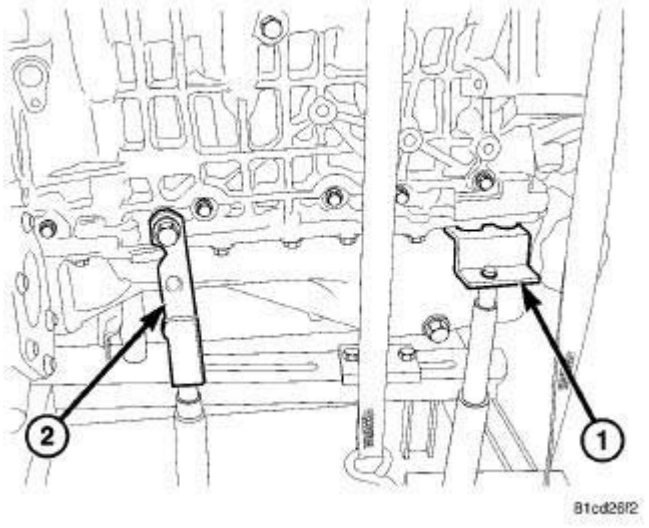

Fig. 43: Rear Engine Fixture Brackets
Courtesy of CHRYSLER LLC

1 - 10107-2 ADAPTER
2 - 10107-1 ADAPTER

45. Install 10107-1 Support Bracket (2) in the engine block, and align the left rear engine cradle post with the hole in the support bracket.
46. Install 10107-2 Support Bracket (1) in the engine block, and align the right rear engine cradle post with the hole in the support bracket.

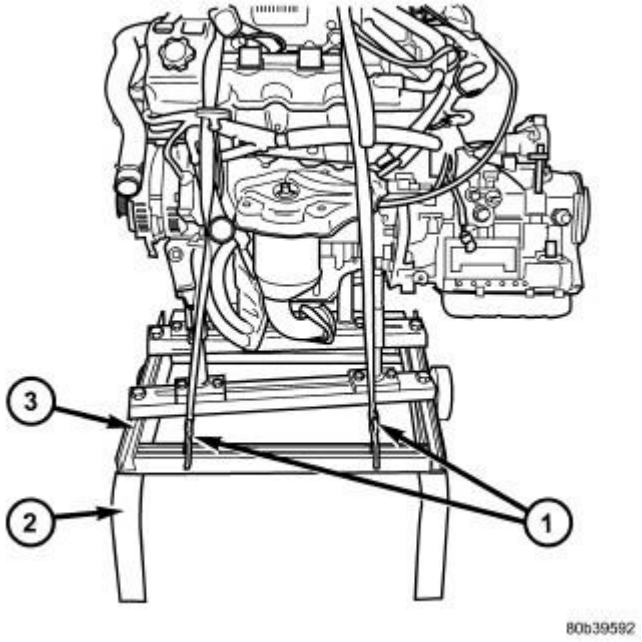

Fig. 44: ENGINE REMOVAL CRADLE
Courtesy of CHRYSLER LLC

1 - SAFETY STRAPS
2 - SPECIAL TOOL 6135
3 - SPECIAL TOOL 6710

47. Install safety straps (1) so that they securely hold the powertrain assembly in the engine cradle. Tighten the fasteners at the base of each engine cradle post, and verify that the engine cradle posts are fully engaged in the lifting points.
48. Lower vehicle so weight of the engine and transmission ONLY is on the cradle.

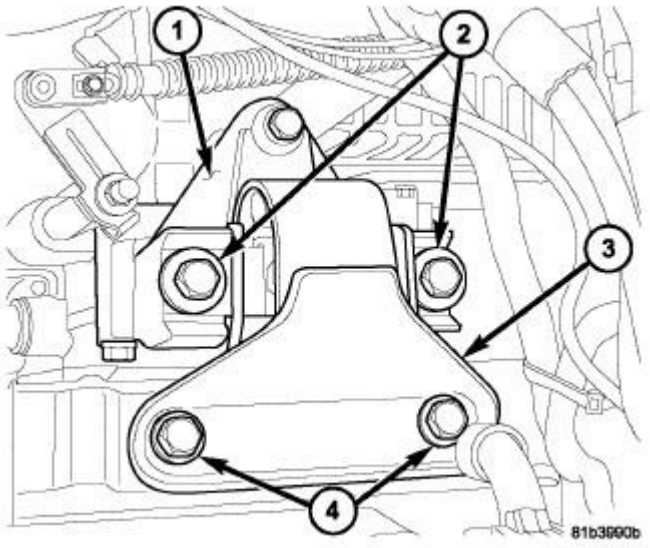

Fig. 45: Identifying Left Engine Mount
Courtesy of CHRYSLER LLC

49. Remove the left side engine mount bolts (2).

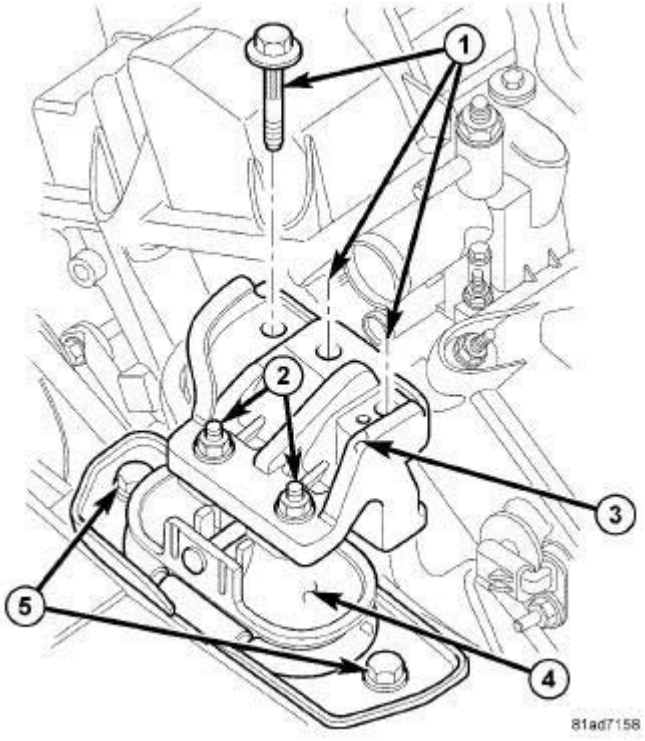

Fig. 46: Right Side Engine Mount Bolts
Courtesy of CHRYSLER LLC

50. Remove the right side engine mount bolts (1).
51. Slowly raise vehicle in short length spans. Inspect at each interval for potential engine or transaxle contact to vehicle components. Move the cradle/dolly fixture as necessary to allow for removal clearance.

INSTALLATION

INSTALL

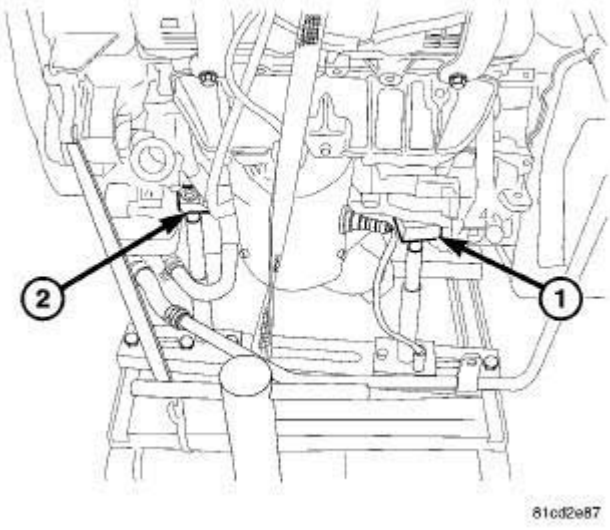

Fig. 47: Front Engine Fixture Brackets
Courtesy of CHRYSLER LLC

1 - 8130 ADAPTER
2 - ENGINE CRADLE POST

1. Align the front right engine cradle post (2) with the Lift Point Hole in the Engine Block.
2. Align the front left engine cradle post and 8130 support bracket (1) with the lift point hole in the engine block.

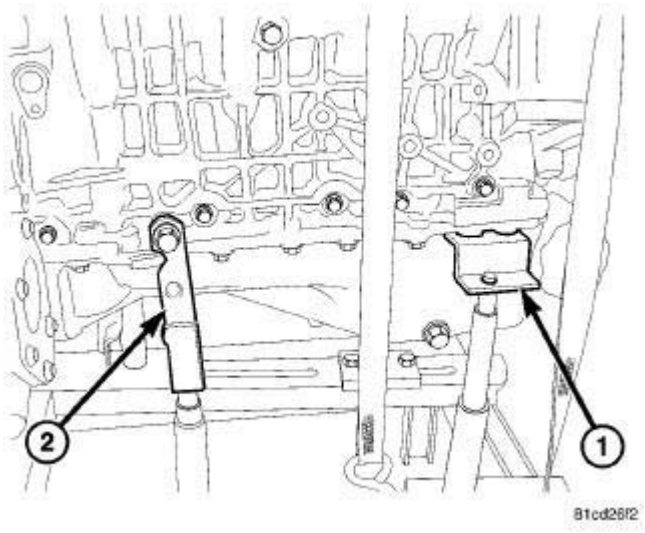

Fig. 48: Rear Engine Fixture Brackets
Courtesy of CHRYSLER LLC

1 - 10107-2 ADAPTER
2 - 10107-1 ADAPTER

3. Install 10107-1 Support Bracket (2) in the engine block, and align the left rear engine cradle post with the hole in the support bracket.
4. Install 10107-2 Support Bracket (1) in the engine block, and align the right rear engine cradle post with the hole in the support bracket.

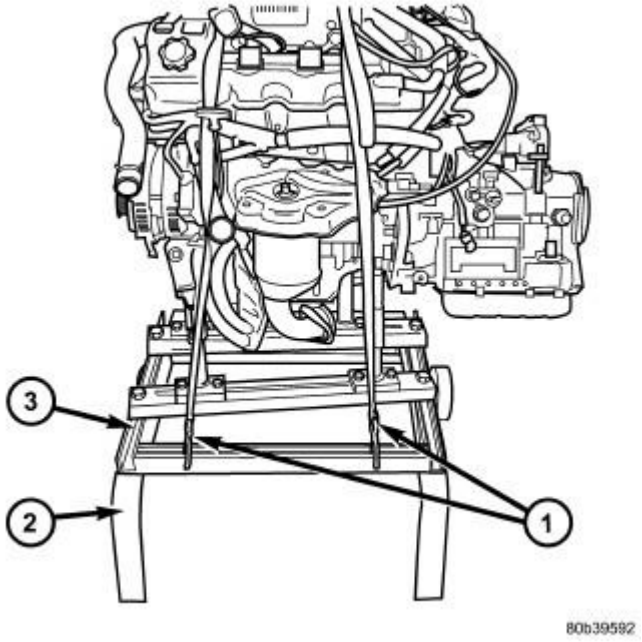

Fig. 49: ENGINE REMOVAL CRADLE
Courtesy of CHRYSLER LLC

1 - SAFETY STRAPS
2 - SPECIAL TOOL 6135
3 - SPECIAL TOOL 6710

5. Install safety straps (1) so that they securely hold the powertrain assembly in the engine cradle. Tighten the fasteners at the base of each engine cradle post, and verify that the engine cradle posts are fully engaged in the lifting points.
6. Raise the vehicle body on a hoist.
7. Position the engine cradle and powertrain beneath the vehicle.
8. Slowly lower the vehicle body in short length spans. Inspect at each interval for potential engine or transaxle contact to body or suspension components. Move the cradle/dolly fixture as necessary.
9. Install ground strap to the hood and position the hood back.

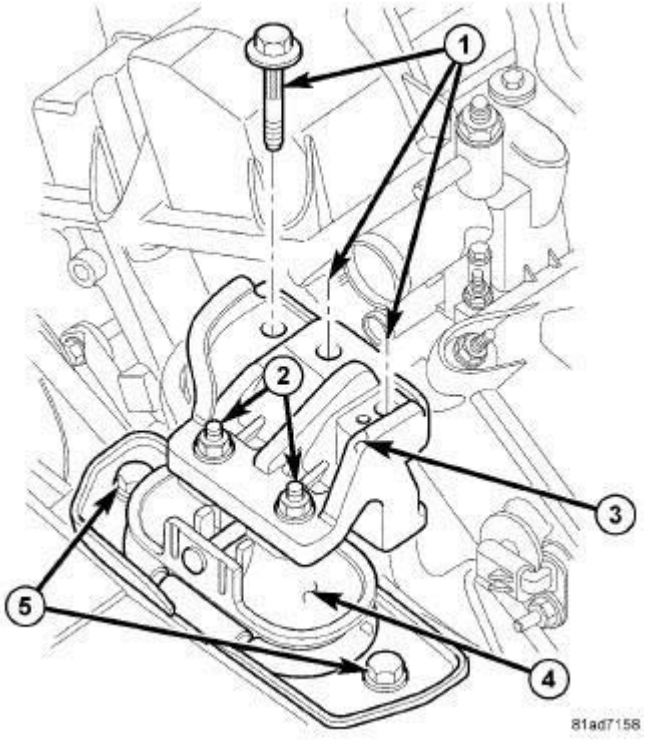

Fig. 50: Right Side Engine Mount Bolts
Courtesy of CHRYSLER LLC

10. Install 3 right engine mount bolts (1). Tighten bolts to 50 N.m (37 ft. lbs.).

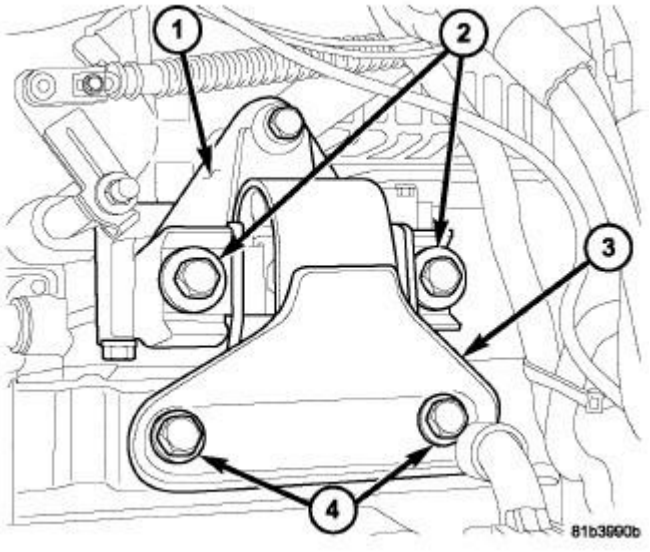

Fig. 51: Identifying Left Engine Mount
Courtesy of CHRYSLER LLC

11. Install the left side engine mount bolts (2). Tighten bolts to 98 N.m (72 ft. lbs.).

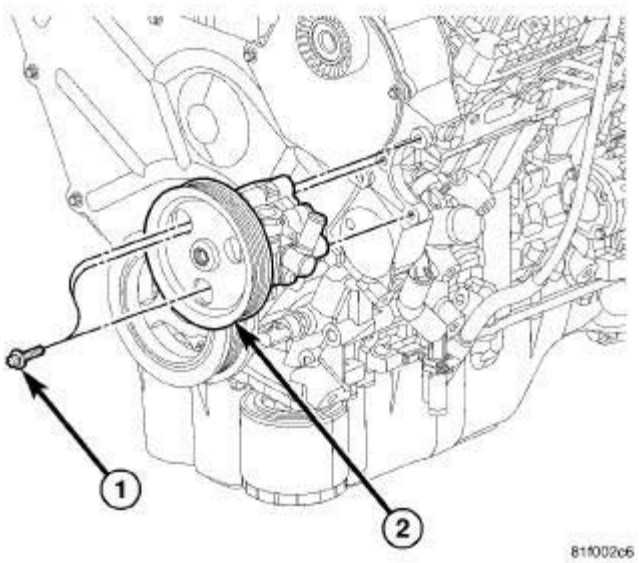

Fig. 52: Power Steering Pump & Reservoir
Courtesy of CHRYSLER LLC

12. Install the power steering pump (2). Refer to **Steering/Pump - Installation** .

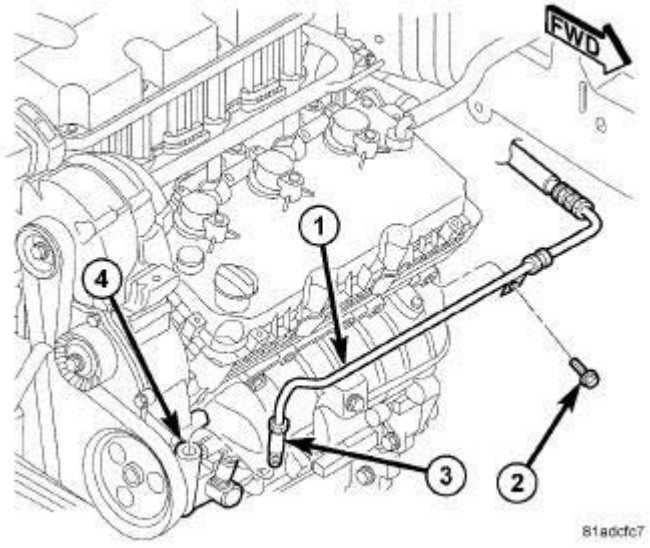

Fig. 53: Power Steering Line Retainer Bolt
Courtesy of CHRYSLER LLC

13. Install the power steering line retainer bolt (2).

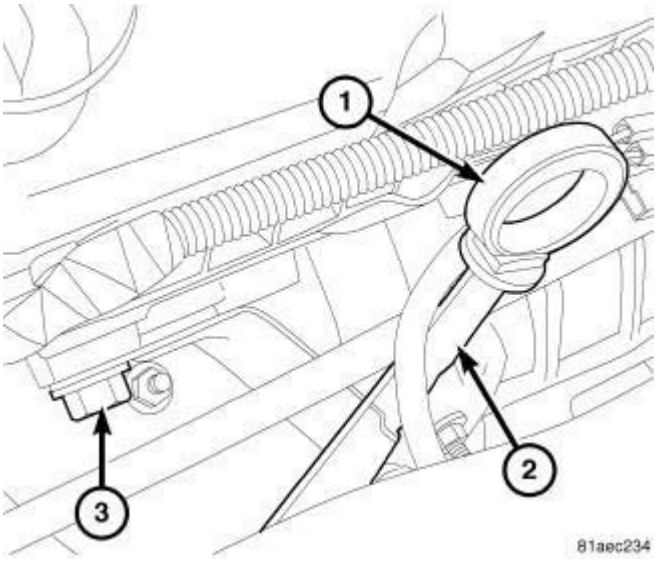

Fig. 54: Engine Oil Dipstick Tube
Courtesy of CHRYSLER LLC

14. Install the fan module. Refer to **Cooling/Engine/FAN, Cooling - Installation** .
15. Install the engine oil dipstick tube (2) and the bolt (3).

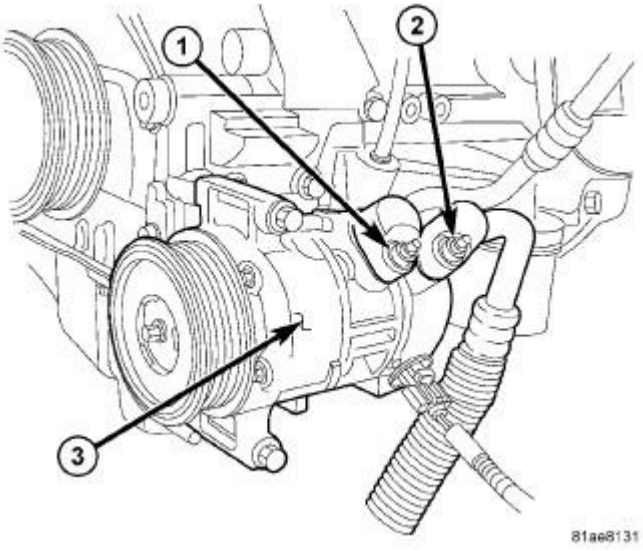

Fig. 55: A/C Discharge Line-Compressor
Courtesy of CHRYSLER LLC

16. Install the A/C compressor (3). Refer to **Heating and Air Conditioning/Plumbing/COMPRESSOR, A/C - Installation** .
17. Reconnect both A/C lines (1) and (2) and the harness connector to the A/C compressor (3).

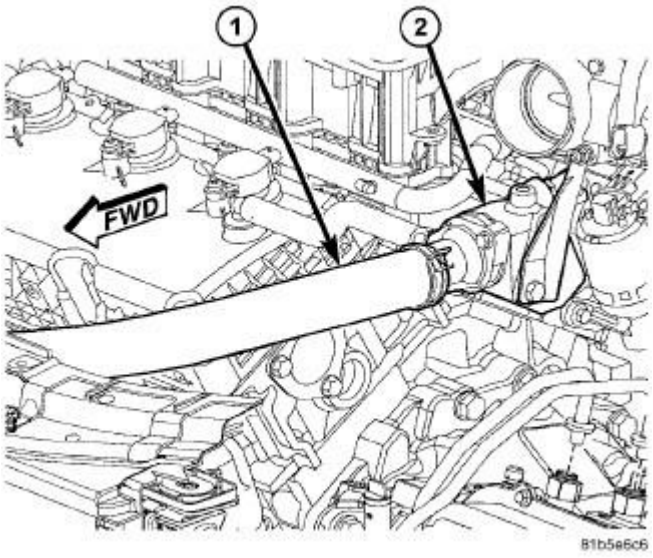

Fig. 56: Upper Radiator Hose From Thermostat Housing
Courtesy of CHRYSLER LLC

18. Reconnect the Upper Radiator hose (1) to the thermostat housing (2) and position aside.

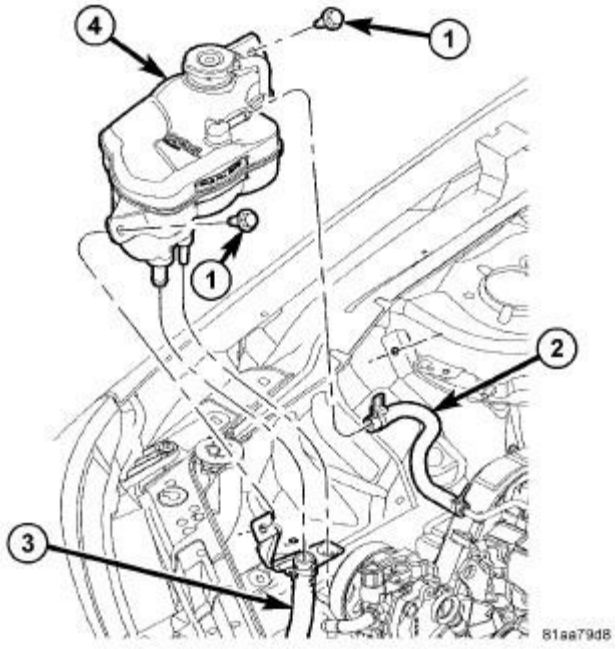

Fig. 57: COOLANT RECOVERY CONTAINER - PRESSURE SYSTEM
Courtesy of CHRYSLER LLC

19. Reconnect the coolant reservoir overflow hose (2) to the coolant bottle (4) and position aside.

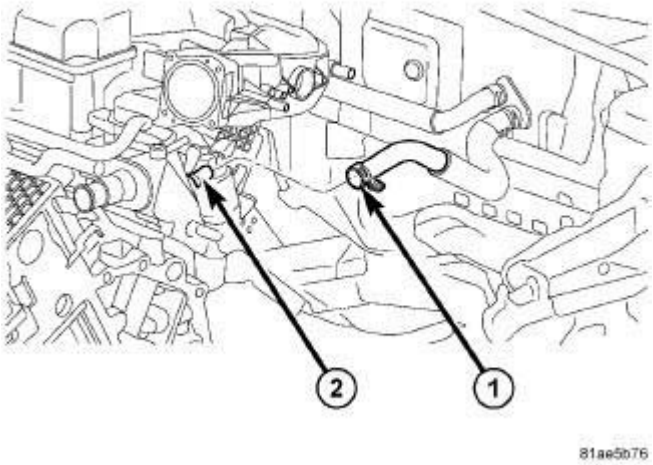

Fig. 58: Heater Core Supply Hose
Courtesy of CHRYSLER LLC

20. Reconnect the heater core supply hose (1) to the intake manifold outlet (2).

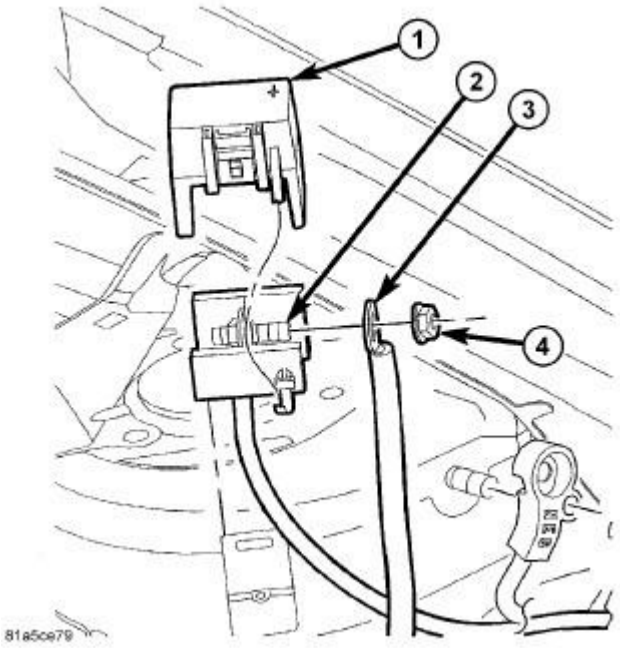

Fig. 59: Positive Auxiliary Battery Post Cable
Courtesy of CHRYSLER LLC

21. Reconnect the positive auxiliary battery post cable (2) and the negative battery cable to the left shock tower and position aside.

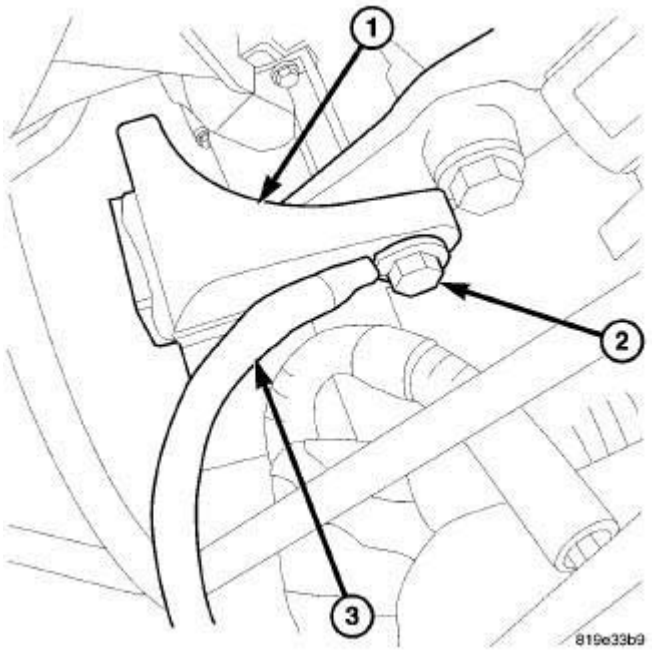

Fig. 60: GROUND CABLE AT FRONT MOUNT
Courtesy of CHRYSLER LLC

22. Reconnect the ground (3) to the front of the transaxle.

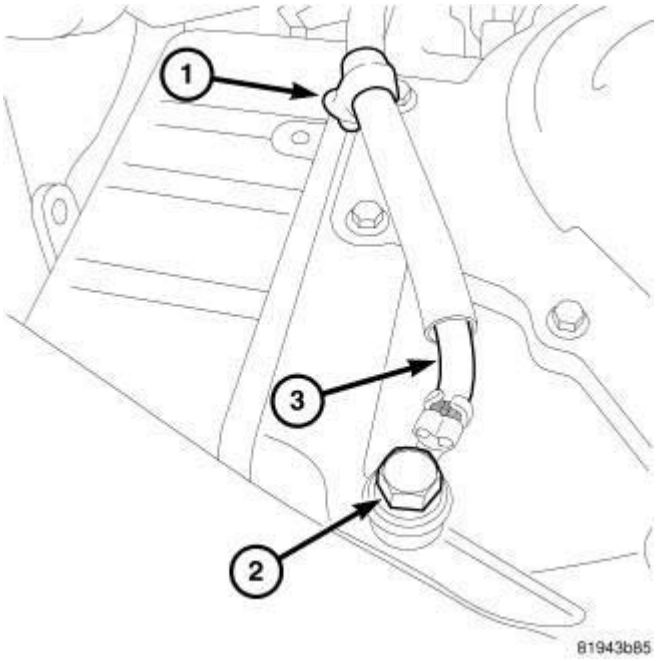

Fig. 61: GROUND CABLE
Courtesy of CHRYSLER LLC

23. Reconnect the ground (3) to the side of the transaxle.

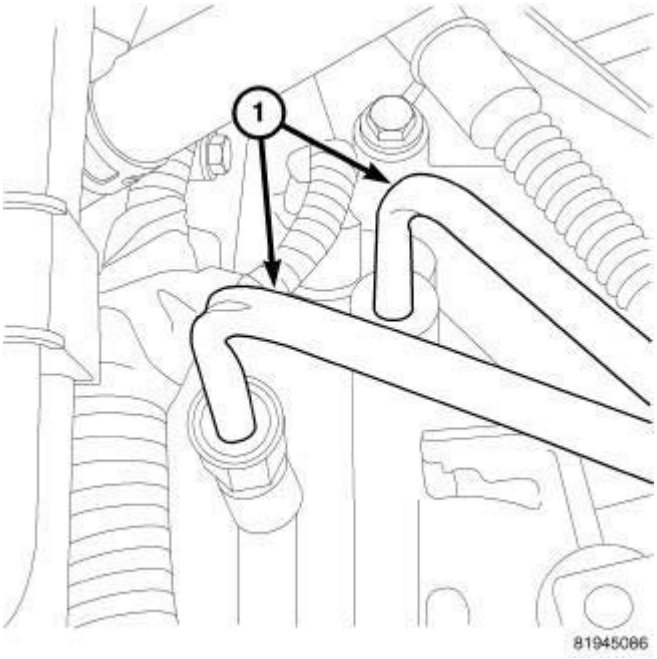

Fig. 62: Transaxle Cooler Lines
Courtesy of CHRYSLER LLC

24. Reconnect the transaxle cooler lines (1).

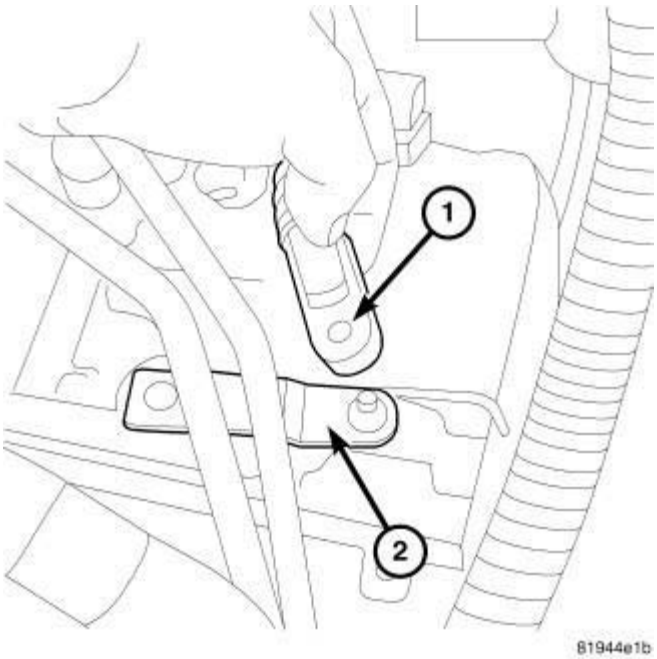

Fig. 63: Transaxle Shifter Cable
Courtesy of CHRYSLER LLC

25. Reconnect the transaxle shifter cable (1).

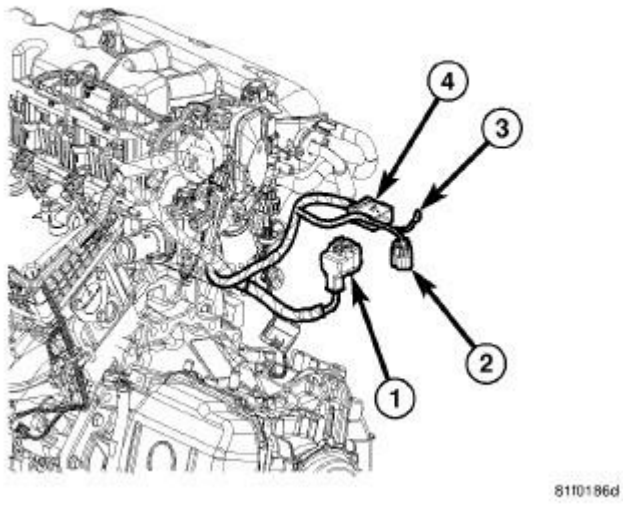

Fig. 64: Transaxle Harness Connectors
Courtesy of CHRYSLER LLC

26. Reconnect the transaxle harness PCM (1), and 6-way (2) connectors.

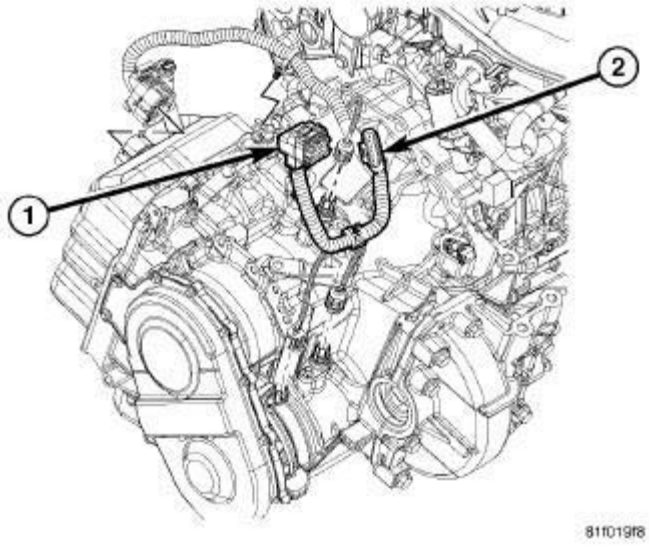

Fig. 65: Engine Harness Connectors
Courtesy of CHRYSLER LLC

27. Reconnect the engine harness PCM (1), 12-way (2), ground (3), 8-way (4) connectors.

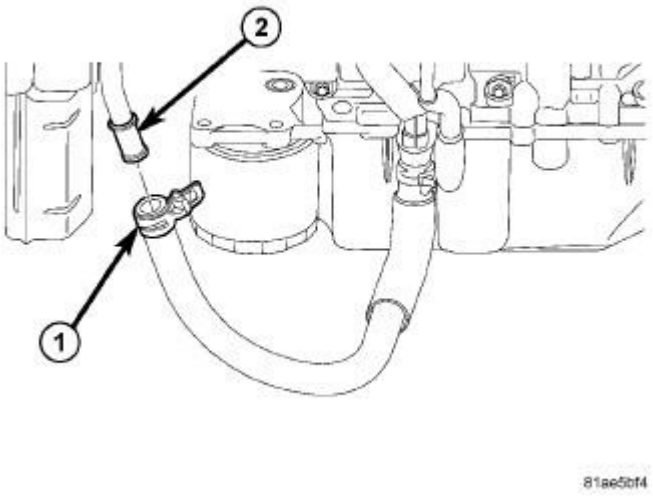

Fig. 66: Lower Coolant Hose From Return Tube
Courtesy of CHRYSLER LLC

28. Raise Vehicle.
29. Install the Left Front Half Shaft. Refer to **Differential and Driveline/Half Shaft - Installation** .
30. Reconnect the Lower Coolant Hose (1) from the return tube (2).

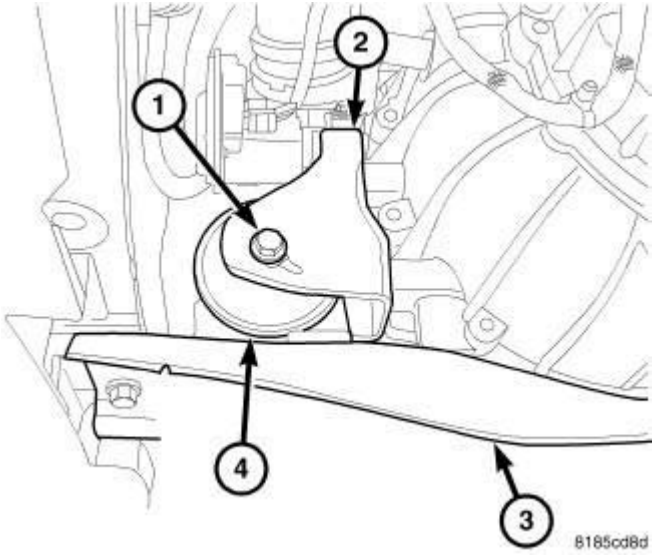

Fig. 67: Removing/Installing Front Mount
Courtesy of CHRYSLER LLC

31. Install the Front Engine Mount Bracket (2). See **Engine/Engine Mounting/INSULATOR, Engine Mount - Installation**.

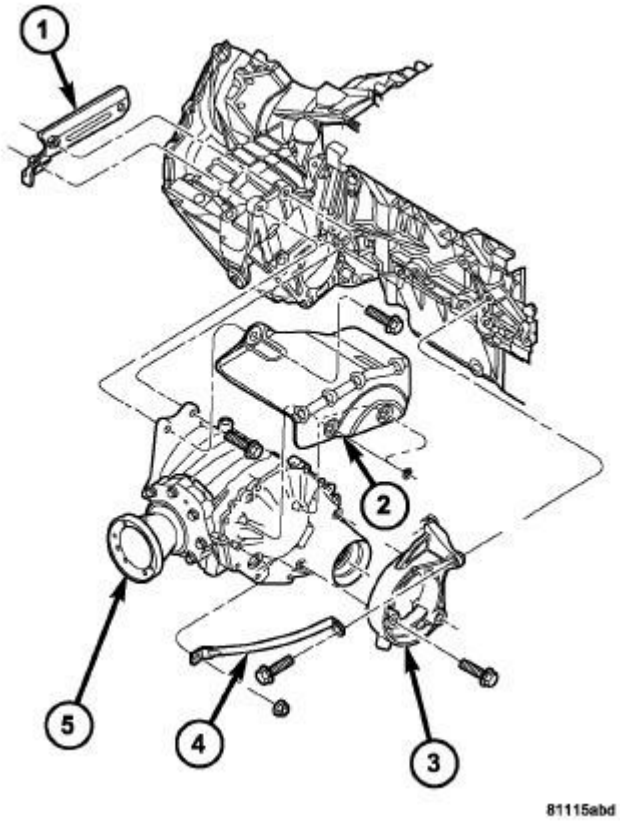

Fig. 68: Power Transfer Unit Mounting
Courtesy of CHRYSLER LLC

1 - BRACKET
2 - HEAT SHIELD
3 - BRACKET
4 - BRACE
5 - POWER TRANSFER UNIT

32. If equipped, install the PTU (5). Refer to **Transmission and Transfer Case/Power Transfer Unit - Installation** .

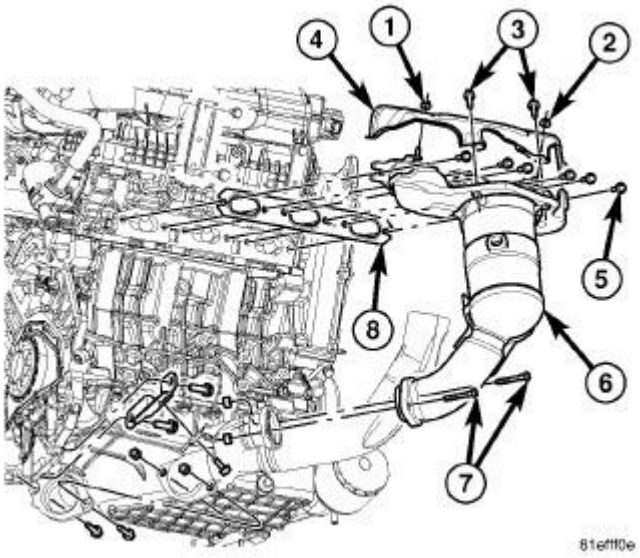

Fig. 69: Maniverter Retaining Bolts
Courtesy of CHRYSLER LLC

33. Install the Left Maniverter (6). See **Engine/Manifolds/MANIFOLD, Exhaust - Installation**.

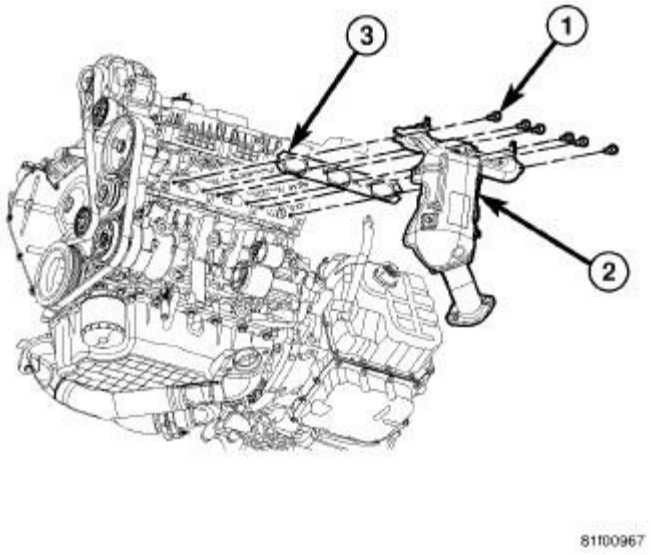

Fig. 70: Right Front Half Shaft Assembly
Courtesy of CHRYSLER LLC

34. Install the Right Maniverter. See **Engine/Manifolds/MANIFOLD, Exhaust - Installation**.

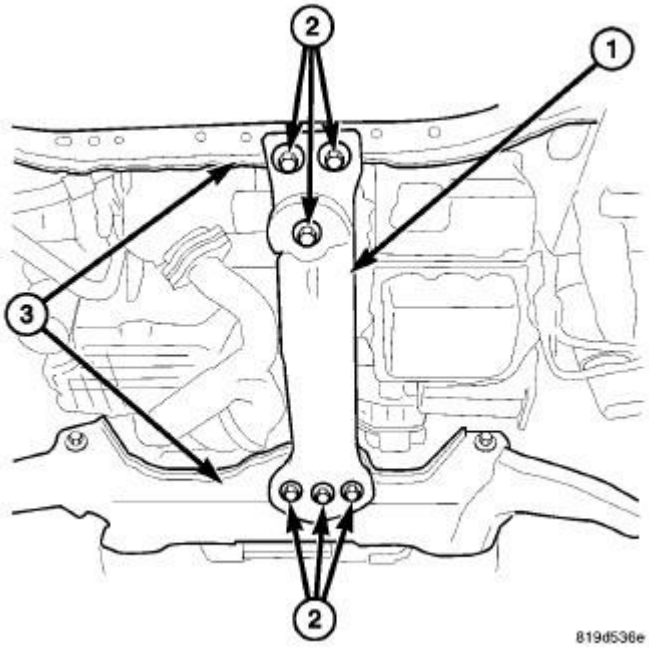

Fig. 71: FORE-AFT Crossmember
Courtesy of CHRYSLER LLC

35. Install the Right Front Half Shaft assembly. Refer to **Differential and Driveline/Half Shaft - Installation** .
36. Install the fore-aft crossmember (1). Refer to **Frame and Bumpers/Frame/CROSSMEMBER - Installation** .

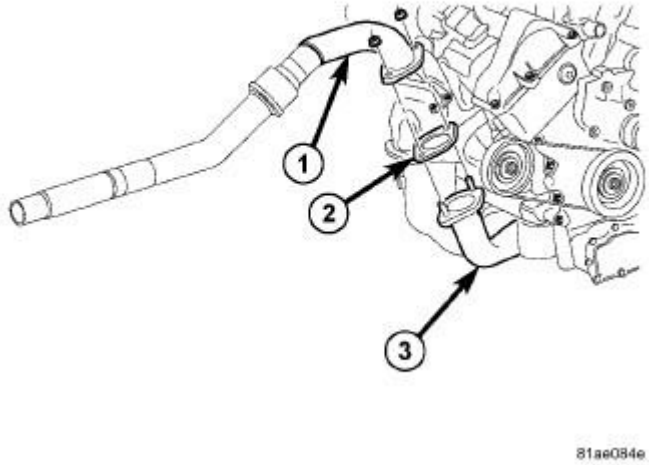

Fig. 72: Exhaust Extension Pipe & Gasket
Courtesy of CHRYSLER LLC

37. Install the Cross Under Pipe (3). See **Engine/Manifolds/MANIFOLD, Exhaust - Installation**.
38. Install the Exhaust Extension Pipe (1) and gasket (2) to the Crossunder pipe (3).

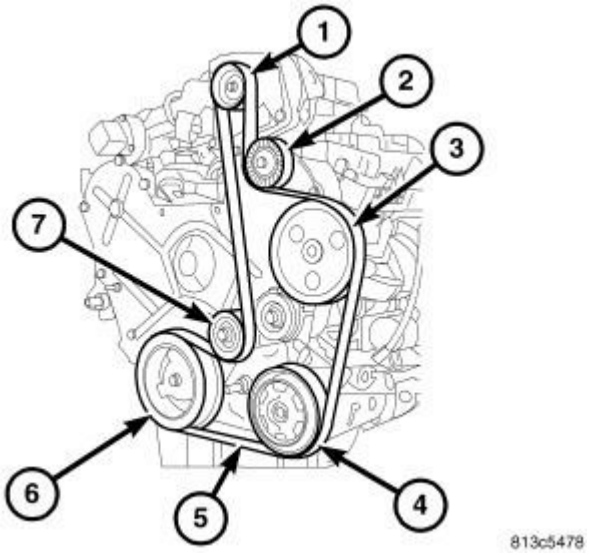

Fig. 73: 3.5L ENGINE ACCESSORY DRIVE BELT INSTALLATION
Courtesy of CHRYSLER LLC

1 - IDLER PULLEY
2 - P/S PUMP
3 - A/C COMPRESSOR
4 - CRANKSHAFT
5 - TENSIONER
6 - GENERATOR

39. Install the accessory drive belt (6). Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation** .

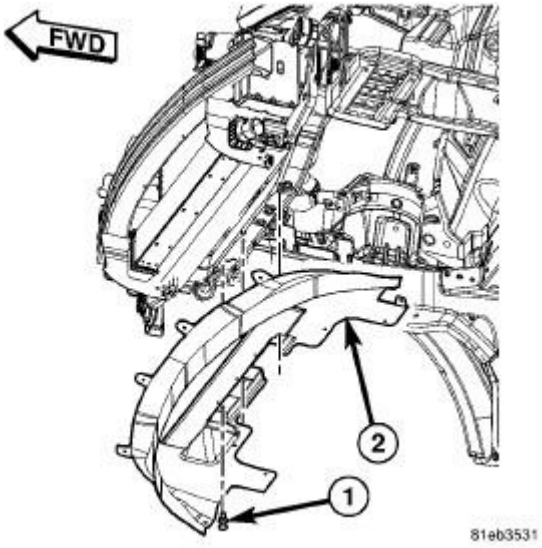

Fig. 74: Front Closeout Panel
Courtesy of CHRYSLER LLC

40. Install the Front Closeout Panel (2). Refer to **Frame and Bumpers/Bumpers/FASCIA, Front Lower - Installation** .

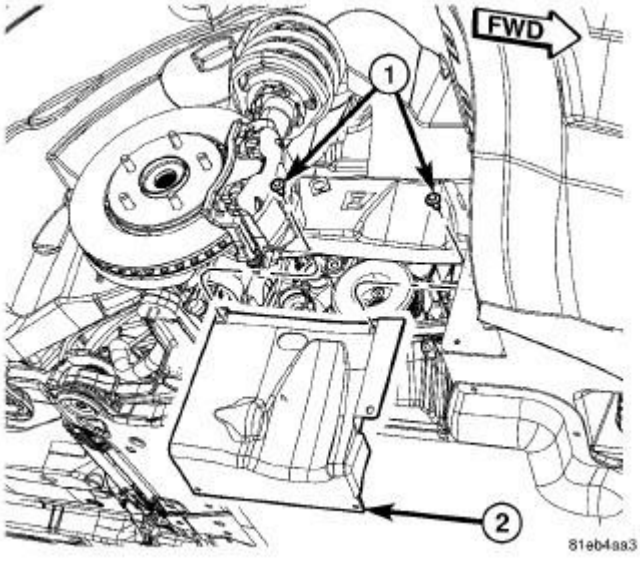

Fig. 75: Left Forward Splash Shield
Courtesy of CHRYSLER LLC

41. Install the Left Forward Splash Shield (2).

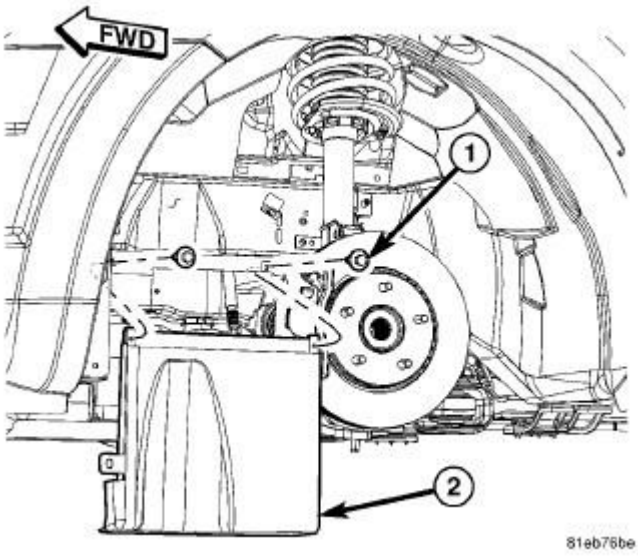

Fig. 76: Right Forward Splash Shield
Courtesy of CHRYSLER LLC

42. Install the Right Forward Splash Shield (2).

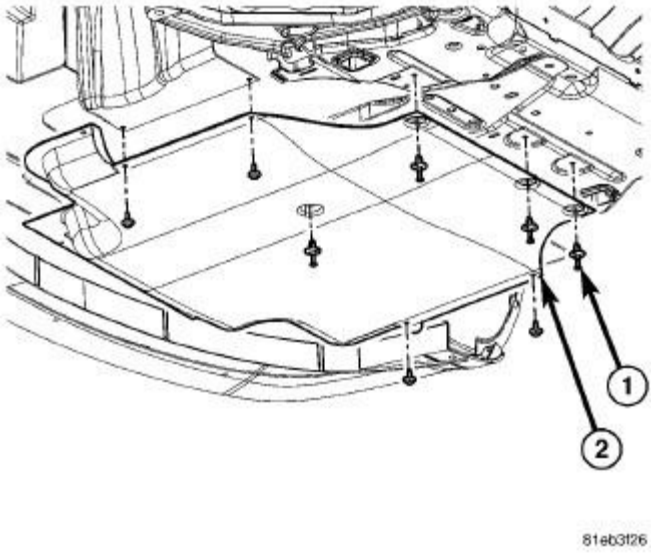

Fig. 77: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

1 - Belly Pan Fasteners
2 - Belly Pan

43. Install the belly pan (2) and install the 12 belly pan fasteners (1).

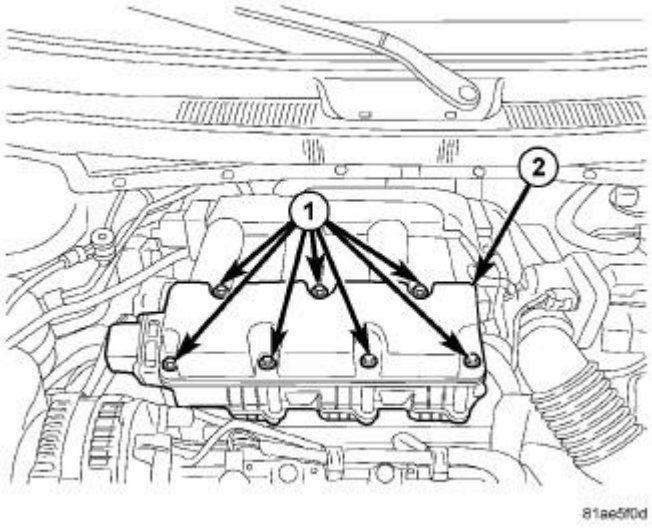

Fig. 78: Upper Intake Manifold
Courtesy of CHRYSLER LLC

44. Install the Upper Intake Manifold (2). See **Engine/Manifolds/MANIFOLD, Intake - Installation**.

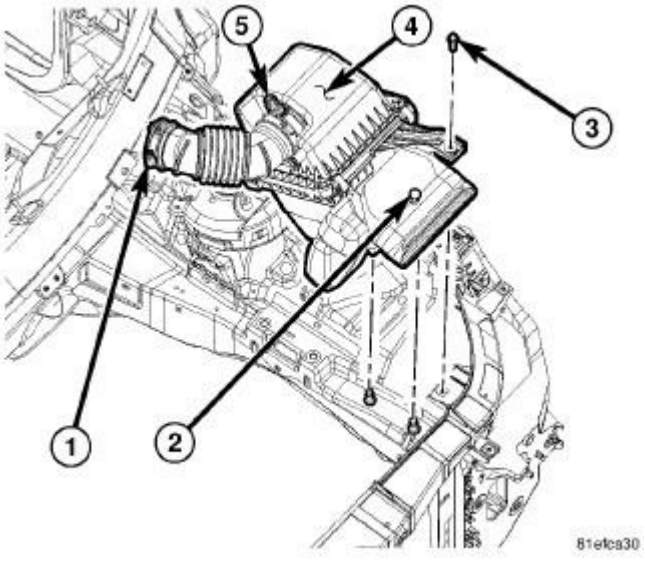

Fig. 79: HOUSING - AIR CLEANER
Courtesy of CHRYSLER LLC

45. Install the Air Cleaner Housing (4). See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.

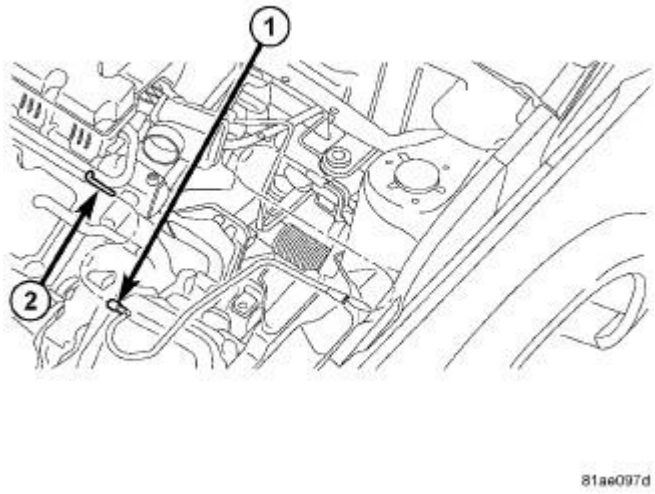

Fig. 80: Fuel Line From Fuel Rail Inlet
Courtesy of CHRYSLER LLC

46. Reconnect the fuel line (1) to the fuel rail inlet (2).
47. Recharge the air conditioning system. Refer to **Heating and Air Conditioning/Plumbing - Standard Procedure** .
48. Fill the cooling system. Refer to **Cooling - Standard Procedure** .

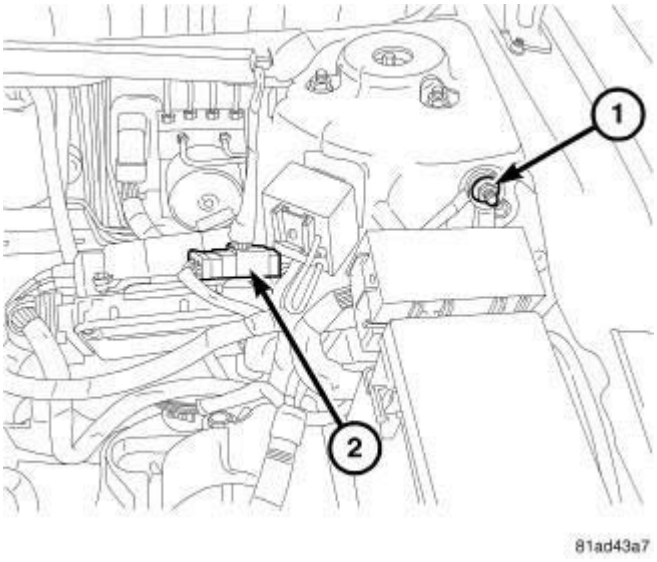

Fig. 81: BATTERY CABLE
Courtesy of CHRYSLER LLC

49. Reconnect the negative battery cable (1).
50. Start the engine and allow it to reach normal operating temperature. Inspect for leaks, and verify normal operation.

51. Install the engine cover.

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

3.5L ENGINE

GENERAL

DESCRIPTION	SPECIFICATION	
Type	60° SOHC V6 24-Valve	
Displacement	3.5L	
Firing Order	1-2-3-4-5-6	
Compression Ratio	10:1	
Lead Cylinder	#1 Right Bank	
-	**Metric**	**Standard**
Displacement	3.5L Liters	214 cu. in.
Bore	96.0 mm	3.780 in.
Stroke	81.0 mm	3.189 in.

CYLINDER BLOCK

DESCRIPTION	SPECIFICATIONS	
	Metric	**Standard**
Cylinder Bore Diameter	96.0 mm ± 0.0076	3.780 in. ± 0.0003 in.
Out-of-Round (Max.)	0.076 mm	0.003 in.
Taper (Max.)	0.051 mm	0.002 in.

PISTONS

DESCRIPTION	SPECIFICATIONS	
	Metric	**Standard**
Material Type	Aluminum (Full Floating Pins)	
Piston Diameter	95.98 mm ± 0.019 mm	3.7788 in. ± 0.0008 in.
Clearance at Size Location	-0.007 to +0.047 mm	-0.003 to +0.0018 in.
Piston Pin Bore Diameter	22.005-22.012 mm	0.8663-0.8666 in.
Piston Weight - A	404.5-409.5 grams	14.27-14.44 oz.
Piston Weight - B	399.5-404.5 grams	14.09-14.27 oz.
Piston Ring Groove Diameter #1	87.4-87.6 mm	3.441-3.449 in.
Piston Ring Groove Diameter #2	86.3-86.5 mm	3.397-3.4055 in.

Piston Ring Groove Diameter #3	85.8-86.0 mm	3.378-3.385 in.

PISTON PINS

DESCRIPTION	SPECIFICATIONS	
	Metric	Standard
Type	Full Floating	
Clearance in Piston	0.005-0.015 mm	0.002-0.0006 in.
Clearance in Rod	0.010-0.023 mm	0.0004-0.0009 in.
Diameter	21.997-22.000 mm	0.8660-0.86614 in.

PISTON RINGS

DESCRIPTION	SPECIFICATIONS	
	Metric	Standard
Ring Gap-Top Compression Ring	0.20-0.36 mm	0.008-0.014 in.
Ring Gap-2nd Compression Ring (Micro-Napier	0.20-0.40 mm	0.0078-0.0157 in.
Ring Gap-Oil Control (Steel Rails)	0.25-0.76 mm	0.010-0.030 in.

PISTON RING SIDE CLEARANCE

DESCRIPTION	SPECIFICATIONS	
	Metric	Standard
Top and Second Compression Ring	0.04-0.08 mm	0.0016-0.0031 in.
Oil Ring (Steel Rails	0.038-0.184 mm	0.0015-0.0073 in.

PISTON RING WIDTH

DESCRIPTION	SPECIFICATIONS	
	Metric	Standard
Top Compression Ring	1.17-1.19 mm	0.0461-0.0469 in.
2nd Compression Ring (Micro-Napier	1.47-1.49 mm	0.058-0.059 in.
Oil Control (Steel Rails)	0.445-0.470 mm	0.0176-0.0186 in.

CONNECTING RODS

DESCRIPTION	SPECIFICATIONS	
	Metric	Standard
Rod Pin Bore Diameter	22.010-22.020 mm	0.8665-0.8669 in.
Side Clearance (MAX)	0.39 mm	0.0153 in.
Total Weight (Less Bearing)	693 grams	24.445 oz.

CRANKSHAFT MAIN BEARING JOURNALS

DESCRIPTION	SPECIFICATIONS

	Metric	Standard
Main Journal Diameter	63.987-64.013 mm	2.5192-2.5202 in.
Main Bearing Diametrical Clearance	0.032-0.062 mm	0.0013-0.0024 in.
Bearing Clearance (Wear Limit)	0.070 mm	0.0027 in.
DIA Out-of-Round (MAX)	0.007 mm	0.0003 in.
Diametrical Taper (MAX)	0.006 mm	0.00025 in.
End Play	0.048-0.260 mm	0.002-0.010 in.
End Play (MAX)	0.330 mm	0.013 in.

CONNECTING ROD JOURNALS

DESCRIPTION	SPECIFICATIONS	
	Metric	Standard
Diameter	57.982-58.002 mm	2.282-2.283 in.
Bearing Diametrical Clearance	0.024-0.054 mm	0.0009-0.0021 in.
Bearing Clearance (Wear Limit)	0.062 mm	0.0024 in.
Out-of-Round (MAX)	0.007 mm	0.0003 in.
Diametrical Taper (MAX)	0.006 mm	0.00025 in.

CAMSHAFT

DESCRIPTION	SPECIFICATIONS	
	Metric	Standard
Bore Diameter	43.038-43.059 mm	1.6944-1.6953 in.
Diametrical Clearance	0.078-0.12 mm	0.003-0.0047 in.
Diametrical Clearance (MAX)	0.15 mm	0.0059 in.
Bearing Journal Diameter	42.939-42.960 mm	1.6905-1.6913 in.
End Play	0.03-0.035 mm	0.001-0.014 in.

VALVE TIMING-INTAKE VALVE

DESCRIPTION	SPECIFICATIONS (CRANKSHAFT DEGREES)
Opens (ATDC)	3°
Closes (ABDC)	61°
Duration	238°
Centerline	122°

VALVE TIMING-EXHAUST VALVE

DESCRIPTION	SPECIFICATIONS (CRANKSHAFT DEGREES)
Opens (BBDC)	56°
Closes (ATDC)	16°

Duration	252°
Centerline	110°

CYLINDER HEAD

DESCRIPTION	SPECIFICATIONS	
	Metric	**Standard**
Gasket Thickness (Compressed)	1.78 mm	0.059 in.
Valve Seat Angle (From Horizontal)	45-45.5°	
Valve Seat Runout (MAX)	0.051 mm	0.002 in.
Valve Seat Width-Intake	0.8-1.2 mm	0.031-0.067 in.
Valve Seat Width-Exhaust	1.3-1.7 mm	0.05-0.067 in.
Guide Bore Diameter (Std.)	6.975-7.00 mm	0.2746-0.2756 in.
Valve Guide Height *	9.5-10.5 mm	0.3740-0.4134 in.
* Measured from cylinder head surface		

VALVES

DESCRIPTION	SPECIFICATIONS	
	Metric	**Standard**
Face Angle (From Horizontal)	44.5°-45°	
Head Diameter-Intake	36.37-36.63 mm	1.4319-14421 in.
Head Diameter-Exhaust	28.87-29.13 mm	1.1366-1.1469 in.
Length-Intake (Overall)	114.41-114.99 mm	4.5043-4.5272 in.
Length-Exhaust (Overall)	126.17-126.75 mm	4.9673-4.9902 in.
Stem Diameter-Intake	6.935-6.953 mm	0.2730-0.2737 in.
Stem Diameter-Exhaust	6.906-6.924 mm	0.2719-0.2726 in.
Stem-to-Guide Clearance-Intake	0.022-0.065 mm	0.0009-0.0026 in.
Stem-to-Guide Clearance-Intake (MAX.) Rocking Method	0.29 mm	0.0114 in.
Stem-to-Guide Clearance-Exhaust	0.051-0.094 mm	0.002-0.0037 in.
Stem-to-Guide Clearance-Intake (MAX.) Rocking Method	0.370 mm	0.0146 in.
Valve Lift-Intake (Zero Lash)	8.55 mm	0.3367 in.
Valve Lift-Exhaust (Zero Lash)	6.53 mm	0.2571 in.
Valve Margin-Intake	0.835-1.165 mm	0.0329-0.0459 in.
Valve Margin-Exhaust	1.44-1.77 mm	0.0567-0.0697 in.
Valve Stem Tip Height-Intake	42.366-43.665 mm	1.6680-1.7187 in.
Valve Stem Tip Height-Exhaust	45.205-46.486 mm	1.780-1.8305 in.

VALVE SPRINGS

DESCRIPTION	SPECIFICATIONS

	Metric	Standard
Free Length-Intake (Approx.)	43.675 mm	1.7195 in.
Free Length-Exhaust- Yellow (Approx.)	47.1 mm	1.8543 in.
Free Length-Exhaust- White (Approx.)	48.3 mm	1.9015 in.
Spring Force-Intake (Valve Closed)	309-358 N @ 38.0 mm	69.5-80.5 lbs. @ 1.4961 in.
Spring Force-Exhaust- Yellow- (Valve Closed)	314-354 N @ 38.0 mm	70.5-79.5 lbs. @ 1.496 in.
Spring Force-Exhaust- White- (Valve Closed)	355-401 N @ 38.0 mm	80-90 lbs. @ 1.496 in.
Spring Force-Exhaust- Yellow- (Valve Open)	579-640 N @ 31.47 mm	130-144 lbs. @ 1.239 in.
Spring Force-Exhaust- White- (Valve Open)	621-687 N @ 31.47 mm	139.5-154.5 lbs. @ 1.239 in.
Spring Force-Intake (Valve Open)	836-907 N @ 29.45 mm	188-204 lbs. @ 1.1594 in.
Number of Coils-Intake	6.86	
Number of Coils-Exhaust	7.66	
Color of Spring (Top of Coils)- Intake-Right Hand Coil Direction	Orange	
Color of Spring (Top of Coils)- Exhaust-Left Hand Coil Direction	Yellow or White	
Wire Diameter-Intake	4.29-4.35 mm	0.1547-0.1570 in.
Wire Diameter-Exhaust	3.93-3.99 mm	0.1547-0.1570 in.
Spring Installed Height *	38.0 mm	1.4961 in.
* Spring Seat to Bottom Retainer-Intake and Exhaust		

OIL PUMP

DESCRIPTION	SPECIFICATIONS	
	Metric	Standard
Clearance Over Rotors	0.077 mm	0.003 in.
Cover-Out-of-Flat (MAX.)	0.025 mm	0.001 in.
Inner and Outer Rotor Thickness (MIN.)	14.229 mm	0.563 in.
Outer Rotor Thickness (MAX.)	0.39 mm	0.015 in.
Outer Rotor Diameter (MIN.)	79.997 mm	3.149 in.
Tip Clearance Between Rotors (MAX.)	0.20 mm	0.008 in.

OIL PRESSURE

DESCRIPTION	SPECIFICATIONS

NOTE: At Normal Operating Temperatures	
Pressure @ Curb Idle Speed *	34.47 kPa Min. (5 PSI MIN.)
Pressure @ 3000 RPM	300-724 kPa (45-105 PSI.)
*CAUTION: If pressure is zero at curb idle, DO NOT run engine at 3000 RPM.	

TORQUE

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Camshaft Sprocket Bolt-Right Side	102 +1/4 Turn	75 +1/4 Turn	-
Camshaft Sprocket Bolt-Left Side	102 +1/4 Turn	75 +1/4 Turn	-
Camshaft Thrust Plate-Bolts	28	-	250
Connecting Rod Cap-Bolts	27 +1/4 Turn	20 +1/4 Turn	-
Crankshaft Main Bearing Cap	-	-	-
-Inner Main Cap Bolts	20 +1/4 Turn	15 +1/4 Turn	-
-Outer Main Cap Bolts	27 +1/4 Turn	20 +1/4 Turn	-
-Tie Bolts (Horizontal)	28	-	250
Crankshaft Damper-Bolt	95	70	-
Cylinder Head Bolts*	-	-	-
-Step 1	61	45	-
-Step 2	88	65	-
-Step 3	88	65	-
-Step 4	+1/4 Turn	+1/4 Turn	-
*Refer to procedure for tightening sequence. See **Engine/Cylinder Head - Installation**.			
Cylinder Head Cover-Bolts	10	-	90
Exhaust Manifold to Cylinder Head-Bolts	23	-	200
Exhaust Manifold Heat Shield-Bolts	12	-	105
Flex plate to Crankshaft	95	70	-
Flex plate to Torque Converter	75	55	-
Intake Manifold - Lower	28	-	250
Intake Manifold - Upper	12	-	105
Left Engine Mount to Body Frame Rail	50	37	-
Oil Pan	27	20	-
-M6 Bolts	12	-	105
-M8 Bolts	28	-	250
Oil Pan Drain Plug	27	20	-
Oil Filter	12	9	-
M8 Oil Pump to Block-Bolts	28	-	250

M10 Oil Pump to Block-Bolt	54	40	-
M6 Oil Pump Cover-Bolts	12	-	105
Oil Pump Pick Up Tube-Bolt	28	-	250
Windage Tray	28 + 90°	20 + 90°	-
Crankshaft Rear Seal Retainer	12	-	105
Right Engine Mount to Body Frame Rail	50	37	-
Rocker Shaft Pedestal Retaining-Bolts	31	-	275
Spark Plugs	28	20	-
Timing Belt Tensioner-Bolts	28	-	250
Timing Belt Tensioner Pulley Assembly-Bolt	61	45	-
Timing Belt Cover	-	-	-
-M6 Bolts	12	-	105
-M8 Bolts	28	-	250
-M10 Bolts	54	40	-
Left Engine Mount to Transmission Bracket	98	72	-
Right Engine Mount to Timing Cover/Support Bracket	98	72	-

SPECIAL TOOLS

SPECIAL TOOLS

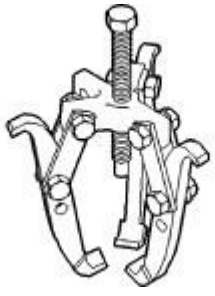

Fig. 82: Puller 1023
Courtesy of CHRYSLER LLC

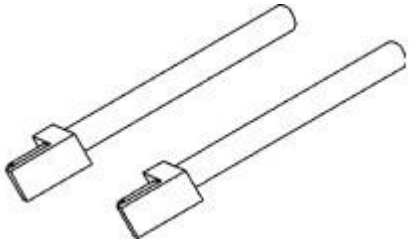

Fig. 83: Connecting Rod Installation Guides 8189
Courtesy of CHRYSLER LLC

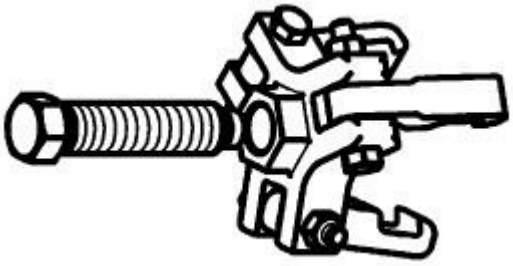

Fig. 84: Puller 8454
Courtesy of CHRYSLER LLC

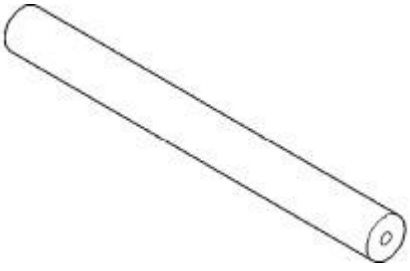

Fig. 85: Vibration Damper Remover Insert 9020 - Crank Sprocket Remover Insert C4685-C2
Courtesy of CHRYSLER LLC

Fig. 86: Camshaft Seal Installer MD-998306
Courtesy of CHRYSLER LLC

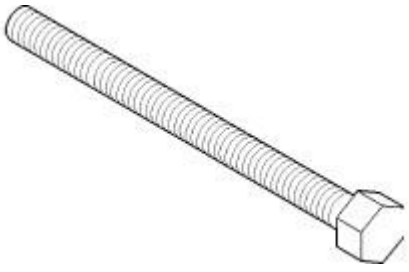

Fig. 87: Crankshaft Damper Installer Bolt C-4685-C1
Courtesy of CHRYSLER LLC

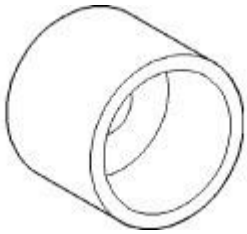

Fig. 88: Crankshaft Damper Installer 6792-1
Courtesy of CHRYSLER LLC

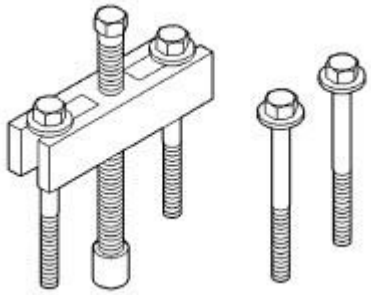

Fig. 89: Gear Puller L-4407A
Courtesy of CHRYSLER LLC

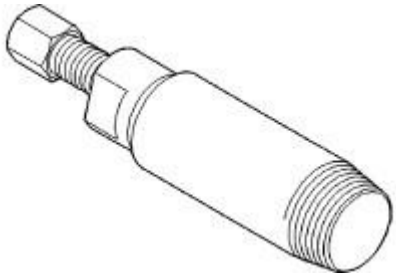

Fig. 90: Front Crankshaft Seal Remover 6341A
Courtesy of CHRYSLER LLC

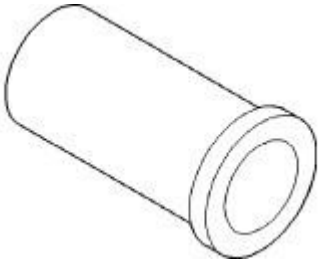

Fig. 91: Driver 6342
Courtesy of CHRYSLER LLC

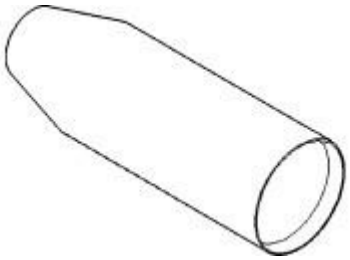

Fig. 92: Crankshaft Seal Protector 6780-2
Courtesy of CHRYSLER LLC

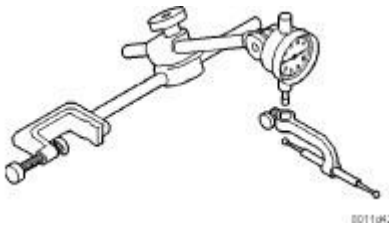

Fig. 93: DIAL INDICATOR C-3339
Courtesy of CHRYSLER LLC

Fig. 94: Valve Spring Compressor C-3422-D
Courtesy of CHRYSLER LLC

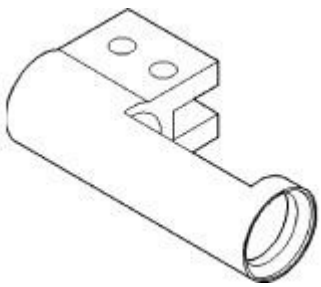

Fig. 95: Spring Compressor Adapter 6526
Courtesy of CHRYSLER LLC

Fig. 96: Valve Spring Tester C-647

Courtesy of CHRYSLER LLC

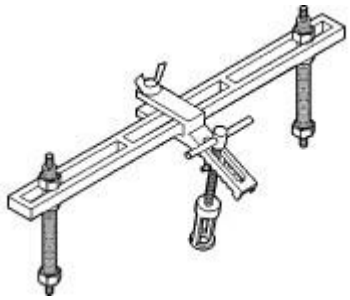

Fig. 97: Valve Spring Compressor MD998772A
Courtesy of CHRYSLER LLC

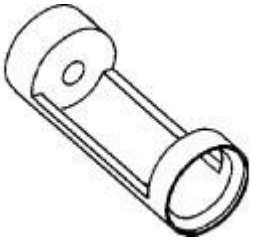

Fig. 98: Valve Spring Adapter 6527
Courtesy of CHRYSLER LLC

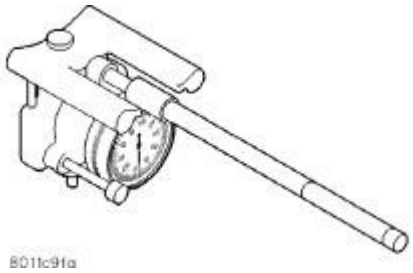

Fig. 99: Indicator, Cylinder Bore C-119
Courtesy of CHRYSLER LLC

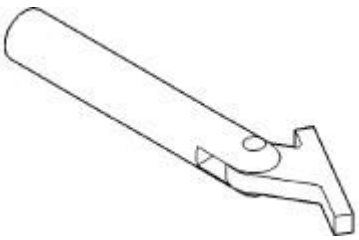

Fig. 100: Crankshaft Main Bearing Remover C-3059
Courtesy of CHRYSLER LLC

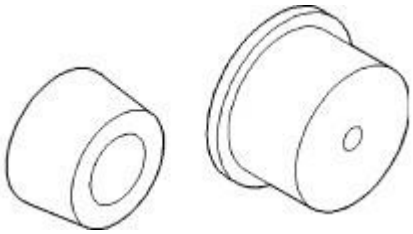

Fig. 101: Rear Crankshaft Oil Seal Installer 6926
Courtesy of CHRYSLER LLC

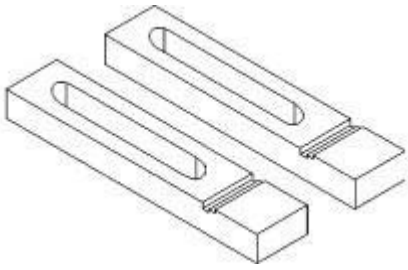

Fig. 102: Crankshaft Real Seal Retainer Alignment Fixture 8225
Courtesy of CHRYSLER LLC

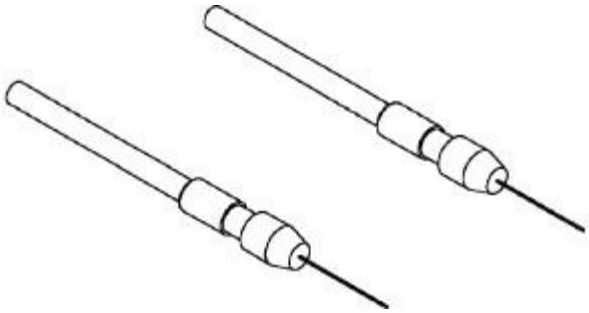

Fig. 103: Release Probe 8351
Courtesy of CHRYSLER LLC

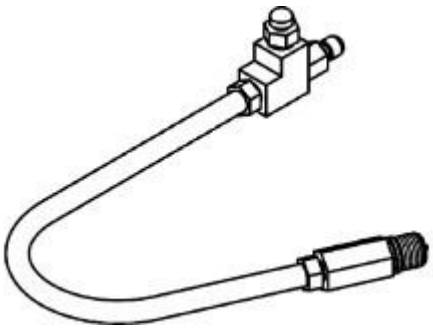

Fig. 104: Cylinder Compression Pressure Adaptor 8116
Courtesy of CHRYSLER LLC

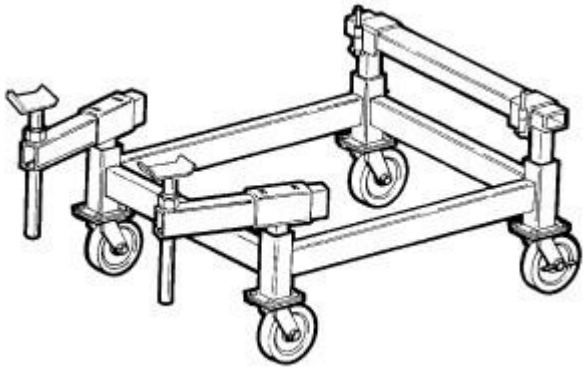

Fig. 105: Driveline Support Table 8874
Courtesy of CHRYSLER LLC

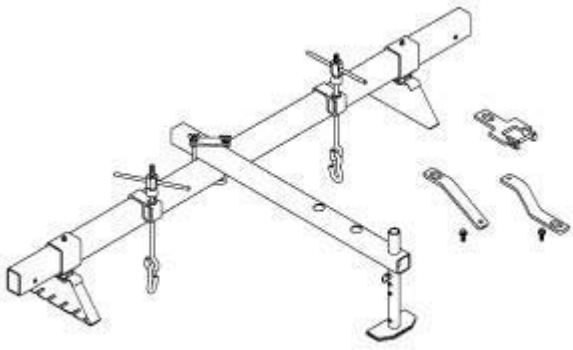

Fig. 106: Driveline Support Fixture 8534B
Courtesy of CHRYSLER LLC

AIR INTAKE SYSTEM

AIR CLEANER

Removal

REMOVAL

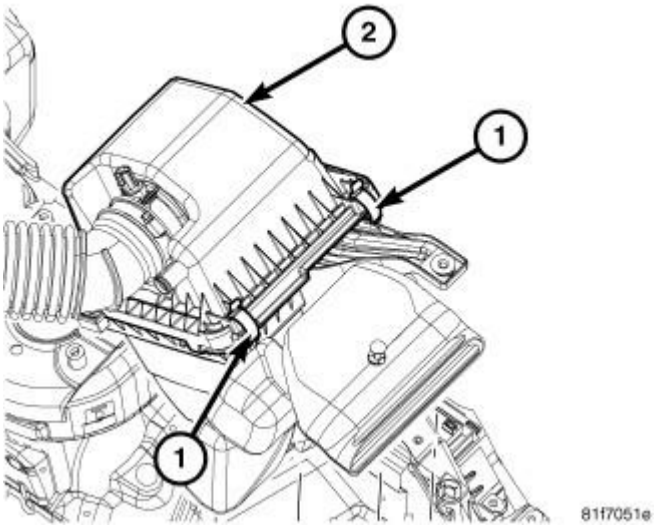

Fig. 107: Air Filter Housing Clips
Courtesy of CHRYSLER LLC

1. Disengage the air filter housing clips (1).
2. Slide the air filter housing cover (2) forward slightly to disengage tabs from the bottom of the air filter housing.
3. Remove air cleaner element from air cleaner housing.

Installation

INSTALLATION

1. Install air filter element into the bottom half of the air filter housing.

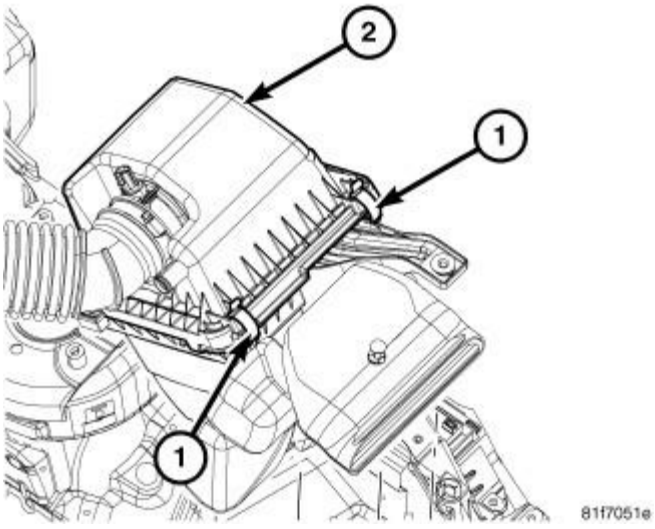

Fig. 108: Air Filter Housing Clips
Courtesy of CHRYSLER LLC

2. Slide the air filter housing cover (2) rearward to engage the tabs into the bottom half of the air filter housing.
3. Reengage the air filter housing clips (1).

BODY, AIR CLEANER

Removal

REMOVAL

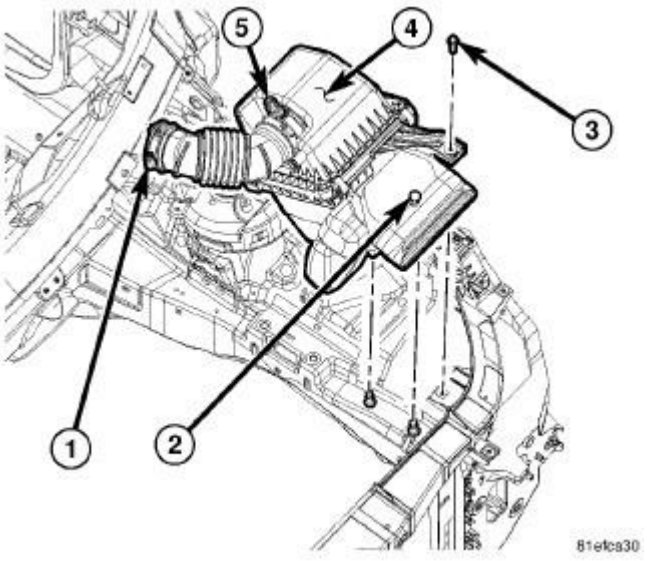

Fig. 109: HOUSING - AIR CLEANER
Courtesy of CHRYSLER LLC

1. Disconnect the Intake Air Temperature (IAT) sensor wiring harness connector from the IAT (5).
2. Loosen the clamp (1) and disconnect the air inlet hose from the throttle body.
3. Disconnect the makeup air hose from the top half of the air filter housing.
4. Remove the air filter housing retaining bolt (3) and the push pin (2) that secures the air scoop to the top of the radiator core support.
5. Pull the air filter housing up and off of the locating pins.

Installation

INSTALLATION

1. Push the air filter housing onto the locating pins.

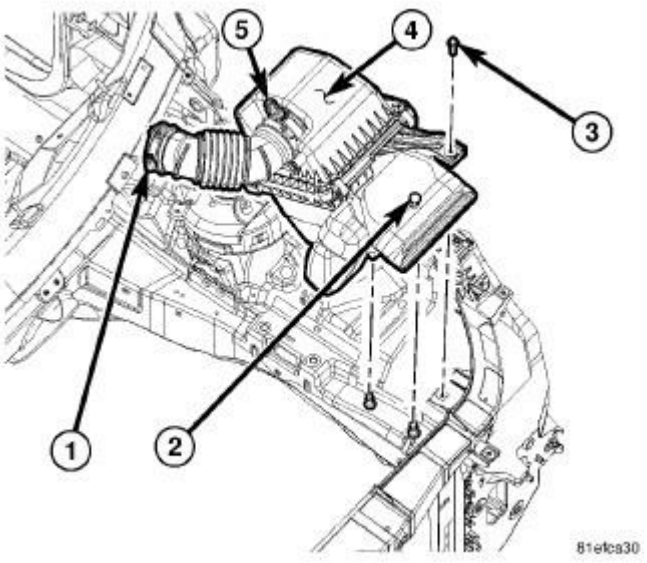

Fig. 110: HOUSING - AIR CLEANER
Courtesy of CHRYSLER LLC

2. Install air filter housing (2) straight down on locating pins.
3. Reposition the bracket and install the retainer (1). Tighten the retainer to 5 Nm (44 in. lbs.).
4. Install the push pin that secures the air scoop to the top of the radiator core support.
5. Connect inlet air temperature sensor harness connector (3).
6. Reconnect the air inlet hose to the throttle body, and tighten the clamp (1).
7. Connect negative battery cable.

CYLINDER HEAD

DESCRIPTION

DESCRIPTION

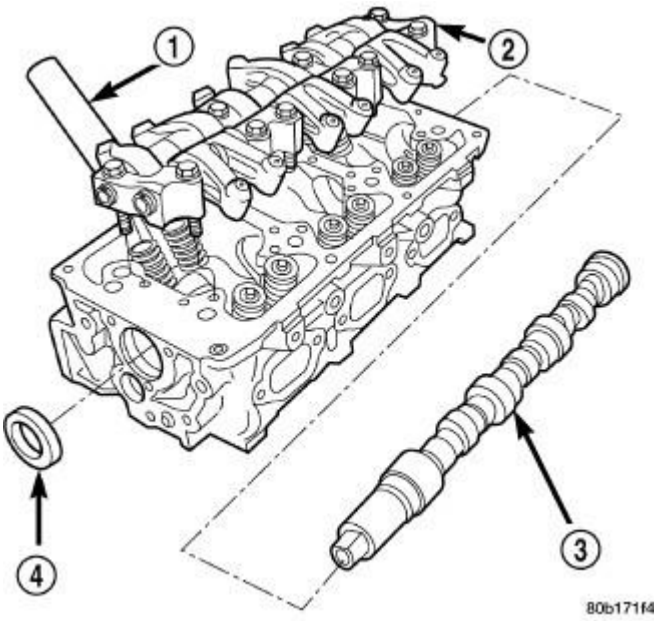

Fig. 111: Cylinder Head, Camshaft & Rocker Arms
Courtesy of CHRYSLER LLC

1 - SPARK PLUG TUBE
2 - ROCKER ARM ASSEMBLY
3 - CAMSHAFT
4 - SEAL

The aluminum alloy cylinder heads feature cross- flow type intake and exhaust ports. Valve guides and seat inserts are powdered metal. Valves are arranged in a "V", with each camshaft on center. To improve combustion speed the chambers are a compact spherical design with a squish area of approximately 30 percent of the piston top area. The cylinder heads are common to either cylinder bank by reversing the direction of installation.

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

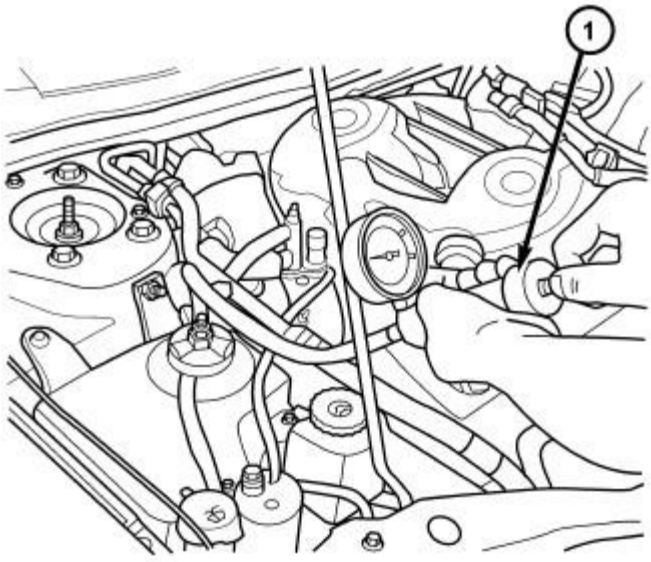

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Fig. 112: PRESSURE TESTING COOLING SYSTEM - 2.7L
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL 7700

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 (1) 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

RIGHT CYLINDER HEAD

1. Remove the engine cover.
2. Perform the fuel pressure release procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .

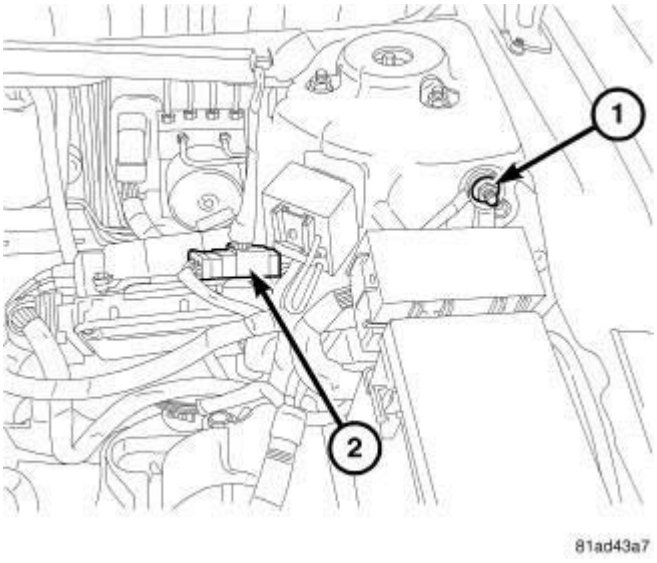

Fig. 113: BATTERY CABLE
Courtesy of CHRYSLER LLC

3. Disconnect the negative battery cable (1).

4. Drain cooling system. Refer to **Cooling - Standard Procedure** .

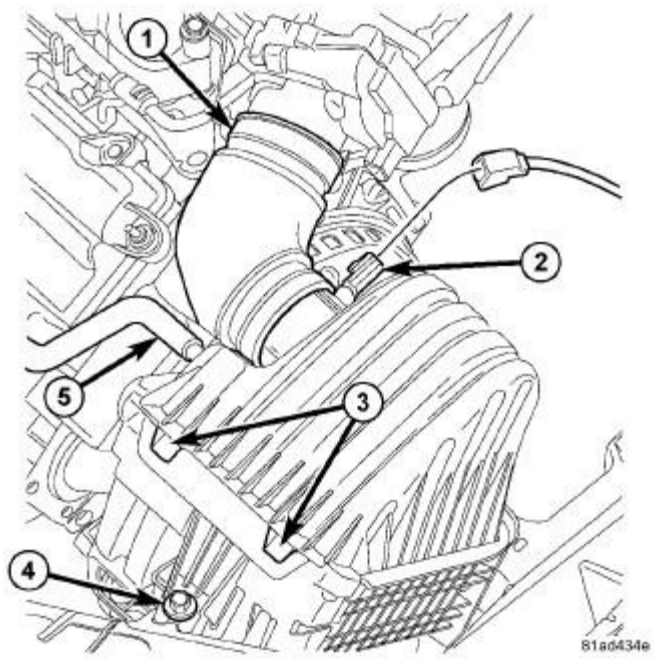

Fig. 114: HOUSING - AIR CLEANER
Courtesy of CHRYSLER LLC

5. Remove air cleaner element housing. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.

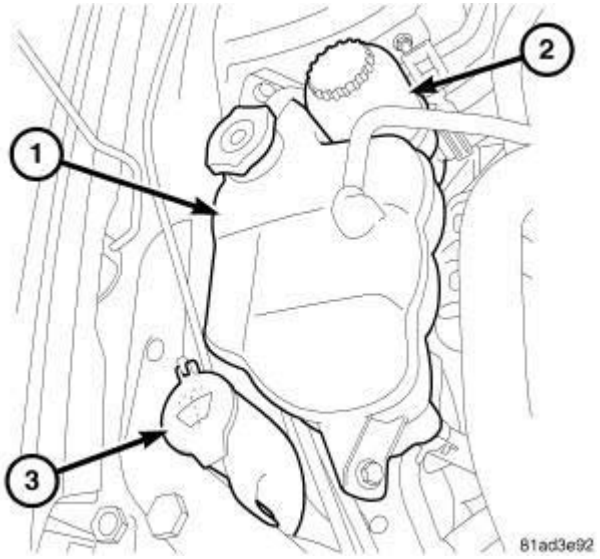

Fig. 115: COOLANT RESERVOIR
Courtesy of CHRYSLER LLC

6. Remove the coolant recovery container (1). Refer to **Cooling/Engine/BOTTLE, Coolant Recovery - Removal**

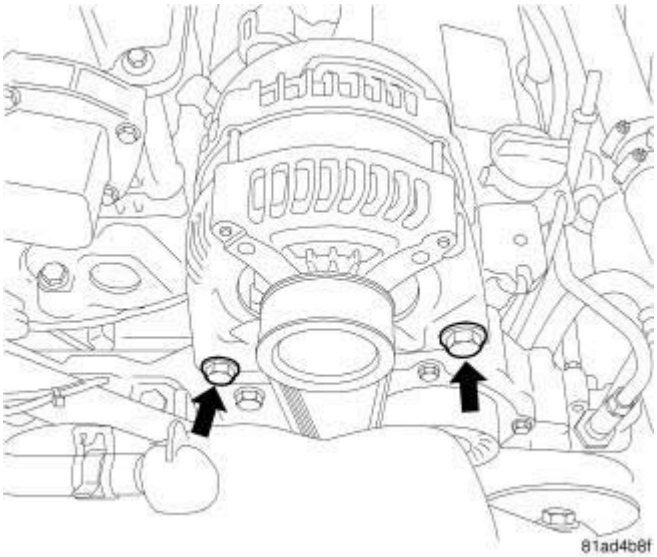

Fig. 116: Identifying Generator Bolts
Courtesy of CHRYSLER LLC

7. Remove the generator. Refer to **Electrical - Engine Systems/Charging/GENERATOR - Removal** .

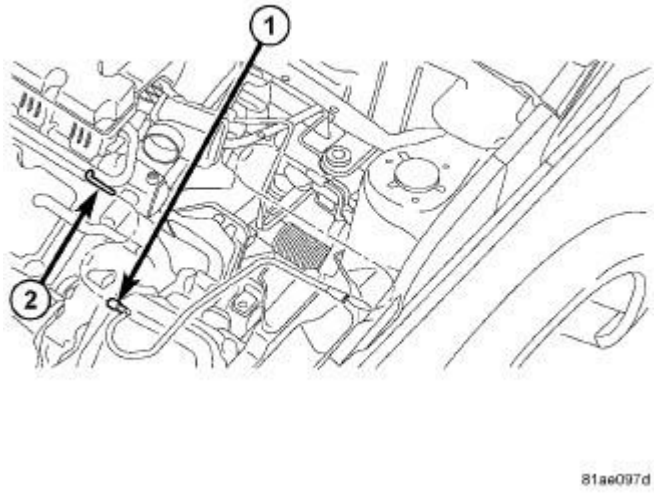

Fig. 117: Fuel Line From Fuel Rail Inlet
Courtesy of CHRYSLER LLC

8. Disconnect the fuel line (1) at the fuel rail (2).

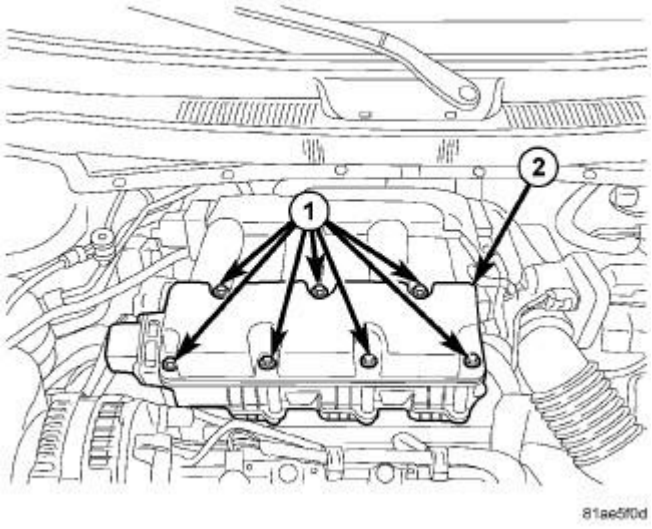

Fig. 118: Upper Intake Manifold
Courtesy of CHRYSLER LLC

9. Remove the upper intake manifold (2). See **Engine/Manifolds/MANIFOLD, Intake - Removal**.

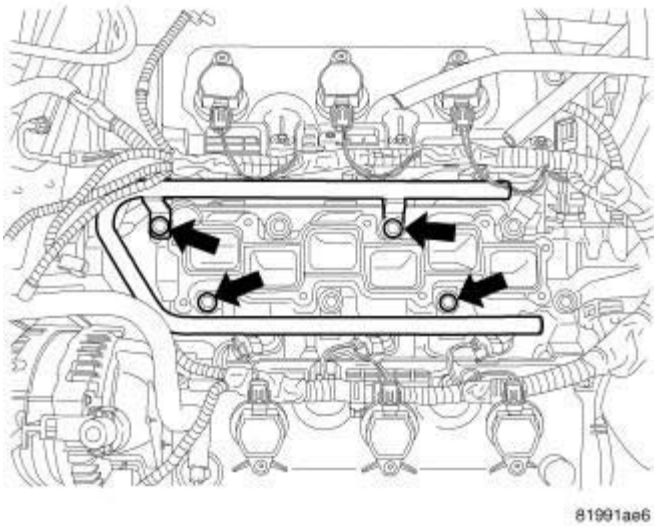

Fig. 119: Fuel Rail Bolts
Courtesy of CHRYSLER LLC

10. Remove the fuel rail. Refer to **Fuel System/Fuel Delivery/RAIL, Fuel - Removal** .

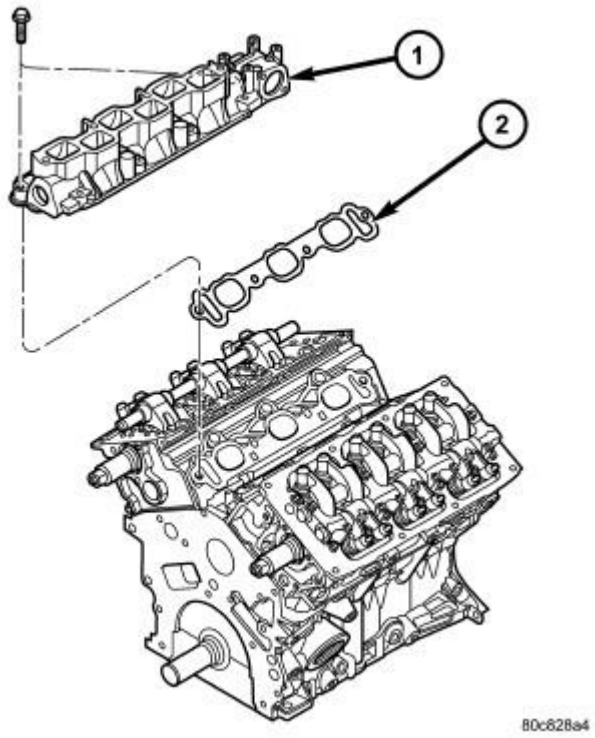

Fig. 120: Lower Intake Manifold
Courtesy of CHRYSLER LLC

1 - LOWER INTAKE MANIFOLD
2 - GASKET

11. Remove the lower intake manifold (1). See **Engine/Manifolds/MANIFOLD, Intake - Removal**.
12. Raise and support the vehicle.
13. Remove right exhaust manifold. See **Engine/Manifolds/MANIFOLD, Exhaust - Removal**.
14. Remove right front tire.
15. Remove right inner splash shield.

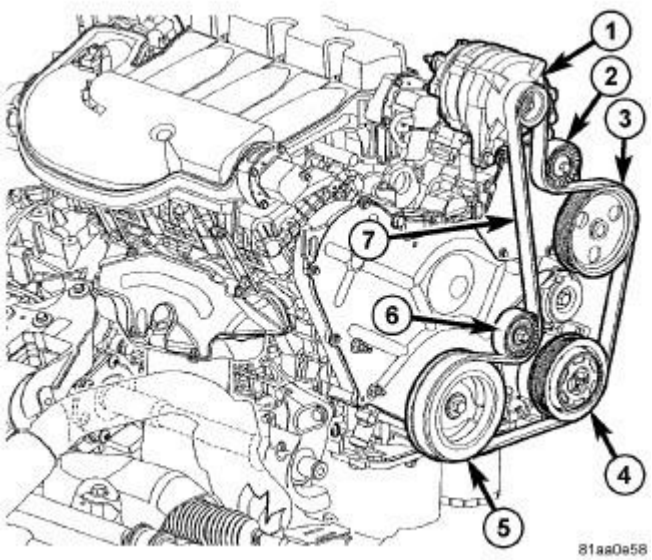

Fig. 121: Identifying Accessory Drive Belt & Pulleys
Courtesy of CHRYSLER LLC

1 - GENERATOR 2 - IDLER PULLEY
3 - POWER STEERING PUMP
4 - A/C COMPRESSOR
5 - CRANKSHAFT PULLEY
6 - TENSIONER

16. Remove vibration damper (5). See **Engine/Engine Block/DAMPER, Vibration - Removal**.
17. Remove lower accessory drive belt idler pulley (6).

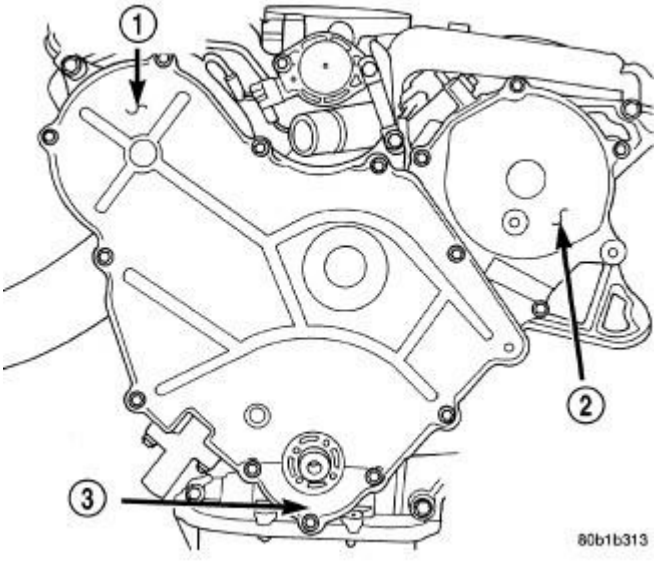

Fig. 122: TIMING BELT COVERS
Courtesy of CHRYSLER LLC

1 - RIGHT SIDE COVER (STAMPED)
2 - LEFT SIDE COVER (CAST)
3 - LOWER COVER

18. Remove lower outer timing belt cover bolts.
19. Remove the supports and lower the vehicle.

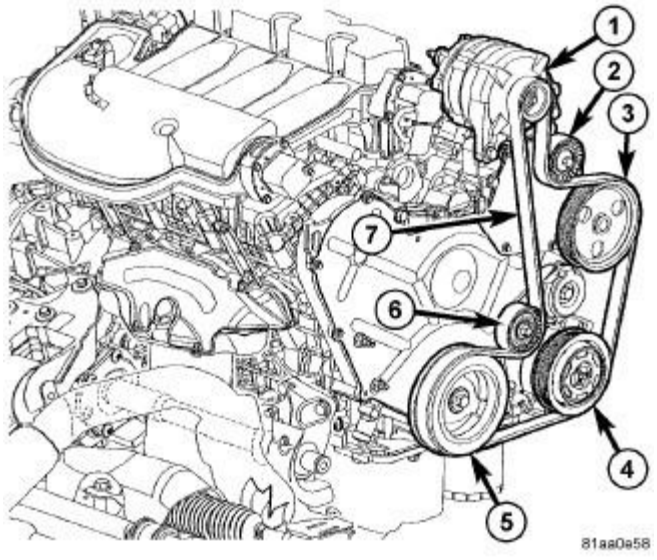

Fig. 123: Identifying Accessory Drive Belt & Pulleys
Courtesy of CHRYSLER LLC

1 - GENERATOR 2 - IDLER PULLEY
3 - POWER STEERING PUMP
4 - A/C COMPRESSOR
5 - CRANKSHAFT PULLEY
6 - TENSIONER

20. Remove the upper accessory drive belt idler pulley (2).
21. Remove the belt tensioner.
22. Support the engine with a block of wood and a floor jack.
23. Remove the upper engine mount. See **Engine/Engine Mounting/INSULATOR, Engine Mount - Removal**.

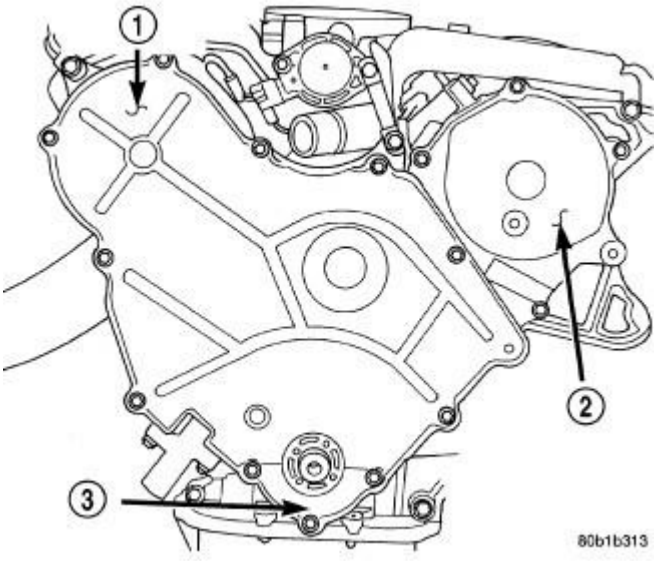

Fig. 124: TIMING BELT COVERS
Courtesy of CHRYSLER LLC

1 - RIGHT SIDE COVER (STAMPED) 2 - LEFT SIDE COVER (CAST) 3 - LOWER COVER

24. Remove the power steering reservoir bolts and set reservoir aside.
25. Remove the remaining outer timing belt cover bolts and cover.
26. Remove the timing belt. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Removal**.
27. Remove the right valve cover to cylinder head ground strap.

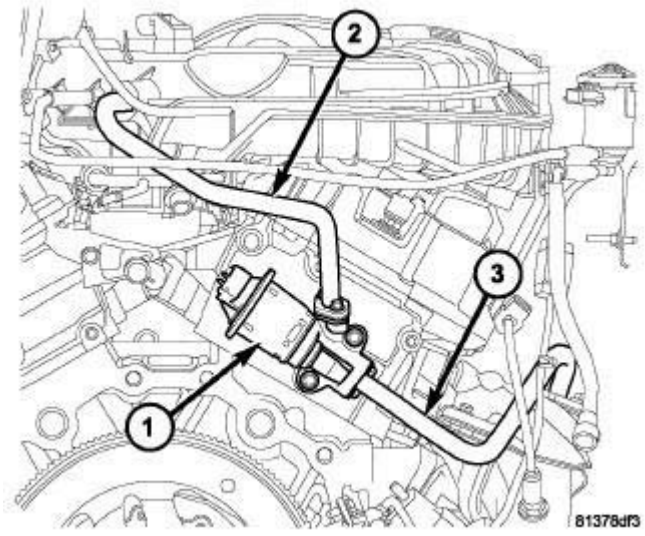

Fig. 125: Exhaust Gas Recirculation System
Courtesy of CHRYSLER LLC

28. Remove the EGR valve (1) and tube assembly (2). Refer to **Emissions Control/Exhaust Gas Recirculation/VALVE, Exhaust Gas Recirculation (EGR) - Removal** .
29. Remove the right cylinder head cover.

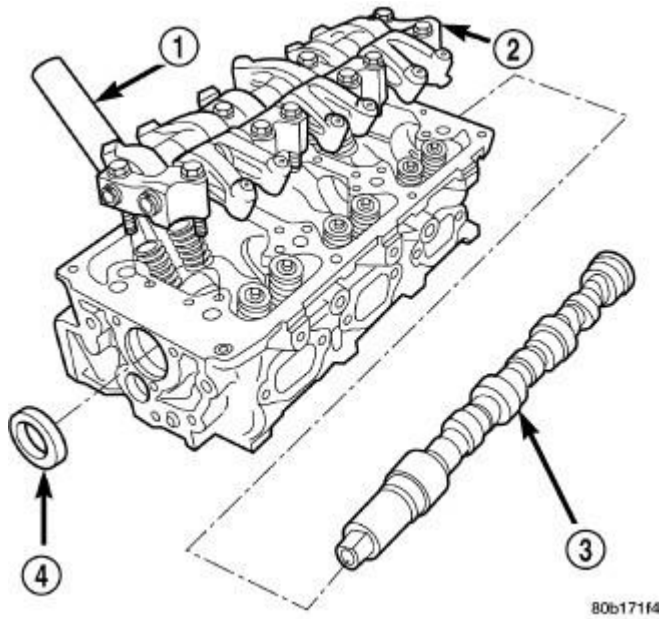

Fig. 126: Cylinder Head, Camshaft & Rocker Arms
Courtesy of CHRYSLER LLC

1 - SPARK PLUG TUBE
2 - ROCKER ARM ASSEMBLY

3 - CAMSHAFT 4 - SEAL

30. Remove the right rocker arm and shaft assembly (2). See **Engine/Cylinder Head/ROCKER ARM, Valve - Disassembly**.

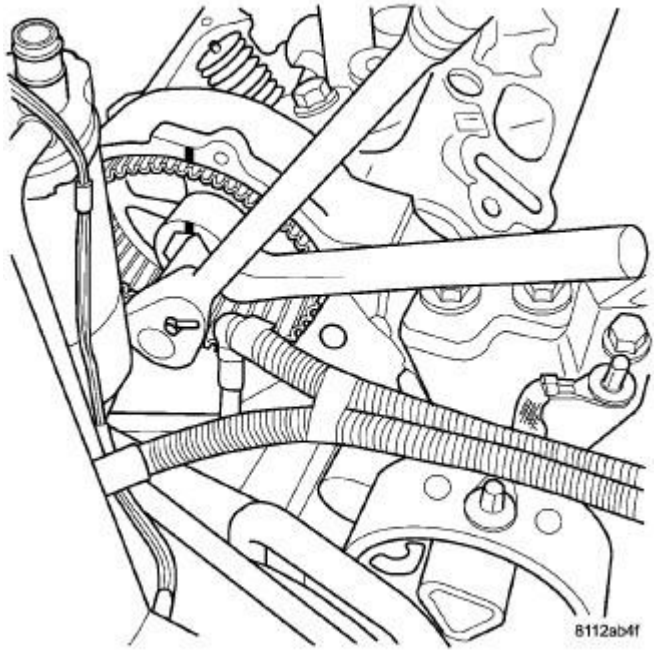

Fig. 127: RIGHT CAMSHAFT SPROCKET
Courtesy of CHRYSLER LLC

31. Hold the cam gear and loosen the right cam gear retaining bolt.

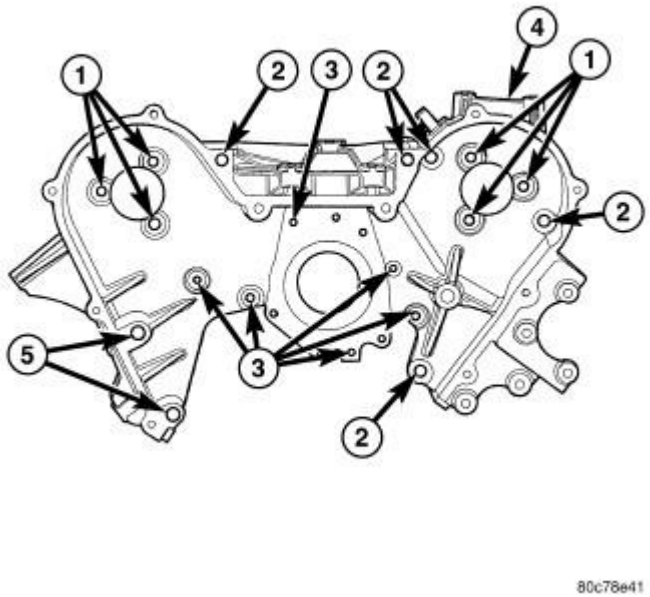

Fig. 128: REAR TIMING BELT COVER FASTENERS
Courtesy of CHRYSLER LLC

1 - M8 FASTENERS (APPLY THREAD SEALANT)
2 - M10 FASTENERS
3 - M6 FASTENERS
4 - REAR TIMING BELT COVER
5 - M10 FASTENERS (STUD/NUT)

32. Remove the inner timing cover to right cylinder head retaining bolts.

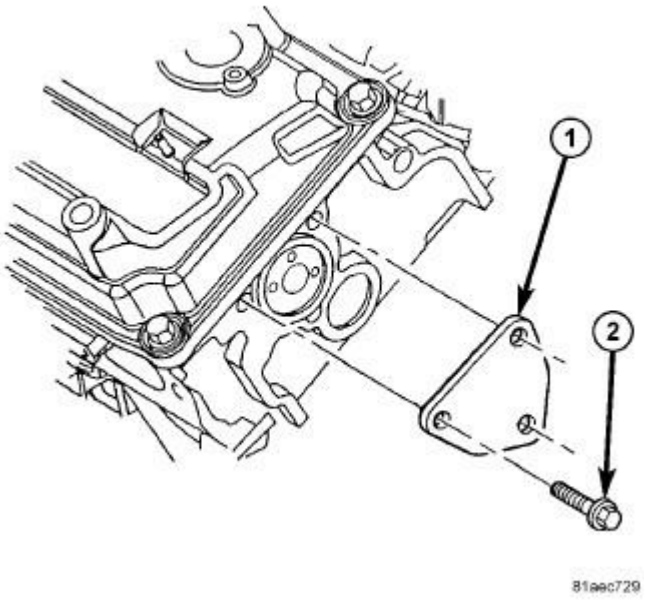

Fig. 129: Camshaft Thrust Plate
Courtesy of CHRYSLER LLC

33. Remove the right rear camshaft thrust plate (1).
34. Carefully push the camshaft out of the back of the cylinder head approximately 3.5 inches. Remove the camshaft sprocket and bolt.
35. **NOTE: It may be necessary to raise the engine slightly in order to remove the camshaft sprocket bolt.**

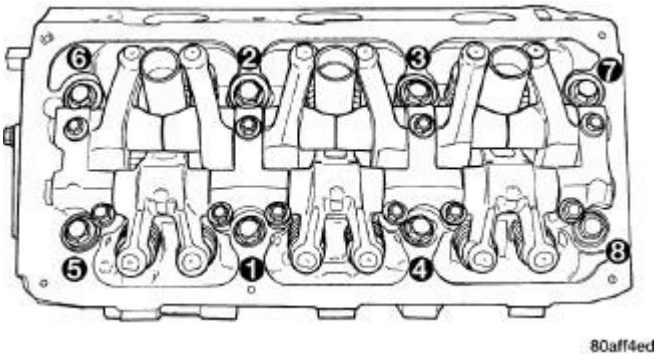

Fig. 130: Cylinder Head Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

36. Remove the cylinder head bolts in REVERSE of tightening sequence.

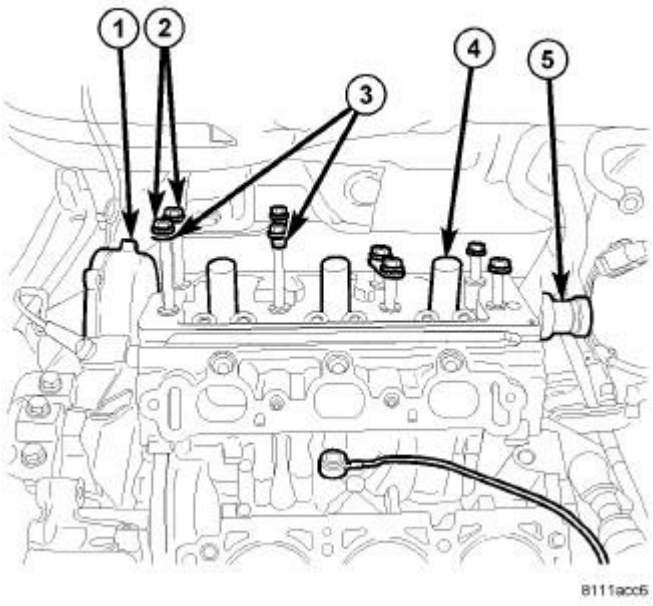

Fig. 131: RIGHT CYLINDER HEAD
Courtesy of CHRYSLER LLC

1 - INNER TIMING BELT COVER
2 - CYLINDER HEAD BOLTS
3 - RUBBER BANDS
4 - SPARK PLUG TUBE
5 - CAMSHAFT

NOTE: Because of clearance restrictions when removing the right cylinder head, the front four cylinder head bolts must be loosened, raised and supported with rubber bands before the cylinder head can be removed.

37. Remove the cylinder head.
38. Clean and inspect all mating surfaces.

LEFT CYLINDER HEAD

1. Remove the engine cover.
2. Perform the fuel pressure release procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .

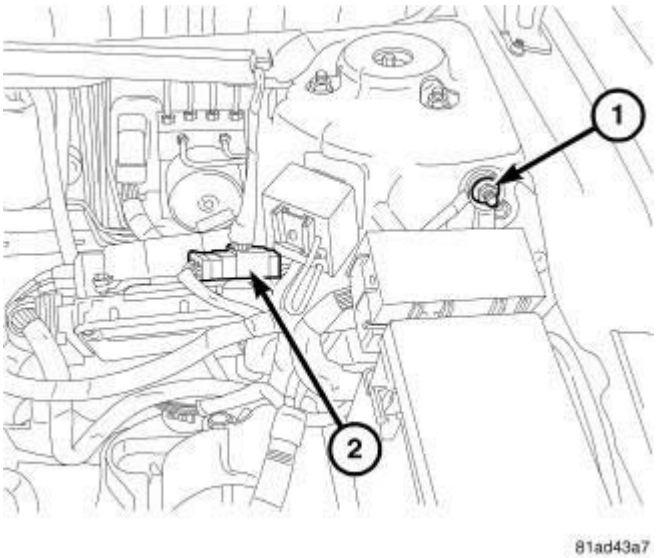

Fig. 132: BATTERY CABLE
Courtesy of CHRYSLER LLC

3. Disconnect the negative battery cable.
4. Drain cooling system. Refer to **Cooling - Standard Procedure** .

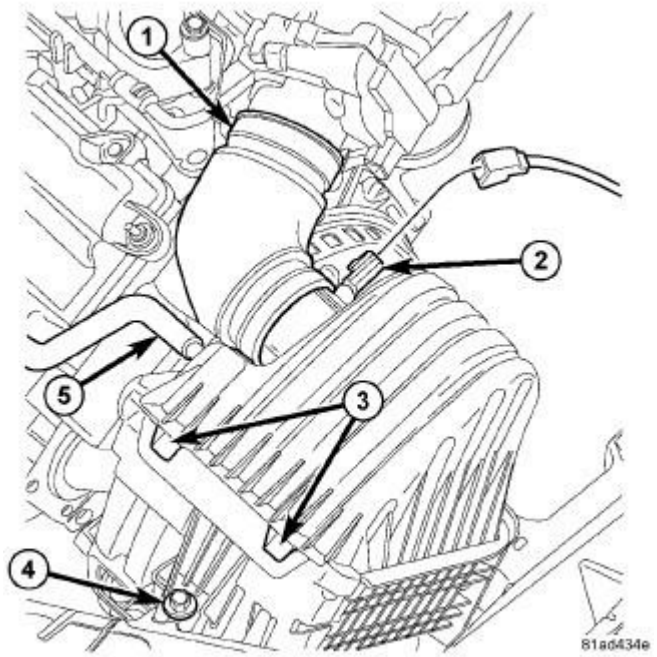

Fig. 133: HOUSING - AIR CLEANER
Courtesy of CHRYSLER LLC

5. Remove air cleaner element housing. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.
6. Remove radiator fan assembly. Refer to **Cooling/Engine/FAN, Cooling - Removal** .

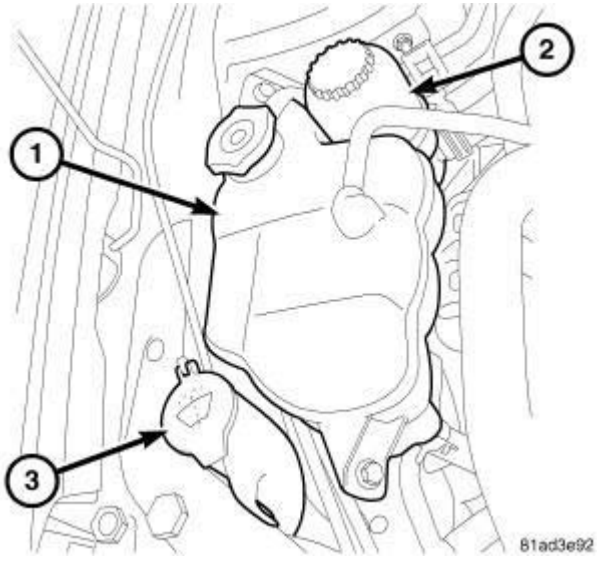

Fig. 134: COOLANT RESERVOIR
Courtesy of CHRYSLER LLC

7. Remove the coolant recovery container. Refer to **Cooling/Engine/BOTTLE, Coolant Recovery - Removal** .

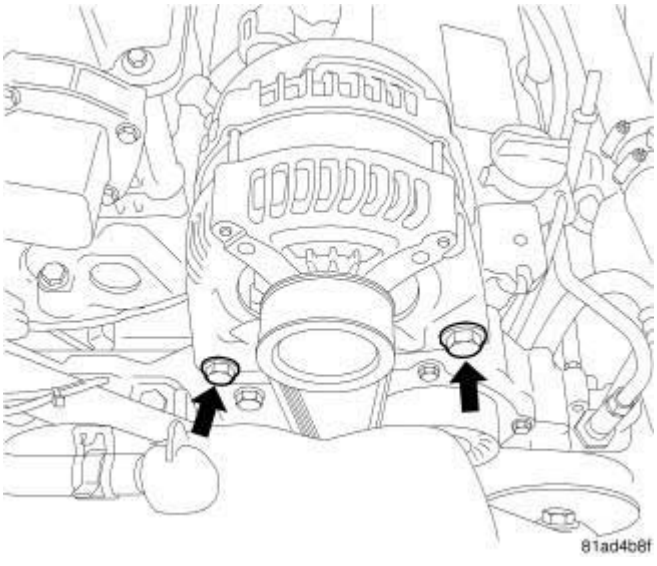

Fig. 135: Identifying Generator Bolts
Courtesy of CHRYSLER LLC

8. Remove the generator. Refer to **Electrical - Engine Systems/Charging/GENERATOR - Removal** .

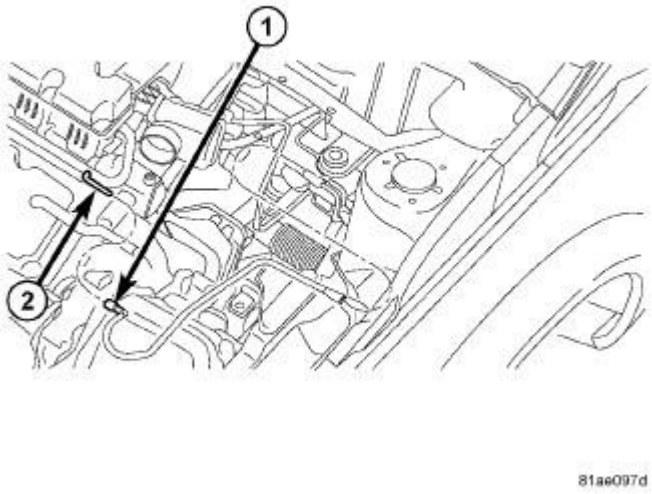

Fig. 136: Fuel Line From Fuel Rail Inlet
Courtesy of CHRYSLER LLC

9. Disconnect the fuel line (1) at the fuel rail (2).

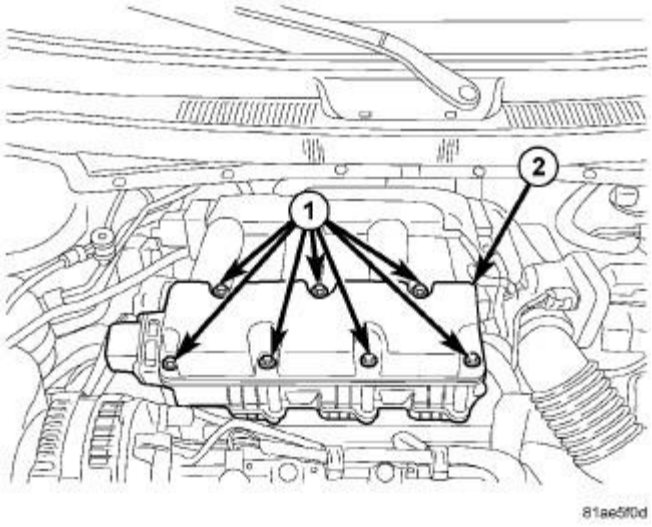

Fig. 137: Upper Intake Manifold
Courtesy of CHRYSLER LLC

10. Remove the upper intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Removal**.

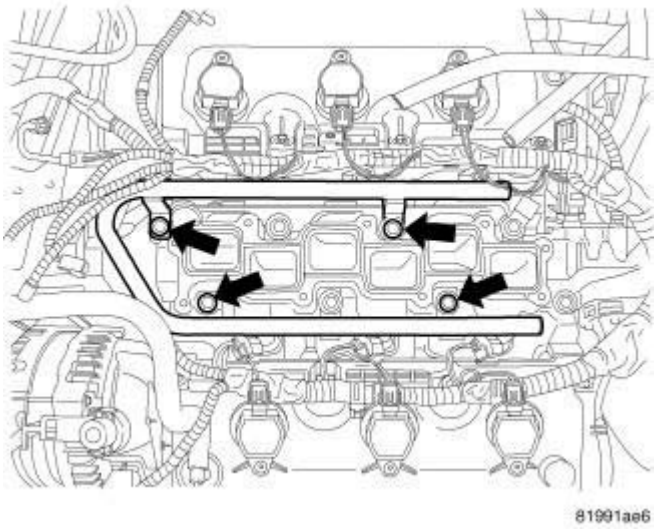

Fig. 138: Fuel Rail Bolts
Courtesy of CHRYSLER LLC

11. Remove the fuel rail. Refer to **Fuel System/Fuel Delivery/RAIL, Fuel - Removal** .

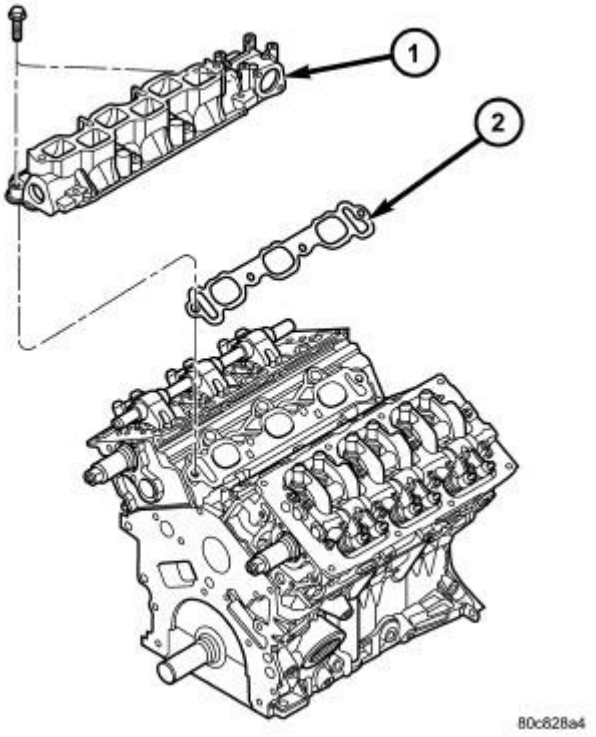

Fig. 139: Lower Intake Manifold
Courtesy of CHRYSLER LLC

1 - LOWER INTAKE MANIFOLD

2 - GASKET

12. Remove the lower intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Removal**.
13. Raise and support the vehicle.

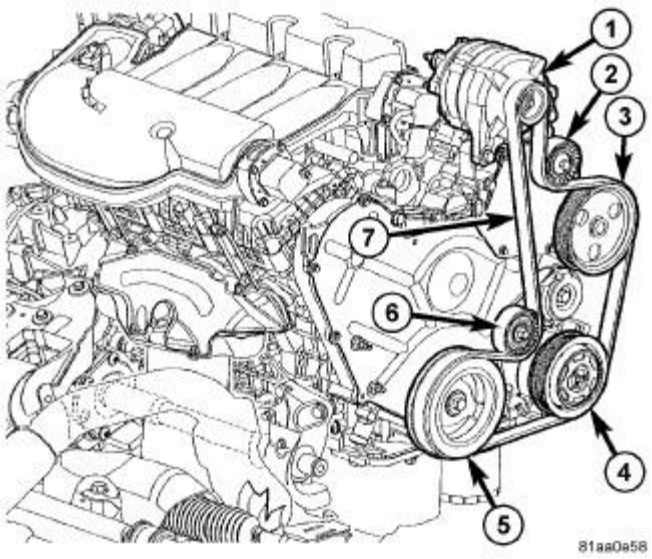

Fig. 140: Identifying Accessory Drive Belt & Pulleys
Courtesy of CHRYSLER LLC

1 - GENERATOR 2 - IDLER PULLEY
3 - POWER STEERING PUMP
4 - A/C COMPRESSOR
5 - CRANKSHAFT PULLEY
6 - TENSIONER

14. Remove the left exhaust manifold. See **Engine/Manifolds/MANIFOLD, Exhaust - Removal**.
15. Remove right front tire.
16. Remove right inner splash shield.

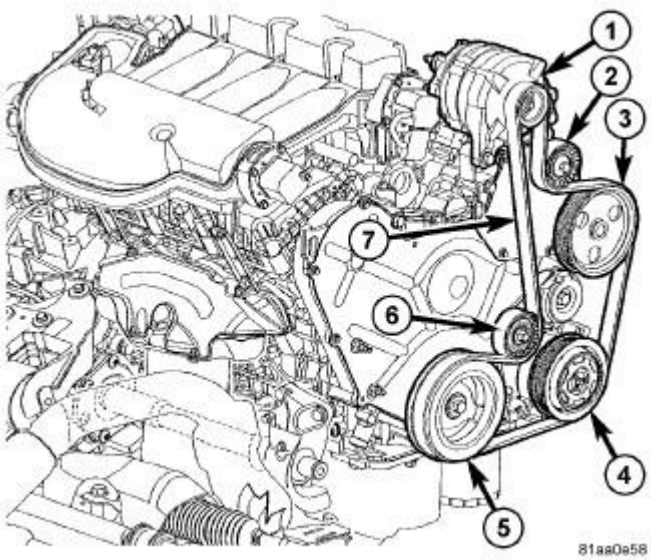

Fig. 141: Identifying Accessory Drive Belt & Pulleys
Courtesy of CHRYSLER LLC

1 - GENERATOR 2 - IDLER PULLEY
3 - POWER STEERING PUMP
4 - A/C COMPRESSOR
5 - CRANKSHAFT PULLEY
6 - TENSIONER

17. Remove vibration damper (5). See **Engine/Engine Block/DAMPER, Vibration - Removal**.
18. Remove lower accessory drive belt idler pulley (6).

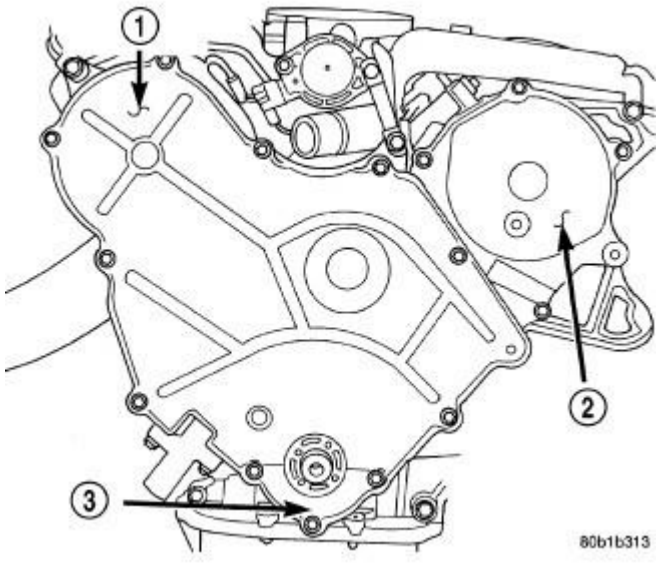

Fig. 142: TIMING BELT COVERS
Courtesy of CHRYSLER LLC

1 - RIGHT SIDE COVER (STAMPED)
2 - LEFT SIDE COVER (CAST)
3 - LOWER COVER

19. Remove the power steering mounting bolts and set the pump aside. Refer to **Steering/Pump - Removal** .
20. Remove lower outer timing belt cover bolts.
21. Remove the support and lower vehicle.

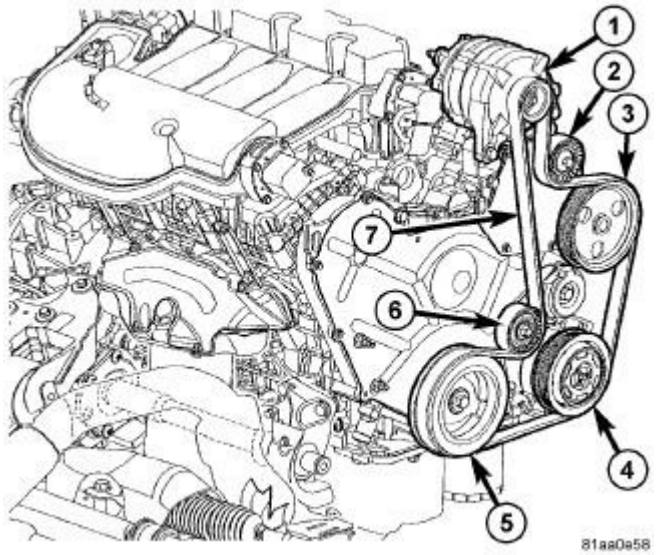

Fig. 143: Identifying Accessory Drive Belt & Pulleys
Courtesy of CHRYSLER LLC

1 - GENERATOR 2 - IDLER PULLEY
3 - POWER STEERING PUMP
4 - A/C COMPRESSOR
5 - CRANKSHAFT PULLEY
6 - TENSIONER

22. Remove the upper accessory drive belt idler pulley (2).
23. Remove the belt tensioner.
24. Support the engine with a block of wood and a floor jack.
25. Remove the upper engine mount. See **Engine/Engine Mounting/INSULATOR, Engine Mount - Removal**.
26. Remove the power steering reservoir bolts and set reservoir aside.

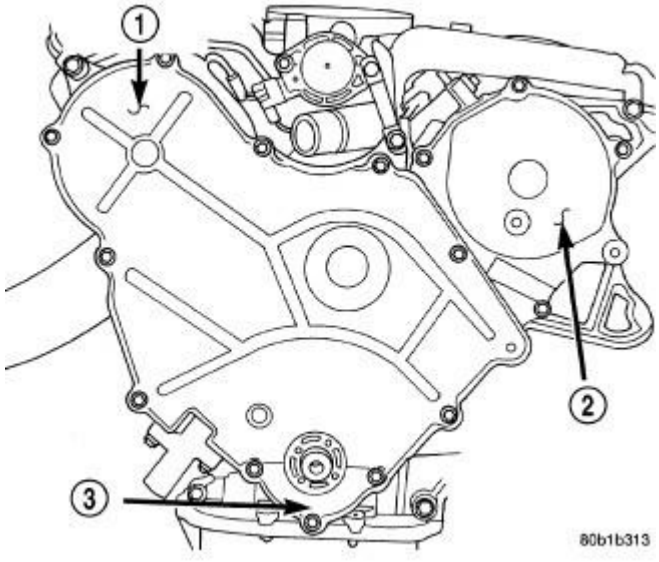

Fig. 144: TIMING BELT COVERS
Courtesy of CHRYSLER LLC

1 - RIGHT SIDE COVER (STAMPED) 2 - LEFT SIDE COVER (CAST) 3 - LOWER COVER

27. Remove the remaining outer timing belt cover bolts and remove cover.
28. Remove the timing belt. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Removal**.
29. Remove the left cylinder head cover to cylinder head ground strap.
30. Remove the left cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.

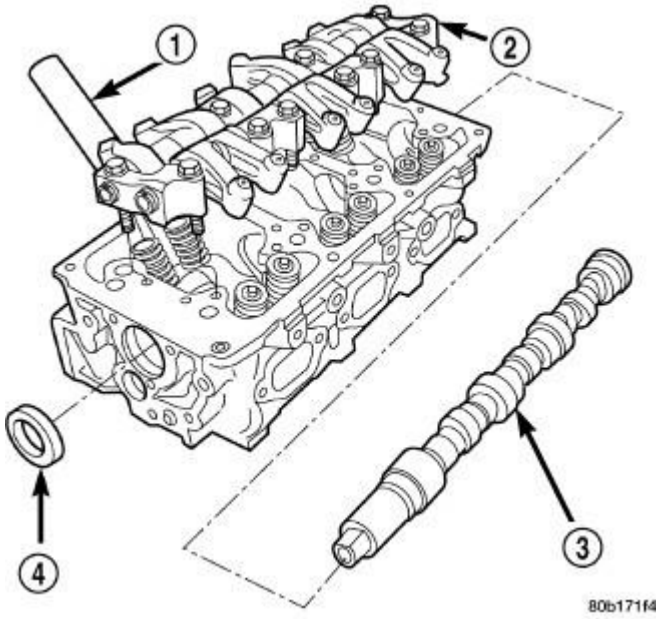

Fig. 145: Cylinder Head, Camshaft & Rocker Arms
Courtesy of CHRYSLER LLC

1 - SPARK PLUG TUBE
2 - ROCKER ARM ASSEMBLY
3 - CAMSHAFT
4 - SEAL

31. Remove the left rocker arm assembly (2). See **Engine/Cylinder Head/ROCKER ARM, Valve - Disassembly**.

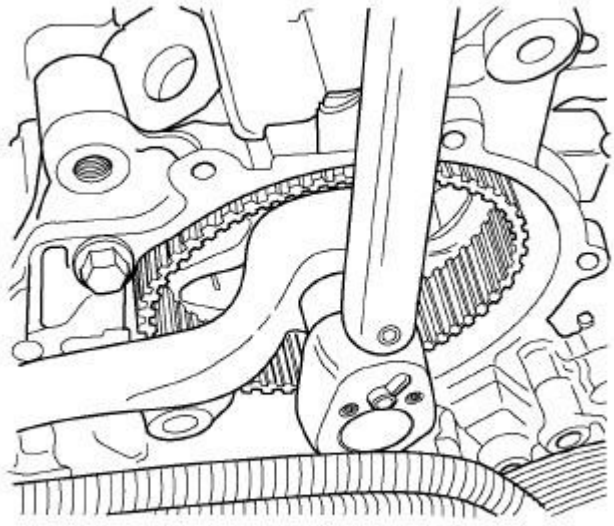

Fig. 146: LEFT CAMSHAFT SPROCKET
Courtesy of CHRYSLER LLC

32. Hold the left cam gear and loosen the cam gear retaining bolt.

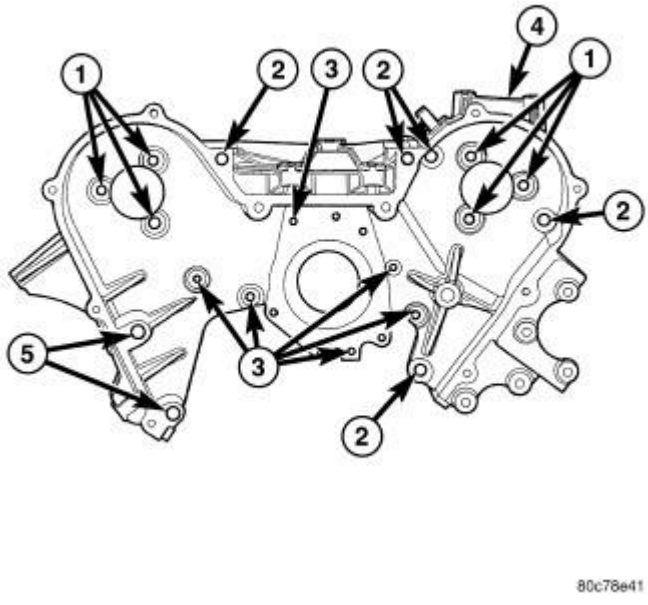

Fig. 147: REAR TIMING BELT COVER FASTENERS
Courtesy of CHRYSLER LLC

1 - M8 FASTENERS (APPLY THREAD SEALANT)
2 - M10 FASTENERS
3 - M6 FASTENERS
4 - REAR TIMING BELT COVER
5 - M10 FASTENERS (STUD/NUT)

33. Remove the front timing belt housing to cylinder head bolts.

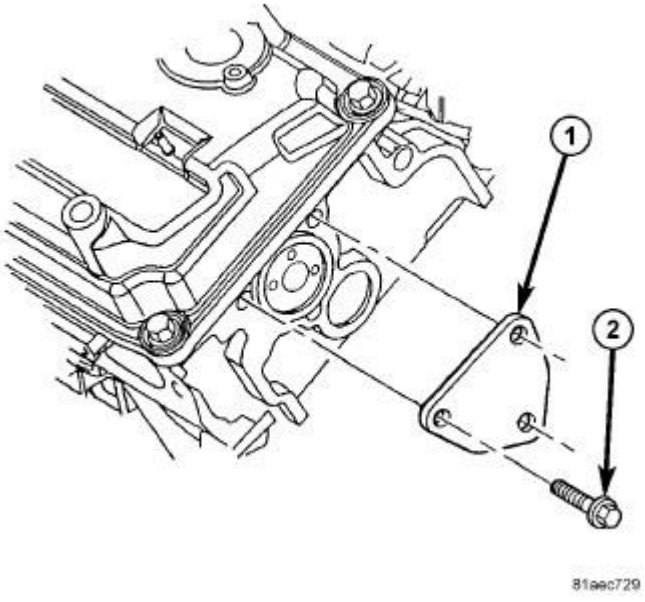

Fig. 148: Camshaft Thrust Plate
Courtesy of CHRYSLER LLC

34. Remove the left camshaft thrust plate.
35. Carefully push the camshaft out of the back of the cylinder head approximately 3.5 inches. Remove the camshaft sprocket and bolt.
36. **NOTE: It may be necessary to raise the engine slightly in order to remove the camshaft sprocket bolt.**

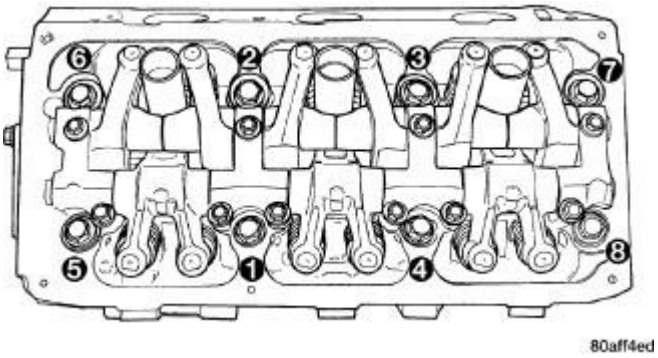

Fig. 149: Cylinder Head Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

37. Remove the cylinder head bolts in REVERSE of tightening sequence.
38. Remove the cylinder head.
39. Clean and inspect all mating surfaces.

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

1. Before cleaning, check for leaks, damage and cracks.
2. Clean cylinder head and oil passages.

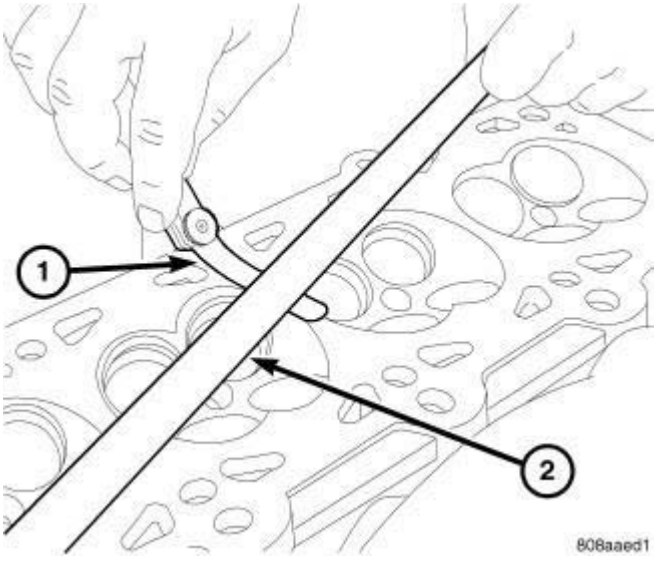

Fig. 150: Checking Cylinder Head Flatness
Courtesy of CHRYSLER LLC

3. Check cylinder head for flatness (1).
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

RIGHT CYLINDER HEAD

CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use ONLY a wooden or plastic scraper

1. Clean sealing surfaces of cylinder head and block. See **Engine - Standard Procedure**.

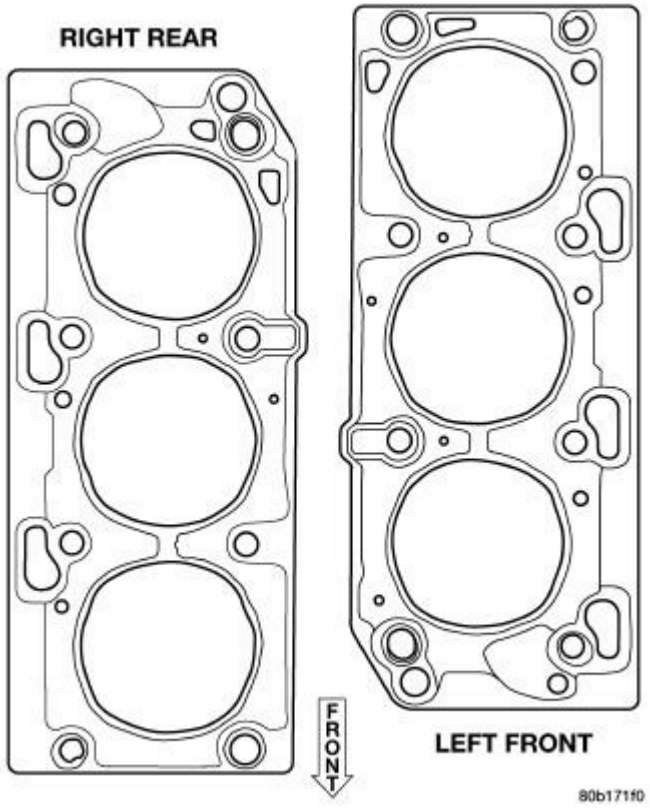

Fig. 151: Cylinder Head Gasket Identification
Courtesy of CHRYSLER LLC

CAUTION: The cylinder head gaskets are not interchangeable between cylinder heads and are clearly marked right or left.

2. Install head gasket over locating dowels. Ensure the gasket is installed on the correct side of engine.

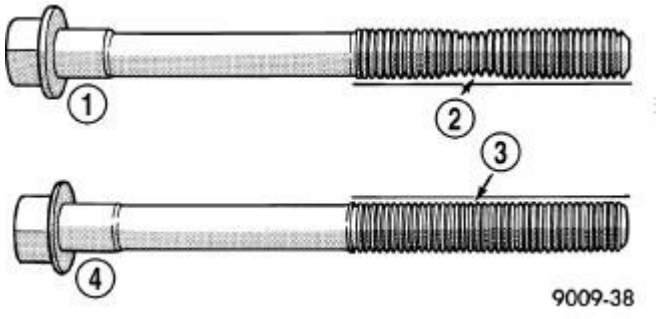

Fig. 152: Check for Stretched Bolts
Courtesy of CHRYSLER LLC

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

CAUTION: Cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down the bolts must be replaced. Failure to replace a damaged bolt may lead to possible engine damage.

3. Inspect the cylinder head bolts (1 and 4) for straightness, head damage, thread damage and necking. Necking can be checked by holding a scale or straight edge against the threads (3). If all the threads do not contact the scale evenly (2) the bolt must be replaced.

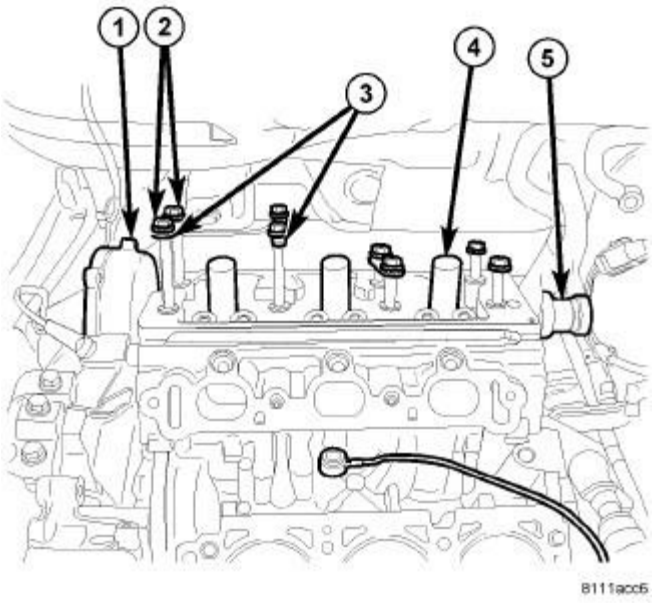

Fig. 153: RIGHT CYLINDER HEAD
Courtesy of CHRYSLER LLC

1 - INNER TIMING BELT COVER
2 - CYLINDER HEAD BOLTS
3 - RUBBER BANDS
4 - SPARK PLUG TUBE
5 - CAMSHAFT

NOTE: Before installing the cylinder head bolts, lubricate the threads with engine oil.

4. Insert the front four cylinder head bolts into the cylinder head. Pull the bolts up to the top of their travel and retain with rubber bands.
5. Install the cylinder head over locating dowels and finger tighten the head bolts.

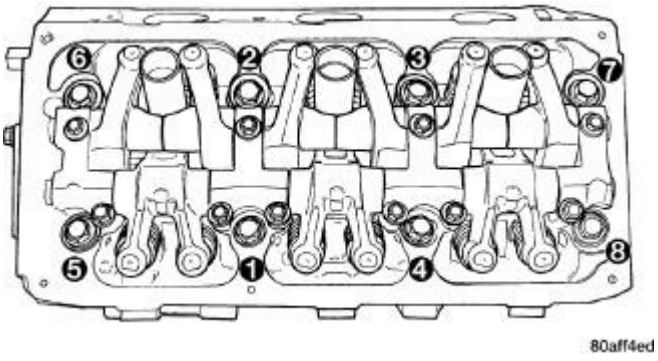

Fig. 154: Cylinder Head Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

6. Tighten the cylinder head bolts in the sequence shown in illustration using the following four step torque-turn method:
   - Step 1: All to 61 N.m (45 ft. lbs.)
   - Step 2: All to 88 N.m (65 ft. lbs.)
   - Step 3: All (again) to 88 N.m (65 ft. lbs.)
   - Step 4: + 90° Turn **Do not use a torque wrench for this step.**
7. Bolt torque after 90° turn should be over 122 N.m (90 ft. lbs.) in the tightening direction. If not, replace the bolt.

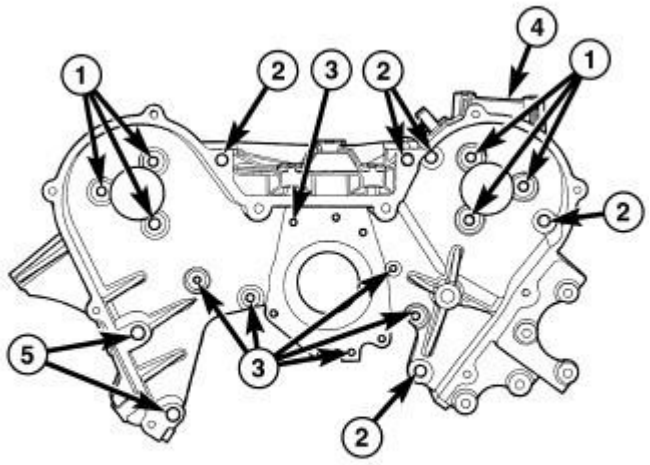

Fig. 155: REAR TIMING BELT COVER FASTENERS
Courtesy of CHRYSLER LLC

1 - M8 FASTENERS (APPLY THREAD SEALANT)
2 - M10 FASTENERS
3 - M6 FASTENERS
4 - REAR TIMING BELT COVER
5 - M10 FASTENERS (STUD/NUT)

8. Install the inner timing cover to cylinder head bolts. Tighten bolts to 54 N.m (40 lbs. ft.).

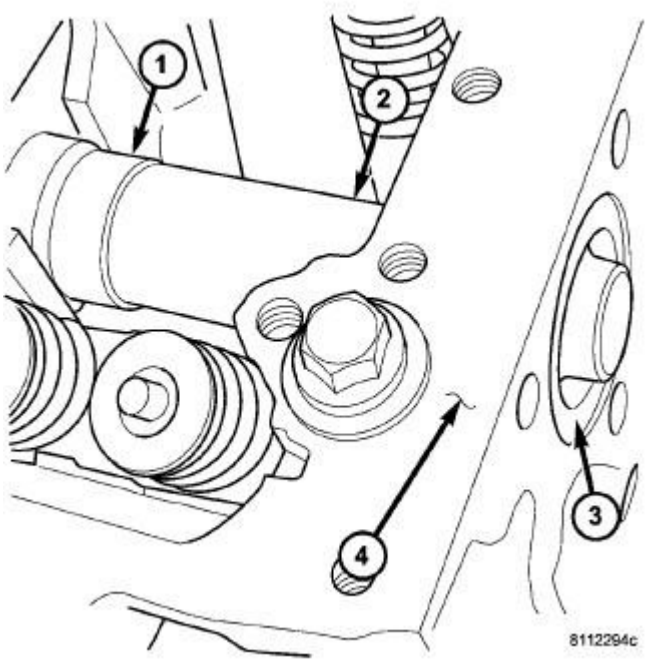

Fig. 156: CAMSHAFT INSTALLATION - LEFT
Courtesy of CHRYSLER LLC

1 - CAMSHAFT
2 - SPECIAL TOOL 6788
3 - CAMSHAFT SEAL
4 - CYLINDER HEAD

9. Apply light coat of clean engine oil to the lip of the camshaft oil seal (3) and Seal Protector Sleeve 6788 (2).

NOTE: When installing the camshaft (1) into the cylinder head (4), you must first insert the Seal Protector Sleeve 6788 (2) through the camshaft seal (3) until the camshaft seats, then remove the Seal Protector Sleeve 6788 (2) from the camshaft.

10. Install the camshaft (1) using Seal Protector Sleeve 6788 (2) into the cylinder head (4).

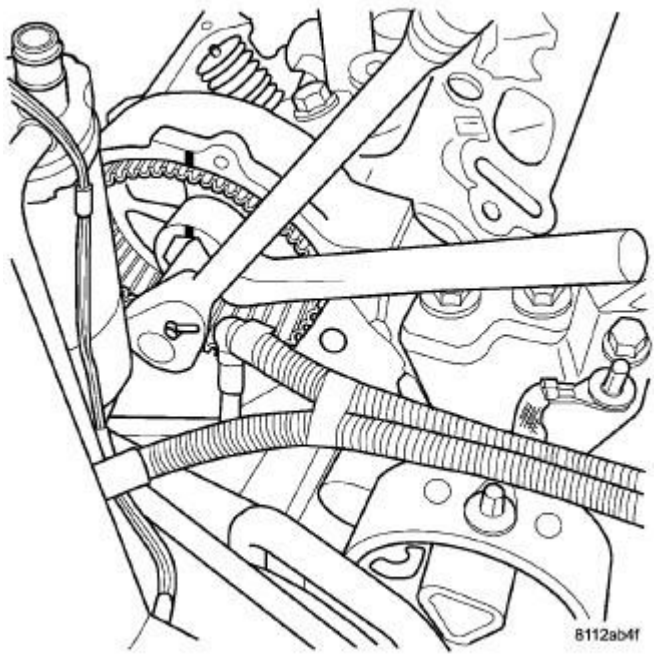

Fig. 157: RIGHT CAMSHAFT SPROCKET
Courtesy of CHRYSLER LLC

11. Install camshaft sprocket. Hold the camshaft sprocket gear and tighten the camshaft sprocket bolt to 102 N.m plus a 1/4 turn (75 lbs. ft. plus a 1/4 turn). See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Installation**.

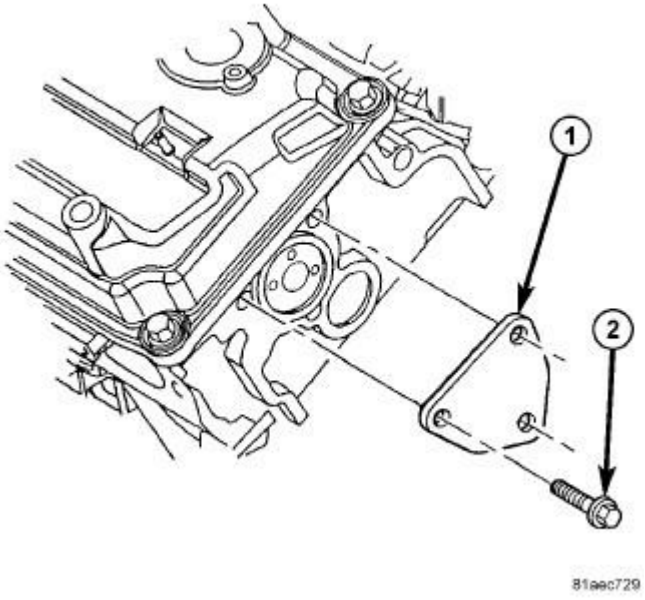

Fig. 158: Camshaft Thrust Plate

Courtesy of CHRYSLER LLC

12. Install the rear camshaft thrust plate (1).

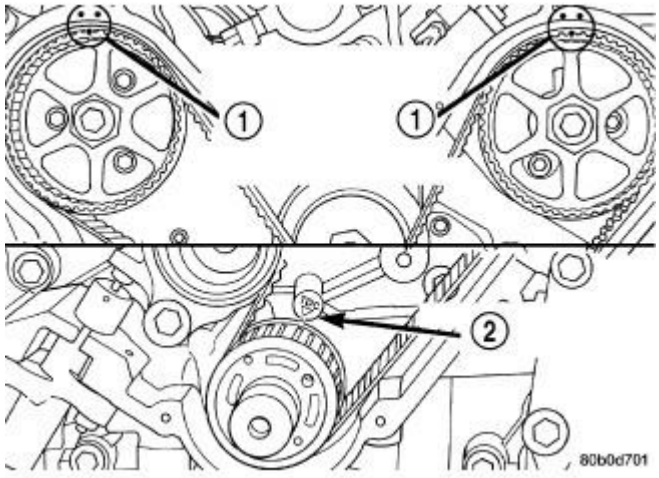

Fig. 159: CAMSHAFT SPROCKET TIMING MARKS
Courtesy of CHRYSLER LLC

1 - ALIGN CAMSHAFT SPROCKET TIMING MARK BETWEEN MARKS ON REAR TIMING BELT COVER 2 - CRANKSHAFT AT TDC

13. Rotate the camshaft gear to the timing mark (1) and verify the left camshaft gear (1) and crankshaft gear timing marks (2) are aligned.
14. Install the timing belt. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Installation**.
15. Install the tensioner. See **Engine/Valve Timing/TENSIONER, Engine Timing - Installation**.

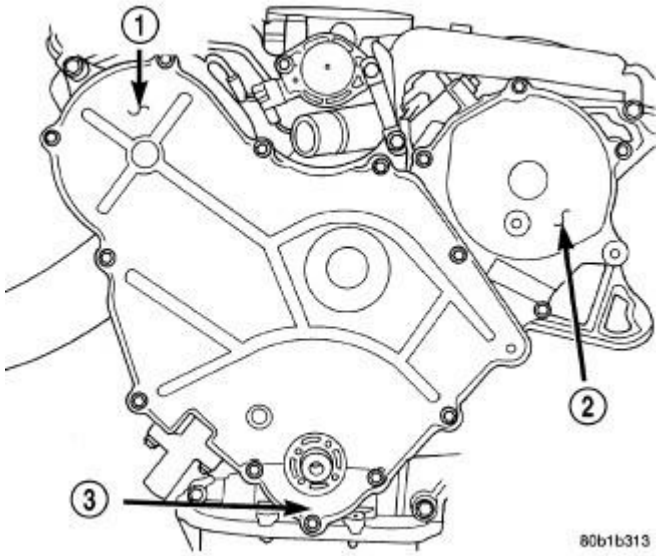

Fig. 160: TIMING BELT COVERS
Courtesy of CHRYSLER LLC

1 - RIGHT SIDE COVER (STAMPED)
2 - LEFT SIDE COVER (CAST)
3 - LOWER COVER

16. Install the timing belt outer cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Installation**.
17. Install the power steering reservoir.

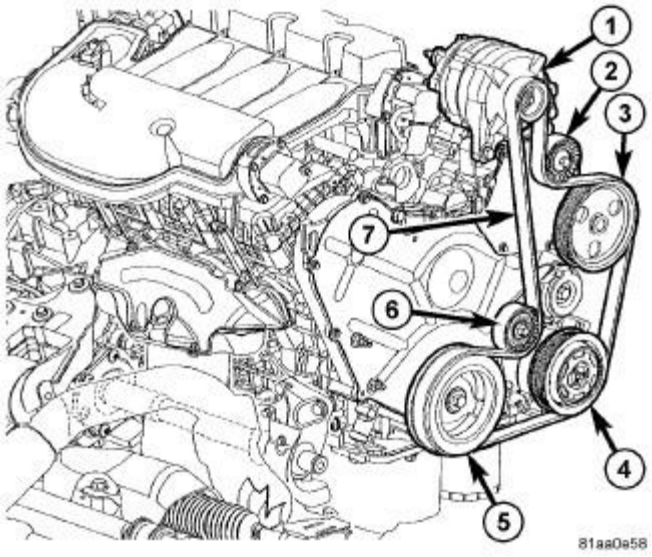

Fig. 161: Identifying Accessory Drive Belt & Pulleys
Courtesy of CHRYSLER LLC

1 - GENERATOR 2 - IDLER PULLEY
3 - POWER STEERING PUMP
4 - A/C COMPRESSOR
5 - CRANKSHAFT PULLEY
6 - TENSIONER

18. Install the vibration damper (5). See **Engine/Engine Block/DAMPER, Vibration - Installation**.
19. Install the upper engine mount. See **Engine/Engine Mounting/INSULATOR, Engine Mount - Installation**.
20. Install the accessory drive belt tensioner (6).
21. Install the lower accessory drive belt idler pulley (2).
22. Install the right exhaust manifold. See **Engine/Manifolds/MANIFOLD, Exhaust - Installation**.

23. Raise the vehicle.
24. Install the exhaust cross over pipe. See **Engine/Manifolds/MANIFOLD, Exhaust - Installation**.
25. Install the catalytic converter and exhaust system.
26. Connect both oxygen sensors.
27. Lower the vehicle.

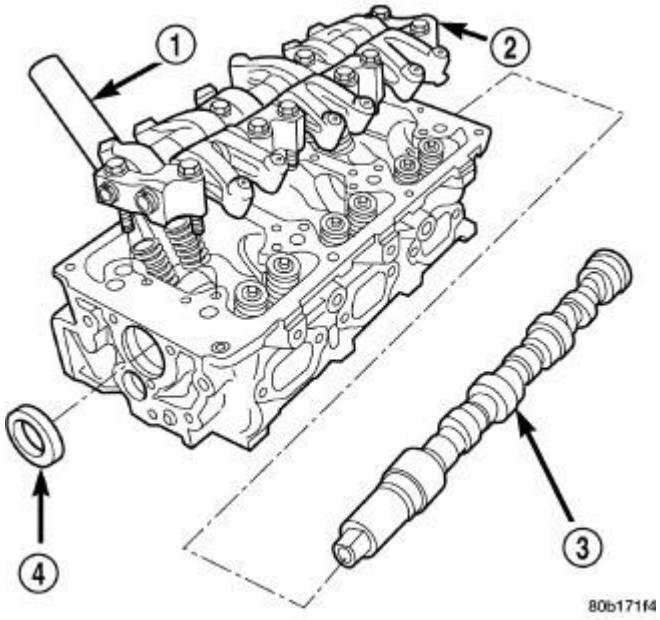

Fig. 162: Cylinder Head, Camshaft & Rocker Arms
Courtesy of CHRYSLER LLC

1 - SPARK PLUG TUBE
2 - ROCKER ARM ASSEMBLY
3 - CAMSHAFT
4 - SEAL

28. Install the right rocker arm assembly (2). See **Engine/Cylinder Head/ROCKER ARM, Valve - Installation**.
29. Install the right cylinder head cover and ground strap.

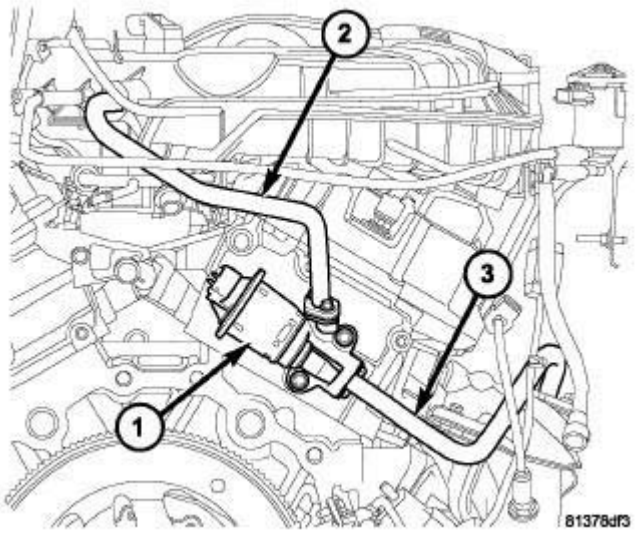

Fig. 163: Exhaust Gas Recirculation System
Courtesy of CHRYSLER LLC

30. Install the EGR valve (1) and tube assembly.

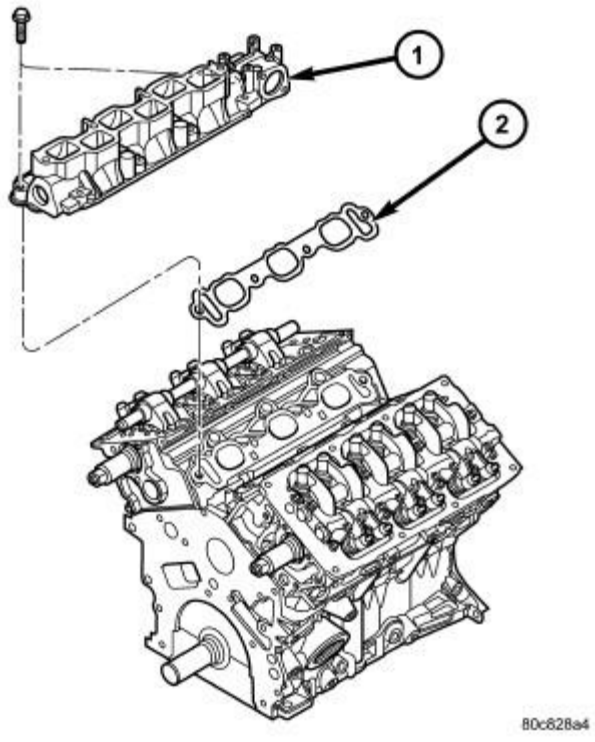

Fig. 164: Lower Intake Manifold
Courtesy of CHRYSLER LLC

1 - LOWER INTAKE MANIFOLD 2 - GASKET

31. Install lower intake manifold (1) and gasket (2). See **Engine/Manifolds/MANIFOLD, Intake - Installation**.

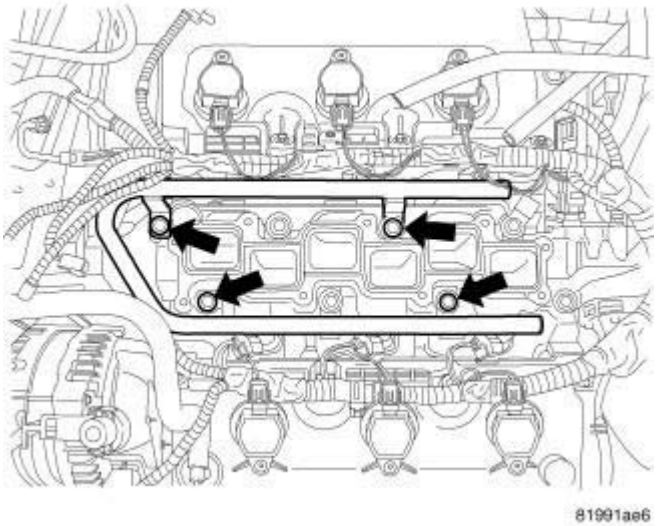

Fig. 165: Fuel Rail Bolts
Courtesy of CHRYSLER LLC

32. Install the fuel rail. Refer to **Fuel System/Fuel Delivery/RAIL, Fuel - Removal** .

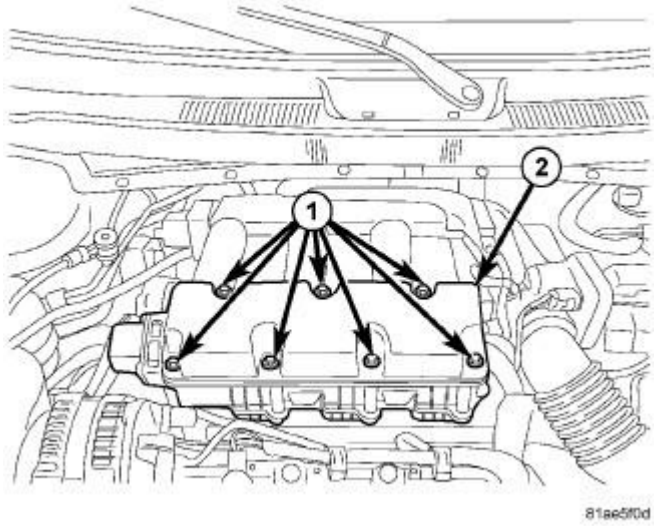

Fig. 166: Upper Intake Manifold
Courtesy of CHRYSLER LLC

33. Install the upper intake manifold (2). See **Engine/Manifolds/MANIFOLD, Intake - Installation**.

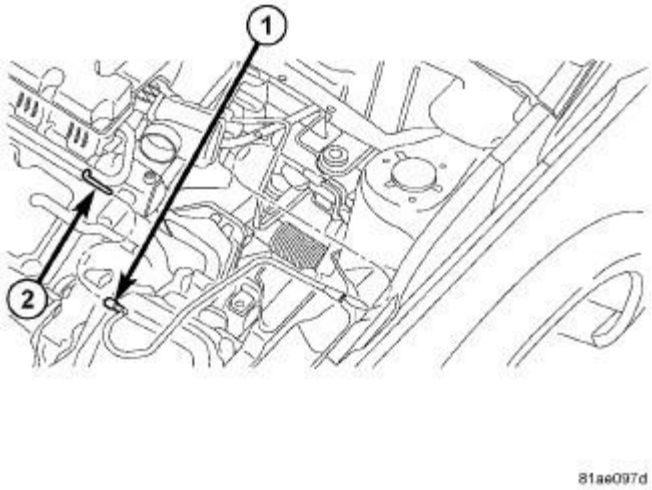

Fig. 167: Fuel Line From Fuel Rail Inlet
Courtesy of CHRYSLER LLC

34. Connect the fuel line (1) to the fuel rail. Refer to **Fuel System/Fuel Delivery/RAIL, Fuel - Installation** .

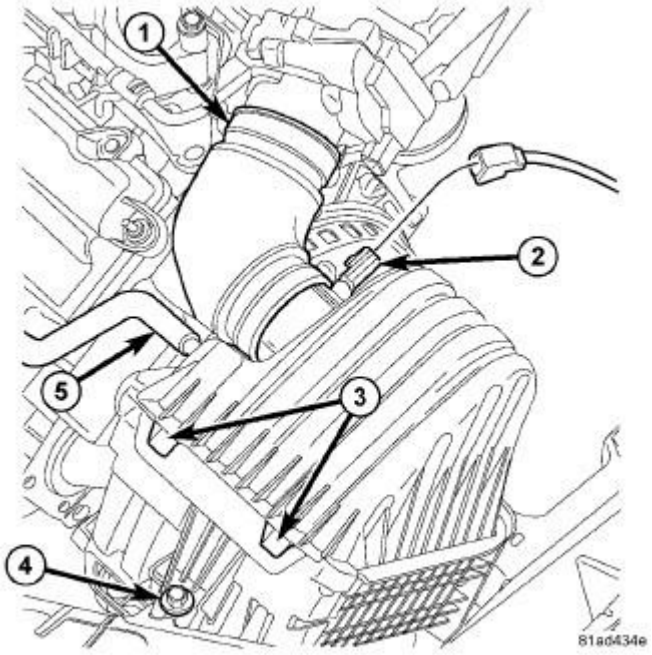

Fig. 168: HOUSING - AIR CLEANER
Courtesy of CHRYSLER LLC

35. Install the air cleaner housing. See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.
36. Install the engine cover.
37. Fill the coolant system.

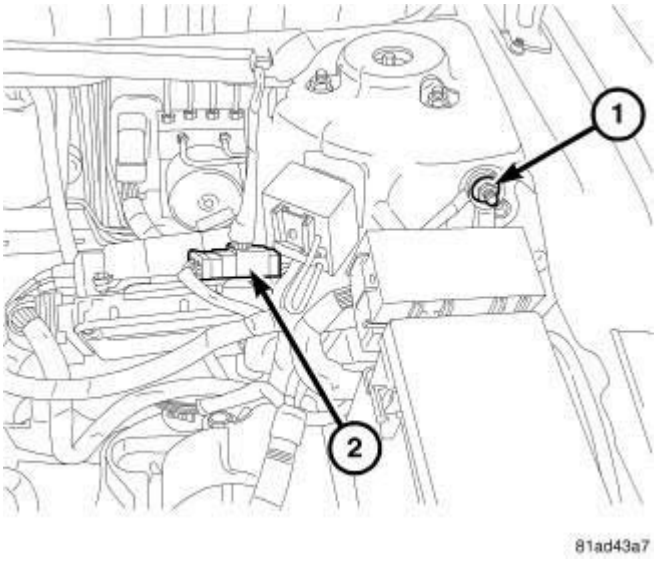

Fig. 169: BATTERY CABLE
Courtesy of CHRYSLER LLC

38. Connect the negative battery cable (1).

LEFT CYLINDER HEAD

CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use ONLY a wooden or plastic scraper.

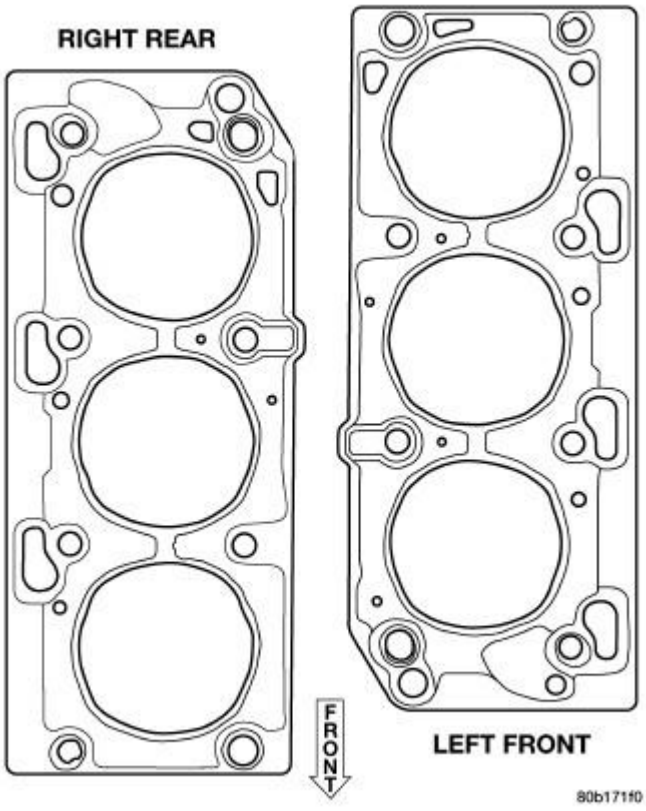

Fig. 170: Cylinder Head Gasket Identification
Courtesy of CHRYSLER LLC

1. Clean sealing surfaces of cylinder head and block. See **Engine - Standard Procedure**.

CAUTION: The cylinder head gaskets are not interchangeable between cylinder heads and are clearly marked right or left.

2. Install head gasket over locating dowels. Ensure the gasket is installed on the correct side of engine.

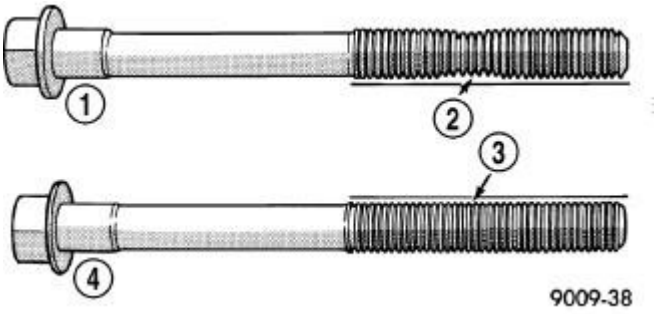

Fig. 171: Check for Stretched Bolts
Courtesy of CHRYSLER LLC

CAUTION: Cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down the bolts must be replaced. Failure to replace a damaged bolt may lead to possible engine damage.

3. inspect the cylinder head bolts (1 and 4) for straightness, head damage, thread damage and necking. Necking can be checked by holding a scale or straight edge against the threads (3). If all the threads do not contact the scale evenly (2) the bolt must be replaced.
4. Install the cylinder head over locating dowels.

NOTE: Lightly lubricate the threads of the cylinder head bolts with clean engine oil prior to installation.

5. Install the cylinder head bolts finger tight.

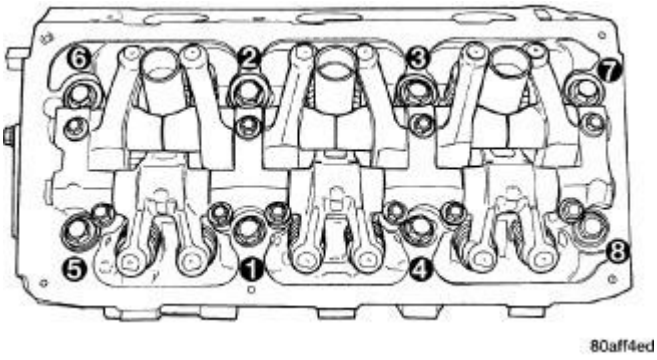

Fig. 172: Cylinder Head Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

6. Tighten the cylinder head bolts in the sequence shown in illustration using the following 4 step torque-turn method:
   - Step 1: All to 61 N.m (45 ft. lbs.)
   - Step 2: All to 88 N.m (65 ft. lbs.)
   - Step 3: All (again) to 88 N.m (65 ft. lbs.)
   - Step 4: + 90° Turn **Do not use a torque wrench for this step.**
7. Bolt torque after 90° turn should be over 122 N.m (90 ft. lbs.) in the tighten direction. If not, replace the bolt.

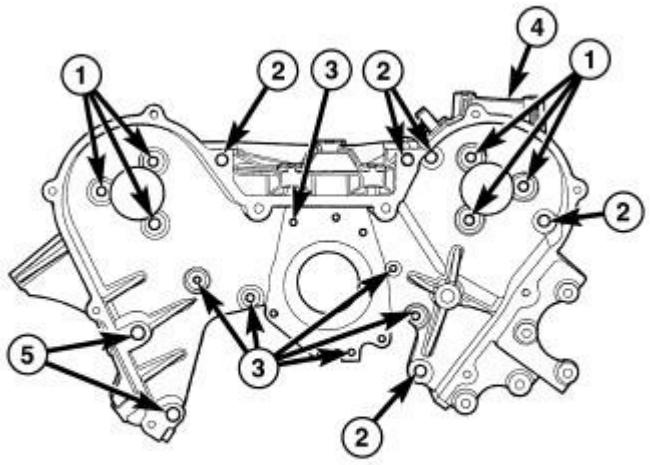

Fig. 173: REAR TIMING BELT COVER FASTENERS
Courtesy of CHRYSLER LLC

1 - M8 FASTENERS (APPLY THREAD SEALANT)
2 - M10 FASTENERS
3 - M6 FASTENERS
4 - REAR TIMING BELT COVER
5 - M10 FASTENERS (STUD/NUT)

8. Install the inner timing cover to cylinder head bolts. Tighten bolts to 54 N.m (40 lbs. ft.).

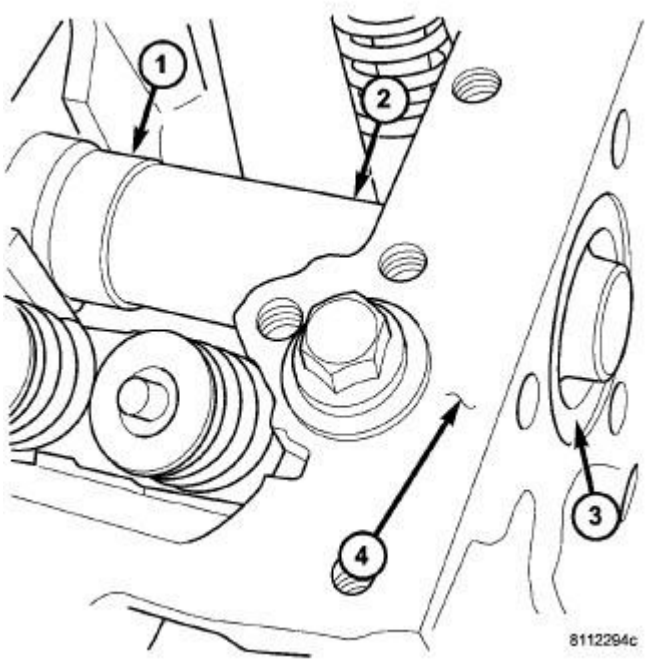

Fig. 174: CAMSHAFT INSTALLATION - LEFT
Courtesy of CHRYSLER LLC

9. Apply light coat of clean engine oil to the lip of the camshaft oil seal (3) and Seal Protector Sleeve 6788 (2).

NOTE: When installing the camshaft into the cylinder head , you must first insert the seal protector through the camshaft seal until the camshaft seats, then remove Seal Protector Sleeve 6788 from the camshaft.

10. Install the oil seal onto the camshaft (1) using Seal Protector Sleeve 6788 and install the camshaft into the cylinder head (4).

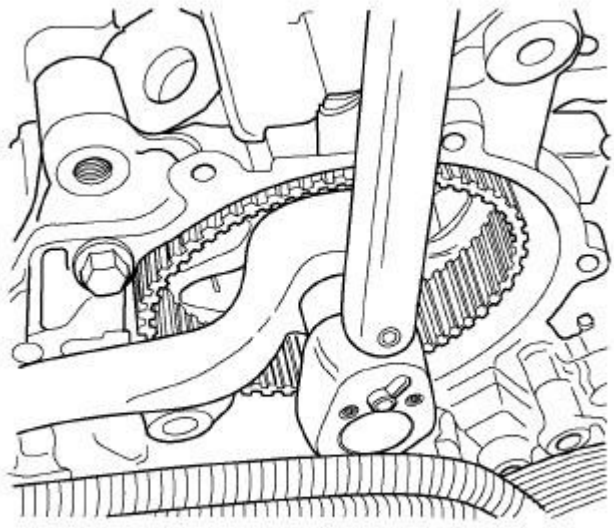

Fig. 175: LEFT CAMSHAFT SPROCKET
Courtesy of CHRYSLER LLC

11. Install camshaft sprocket. Hold the camshaft sprocket gear and tighten the camshaft sprocket bolt to 115 N.m plus a 1/4 turn (85 lbs. ft. plus a 1/4 turn). See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Installation**.

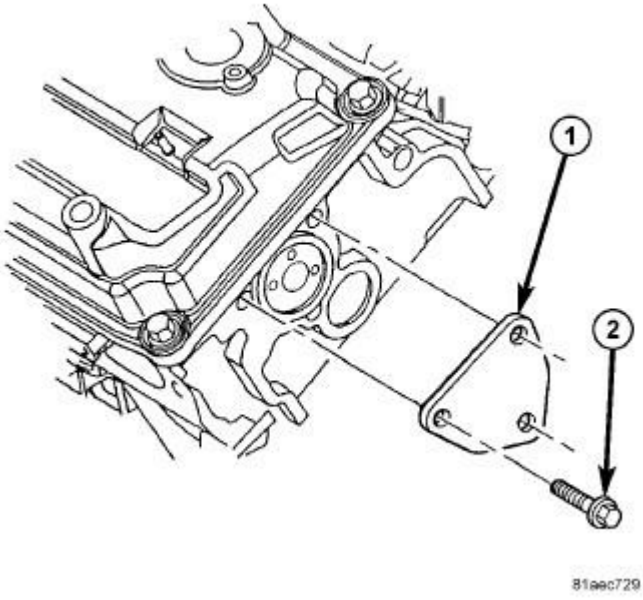

Fig. 176: Camshaft Thrust Plate

Courtesy of CHRYSLER LLC

12. Install the rear camshaft thrust plate (1).

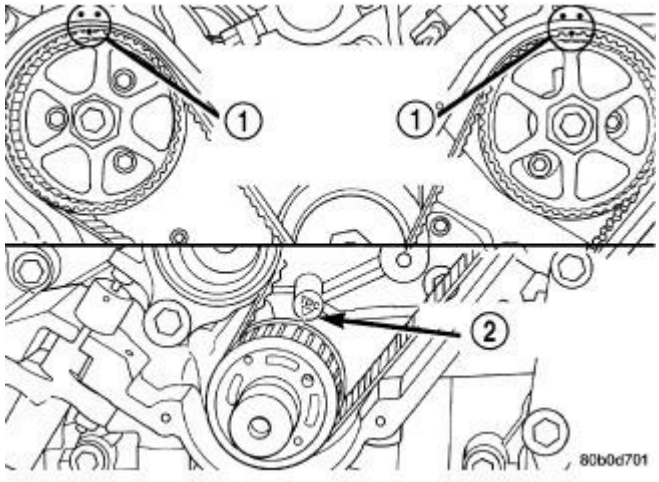

Fig. 177: CAMSHAFT SPROCKET TIMING MARKS
Courtesy of CHRYSLER LLC

13. Rotate the left camshaft gear to the alignment mark (1) on rear timing belt cover. Check the right camshaft gear and crankshaft gear timing alignment marks (1 and 2).
14. Install the timing belt. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Installation**.
15. Install the tensioner. See **Engine/Valve Timing/TENSIONER, Engine Timing - Installation**.

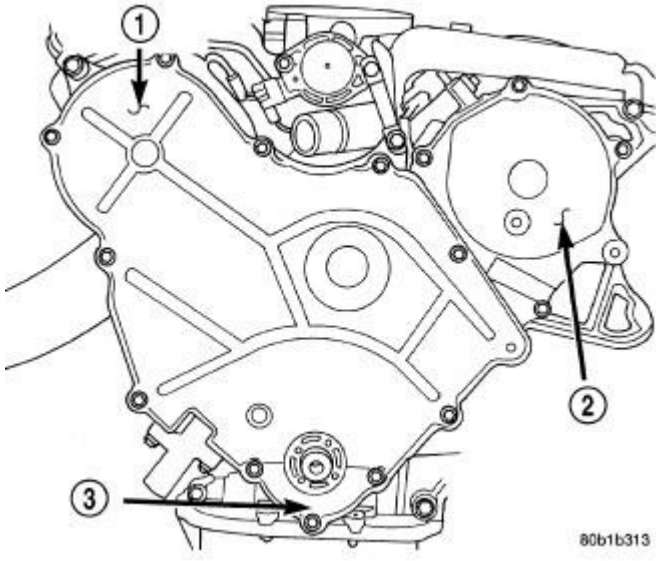

Fig. 178: TIMING BELT COVERS
Courtesy of CHRYSLER LLC

16. Install the timing belt front covers (1, 2 and 3). See **Engine/Valve Timing/COVER(S), Engine Timing -**

Installation.

17. Install the power steering reservoir.

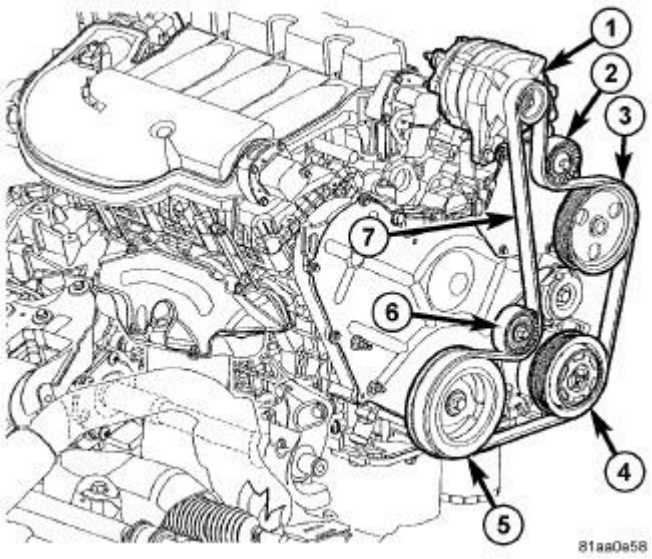

Fig. 179: Identifying Accessory Drive Belt & Pulleys
Courtesy of CHRYSLER LLC

18. Install the vibration damper (5). See **Engine/Engine Block/DAMPER, Vibration - Installation**.
19. Install the upper engine mount. See **Engine/Engine Mounting/INSULATOR, Engine Mount - Installation**.
20. Install the accessory drive belt tensioner (6).
21. Install the lower accessory drive belt idler pulley (2).
22. Install the left exhaust manifold. See **Engine/Manifolds/MANIFOLD, Exhaust - Installation**.
23. Install the exhaust cross over pipe. See **Engine/Manifolds/MANIFOLD, Exhaust - Installation**.

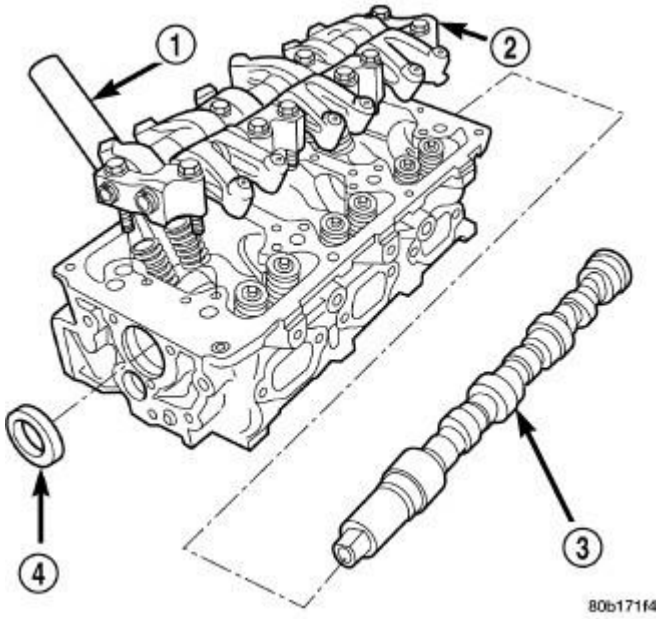

Fig. 180: Cylinder Head, Camshaft & Rocker Arms
Courtesy of CHRYSLER LLC

24. Install the left rocker arm assembly (2). See **Engine/Cylinder Head/ROCKER ARM, Valve - Installation**.
25. Install the left cylinder head cover and ground strap.

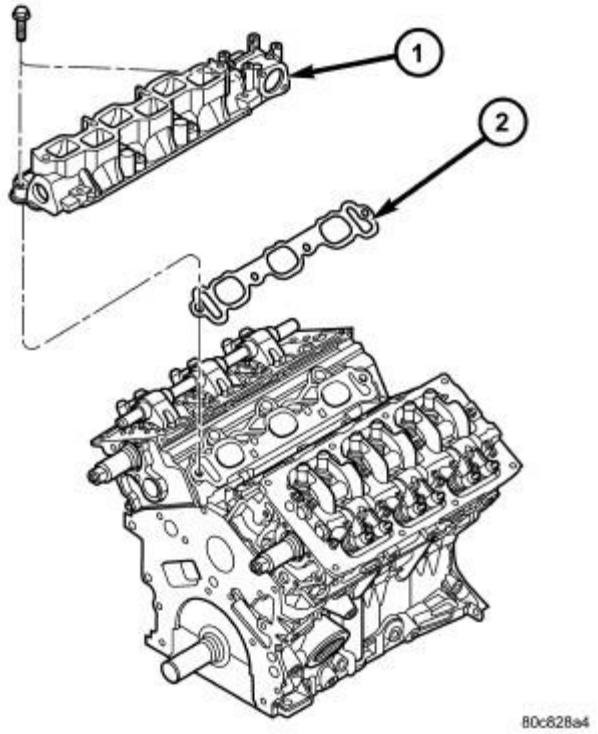

Fig. 181: Lower Intake Manifold
Courtesy of CHRYSLER LLC

26. Install lower intake manifold (1) and gasket (2). See **Engine/Manifolds/MANIFOLD, Intake - Installation**.

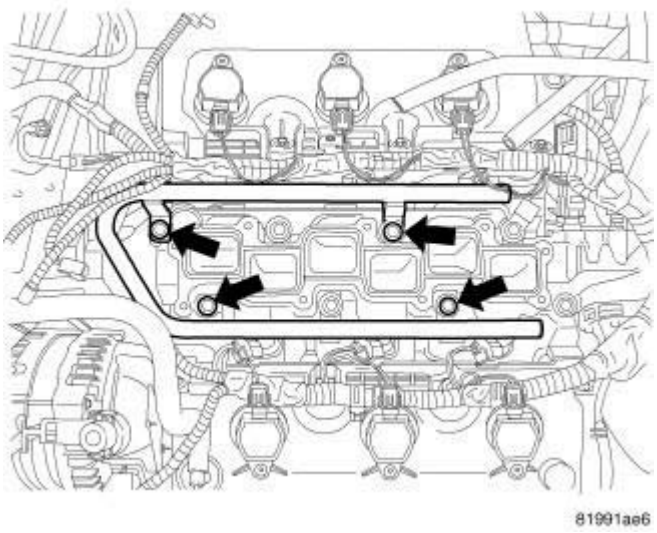

Fig. 182: Fuel Rail Bolts
Courtesy of CHRYSLER LLC

27. Install the fuel rail. Refer to **Fuel System/Fuel Delivery/RAIL, Fuel - Installation** .

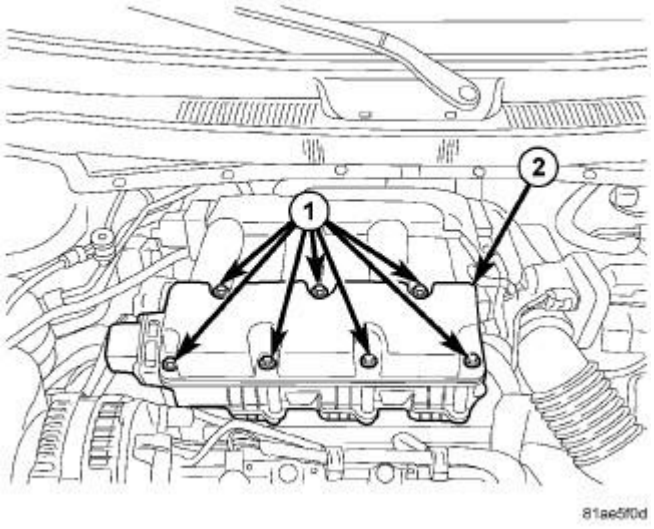

Fig. 183: Upper Intake Manifold
Courtesy of CHRYSLER LLC

28. Install the upper intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Installation**.

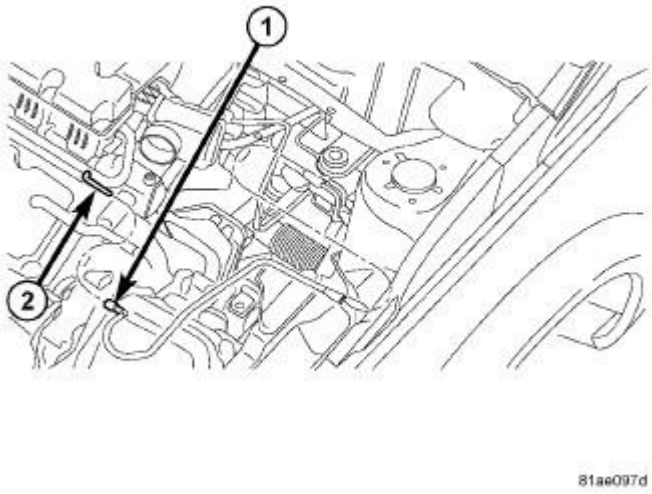

Fig. 184: Fuel Line From Fuel Rail Inlet
Courtesy of CHRYSLER LLC

29. Connect the fuel line (1) to the fuel rail.
30. Install the radiator cooling fan assembly. Refer to **Cooling/Engine/FAN, Cooling - Installation** .
31. Install the radiator core support.
32. Install the radiator close out panel.

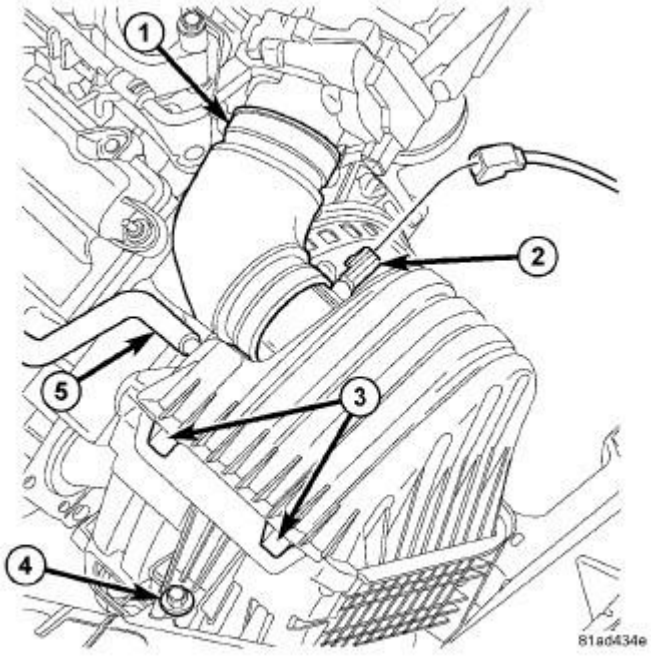

Fig. 185: HOUSING - AIR CLEANER
Courtesy of CHRYSLER LLC

33. Install the air cleaner housing. See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.
34. Install the engine cover.
35. Fill the coolant system.

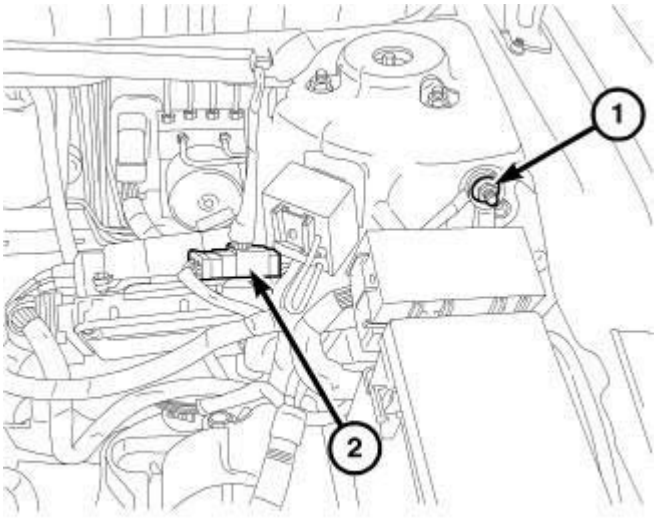

Fig. 186: BATTERY CABLE
Courtesy of CHRYSLER LLC

36. Connect the negative battery cable (1).

CAMSHAFT, ENGINE

Description

DESCRIPTION

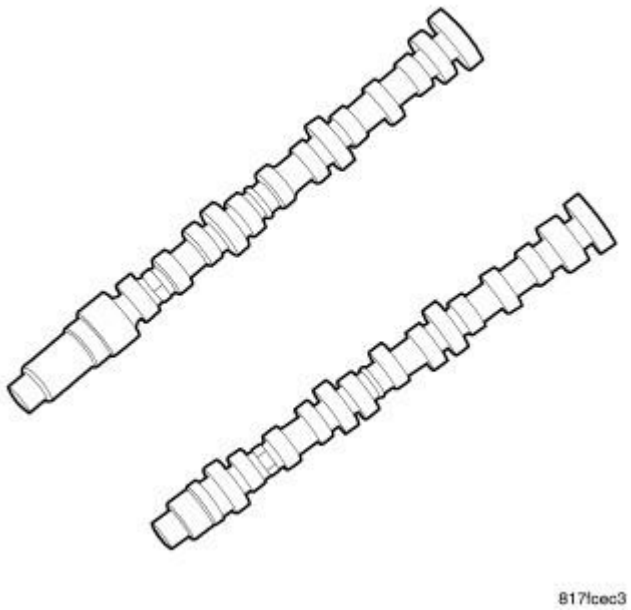

Fig. 187: CAMSHAFTS
Courtesy of CHRYSLER LLC

A single overhead camshaft per cylinder head provides valve actuation. The left camshaft accommodates a cam sensor pick-up wheel and is therefore longer. Each camshaft is supported by four bearing journals. A thrust plate attached to the rear of each cylinder head controls camshaft end play. Right and left camshaft driving sprockets support a timing mark, are keyed, and not interchangeable because of the cam sensor pick-up wheel on the left sprocket. Camshaft bearing lubrication is provided via a oil supply passage through each rocker shaft pedestal dowel.

Operation

OPERATION

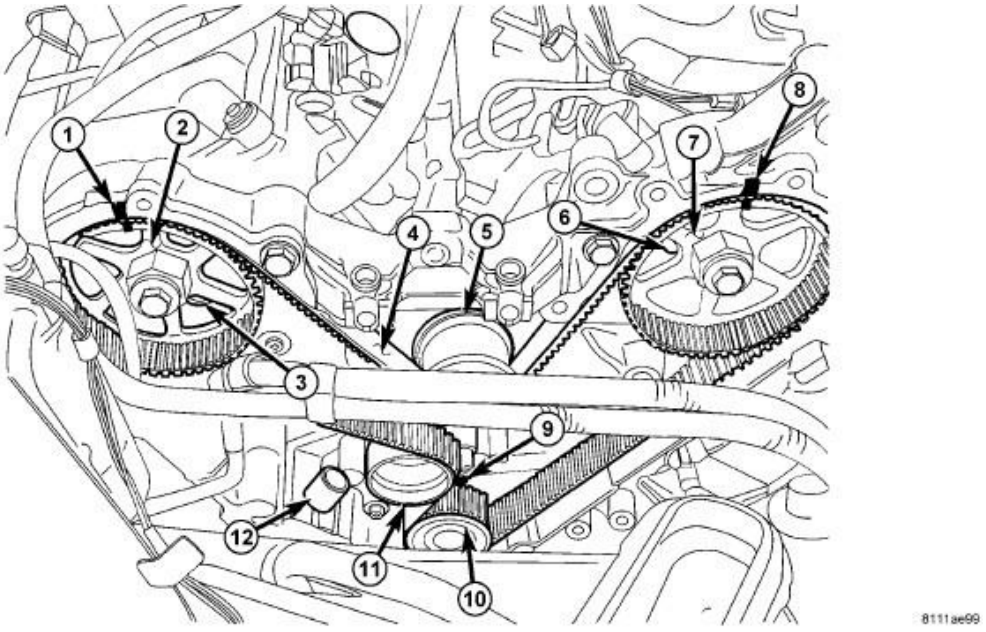

Fig. 188: TIMING GEAR MARKS
Courtesy of CHRYSLER LLC

1 - RIGHT CAMSHAFT GEAR ALIGNMENT MARK	7 - LEFT CAMSHAFT GEAR
2 - RIGHT CAMSHAFT GEAR	8 - LEFT CAMSHAFT GEAR ALIGNMENT MARK
3 - CYLINDER HEAD TO INNER TIMING BELT COVER BOLTS - RIGHT	9 - CRANKSHAFT GEAR ALIGNMENT MARK
4 - TIMING BELT	10 - CRANKSHAFT GEAR
5 - WATER PUMP PULLEY	11 - TIMING BELT TENSIONER PULLEY
6 - CYLINDER HEAD TO INNER TIMING BELT COVER BOLTS - LEFT	12 - TIMING BELT TENSIONER

The camshaft is driven by the crankshaft via drive sprockets and belt. As the crankshaft turns, the timing belt turns the camshaft. The camshaft lobes press the lifters which in turn open the valves at the correct time. The valve spring returns the valve to the closed state.

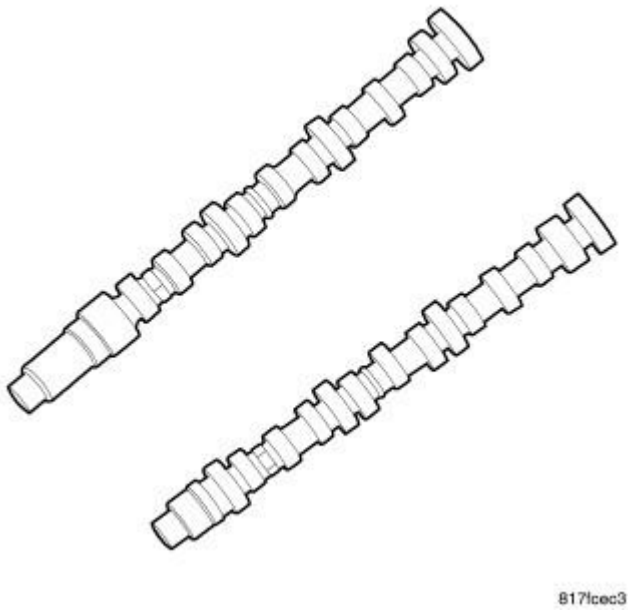

Fig. 189: CAMSHAFTS
Courtesy of CHRYSLER LLC

The camshaft has precisely machined lobes to provide accurate valve timing and duration.

Removal

REMOVAL

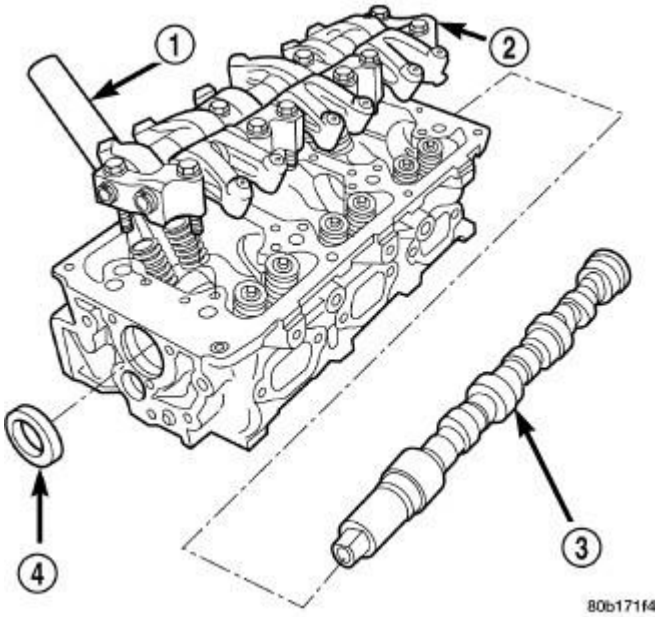

Fig. 190: Cylinder Head, Camshaft & Rocker Arms
Courtesy of CHRYSLER LLC

1 - SPARK PLUG TUBE
2 - ROCKER ARM ASSEMBLY
3 - CAMSHAFT
4 - SEAL

NOTE: Camshafts are removed from the rear of each cylinder head.

CAUTION: Care must be taken not to nick or scratch the journals when removing the camshaft.

1. Remove the camshaft sprocket. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Removal**.
2. Remove the rocker arm shaft assembly. See **Engine/Cylinder Head/ROCKER ARM, Valve - Disassembly**

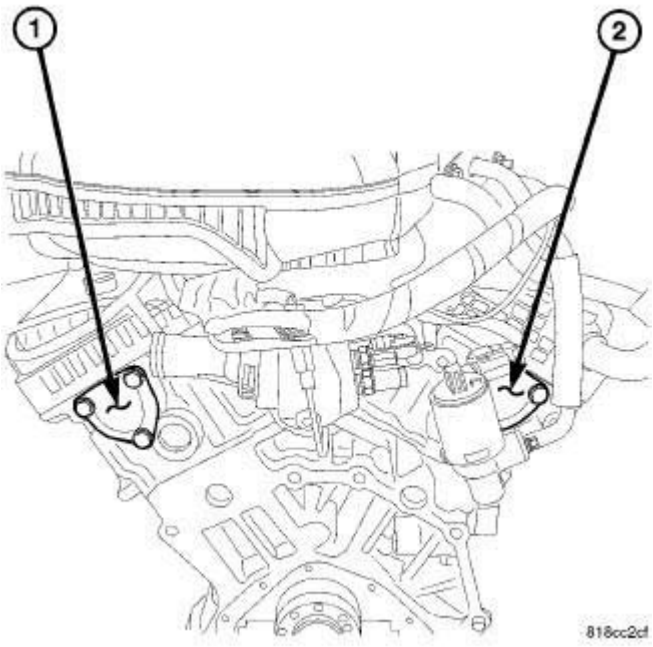

Fig. 191: CAMSHAFT THRUST PLATES
Courtesy of CHRYSLER LLC

3. To remove the right camshaft, remove the EGR Valve assembly.
4. Remove the camshaft thrust plate (1) or (2).
5. Carefully remove the camshaft from the rear of the cylinder head.
6. **NOTE: It may be necessary to remove the Powertrain Control Module (PCM) in order to remove the camshaft from the right cylinder head.**

Inspection

INSPECTION

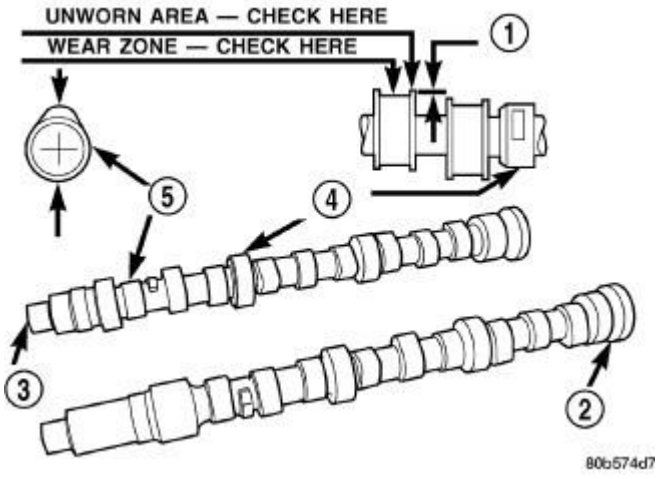

Fig. 192: Camshaft Inspection
Courtesy of CHRYSLER LLC

1 - ACTUAL WEAR
2 - LEFT CAMSHAFT
3 - RIGHT CAMSHAFT
4 - BEARING JOURNAL
5 - LOBE

1. Inspect camshaft bearing journals for damage and binding. If journals are binding, check the cylinder head for damage. Also check cylinder head oil holes for clogging.
2. Check the cam lobe and bearing surfaces for abnormal wear and damage. Replace camshaft if defective.

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

3. Measure the lobe actual wear and replace camshaft if out of limit. Standard value is 0.0254 mm (0.001 in.), wear **limit** is 0.254 mm (0.010 in.).

Installation

INSTALLATION

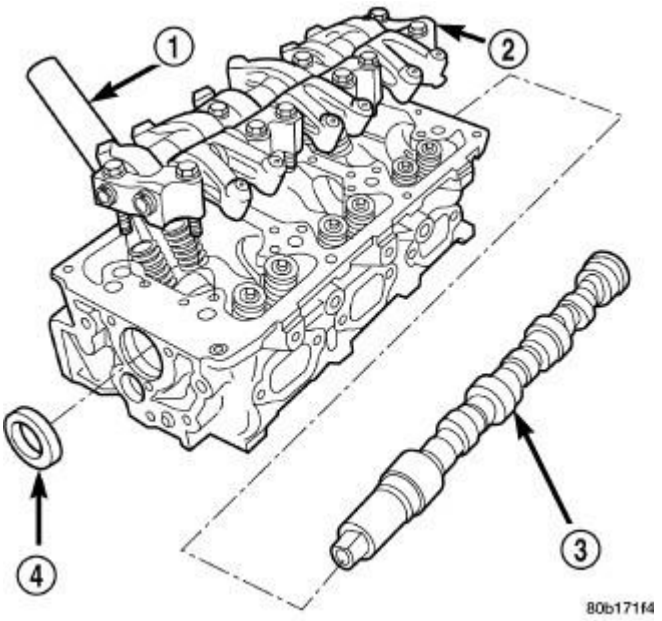

Fig. 193: Cylinder Head, Camshaft & Rocker Arms
Courtesy of CHRYSLER LLC

1 - SPARK PLUG TUBE
2 - ROCKER ARM ASSEMBLY
3 - CAMSHAFT
4 - SEAL

NOTE: Care must be taken not to scrape or nick the camshaft journals when installing the camshaft into position.

1. Lubricate camshaft bearing journals, camshaft lobes and camshaft seal with clean engine oil and install camshaft into cylinder head.

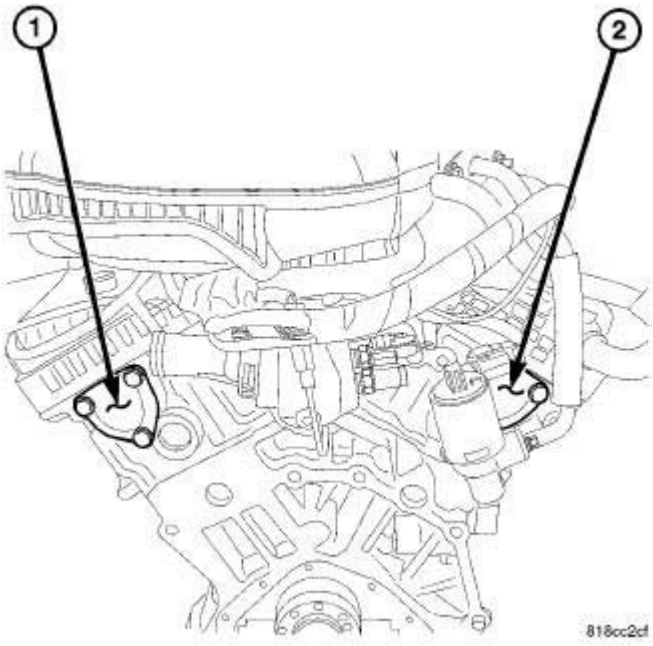

Fig. 194: CAMSHAFT THRUST PLATES
Courtesy of CHRYSLER LLC

2. Install the camshaft sprocket. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Installation**
3. Install the camshaft thrust plate (1) or (2). Clean the mating surfaces and apply the appropriate sealer as necessary. Torque fasteners to 28 N.m (250 in. lbs.).
4. If necessary, install the EGR Valve assembly and Powertrain Control Module (PCM).
5. Install the rocker arm assembly. See **Engine/Cylinder Head/ROCKER ARM, Valve - Installation**

COVER(S), CYLINDER HEAD, LEFT

Removal

REMOVAL

WARNING: Do not start or run the engine with the cylinder head cover removed. Damage or personal injury may occur.

1. Disconnect and isolate the negative battery cable.

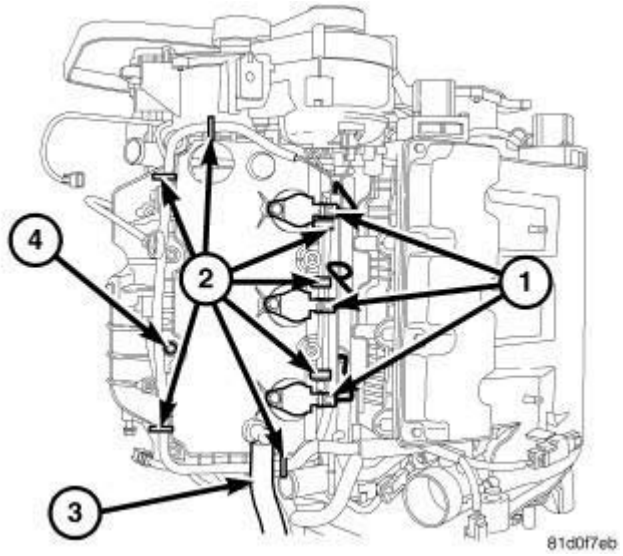

Fig. 195: IGNITION COILS
Courtesy of CHRYSLER LLC

1 - Ignition coil	3 - PCV
ELECTRICAL CONNECTORS	
2 - Engine harness retainer tabs	4 - BRACKET

2. Disconnect and remove the three ignition coils. Refer to **Electrical - Ignition Control/Ignition Control/COIL, Ignition - Removal** .
3. Disconnect engine harness retaining clips (2) from cylinder head cover studs. Position the engine harness aside.
4. Disconnect the PCV hose (3) from the valve cover assembly (if required).
5. Completely loosen the eight cylinder head cover retaining bolts (4) and remove the cylinder head cover.

Installation

INSTALLATION

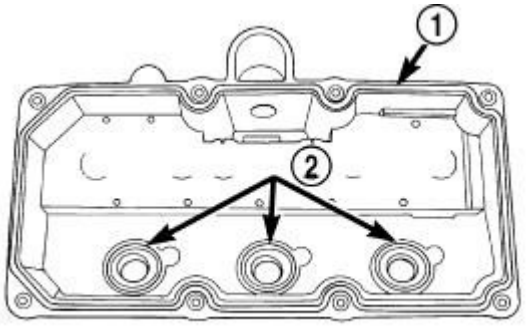

Fig. 196: Cylinder Head Cover Gasket & Spark Plug Tube Seals

Courtesy of CHRYSLER LLC

1 - CYLINDER HEAD COVER GASKET 2 - SPARK PLUG TUBE SEALS

1. Clean cylinder head and all gasket sealing surfaces. Inspect and replace gasket and seals as necessary.
2. Using a suitable pry tool, carefully remove spark plug tube seals (2).
3. Position new seal with the part number on seal facing cylinder head cover.

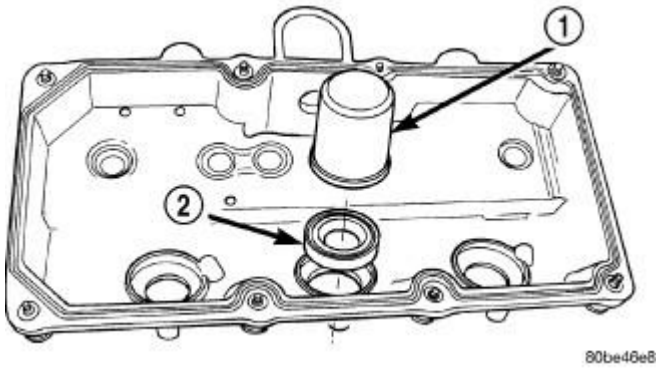

Fig. 197: Spark Plug Tube Seal Installation
Courtesy of CHRYSLER LLC

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

4. Install seals using Camshaft Installer MD-998306 (1).

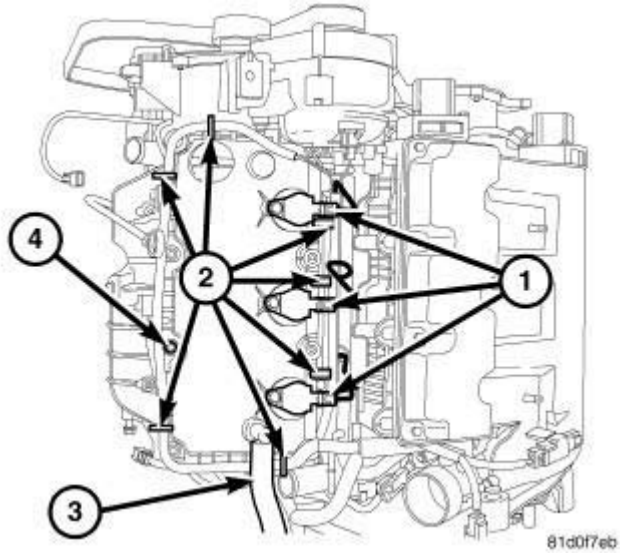

Fig. 198: IGNITION COILS
Courtesy of CHRYSLER LLC

1 - Ignition coil ELECTRICAL CONNECTORS	3 - PCV
2 - Engine harness retainer tabs	4 - BRACKET

5. Install cylinder head cover and bolts (4). Tighten to 10 N.m (90 in. lbs.).
6. Install the PCV hose (3) (if required).
7. Position the wiring harness on the cylinder head cover.
8. Reinstall the wire harness retainers (2) around the perimeter of the valve cover.
9. Install the ignition coils. Refer to **Electrical - Ignition Control/Ignition Control/COIL, Ignition - Installation** .
10. Connect the ignition coil electrical connectors (1).
11. Connect negative battery cable.

COVER(S), CYLINDER HEAD, RIGHT

Removal

REMOVAL

WARNING: Do not start or run the engine with the cylinder head cover removed. Damage or personal injury may occur.

1. Disconnect the negative battery cable.
2. Remove the upper intake manifold from the engine. See **Engine/Manifolds/MANIFOLD, Intake - Removal**.
3. Cover lower intake manifold intake ports with a clean cover to prevent dirt or debris from entering the ports during service.

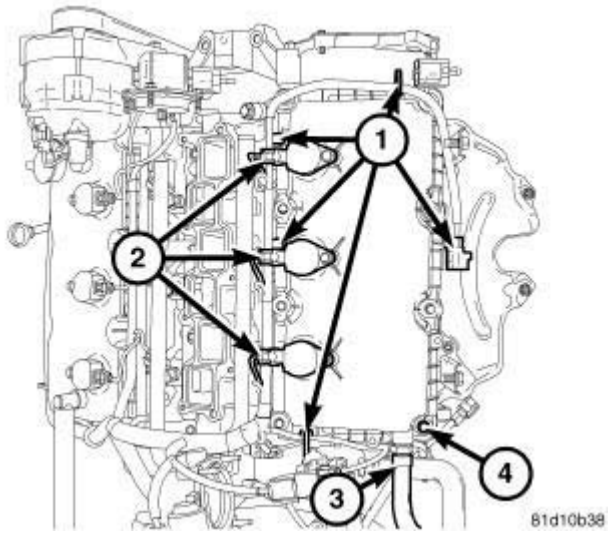

Fig. 199: Cylinder Head Cover Bolts
Courtesy of CHRYSLER LLC

1 - ELECTRICAL CONNECTORS 2 - IGNITION COILS

4. Disconnect the ignition coil harness connectors (2).
5. Remove ignition coils. Refer to **Electrical - Ignition Control/Ignition Control/COIL, Ignition - Removal** .
6. Disconnect the engine wiring harness retainers (1) from the valve cover.
7. Disconnect the makeup air hose (3).
8. Completely loosen the cylinder head cover retaining bolts (4) and remove the cylinder head cover.

Installation

INSTALLATION

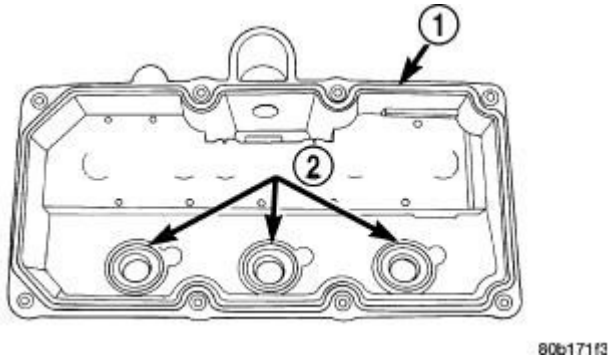

Fig. 200: Cylinder Head Cover Gasket & Spark Plug Tube Seals
Courtesy of CHRYSLER LLC

1 - CYLINDER HEAD COVER GASKET 2 - SPARK PLUG TUBE SEALS

1. Clean cylinder head and cover mating surfaces. Inspect and replace gasket and seals as necessary.
2. Using a suitable pry tool, carefully remove tube seals (2).
3. Position new seal with the part number on seal facing cylinder head cover.

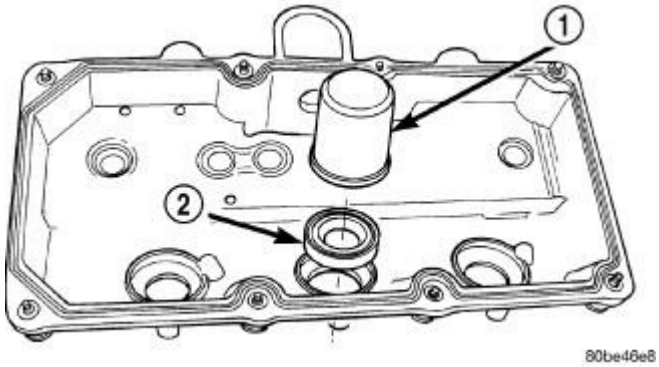

Fig. 201: Spark Plug Tube Seal Installation
Courtesy of CHRYSLER LLC

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

4. Install seals using Camshaft Installer MD-998306 (1).

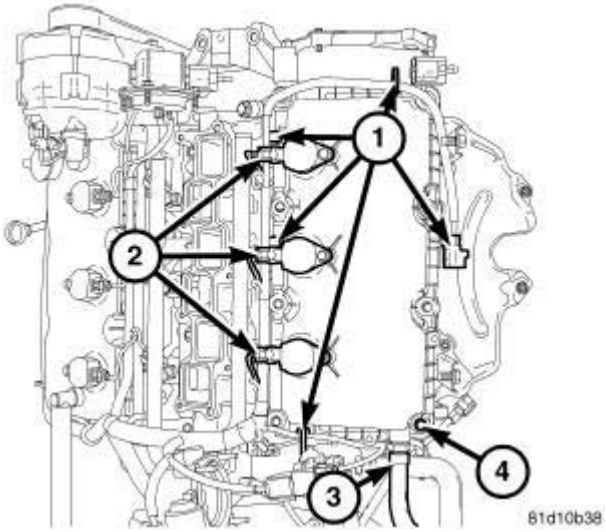

Fig. 202: Cylinder Head Cover Bolts
Courtesy of CHRYSLER LLC

1 - ELECTRICAL CONNECTORS

2 - IGNITION COILS

5. Install cylinder head cover bolts (4) and tighten to 10 N.m (90 in. lbs.).
6. Reconnect the wire harness retainers (1) to the valve cover.
7. Install the ignition coils. Refer to **Electrical - Ignition Control/Ignition Control/COIL, Ignition - Installation** .
8. Connect the ignition coil electrical connectors (2).
9. Reconnect the makeup air hose (3).
10. Install upper intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Installation**.
11. Connect negative battery cable.

ROCKER ARM, VALVE

Description

ROCKER ARM

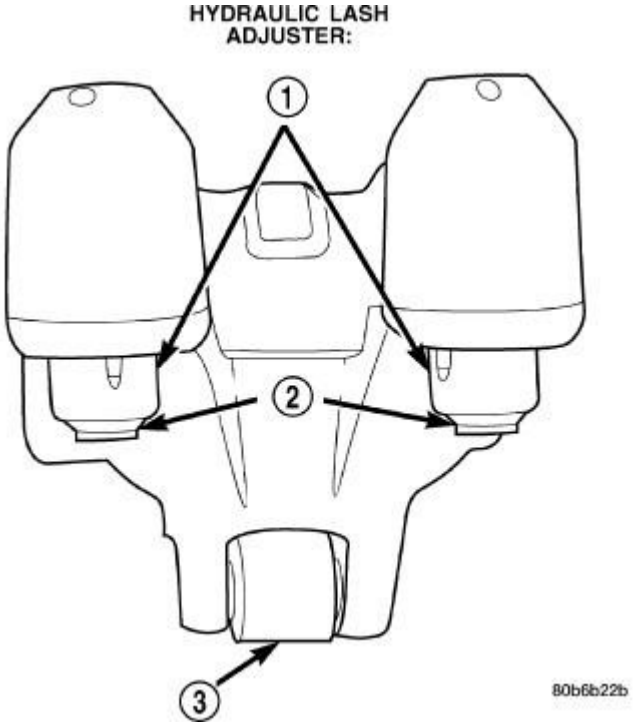

Fig. 203: Rocker Arm Assembly
Courtesy of CHRYSLER LLC

1 - RETAINER
2 - SWIVEL PAD
3 - ROLLER

Rocker arms are made of light weight permanent mold aluminum alloy with a roller type follower operating

against the camshaft. The valve actuating end of the rocker arms are machined to retain hydraulic lash adjusters, eliminating the need for manual valve lash adjustment.

ROCKER ARM SHAFTS

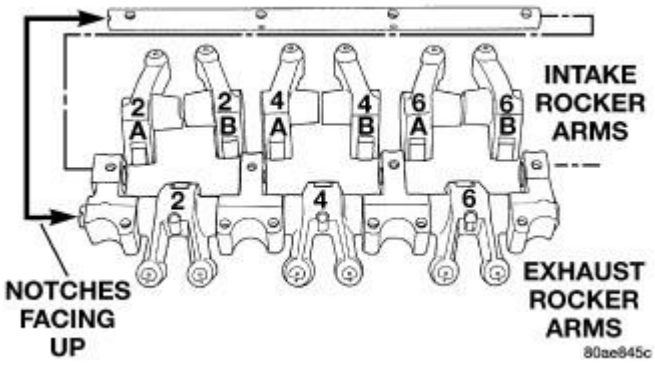

Fig. 204: Rocker Arms & Shafts
Courtesy of CHRYSLER LLC

The rocker arm shafts are tubular steel and supported by several forged aluminum alloy pedestals, which are fastened to the cylinder head. Four shafts are used, one for each intake and exhaust rocker arm bank on each cylinder head. The shafts are hollow to provide a duct for lubricating oil flow from the cylinder head to the valve mechanisms. One hollow dowel per pedestal is used to locate the pedestal to the cylinder head, orient the exhaust rocker shaft, and serve as a cam bearing oil feed passage.

Operation

OPERATION

The rocker arm is the pivot point between the camshaft lobe and the valve.

Diagnosis and Testing

LASH ADJUSTER (TAPPET) NOISE DIAGNOSIS

Proper noise diagnosis is essential in locating the source of a NVH complaint. Locating a lash adjuster (tappet) type noise can sometimes be difficult. As a result, an initial misdiagnosis may occur.

Refer to the following chart indicating possible lash adjuster (tappet) noise sources and possible sources that could lead to a misdiagnosis.

Refer to Lash Adjuster (Tappet) Noise Chart for Possible Causes and Correction of a lash adjuster (tappet) type noise.

POSSIBLE NOISE SOURCES	POSSIBLE NOISE MISDIAGNOSIS SOURCES
Spongy/soft/aerated lash adjusters.	Exhaust leak.
Missing lash adjuster swivel contact pads.	Exhaust rocker arm-to-cylinder head cover contact.

Intake rocker-to-camshaft bearing journal contact.	Piston pin bore fit.
Rocker arm bind-up.	Timing drive hydraulic tensioner tick.
Intake rocker arm-to-spark plug tube contact.	Accessory drive belt deterioration.
Excessive cam end play.	Piston-to-bore clearance knock.
Broken valve spring.	Crankshaft bearing noise.
Broken/loose camshaft sprocket bolt.	-
Incomplete cam lobe machining.	
Cracked lash adjuster cartridge body.	

LASH ADJUSTER (TAPPET) NOISE CHART

POSSIBLE CAUSES	CORRECTION
1. Engine oil level-too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.	1. Check and correct engine oil level.
2. Insufficient running time after rebuilding cylinder head.	2. Low speed running of up to 1 hour may be required to fully evacuate trapped air from the valve train system. During this time, turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.
3. Air trapped in lash adjuster (after 1 hour run time).	3. See below: (a) Check lash adjusters for sponginess while installed in cylinder head. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Very spongy adjusters can be bottomed out easily. (b) Before proceeding, perform **HYDRAULIC LASH ADJUSTER BLEEDING** procedure. (c) If lash adjuster(s) are still spongy, replace with new adjuster/rocker arm assembly*.
4. Low oil pressure	4. See below: (a) Check and correct engine oil level. (b) Check engine oil pressure. (c) Check for excessive bearing clearance and correct. (d) Check for worn oil pump.
5. Oil passage to cylinder head(s) plugged with debris.	5. Check cylinder head oil passages and cylinder head gasket restrictor for blockage. Clean or replace as necessary.
6. Worn valve guide(s).	6. Ream guide(s) and replace valve(s) with oversize valves and seal(s).
7. Air ingested into oil due to broken or cracked oil pump pickup tube.	7. Inspect pickup tube and replace as necessary.
8. Collapsed lash adjuster due to debris ingestion.	8. Clean debris from engine and replace lash

	adjuster/rocker assembly*.
9. Intake rocker arm roller clevis ear(s) contacting camshaft bearing journal(s) on side.	9. Inspect camshaft end play and all valve train components for wear. Replace as necessary.
***Lash adjusters are serviced with the rocker arms-do not disassemble.**	

Standard Procedure

HYDRAULIC LASH ADJUSTER BLEEDING

NOTE: Use this procedure to manually bleed aerated oil from the lash adjuster and remove sponginess.

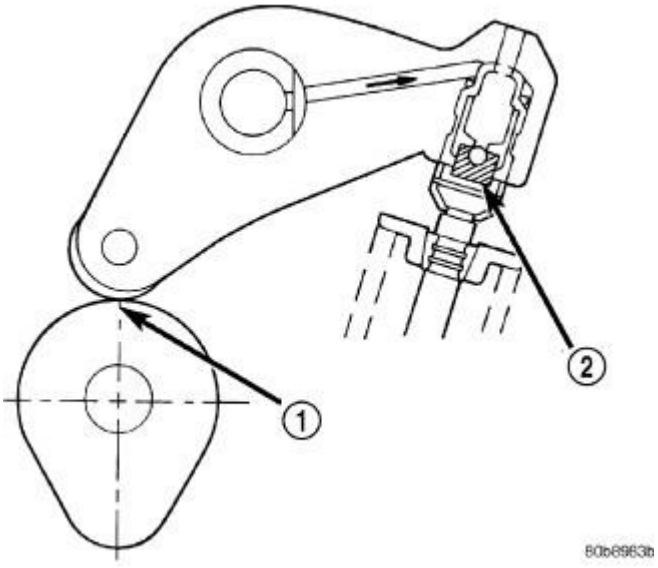

Fig. 205: Rocker Arm Positioned On Base Circle Of Camshaft
Courtesy of CHRYSLER LLC

1. Run the engine, bringing it to operating temperature in order to freshly pressurize and warm the valvetrain system oil supply.
2. Remove cylinder head cover(s).
3. Rotate engine until the rocker arm is positioned on the base circle of the cam (1).

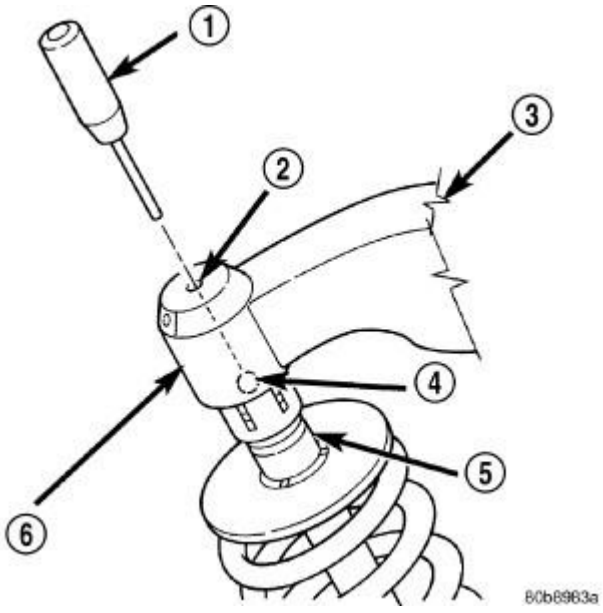

Fig. 206: Purging Air From Lash Adjuster
Courtesy of CHRYSLER LLC

4. For intake rocker arm positions:

CAUTION: If probe tip breaks off within the lash adjuster, replace the affected rocker arm.

a. Adjust the gauge pin of Release Probe 8351 (1) to extend approximately 20 mm (0.787 in.). Then, carefully insert the release probe gauge pin into the lash adjuster service access hole (2).
b. Gently unseat lash adjuster's internal check ball (4).
c. While the internal check ball is held unseated, press the rocker arm (3) into the valve tip (5), allowing the hydraulic lash adjuster (6) within the rocker arm to fully collapse. Hold fully collapsed position for at least one second, or longer.
d. Slowly release the rocker arm, thereby allowing the lash adjuster to extend, which in turn refills the high pressure chamber with non-aerated oil.
e. Remove Release Probe 8351 to allow check ball to seat.
f. Recheck for sponginess. If the lash adjuster sponginess is not completely or nearly eliminated, then repeat procedure.
g. If the spongy condition cannot be removed, replace effected rocker arm(s).

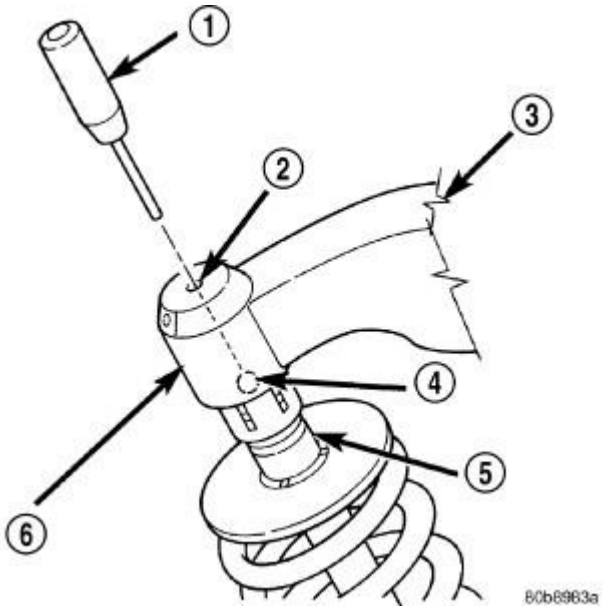

Fig. 207: Purging Air From Lash Adjuster
Courtesy of CHRYSLER LLC

5. For exhaust rocker arm positions:

CAUTION: If probe tip breaks off within the lash adjuster, replace the affected rocker arm.

   a. Adjust the gauge pins of two Release Probes 8351 (1) to extend approximately 20 mm (0.787 in.). Then, using the two release probes, carefully insert gauge pins into the lash adjuster service access holes (2).
   b. Gently unseat BOTH lash adjuster's internal check balls (4) at the same time.
   c. While the internal check balls are held unseated, press the rocker arm (3) into the valve tip (5), allowing the hydraulic lash adjuster (6) within the rocker arm to fully collapse. Hold fully collapsed position for at least one second, or longer.
   d. Slowly release the rocker arm, thereby allowing the lash adjuster to extend, which in turn refills the high pressure chamber with non-aerated oil.
   e. Remove the two Release Probes 8351 to allow check balls to seat.
   f. Recheck for sponginess. If the lash adjuster sponginess is not completely or nearly eliminated, repeat procedure.
   g. If the spongy condition cannot be removed, replace effected rocker arm(s).
6. Install the cylinder head cover(s).

Removal

REMOVAL

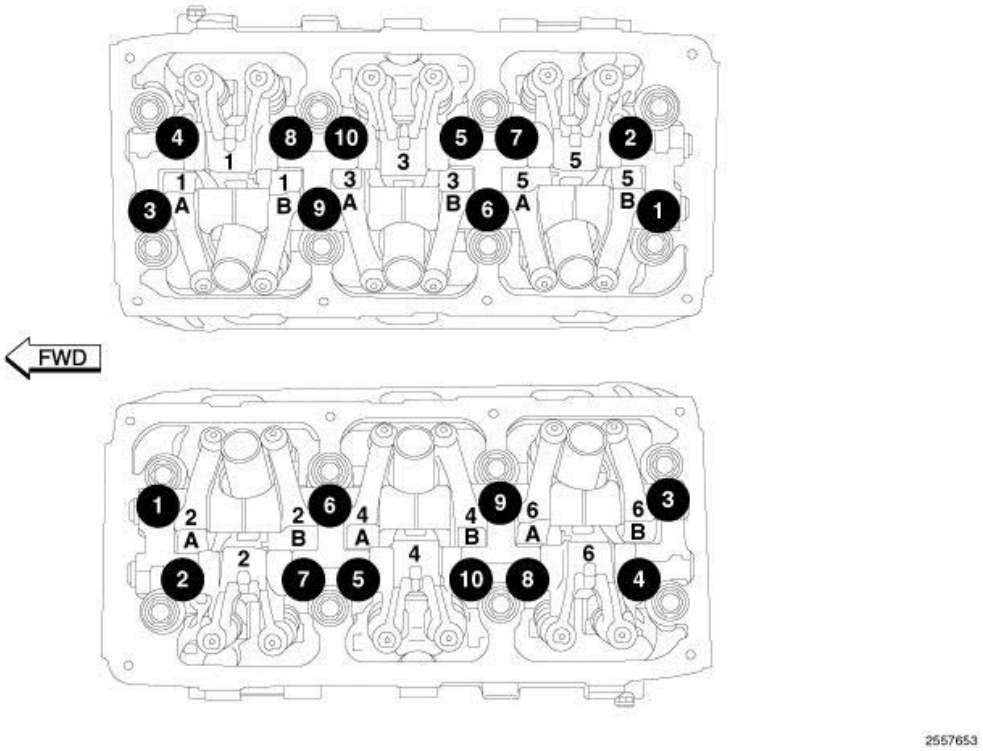

Fig. 208: Rocker Arm Assembly Bolts Torque Sequence
Courtesy of CHRYSLER LLC

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

CAUTION: DO NOT use a number stamp or a punch to mark the rocker arms. Damage to the rocker arms could occur.

2. Using a permanent ink or paint marker, identify the location and position on each rocker arm.
3. Remove the rocker arm assembly bolts in the sequence shown in illustration.

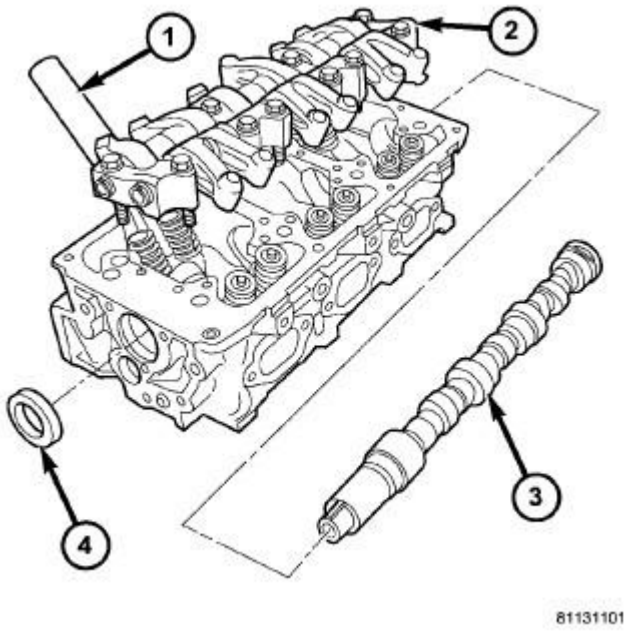

Fig. 209: CYLINDER HEAD, CAMSHAFT & ROCKER ARM
Courtesy of CHRYSLER LLC

1 - SPARK PLUG TUBE
2 - ROCKER ARM ASSEMBLY
3 - CAMSHAFT
4 - SEAL

4. Remove the rocker arm assembly (2).

NOTE: To prevent air ingestion into the lash adjusters, avoid turning the rocker arm assembly upside down.

CAUTION: Do not allow rocker arm assembly to rest on lash adjusters, as damage may occur to lash adjusters and/or plastic retainers.

Disassembly

DISASSEMBLY

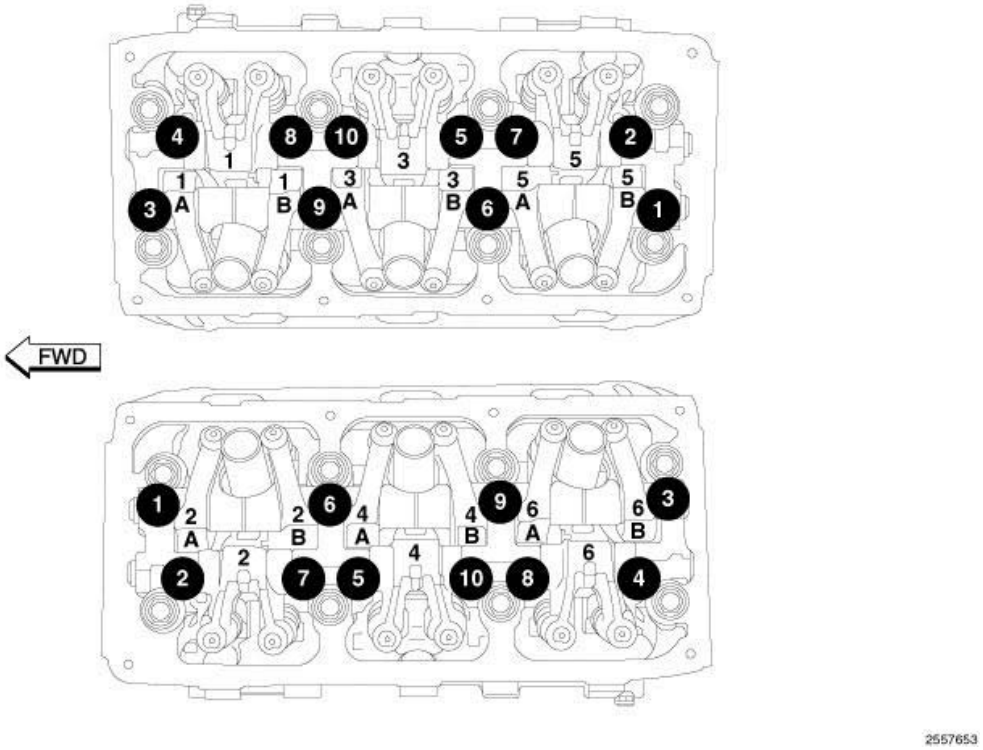

Fig. 210: Rocker Arm Assembly Bolts Torque Sequence
Courtesy of CHRYSLER LLC

CAUTION: DO NOT use a number stamp or a punch to mark the rocker arms. Damage to the rocker arms could occur.

1. Using a permanent ink or paint marker, identify the location and position on each rocker arm and remove the rocker arm and shaft assembly. See **Engine/Cylinder Head/ROCKER ARM, Valve - Removal**

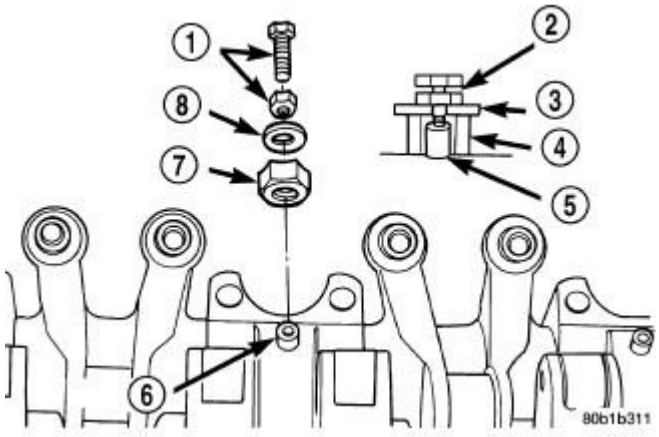

Fig. 211: Rocker Arms & Shaft - Disassembly
Courtesy of CHRYSLER LLC

1 - 4 mm SCREW AND NUT
2 - 4 mm SCREW AND NUT
3 - WASHER
4 - SPACER
5 - DOWEL
6 - DOWEL
7 - SPACER
8 - WASHER

2. Remove the dowel pins using a 4 mm screw, nut, spacer, and washer installed into the pin. Thread the screw into the pin, then loosen the nut on the screw. This will pull the dowel out of the shaft support. Do not reuse the dowel pins.

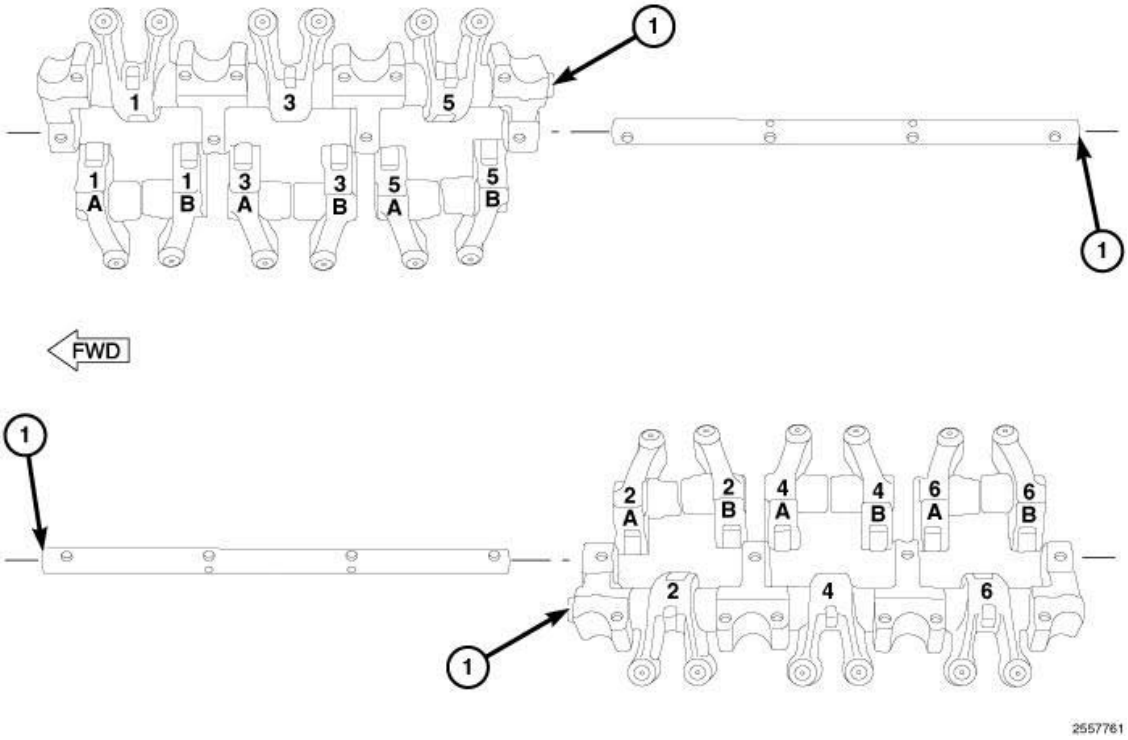

Fig. 212: Identification Marks Face Toward Front Of Engine
Courtesy of CHRYSLER LLC

NOTE: The identification marks (notches) (1) face toward the front of the engine for the left head and toward the rear of the engine for the right head.

3. Remove the rocker arms and pedestals in order.
4. Check the rocker arm mounting portion of the shafts for wear or damage. Replace if damaged or heavily worn.
5. Check the shaft oil holes for clogging with a small wire, clean as required.

Inspection

INSPECTION

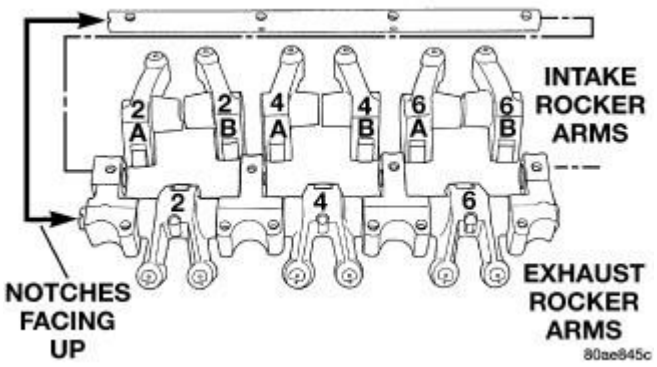

Fig. 213: Rocker Arms & Shafts
Courtesy of CHRYSLER LLC

The rocker arm shafts are hollow and are used as lubrication oil ducts. The rocker arm and shaft assembly on the **right** side of the engine has an oil passage hole from the cylinder head located at the third rocker shaft support pedestal. The rocker arm and shaft assembly on the **left** side of the engine has an oil passage hole from the cylinder head located at the second rocker shaft support pedestal.

NOTE: To prevent air ingestion into lash adjusters, avoid turning rocker arm assembly upside down.

CAUTION: Do not allow rocker arm assembly to rest on lash adjusters, as damage may occur to lash adjuster and plastic retainer.

The intake and exhaust rocker arms are different. They should be identified before disassembling the assembly.

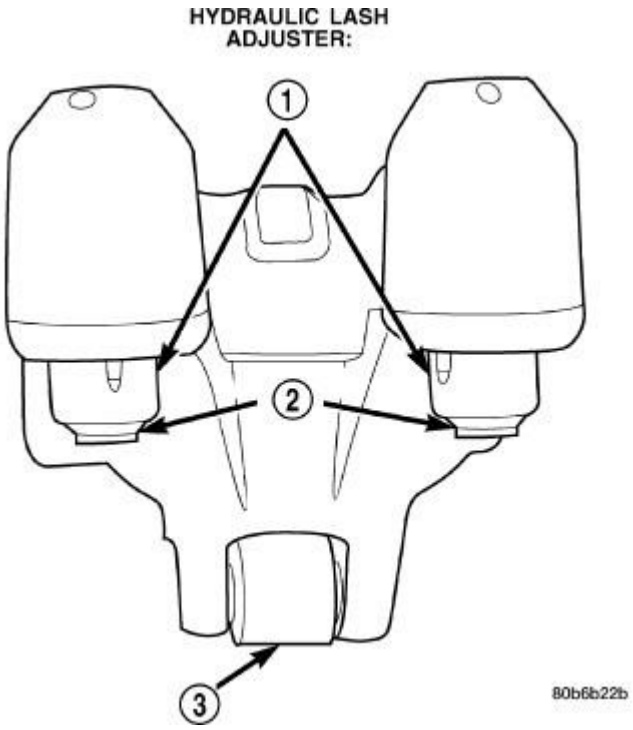

Fig. 214: Rocker Arm Assembly
Courtesy of CHRYSLER LLC

1 - RETAINER 2 - SWIVEL PAD 3 - ROLLER

Check rocker arms for wear or damage:

- Roller scuffing or wear
- Shaft bore scuffing or wear
- Swivel pad on lash adjuster missing or broken
- Rocker arm showing signs of fatigue or cracking
- Roller axle protruding from arm

Replace assembly as necessary if any rocker arms shows signs of wear.

CAUTION: Do not remove lash adjuster from rocker arm assembly. Damage to the adjuster and rocker arm will result.

Assembly

ASSEMBLY

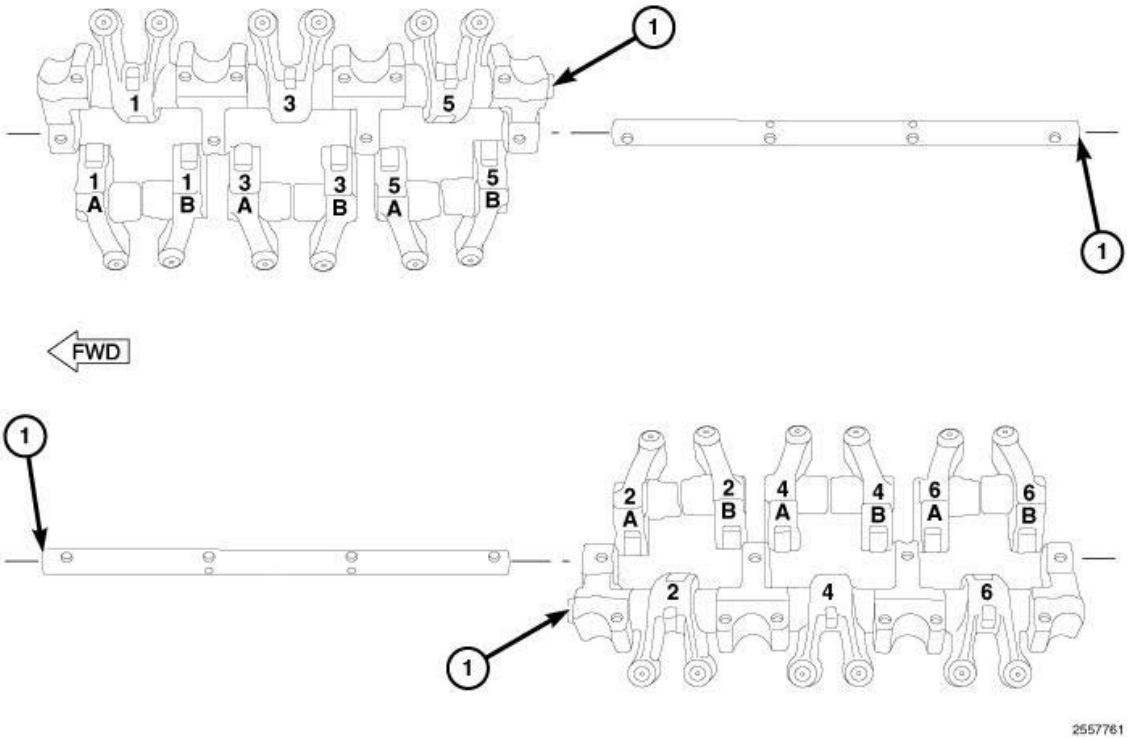

Fig. 215: Identification Marks Face Toward Front Of Engine
Courtesy of CHRYSLER LLC

CAUTION: The rocker arm shafts are hollow and are used as lubrication oil passages. The rocker arm and shaft assembly on the RIGHT side of the engine has an oil passage hole from the cylinder head to the third rocker shaft support. The rocker arm shaft assembly on the LEFT side of the engine has an oil passage hole from the cylinder head to the second rocker shaft support.

NOTE: A new fully assembled rocker arm and shaft assembly can be installed on either the right or left side of the engine. The identification marks (notches) (1) face toward the front of the engine for the left head and toward the rear of the engine for the right head.

1. Position the shafts with the notches (1) facing up. Install the rocker arms and pedestals onto the shafts.

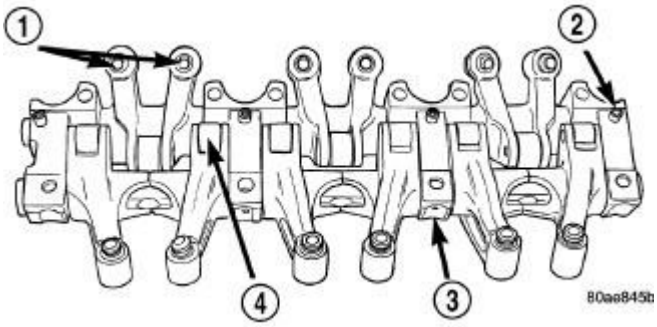

Fig. 216: Assemble Rocker Arms & Shaft
Courtesy of CHRYSLER LLC

1 - HYDRAULIC LASH ADJUSTERS
2 - DOWEL PIN
3 - PEDESTAL
4 - ROLLER

CAUTION: New dowel pins must be installed when reassembling.

2. Install the dowel pins (2). The dowel pins (2) pass through the pedestal (3) into the exhaust rocker shafts. Dowel pins (2) should be pressed in until they bottom-out against the rocker shaft in the pedestal (3).
3. Install the rocker arm and shafts assembly. See **Engine/Cylinder Head/ROCKER ARM, Valve - Installation**

Installation

INSTALLATION

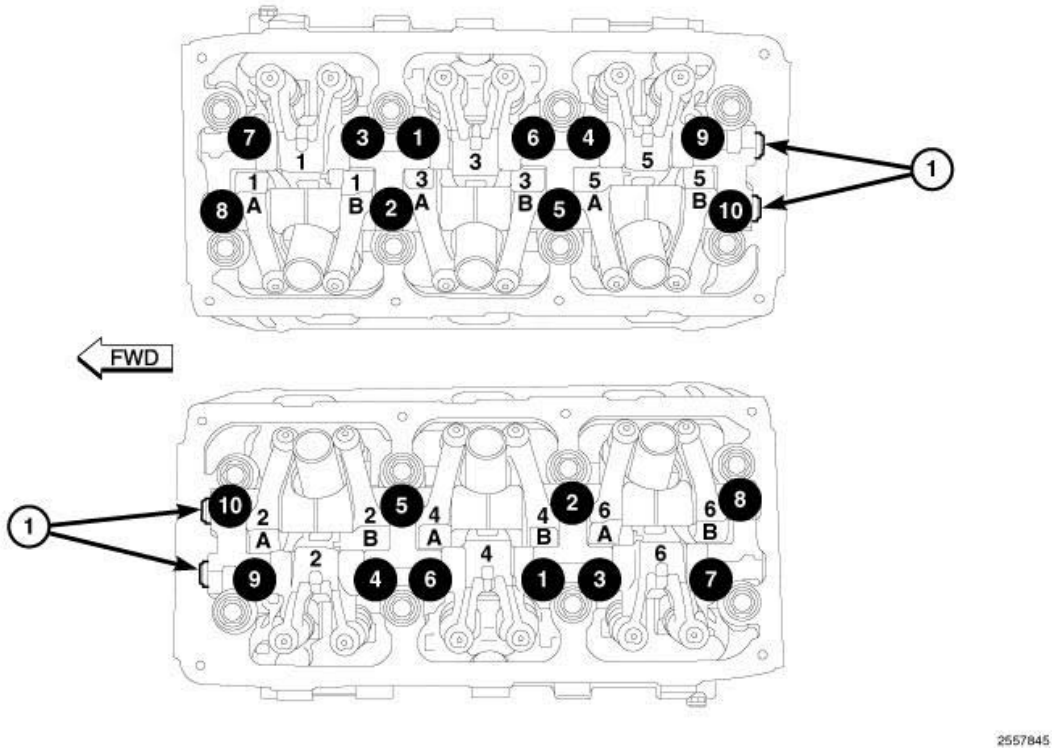

Fig. 217: Identification Marks On Rocker Arm & Shaft Assembly
Courtesy of CHRYSLER LLC

NOTE: The rocker arm and shaft assembly can be installed either prior to or after (preferred) cylinder head installation.

1. Rotate camshaft gears clockwise to where the number one cylinder intake valves would just start to open. The camshaft lobes are now in a neutral position (no load to the valve). This will allow the rocker arm shaft assembly to be tightened into position with little or no valve spring load on it.

NOTE: A new fully assembled rocker arm and shaft assembly can be installed on either the right or left side of the engine. The identification marks (notches) (1) face toward the front of the engine for the left head and toward the rear of the engine for the right head.

2. Install the rocker arm and shaft assembly making sure that the identification marks (1) face toward the front of engine for left head and toward the rear of the engine for right head.
3. Tighten the rocker arm/shaft assembly bolts in the sequence shown in illustration to 31 N.m (275 in. lbs.).
4. Install the cylinder head covers. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.

SEAL(S), CAMSHAFT

Removal

REMOVAL

1. Perform the fuel pressure release procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .

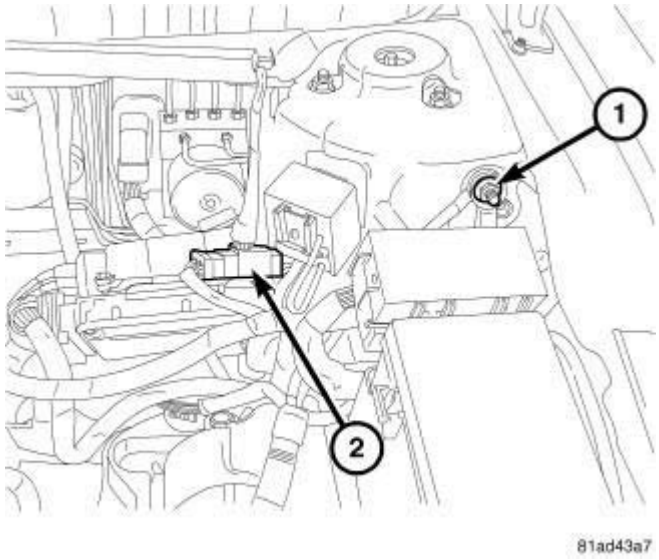

Fig. 218: BATTERY CABLE
Courtesy of CHRYSLER LLC

2. Disconnect the negative battery cable (1).
3. Drain cooling system. Refer to **Cooling - Standard Procedure** .
4. Remove the engine cover.

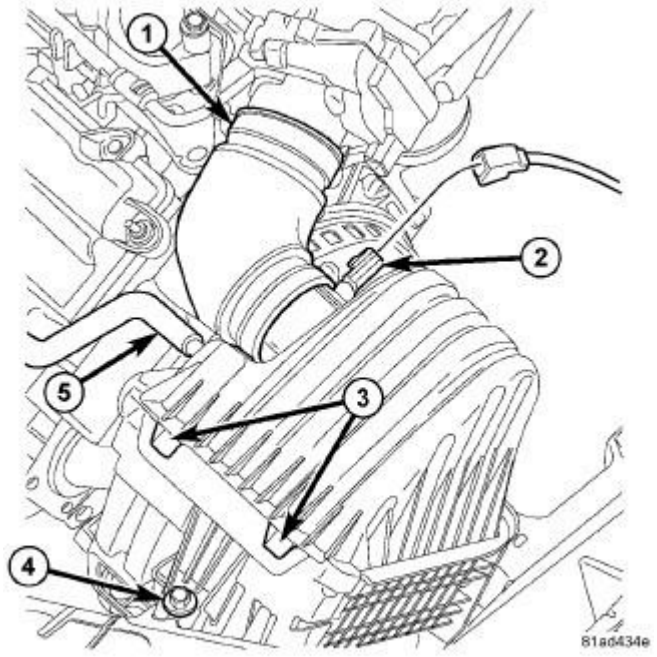

Fig. 219: HOUSING - AIR CLEANER

Courtesy of CHRYSLER LLC

5. Remove air cleaner element housing. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.

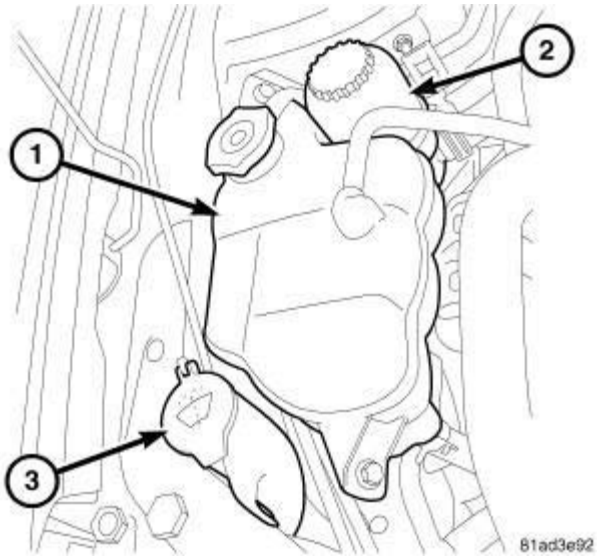

Fig. 220: COOLANT RESERVOIR
Courtesy of CHRYSLER LLC

6. Remove the coolant recovery container (1). Refer to **Cooling/Engine/BOTTLE, Coolant Recovery - Removal** .

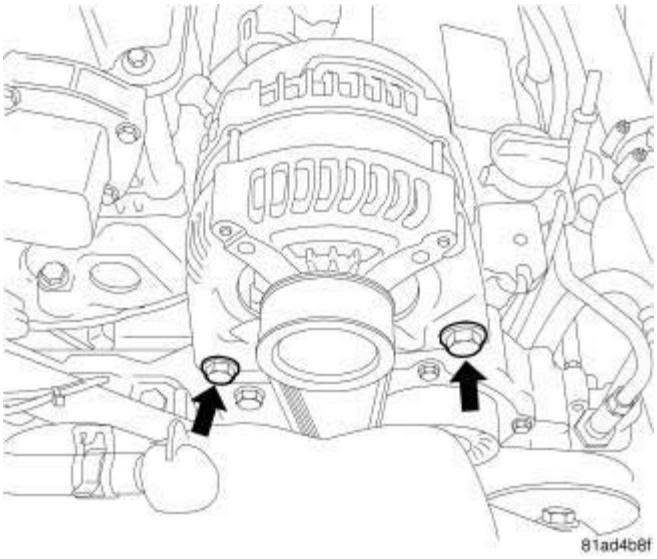

Fig. 221: Identifying Generator Bolts
Courtesy of CHRYSLER LLC

7. Remove the generator. Refer to **Electrical - Engine Systems/Charging/GENERATOR - Removal** .

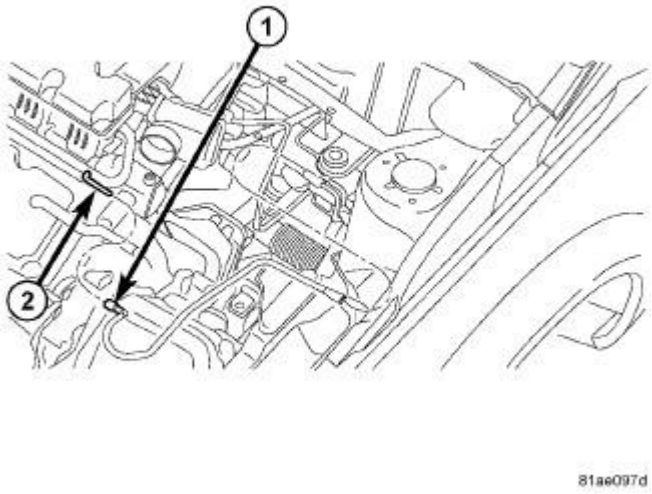

Fig. 222: Fuel Line From Fuel Rail Inlet
Courtesy of CHRYSLER LLC

8. Disconnect the fuel line (1) at the fuel rail (2).

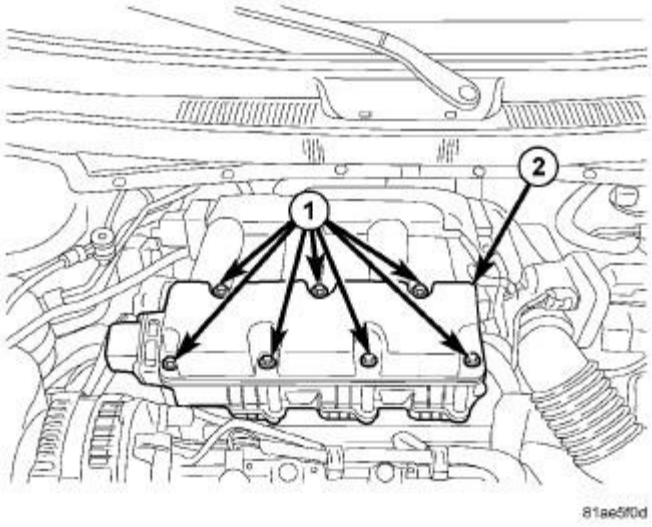

Fig. 223: Upper Intake Manifold
Courtesy of CHRYSLER LLC

9. Remove the upper intake manifold (2). See **Engine/Manifolds/MANIFOLD, Intake - Removal**.

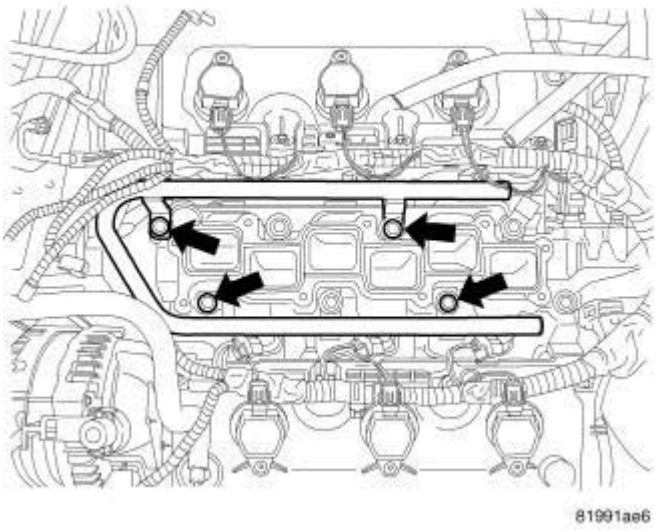

Fig. 224: Fuel Rail Bolts
Courtesy of CHRYSLER LLC

10. Remove the fuel rail. Refer to **Fuel System/Fuel Delivery/RAIL, Fuel - Removal** .

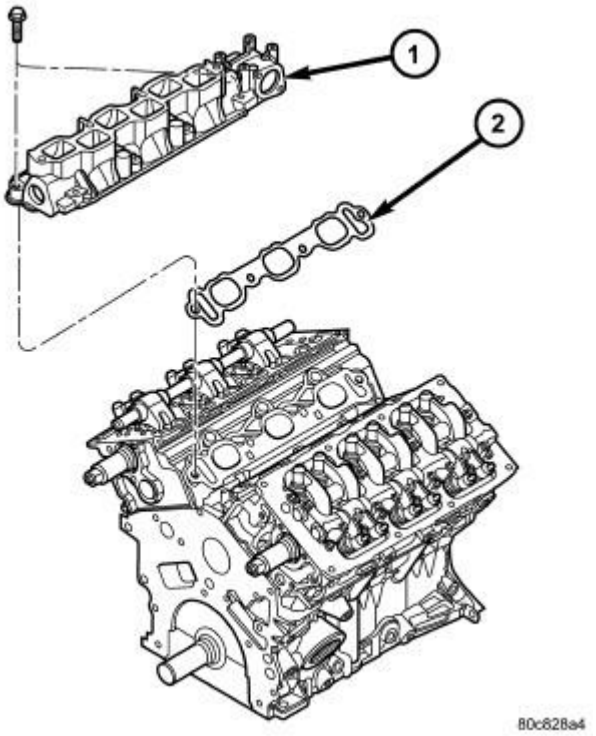

Fig. 225: Lower Intake Manifold
Courtesy of CHRYSLER LLC

11. Remove the lower intake manifold (1). See **Engine/Manifolds/MANIFOLD, Intake - Removal**.

12. Raise the vehicle.
13. Remove right exhaust manifold. See **Engine/Manifolds/MANIFOLD, Exhaust - Removal**.
14. Remove right front tire.
15. Remove right inner splash shield.

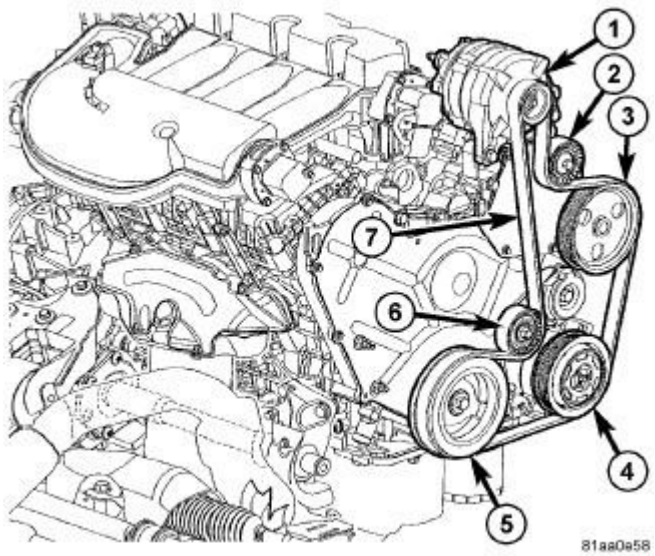

Fig. 226: Identifying Accessory Drive Belt & Pulleys
Courtesy of CHRYSLER LLC

16. Remove accessory drive belt (7).
17. Remove vibration damper (5). See **Engine/Engine Block/DAMPER, Vibration - Removal**.
18. Remove lower accessory drive belt idler pulley (6).

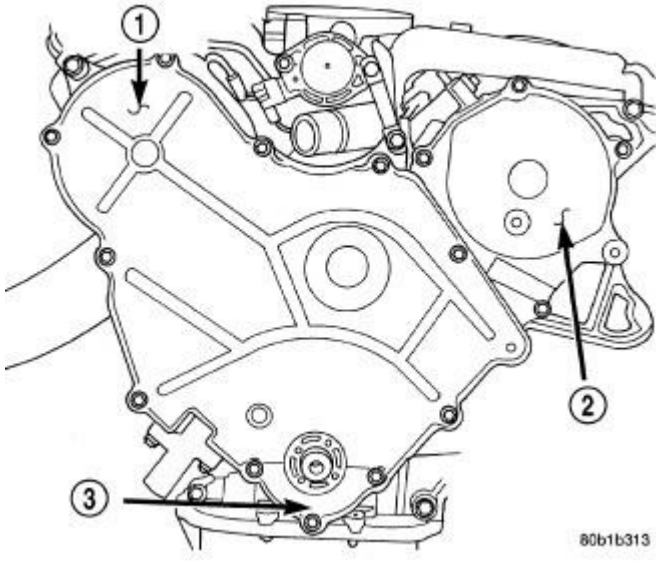

Fig. 227: TIMING BELT COVERS
Courtesy of CHRYSLER LLC

19. Remove lower outer timing belt cover bolts.
20. Lower vehicle.

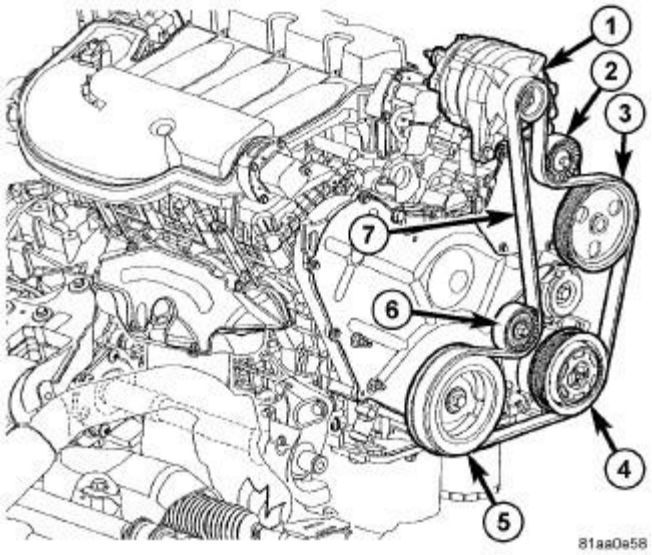

Fig. 228: Identifying Accessory Drive Belt & Pulleys
Courtesy of CHRYSLER LLC

21. Remove the upper accessory drive belt idler pulley (2).
22. Remove the belt tensioner.
23. Support the engine with a block of wood and a floor jack.
24. Remove the upper engine mount. See **Engine/Engine Mounting/INSULATOR, Engine Mount - Removal**.

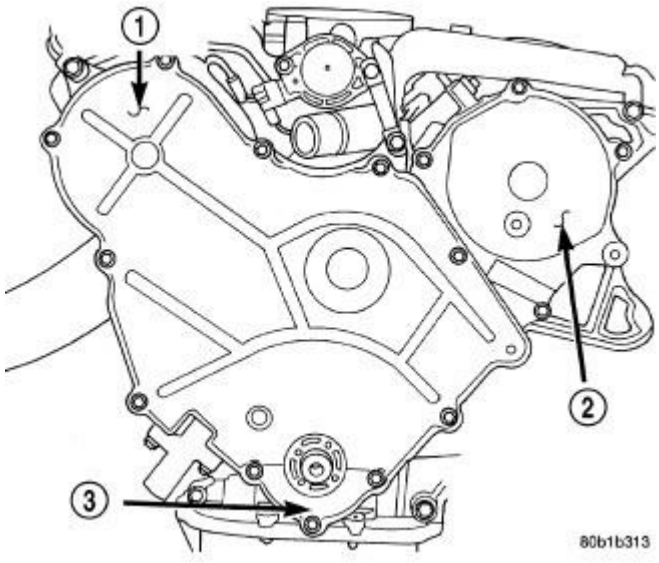

Fig. 229: TIMING BELT COVERS
Courtesy of CHRYSLER LLC

25. Remove the power steering reservoir bolts and set reservoir aside.
26. Remove the remaining outer timing belt cover bolts and cover.
27. Remove the timing belt. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Removal**.
28. Remove the right valve cover to cylinder head ground strap.

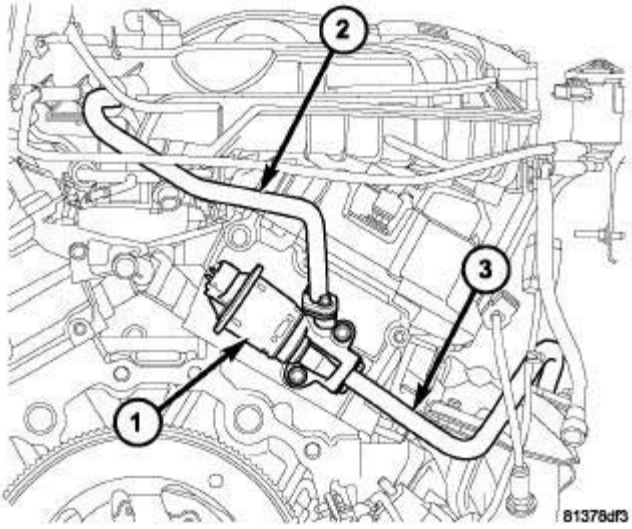

Fig. 230: Exhaust Gas Recirculation System
Courtesy of CHRYSLER LLC

29. Remove the EGR valve (1) and tube assembly (2).
30. Remove the right cylinder head cover.

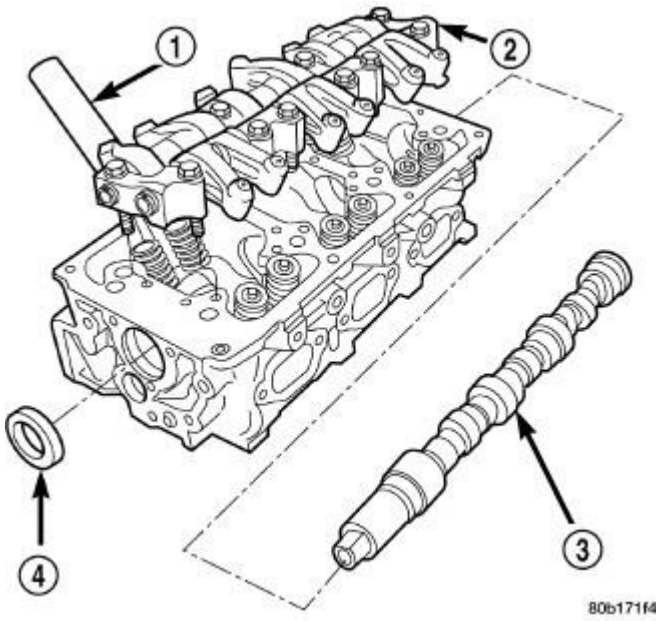

Fig. 231: Cylinder Head, Camshaft & Rocker Arms
Courtesy of CHRYSLER LLC

31. Remove the right rocker arm and shaft assembly (2). See **Engine/Cylinder Head/ROCKER ARM, Valve - Disassembly**.

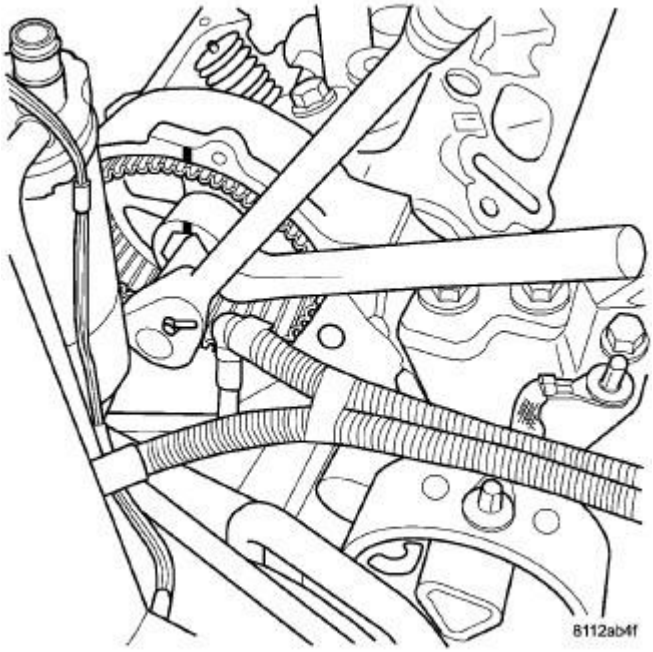

Fig. 232: Identifying Right Camshaft Sprocket
Courtesy of CHRYSLER LLC

32. Counterhold the cam gear and loosen the right cam gear retaining bolt.

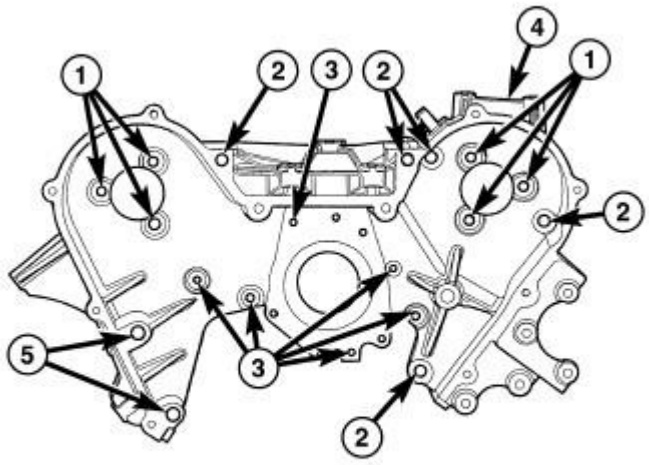

Fig. 233: REAR TIMING BELT COVER FASTENERS
Courtesy of CHRYSLER LLC

33. Remove the inner timing cover to right cylinder head retaining bolts.

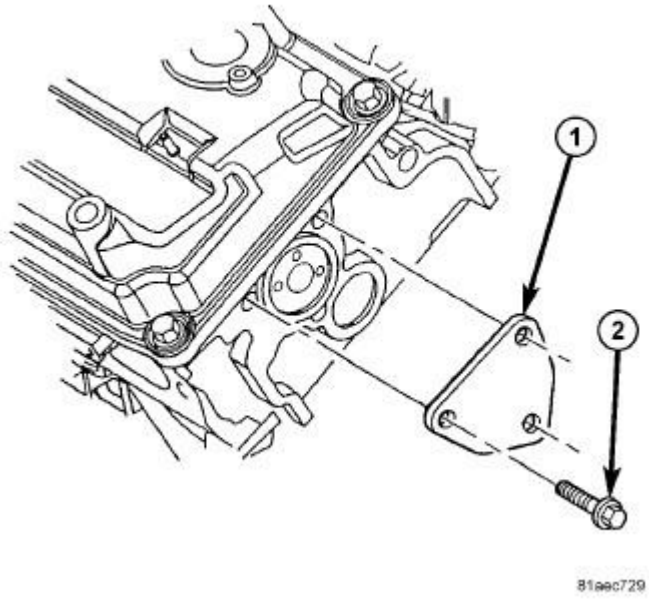

Fig. 234: Camshaft Thrust Plate
Courtesy of CHRYSLER LLC

34. Remove the right rear camshaft thrust plate (1).
35. Carefully push the camshaft out of the back of the cylinder head approximately 3.5 inches. Remove the camshaft sprocket and bolt.
36. **NOTE: It may be necessary to raise the engine slightly in order to remove the camshaft sprocket bolt.**

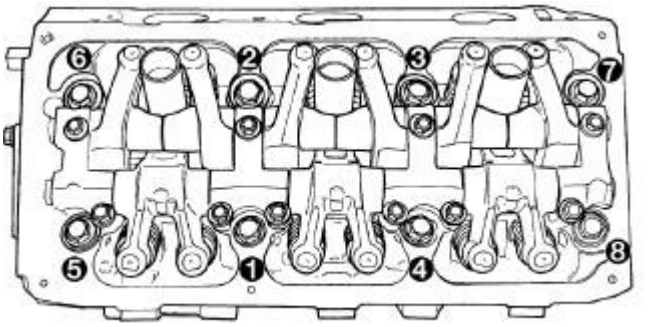

Fig. 235: Cylinder Head Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

37. Remove the cylinder head bolts in REVERSE of tightening sequence.

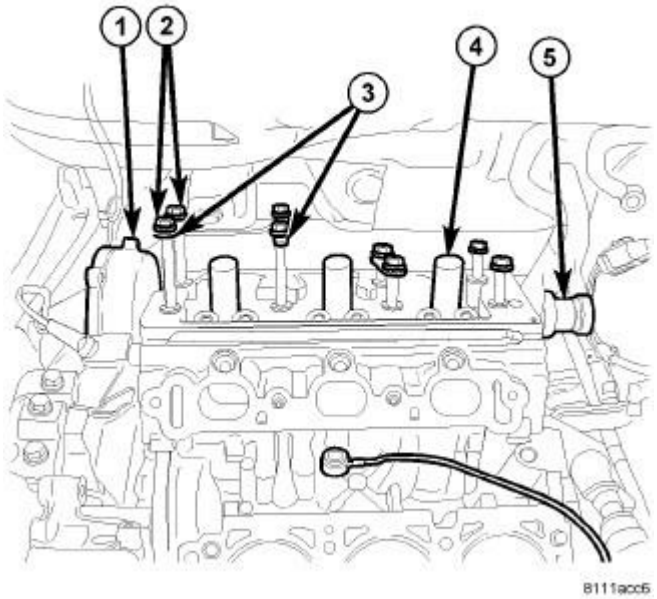

Fig. 236: RIGHT CYLINDER HEAD
Courtesy of CHRYSLER LLC

NOTE: Because of clearance restrictions when removing the right cylinder head, the front four cylinder head bolts must be loosened, raised and supported

with rubber bands before the cylinder head can be removed.

38. Remove the cylinder head.
39. Clean and inspect all mating surfaces.

Installation

INSTALLATION

RIGHT CYLINDER HEAD

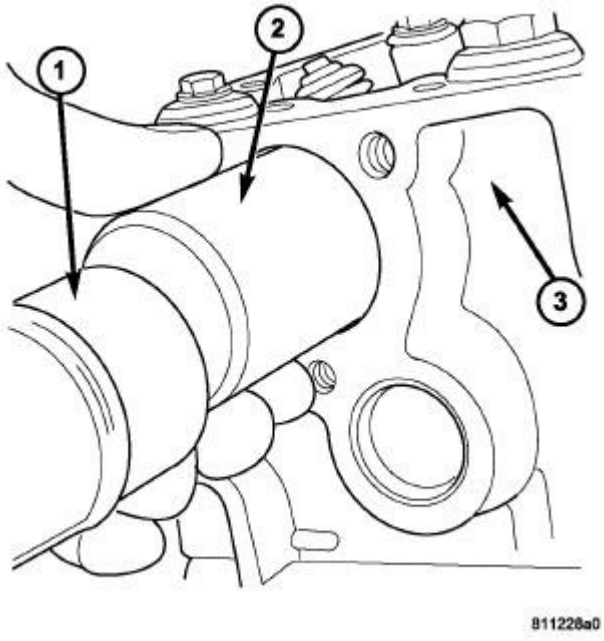

Fig. 237: CAMSHAFT SEAL
Courtesy of CHRYSLER LLC

1 - MALLET
2 - SPECIAL TOOL MD-998306
3 - CYLINDER HEAD

1. Position the camshaft seal into the cylinder head (3).
2. Using Camshaft installer MD-998306 (2) tap the seal into place using a mallet (1).

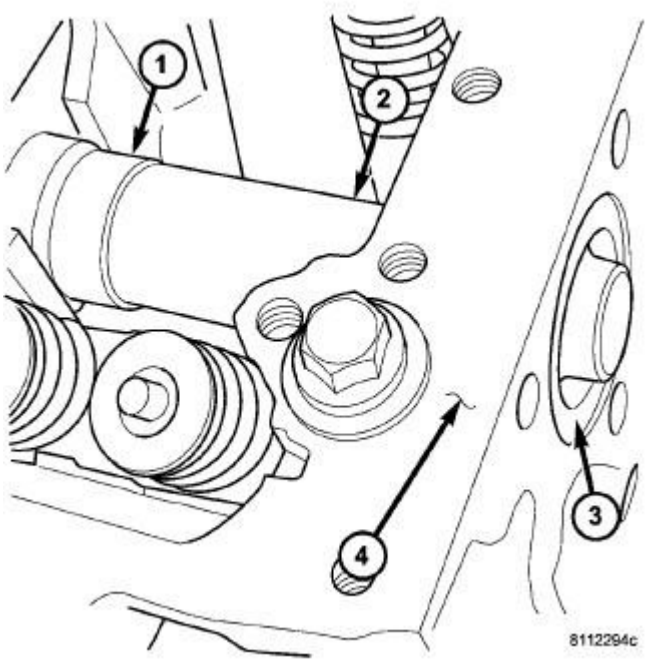

Fig. 238: CAMSHAFT INSTALLATION - LEFT
Courtesy of CHRYSLER LLC

1 - CAMSHAFT
2 - SPECIAL TOOL6788
3 - CAMSHAFT SEAL
4 - CYLINDER HEAD

3. Apply light coat of clean engine oil to the camshaft oil seal lip (3) and Seal Protector Sleeve 6788 (2).

NOTE: When installing the camshaft (1) into the cylinder head (4), you must first insert Seal Protector Sleeve 6788 (2) through the camshaft seal (3) until the camshaft seats, then remove Seal Protector Sleeve 6788 (2) from the camshaft.

4. Install the camshaft using Seal Protector Sleeve 6788.
5. Install the right cylinder head. See **Engine/Cylinder Head - Installation**.

LEFT CYLINDER HEAD

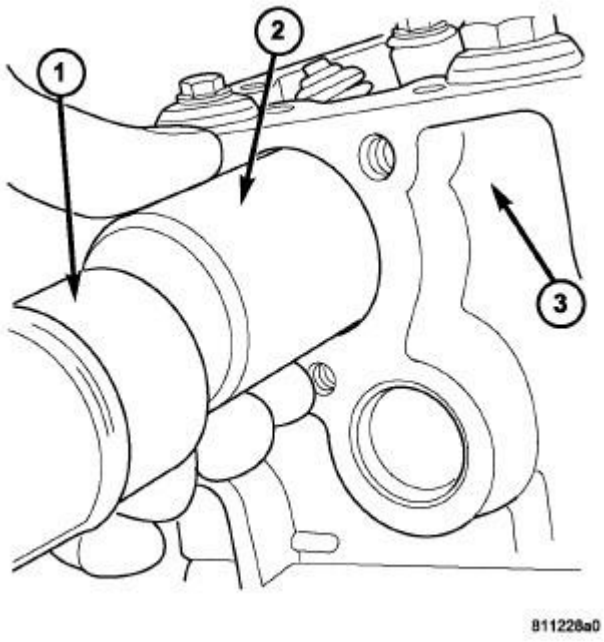

Fig. 239: CAMSHAFT SEAL
Courtesy of CHRYSLER LLC

1 - MALLET
2 - SPECIAL TOOL MD-998306
3 - CYLINDER HEAD

1. Position the camshaft seal into the cylinder head (3).
2. Using Camshaft installer MD-998306 (2) tap the seal into place using a mallet (1).

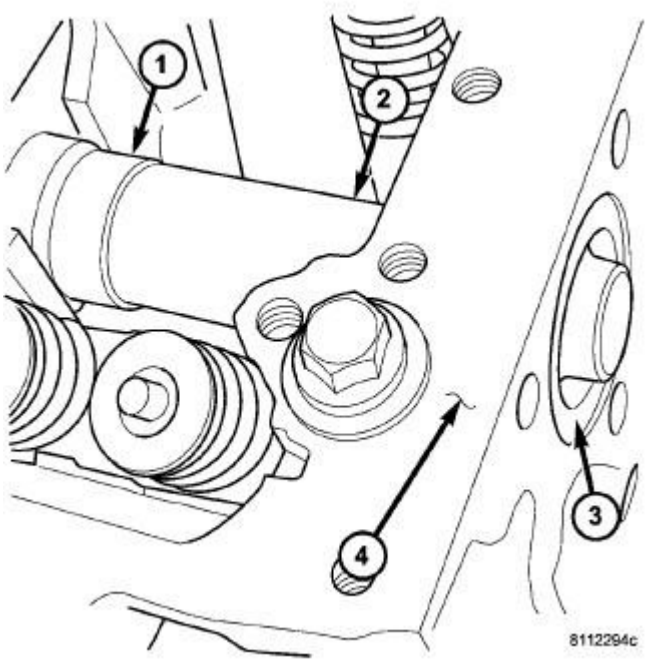

Fig. 240: CAMSHAFT INSTALLATION - LEFT
Courtesy of CHRYSLER LLC

1 - CAMSHAFT
2 - SPECIAL TOOL6788
3 - CAMSHAFT SEAL
4 - CYLINDER HEAD

3. Apply light coat of clean engine oil to the camshaft oil seal lip (3) and Seal Protector Sleeve 6788 (2).

NOTE: When installing the camshaft (1) into the cylinder head (4), you must first insert Seal Protector Sleeve 6788 (2) through the camshaft seal (3) until the camshaft seats, then remove Seal Protector Sleeve 6788 (2) from the camshaft.

4. Install the camshaft using Seal Protector Sleeve 6788.
5. Install the left cylinder head. See **Engine/Cylinder Head - Installation**.

SEAL(S), VALVE GUIDE

Removal

REMOVAL

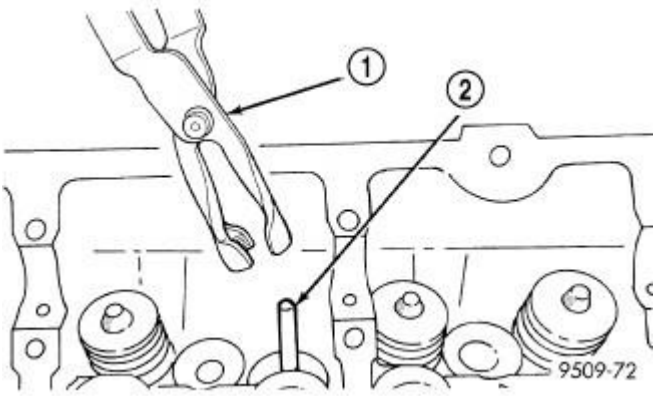

Fig. 241: Valve Stem Seal - Removal
Courtesy of CHRYSLER LLC

1 - VALVE SEAL TOOL 2 - VALVE STEM

1. Remove valve spring. See **Engine/Cylinder Head/SPRING(S), Valve - Removal**
2. Remove valve stem seals using a valve stem seal tool.

Installation

INSTALLATION

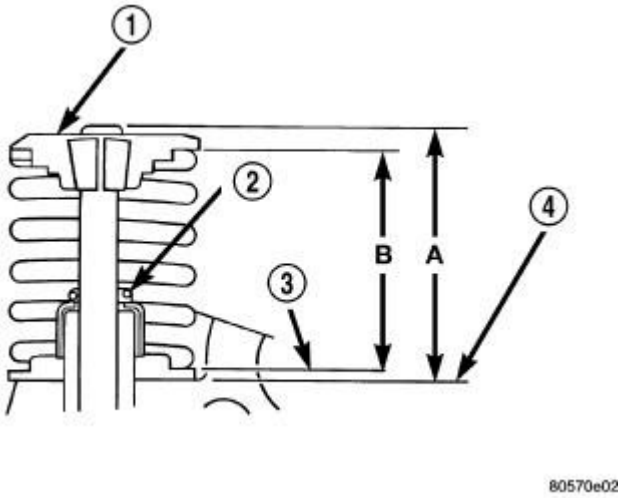

Fig. 242: Checking Valve Tip Height & Valve Spring Installed Height
Courtesy of CHRYSLER LLC

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

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

CAUTION: Do not remove garter spring (2) around the seal at the top of the valve stem seal.

2. Install valve spring. See **Engine/Cylinder Head/SPRING(S), Valve - Installation**

SPRING(S), VALVE

Description

DESCRIPTION

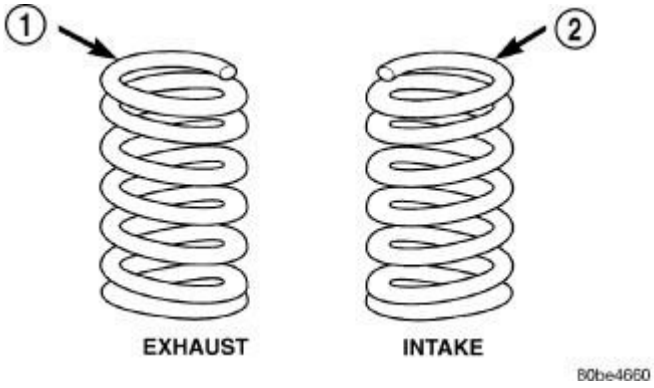

Fig. 243: Valve Spring Identification
Courtesy of CHRYSLER LLC

1 - YELLOW OR WHITE DYE 2 - ORANGE DYE

The valve springs are made from chrome silicon alloy wire and incorporate a "bee-hive" design. Valve spring retainers and locks are common from valve-to-valve. The valve spring seat is integral with the valve stem oil seal, which incorporates a garter spring to maintain consistent lubrication control to the valve stem.

The valve springs are unique for intake compared to exhaust. Both have different lengths and are wound in opposite directions. The valve springs are color coded, intake spring is right hand coil direction with grey dye on the top coils, and the exhaust spring is left hand coil direction with a blue dye on the top coils.

Operation

OPERATION

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

Removal

CYLINDER HEAD OFF

1. Compress valve spring with valve spring compressor C-3422-D and adapter 6526A. See **Engine - Special Tools**.
2. Remove valve retaining locks. Release valve spring compressor. Remove valve spring retainer and valve spring.
3. Remove valve stem seal assembly. See **Engine/Cylinder Head/SEAL(S), Valve Guide - Removal**

CYLINDER HEAD ON

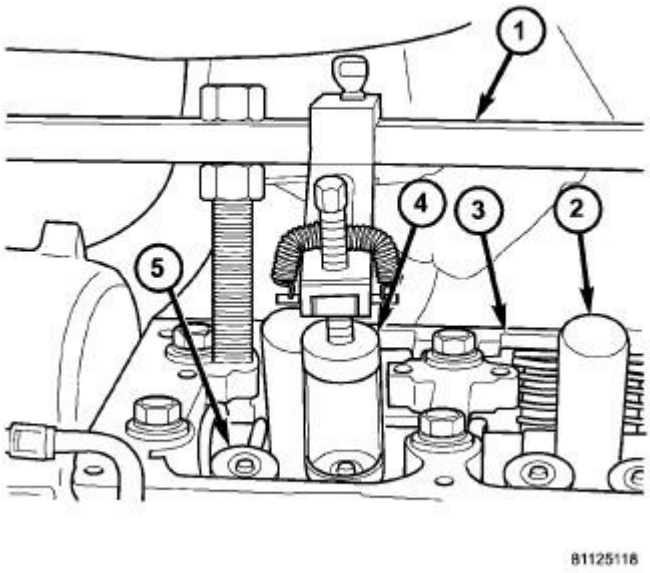

Fig. 244: VALVE SPRING REMOVAL
Courtesy of CHRYSLER LLC

1 - MD 998772A
2 - SPARK PLUG TUBES
3 - CYLINDER HEAD
4 - 6527 - ADAPTOR
5 - VALVE SPRING RETAINER

1. Disconnect negative battery cable.
2. Remove upper intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Removal**.
3. Remove cylinder head cover(s). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
4. Remove rocker arm and shaft assembly. See **Engine/Cylinder Head/ROCKER ARM, Valve - Removal**.

5. Remove spark plugs.
6. Rotate the crankshaft clockwise, until the number 1 piston is at TDC (Top Dead Center) on the compression stroke.
7. With air hose attached to spark plug adapter installed in number 1 spark plug hole, apply 620.5 to 689 kPa (90 to 100 psi) air pressure. This is to hold valves into place while servicing components.

NOTE: It may be necessary to use accessory studs 6886, adapter arm 6887 and 6885 valve adaptor along with MD 998772A, to compress the valve spring on the right cylinder head exhaust valves.

8. Using Tool MD 998772A (1), with adapter 6527 (4) or equivalent, compress valve spring and remove valve locks (5). Release tension on valve spring, remove retainer (5) and valve spring. See **Engine - Special Tools**.
9. Remove valve stem seal, if required. See **Engine/Cylinder Head/SEAL(S), Valve Guide - Removal**
10. Follow the same procedure on the remaining 5 cylinders using the firing sequence 1-2-3-4-5-6. **Make sure piston is at TDC in each cylinder of the valve spring that is being removed.**
11. Remove spark plug adapter tool.

Inspection

INSPECTION

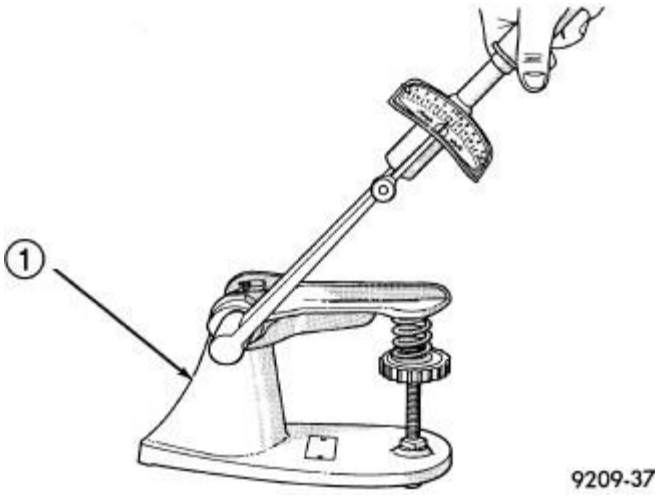

Fig. 245: Testing Valve Spring
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL C-647

When valves have been removed for inspection, reconditioning or replacement, valve springs should be tested. **As an example;** the compression length of the spring to be tested is 38.00 mm (1.496 in.). Turn table of Tool C-647 until surface is in line with the 38.00 mm (1.496 inches.) mark on the threaded stud and the zero mark on the front. Place spring over stud on the table and lift compressing lever to set tone device. Pull on torque wrench

until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to **Engine - Specifications** to obtain specified height and allowable tensions. Replace springs that do not meet specifications.

Installation

CYLINDER HEAD OFF

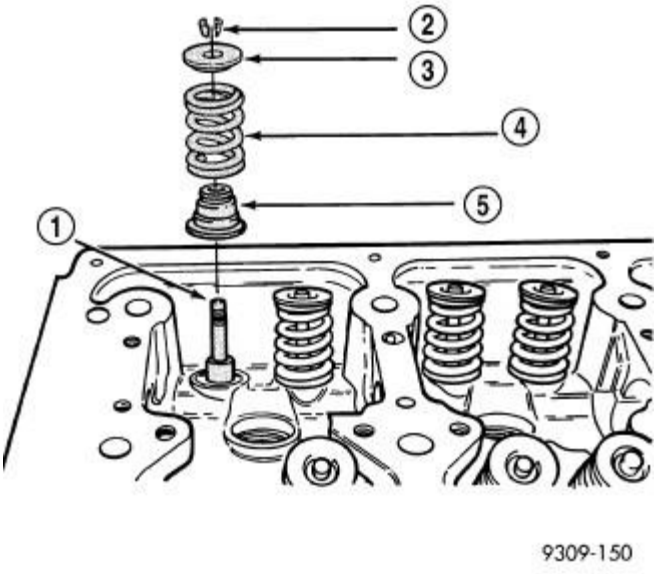

Fig. 246: Valve Seal & Spring-Installation
Courtesy of CHRYSLER LLC

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

1. Install valves if removed.
2. Install valve stem seal/spring seat assembly (5) over valve guides on all valve stems. Ensure that the garter spring is intact around the top of the rubber seal.
3. Place valve spring (color-coded end facing up) (4) and valve retainer into position.

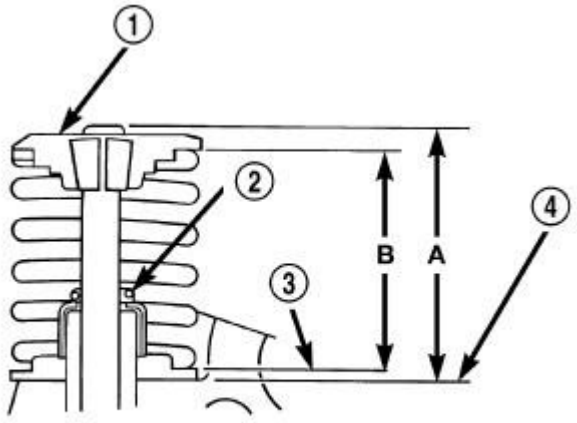

Fig. 247: Checking Valve Tip Height & Valve Spring Installed Height
Courtesy of CHRYSLER LLC

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

4. Compress valve spring with valve spring compressor. Install locks and release tool. **If valve and/or seat are reground, measure the installed height of springs (B), make sure measurements are taken from top of spring seat to the bottom surface of spring retainer** . If height is greater than 38.75 mm (1.5256 in.), install a 0.762 mm (0.030 in.) spacer in head counterbore under the valve spring seat to bring spring height back within specification.

CYLINDER HEAD ON

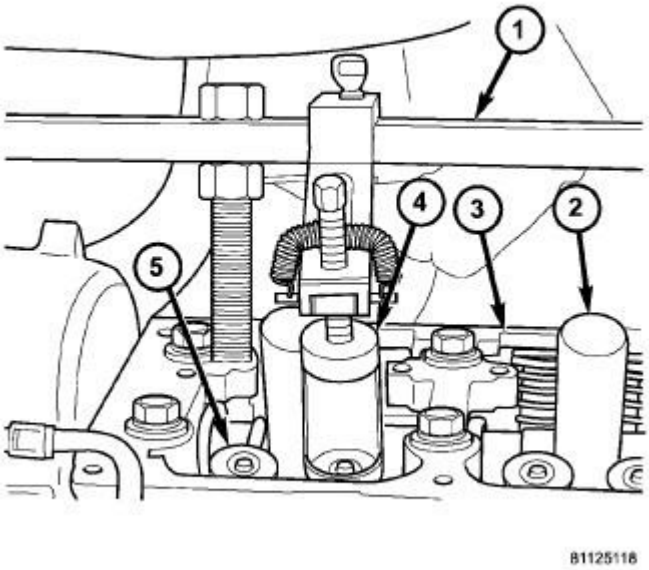

Fig. 248: VALVE SPRING SERVICING
Courtesy of CHRYSLER LLC

1 - MD 998772A
2 - SPARK PLUG TUBES
3 - CYLINDER HEAD
4 - 6527 - ADAPTOR
5 - VALVE SPRING RETAINER

1. Install new valve seal(s) if required. See **Engine/Cylinder Head/SEAL(S), Valve Guide - Installation**.
2. Place valve spring (color-coded end facing up) and valve retainer into position.

NOTE: It may be necessary to use accessory studs 6886, adaptor arm 6887 and 6885 valve adaptor along with MD 998772A, to compress the valve spring on the right cylinder head exhaust valves.

3. Compress valve spring using Special Tool MD 998772A (1) with Adaptor 6527 (4), only enough to install locks (5).
4. After installing locks, release tension on valve spring and verify proper installation.
5. Remove Special Tool MD 998772A (1) and spark plug adapter tool.
6. Install rocker arm and shaft assembly. See **Engine/Cylinder Head/ROCKER ARM, Valve - Installation**
7. Install cylinder head cover(s). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.
8. Install spark plugs.

9. Install upper intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Installation**.
10. Connect negative battery cable.

TUBE, SPARK PLUG

Removal

REMOVAL

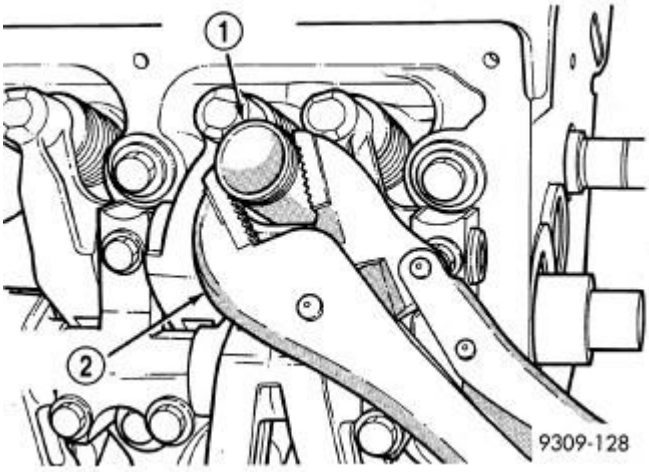

Fig. 249: Servicing Spark Plug Tubes
Courtesy of CHRYSLER LLC

1 - SPARK PLUG TUBE 2 - LOCKING PLIERS

1. Remove cylinder head cover(s). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
2. Using suitable locking pliers, remove the tube (1) from the cylinder head and discard tube.
3. Clean area around spark plug with Mopar® Parts Cleaner or equivalent.

Installation

INSTALLATION

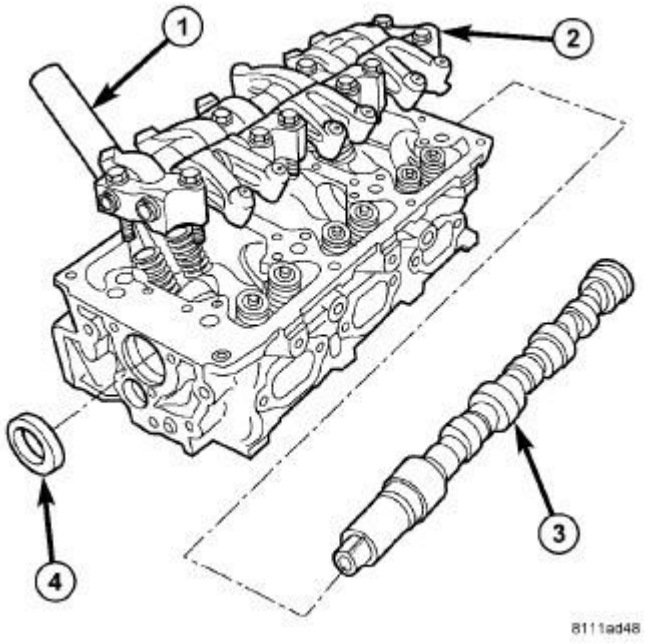

Fig. 250: CAMSHAFT, ROCKER ARM ASSEMBLY & CYLINDER HEAD
Courtesy of CHRYSLER LLC

1 - SPARK PLUG TUBE
2 - ROCKER ARM ASSEMBLY
3 - CAMSHAFT
4 - CAMSHAFT SEAL

1. Apply Mopar® Stud and Bearing Mount to a new tube (1) approximately 1 mm (0.039 in.) from the end of tube, in a 3 mm (0.118 in.) wide area.
2. Install sealer end of tube (1) into the cylinder head. Then carefully install the tube (1) using a hardwood block and mallet. Install the tube (1) until it is seated into the bottom of the bore.
3. For spark plug tube (1) seal replacement. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
4. Install cylinder head cover(s). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.

VALVES, INTAKE AND EXHAUST

Description

DESCRIPTION

Valves are made of highly heat-resistant steel and are chrome plated to prevent stem scuffing. The intake valve is a one-piece forging, while the exhaust valve has a forged head with a welded stem for lock groove durability. The four valves (two intake and two exhaust) employ a three-groove lock design to help facilitate valve rotation.

Operation

OPERATION

The intake valve allows the air/fuel mixture to enter the combustion chamber. The exhaust valve allows the burned air/fuel mixture to exit the combustion chamber. Also, the intake and exhaust valves seal the combustion chamber during the compression and power strokes.

Standard Procedure

VALVE AND VALVE SEAT REFACING

Refer to **Engine - Specifications** for the valve face and valve seat angles.

VALVES

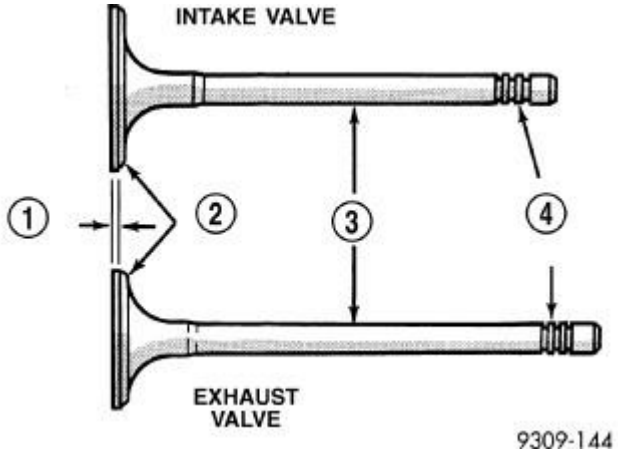

Fig. 251: Intake & Exhaust Valves
Courtesy of CHRYSLER LLC

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

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

VALVE SEATS

1. When refacing valve seats, it is important that the correct size valve guide pilot be used for re-seating stones. A true and complete surface must be obtained.
2. Measure the concentricity of valve seat using dial indicator. Total runout should not exceed 0.051 mm (0.002 inch.) total indicator reading.

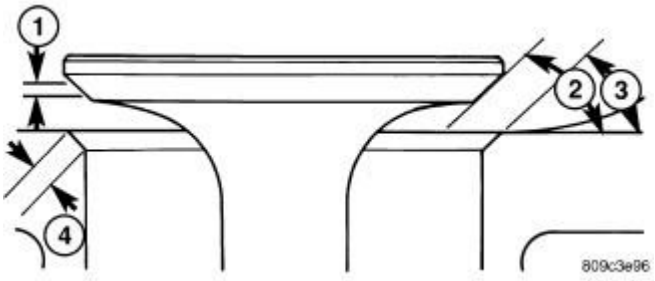

Fig. 252: Valve Face & Seat
Courtesy of CHRYSLER LLC

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

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

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

4. When seat is properly positioned, the width of the intake seats should be 0.75 to 1.25 mm (0.0296 to 0.0493 in.) and exhaust seats should be 1.25 to 1.75 mm (0.049 to 0.069 in.).

VALVE AND SPRING INSTALLED HEIGHT

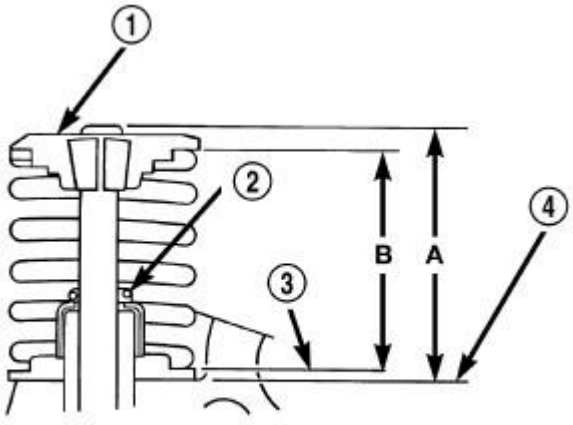

Fig. 253: Checking Valve Tip Height & Valve Spring Installed Height
Courtesy of CHRYSLER LLC

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

1. Coat valve stems with clean engine oil and insert the valves into the cylinder head.
2. If valves or seats have been refaced, check valve tip height (A). If valve tip height is greater than 43.65 mm (1.7185 in.) intake or 45.98 mm (1.8102 in.) exhaust, grind valve tip until within specifications. Make sure measurement is taken from cylinder head surface to the top of valve stem.

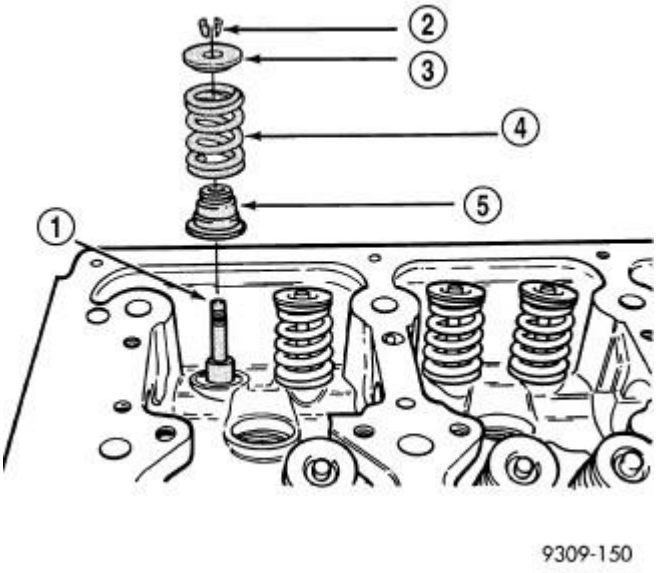

Fig. 254: Valve Seal & Spring-Installation
Courtesy of CHRYSLER LLC

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

3. Install valve seal/spring seat assembly over valve guides on all valve stems. Ensure that the garter spring is intact around the top of the valve seal.
4. Place valve spring (color-coded end facing up) and valve retainer into position on spring seat.
5. Compress valve springs with valve spring compressor C-3422-D and adapter 6526A. See **Engine - Special Tools**, install locks and release tool.

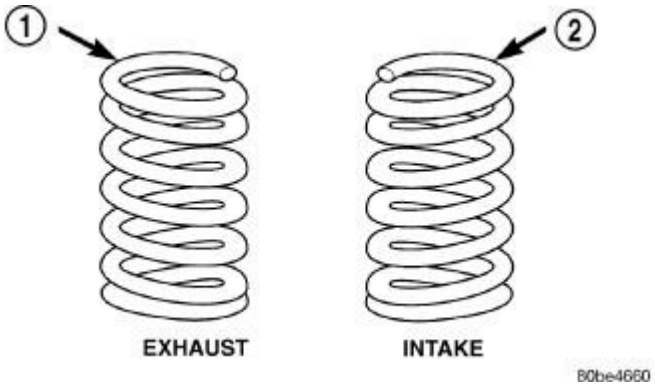

Fig. 255: Valve Spring Identification
Courtesy of CHRYSLER LLC

1 - YELLOW OR WHITE DYE 2 - ORANGE DYE

6. If valves and/or seats are refaced, measure the installed height of springs. Measurements are taken from top of spring seat to the bottom surface of spring retainer. If height is greater than 38.75 mm (1.5256 in.), install a 0.762 mm (0.030 in.) spacer in head counterbore under the valve spring seat to bring spring height back within specification.

Removal

REMOVAL

1. Remove cylinder head(s). See **Engine/Cylinder Head - Removal**.
2. Remove rocker arm assembly. See **Engine/Cylinder Head/ROCKER ARM, Valve - Removal**.
3. Remove valve spring(s). See **Engine/Cylinder Head/SPRING(S), Valve - Removal**.
4. Before removing valve, **remove any burrs from valve stem lock grooves to prevent damage to the valve guides.** Identify valves to insure installation in original location.
5. Remove valve(s) from cylinder head.

Cleaning

CLEANING

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

Inspection

VALVES

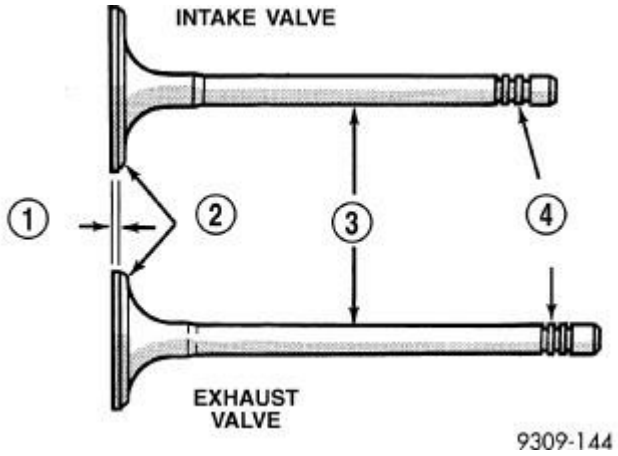

Fig. 256: Intake & Exhaust Valves
Courtesy of CHRYSLER LLC

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

1. Measure valve stems for wear approximately 60 mm (2.36 in.) below the valve lock grooves.
2. Compare measurement to specifications. See **Engine - Specifications**.

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

VALVE GUIDES

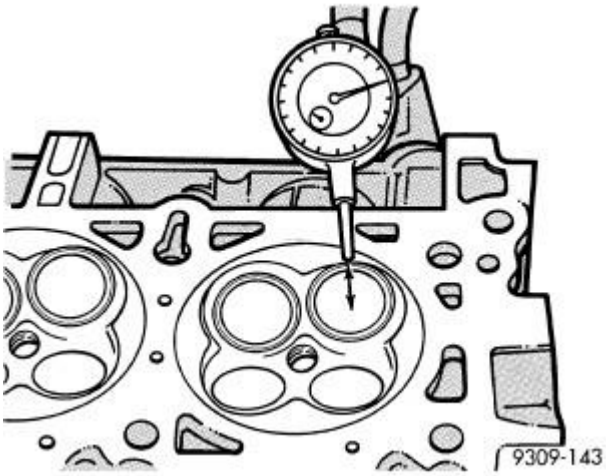

Fig. 257: Measuring Valve Guide Wear
Courtesy of CHRYSLER LLC

1. Measure valve stem-to-guide clearance as follows:

2. 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.
3. Attach dial indicator Tool C-3339A to cylinder head and set it at right angle of valve stem being measured.
4. Move valve to and from the indicator.
5. Note dial indicator reading and compare to engine 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

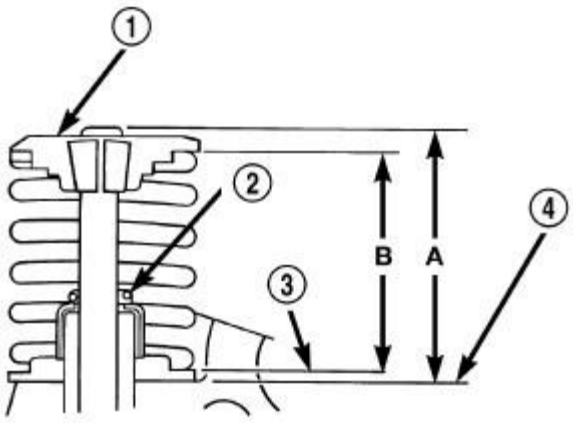

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Fig. 258: Checking Valve Tip Height & Valve Spring Installed Height
Courtesy of CHRYSLER LLC

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

1. Coat valve stems with clean engine oil and insert the valves into the cylinder head.
2. If valves or seats have been reground, check valve tip height (A). If valve tip height is greater than 43.65 mm (1.7185 in.) intake or 45.98 mm (1.8102 in.) exhaust, grind valve tip until within specifications. Make sure measurement is taken from cylinder head surface to the top of valve stem.
3. Install new valve stem seals.
4. Install valve springs. See **Engine/Cylinder Head/SPRING(S), Valve - Installation**.
5. Install cylinder head(s). See **Engine/Cylinder Head - Installation**.

ENGINE BLOCK

DESCRIPTION

DESCRIPTION

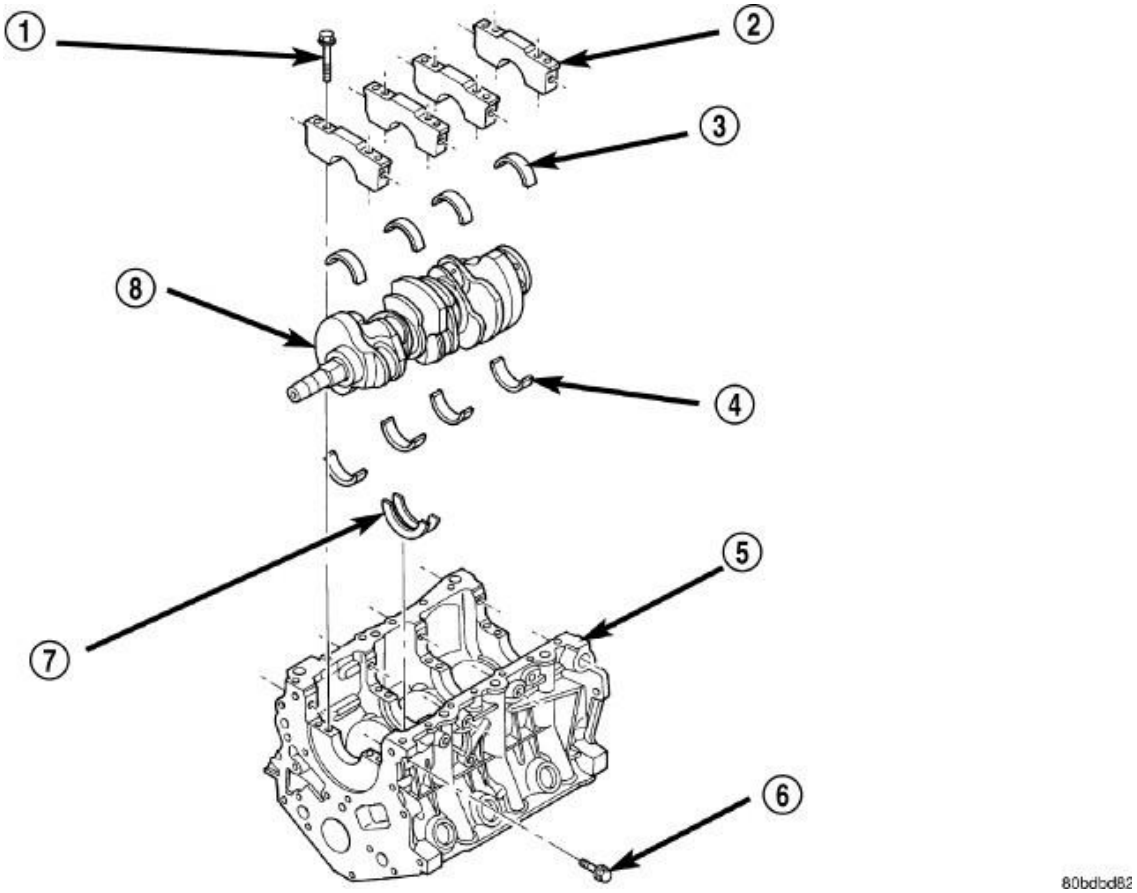


Fig. 259: Cylinder Block & Crankshaft
Courtesy of CHRYSLER LLC

1 - MAIN CAP BOLT - VERTICAL	5 - CYLINDER BLOCK
2 - MAIN CAP	6 - MAIN CAP BOLT - HORIZONTAL
3 - MAIN BEARING - LOWER	7 - CRANKSHAFT THRUST WASHER
4 - MAIN BEARING - UPPER	8 - CRANKSHAFT

The cylinder block (5) is made of heat treated aluminum with cast-in-place iron liners. The block is a closed deck design with the right bank forward. To provide high rigidity and improved noise, vibration and harshness (NVH), the block has cast-in contours and ribs, along with powdered metal 6 bolt main caps (4 vertical, 2 horizontal), with a die cast aluminum structural beam windage tray mounted to the main caps.

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.

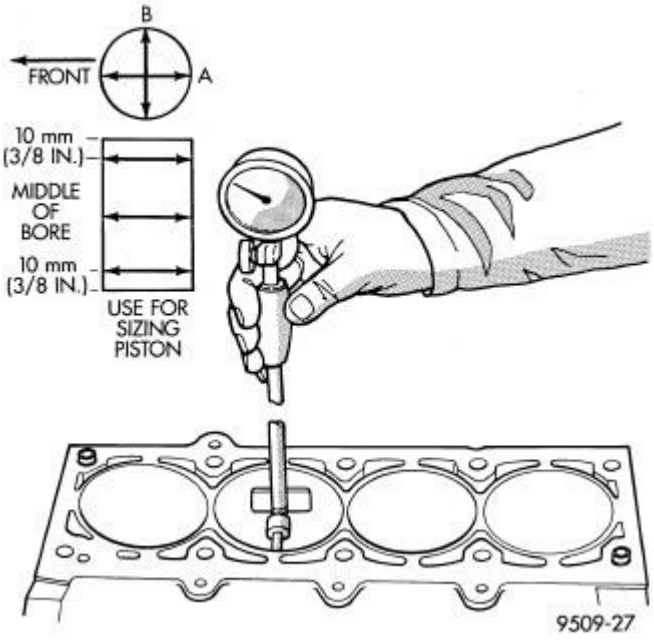


Fig. 260: Cylinder Bore Measurement
Courtesy of CHRYSLER LLC

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

CONNECTING RODS AND BEARINGS

CONNECTING ROD BEARINGS

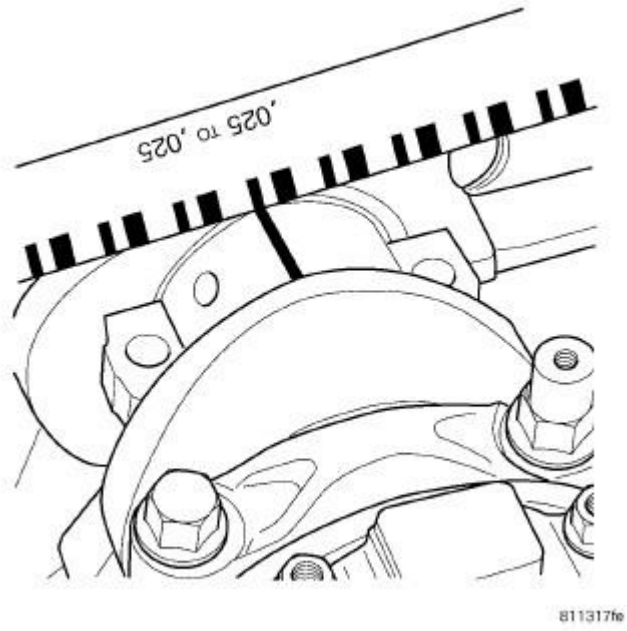


Fig. 261: CONNECTING ROD BEARING CLEARANCE
Courtesy of CHRYSLER LLC

The bearing caps are not interchangeable and should be marked at removal to insure 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.

Limits of taper or out-of-round on any crankshaft journals should be held to specification limits. Bearings are available in 0.007 mm oversize (0.0003 in oversize), standard, 0.007 mm (0.0003 in) undersize 0.025 mm (0.001 in) undersize, and 0.254 mm (0.010 in undersize. **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.**

1. For measuring main bearing clearance and connecting rod bearing clearance use plastigage. For more

information on using plastigage, see **Engine - Standard Procedure**. Refer to **Engine - Specifications** for bearing clearance specifications.

SELECT FIT ROD BEARINGS

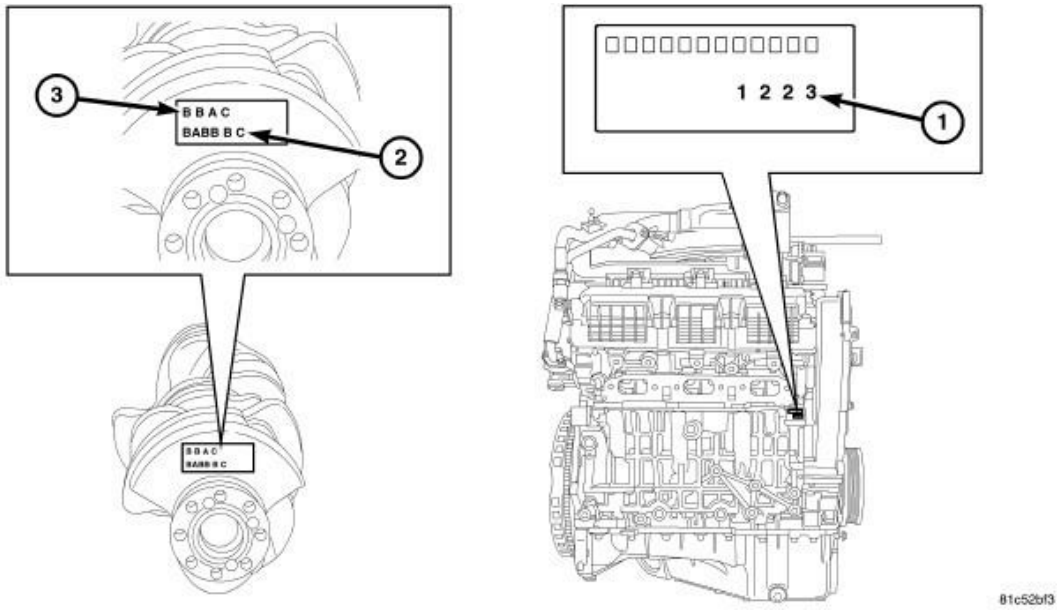


Fig. 262: Crankshaft Engine Block Codes
Courtesy of CHRYSLER LLC

1 - Engine Block Main Bearing Codes 2 - Rod Bearing Codes
3 - Crank Main Bearing Code

1. Connecting rod bearings use select fit to achieve improved clearance control. On a new engine, the crankshaft journal is gaged to use a specific bearing size. The grade is indicated on the #9 counterweight (2) of the crankshaft and listed from left to right with the recommended size.

SELECT FIT ROD BEARING GRADES

GRADE	ROD BEARING CLASS	DESCRIPTION
A	1	0.007 mm (0.0003 in) undersize (+0.0035 mm shell thickness)
B	2	Standard
C	3	0.007 mm (0.0003 in) Oversize (-0.0035 mm Shell Thickness)

How to Determine Rod Bearing Class

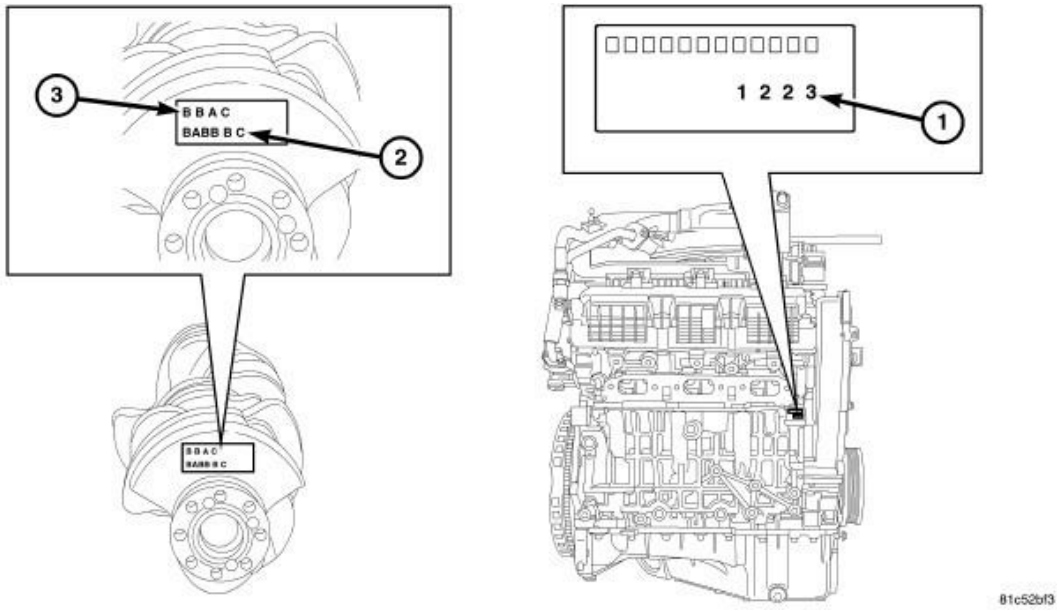


Fig. 263: Crankshaft Engine Block Codes
Courtesy of CHRYSLER LLC

1 - Engine Block Main Bearing Codes
2 - Rod Bearing Codes
3 - Crank Main Bearing Code

This example shows how to determine the bearing class needed for each rod bearing, assuming that a new crankshaft is being installed in a new or existing engine block. If the code 'B' 'A' 'B' 'B' 'B' 'C' is stamped on the #9 counterweight of the crankshaft (3), then rod #1 would require Class 2 bearings, rod #2 would require Class 1 bearings, rod #3 would require Class 2 bearings, rod #4 would require Class 2 bearings, rod #5 would require Class 2 bearings, and rod #6 would require Class 3 bearings.

EXAMPLE

ROD BEARING SELECTION DATA						
Crankshaft #9 Counterweight Rod Bearing Grade Codes	B	A	B	B	B	C
Required rod bearing class	**2**	**1**	**2**	**2**	**2**	**3**

CONNECTING ROD BOLTS

NOTE: The rod bearing bolts should be examined before reuse. If the threads are necked down the bolts must be replaced.

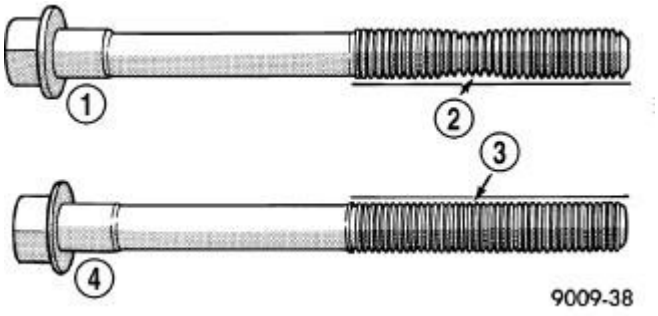


Fig. 264: Check for Stretched Bolts
Courtesy of CHRYSLER LLC

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

1. Examine connecting rod bolts for stretching. Stretching can be checked by holding a scale or straight edge against the threads. If all the threads do not contact the scale the bolt must be replaced.
2. Before installing the bolts the threads should be cleaned and inspected.
3. Install clean bolts finger tight. Then alternately torque each bolt to assemble the cap properly.
4. Tighten the connecting rod cap bolts to specification. See **Engine - Specifications**

CONNECTING ROD SIDE CLEARANCE

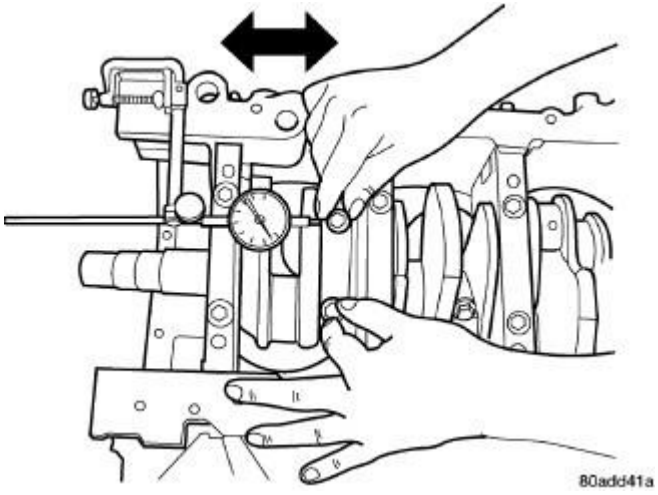


Fig. 265: Connecting Rod Side Clearance Measuring
Courtesy of CHRYSLER LLC

1. Mount a dial indicator to a stationary point on engine. Locate probe perpendicular to and resting against the connecting rod cap being checked. Move connecting rod all the way to rear of its travel (toward flywheel end of crank). Zero the dial indicator. Move connecting rod forward of to limit of travel (toward pulley end of crank) and read the dial indicator. Compare measurement to specification listed in engine

specifications. See **Engine - Specifications**. Repeat procedure for each connecting rod. Turn crankshaft for connecting rod accessibility.

BEARING(S), CRANKSHAFT, MAIN

Standard Procedure

CRANKSHAFT MAIN BEARING FITTING

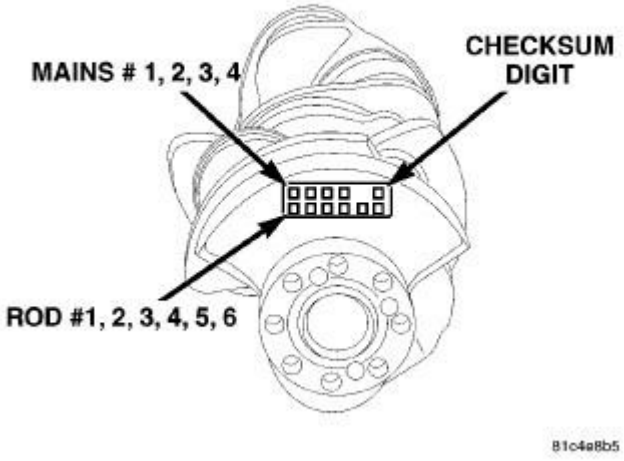


Fig. 266: Crankshaft Main Journal Grade Marking Location-Rear Of Block
Courtesy of CHRYSLER LLC

The main bearings use a "select fit" system to achieve proper oil clearances between the bearings and the crankshaft. When main bearings are being selected for a new crankshaft, the block and crankshaft grade identification marks must be used to identify the correct main bearings to use.

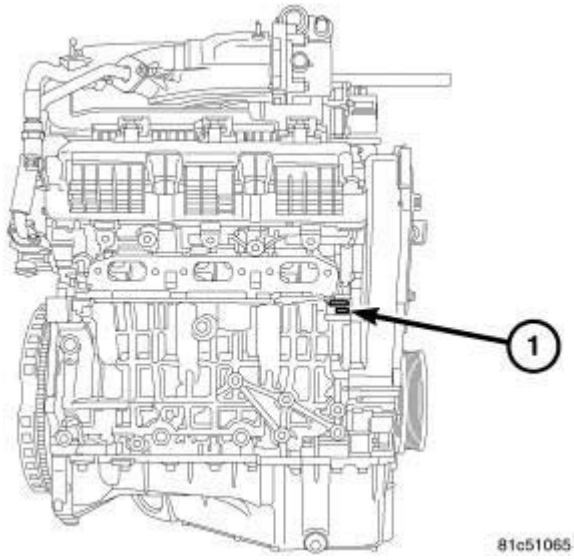


Fig. 267: Cylinder Block Main Bearing Bore Grade Codes
Courtesy of CHRYSLER LLC

1 - cylinder block main bearing bore grade codes

The cylinder block main bearing bore grade codes (1) are located on the left side front of the engine block, just below the cylinder head mounting surface. These grade marks (1, 2, 3, or 4) are read left to right, corresponding to main bearing bore 1, 2, 3, or 4.

The grade marks for the crankshaft are located on the rearmost crankshaft counter weight. The crankshaft journal grade marks (A, B, or C) are read left to right, corresponding with journal number 1, 2, 3, 4. For an example, if the main bore grade on the side of the engine block is 3 and the journal grade on the #9 counterweight of the crankshaft is B, the proper select fit bearing would be a (2) +0.003 mm (+0.0001 in.).

Refer to the **EXAMPLE CRANKSHAFT MAIN BEARING SELECTION DATA** table for a more detailed example of how to properly select the main bearings.

NOTE: Service main bearings have a number from (1-5) marked in ink on the bearing surface. For verification, refer to the MAIN BEARING SELECTION CHART table for number to size identification.

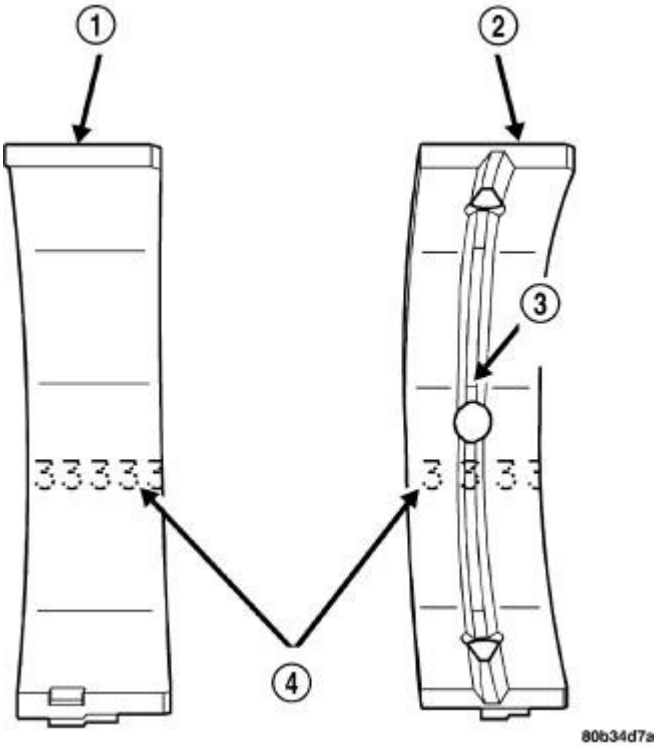


Fig. 268: Main Bearing Grade Marks
Courtesy of CHRYSLER LLC

1 - LOWER MAIN BEARING
2 - UPPER MAIN BEARING
3 - OIL FEED HOLE AND GROOVE
4 - GRADE SELECTION INK MARKS

The upper main bearing (2) has an oil feed hole and a center groove to allow lubrication of the main journal and must be properly positioned in the block.

MAIN BEARING SELECTION CHART

-	Crankshaft Journal Grade Mark	Main Bearing Bore Grade Marks		
		1	2	3
Crankshaft Main Journal Grade Marks	A	(3) Standard	(2) +.003 mm (+0.0001 in.)	(1) +0.006 mm (+0.0002 in.)
	B	(4) -0.003 mm (-0.0001 in.)	(3) Standard	(2) +.003 mm (+0.0001 in.)
	C	(5) -0.006 mm (-0.0002 in.)	(4) -0.003 mm (-0.0001 in.)	(3) Standard

How to Determine Crankshaft Main Bearing Class

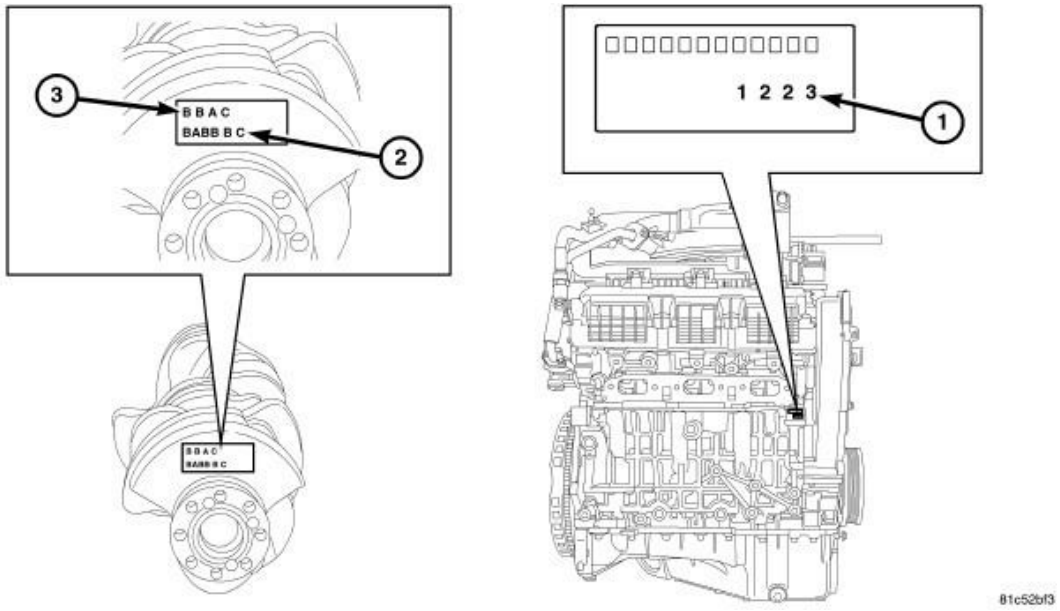


Fig. 269: Crankshaft Engine Block Codes
Courtesy of CHRYSLER LLC

1 - Engine Block Main Bearing Codes 2 - Rod Bearing Codes
3 - Crank Main Bearing Code

This example shows how to determine the bearing class needed for each crankshaft main journal, assuming that a new crankshaft is being installed in a new or existing engine block. If the code 'B' 'B' 'A' 'C' is stamped on the #9 counterweight of the crankshaft (3), and the code '1' '2' '2' '3' is stamped on the side of the engine block (1), then main #1 would require Class 4 bearings, main #2 would require Class 3 bearings, main #3 would require Class 2 bearings, and main #4 would require Class 3 bearings.

EXAMPLE CRANKSHAFT MAIN BEARING SELECTION DATA

Crankshaft Main Journal Grade Codes	**B**	**B**	**A**	**C**
Cylinder Block Main Journal Grade Codes	1	2	2	3
Required bearing class	**4**	**3**	**2**	**3**

Removal

REMOVAL

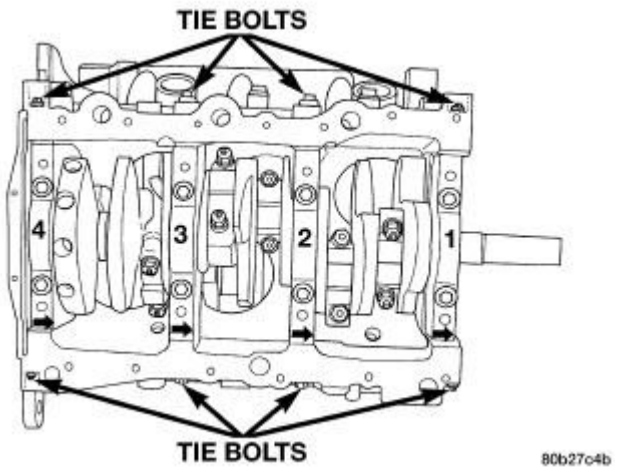


Fig. 270: Main Bearing Cap Identification
Courtesy of CHRYSLER LLC

Bearing caps are not interchangeable and are marked to insure correct assembly. Upper and lower bearing halves are NOT interchangeable.

1. Remove oil pan. See **Engine/Lubrication/PAN, Oil - Removal**
2. Remove oil pick-up tube and windage tray.
3. Identify bearing caps before removal.

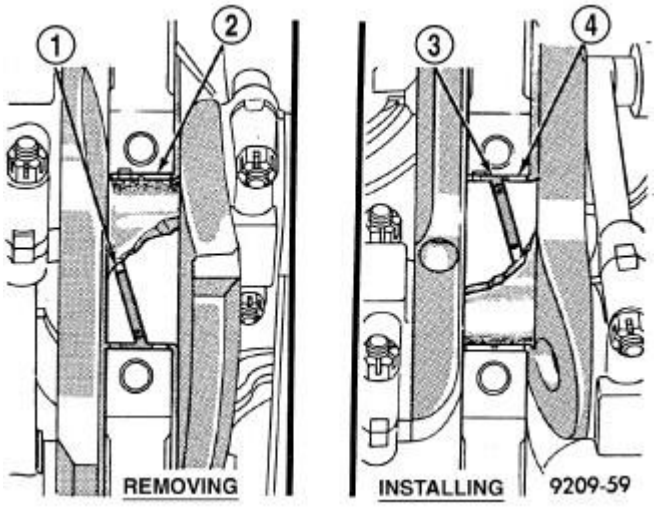


Fig. 271: Removing & Installing Upper Main Bearing With Special Tool C-3059C
Courtesy of CHRYSLER LLC

4. Remove bearing caps one at a time. Remove upper half of bearing (2 and 4) by inserting Special Main Bearing Tool C-3059A (1 and 3) into the oil hole of crankshaft.
5. Slowly rotate crankshaft clockwise, forcing out upper half of bearing shell.

Installation

INSTALLATION

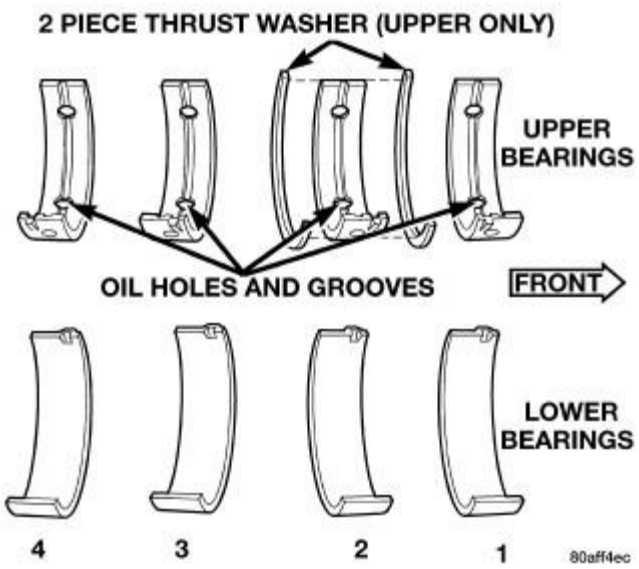


Fig. 272: Main Bearing Identification
Courtesy of CHRYSLER LLC

Bearing caps are not interchangeable and are marked to insure correct assembly. Upper and lower bearing halves are NOT interchangeable.

CAUTION: Main bearings are select fit. See Engine/Engine Block/BEARING(S), Crankshaft - Standard Procedure

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

When installing a new upper bearing shell, slightly chamfer the sharp edges from the plain side.

1. Lubricate main bearing with clean engine oil.
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.

NOTE: Lubricate main bearing cap bolts with engine oil before installation.

4. Lubricate and install lower bearing half and main cap Tighten bolts finger tight.

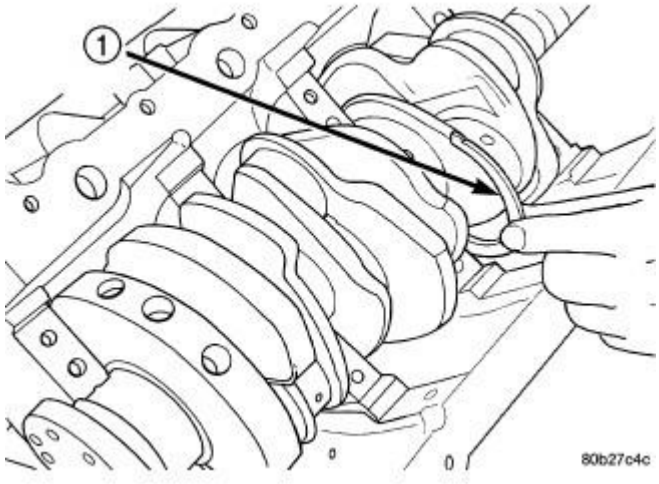


Fig. 273: Thrust Washer Installation
Courtesy of CHRYSLER LLC

5. For installing thrust washers (1) at the No. 2 main bearing location, use the following procedure:
   a. Move crankshaft forward to limit of travel. Lubricate and install the front thrust washer by rolling the washer (1) onto the machined shelf between the No. 2 upper main bulk head and crankshaft thrust surface.
   b. Move crankshaft rearward to limit of travel. Lubricate and install the rear thrust washer by rolling the washer onto the machined shelf between the No. 2 upper main bulk head and crankshaft thrust surface.

   The main bearing cap bolts must be tightened in the proper sequence. First the inner main cap bolts, secondly the windage tray bolts, lastly the main cap tie (horizontal) bolts.

6. Install each main bearing cap and tighten inner bolts finger tight.
7. Tighten inner main bearing cap bolts to 20 N.m + 1/4 turn (15 ft. lbs. + 1/4 turn).
8. Measure crankshaft end play. See **Engine/Engine Block/CRANKSHAFT - Standard Procedure**
9. Install windage tray. Lubricate bolts with engine oil and tighten to 27 N.m + 1/4 turn (20 ft. lbs. + 1/4 turn).
10. Install the main cap tie (horizontal) bolts and tighten to 28 N.m (250 in. lbs.).
11. Install oil pick-up tube.
12. Install oil pan. See **Engine/Lubrication/PAN, Oil - Installation**
13. Fill engine crankcase with proper oil to correct level.

CRANKSHAFT

Description

DESCRIPTION

The crankshaft is constructed of a forged micro alloy steel. A six throw, nine counterweight crankshaft is

supported by four select fit main bearings with number two serving as the thrust washer location. The six separate connecting rod throws are an even-firing design which reduces torque fluctuations while a torsional vibration damper is used to control torsion caused vibration of the crankshaft. Rubber lipped seals are used at front and rear. The front seal is retained in the oil pump case and the rear seal is retained in a block-mounted housing.

Operation

OPERATION

The crankshaft transfers force generated by combustion within the cylinder to the flywheel or flexplate.

Standard Procedure

MEASURING CRANKSHAFT END PLAY

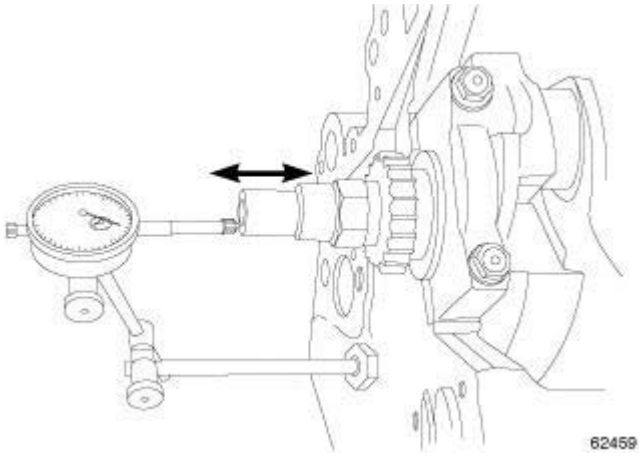


Fig. 274: CRANKSHAFT END PLAY TYPICAL
Courtesy of CHRYSLER LLC

1. Mount a dial indicator to front of engine with the locating probe on nose of crankshaft.
2. Move crankshaft all the way to the rear of its travel.
3. Zero the dial indicator.
4. Move crankshaft all the way to the front and read the dial indicator. Crankshaft end play must be within specification. See **Engine - Specifications**.

Removal

REMOVAL

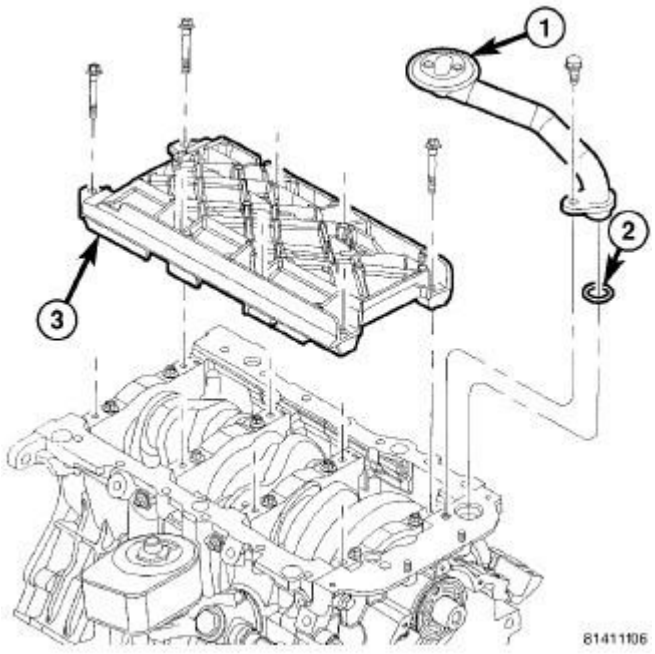


Fig. 275: OIL PICK UP TUBE & WINDAGE TRAY
Courtesy of CHRYSLER LLC

1 - OIL PICK UP TUBE 2 - SEAL 3 - WINDAGE TRAY

1. Remove engine from vehicle. See **Engine - Removal**.
2. Remove oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.
3. Remove oil pickup tube (1) and windage tray (3).
4. Remove front timing belt cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.
5. Remove timing belt and tensioner. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Removal**.
6. Remove crankshaft sprocket. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Removal**.
7. Tap dowel pin out of crankshaft.
8. Remove oil pump assembly. See **Engine/Lubrication/PUMP, Engine Oil - Removal**.

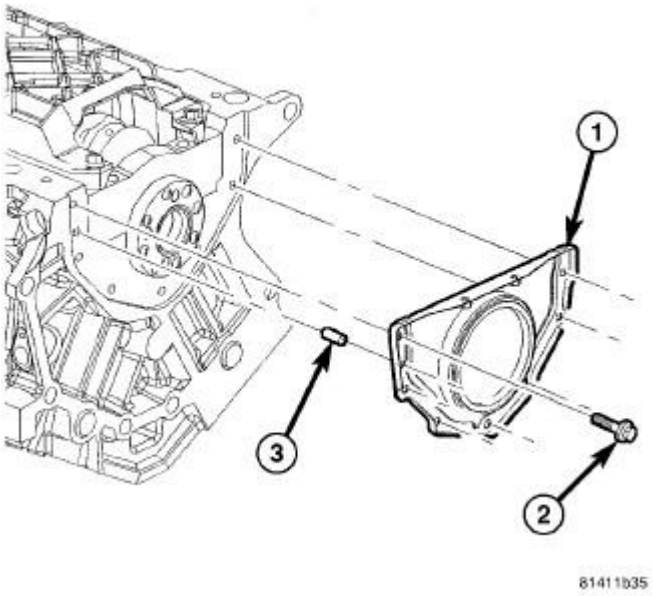


Fig. 276: REAR CRANKSHAFT OIL SEAL & RETAINER
Courtesy of CHRYSLER LLC

1 - REAR OIL SEAL AND RETAINER ASSEMBLY
2 - BOLT
3 - ALIGNMENT DOWEL

9. Remove crankshaft rear oil seal retainer (1).

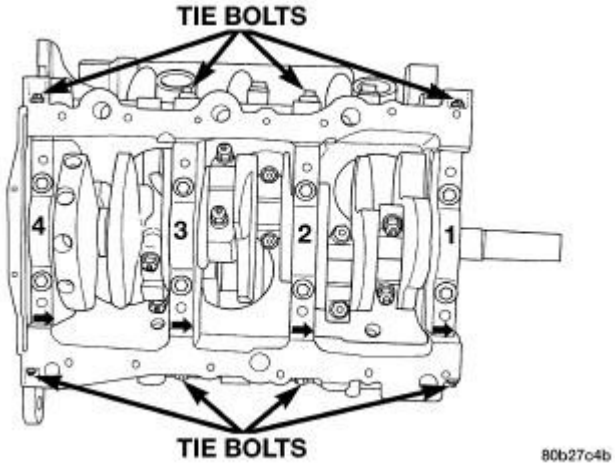


Fig. 277: Main Bearing Cap Identification
Courtesy of CHRYSLER LLC

NOTE: Do not use a metal stamp to mark the bearing caps. Do use a scribe or paint mark.

10. Identify rod bearing caps before removal. Also scribe a location reference mark from the #2 main bearing cap to the engine block to use as a guide during reassembly.
11. Remove connecting rod bearing caps. Connecting rod bearing caps are not interchangeable and should be paint marked or scribed before removal to insure correct assembly.

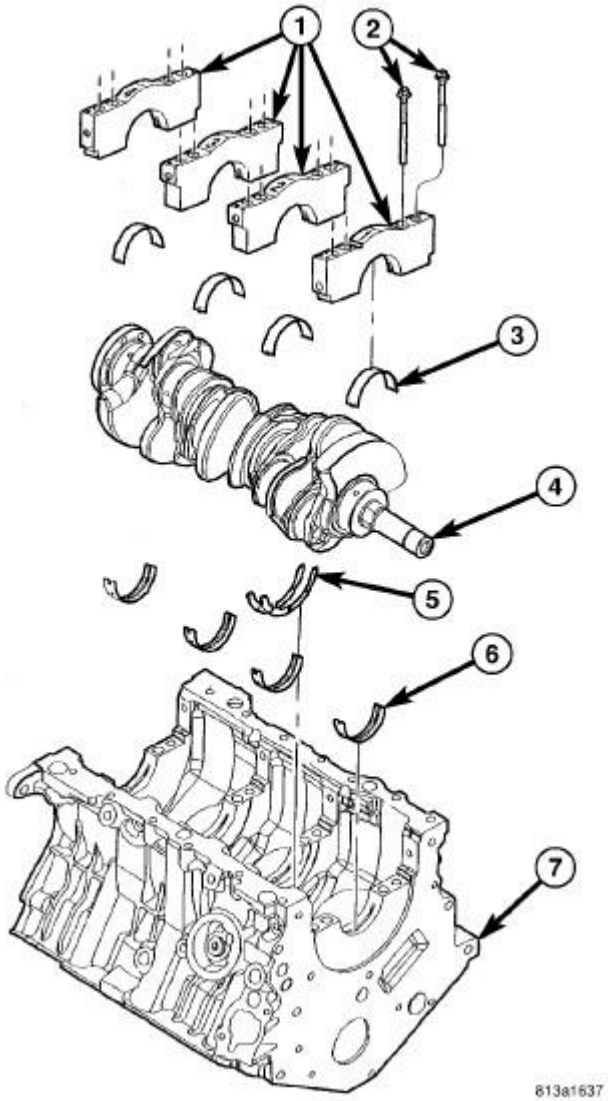


Fig. 278: Cylinder Block & Crankshaft
Courtesy of CHRYSLER LLC

12. Remove main bearing caps (1). Main bearing caps are not interchangeable and are marked to insure correct assembly and location.

13. Remove crankshaft (4) from cylinder block (7).

NOTE: Before installing crankshaft, refer to fitting of main bearings and installation of connecting rod bearings. See Engine/Engine Block/BEARING(S), Crankshaft - Standard Procedure and Engine/Engine Block/BEARING(S), Connecting Rod - Standard Procedure.

Inspection

INSPECTION

The crankshaft journals should be checked for excessive wear, taper and scoring. Limits of taper on any crankshaft journals should be held to 0.015 mm (0.0006 in.). Limits for journal roundness should be 0.010 mm (0.0004 in.). Journal grinding should not exceed 0.254 mm (0.010 in.) under the standard journal diameter. DO NOT grind thrust faces of Number 2 main bearing. DO NOT nick crank pin or bearing fillets. After grinding, remove rough edges from crankshaft oil holes and clean out all passages.

CAUTION: With a forged steel crankshaft it is important that the final paper or cloth polish after any journal regrind be in the same direction as normal rotation in the engine.

Installation

INSTALLATION

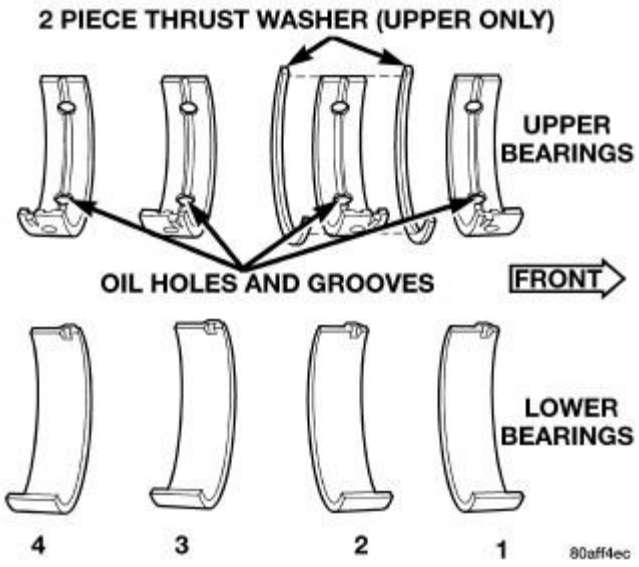


Fig. 279: Main Bearing Identification
Courtesy of CHRYSLER LLC

CAUTION: Main bearings are select fit. See Engine/Engine Block/BEARING(S),

Crankshaft - Standard Procedure for proper bearing size selection.

1. Install crankshaft upper main bearings in cylinder block. Ensure oil holes in bearings line up with oil holes in cylinder block. See **Engine/Engine Block/BEARING(S), Crankshaft - Standard Procedure**.
2. Install the crankshaft to cylinder block.

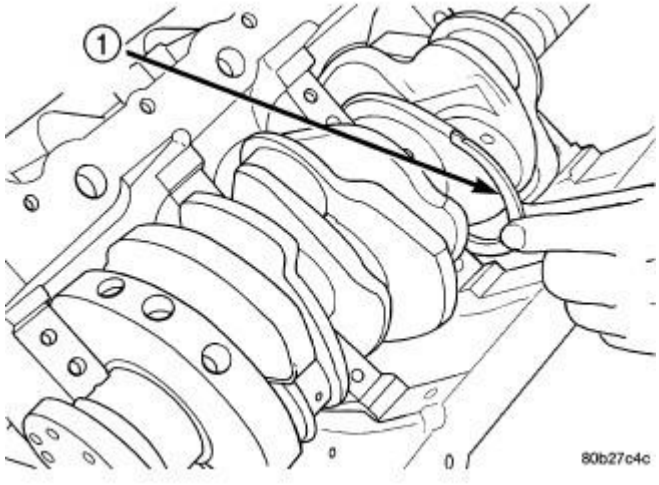


Fig. 280: Thrust Washer Installation
Courtesy of CHRYSLER LLC

1 - FRONT THRUST WASHER

3. Move crankshaft forward to limit of travel. Lubricate and install the front thrust washer by rolling the washer onto the machined shelf between the No. 2 upper main bulk head and crankshaft thrust surface.
4. Move crankshaft rearward to limit of travel. Lubricate and install the rear thrust washer by rolling the washer onto the machined shelf between the No. 2 upper main bulk head and crankshaft thrust surface.

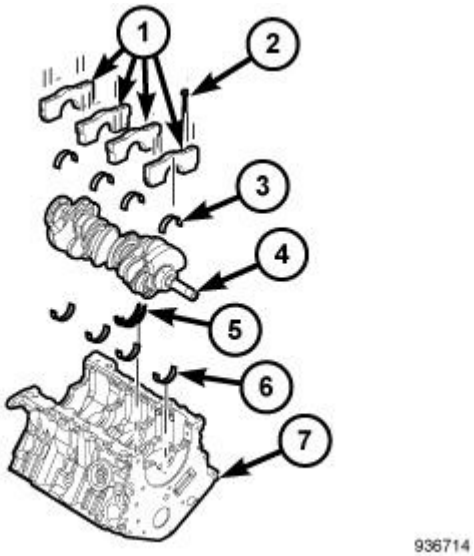


Fig. 281: Main Bearings Assembly
Courtesy of CHRYSLER LLC

5. Install lower main bearings (3) into main main bearing caps (1).
6. Lubricate lower main bearings (3) with clean engine oil.

NOTE: Lubricate main bearing cap inner bolts (2) with engine oil before installation.

7. Install each main cap (1) and tighten inner bolts (2) finger tight. Align the location reference mark scribed on the #2 main bearing cap during disassembly.

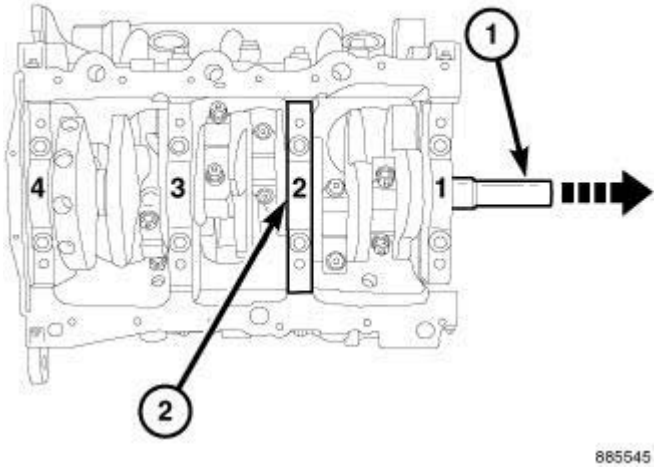


Fig. 282: Moving Crankshaft Forward To Limit Of Travel
Courtesy of CHRYSLER LLC

CAUTION: The #2 main bearing cap must be centered over the inner bolt holes located on the block. Failure to center the bearing cap can result in contact with the crankshaft counterweights and thrust bearing failure.

8. Verify that the #2 main bearing cap is properly centered over the inner bolt holes located in the block. Tighten main bearing cap inner bolts to 20 N.m (15 ft. lbs.).
9. Move crankshaft (1) forward to limit of travel so that crankshaft thrust face (2) is tight against thrust bearing.
10. Verify that a 0.25 mm (0.010 inch) shim or feeler gage will fit between the #2 main cap (rear face) and the crankshaft thrust face. Slide the gage side-to-side all of the way across the cap making sure that the clearance at all areas exceeds 0.25 mm (0.010 inch). The feeler gage should slide all the way down to the #2 main journal.

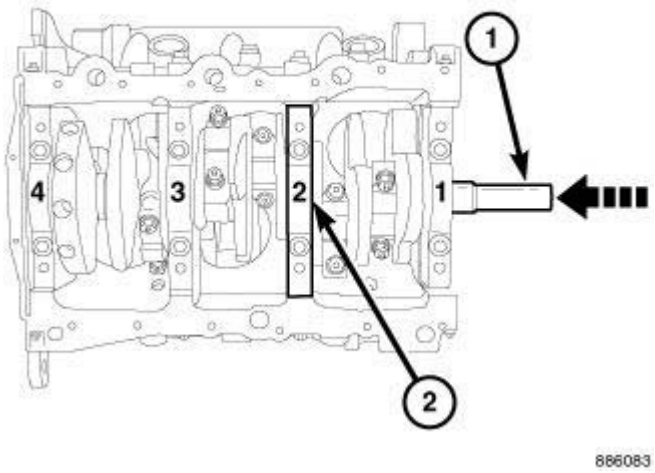


Fig. 283: Moving Crankshaft Rearward To Limit Of Travel
Courtesy of CHRYSLER LLC

11. Move crankshaft (1) rearward to limit of travel so that crankshaft thrust face (2) is tight against thrust bearing.
12. Verify that a 0.25 mm (0.010 inch) shim or feeler gage will fit between the #2 main cap (front face) and the crankshaft thrust face. Slide the gage side-to-side all of the way across the cap making sure that the clearance at all areas exceeds 0.25 mm (0.010 inch). The feeler gage should slide all the way down to the #2 main journal.
13. A properly centered #2 main bearing cap has a minimum of 0.25 mm (0.010 inch) clearance in both the forward and rearward crankshaft positions. If measured clearance is less than 0.25 mm (0.010 inch), loosen and reposition #2 main bearing cap until this minimum clearance can be verified by repeating this procedure.
14. Following verification of proper #2 bearing cap centering, finish tightening the main bearing cap inner bolts an additional 90° turn.

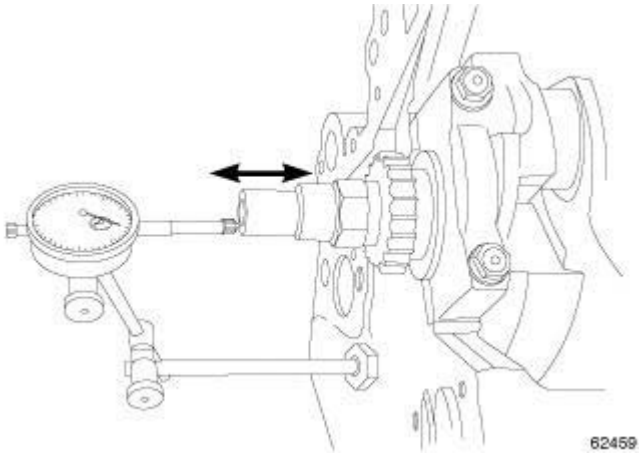


Fig. 284: CRANKSHAFT END PLAY TYPICAL
Courtesy of CHRYSLER LLC

15. Measure crankshaft end play. See **Engine/Engine Block/CRANKSHAFT - Standard Procedure**.

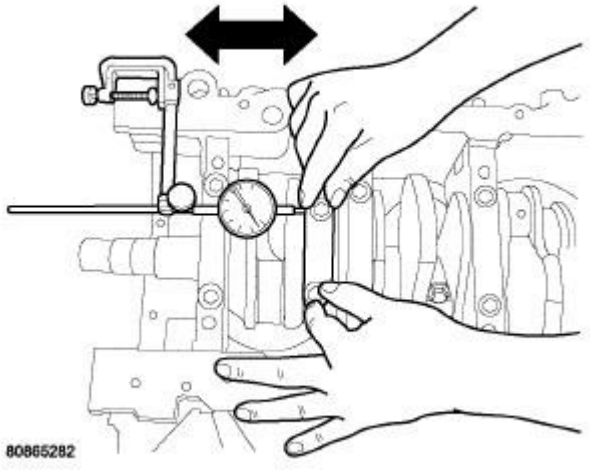


Fig. 285: Measuring Connecting Rod Side Clearance
Courtesy of CHRYSLER LLC

16. Install connecting rods and measure side clearance. See **Engine/Engine Block/BEARING(S), Connecting Rod - Standard Procedure**.

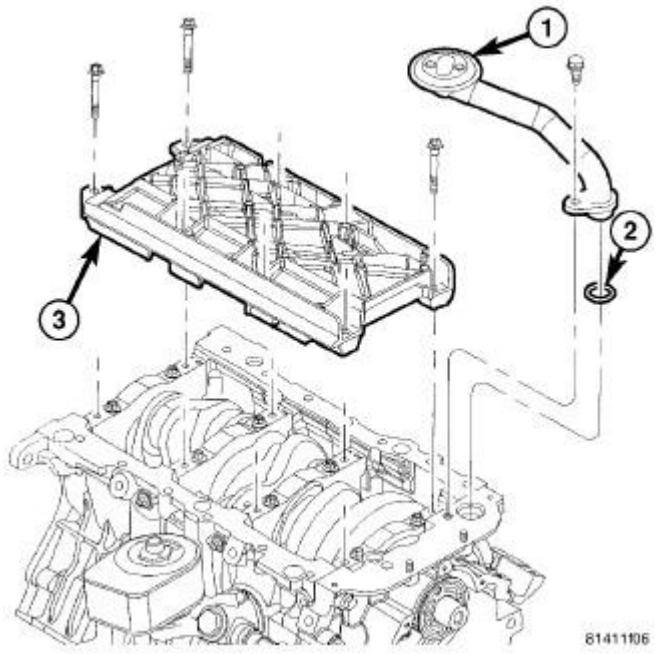


Fig. 286: OIL PICK UP TUBE & WINDAGE TRAY
Courtesy of CHRYSLER LLC

1 - OIL PICK UP TUBE
2 - SEAL
3 - WINDAGE TRAY

NOTE: The main bearing cap bolts must be tightened in the proper sequence. First the inner main cap bolts, secondly the windage tray bolts, lastly the main cap tie (horizontal) bolts.

17. Install windage tray (3). Lubricate bolts with engine oil. Finger tighten all bolts first, then tighten to 28 N.m + 90° turn (20 ft. lbs. + 90° turn) beginning with the inside bolts tightening outward.
18. Install oil pickup tube (1) and tighten bolt to 28 N.m (20 ft. lbs.).

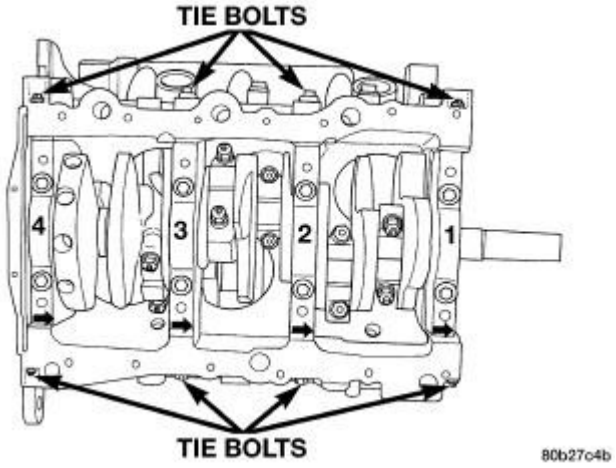


Fig. 287: Main Bearing Cap Identification
Courtesy of CHRYSLER LLC

19. Install the main cap tie (horizontal) bolts and tighten to 28 N.m (20 ft. lbs.).

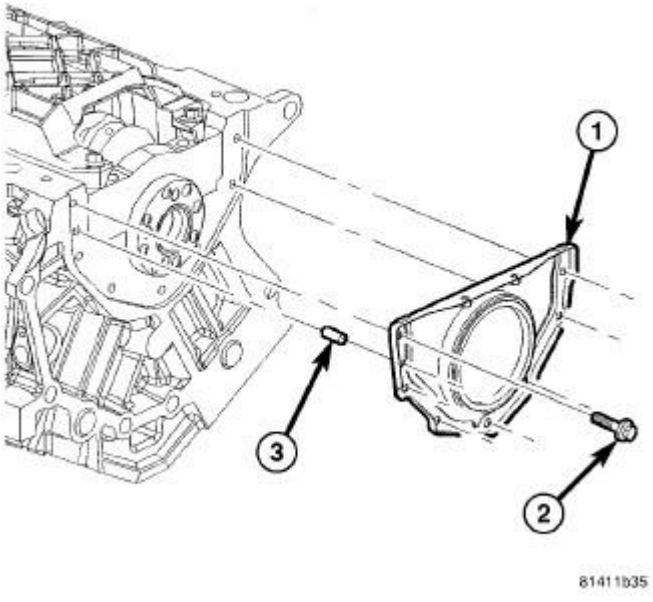


Fig. 288: REAR CRANKSHAFT OIL SEAL & RETAINER
Courtesy of CHRYSLER LLC

1 - REAR OIL SEAL AND RETAINER ASSEMBLY
2 - BOLT
3 - ALIGNMENT DOWEL

20. Install rear crankshaft oil seal retainer and oil seal. See **Engine/Engine Block/RETAINER, Crankshaft**

Rear Oil Seal - Installation and. See **Engine/Engine Block/SEAL, Crankshaft Oil - Installation**.

21. Install oil pump assembly. See **Engine/Lubrication/PUMP, Engine Oil - Installation**.
22. Install dowel pin in crankshaft. See **Engine/Engine Block/SEAL, Crankshaft Oil - Installation**.
23. Install crankshaft sprocket. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Installation**.
24. Install timing belt and tensioner. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Installation**.
25. Install front timing belt cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Installation**.
26. Install oil pan. See **Engine/Lubrication/PAN, Oil - Installation**.
27. Install engine assembly. See **Engine - Installation**.
28. Fill engine crankcase with proper amount of oil.

DAMPER, VIBRATION

Removal

REMOVAL

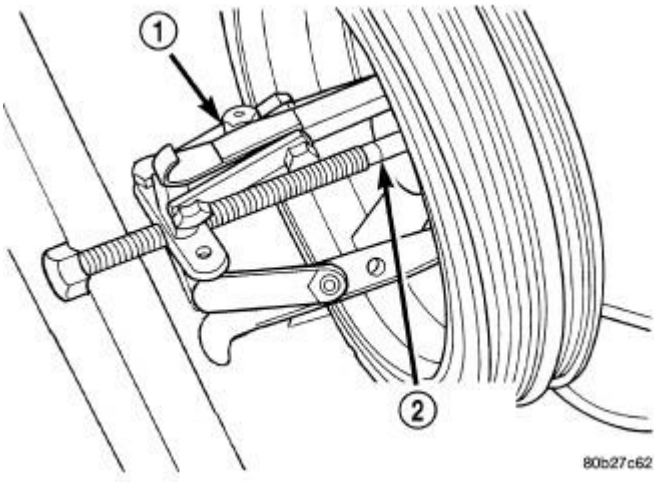


Fig. 289: Crankshaft Damper-Removal
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Raise vehicle on hoist.
3. Remove the right engine mount. See **Engine/Engine Mounting/INSULATOR, Engine Mount - Removal**.
4. Remove the right front wheel and accessory drive belt splash shield.
5. Remove accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal** .
6. Suitably support the engine.
7. Remove the lower crossmember. Refer to **Frame and Bumpers/Frame/CROSSMEMBER - Removal** .

8. Low the engine.
9. Remove vibration damper bolt.
10. Use Special Tool 1023 puller (1) , and insert 9020 (2), remove crankshaft damper.

Installation

INSTALLATION

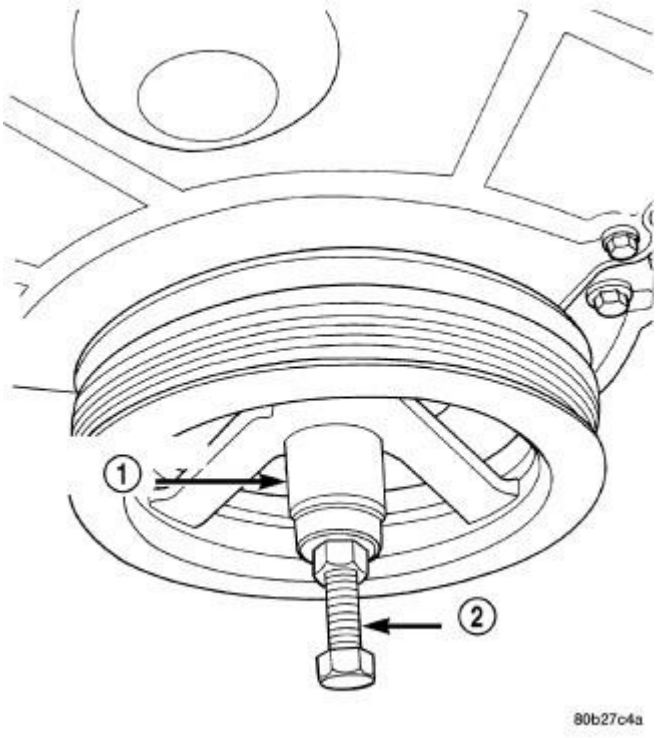


Fig. 290: Crankshaft Damper-Installation
Courtesy of CHRYSLER LLC

1. Install crankshaft damper using Special Tools C-4685-C1 (5.9 in.) Bolt (2), with Nut and Thrust Bearing from 6792, and 6792-1 (1) Installer.
2. Install vibration damper bolt. Torque bolt to 95 N.m (70 ft. lbs.).
3. Install the lower crossmember. Refer to **Frame and Bumpers/Frame/CROSSMEMBER - Installation** .
4. Install accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation** .
5. Install the accessory drive belt splash shield and right front wheel.
6. Lower vehicle.
7. Install the right engine mount. See **Engine/Engine Mounting/INSULATOR, Engine Mount - Installation**.
8. Connect the negative battery cable.

FLEXPLATE

Removal

REMOVAL

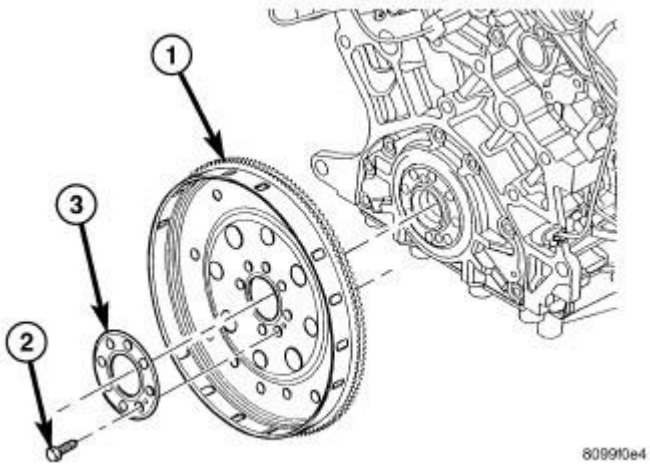


Fig. 291: FLEX PLATE
Courtesy of CHRYSLER LLC

1. Remove the transaxle. Refer to **Transmission and Transfer Case/Automatic - 41TE - Removal** or **Transmission and Transfer Case/Automatic - 62TE - Removal** .
2. Remove 8 flex plate attaching bolts (2).
3. Remove backing plate (3)
4. Remove the flex plate (1).

Installation

INSTALLATION

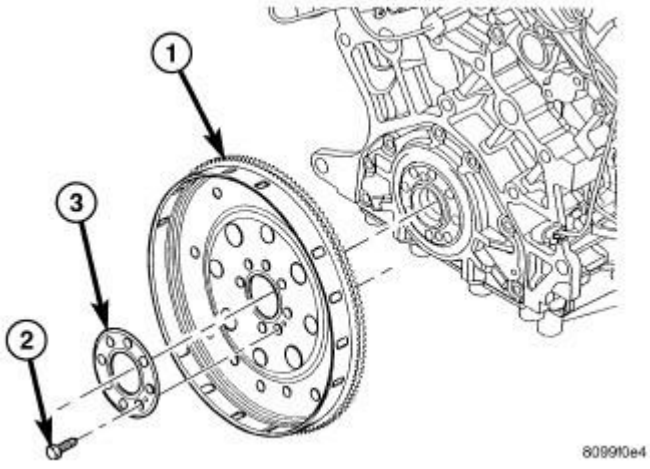


Fig. 292: FLEX PLATE

Courtesy of CHRYSLER LLC

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 - 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 .

RETAINER, CRANKSHAFT REAR OIL SEAL

Removal

REMOVAL

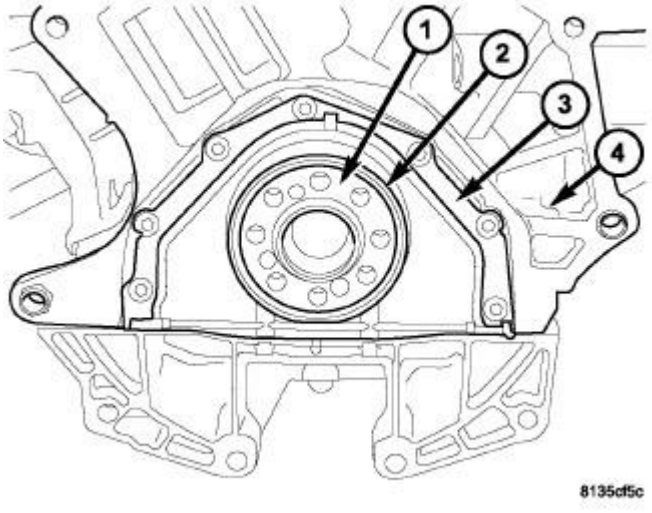


Fig. 293: REAR MAIN SEAL & RETAINER
Courtesy of CHRYSLER LLC

1 - CRANKSHAFT
2 - REAR CRANKSHAFT OIL SEAL
3 - REAR CRANKSHAFT OIL SEAL RETAINER
4 - ENGINE BLOCK

1. Remove the engine oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.

2. Lower the weight of the engine back onto the engine mounts.

NOTE: Before separating the transmission from the engine, use an appropriate support fixture or lifting device to support the weight of the engine.

3. Remove transmission from vehicle.
4. Remove the flex plate.
5. Remove the rear crankshaft oil seal retainer bolts.
6. Remove the crankshaft oil seal and clean all mating surfaces.

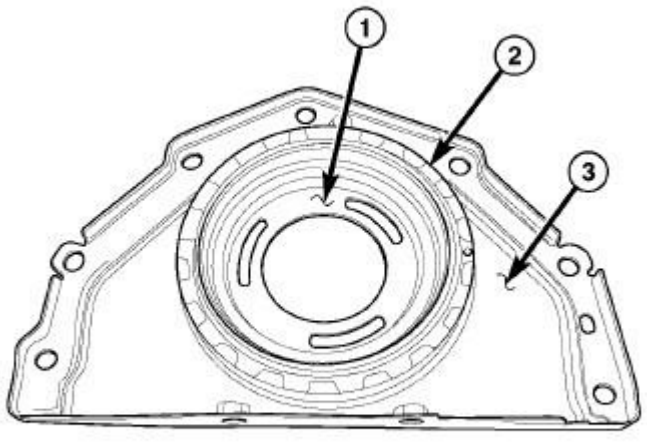
Installation

INSTALLATION

CAUTION: If a burr or scratch is present on the crankshaft edge (chamfer), clean surface using 400 grit sand paper to prevent seal damage during installation. Make sure the rear crankshaft oil seal surface is clean and free of any abrasive materials.

NOTE: The rear crankshaft oil seal and retainer are an assembly. DO NOT separate the seal protector from the rear crankshaft oil seal before installation on engine. Damage to the seal lip will occur if the seal protector is removed and installed prior to installation on engine.

1. Apply engine oil to crankshaft seal surface.



8137ce76

Fig. 294: CRANKSHAFT OIL SEAL - REAR
Courtesy of CHRYSLER LLC

1 - SEAL PROTECTOR
2 - SEAL
3 - RETAINER

2. If the seal protector (1) is missing or was accidentally dislodged, go to step 3. Otherwise, carefully position the oil seal retainer assembly (3), and seal protector (1) on crankshaft and push firmly into place on engine block (during this step, the seal protector will be pushed from the rear oil seal assembly as a result of installing the rear oil seal). Hand tighten the rear oil seal fasteners, and go to step 4.

NOTE: The seal lip (2) must always uniformly curl inward toward the engine on the crankshaft (1).

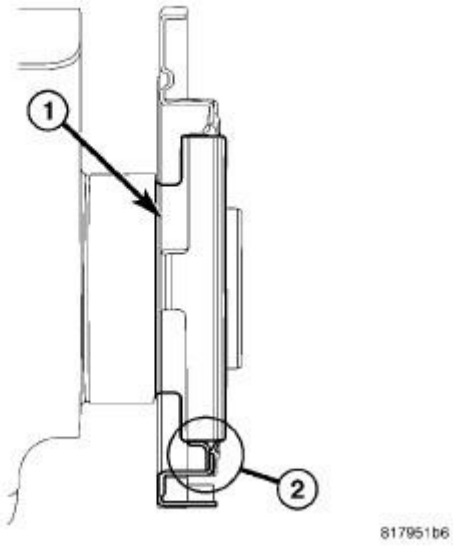


Fig. 295: REAR SEAL INSTALLED
Courtesy of CHRYSLER LLC

CAUTION: If for any reason the installation sleeve is missing or dislodged from rear crankshaft oil seal prior to installation, the following procedure must be performed.

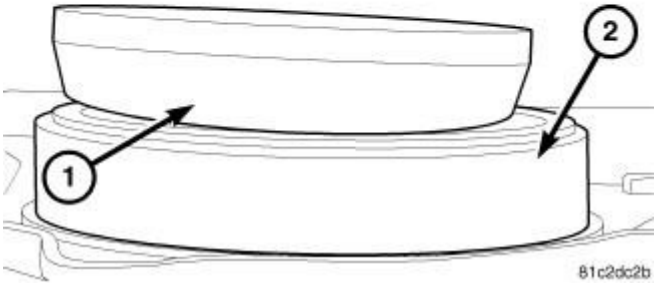


Fig. 296: Rear Crankshaft Oil Seal Assembly
Courtesy of CHRYSLER LLC

3. Using the chamfered seal guide from Special Tool 6926, insert the tapered end (1) into the transmission side of the rear crankshaft oil seal assembly (2), and push the seal guide through the seal assembly. This will ensure the seal lip is positioned toward the engine when the seal assembly is installed. When the seal lip is correctly positioned, go to step 2.

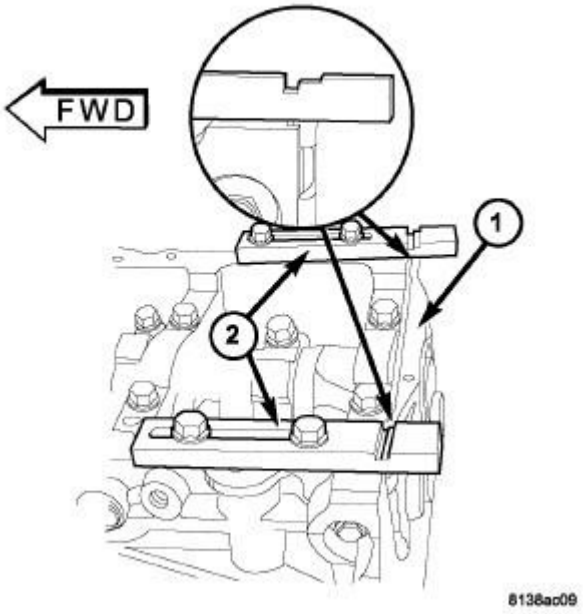


Fig. 297: REAR CRANKSHAFT SEAL RETAINER ALIGNMENT
Courtesy of CHRYSLER LLC

1 - SEAL RETAINER

2 - SPECIAL TOOLS 8225

NOTE: The following steps must be performed to prevent oil leaks at sealing joints.

4. Attach Special Tools 8225 (1) to pan rail using the oil pan fasteners.

NOTE: Special Tools 8225 (1), are use to assist with the fit of the flush mount rear main seal retainer. The notch on tool should be located away the seal retainer.

5. While applying firm pressure to the seal retainer against Special Tools 8225 (1), tighten seal retainer screws to 12 N.m (105 in. lbs.).
6. Remove special tool #8225 (1).

NOTE: Make sure that the seal flange is flush with the block oil pan sealing surface.

7. Install oil pan. Tighten the 6 mm fasteners to 12 N.m (105 in. lbs.) and the 8 mm fasteners to 28 N.m (250 in. lbs.).
8. Install the flex plate and transmission.

RING(S), PISTON

Description

DESCRIPTION

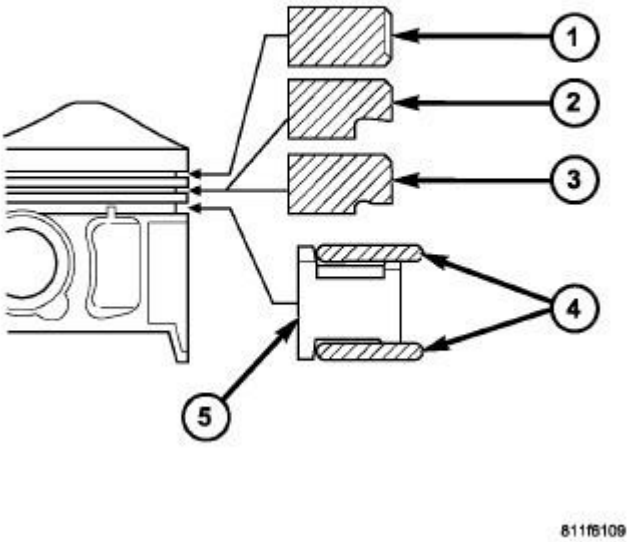


Fig. 298: PISTON RINGS
Courtesy of CHRYSLER LLC

The piston rings include a moly-filled top ring with a symmetrical barrel face. The intermediate piston ring (2 and 3) is of the Micro-Napier design. The Micro-Napier design has a reduced "hook" on the running face, removes the need for chroming and improves oil economy. The oil control package consists of two steel rails and an expander spacer.

Standard Procedure

PISTON RING FITTING

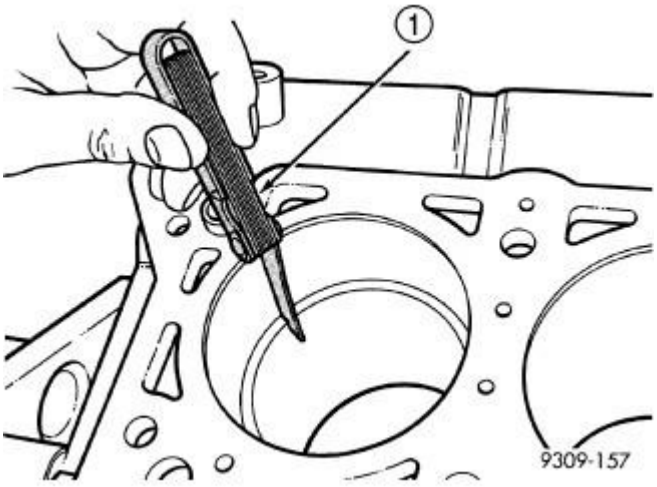


Fig. 299: CHECK GAP ON PISTON RINGS

Courtesy of CHRYSLER LLC

1. Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 12 mm (0.50 in.) from bottom of cylinder bore. Check gap with feeler gauge (1). For clearance specifications. See **Engine - Specifications**.

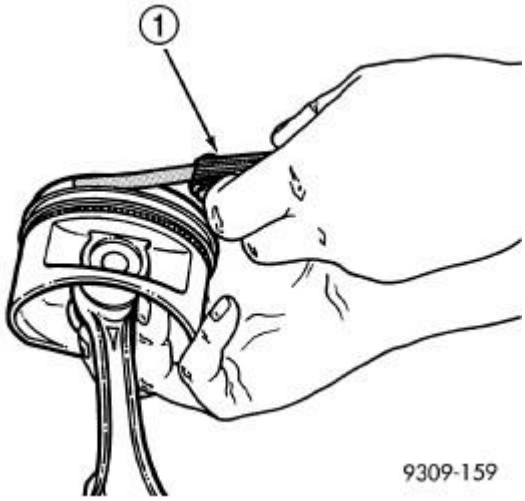


Fig. 300: MEASURING PISTON RING SIDE CLEARANCE
Courtesy of CHRYSLER LLC

1 - FEELER GAUGE

2. Check piston ring to groove clearance (1). For clearance specifications. See **Engine - Specifications**.

Removal

REMOVAL

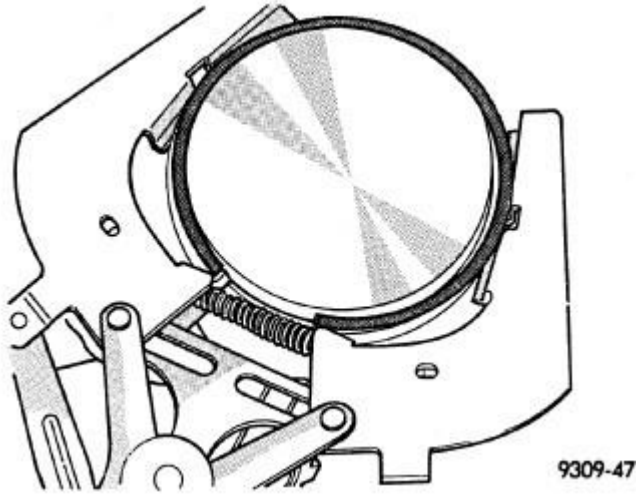


Fig. 301: Removing/Installing Upper And Intermediate Rings
Courtesy of CHRYSLER LLC

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

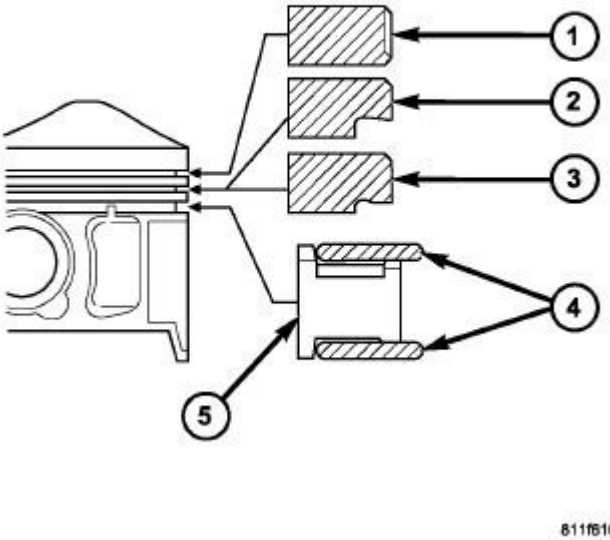


Fig. 302: PISTON RINGS
Courtesy of CHRYSLER LLC

1. Measure clearance of piston rings to the cylinder bore and piston. See **Engine/Engine Block/RING(S), Piston - Standard Procedure**

   The No. 1 and No. 2 piston rings have a different cross section. Ensure that which ever design No. 2 ring is installed, it is installed with manufacturers I.D. mark (dot) facing up, towards top of the piston. See **Engine/Engine Block/RING(S), Piston - Description**.

   Do not use a piston ring expander during this step.

   - Oil ring expander.
   - Lower oil ring side rail.
   - Upper oil ring side rail.

- No. 2 Intermediate piston ring.
- No. 1 Upper piston ring.

2. Install the side rail (1) 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.

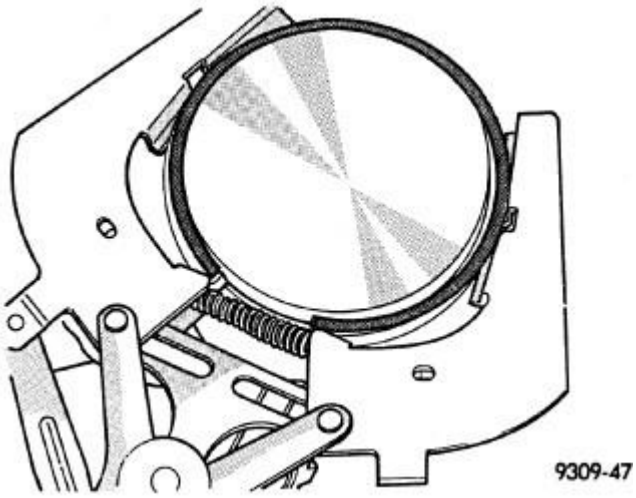


Fig. 303: Removing/Installing Upper And Intermediate Rings
Courtesy of CHRYSLER LLC

The No. 1 and No. 2 piston rings have a different cross section. Ensure that when the No. 2 ring is installed, it is installed with manufacturers I.D. mark facing up, towards top of the piston. See **Engine/Engine Block/RING(S), Piston - Description**.

3. Install upper side rail first and then the lower side rail.
4. Install the No. 2 piston ring and then No. 1 piston ring.

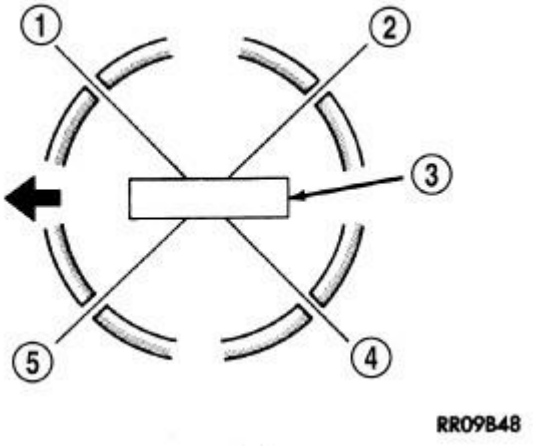


Fig. 304: PISTON RING END GAP POSITION
Courtesy of CHRYSLER LLC

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

ROD, PISTON AND CONNECTING

Description

DESCRIPTION

The pistons are made of a high strength aluminum alloy. Top land height has been decreased to reduce emissions. Piston skirts are coated with a solid lubricant for scuff resistance. Connecting rod is forged steel with a fractured connecting rod cap design. The connecting rod is also equipped with a squirt hole and attaches to the piston with a full floating pin retained by lock rings.

Standard Procedure

FITTING PISTONS

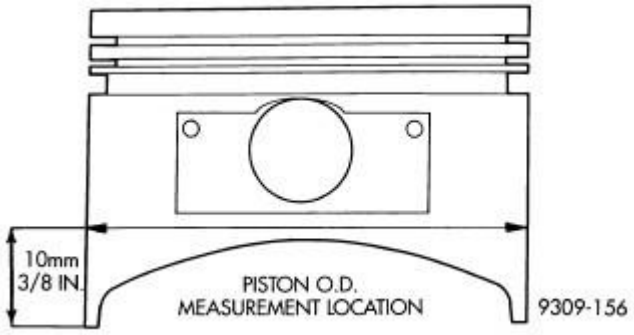


Fig. 305: Piston Measurements
Courtesy of CHRYSLER LLC

The pistons are machined to two different weight specifications and matched to rods based on weight. All piston and rod assemblies weigh the same to maintain engine balance.

Piston and cylinder wall must be clean and dry. Piston diameter should be measured 90 degrees to piston pin at size location. Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line. See **Engine - Specifications**. **Pistons and cylinder bores should be measured at normal room temperature, 70°F (21°C).**

Removal

REMOVAL

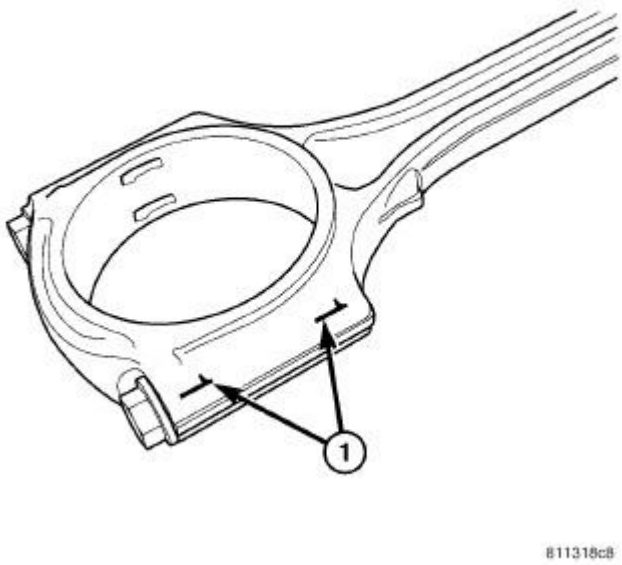


Fig. 306: CONNECTING ROD TO CYLINDER IDENTIFICATION
Courtesy of CHRYSLER LLC

1 - PAINT MARK OR SCRIBE

1. Remove the cylinder heads. See **Engine/Cylinder Head - Removal**
2. Remove the oil pan. See **Engine/Lubrication/PAN, Oil - Removal**
3. Remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation. 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.**
4. Inspect connecting rods and connecting rod caps for cylinder identification. Identify them with a paint mark or scribe (1).
5. Remove connecting rod cap. Install protectors on connecting rod. Push each piston and rod assembly out of cylinder bore.

NOTE: Be careful not to nick crankshaft journals.

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

Installation

INSTALLATION

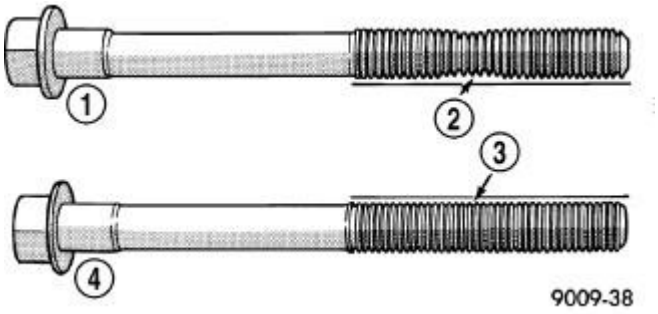


Fig. 307: Check for Stretched Bolts
Courtesy of CHRYSLER LLC

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

1. Install the piston rings. See **Engine/Engine Block/RING(S), Piston - Installation**

NOTE: The connecting rod bearing cap bolts must be examined before reuse. If the threads are necked down (1 and 2), the bolts must be replaced.

2. Check connecting rod bolts for necking by holding a scale or straight edge against the threads. If all threads do not contact the scale, the bolt must be replaced.

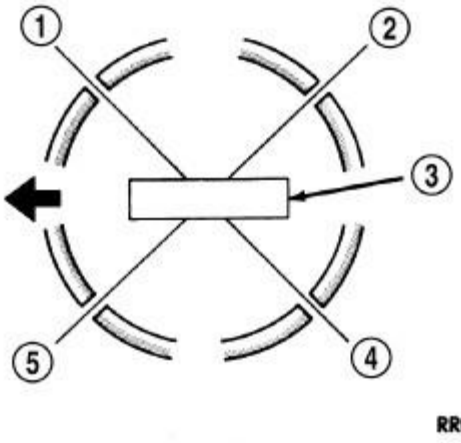


Fig. 308: PISTON RING END GAP POSITION
Courtesy of CHRYSLER LLC

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

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

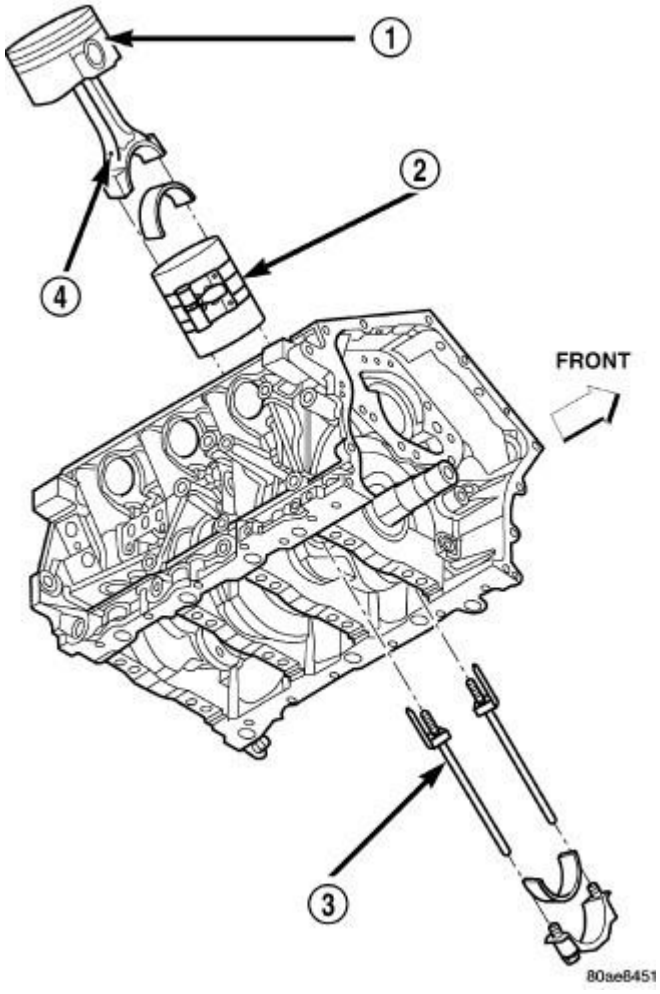


Fig. 309: Piston & Connecting Rod
Courtesy of CHRYSLER LLC

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

4. Immerse the piston head and rings in clean engine oil, slide the ring compressor over the piston and tighten with the special wrench. **Ensure position of rings does not change during this operation.**
5. Install connecting rod bolt protectors on rod bolts.
6. Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and

piston into cylinder bore and guide rod over the crankshaft journal.

CAUTION: Do Not interchange piston assemblies cylinder-to-cylinder or bank-to-bank.

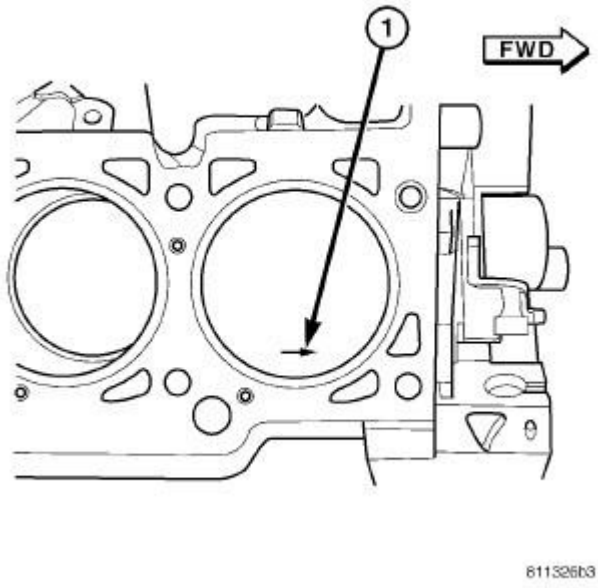


Fig. 310: PISTON ORIENTATION
Courtesy of CHRYSLER LLC

7. The arrow (1) on top of piston must be pointing toward front of engine and oil squirt hole on connecting rod faces the major thrust (right) side of the cylinder bore.

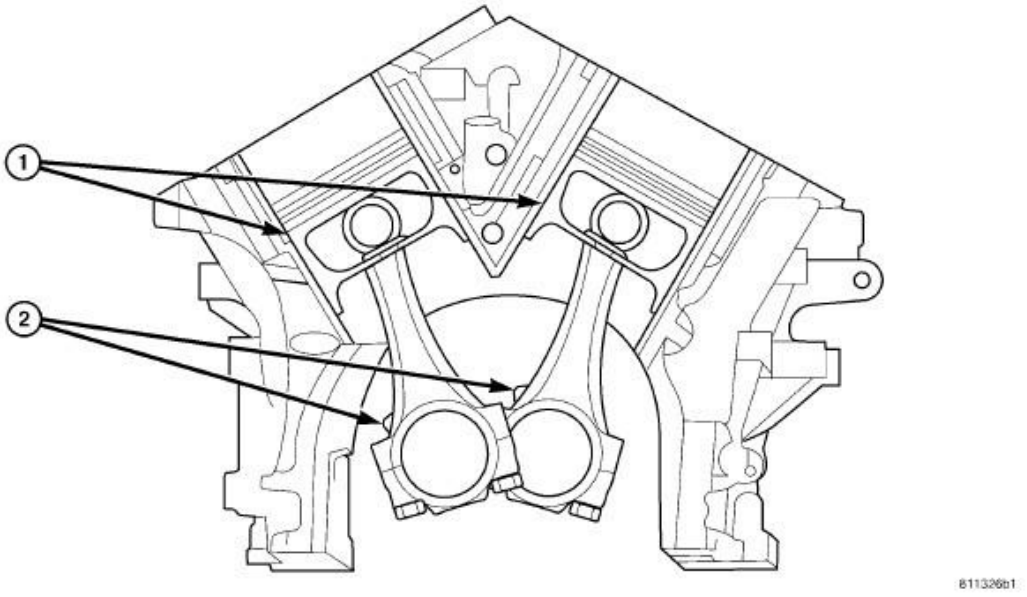


Fig. 311: PISTON & CONNECTING ROD POSITIONING
Courtesy of CHRYSLER LLC

8. Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal.
9. Install rod caps. Install cleaned and inspected connecting rod bolts and tighten to 27 N.m (20 ft. lbs.) Plus 1/4 turn.
10. Install the cylinder head(s). See **Engine/Cylinder Head - Installation**
11. Install the oil pan. See **Engine/Lubrication/PAN, Oil - Installation**

SEAL, CRANKSHAFT OIL, FRONT

Removal

REMOVAL

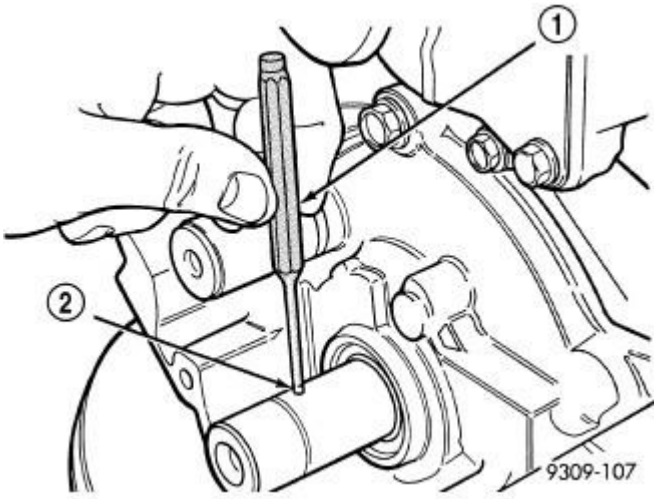


Fig. 312: Crankshaft Sprocket Dowel Pin-Removal/Installation
Courtesy of CHRYSLER LLC

1. Remove the crankshaft sprocket. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Removal**.
2. Tap the dowel pin (2) out of the crankshaft.

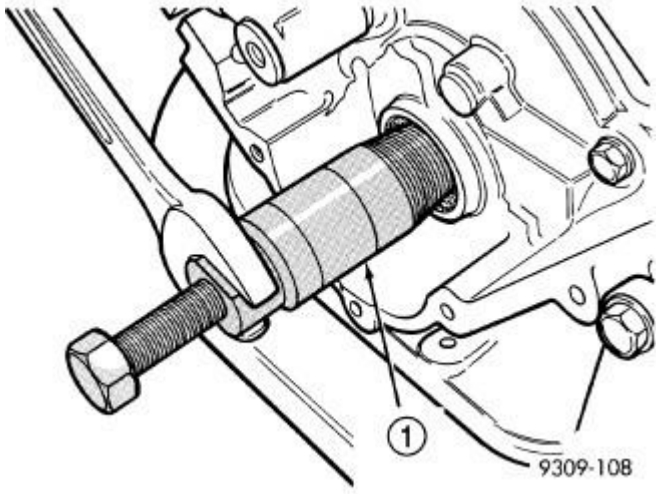


Fig. 313: Crankshaft Oil Seal with Special Tool 6341A-Removal
Courtesy of CHRYSLER LLC

3. Remove crankshaft seal using Special Tool 6341A (1).

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

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

Installation

INSTALLATION

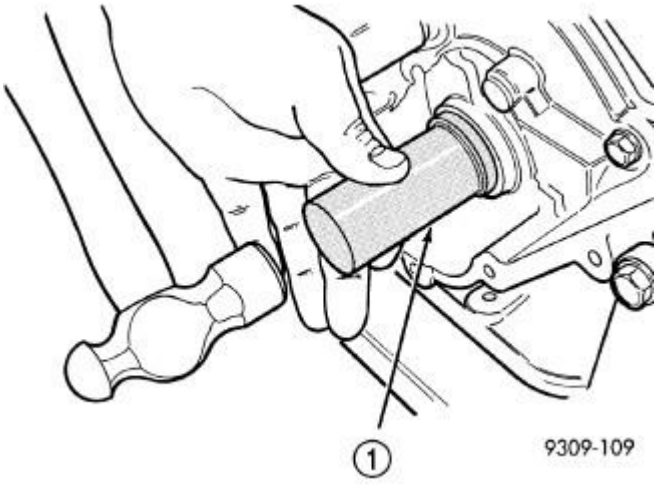


Fig. 314: Crankshaft Oil Seal with Special Tool 6342 - Installation
Courtesy of CHRYSLER LLC

1. Install crankshaft seal using Special Tool 6342 (1).
2. Install the dowel pin into the crankshaft to 1.2 mm (0.047 in.) protrusion.
3. Install the crankshaft sprocket. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Installation**.

ENGINE MOUNTING

INSULATOR, ENGINE MOUNT, LEFT

Removal

REMOVAL

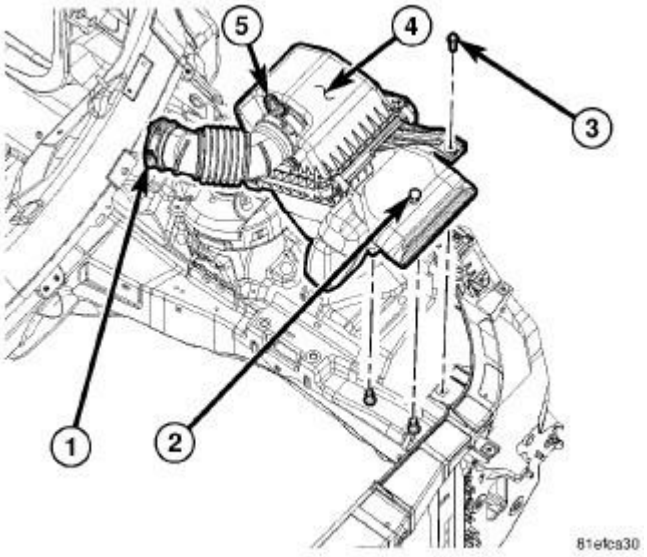


Fig. 315: HOUSING - AIR CLEANER
Courtesy of CHRYSLER LLC

1. Disconnect and isolate the negative battery cable.
2. Remove air cleaner housing assembly (4). See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.

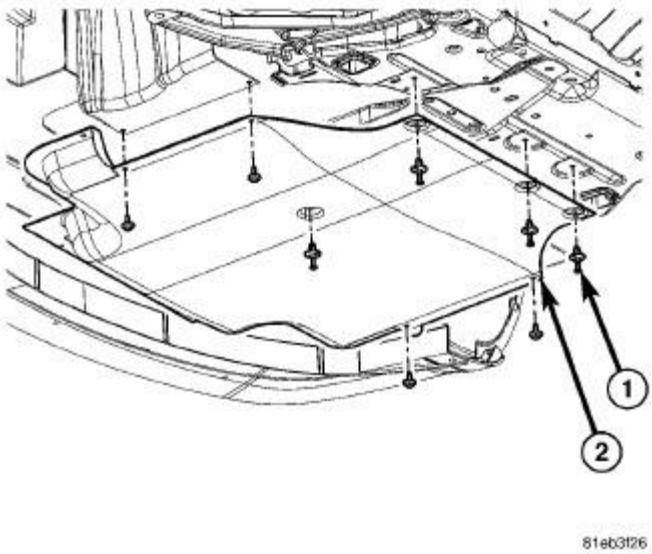


Fig. 316: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

3. Remove the belly pan (2).

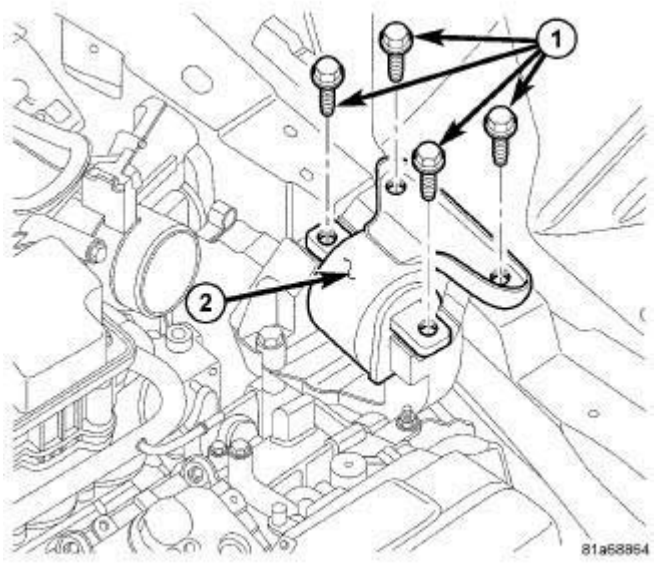


Fig. 317: Vertical Bolts From Left Engine Mount To Transmission Bracket
Courtesy of CHRYSLER LLC

4. Support transmission with floor jack and wooden block.
5. Remove the vertical bolts (1) from the left engine mount (2) to transmission bracket.

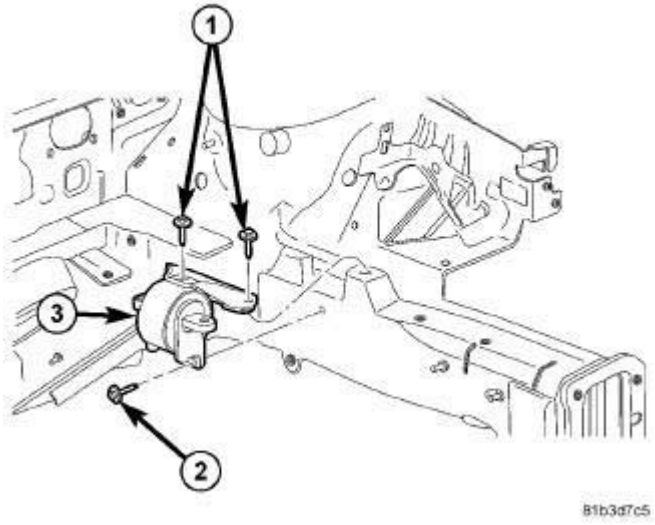


Fig. 318: LEFT ISOLATOR INSTALLATION
Courtesy of CHRYSLER LLC

6. Slightly lower transmission with floor jack to gain access to mount to frame rail fastener (2).
7. Remove mount isolator (3).

Installation

INSTALLATION

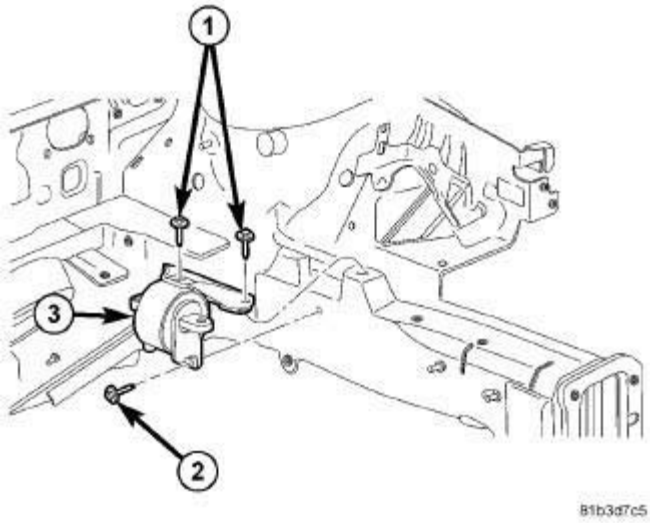


Fig. 319: LEFT ISOLATOR INSTALLATION
Courtesy of CHRYSLER LLC

1. Position mount isolator (3) in place, install bolts (1, 2) and tighten to 50 N.m (37 ft. lbs.).

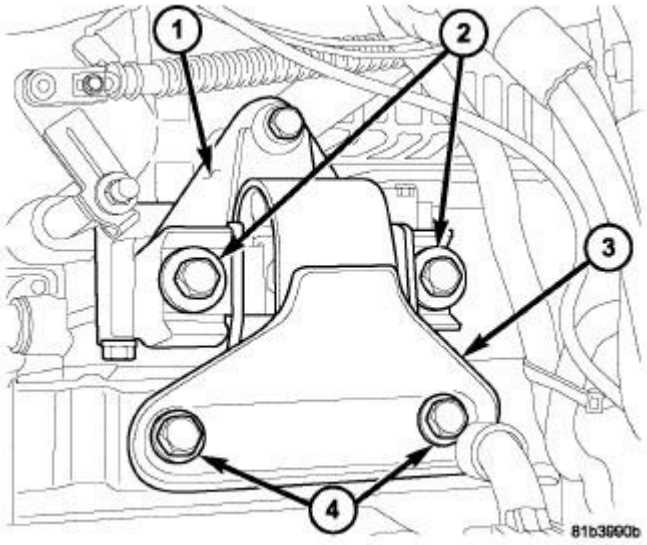


Fig. 320: LEFT MOUNT
Courtesy of CHRYSLER LLC

2. Raise transaxle into position, install bolts (2) and tighten to 98 N.m (72 ft. lbs.).
3. Remove floor jack and wooden block.

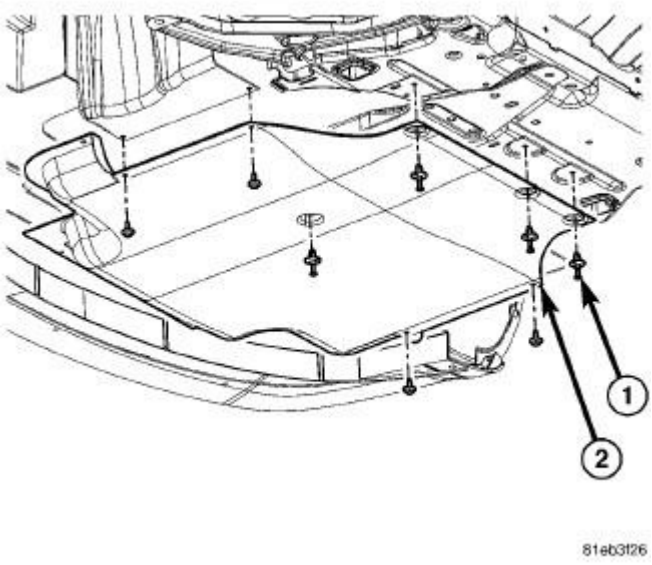


Fig. 321: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

4. Install belly pan (2).

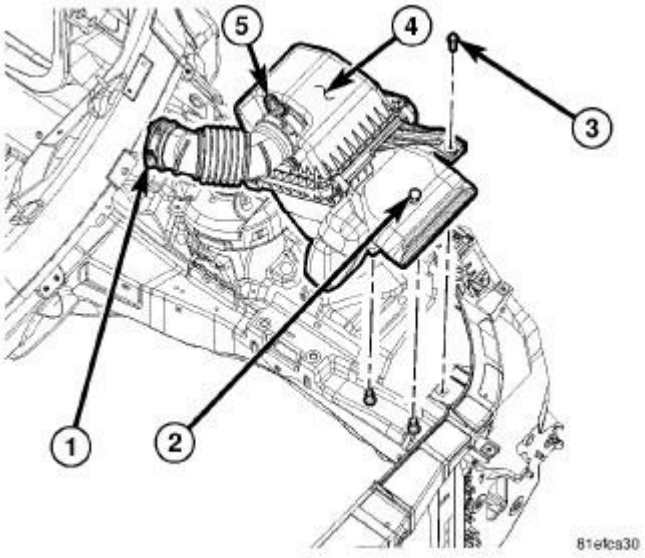


Fig. 322: HOUSING - AIR CLEANER
Courtesy of CHRYSLER LLC

5. Install the air cleaner housing assembly (4). See **Engine/Air Intake System/BODY, Air Cleaner - Removal**
6. Connect negative battery cable.

INSULATOR, ENGINE MOUNT, RIGHT

Removal

REMOVAL

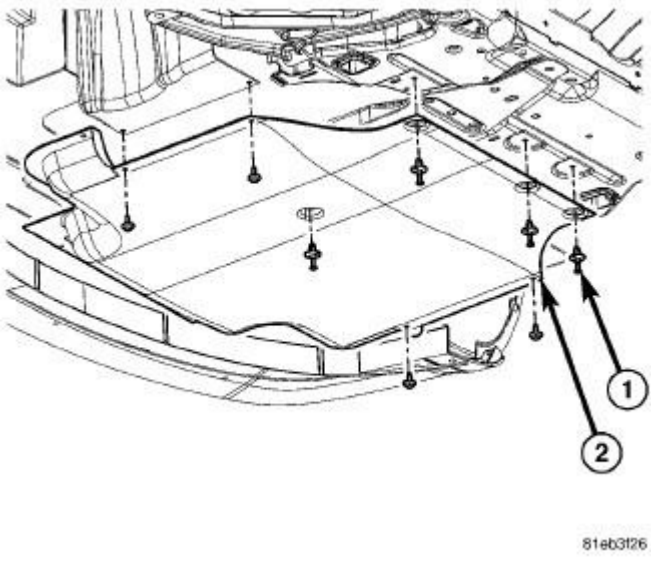


Fig. 323: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

1. Remove the belly pan (2).

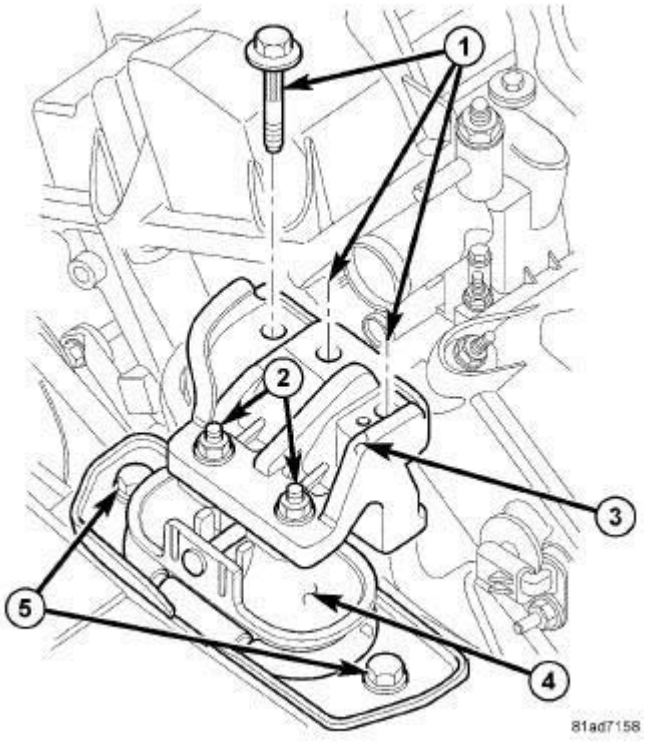


Fig. 324: Right Side Engine Mount Bolts
Courtesy of CHRYSLER LLC

2. Lower vehicle. Remove the load on the engine motor mounts by carefully supporting the engine assembly from below.
3. Remove Power Steering Fluid Reservoir and set aside. Refer to **Steering/Pump/RESERVOIR, Power Steering Pump - Removal** .
4. Disconnect the ground strap.
5. Remove the right engine support bracket vertical fasteners (1) and (2) and remove support bracket (3).
6. Remove the bolts (5) attaching the right isolator (4) to the frame rail.
7. Remove right isolator (4).

Installation

INSTALLATION

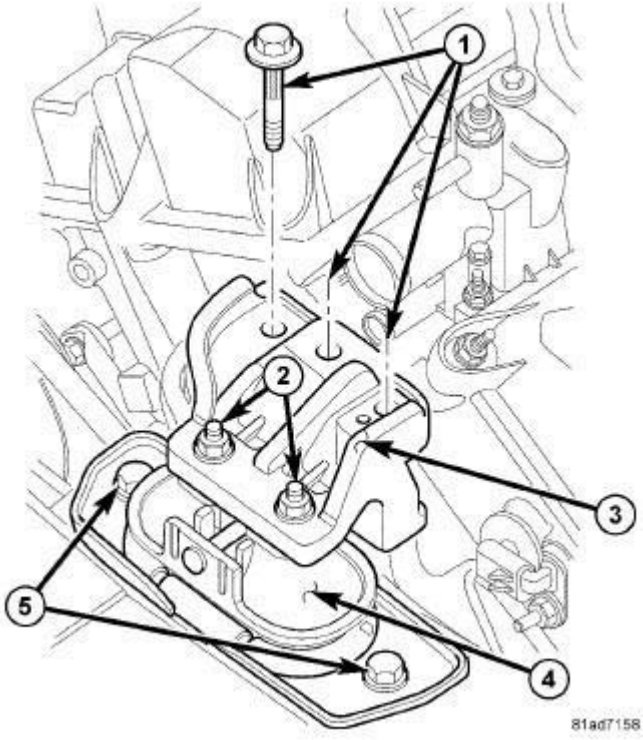


Fig. 325: Right Side Engine Mount Bolts
Courtesy of CHRYSLER LLC

1. Position right isolator (4) and install the isolator to frame rail bolts (5). Tighten bolts to 55 N.m (40 ft. lbs.).
2. Install the engine support bracket (3) and bolts (1). Tighten bolts to 50 N.m (37 ft. lbs).
3. Install the support bracket to isolator nuts (2) and tighten to 30 N.m (22 ft. lbs).
4. Reconnect the ground strap.

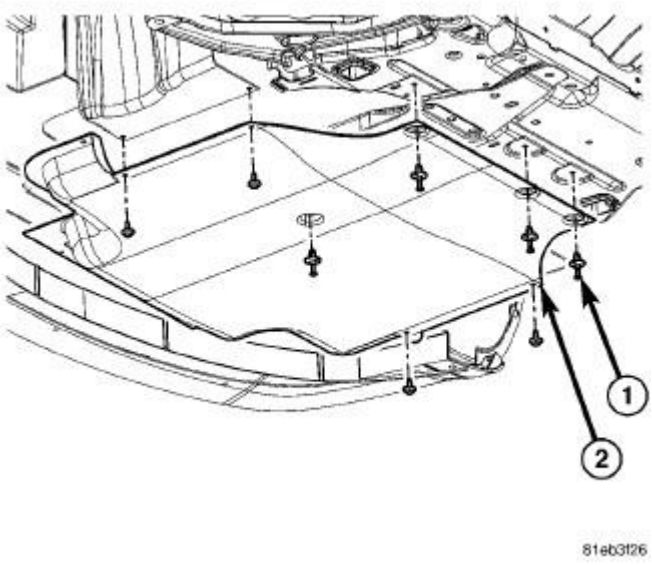


Fig. 326: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

5. Raise vehicle on a hoist.
6. Install the belly pan (2).
7. Install power steering reservoir. Refer to **Steering/Pump/RESERVOIR, Power Steering Pump - Installation** .

INSULATOR, ENGINE MOUNT, REAR

Removal

REMOVAL

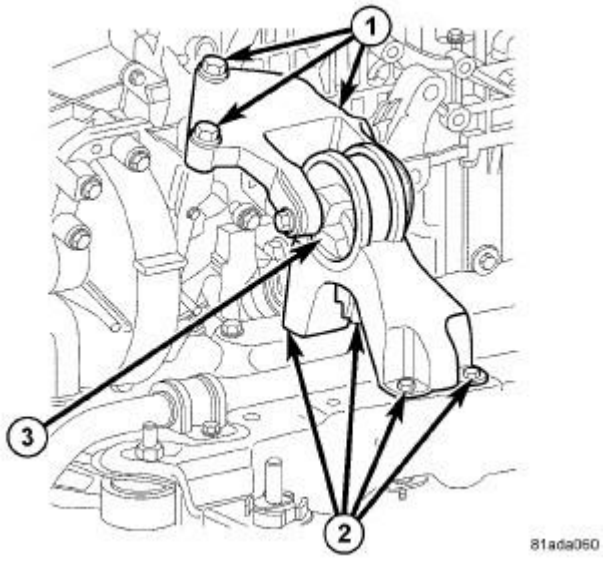


Fig. 327: REAR MOUNT
Courtesy of CHRYSLER LLC

1. Remove the three top mount bracket bolts (1) and one side mount bracket bolt.
2. Raise the vehicle.

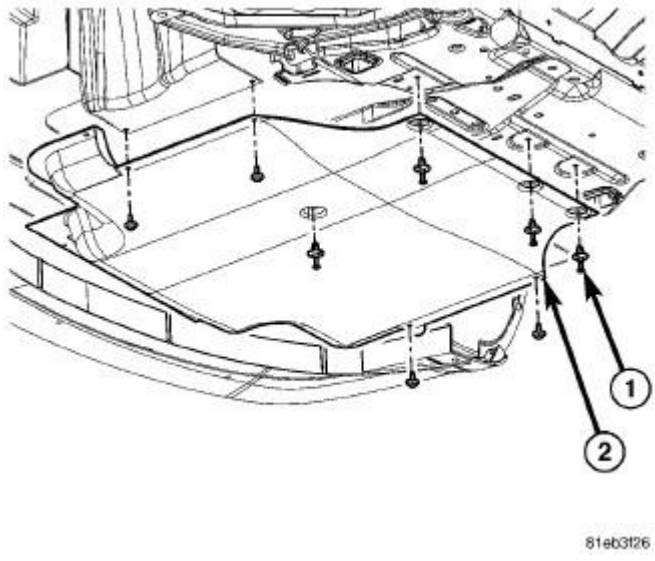


Fig. 328: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

3. Remove the belly pan (2).

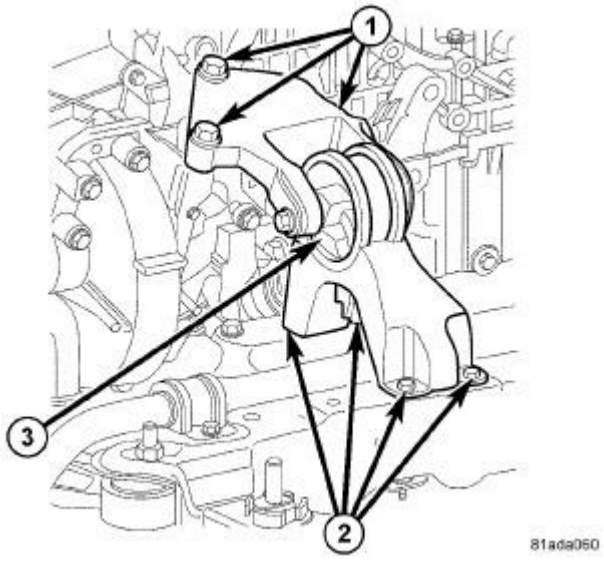


Fig. 329: Removing/Installing Rear Mount
Courtesy of CHRYSLER LLC

4. Remove rear mount bracket through bolt.
5. Remove rear mount bracket from transaxle case.
6. Remove the four rear isolator to suspension crossmember attaching bolts (2).
7. Remove rear isolator (3).

Installation

INSTALLATION

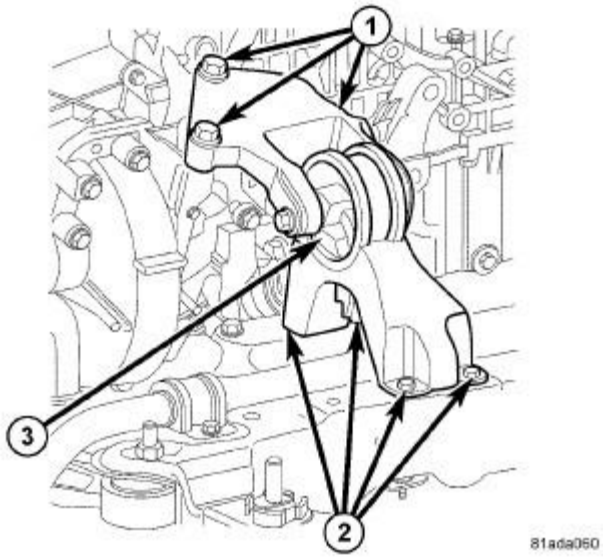


Fig. 330: REAR MOUNT

Courtesy of CHRYSLER LLC

1. Position rear isolator (3).
2. Install the four rear isolator to suspension crossmember attaching bolts (2) and tighten to 50 N.m (37 ft. lbs.).

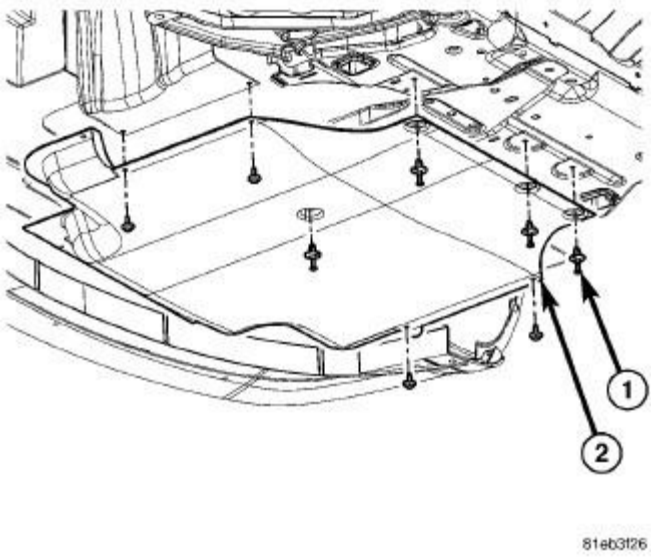


Fig. 331: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

3. Install the belly pan (2).
4. Lower the vehicle.

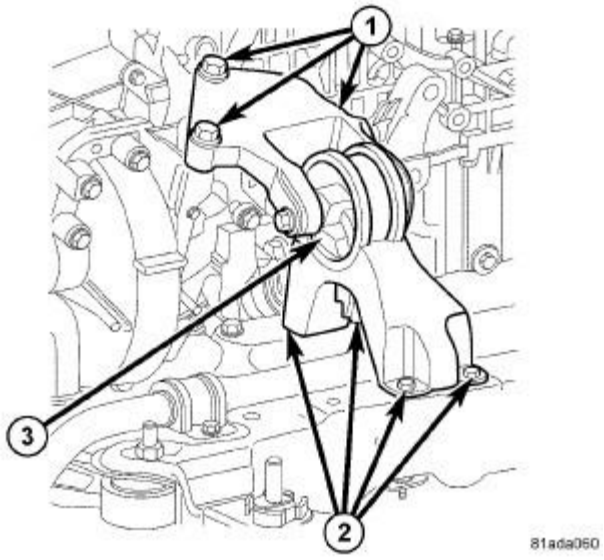


Fig. 332: REAR MOUNT

Courtesy of CHRYSLER LLC

5. Position the rear mount bracket on the transaxle case.
6. Install three top mount bracket bolts (1) and one side mount bracket bolt. Tighten bolts to 88 N.m (65 ft. lbs.).
7. Install rear mount bracket through bolt. Tighten to 75 N.m (55 ft. lbs.).

INSULATOR, ENGINE MOUNT, AWD REAR

Removal

REMOVAL

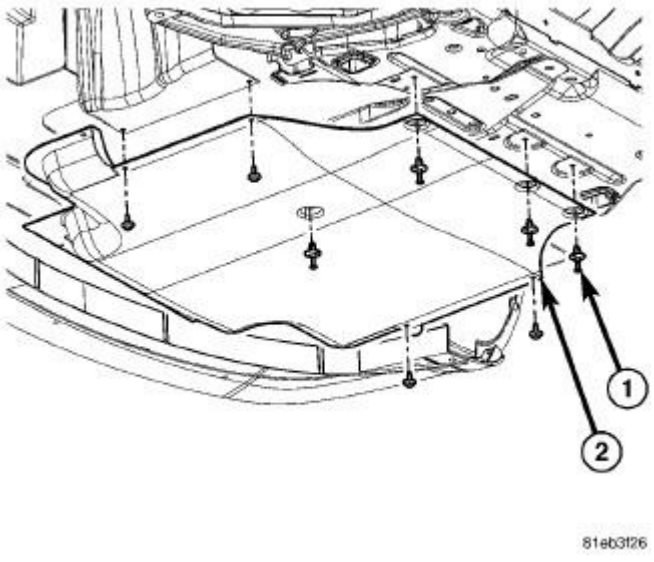


Fig. 333: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

1 - belly pan fasteners 2 - belly pan

1. Remove the belly pan (2).

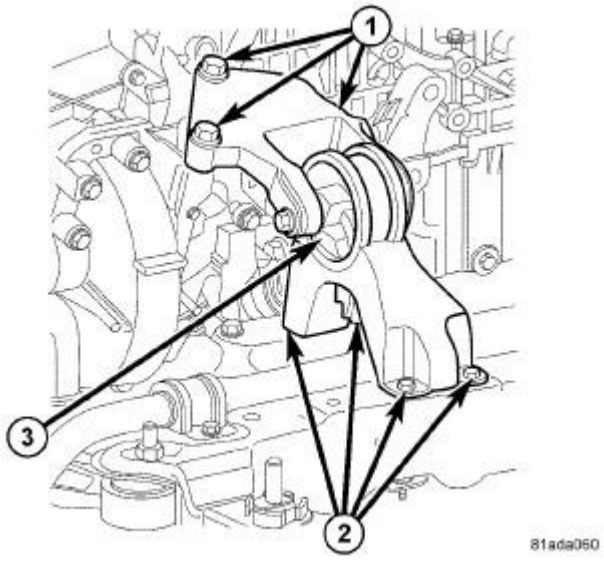


Fig. 334: REAR MOUNT
Courtesy of CHRYSLER LLC

2. Remove the Power Transfer Unit (PTU). Refer to **Transmission and Transfer Case/Power Transfer Unit - Removal** .
3. Remove the 3 top mount bracket bolts (1).
4. Remove the 4 lower mount to cradle bolts (2).
5. Remove rear mount (3).

Installation

INSTALLATION

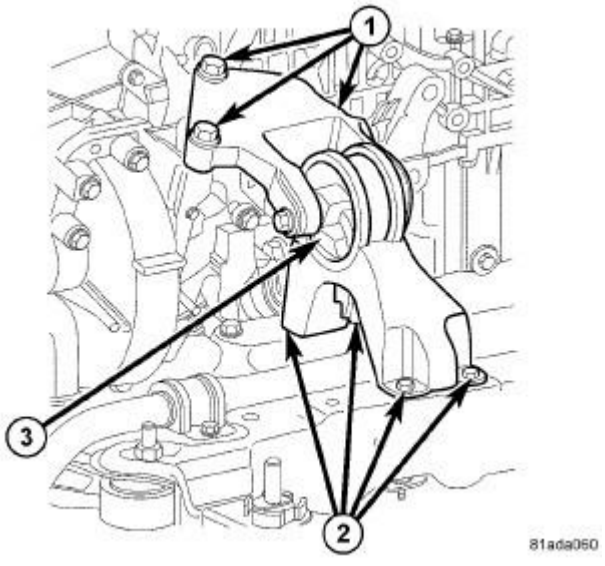


Fig. 335: REAR MOUNT
Courtesy of CHRYSLER LLC

1. Position rear mount (3).
2. Install the 4 lower mount to cradle bolts (2) and torque to 50 N.m (37 ft. lbs.).
3. Install 3 top mount bracket bolts and torque 50 N.m (37 ft. lbs.).
4. Install the Power Transfer Unit (PTU). Refer to **Transmission and Transfer Case/Power Transfer Unit - Installation** .

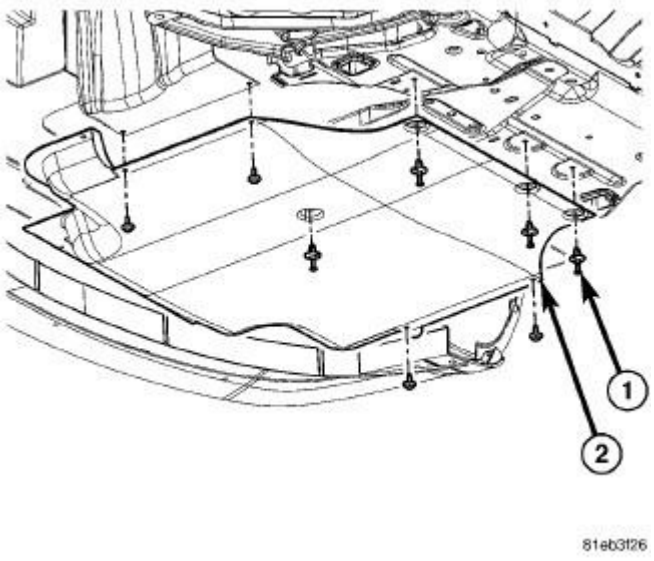


Fig. 336: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

1 - belly pan fasteners 2 - belly pan

5. Install the belly pan (2).

INSULATOR, ENGINE MOUNT, FRONT

Removal

REMOVAL

1. Raise vehicle.

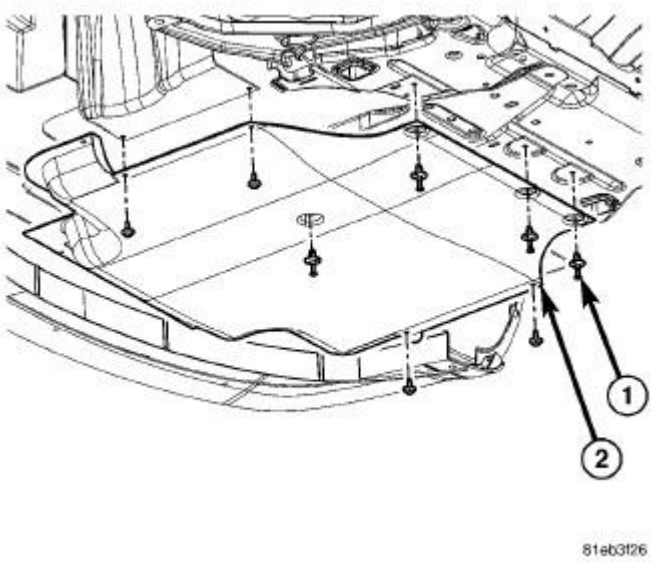


Fig. 337: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

1 - belly pan fasteners 2 - belly pan

2. Remove the belly pan (2).

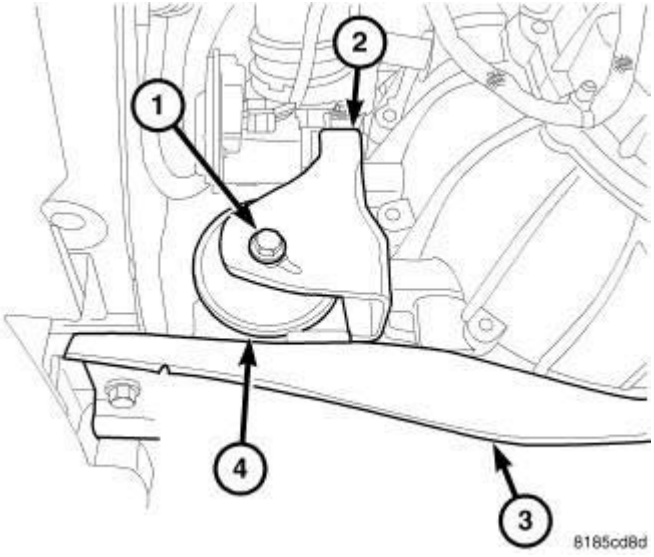


Fig. 338: Removing/Installing Front Mount
Courtesy of CHRYSLER LLC

3. Remove fore aft member (3) to mount (4) bolts.
4. Remove mount through bolt (1).
5. Remove fore aft member (3) mounting bolts and remove.

6. Remove front mount (4).

Installation

INSTALLATION

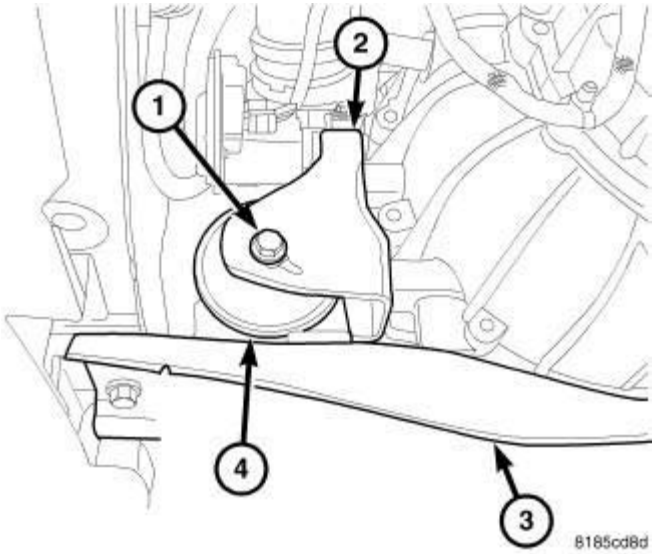


Fig. 339: Removing/Installing Front Mount
Courtesy of CHRYSLER LLC

1. Position mount (4) and torque bolts to 47 N.m (35 ft. lbs.).
2. Install fore aft member (3) and torque bolts to 100 N.m (74 ft. lbs.).
3. Install mount through bolt (1) and torque to 47 N.m (35 ft. lbs.).

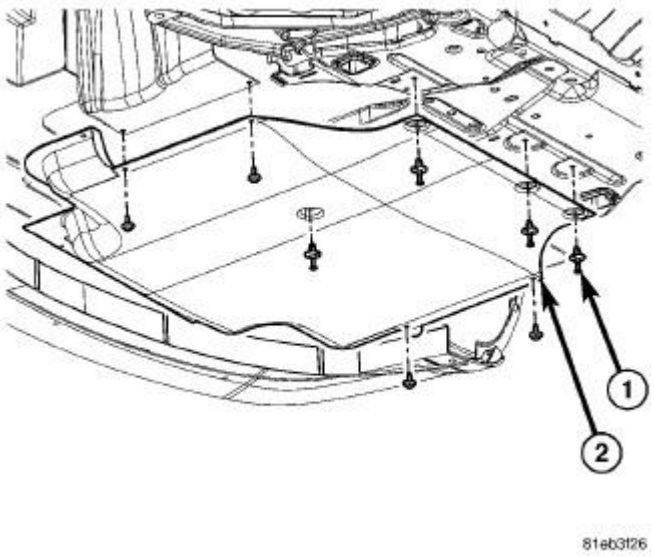


Fig. 340: Belly Pan Fasteners

Courtesy of CHRYSLER LLC

1 - belly pan fasteners 2 - belly pan

4. Install the belly pan (2).
5. Lower vehicle.

LUBRICATION

DESCRIPTION

DESCRIPTION

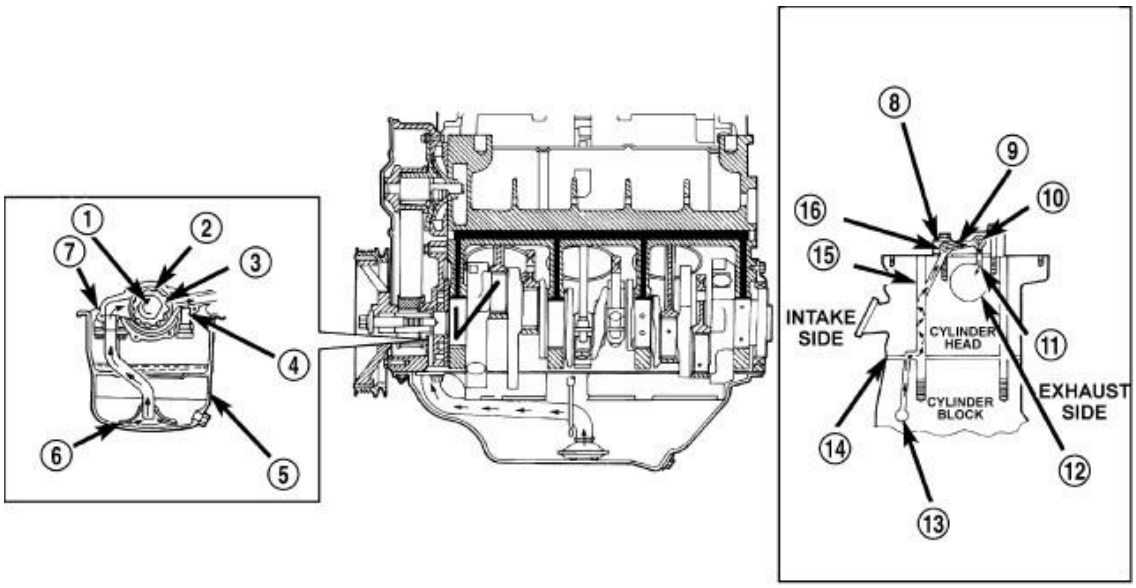


Fig. 341: Oil Lubrication System
Courtesy of CHRYSLER LLC

1 - CRANKSHAFT	9 - PEDESTAL DRILLED PASSAGE
2 - OUTER ROTOR	10 - EXHAUST ROCKER SHAFT
3 - INNER ROTOR	11 - SHAFT/PEDESTAL DOWEL PASSAGE
4 - RELIEF VALVE	12 - CAMSHAFT BEARING BORE
5 - OIL PAN	13 - CYLINDER BLOCK OIL GALLERY
6 - OIL SCREEN	14 - CYLINDER HEAD GASKET
7 - OIL PUMP CASE	15 - HEAD BOLT HOLE
8 - OIL FLOWS TO ONLY ONE PEDESTAL ON EACH HEAD - SECOND FROM REAR ON RIGHT HEAD - SECOND FROM FRONT ON LEFT HEAD	16 - INTAKE ROCKER SHAFT

The oil lubrication system is a full-flow filtration, pressure feed type. The oil pump body (7) is mounted to the engine block. The pump inner rotor (3) is driven by the crankshaft (1). A windage tray, increases engine power by minimizing oil windage at high engine RPM. For increased engine oil cooling, an engine oil-to-engine coolant oil cooler is used.

OPERATION

OPERATION

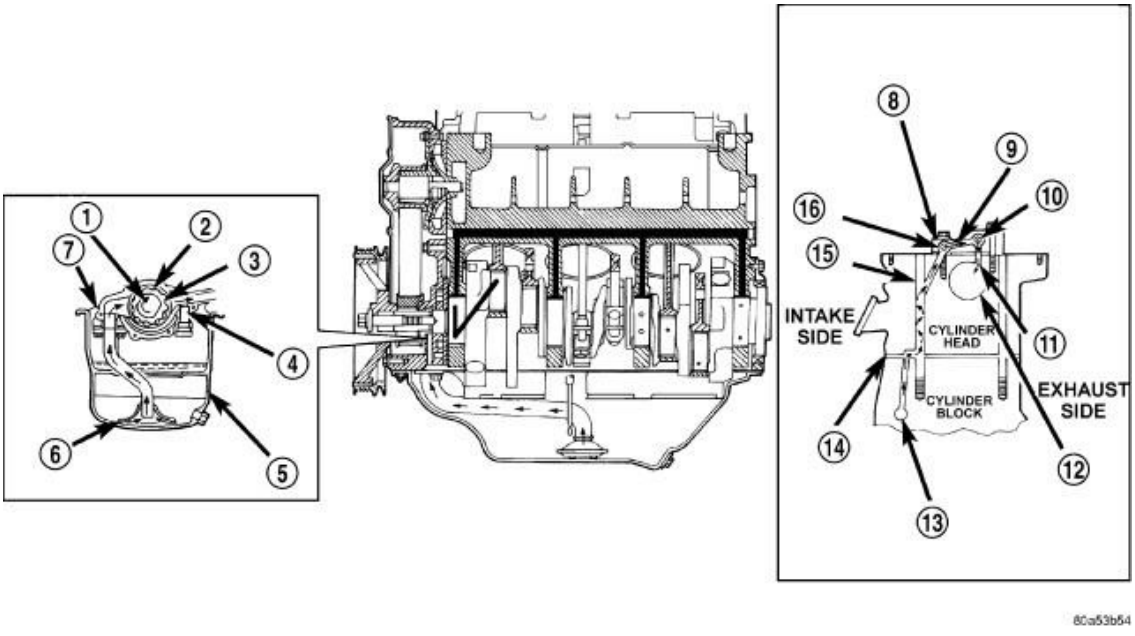


Fig. 342: Oil Lubrication System
Courtesy of CHRYSLER LLC

1 - CRANKSHAFT	9 - PEDESTAL DRILLED PASSAGE
2 - OUTER ROTOR	10 - EXHAUST ROCKER SHAFT
3 - INNER ROTOR	11 - SHAFT/PEDESTAL DOWEL PASSAGE
4 - RELIEF VALVE	12 - CAMSHAFT BEARING BORE
5 - OIL PAN	13 - CYLINDER BLOCK OIL GALLERY
6 - OIL SCREEN	14 - CYLINDER HEAD GASKET
7 - OIL PUMP CASE	15 - HEAD BOLT HOLE
8 - OIL FLOWS TO ONLY ONE PEDESTAL ON EACH HEAD - SECOND FROM REAR ON RIGHT HEAD - SECOND FROM FRONT ON LEFT HEAD	16 - INTAKE ROCKER SHAFT

Engine oil stored in the oil pan is drawn in and discharged by a gerotor type oil pump. The oil pump is directly coupled to the crankshaft. Oil pressure is regulated by a relief valve. The oil is fed through an oil filter and to the crankshaft journals from the oil gallery in the cylinder block. This gallery also feeds oil under pressure to the cylinder heads. Oil flows through each cylinder heads oil passage to the rocker shafts. Oil then feeds the camshaft journals, rocker arms, and hydraulic lash adjusters.

DIAGNOSIS AND TESTING

CHECKING ENGINE OIL PRESSURE

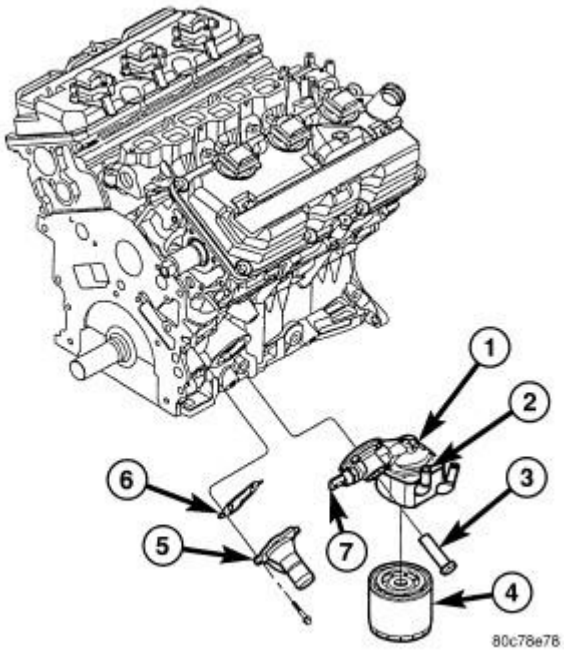


Fig. 343: Engine Oil Cooler & Filter
Courtesy of CHRYSLER LLC

1 - OIL FILTER ADAPTER
2 - OIL COOLER
3 - FASTENER-OIL FILTER ADAPTER
4 - OIL FILTER
5 - WATER INLET TUBE
6 - GASKET
7 - OIL PRESSURE SENSOR

Check oil pressure using a gauge at oil pressure switch location (7).

1. Remove the oil pressure switch (7). See **Engine/Lubrication/SWITCH, Oil Pressure - Removal**.
2. Install oil pressure test gauge, Special Tool C-3292A with Adapter 8406. For Special Tool identification. See **Engine - Special Tools**.

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

3. Warm engine to normal operating temperature.

4. Monitor gauge readings at idle and 3000 RPM. For specifications. See **Engine - Specifications**.

FILTER, ENGINE OIL

Removal

REMOVAL

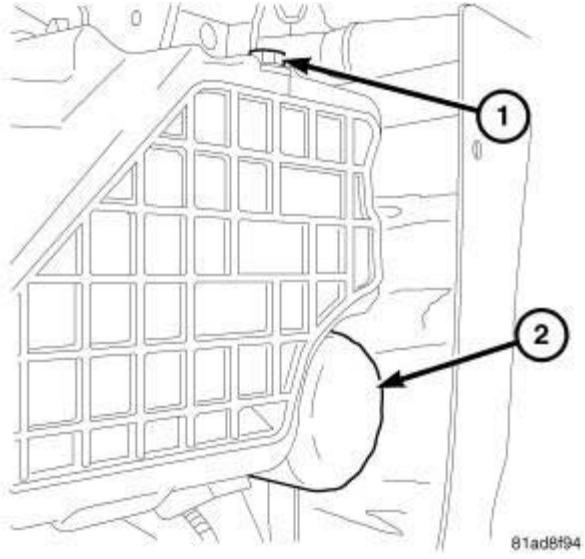


Fig. 344: ENGINE OIL FILTER & COOLER
Courtesy of CHRYSLER LLC

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

1. Using a suitable oil filter wrench, unscrew filter (2) from base and discard.

Installation

INSTALLATION

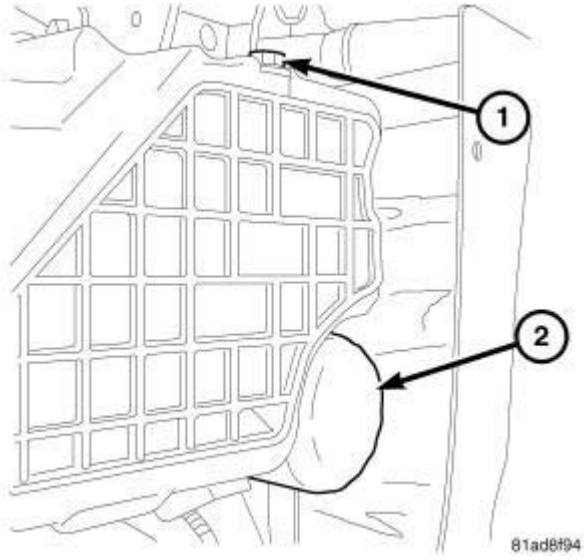


Fig. 345: ENGINE OIL FILTER & COOLER
Courtesy of CHRYSLER LLC

All engines are equipped with a high quality full-flow, disposable type oil filter (2). When replacing oil filter, use a Mopar® filter or equivalent.

1. Wipe base clean, then inspect gasket contact surface.
2. Lubricate gasket of new filter with clean engine oil.
3. Install and tighten oil filter (2) to 16 N.m (12 ft. lbs.) of torque after gasket contacts base. Use filter wrench if necessary.
4. Start engine and check for leaks.

OIL

Description

DESCRIPTION

For engine oil type and capacity, refer to **Vehicle Quick Reference/Capacities and Recommended Fluids - Description** .

Standard Procedure

ENGINE OIL LEVEL CHECK

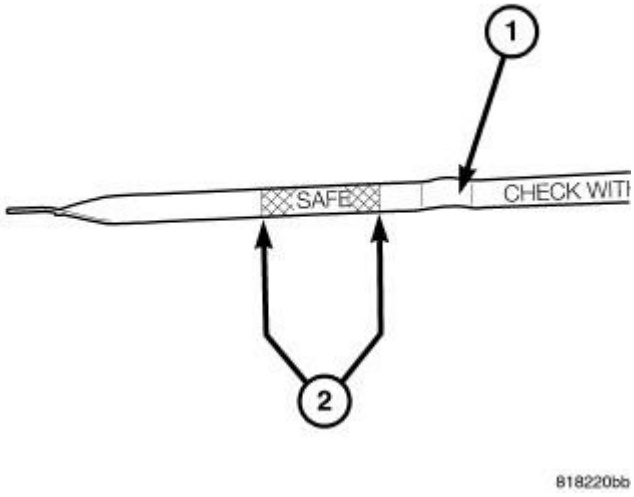


Fig. 346: OIL LEVEL
Courtesy of CHRYSLER LLC

Checking the oil while the vehicle is on level ground will improve the accuracy of the oil level reading. Remove dipstick (1), and observe oil level. Add oil only when the level is at or below the SAFE mark. If the oil level is in the safe (2) range, do not add oil.

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

ENGINE OIL AND FILTER CHANGE

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.

TO CHANGE ENGINE OIL

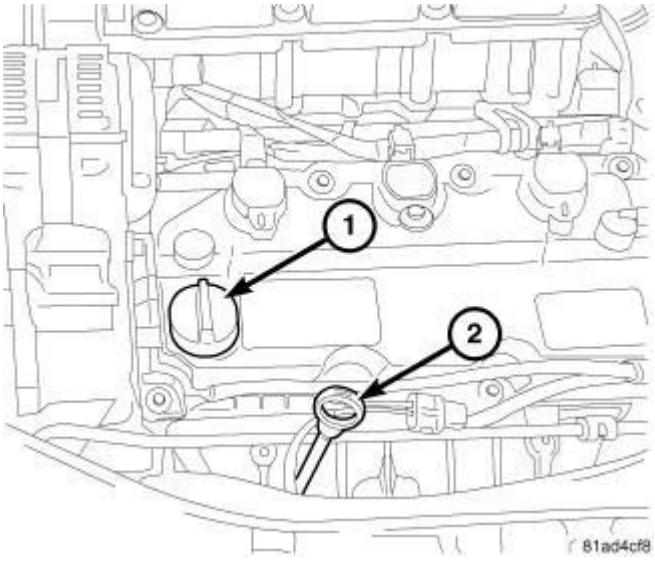


Fig. 347: ENGINE OIL FILLER CAP & DIPSTICK
Courtesy of CHRYSLER LLC

1 - ENGINE OIL FILL CAP 2 - ENGINE OIL DIPSTICK

1. Run engine until achieving normal operating temperature.
2. Position the vehicle on a level surface and turn engine off.
3. Open hood, remove engine oil fill cap (1).
4. Raise vehicle on hoist.
5. Place a suitable drain pan under crankcase drain.

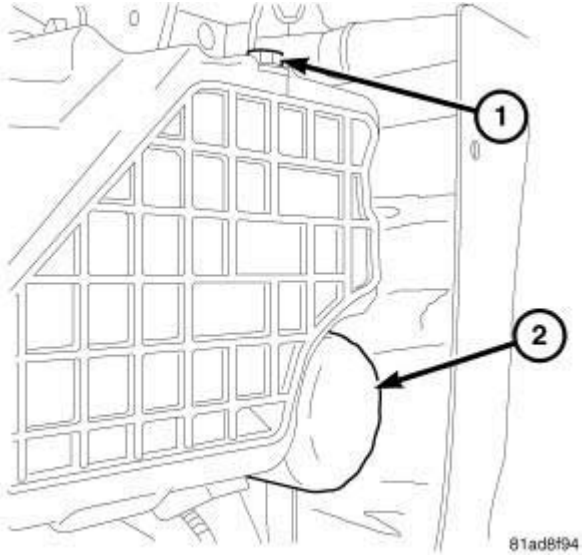


Fig. 348: ENGINE OIL FILTER & COOLER
Courtesy of CHRYSLER LLC

6. Remove oil pan 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.
7. Remove oil filter (2).
8. Install drain plug (1) in crankcase. Tighten oil pan drain plug to 27 N.m (20 ft. lbs.).
9. Install new oil filter (2).
10. Lower vehicle.

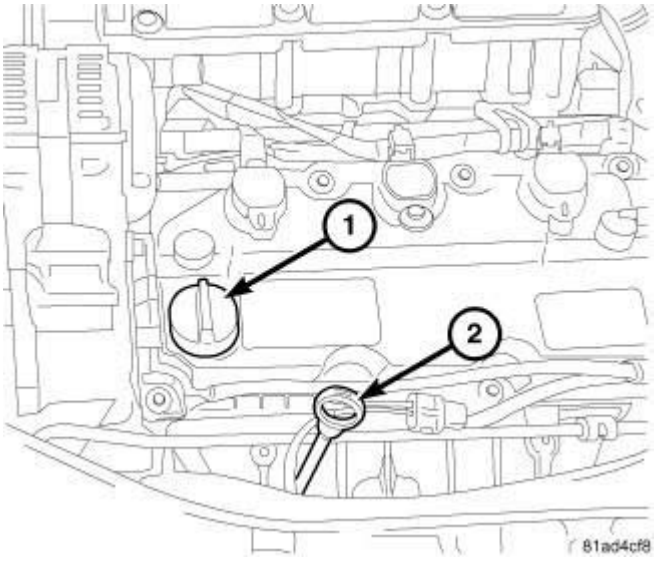


Fig. 349: ENGINE OIL FILLER CAP & DIPSTICK
Courtesy of CHRYSLER LLC

1 - ENGINE OIL FILL CAP
2 - ENGINE OIL DIPSTICK

11. Fill crankcase with specified type and amount of engine oil. Refer to **Vehicle Quick Reference/Capacities and Recommended Fluids - Description** or **Vehicle Quick Reference/Capacities and Recommended Fluids - Specifications** .
12. Install oil fill cap (1).
13. Start engine and inspect for leaks.
14. Turn engine off and inspect oil level.

OIL FILTER SPECIFICATION

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

USED ENGINE OIL DISPOSAL

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

PAN, OIL

Removal

REMOVAL

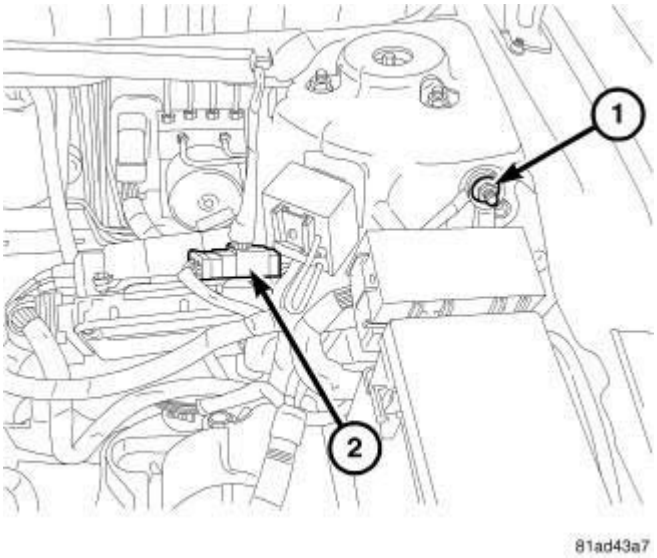


Fig. 350: BATTERY CABLE
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable (1).

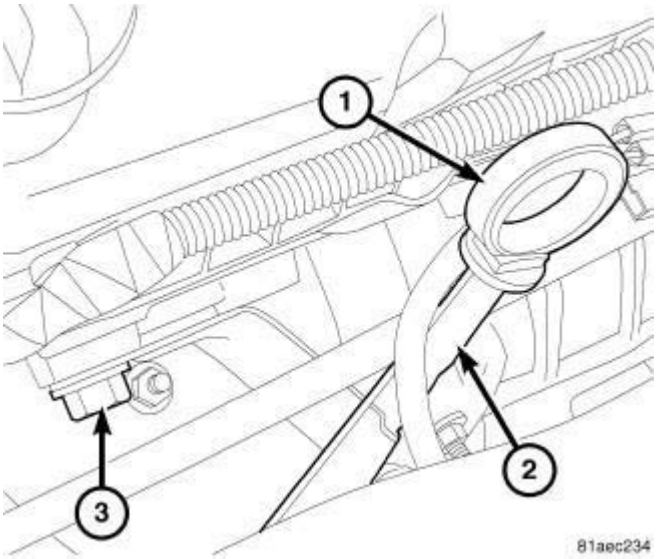


Fig. 351: Engine Oil Dipstick Tube
Courtesy of CHRYSLER LLC

2. Remove the engine oil indicator (1).
3. Remove the engine oil indicator tube bolt (3).

4. Remove the engine oil indicator tube (2).
5. Raise and support the vehicle.

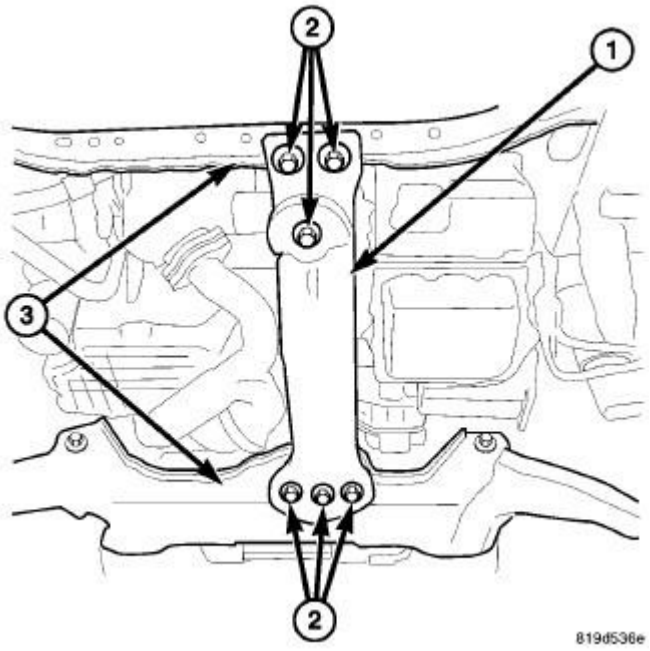


Fig. 352: FORE-AFT Crossmember
Courtesy of CHRYSLER LLC

6. Remove the front crossmember. Refer to **Frame and Bumpers/Frame/CROSSMEMBER - Removal** .

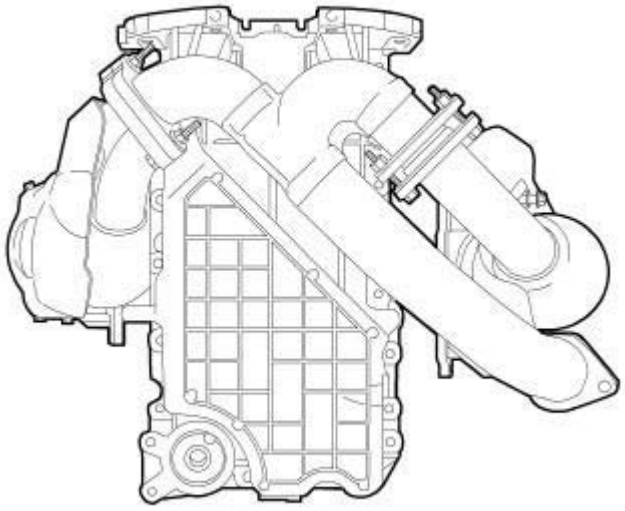


Fig. 353: Maniverters
Courtesy of CHRYSLER LLC

7. Remove the crossover pipe. See **Engine/Manifolds/MANIFOLD, Exhaust - Removal**.
8. Loosen the front exhaust manifold. See **Engine/Manifolds/MANIFOLD, Exhaust - Removal**.

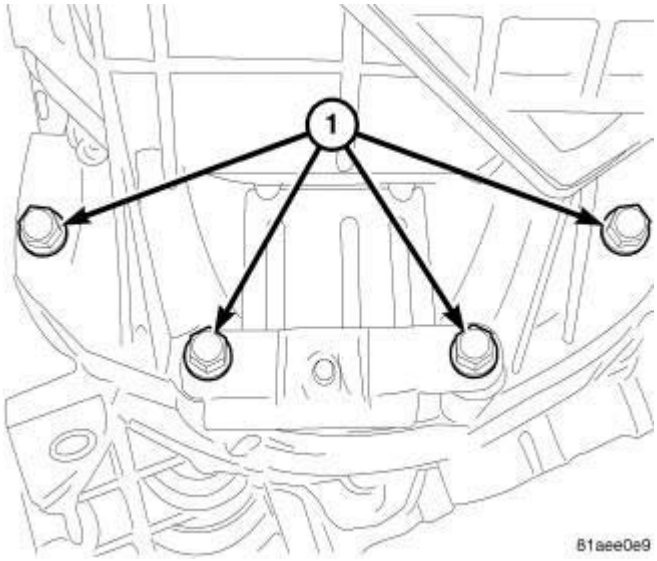


Fig. 354: Oil Pan Bell Housing Bolts
Courtesy of CHRYSLER LLC

9. Remove the oil pan bell housing bolts (1).

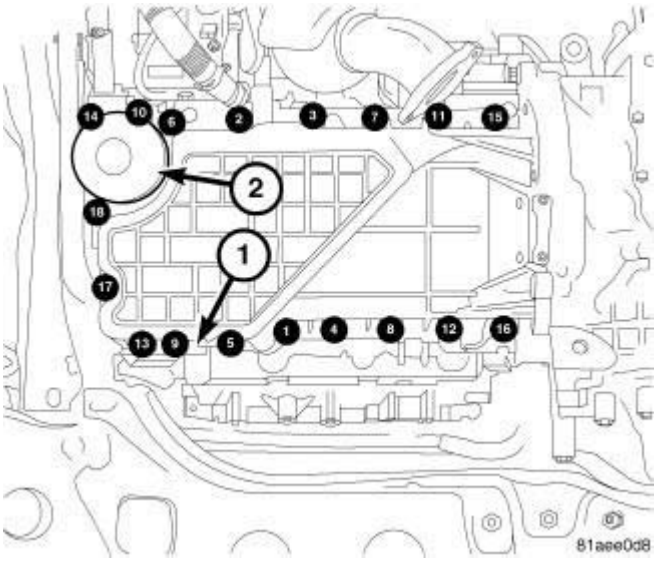


Fig. 355: OIL PAN
Courtesy of CHRYSLER LLC

10. Drain the engine oil (1).

11. Remove the engine oil filter (2).
12. Remove the oil pan fasteners. Remove the oil pan.

NOTE: A small amount of oil will remain in the oil pan. Use care when removing the oil pan from the engine.

13. Remove oil pan gasket.

Installation

INSTALLATION

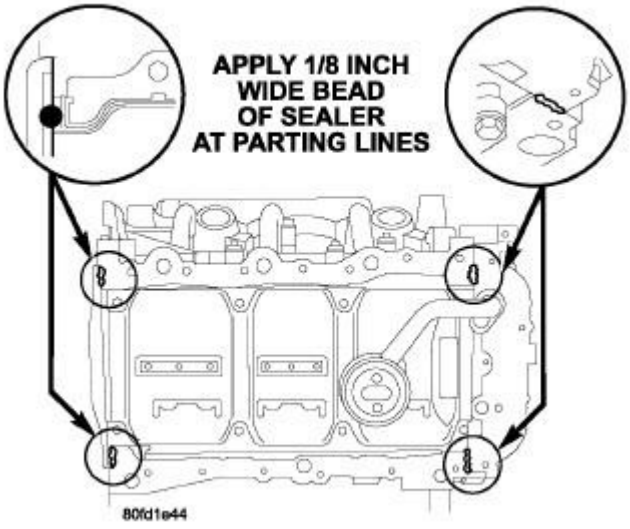


Fig. 356: OIL PAN SEALING - TYPICAL
Courtesy of CHRYSLER LLC

1. Clean oil pan and all gasket surfaces.
2. Apply a 1/8 inch bead of Mopar® Engine RTV GEN II at the parting line of the oil pump housing and the rear seal retainer.
3. Install oil pan gasket to the engine block.

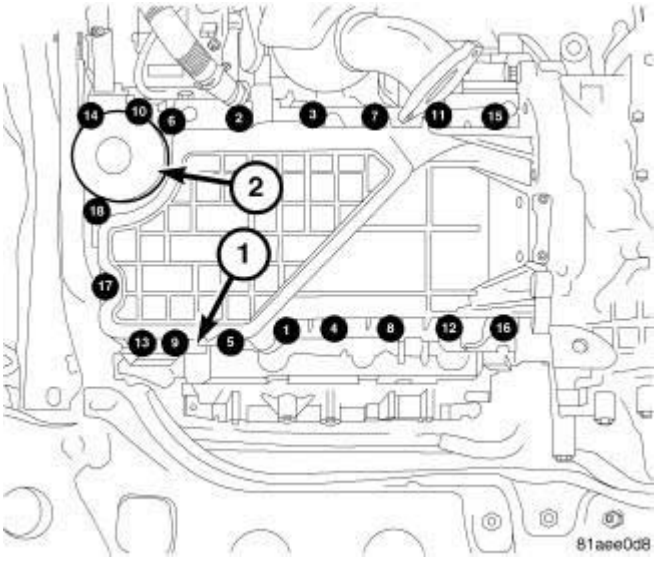


Fig. 357: OIL PAN
Courtesy of CHRYSLER LLC

4. Install the oil pan and tighten the oil pan bolts to 28 N.m (21 ft. lbs.).

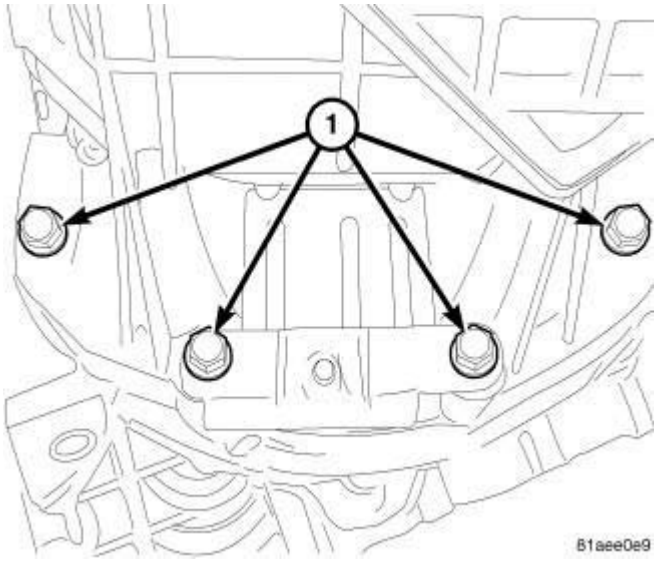


Fig. 358: Oil Pan Bell Housing Bolts
Courtesy of CHRYSLER LLC

5. Tighten the oil pan bell housing bolts to 55 N.m (40 ft. lbs.).

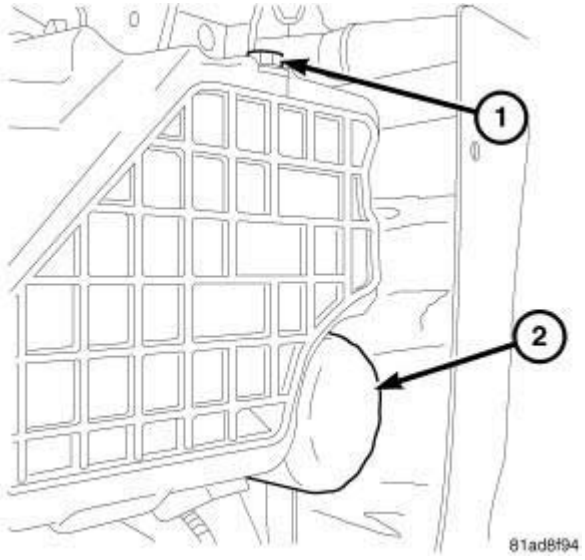


Fig. 359: ENGINE OIL FILTER & COOLER
Courtesy of CHRYSLER LLC

6. All engines are equipped with a high quality full-flow, disposable type oil filter (2). When replacing oil filter, use a Mopar® filter or equivalent.
7. Wipe base clean, then inspect gasket contact surface.
8. Lubricate gasket of new filter with clean engine oil.
9. Install and tighten oil filter (2) to 16 N.m (12 ft. lbs.) of torque after gasket contacts base. Use filter wrench if necessary.

   Lower vehicle.

10. Install and tighten the oil pan drain bolt (1) to 27 N.m (20 ft. lbs.).
11. Tighten the front maniverter bolts. See **Engine/Manifolds/MANIFOLD, Exhaust - Removal**.

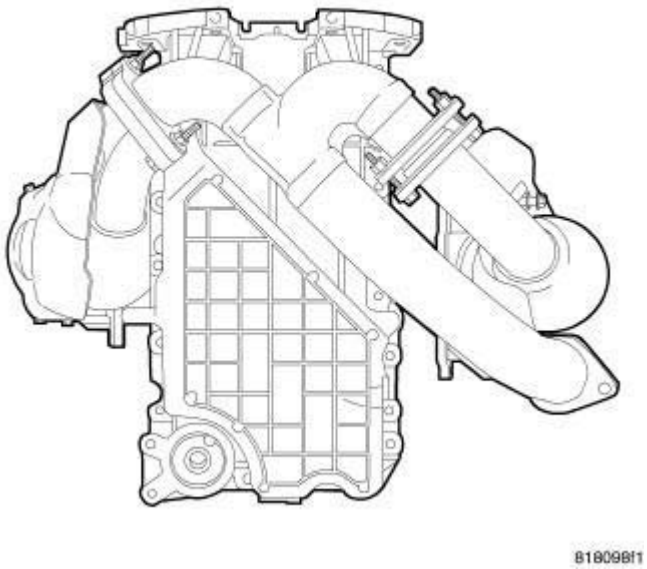


Fig. 360: Maniverters
Courtesy of CHRYSLER LLC

12. Install the crossover pipe. See **Engine/Manifolds/MANIFOLD, Exhaust - Removal**.

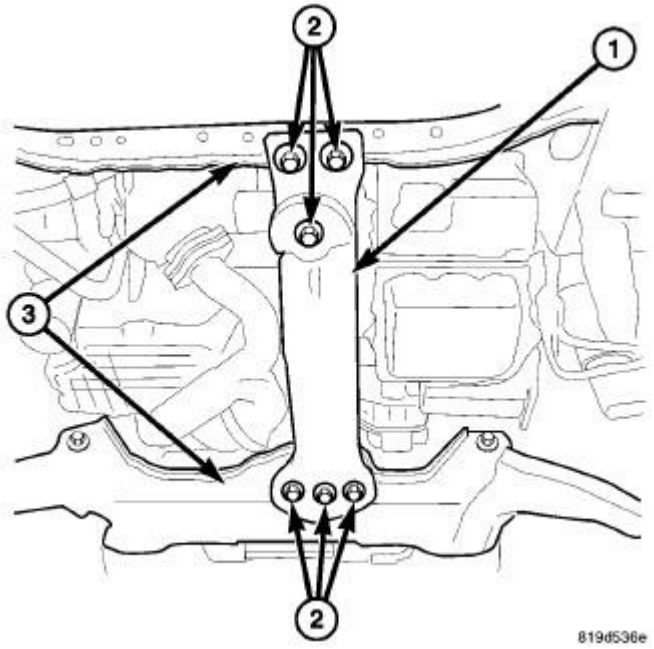


Fig. 361: FORE-AFT Crossmember
Courtesy of CHRYSLER LLC

13. Install the front crossmember. Refer to **Frame and Bumpers/Frame/CROSSMEMBER - Removal** .

14. Lower vehicle.

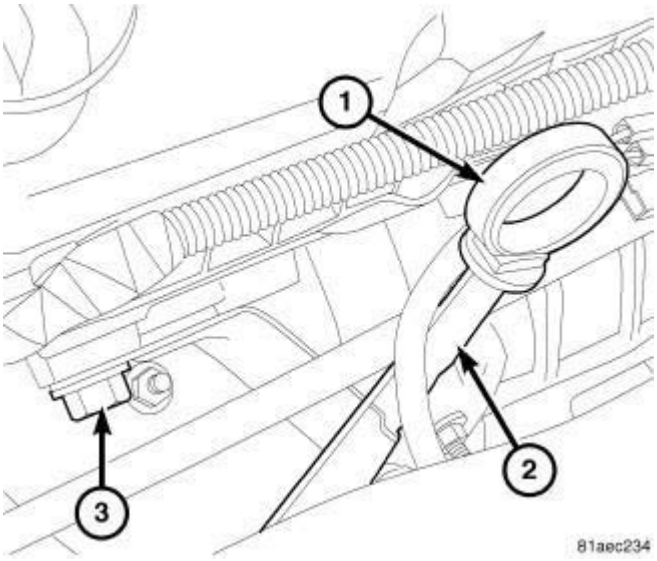


Fig. 362: Engine Oil Dipstick Tube
Courtesy of CHRYSLER LLC

15. Install the oil level indicator tube (2).
16. Tighten the oil level indicator tube bolt (3).
17. Install the oil indicator (1).
18. Fill engine crankcase with proper oil to correct level.

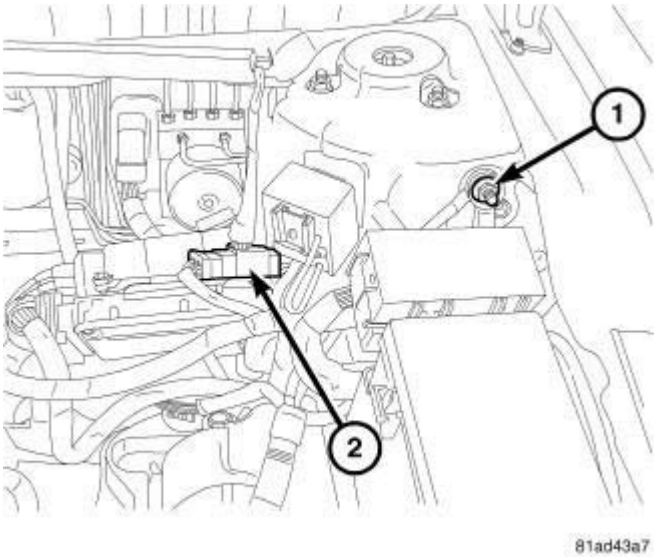


Fig. 363: BATTERY CABLE
Courtesy of CHRYSLER LLC

19. Connect negative battery cable (1).

PUMP, ENGINE OIL

Removal

REMOVAL

It is necessary to remove the oil pump body to service the oil pump rotors.

The oil pump pressure relief valve can be serviced by removing the oil pan. See **Engine/Lubrication/VALVE, Oil Pressure Relief - Removal**

1. Drain the cooling system. Refer to **Cooling - Standard Procedure** .
2. Remove the timing belt. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Removal**.
3. Remove the crankshaft sprocket. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Removal**.
4. Remove the oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.
5. Remove the oil pickup tube.
6. Remove the oil pump fasteners. Remove pump and gasket from engine.

Disassembly

DISASSEMBLY

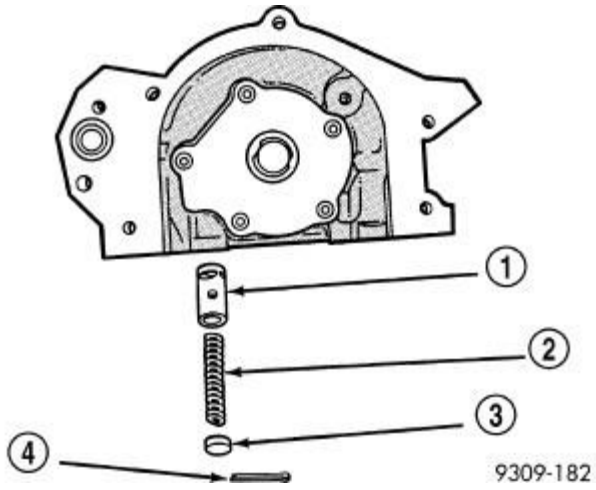


Fig. 364: Oil Pressure Relief Valve
Courtesy of CHRYSLER LLC

1 - RELIEF VALVE
2 - SPRING
3 - RETAINER CAP
4 - COTTER PIN

1. To remove the relief valve (1), proceed as follows:

2. Drill a 3.175 mm (1/8 inch.) hole into the relief valve retainer cap (3) and insert a self-threading sheet metal screw into cap (3).
3. Clamp screw into a vise and while supporting oil pump body, remove cap by tapping oil pump body using a soft hammer. Discard retainer cap (3) and remove spring (2) and relief valve (1).
4. Remove oil pump cover screws, and lift off cover.
5. Remove pump rotors.
6. Wash all parts in a suitable solvent and inspect carefully for damage or wear.

Cleaning

CLEANING

1. Clean all parts thoroughly in a suitable solvent.

Inspection

INSPECTION

1. Disassemble oil pump. See **Engine/Lubrication/PUMP, Engine Oil - Disassembly**
2. Clean all parts thoroughly. Mating surface of the oil pump housing should be smooth. Replace pump cover if scratched or grooved.

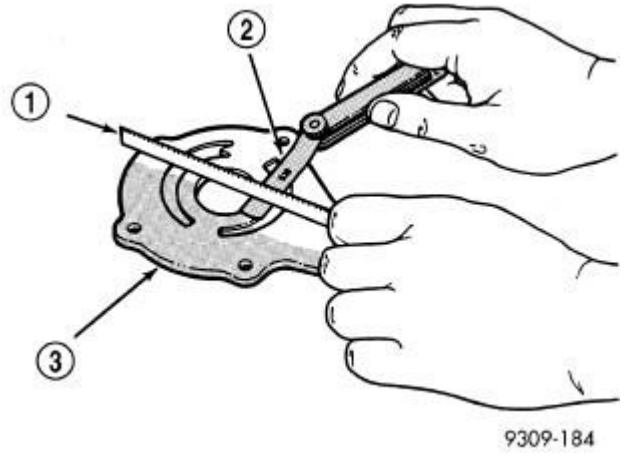


Fig. 365: Checking Oil Pump Cover Flatness
Courtesy of CHRYSLER LLC

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

3. Lay a straightedge (1) across the pump cover surface. If a 0.025 mm (0.001 in.) feeler gauge blade (2) can be inserted between cover and straight edge, cover should be replaced.

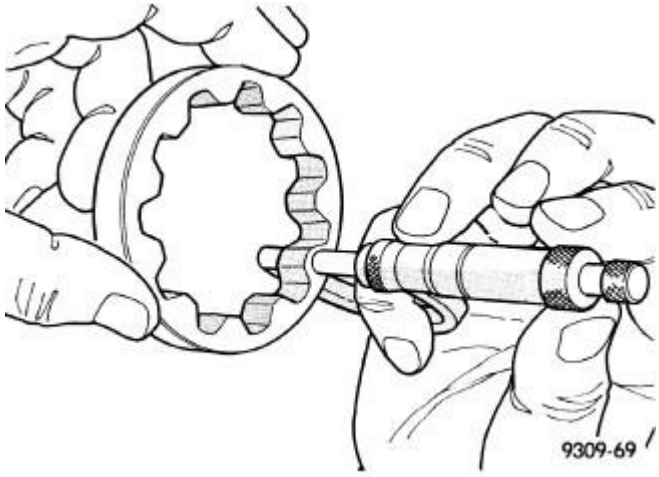


Fig. 366: Measuring Outer Rotor Thickness
Courtesy of CHRYSLER LLC

4. Measure thickness and diameter of outer rotor. If outer rotor thickness measures 14.299 mm (0.563 in.) or less, or if the diameter is 79.78 mm (3.141 inches.) or less, replace outer rotor.

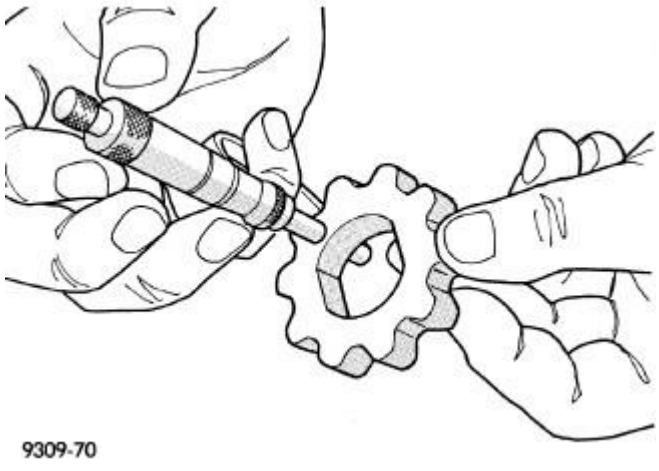


Fig. 367: Measuring Inner Rotor Thickness
Courtesy of CHRYSLER LLC

5. If inner rotor measures 14.299 mm (0.563 in.) or less replace inner rotor.

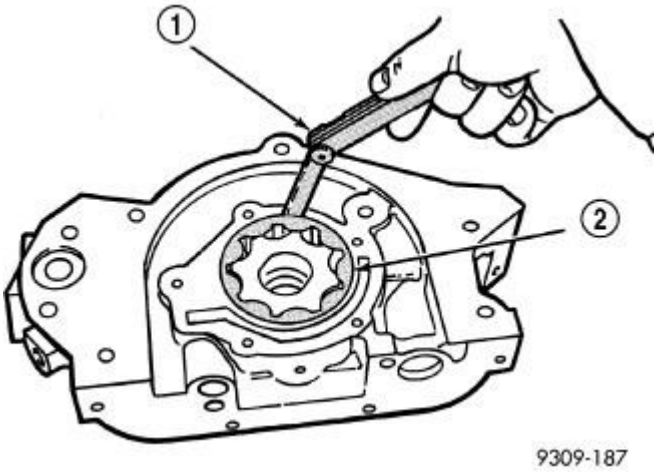


Fig. 368: Measuring Outer Rotor Clearance in Housing
Courtesy of CHRYSLER LLC

1 - FEELER GAUGE 2 - OUTER ROTOR

6. Slide outer rotor into body, press to one side with fingers and measure clearance between rotor and body. If measurement is 0.39 mm (0.015 inch.) or more, replace body only if outer rotor is in specifications.

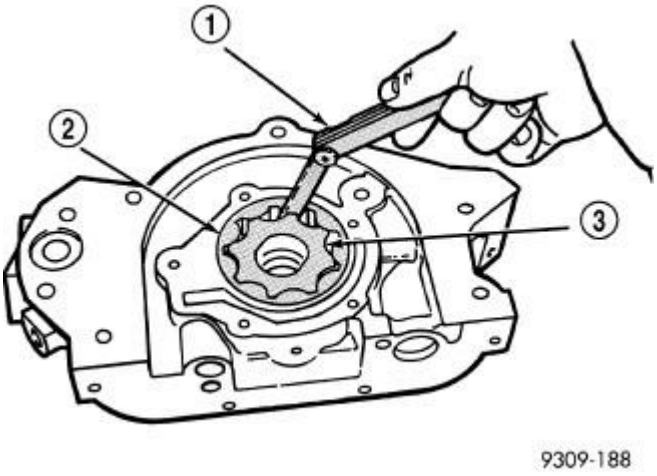


Fig. 369: Measuring Clearance Between Rotors
Courtesy of CHRYSLER LLC

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

7. Install inner rotor into body. If clearance between inner (3) and outer (2) rotors is 0.20 mm (0.008 inch.) or more, replace both rotors.

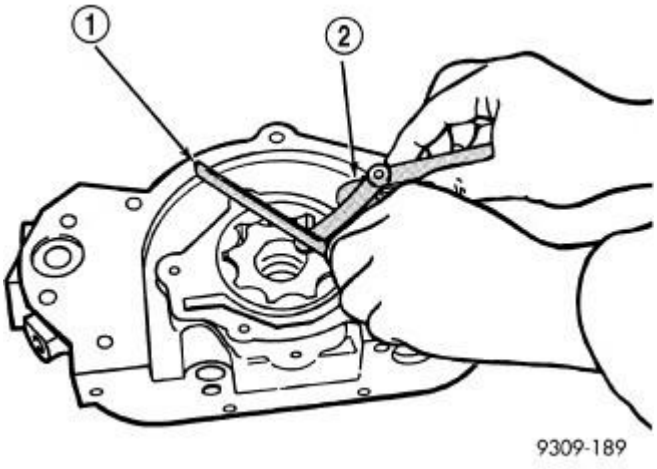


Fig. 370: Measuring Clearance Over Rotors
Courtesy of CHRYSLER LLC

1 - STRAIGHT EDGE
2 - FEELER GAUGES

8. Place a straightedge across the face of the body, between bolt holes. If a feeler gauge of 0.077 mm (0.003 in.) or more can be inserted between rotors and the straightedge, replace pump assembly **ONLY** if rotors are in specs.
9. Inspect oil pressure relief valve plunger for scoring and free operation in its bore. Small marks may be removed with 400-grit wet or dry sandpaper.

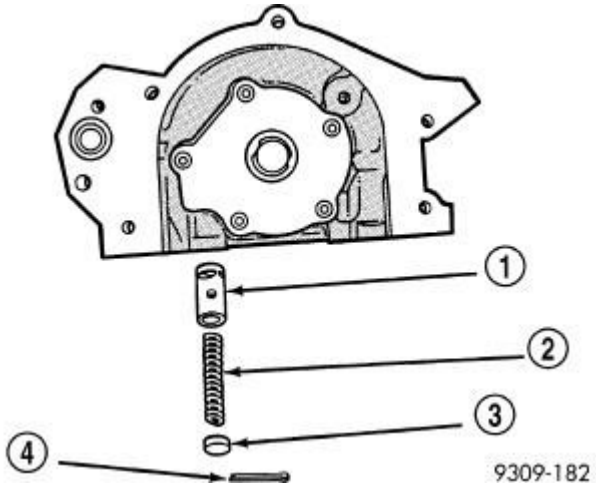


Fig. 371: Oil Pressure Relief Valve
Courtesy of CHRYSLER LLC

1 - RELIEF VALVE
2 - SPRING
3 - RETAINER CAP
4 - COTTER PIN

10. The relief valve spring (2) has a free length of approximately 49.5 mm (1.95 in.) it should test between 101-110 N (23-25 lbs.) when compressed to 34 mm (1-11/32 in.). Replace spring that fails to meet specifications.
11. Assemble oil pump. See **Engine/Lubrication/PUMP, Engine Oil - Assembly**

Assembly

ASSEMBLY

1. Assemble oil pump using new parts as required.
2. Tighten cover screws to 12 N.m (105 in. lbs.).
3. Prime oil pump before installation by filling rotor cavity with engine oil.
4. If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other reasons for oil pressure loss.

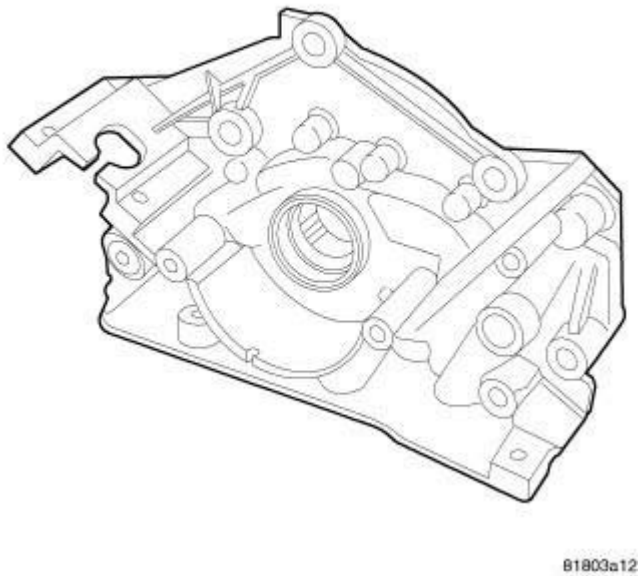


Fig. 372: Oil Pump
Courtesy of CHRYSLER LLC

Installation

INSTALLATION

NOTE: Thoroughly clean all bolt threads and threaded area in the engine, removing all oil residue, before assembly.

1. Prime oil pump before installation by filling rotor cavity with clean engine oil.
2. Install oil pump and gasket carefully over the crankshaft and position pump onto block.

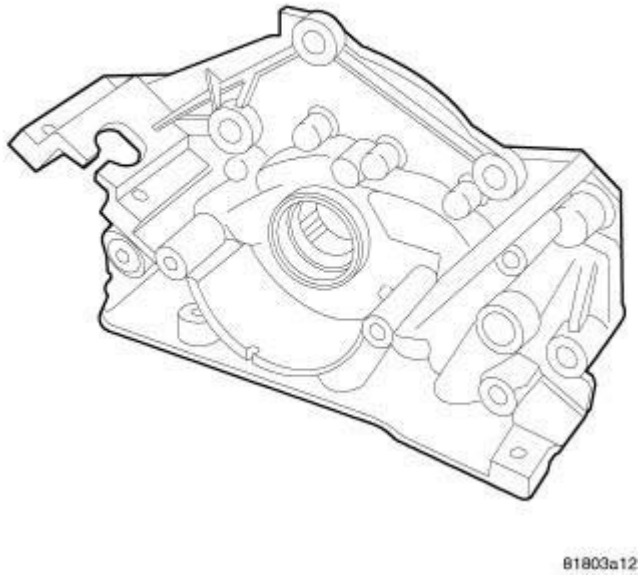


Fig. 373: Oil Pump
Courtesy of CHRYSLER LLC

NOTE: DO NOT apply the thread sealant to the underside of the bolt head.

3. Apply Mopar Thread Sealant as directed on the package to the oil pump cover bolts where indicated. The sealant must be applied from the tip to approximately 10 mm of the thread length. Tighten the oil pump cover bolts to 12 N.m (105 in. lbs.). Tighten oil pump to block bolts to 28 N.m (250 in. lbs.)

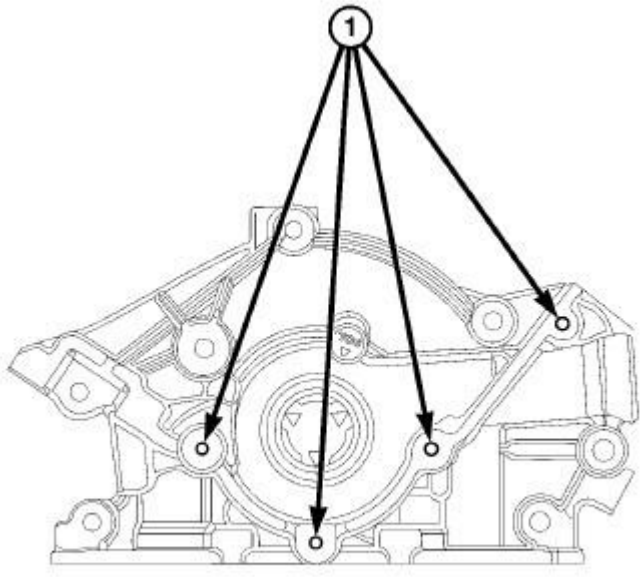


Fig. 374: Oil Pump Cover Bolts
Courtesy of CHRYSLER LLC

1 - SEALANT APPLICATION LOCATION

4. Install new O-ring on oil pickup tube.
5. Install oil pickup tube.
6. Install oil pan. See **Engine/Lubrication/PAN, Oil - Installation**
7. Install crankshaft sprocket. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Installation**
8. Install timing belt. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Installation**.
9. Install the timing belt covers. See **Engine/Valve Timing/COVER(S), Engine Timing - Installation**.
10. Install the crankshaft vibration damper. See **Engine/Engine Block/DAMPER, Vibration - Installation**
11. Install the accessory drive belts. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation** .
12. Fill the cooling system. Refer to **Cooling - Standard Procedure** .
13. Fill engine crankcase with proper oil to the correct level.

SWITCH, OIL PRESSURE

Removal

REMOVAL

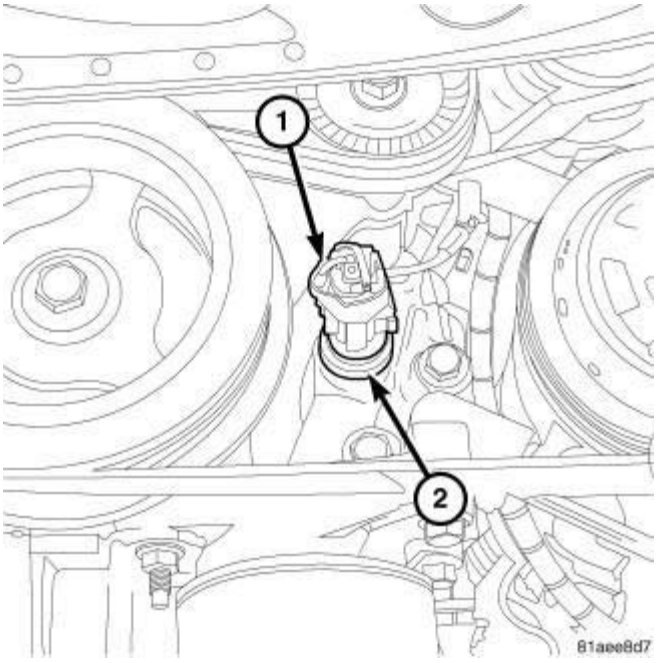


Fig. 375: OIL PRESSURE SWITCH
Courtesy of CHRYSLER LLC

1. Raise vehicle on hoist.

2. Position an oil collecting container under switch location.
3. Disconnect electrical connector (1).
4. Remove the oil pressure switch (2).

Installation

INSTALLATION

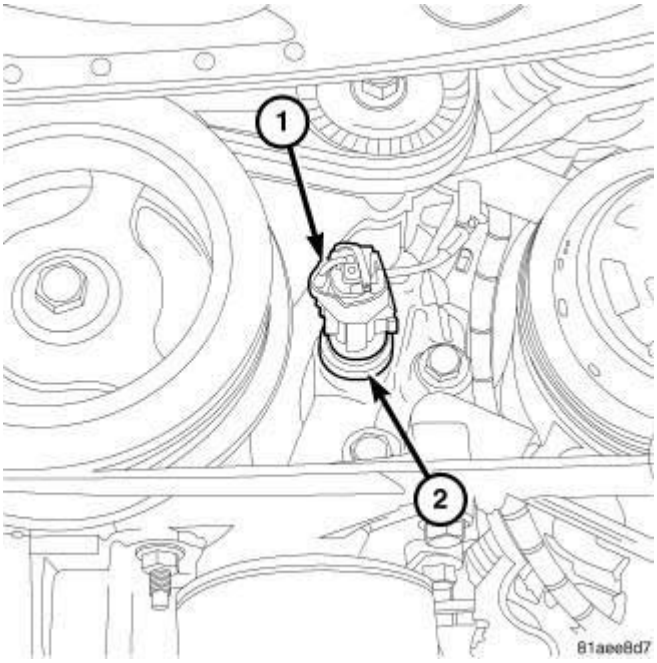


Fig. 376: OIL PRESSURE SWITCH
Courtesy of CHRYSLER LLC

1. Apply Mopar® Thread Sealant to the switch threads.
2. Install oil pressure switch (2).
3. Connect electrical connector (1).
4. Lower vehicle.
5. Start engine and check for leaks.
6. Check engine oil level and adjust as necessary.

VALVE, OIL PRESSURE RELIEF

Removal

REMOVAL

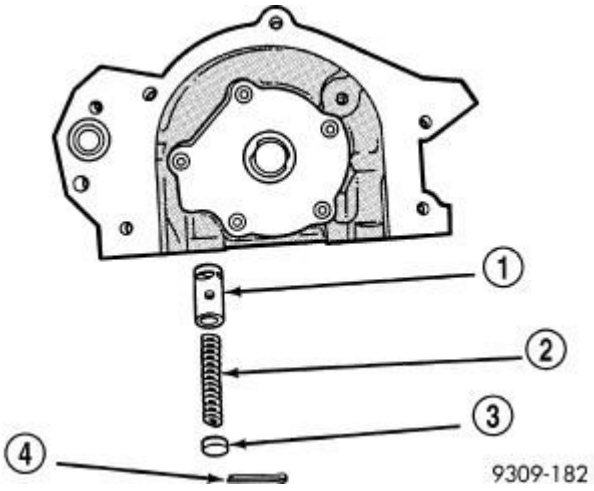


Fig. 377: Oil Pressure Relief Valve
Courtesy of CHRYSLER LLC

1 - RELIEF VALVE
2 - SPRING
3 - RETAINER CAP
4 - COTTER PIN

1. Remove the oil pan. See **Engine/Lubrication/PAN, Oil - Removal**
2. To remove the relief valve, proceed as follows:
    a. Remove the cotter pin that retains the retainer cap.
    b. Drill a 3.175 mm (1/8 inch.) hole into the relief valve retainer cap
    c. Insert a self-threading sheet metal screw into cap.
    d. Using a suitable slide hammer tool, remove retainer cap. Discard retainer cap
    e. Remove spring (2) and relief valve (1).

Inspection

INSPECTION

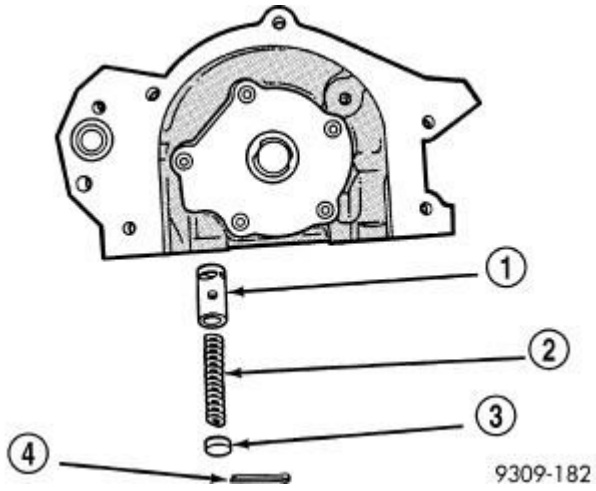


Fig. 378: Oil Pressure Relief Valve
Courtesy of CHRYSLER LLC

1 - RELIEF VALVE
2 - SPRING
3 - RETAINER CAP
4 - COTTER PIN

1. Inspect oil pressure relief valve (1) plunger for scoring and free operation in its bore. Small marks may be removed with 400-grit wet or dry sandpaper.
2. The relief valve spring (2) has a free length of approximately 49.5 mm (1.95 in.) it should test between 101-110 N (23-25 lbs.) when compressed to 34 mm (1.34 in.). Replace spring that fails to meet specifications.

Installation

INSTALLATION

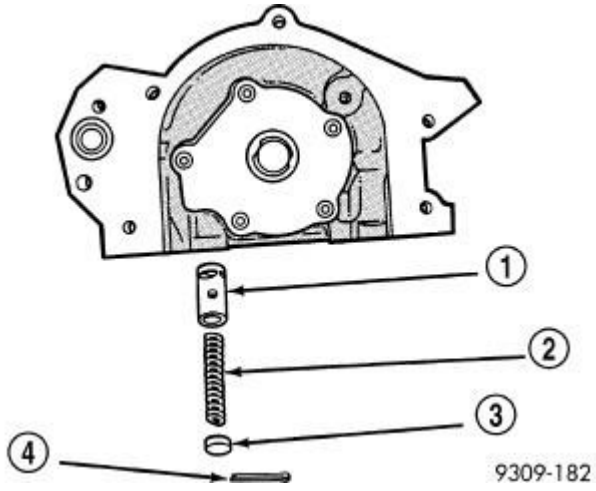


Fig. 379: Oil Pressure Relief Valve

Courtesy of CHRYSLER LLC

1 - RELIEF VALVE 2 - SPRING 3 - RETAINER CAP 4 - COTTER PIN

1. Lubricate relief valve (1) with oil.

CAUTION: The pressure relief valve must be installed as shown in Fig. 379 or engine damage may occur.

2. Install valve (1), spring (2) and retainer cap.
3. Install new cotter pin (4).
4. Install the oil pan. See **Engine/Lubrication/PAN, Oil - Installation**

MANIFOLDS

MANIFOLD, EXHAUST, FRONT

Removal

REMOVAL - FRONT EXHAUST MANIVERTER

1. Disconnect and isolate the negative battery cable.

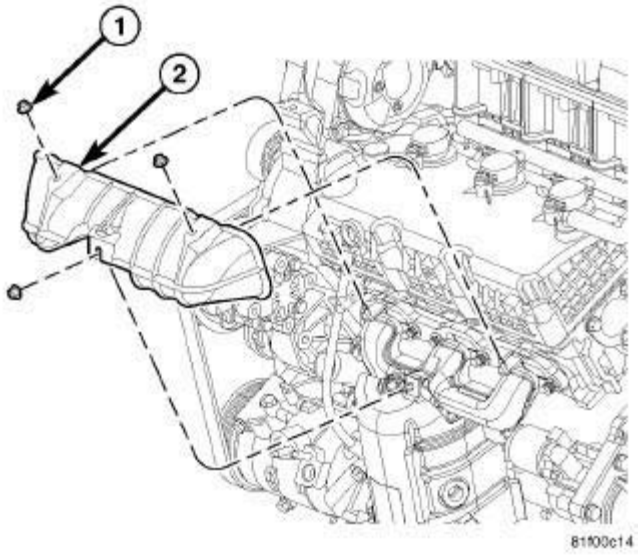


Fig. 380: Upper Heat Shield Fasteners
Courtesy of CHRYSLER LLC

2. Remove the fasteners (1), and remove the upper heat shield (2).

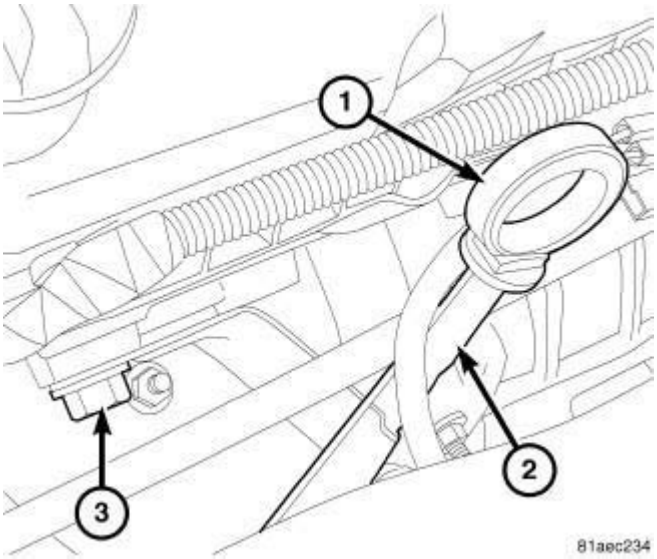


Fig. 381: Engine Oil Dipstick Tube
Courtesy of CHRYSLER LLC

3. Loosen the oil level indicator tube retaining bolt (3) and position the dipstick tube (2) aside.

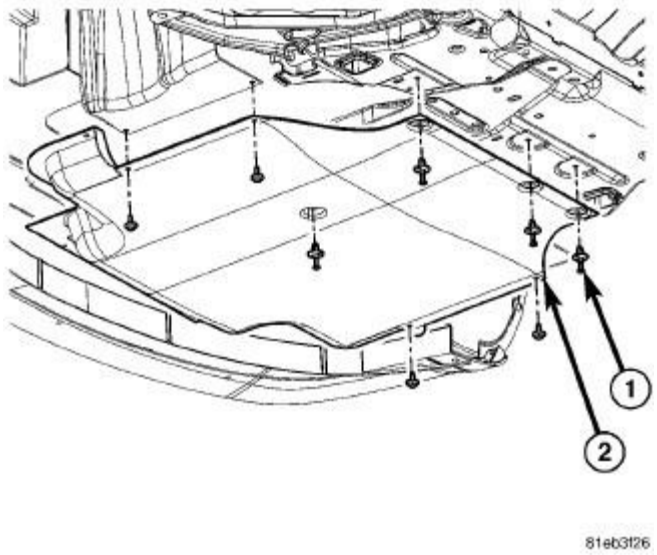


Fig. 382: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

1 - belly pan fasteners
2 - belly pan

4. Remove the 12 belly pan fasteners (1) and remove the belly pan (2).

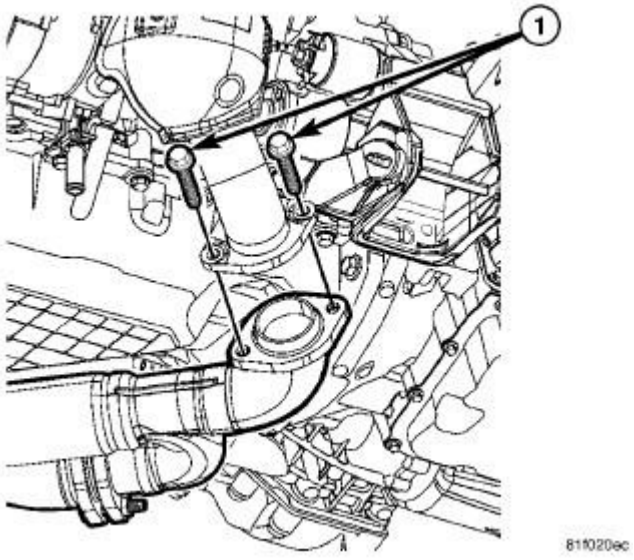


Fig. 383: Left Maniverter-To-Crossunder Pipe Fasteners
Courtesy of CHRYSLER LLC

5. Remove the left maniverter-to-crossunder pipe fasteners (1).

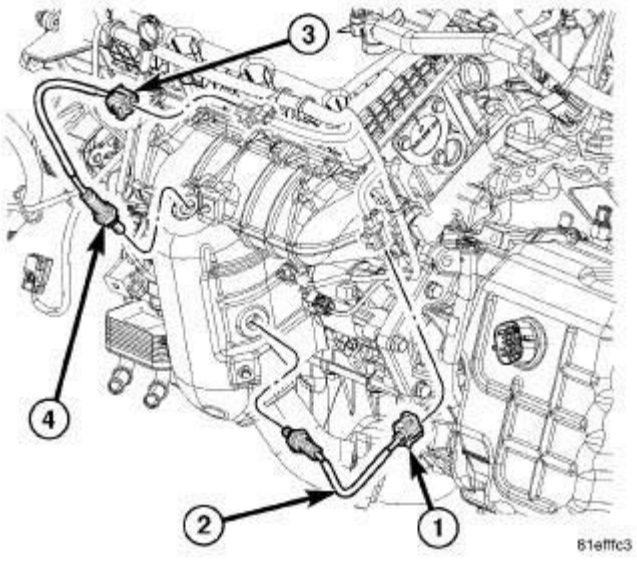


Fig. 384: Harness Connector From Front Maniverter Oxygen Sensor
Courtesy of CHRYSLER LLC

6. Disconnect the harness connector (1) and remove the front lower maniverter oxygen sensor (2).
7. Disconnect the harness connector (3) and remove the front upper maniverter oxygen sensor (4).

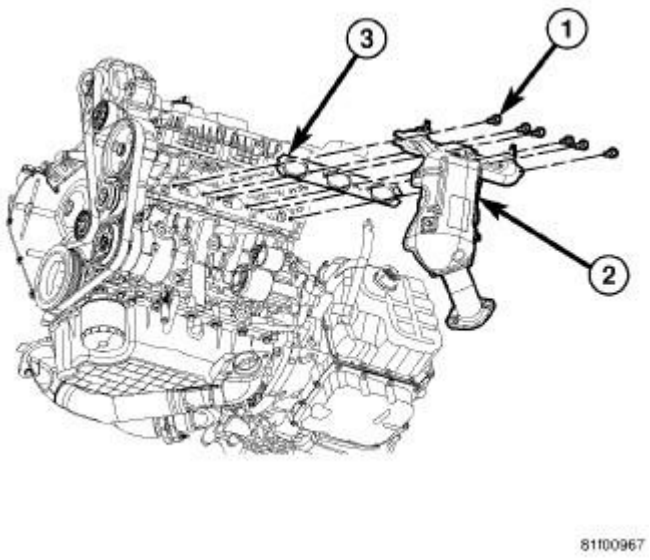


Fig. 385: Right Front Half Shaft Assembly
Courtesy of CHRYSLER LLC

8. Remove the maniverter retaining bolts (1), the maniverter (2), and gasket (3).

Inspection

INSPECTION

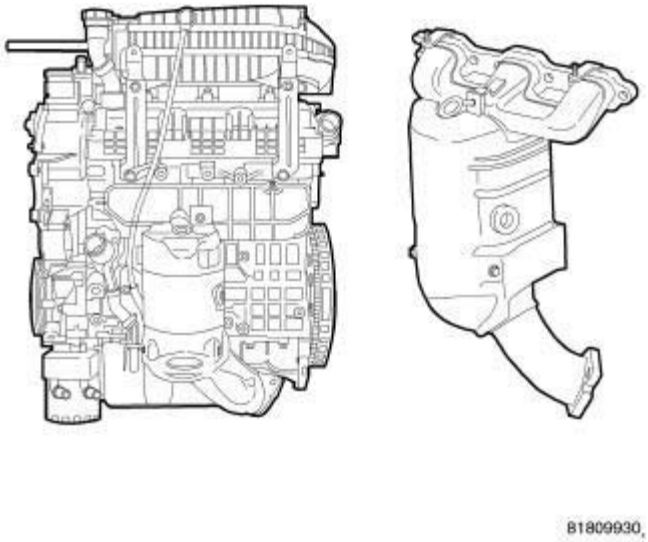


Fig. 386: LEFT MANIVERTER
Courtesy of CHRYSLER LLC

1. Inspect exhaust maniverters for damage or cracks.
2. Check maniverter mounting surface flatness.
3. Inspect the exhaust manifold gasket for obvious discoloration or distortion.
4. Check distortion of the cylinder head mounting surface with a straightedge and thickness gauge.

Installation

INSTALLATION - FRONT EXHAUST MANIVERTER

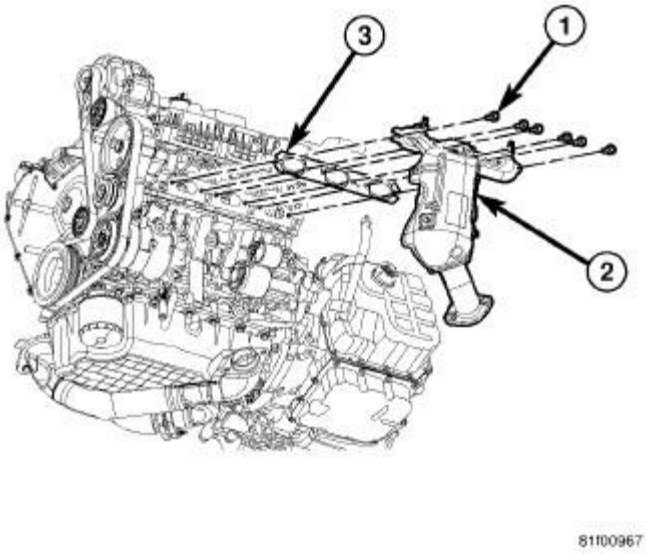


Fig. 387: Right Front Half Shaft Assembly
Courtesy of CHRYSLER LLC

1. Position the maniverter (2) and gasket (3). Install the retaining bolts (1). Tighten bolts starting at the center working outward to 23 N.m (200 in. lbs.).

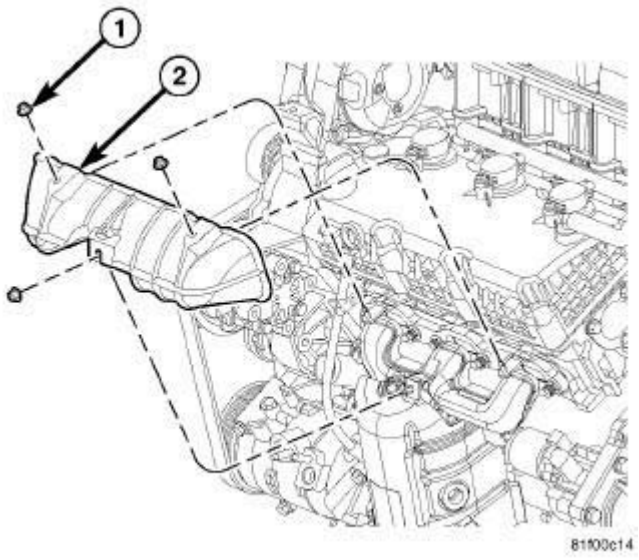


Fig. 388: Upper Heat Shield Fasteners
Courtesy of CHRYSLER LLC

2. Install the upper heat shield (2), and torque nuts (1) to 12 Nm (105 in. lbs).

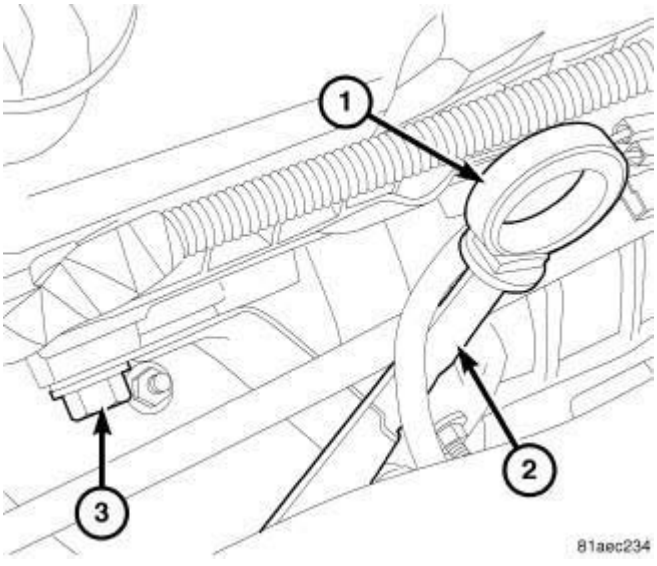


Fig. 389: Engine Oil Dipstick Tube
Courtesy of CHRYSLER LLC

3. Install the oil level indicator tube (2) and the retaining bolt (3).

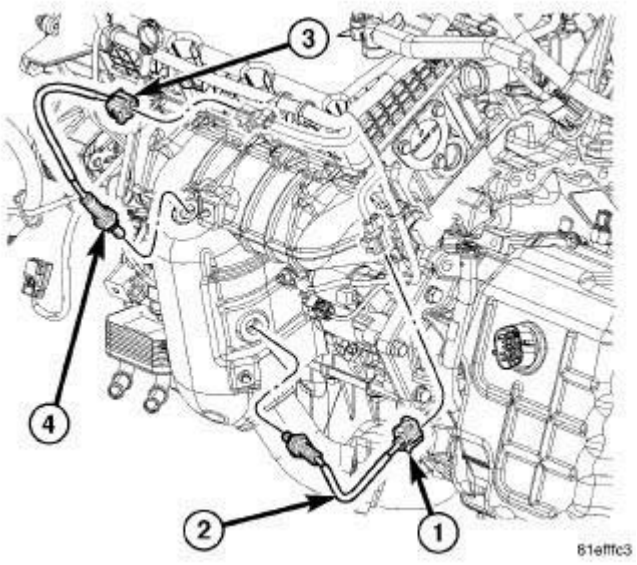


Fig. 390: Harness Connector From Front Maniverter Oxygen Sensor
Courtesy of CHRYSLER LLC

4. Install the left upstream oxygen sensor (4) and connect the harness connector (3).
5. Install the left downstream oxygen sensor (2) and connect the harness connector (1).

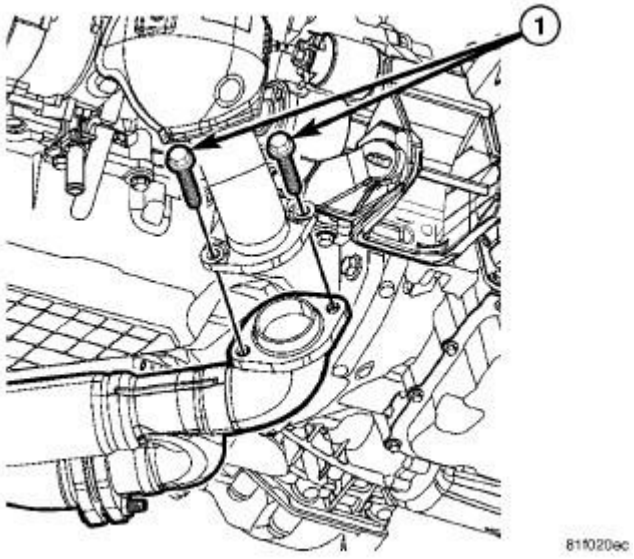


Fig. 391: Left Maniverter-To-Crossunder Pipe Fasteners
Courtesy of CHRYSLER LLC

6. Install the left maniverter cross under pipe retaining bolts (1). Tighten bolts to 31 N.m (275 in. lbs.).

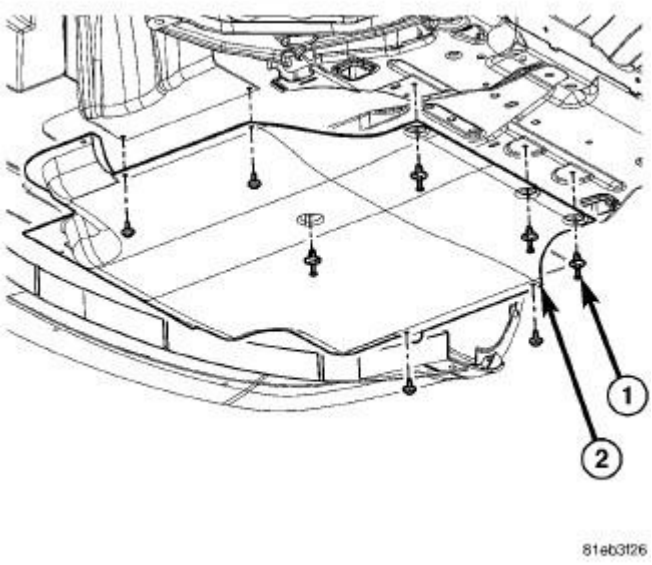


Fig. 392: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

1 - belly pan fasteners
2 - belly pan

7. Install the belly pan (2) and the 12 belly pan fasteners (1).
8. Connect the negative battery cable. Refer to **Electrical - Engine Systems/Battery System - Standard Procedure** .

MANIFOLD, EXHAUST, REAR

Removal

REMOVAL - REAR EXHAUST MANIVERTER, FWD

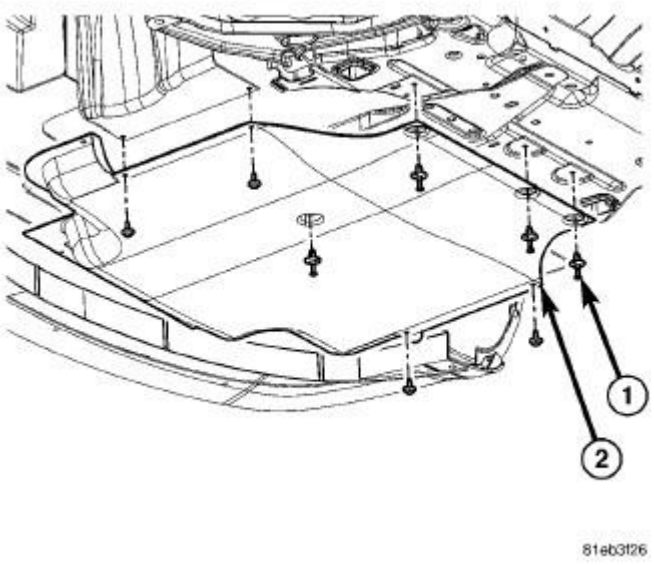


Fig. 393: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

1. Disconnect and isolate the negative battery cable.
2. Raise and support the vehicle. Refer to **Vehicle Quick Reference/Hoisting - Standard Procedure** .
3. Remove twelve belly pan fasteners (1) and remove the belly pan (2).

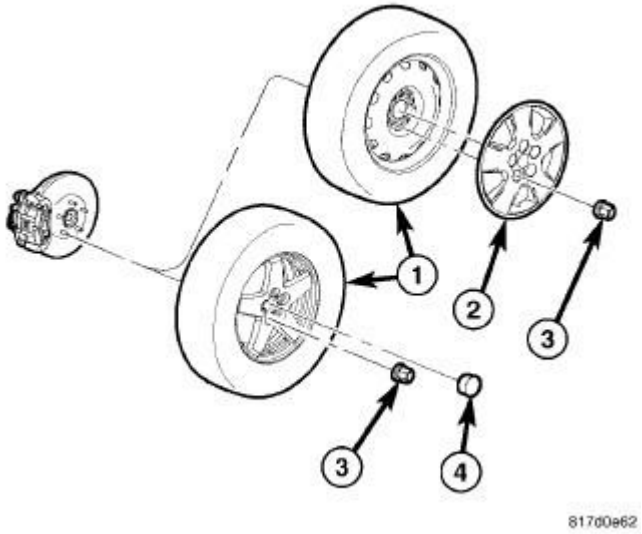


Fig. 394: TIRE & WHEEL MOUNTING
Courtesy of CHRYSLER LLC

4. Remove the right front tire and wheel assembly. Refer to **Tires and Wheels - Removal** .

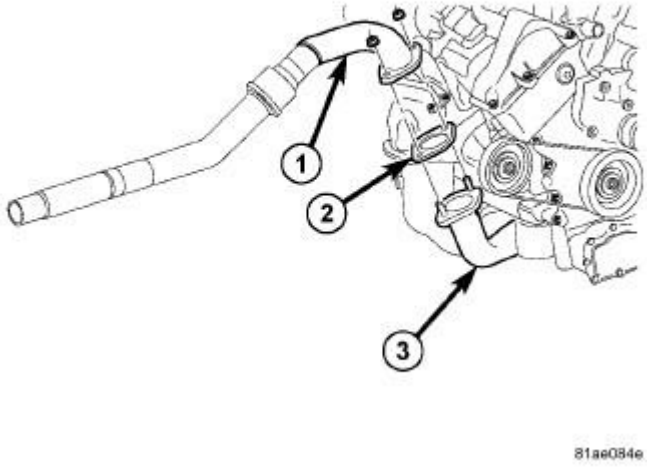


Fig. 395: Exhaust Extension Pipe & Gasket
Courtesy of CHRYSLER LLC

5. Remove the exhaust extension pipe (1). Refer to **Exhaust System/PIPE, Exhaust - Removal** .
6. Remove the exhaust crossunder pipe (3). Refer to **Exhaust System/PIPE, Exhaust Crossunder - Removal** .

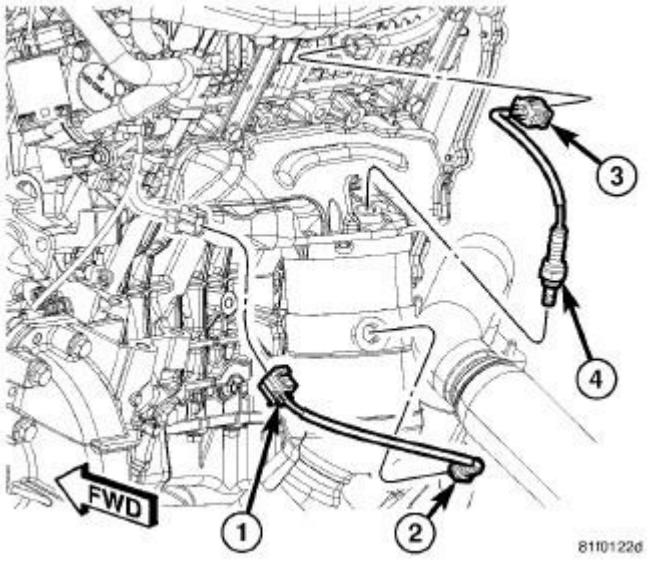


Fig. 396: Right Maniverter Downstream/Upstream Oxygen Sensors
Courtesy of CHRYSLER LLC

7. Disconnect harness connectors (1) and (3). Remove the right maniverter downstream (2) and upstream (4) oxygen sensors. Refer to **Fuel System/Fuel Injection/SENSOR, Oxygen - Removal** .

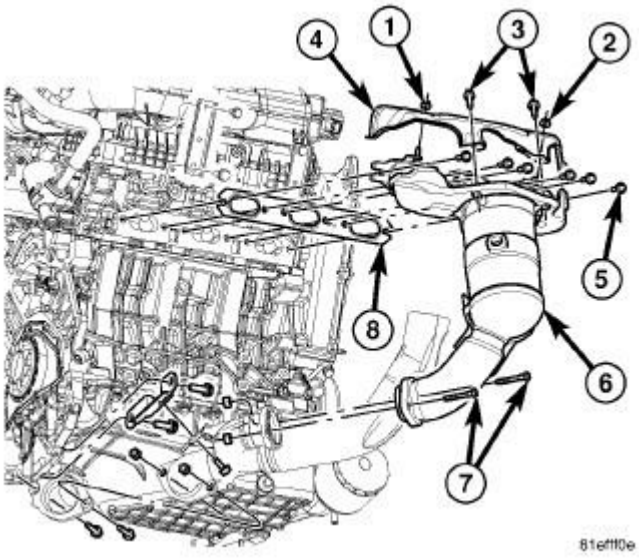


Fig. 397: Maniverter Retaining Bolts
Courtesy of CHRYSLER LLC

8. Remove heat shield retainers (1), (2), and (3) and remove the upper heat shield (4).
9. Remove the right maniverter retaining bolts (5) and remove the right maniverter (6) and gasket (8).

REMOVAL - REAR EXHAUST MANIVERTER, AWD

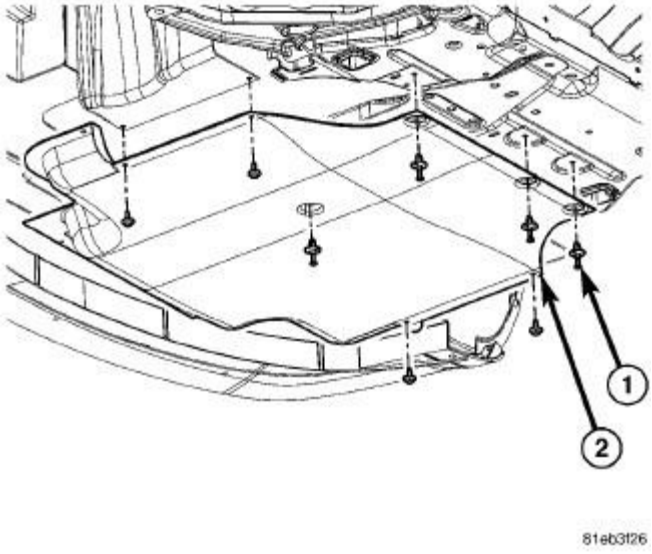


Fig. 398: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

1. Disconnect and isolate the negative battery cable.
2. Raise and support the vehicle. Refer to **Vehicle Quick Reference/Hoisting - Standard Procedure** .

3. Remove twelve belly pan fasteners (1) and remove the belly pan (2).

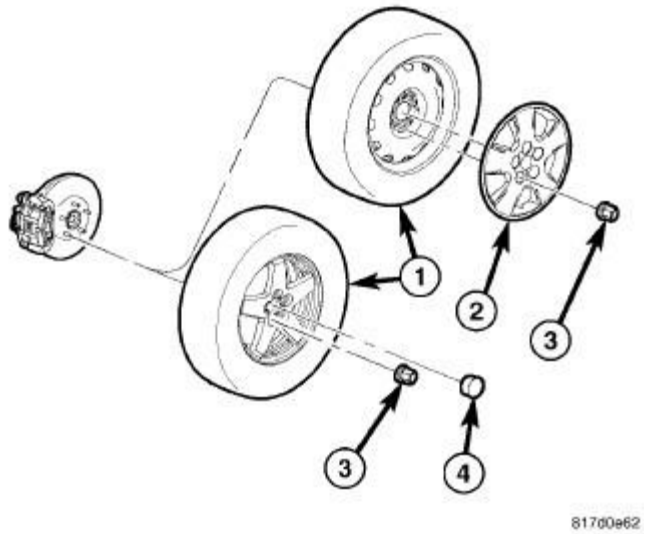


Fig. 399: TIRE & WHEEL MOUNTING
Courtesy of CHRYSLER LLC

4. Remove the right front tire and wheel assembly. Refer to **Tires and Wheels - Removal** .

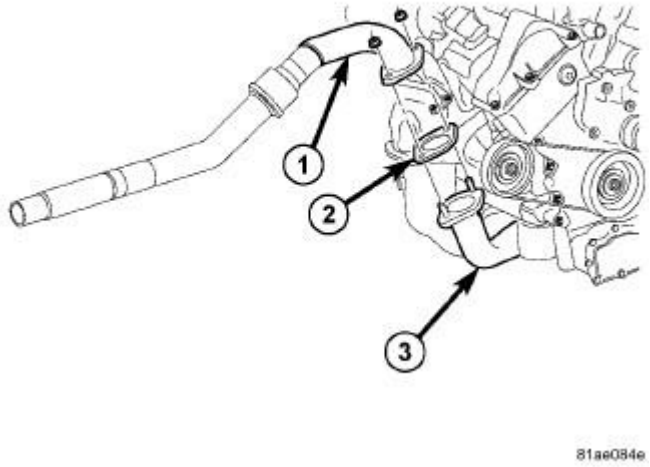


Fig. 400: Exhaust Extension Pipe & Gasket
Courtesy of CHRYSLER LLC

5. Remove the exhaust extension pipe (1). Refer to **Exhaust System/PIPE, Exhaust - Removal** .
6. Remove the exhaust crossunder pipe (3). Refer to **Exhaust System/PIPE, Exhaust Crossunder - Removal** .

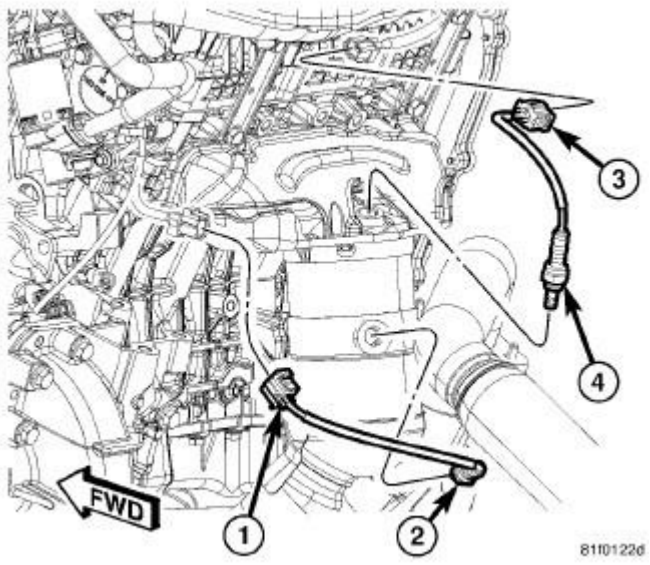


Fig. 401: Right Maniverter Downstream/Upstream Oxygen Sensors
Courtesy of CHRYSLER LLC

7. Disconnect harness connectors (1) and (3). Remove the right maniverter downstream (2) and upstream (4) oxygen sensors. Refer to **Fuel System/Fuel Injection/SENSOR, Oxygen - Removal** .

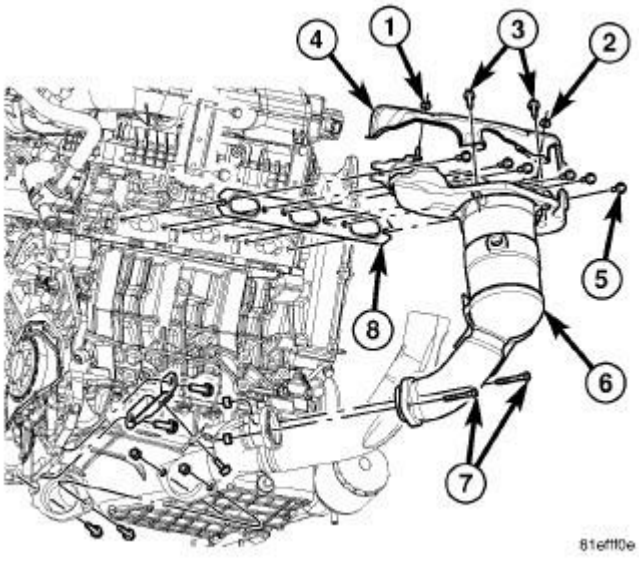


Fig. 402: Maniverter Retaining Bolts
Courtesy of CHRYSLER LLC

8. Remove heat shield retainers (1), (2), and (3) and remove the upper heat shield (4).

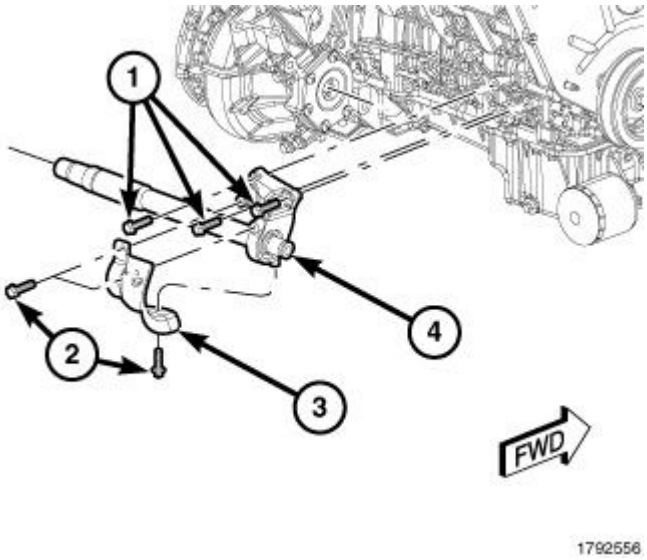


Fig. 403: Right Half Shaft & Intermediate Shaft
Courtesy of CHRYSLER LLC

9. Remove the right half shaft and intermediate shaft (4). Refer to **Differential and Driveline/Intermediate Shaft - Removal** .

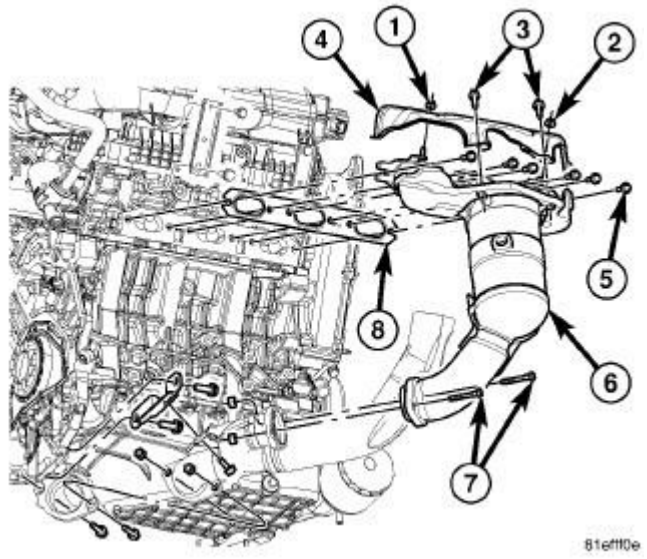


Fig. 404: Maniverter Retaining Bolts
Courtesy of CHRYSLER LLC

10. Remove the maniverter retaining bolts (5).

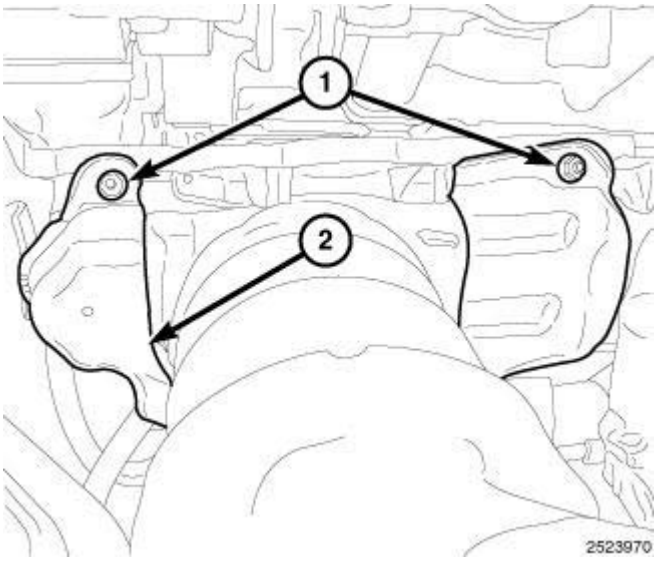


Fig. 405: Lower Maniverter Heatshield
Courtesy of CHRYSLER LLC

11. Reposition the maniverter to allow removal of the lower maniverter heatshield (2).
12. Remove the lower maniverter heat shield retainers (1) and remove the lower maniverter heat shield (2).
13. Remove the maniverter and gasket from the vehicle.

Installation

INSTALLATION - REAR EXHAUST MANIVERTER, FWD

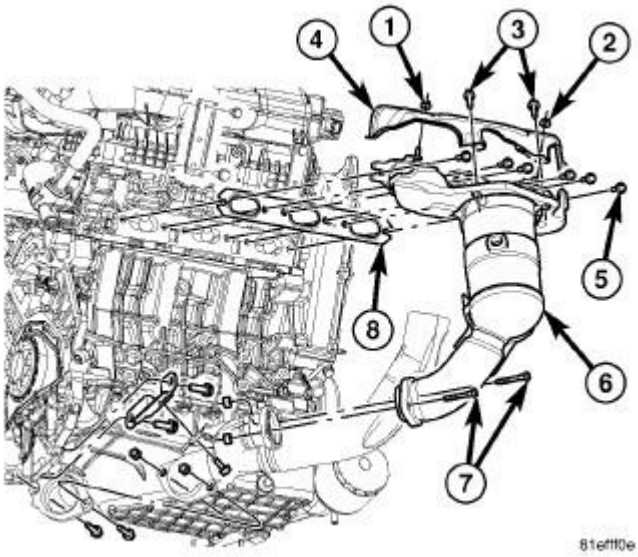


Fig. 406: Maniverter Retaining Bolts
Courtesy of CHRYSLER LLC

1. Clean the right maniverter gasket sealing surfaces with an appropriate tool. See **Engine - Standard Procedure**.
2. Position the right maniverter (6) and gasket (8). Install the retaining bolts (5) and tighten the bolts starting at the center working outward to 23 N.m (200 in. lbs.).
3. Install the right maniverter upper heat shield (4) with heat shield retainers (1), (2), and (3).

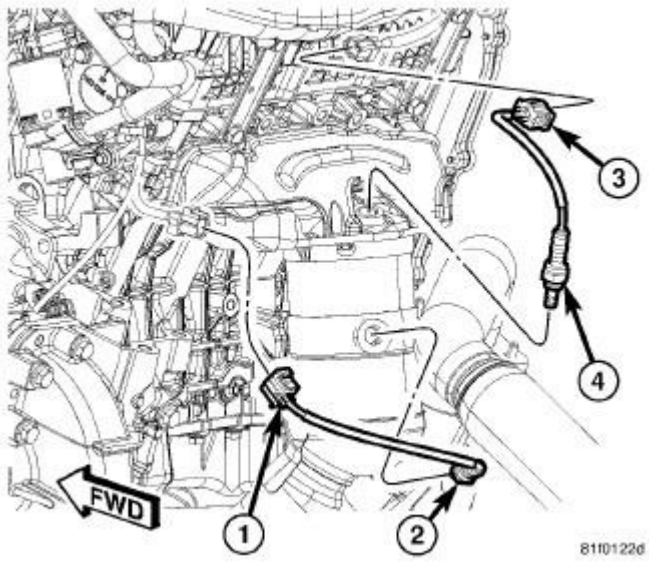


Fig. 407: Right Maniverter Downstream/Upstream Oxygen Sensors
Courtesy of CHRYSLER LLC

4. Install the right maniverter upstream (4) and downstream (2) oxygen sensors and reconnect the harness connectors (1) and (3). Refer to **Fuel System/Fuel Injection/SENSOR, Oxygen - Installation** .

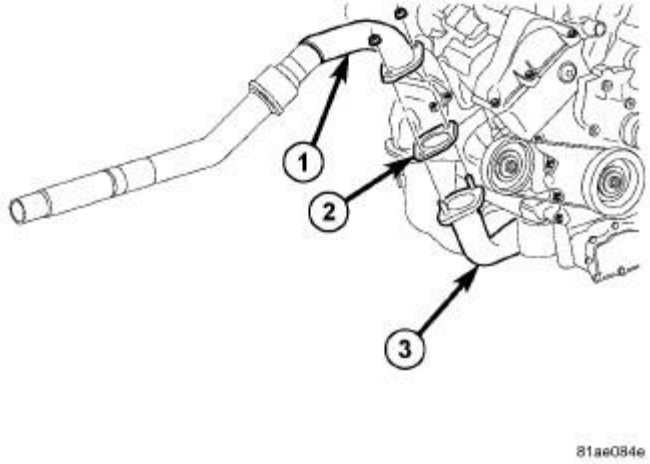


Fig. 408: Exhaust Extension Pipe & Gasket

Courtesy of CHRYSLER LLC

5. Install the exhaust crossunder pipe (3). Refer to **Exhaust System/PIPE, Exhaust Crossunder - Installation** .
6. Install the exhaust extension pipe (1). Refer to **Exhaust System/PIPE, Exhaust - Installation** .

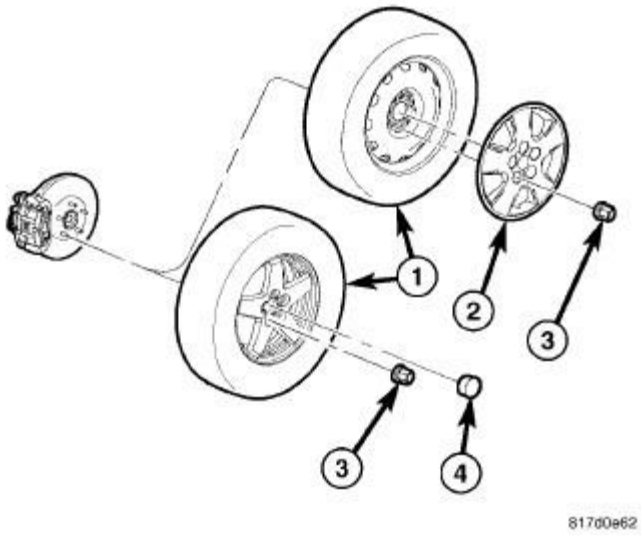


Fig. 409: TIRE & WHEEL MOUNTING
Courtesy of CHRYSLER LLC

7. Install the right front tire and wheel assembly. Refer to **Tires and Wheels - Installation** .

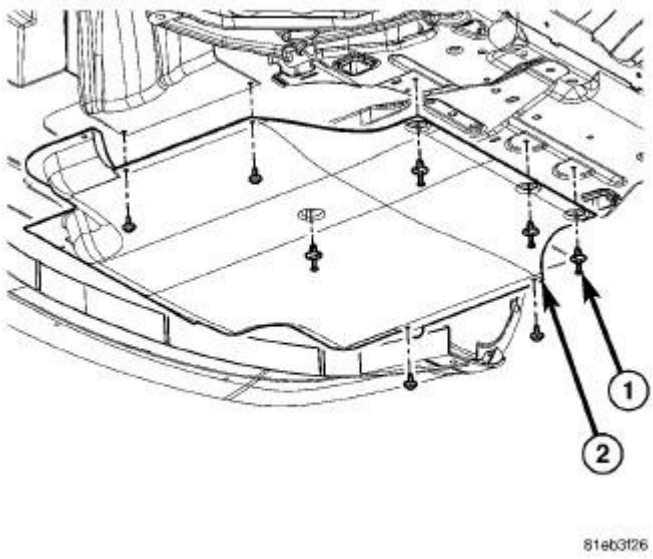


Fig. 410: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

8. Install the belly pan (2) and the twelve belly pan fasteners (1).
9. Lower the vehicle.
10. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).

INSTALLATION - REAR EXHAUST MANIVERTER, AWD

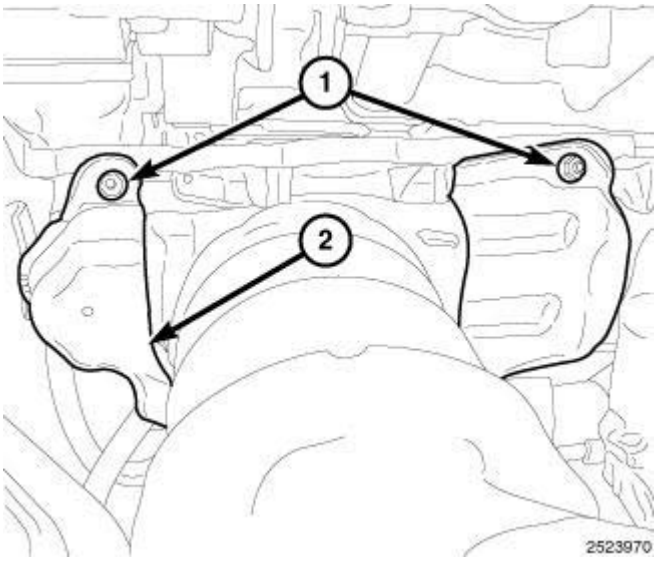


Fig. 411: Lower Maniverter Heatshield
Courtesy of CHRYSLER LLC

1. Clean the right maniverter gasket sealing surfaces with an appropriate tool. See **Engine - Standard Procedure**.
2. Place the right maniverter in the engine compartment and position to allow installation of the maniverter lower heatshield (2).
3. Install the right maniverter lower heat shield (2) with heat shield retainers (1).

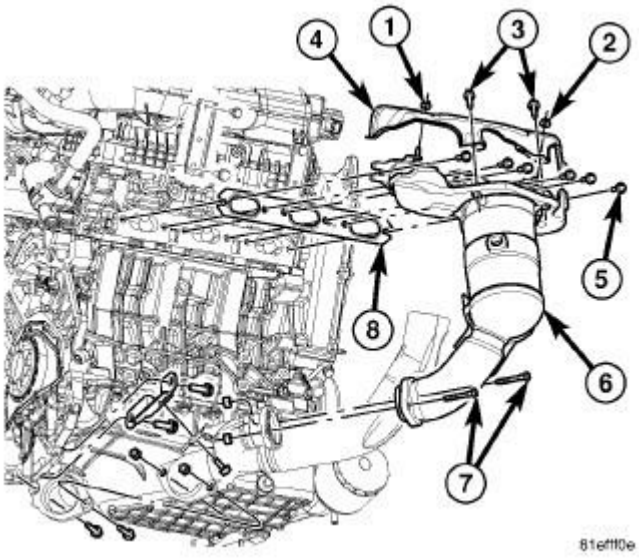


Fig. 412: Maniverter Retaining Bolts
Courtesy of CHRYSLER LLC

4. Install the right maniverter (6) and gasket (8) with retaining bolts (5). Tighten the bolts starting at the center working outward to 23 N.m (200 in. lbs.).
5. Install the right maniverter upper heat shield (4) with heat shield retainers (1), (2), and (3).

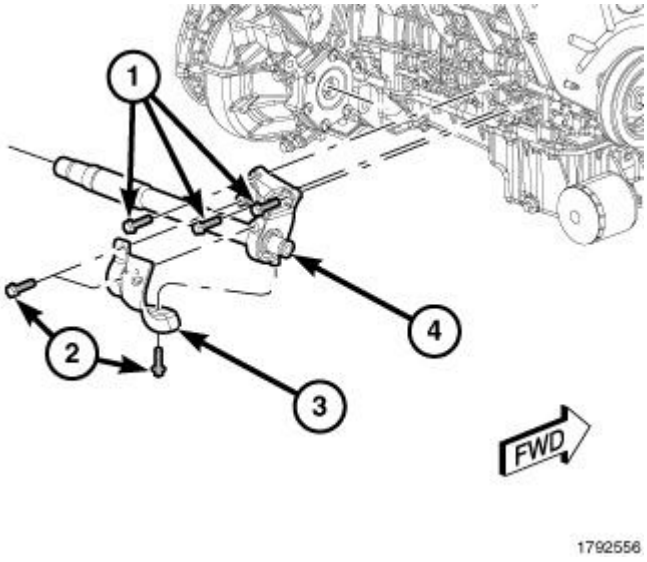


Fig. 413: Right Half Shaft & Intermediate Shaft
Courtesy of CHRYSLER LLC

6. Install the intermediate shaft (4) and right half shaft. Refer to **Differential and Driveline/Intermediate Shaft - Installation** .

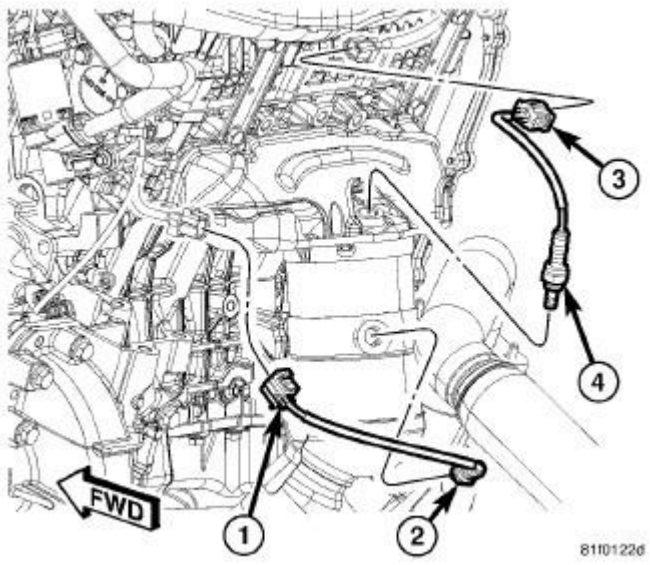


Fig. 414: Right Maniverter Downstream/Upstream Oxygen Sensors
Courtesy of CHRYSLER LLC

7. Install the right maniverter upstream (4) and downstream (2) oxygen sensors and reconnect the harness connectors (1) and (3). Refer to **Fuel System/Fuel Injection/SENSOR, Oxygen - Installation** .

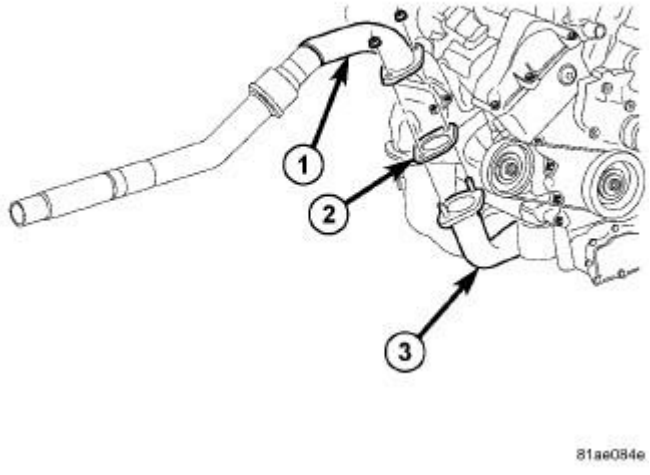


Fig. 415: Exhaust Extension Pipe & Gasket
Courtesy of CHRYSLER LLC

8. Install the exhaust crossunder pipe (3). Refer to **Exhaust System/PIPE, Exhaust Crossunder - Installation** .
9. Install the exhaust extension pipe (1). Refer to **Exhaust System/PIPE, Exhaust - Installation** .

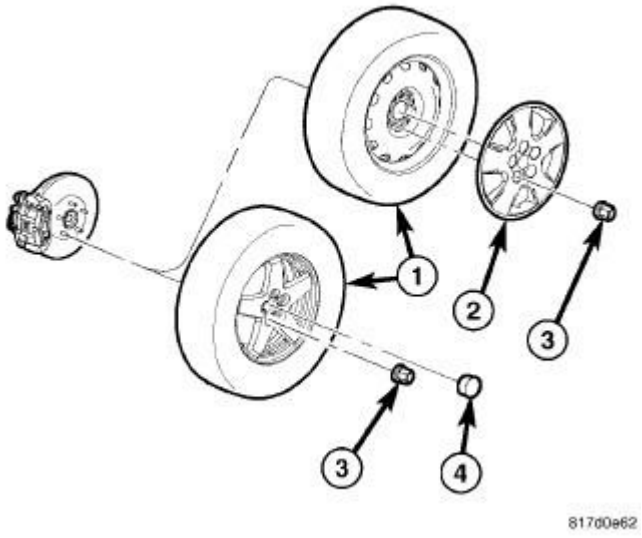


Fig. 416: TIRE & WHEEL MOUNTING
Courtesy of CHRYSLER LLC

10. Install the right front tire and wheel assembly. Refer to **Tires and Wheels - Installation** .

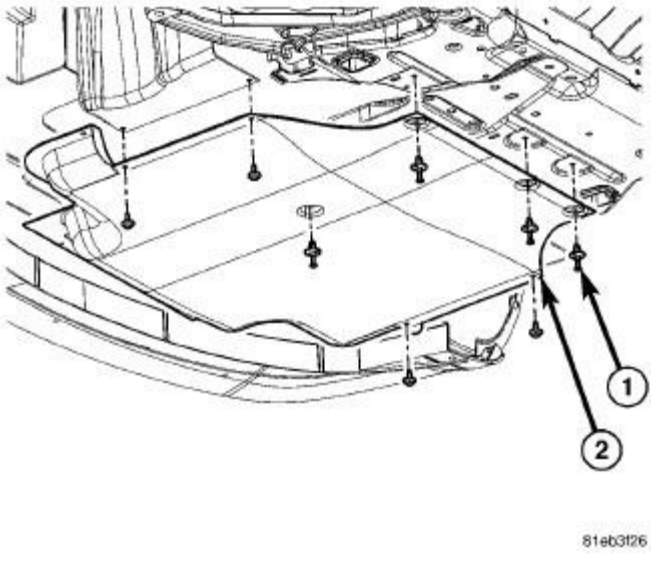


Fig. 417: Belly Pan Fasteners
Courtesy of CHRYSLER LLC

11. Install the belly pan (2) and the twelve belly pan fasteners (1).
12. Lower the vehicle.
13. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).

MANIFOLD, INTAKE

Removal

REMOVAL - UPPER INTAKE MANIFOLD

1. Remove engine cover.

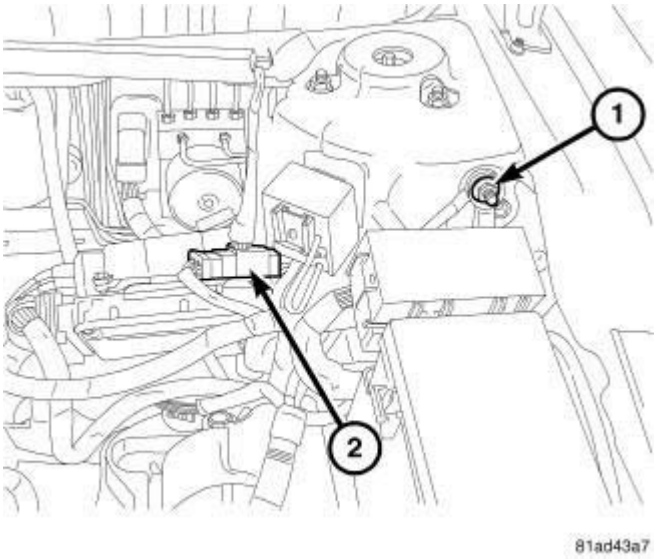


Fig. 418: BATTERY CABLE
Courtesy of CHRYSLER LLC

2. Disconnect negative battery cable.

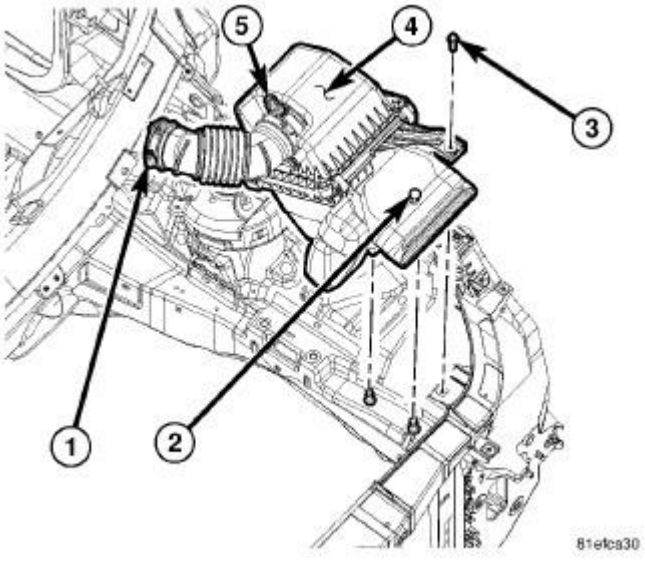


Fig. 419: HOUSING - AIR CLEANER
Courtesy of CHRYSLER LLC

3. Remove air cleaner housing (4) and inlet hose (1). See **Engine/Air Intake System/BODY, Air Cleaner -**

Removal.

4. Disconnect the EGR tube. Refer to **Emissions Control/Exhaust Gas Recirculation/VALVE, Exhaust Gas Recirculation (EGR) - Removal** .

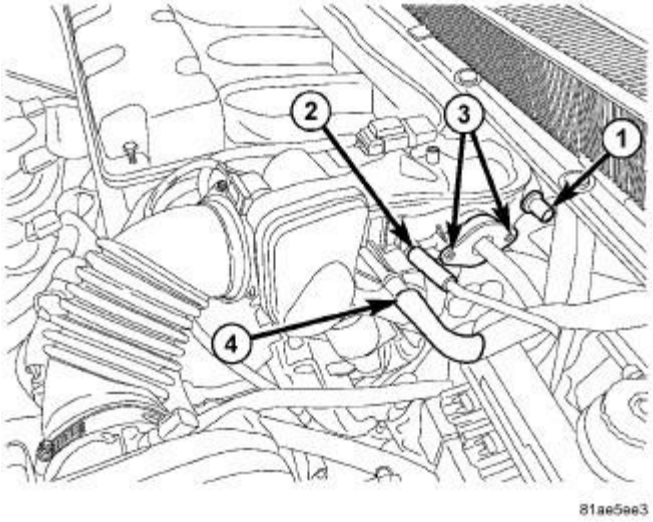


Fig. 420: Locating Manifold Tuning Valve, Short Runner Valve, TP Sensor & MAP Sensor Connections
Courtesy of CHRYSLER LLC

5. Disconnect the following vacuum hoses from the upper intake manifold:

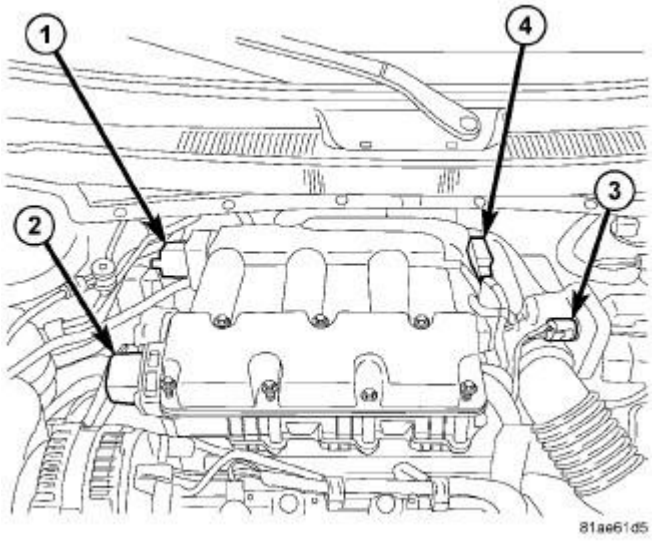


Fig. 421: Identifying PCV Valve, EVAP Purge Solenoid, EGR Tube & Power Brake Booster
Courtesy of CHRYSLER LLC

- Positive Crankcase Ventilation (PCV) Valve (1)
- EVAP Purge Solenoid (2)
- EGR Tube (3)
- Power Brake Booster (4)

6. Disconnect electrical connectors from the following sensors and actuators:

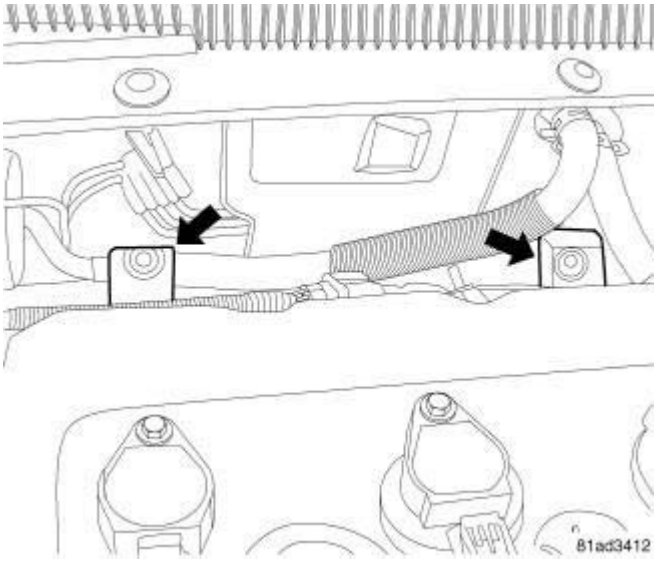


Fig. 422: REAR BRACKETS
Courtesy of CHRYSLER LLC

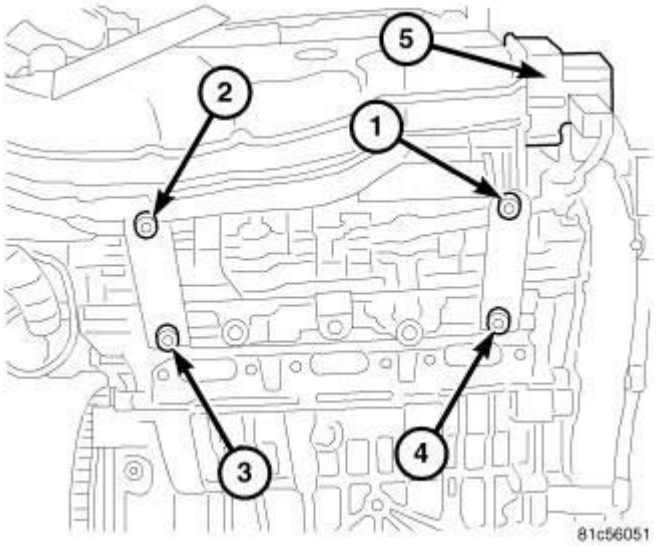


Fig. 423: Manifold Tuning Valve, Short Runner Valve, Throttle Position Sensor & Manifold Absolute Pressure
Courtesy of CHRYSLER LLC

- Manifold Tuning Valve (MTV) (1)

- Short Runner Valve (2)
- Throttle Position Sensor (TPS) (3)
- Manifold Absolute Pressure (MAP) (4)

7. Remove the Manifold Tuning Valve (5), then Remove the 2 nuts (1) and (2) from the rear intake manifold brackets.
8. Loosen the 2 bolts (3) and (4) from rear intake manifold brackets and position brackets aside.

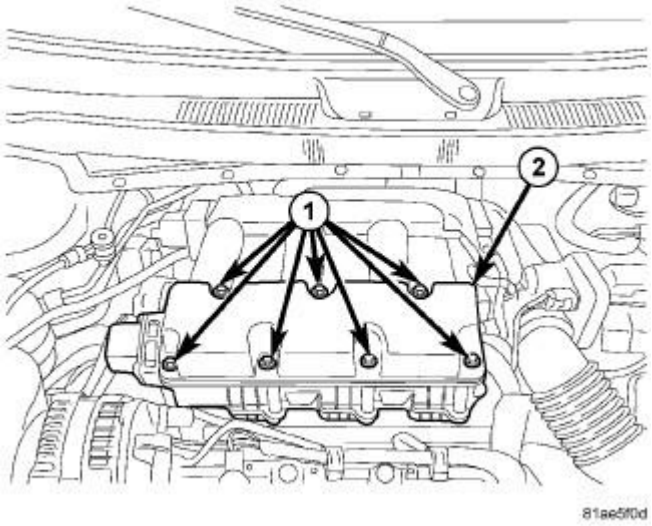


Fig. 424: Upper Intake Manifold
Courtesy of CHRYSLER LLC

9. Remove the 7 upper intake manifold retaining bolts (1) and the upper intake manifold (2). Clean all gasket sealing surfaces.

LOWER INTAKE MANIFOLD

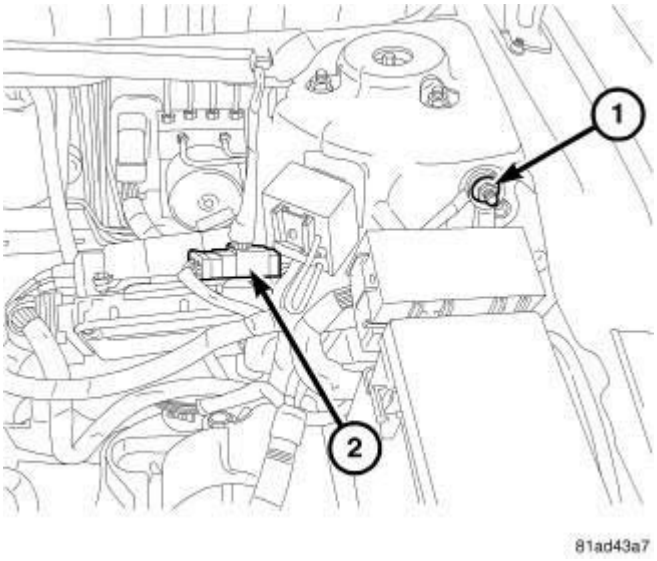


Fig. 425: BATTERY CABLE
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable (1).
2. Perform fuel pressure release procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .
3. Drain the cooling system. Refer to **Cooling - Standard Procedure** .

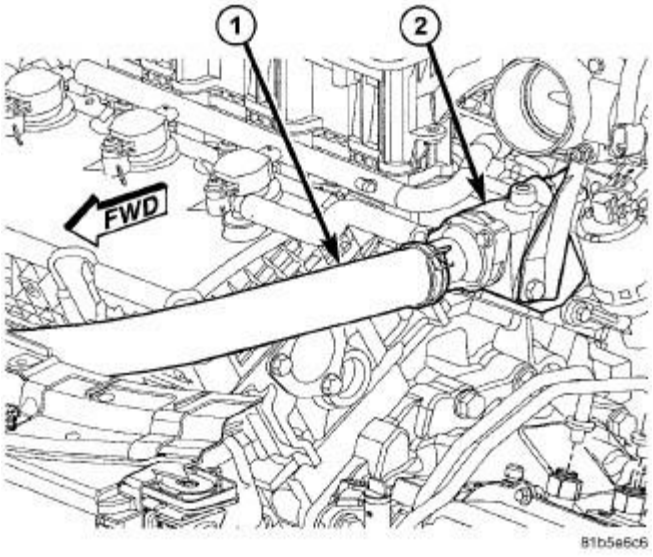


Fig. 426: Upper Radiator Hose From Thermostat Housing
Courtesy of CHRYSLER LLC

4. Disconnect the upper radiator hose (1) from the thermostat housing (2).
5. Remove the upper intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Removal**.
6. Disconnect the electrical connectors to fuel injectors and coolant temperature sensor.

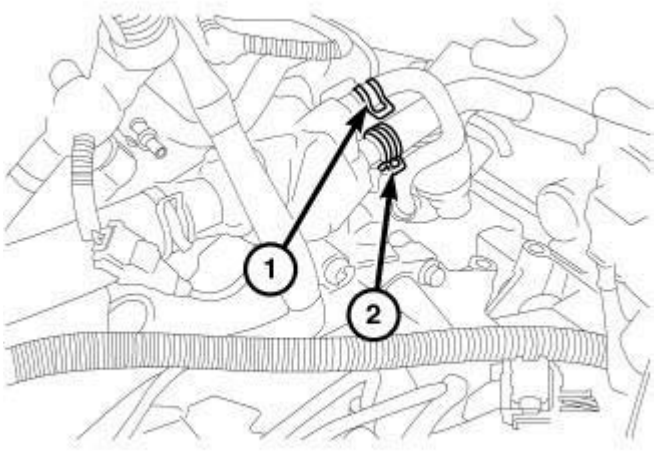


Fig. 427: Heater Supply & Return Hoses
Courtesy of CHRYSLER LLC

7. Disconnect heater supply and return hoses from the thermostat housing.

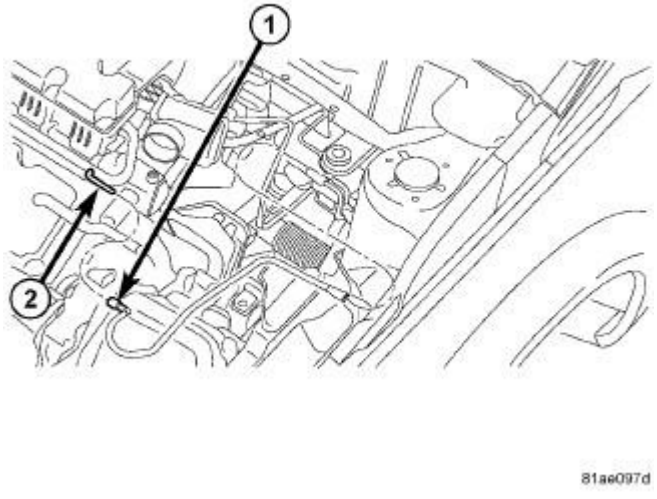


Fig. 428: Fuel Line From Fuel Rail Inlet
Courtesy of CHRYSLER LLC

8. Disconnect the fuel line from the fuel rail.

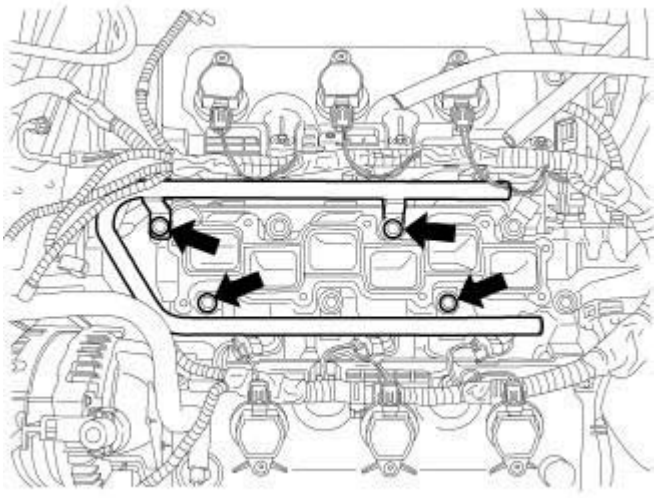


Fig. 429: Fuel Rail Bolts
Courtesy of CHRYSLER LLC

9. Remove the 4 bolts attaching fuel rail.
10. Remove fuel rail and injectors as an assembly.

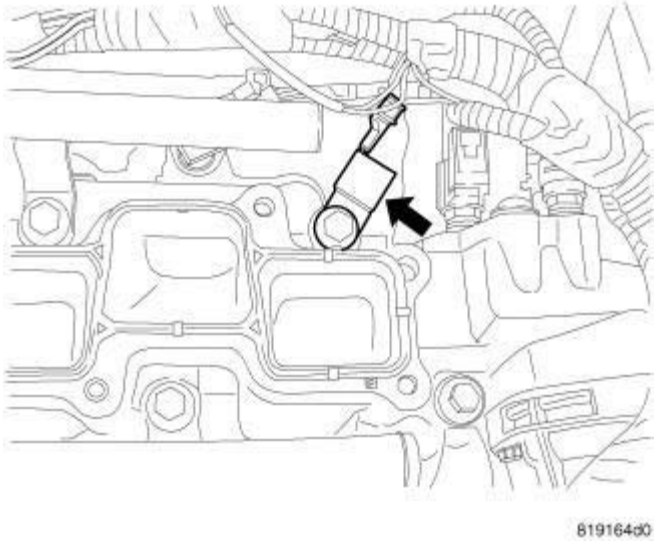


Fig. 430: CAPACITOR LOCATION
Courtesy of CHRYSLER LLC

11. Remove lower intake 4 bolts and position the ignition coil capacitor aside.

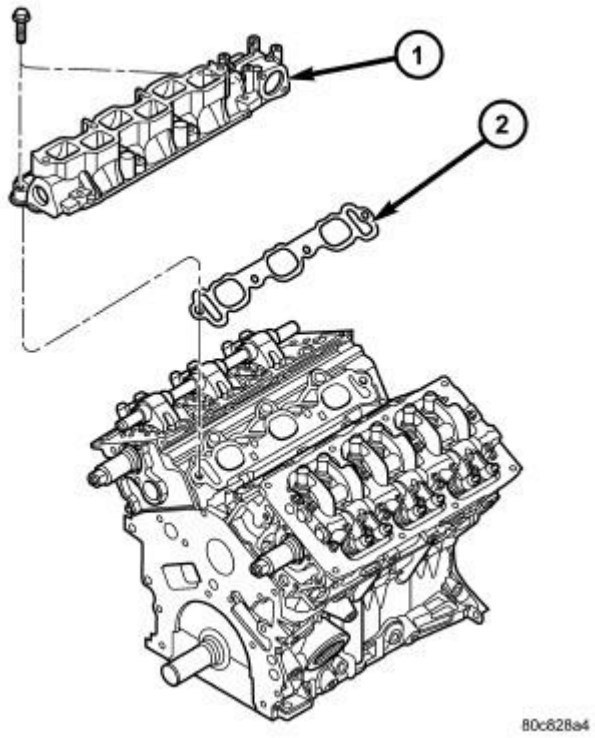


Fig. 431: Lower Intake Manifold
Courtesy of CHRYSLER LLC

1 - LOWER INTAKE MANIFOLD 2 - GASKET

12. Remove the lower intake manifold (1).

Installation

LOWER INTAKE MANIFOLD

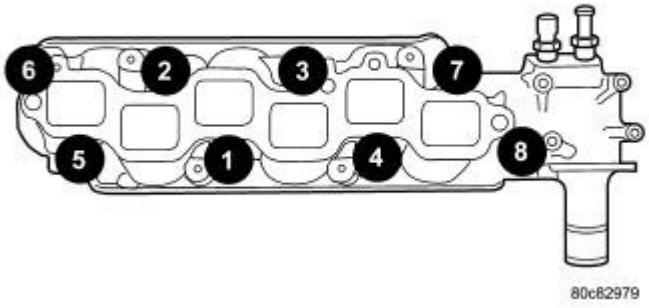


Fig. 432: Lower Intake Manifold Tightening Sequence

Courtesy of CHRYSLER LLC

1. Clean all sealing surfaces.
2. Position new gaskets and intake manifold on cylinder head surfaces.
3. Position the ignition coil capacitor and install the intake manifold bolts. Gradually tighten in sequence shown in illustration until a torque of 28 N.m (250 in. lbs.) is obtained.
4. Install fuel rail and injectors as an assembly.
5. Connect fuel supply hose to fuel rail.
6. Connect heater supply and return hoses to the intake manifold.
7. Connect electrical connectors to fuel injectors and coolant temperature sensor.
8. Install upper intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Installation**.
9. Connect upper radiator hose to thermostat housing.
10. Fill cooling system. Refer to **Cooling - Standard Procedure** .
11. Connect negative battery cable. Refer to **Electrical - Engine Systems/Battery System - Standard Procedure** .

INSTALLATION - UPPER INTAKE MANIFOLD

1. Clean and inspect gasket sealing surfaces.
2. Position new gasket.
3. Install the throttle body on the upper intake (if required). Refer to **Fuel System/Fuel Injection/THROTTLE BODY - Installation** .

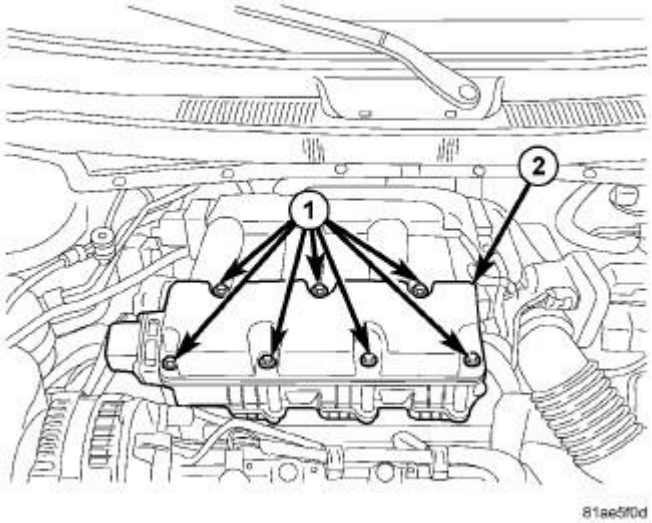


Fig. 433: Upper Intake Manifold
Courtesy of CHRYSLER LLC

4. Install upper intake manifold (2) and hand start all attaching bolts (1).

5. Tighten bolts gradually starting in the center working outward until a torque of 12 N.m (105 in. lbs.) is obtained.
6. Install the rear intake manifold brackets to the head.

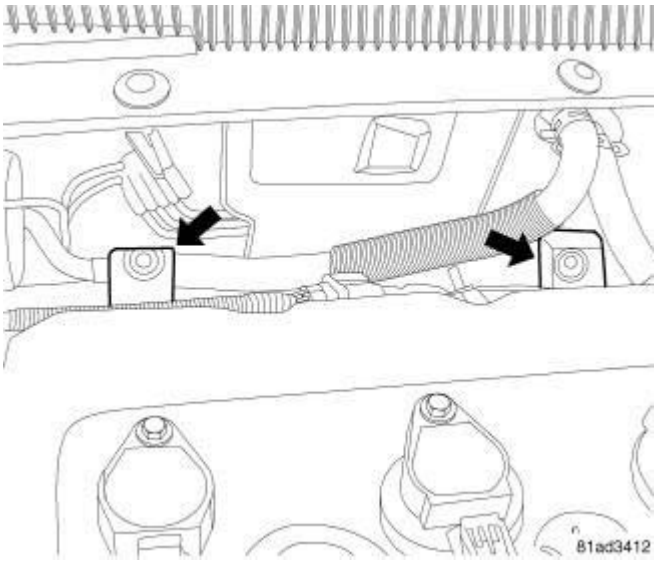


Fig. 434: REAR BRACKETS
Courtesy of CHRYSLER LLC

7. Install the 2 intake manifold to bracket nut retainers.
8. Install the EGR tube. Refer to **Emissions Control/Exhaust Gas Recirculation/VALVE, Exhaust Gas Recirculation (EGR) - Installation** .

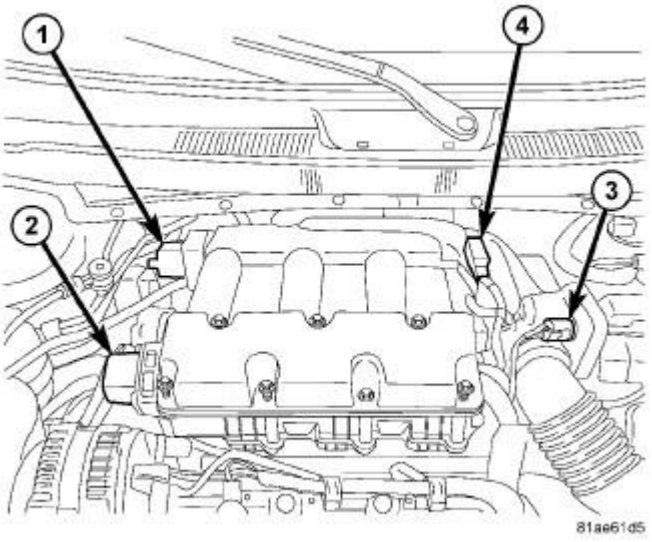


Fig. 435: Identifying PCV Valve, EVAP Purge Solenoid, EGR Tube & Power Brake Booster
Courtesy of CHRYSLER LLC

9. Connect electrical connectors to the following sensors and actuators:

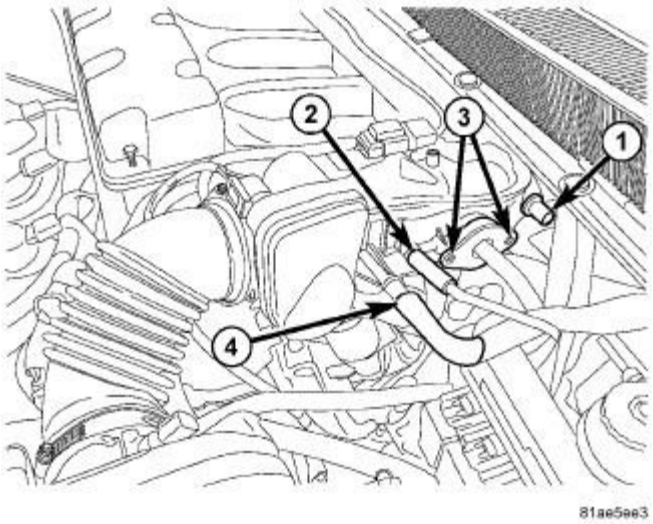


Fig. 436: Locating Manifold Tuning Valve, Short Runner Valve, TP Sensor & MAP Sensor Connections
Courtesy of CHRYSLER LLC

- Manifold Tuning Valve (MTV) (1)
- Short Runner Valve (2)
- Throttle Position Sensor (TPS) (3)
- Manifold Absolute Pressure (MAP) (4)

10. Connect the following vacuum hoses to the upper intake manifold:

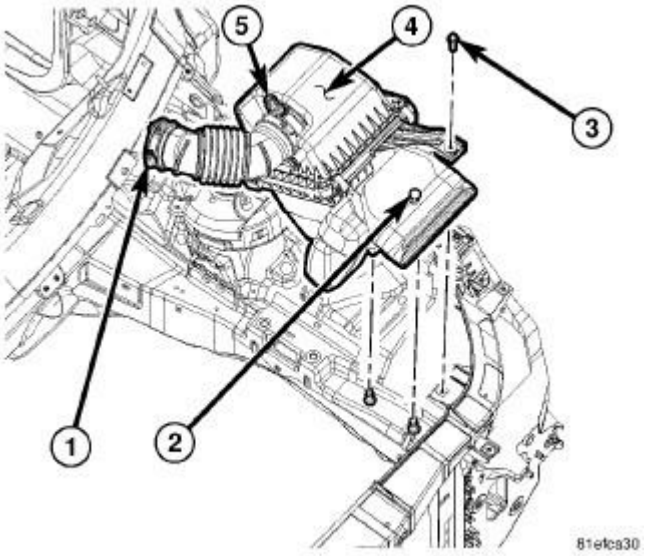


Fig. 437: HOUSING - AIR CLEANER
Courtesy of CHRYSLER LLC

- Positive Crankcase Ventilation (PCV) Valve (1)
- EVAP Purge Solenoid (2)
- EGR Tube (3)
- Power Brake Booster (4)

11. Install air cleaner housing (4) and inlet hose (1). See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.

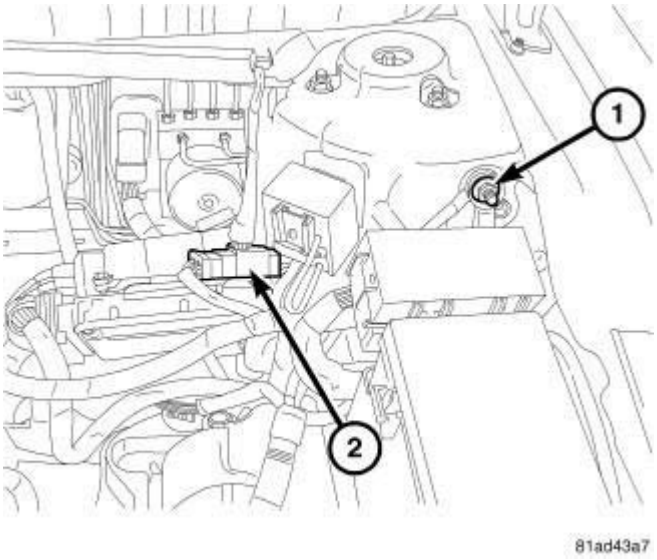


Fig. 438: BATTERY CABLE
Courtesy of CHRYSLER LLC

12. Connect negative battery cable. Refer to **Electrical - Engine Systems/Battery System - Standard Procedure** .
13. Install the engine cover.

VALVE TIMING

DESCRIPTION

DESCRIPTION

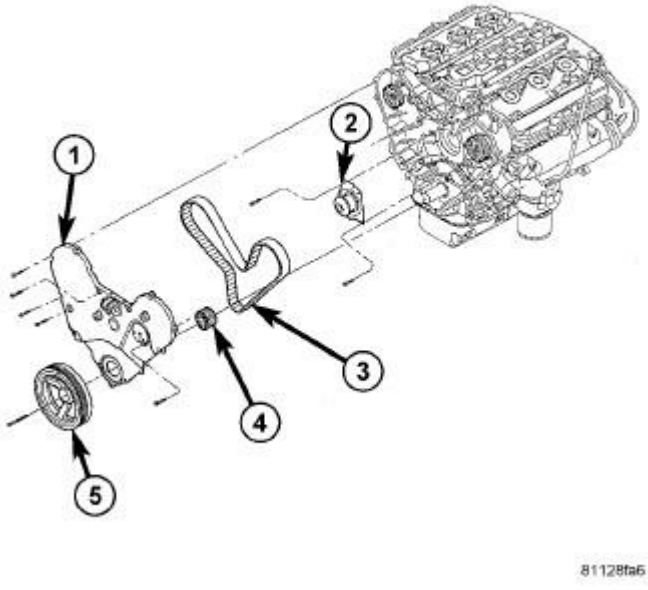


Fig. 439: TIMING DRIVE SYSTEM
Courtesy of CHRYSLER LLC

1 - FRONT TIMING COVER
2 - WATER PUMP
3 - TIMING BELT
4 - CRANKSHAFT SPROCKET
5 - CRANKSHAFT DAMPER

The timing drive system has been designed to provide quiet performance and reliability to support a **NON** free-wheeling engine.

The timing drive components include a crankshaft sprocket, camshaft sprockets, tensioner pulley, hydraulic tensioner and a timing belt. The water pump is driven by the back side of the timing belt. The right and left camshaft sprockets are keyed and not interchangeable because of the cam sensor pick-up wheel on the left sprocket.

STANDARD PROCEDURE

TIMING VERIFICATION

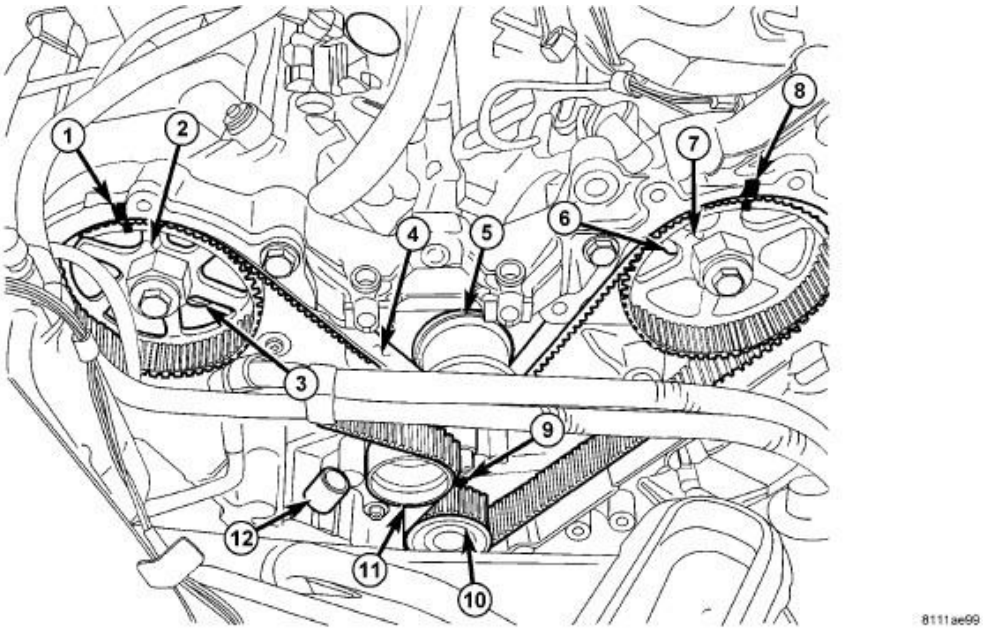


Fig. 440: TIMING GEAR MARKS
Courtesy of CHRYSLER LLC

1 - RIGHT CAMSHAFT GEAR ALIGNMENT MARK	7 - LEFT CAMSHAFT GEAR
2 - RIGHT CAMSHAFT GEAR	8 - LEFT CAMSHAFT GEAR ALIGNMENT MARK
3 - CYLINDER HEAD TO INNER TIMING BELT COVER BOLTS - RIGHT	9 - CRANKSHAFT GEAR ALIGNMENT MARK
4 - TIMING BELT	10 - CRANKSHAFT GEAR
5 - WATER PUMP PULLEY	11 - TIMING BELT TENSIONER PULLEY
6 - CYLINDER HEAD TO INNER TIMING BELT COVER BOLTS - LEFT	12 - TIMING BELT TENSIONER

Remove the outer timing covers. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal** Rotate the crankshaft until the pointer on the crankshaft sprocket aligns the TDC mark on the oil pump. Check to determine if the camshaft sprocket timing marks are aligned with the marks on the inner timing cover. It may take an additional full revolution of the crankshaft before the camshaft sprocket marks are aligned.

BELT AND SPROCKETS, TIMING

Removal

TIMING BELT

1. Perform fuel pressure release procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .
2. Disconnect negative battery cable.
3. Remove both cylinder head covers.

4. Remove the front timing belt cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.
5. Mark belt running direction, if timing belt is to be reused.

CAUTION: When aligning timing marks, always rotate engine by turning the crankshaft. Failure to do so will result in valve and/or piston damage.

6. Rotate engine clockwise until crankshaft mark aligns with the TDC mark on oil pump housing and the camshaft sprocket timing marks are aligned with the marks on the rear cover.
7. Remove the timing belt tensioner and remove timing belt.

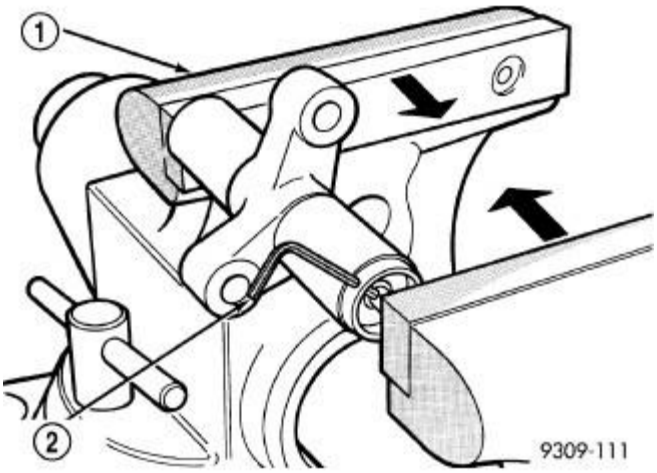


Fig. 441: Compressing Timing Belt Tensioner
Courtesy of CHRYSLER LLC

1 - VISE 2 - LOCKING PIN

8. Inspect the tensioner for fluid leakage.
9. Inspect the pivot and bolt for free movement, bearing grease leakage, and smooth rotation. If not rotating freely, replace the arm and pulley assembly.
10. When tensioner is removed from the engine it is necessary to compress the plunger into the tensioner body.

CAUTION: Index the tensioner in the vise the same way it is installed on the engine. This ensures proper pin orientation when tensioner is installed on the engine.

a. Place the tensioner into a vise and SLOWLY compress the plunger. Total bleed down of tensioner should take about 5 minutes.
b. When plunger is compressed into the tensioner body install a pin through the body and plunger to retain plunger in place until tensioner is installed.

CAMSHAFT SPROCKETS

CAUTION: The 3.5L engine is NOT a free-wheeling design. Therefore, care should be taken not to rotate the camshafts or crankshaft with the timing belt removed.

NOTE: The camshaft timing gears are keyed to the camshaft.

1. Perform fuel pressure release procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .
2. Remove front timing belt cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.
3. Position crankshaft sprocket to the TDC mark on the oil pump housing by turning crankshaft in the clockwise direction
4. Install a dial indicator in number 1 cylinder to check TDC of the piston. Rotate the crankshaft until the piston is at exactly TDC.
5. Remove camshaft retainer/thrust plate from rear of right cylinder head.

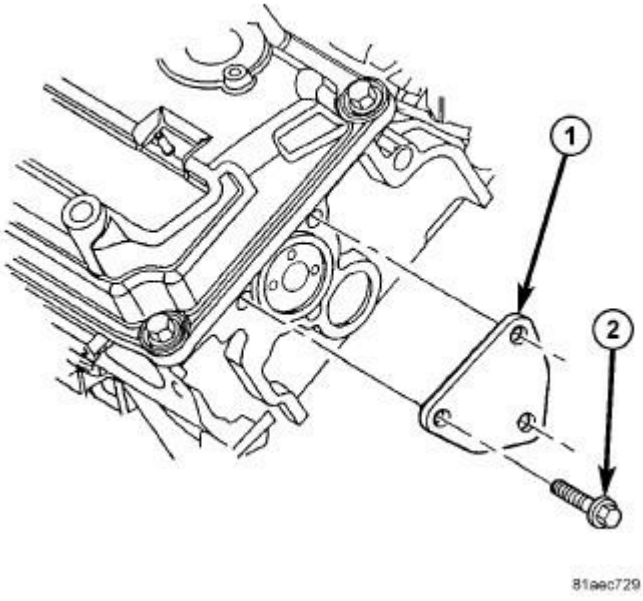


Fig. 442: Camshaft Thrust Plate
Courtesy of CHRYSLER LLC

6. Remove the cylinder head covers.
7. Remove rocker arm assemblies.
8. Remove the timing belt tensioner and timing belt.

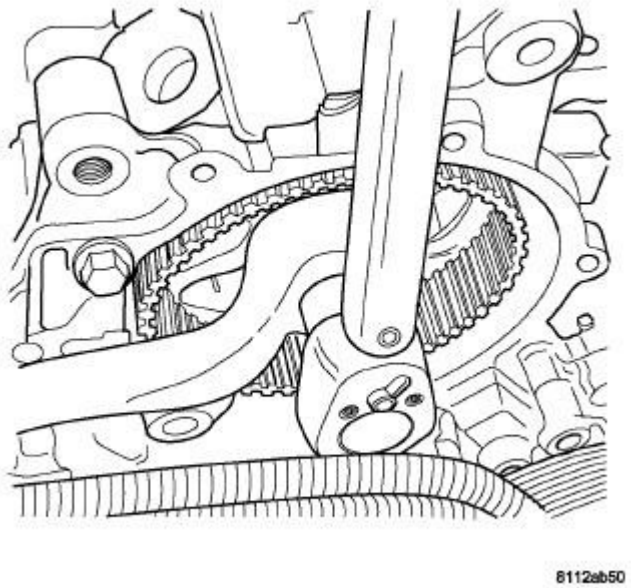


Fig. 443: LEFT CAMSHAFT SPROCKET
Courtesy of CHRYSLER LLC

9. Loosen and remove the left camshaft gear retaining bolt and washer. The left bolt is 255 mm (10.0 in.) long.

NOTE: The camshaft timing gears are keyed to the camshaft.

10. Hold the left camshaft sprocket with 36 mm (1 7/16 in.) box end wrench.
11. Remove the left camshaft sprocket.

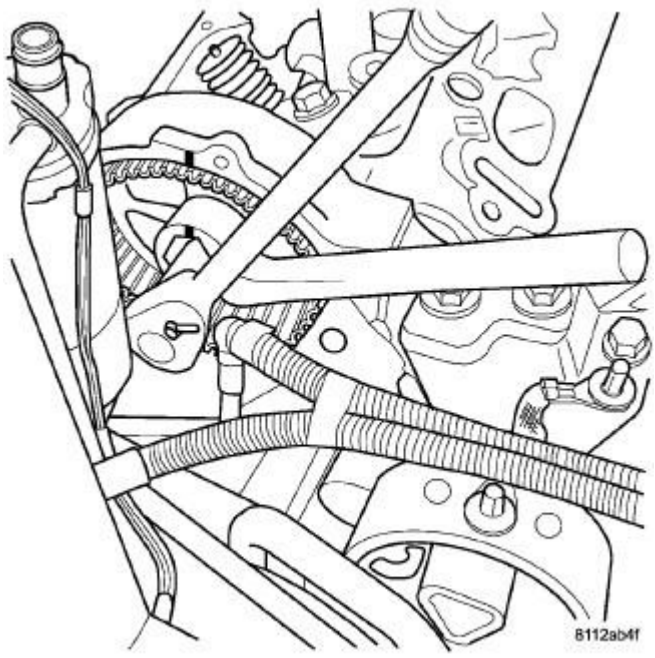


Fig. 444: RIGHT CAMSHAFT SPROCKET
Courtesy of CHRYSLER LLC

CAUTION: The camshaft must be pushed rearward approximately 3 1/2 inches to remove the camshaft gear retaining bolt and gear. Care must be taken not to scratch or nick the camshaft or cylinder head journals when moving camshaft.

12. Loosen and remove the right camshaft gear retaining bolt and washer. The right bolt is 213 mm (8 3/8 in.) long.

NOTE: The camshaft timing gears are keyed to the camshaft.

13. Hold the right camshaft sprocket with 36 mm (1 7/16 in.) box end wrench and loosen the camshaft bolt.
14. Using a floor jack, raise the right side of the engine enough to allow clearance to remove the right camshaft bolt and washer.
15. Remove the right camshaft sprocket.

CRANKSHAFT SPROCKET

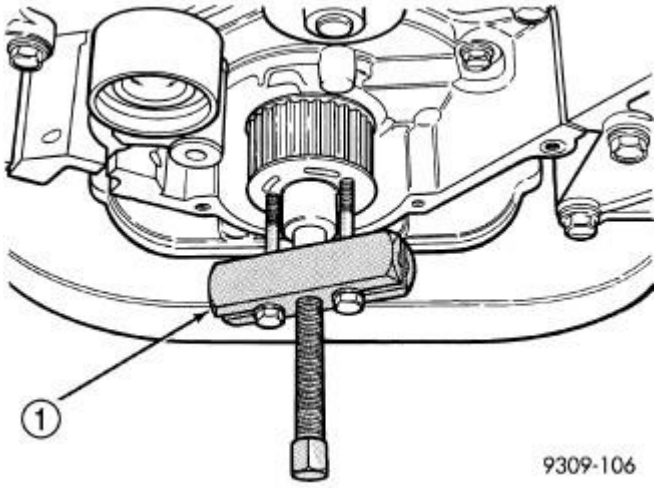


Fig. 445: Crankshaft Sprocket - Removal
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL L-4407A

1. Remove the timing belt. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Removal**.
2. Remove crankshaft sprocket using Special Tool L-4407A.

Inspection

TIMING VERIFICATION

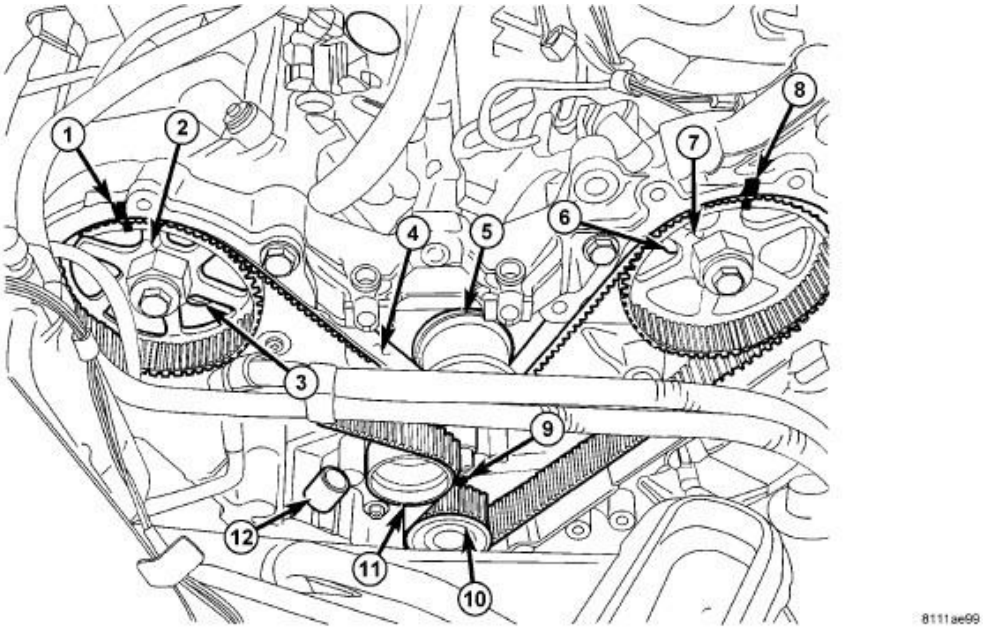


Fig. 446: TIMING GEAR MARKS
Courtesy of CHRYSLER LLC

1 - RIGHT CAMSHAFT GEAR ALIGNMENT MARK	7 - LEFT CAMSHAFT GEAR
2 - RIGHT CAMSHAFT GEAR	8 - LEFT CAMSHAFT GEAR ALIGNMENT MARK
3 - CYLINDER HEAD TO INNER TIMING BELT COVER BOLTS - RIGHT	9 - CRANKSHAFT GEAR ALIGNMENT MARK
4 - TIMING BELT	10 - CRANKSHAFT GEAR
5 - WATER PUMP PULLEY	11 - TIMING BELT TENSIONER PULLEY
6 - CYLINDER HEAD TO INNER TIMING BELT COVER BOLTS - LEFT	12 - TIMING BELT TENSIONER

Remove the outer timing covers. Rotate the crankshaft until the pointer on the crankshaft sprocket (10) aligns the TDC mark on the oil pump (9). Check to determine if the camshaft sprocket (2, 7) timing marks (1, 8) are aligned with the marks on the inner timing cover. It may take an additional full revolution of the crankshaft before the camshaft sprocket marks are aligned.

TIMING BELT

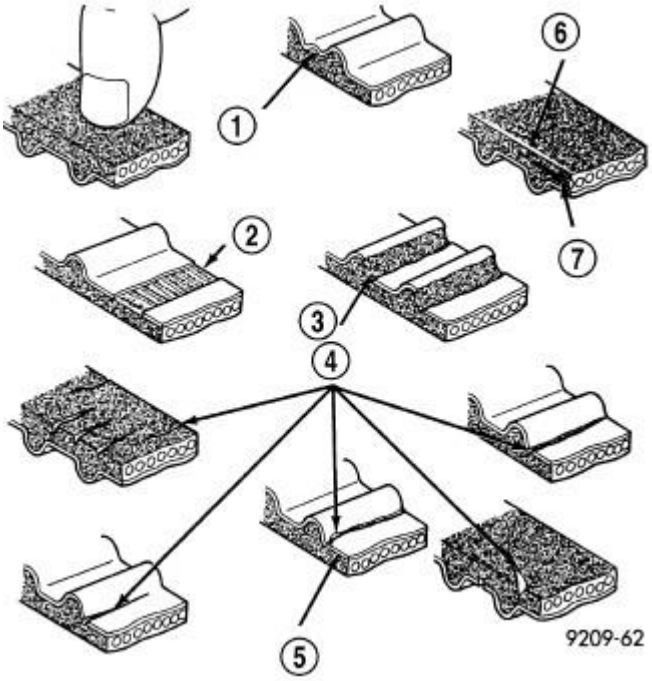


Fig. 447: Timing Belt Inspection
Courtesy of CHRYSLER LLC

1 - PEELING
2 - TOOTH MISSING AND CANVAS FIBER EXPOSED
3 - RUBBER EXPOSED
4 - CRACKS
5 - PEELING

6 - ROUNDED EDGE
7 - ABNORMAL WEAR (FLUFFY STRAND)

1. Remove front timing belt cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.
2. Inspect both sides of the timing belt. Replace belt if any of the following conditions exist:
   a. Hardening of back rubber back side is glossy without resilience and leaves no indent when pressed with fingernail.
   b. Cracks on rubber back.
   c. Cracks or peeling of canvas.
   d. Cracks on rib root.
   e. Cracks on belt sides.
   f. Missing teeth.
   g. Abnormal wear of belt sides. The sides are normal if they are sharp as if cut by a knife.
   h. Vehicle mileage or time at component maintenance requirement. Refer to **Vehicle Quick Reference/Maintenance Schedules - Description** .
3. If none of the above conditions are seen on the belt, the front timing belt cover can be installed. See **Engine/Valve Timing/COVER(S), Engine Timing - Installation**.

Installation

CRANKSHAFT SPROCKET

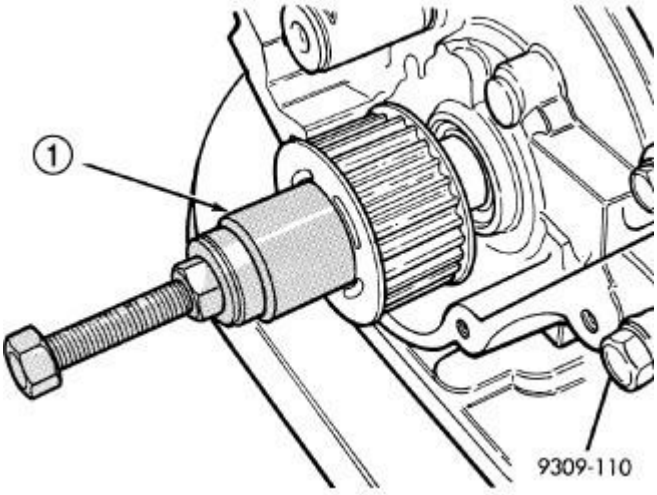


Fig. 448: Crankshaft Sprocket - Installation
Courtesy of CHRYSLER LLC

1 - INSTALL WITH SPECIAL TOOL 6641 WITH 12 mm SCREW C-4685-C1 AND THRUST BEARING AND WASHER

CAUTION: To ensure proper installation depth of crankshaft sprocket, Sprocket Installer 6641 must be used.

1. Install crankshaft sprocket using Special Tools 6641 and C-4685-C1.
2. Install timing belt. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Installation**.

CAMSHAFT SPROCKETS

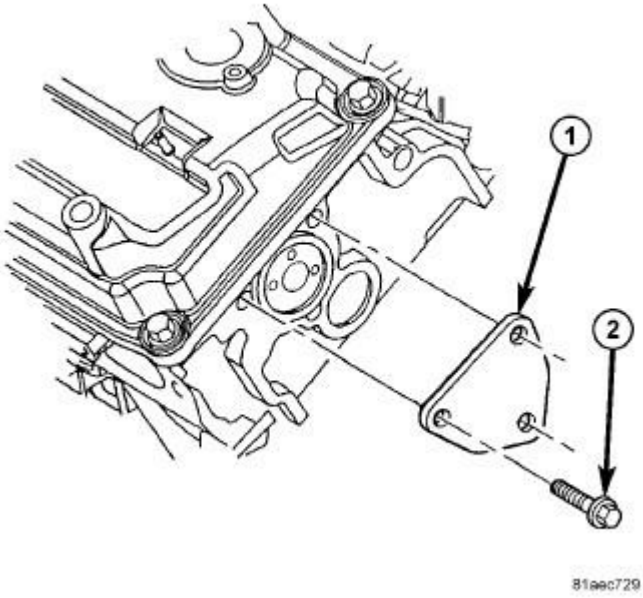


Fig. 449: Camshaft Thrust Plate
Courtesy of CHRYSLER LLC

CAUTION: The camshaft sprockets are keyed and not interchangeable from side to side because of the camshaft position sensor pick-up.

CAUTION: The camshafts must be pushed back into the cylinder head after the camshaft sprockets and retaining bolts are positioned. Care must be taken not to scratch or nick the camshaft or cylinder head journals when moving the camshafts.

1. Install the camshaft sprockets onto the camshafts. Install **NEW** sprocket attaching bolts into place. The 255 mm (10 in.) bolt is installed in the left camshaft and the 213 mm (8 3/8 in.) bolt is installed into the right camshaft. **Do not tighten the bolts at this time, they will be tightened at a later step.** Camshaft sprocket timing marks should be aligned with inner cover timing marks at both sprockets.
2. Install the camshaft thrust plates (1) and seals. Tighten the bolts (2) to 28 N.m (250 in. lbs.).

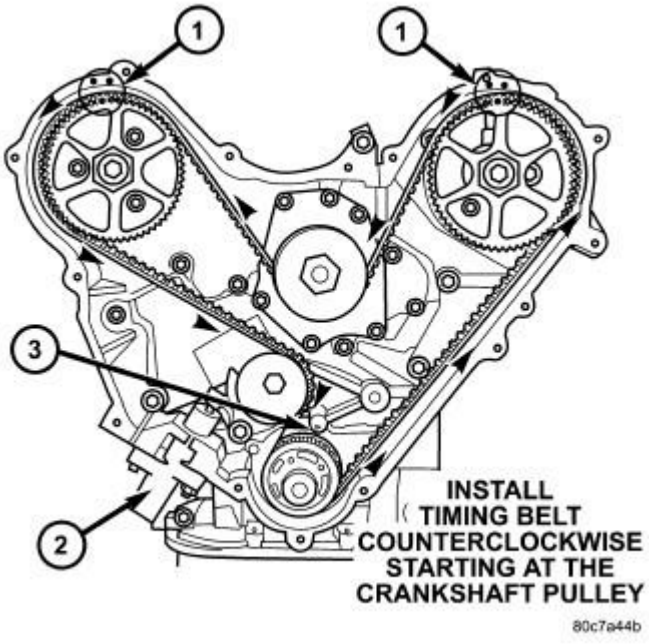


Fig. 450: TIMING BELT INSTALLATION
Courtesy of CHRYSLER LLC

1 - ALIGN CAMSHAFTS WITH TIMING MARKS
2 - INSTALL TENSIONER LOOSE
3 - CRANKSHAFT AT TDC

3. Install the timing belt starting first at the crankshaft sprocket, then to remaining sprockets in a counterclockwise direction.
4. Install the belt around the last sprocket. Maintain tension on the belt as it is positioned around the tensioner pulley. Camshaft sprocket timing marks (1) and crankshaft sprocket timing mark (3) should still be aligned with the inner cover marks.

NOTE: It is necessary to compress the plunger into the tensioner body and install a locking pin prior to reinstalling the tensioner. See Timing Belt Removal for tensioner compression procedure. See Engine/Valve Timing/BELT and SPROCKETS, Timing - Removal.

5. Hold the tensioner pulley against the belt and install the reset (pinned) timing belt tensioner (2) into the housing. Tighten attaching bolts to 28 N.m (250 in. lbs.).
6. Remove tensioner retaining pin to allow the tensioner to extend to the pulley bracket.

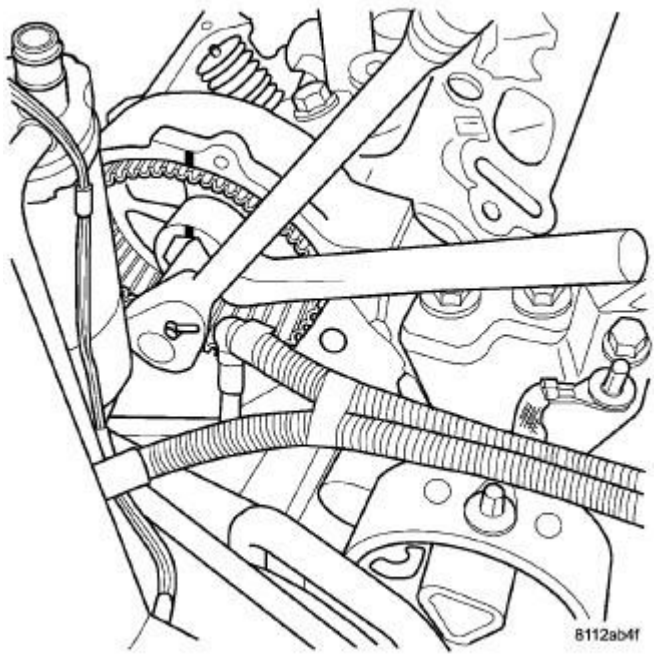


Fig. 451: RIGHT CAMSHAFT SPROCKET
Courtesy of CHRYSLER LLC

7. Hold the right camshaft sprocket hex with a 36 mm (1 7/16 in.) wrench and tighten the right camshaft bolt to 102 N.m (75 ft. lbs.) +90° turn.

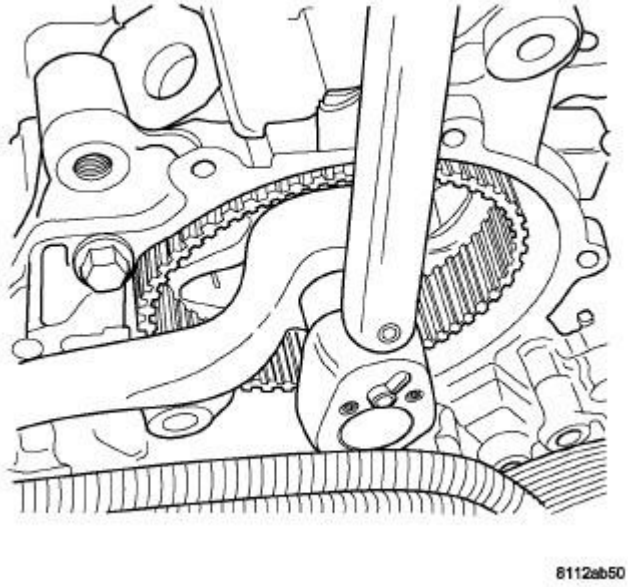


Fig. 452: LEFT CAMSHAFT SPROCKET
Courtesy of CHRYSLER LLC

8. Hold the left camshaft sprocket hex with a 36 mm (1 7/16 in.) wrench and tighten the left camshaft bolts to 102 N.m (75 ft. lbs.) +90° turn.
9. Install the rocker arm assemblies and cylinder head covers. See **Engine/Cylinder Head/ROCKER ARM, Valve - Installation**
10. Install the front timing belt cover. See **Engine/Valve Timing/COVER(S), Engine Timing - 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 .

TIMING BELT

CAUTION: The 3.5L is NOT a freewheeling engine. Therefore, the valve train rocker assemblies must be removed before attempting to rotate either crankshaft or camshafts independently of each other.

CAUTION: If camshafts have moved from the timing marks, always rotate camshaft towards the direction nearest to the timing marks (DO NOT TURN CAMSHAFTS A FULL REVOLUTION OR DAMAGE to valves and/or pistons could result).

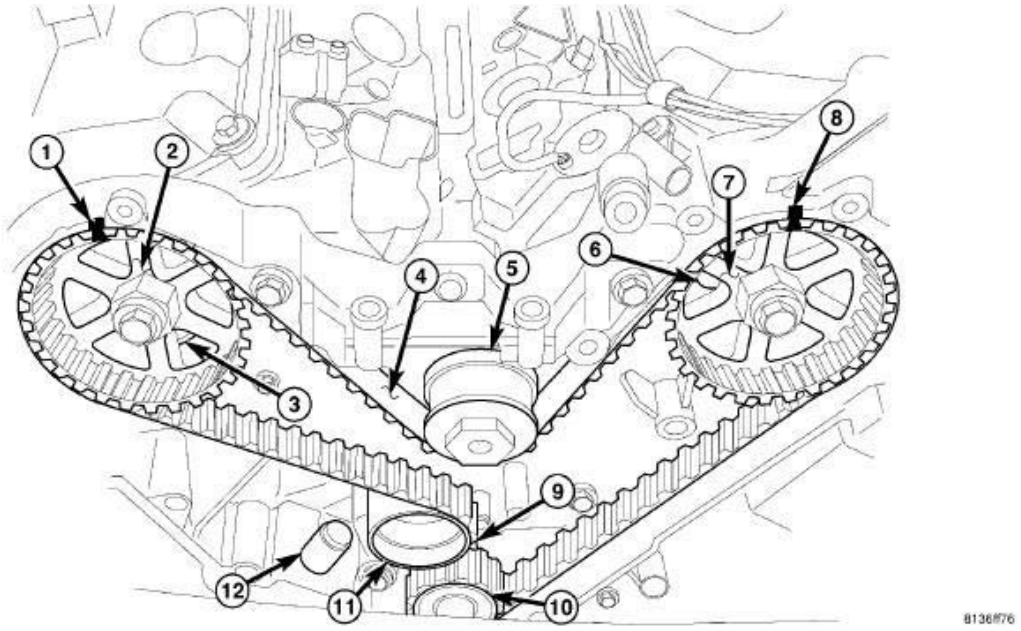


Fig. 453: TIMING GEAR ALIGNMENT
Courtesy of CHRYSLER LLC

1. Align the crankshaft sprocket (10) with the TDC mark (9) on the oil pump cover.
2. Align the camshaft sprockets (2, 7) timing reference marks (1, 8) with the marks on the rear cover.

3. Install the timing belt (4) starting at the crankshaft sprocket (10) going in a counterclockwise direction. Install the belt around the last sprocket and maintain tension on the belt as it is positioned around the tensioner pulley (11).

NOTE: It is necessary to compress the plunger into the tensioner body and install a locking pin prior to reinstalling the tensioner. See Timing Belt Removal for tensioner compression procedure. See Engine/Valve Timing/BELT and SPROCKETS, Timing - Removal.

4. Hold the tensioner pulley (11) against the belt and install the reset (pinned) timing belt tensioner (2) into the housing. Tighten attaching bolts to 28 N.m (250 in. lbs.).
5. When tensioner (12) is in place, pull the retaining pin to allow the tensioner to extend to the pulley bracket.
6. Rotate the crankshaft sprocket (10) two revolutions and check the timing marks on the camshafts and crankshaft. The marks should line up within their respective locations. If the marks do not line up, repeat the procedure.
7. Install the front timing belt cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Installation**.
8. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).

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

COVER(S), ENGINE TIMING, FRONT

Removal

REMOVAL

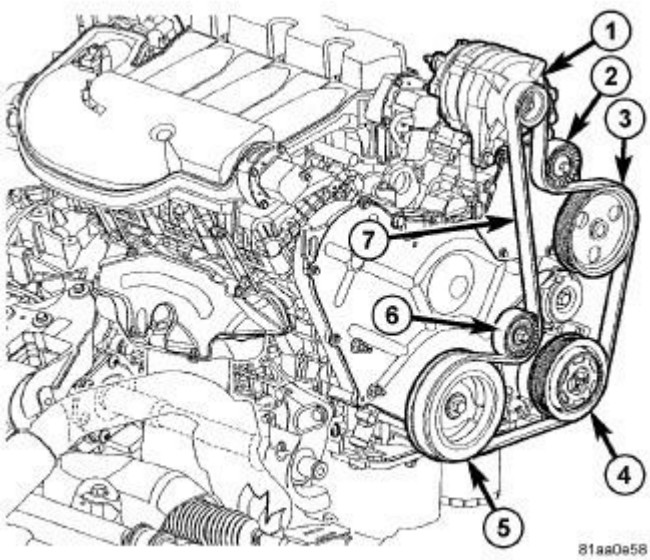


Fig. 454: Identifying Accessory Drive Belt & Pulleys
Courtesy of CHRYSLER LLC

1 - GENERATOR 2 - IDLER PULLEY
3 - POWER STEERING PUMP
4 - A/C COMPRESSOR
5 - CRANKSHAFT PULLEY
6 - TENSIONER

1. Perform fuel pressure release procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .
2. Disconnect negative battery cable.
3. Raise the vehicle.
4. Remove the accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal** .
5. Remove accessory drive belt tensioner.
6. Remove bolts for power steering pump. Reposition power steering pump aside.
7. Remove crankshaft damper. See **Engine/Engine Block/DAMPER, Vibration - Removal**.

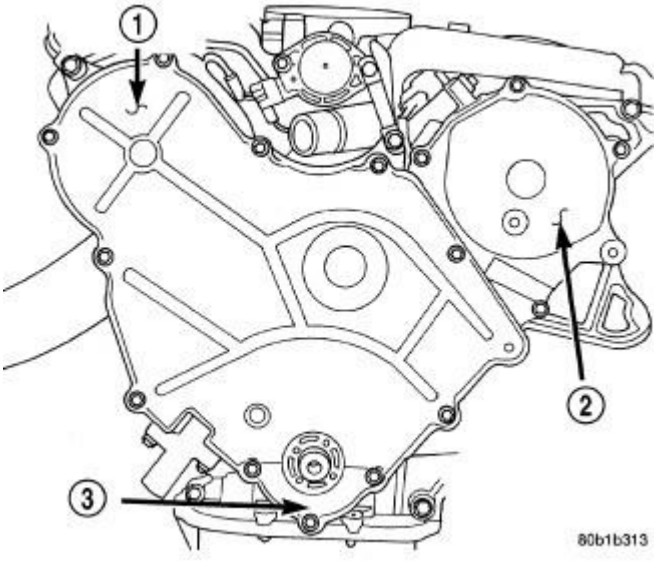


Fig. 455: TIMING BELT COVERS
Courtesy of CHRYSLER LLC

1 - RIGHT SIDE COVER (STAMPED)
2 - LEFT SIDE COVER (CAST)
3 - LOWER COVER

8. Remove the lower front timing belt cover fasteners.
9. Lower the vehicle.
10. Support the engine with a floor jack.
11. Remove the front engine mount. See **Engine/Engine Mounting/INSULATOR, Engine Mount - Removal**.
12. Disconnect the fuel supply line at the fuel rail.
13. Remove the upper timing belt cover bolts and remove front timing belt cover. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.

Installation

INSTALLATION

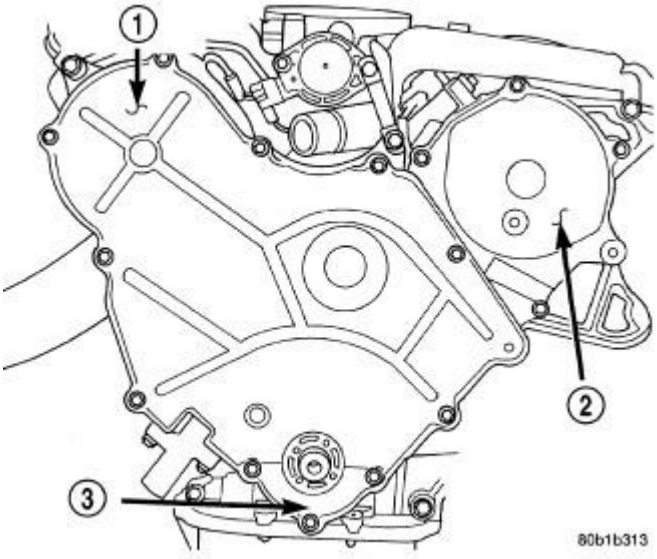


Fig. 456: TIMING BELT COVERS
Courtesy of CHRYSLER LLC

1 - RIGHT SIDE COVER (STAMPED)
2 - LEFT SIDE COVER (CAST)
3 - LOWER COVER

NOTE: The timing cover bolts and both holes to the engine block must be thoroughly cleaned and free of oil residue before assembly. IN ADDITION, add thread sealant to the timing cover bolts that mount to the oil pump. See Engine/Lubrication/PUMP, Engine Oil - Installation.

1. Install front timing belt cover.
2. Install the upper engine mount. See **Engine/Engine Mounting/INSULATOR, Engine Mount - Installation**.
3. Connect fuel supply line at fuel rail.
4. Raise the vehicle.

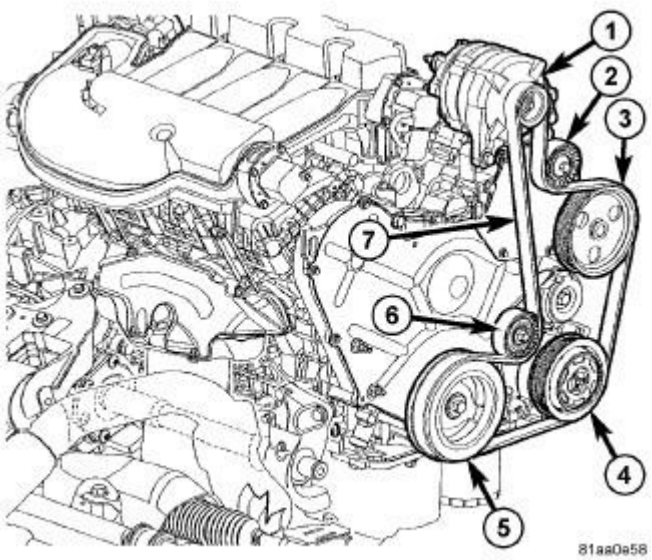


Fig. 457: Identifying Accessory Drive Belt & Pulleys
Courtesy of CHRYSLER LLC

1 - GENERATOR 2 - IDLER PULLEY
3 - POWER STEERING PUMP
4 - A/C COMPRESSOR
5 - CRANKSHAFT PULLEY
6 - TENSIONER

5. Install power steering pump fasteners. Tighten bolts to 23 N.m (200 lbs. in.).
6. Install crankshaft damper. See **Engine/Engine Block/DAMPER, Vibration - Installation**.
7. Install accessory drive belt tensioner. Torque fastener to 28 N.m (250 in. lbs.).
8. Install accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation** .
9. Lower the vehicle.
10. Connect negative battery cable.

COVER(S), ENGINE TIMING, REAR

Removal

REMOVAL

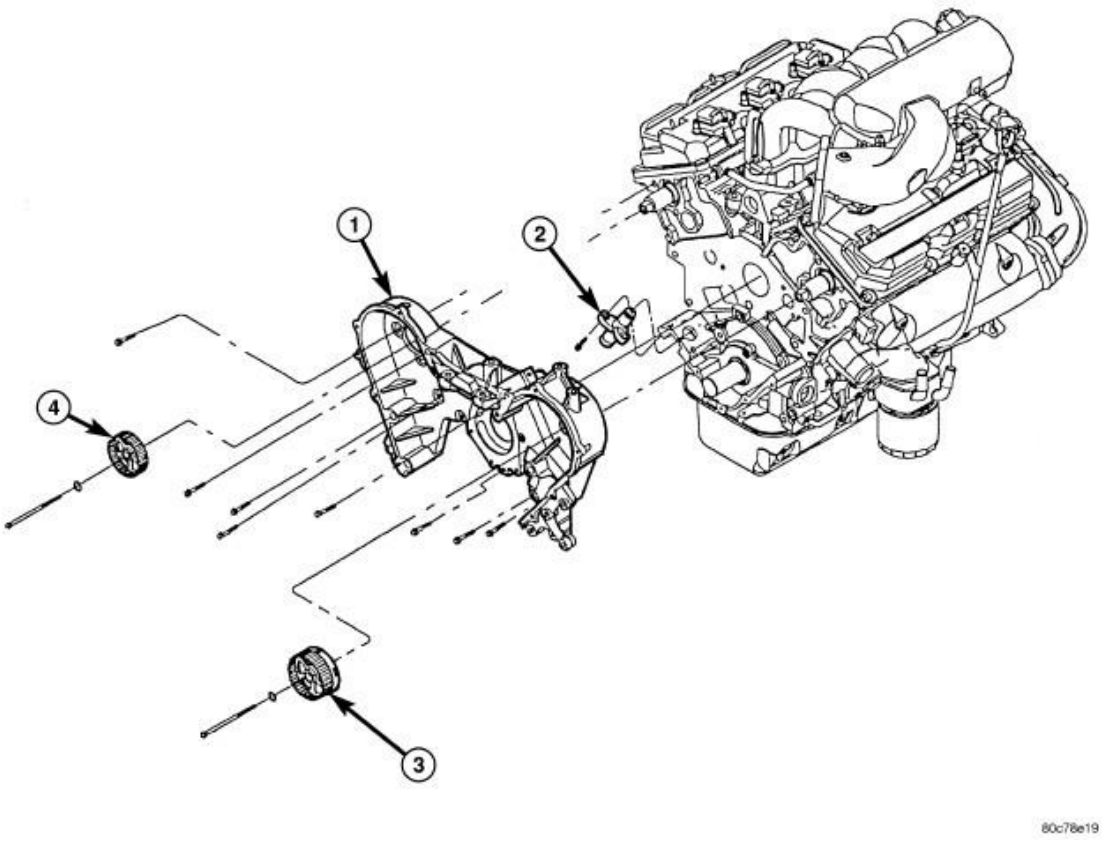


Fig. 458: TIMING BELT COVER - REAR
Courtesy of CHRYSLER LLC

1. Perform fuel pressure release procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .
2. Disconnect the negative battery cable.
3. Remove timing belt. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Removal**.
4. Remove camshaft sprockets. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Removal**.

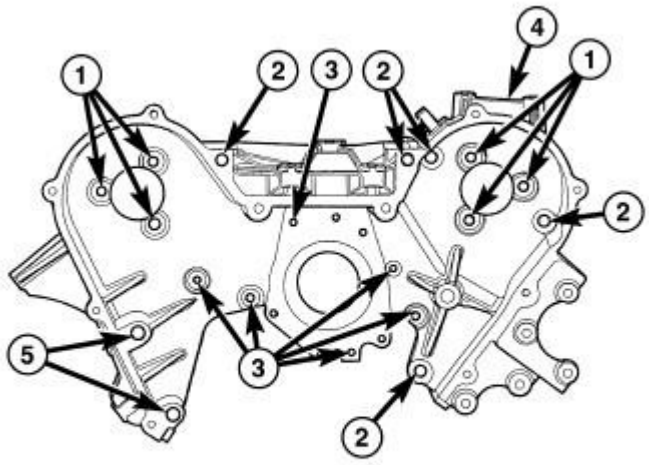


Fig. 459: Rear Timing Belt Cover Fasteners
Courtesy of CHRYSLER LLC

1 - M8 FASTENERS (APPLY THREAD SEALANT)
2 - M10 FASTENERS
3 - M6 FASTENERS
4 - REAR TIMING BELT COVER
5 - M10 FASTENERS (STUD/NUT)

5. Remove rear timing belt cover bolts.
6. Remove the rear cover.

NOTE: The rear timing belt cover has O-rings to seal the water pump passages to cylinder block. Do not reuse the O-rings.

Installation

INSTALLATION

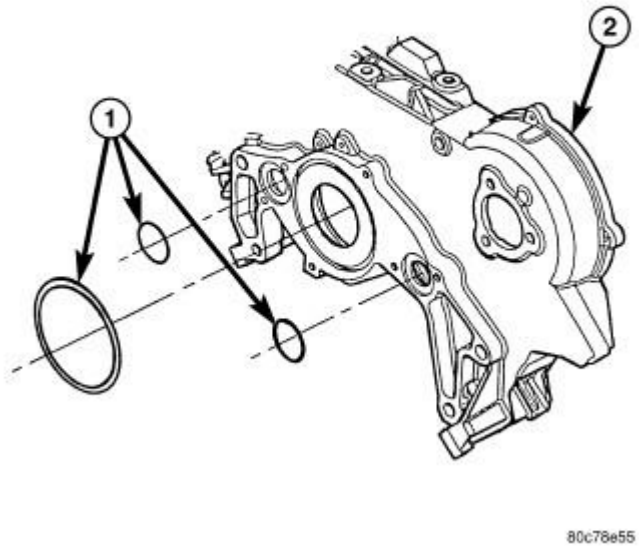


Fig. 460: Rear Timing Belt Cover Seals
Courtesy of CHRYSLER LLC

1 - REAR TIMING BELT COVER SEALS
2 - REAR TIMING BELT COVER

1. Clean rear timing belt cover O-ring sealing surfaces and grooves. Lubricate new O-rings with Mopar® Dielectric Grease or equivalent to facilitate assembly.
2. Position NEW O-rings on cover.

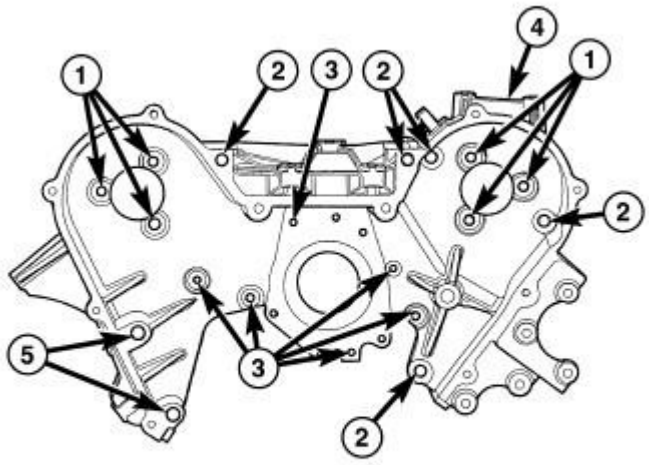


Fig. 461: Rear Timing Belt Cover Fasteners
Courtesy of CHRYSLER LLC

1 - M8 FASTENERS (APPLY THREAD SEALANT)
2 - M10 FASTENERS
3 - M6 FASTENERS
4 - REAR TIMING BELT COVER
5 - M10 FASTENERS (STUD/NUT)

3. Install rear timing belt cover. Tighten bolts to the following specified torque:
   - M10-54 N.m (40 ft. lbs.)
   - M8-28 N.m (20 ft. lbs.)
   - M6-12 N.m (105 in. lbs.)
4. Install camshaft sprockets. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Installation**.
5. Install timing belt. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Installation**.

TENSIONER, ENGINE TIMING

Removal

TENSIONER

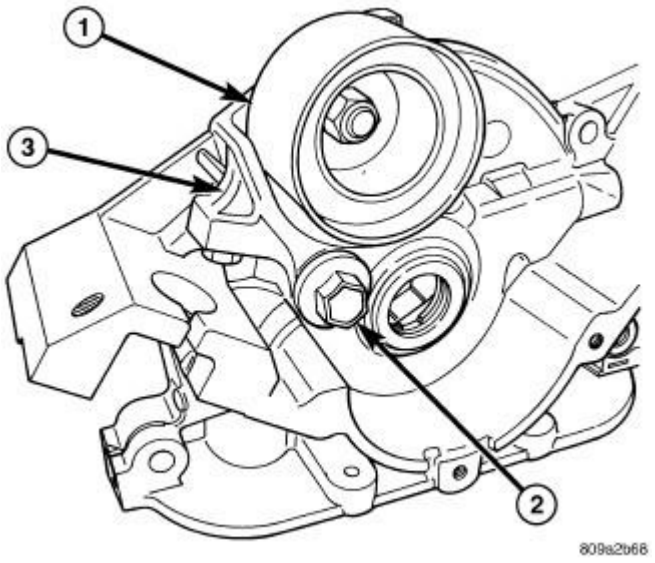


Fig. 462: TENSIONER PULLEY
Courtesy of CHRYSLER LLC

1 - TENSIONER PULLEY
2 - PIVOT BOLT
3 - TENSIONER BRACKET

1. For timing belt tensioner removal procedure. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Removal**.

TENSIONER PULLEY ASSEMBLY

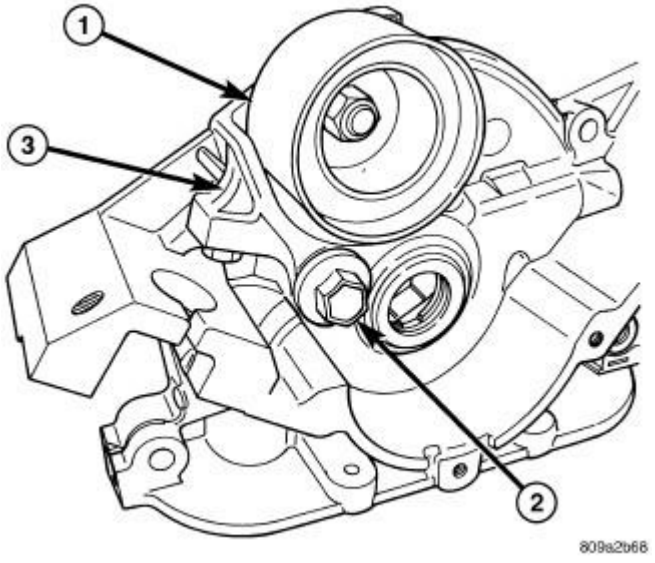


Fig. 463: TENSIONER PULLEY
Courtesy of CHRYSLER LLC

1 - TENSIONER PULLEY
2 - PIVOT BOLT
3 - TENSIONER BRACKET

1. Remove the timing belt. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Removal**.
2. Remove the timing belt tensioner pulley and bracket assembly by unscrewing the pivot bolt from the oil pump housing.

Inspection

TENSIONER

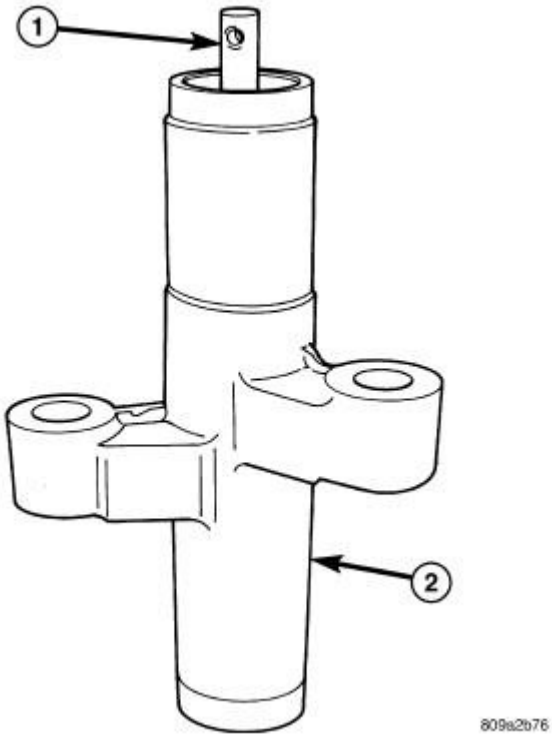


Fig. 464: TIMING BELT TENSIONER
Courtesy of CHRYSLER LLC

1 - PLUNGER (EXTENDED POSITION)
2 - TENSIONER HOUSING

1. Inspect hydraulic tensioner for fluid loss around the plunger seal. Replace tensioner if leaking.

TENSIONER PULLEY ASSEMBLY

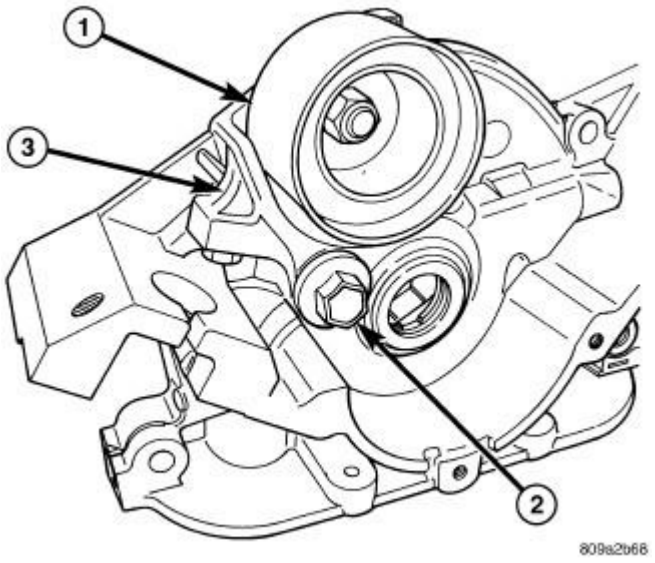


Fig. 465: TENSIONER PULLEY
Courtesy of CHRYSLER LLC

1 - TENSIONER PULLEY
2 - PIVOT BOLT
3 - TENSIONER BRACKET

NOTE: The tensioner pulley, bracket, and pivot bolt is serviced as an assembly.

1. Inspect pulley for free movement. Replace if pulley is loose, seized, or rough turning.
2. Inspect pulley bearing and seal. Replace if damaged.
3. Inspect pivot bolt for free movement in assembly housing. Replace assembly if seized or excessive looseness.

Installation

TENSIONER PULLEY ASSEMBLY

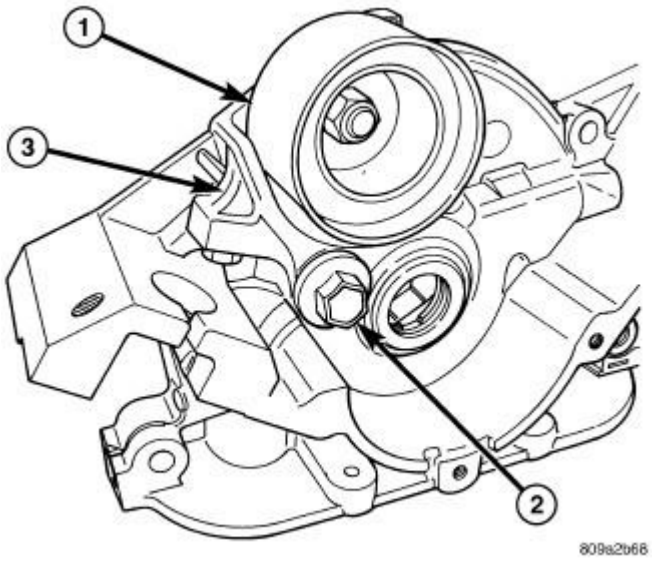


Fig. 466: TENSIONER PULLEY
Courtesy of CHRYSLER LLC

1 - TENSIONER PULLEY
2 - PIVOT BOLT
3 - TENSIONER BRACKET

1. Install the timing belt tensioner pulley (1) assembly. Tighten the pivot bolt (2) to 61 N.m (45 ft. lbs.).
2. Install the timing belt. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Installation**.

TENSIONER

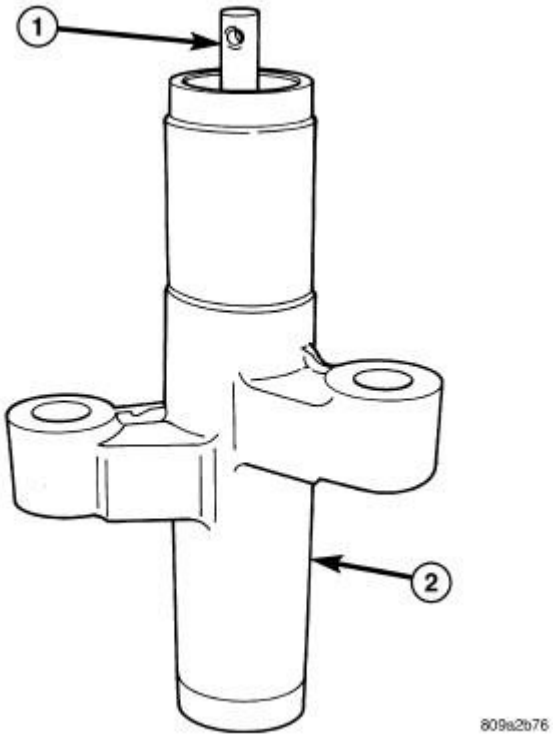


Fig. 467: TIMING BELT TENSIONER
Courtesy of CHRYSLER LLC

1 - PLUNGER (EXTENDED POSITION) 2 - TENSIONER HOUSING

1. For timing belt tensioner installation procedure. See **Engine/Valve Timing/BELT and SPROCKETS, Timing - Installation**.