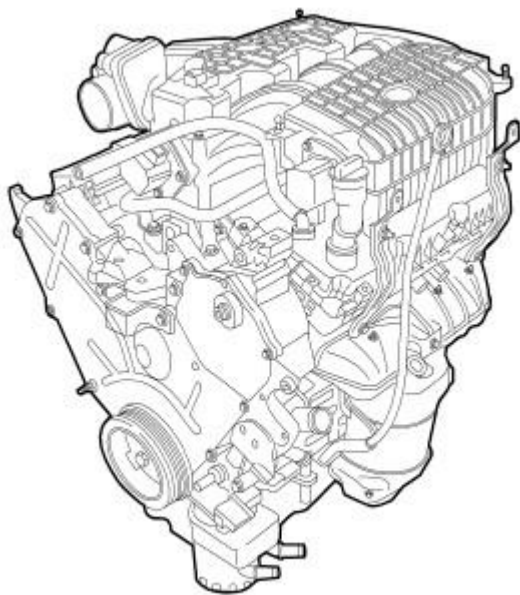


2010 ENGINE

4.0L - Service Information - Grand Caravan, Town & Country

DESCRIPTION

DESCRIPTION



8180983d

Fig. 1: 4.0L Engine

Courtesy of CHRYSLER LLC

The 4.0 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.

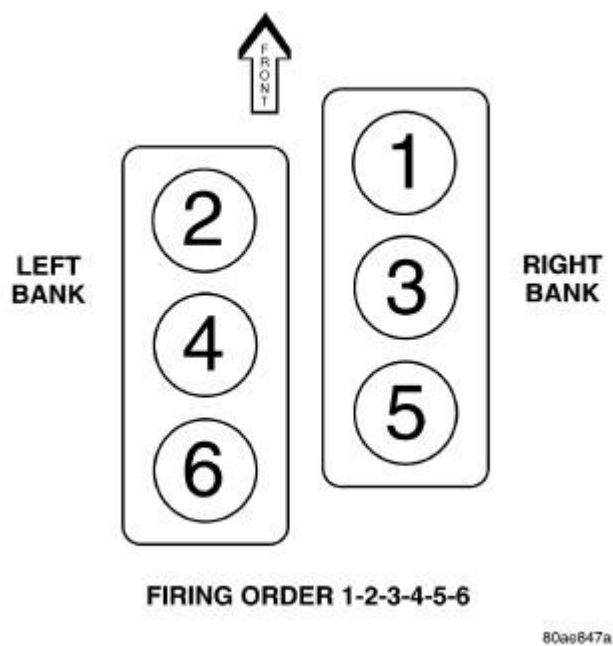


Fig. 2: Cylinder Numbering & Firing Order
Courtesy of CHRYSLER LLC

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.

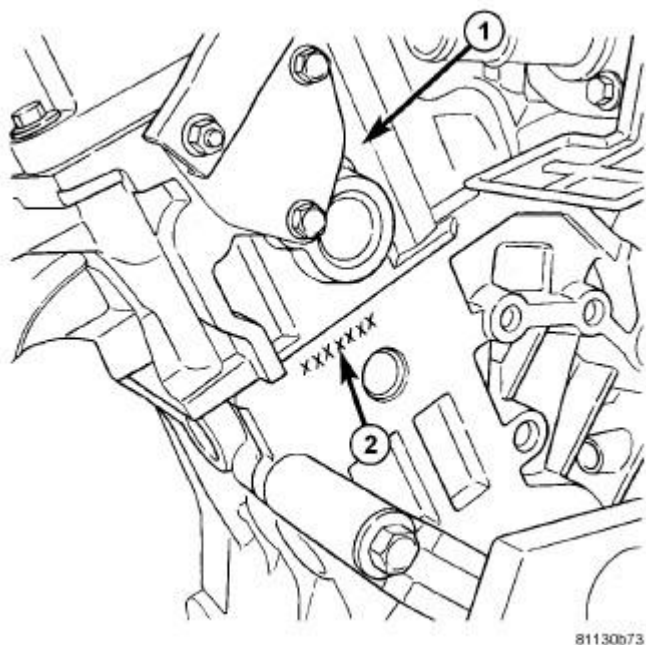


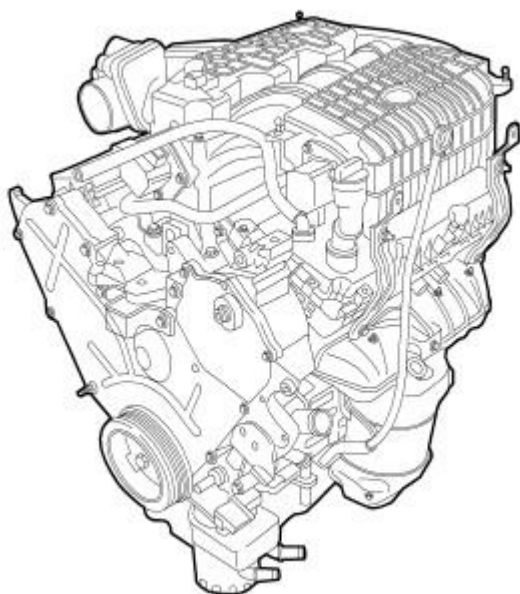
Fig. 3: Engine Identification
Courtesy of CHRYSLER LLC

- 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



8180983d

Fig. 4: 4.0L 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 **ENGINE MECHANICAL**.

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 DOES NOT CRANK, OR CRANKS SLOWLY	1. Weak battery. 2. Corroded or loose battery connections. 3. Faulty starter.	1. Test battery. Charge or replace as necessary. Refer to <u>Electrical/Battery System/BATTERY - Standard Procedure</u> . 2. Clean and tighten battery connections. Apply a coat of light mineral grease to terminals. 3. Test starting system. Refer to <u>Electrical/Starting - Diagnosis and Testing</u> .
ENGINE CRANKS, BUT WILL NOT START	1. Faulty coil(s), related control circuits, or PCM. 2. Incorrect spark plug gap. 3. Contamination in fuel system. 4. Faulty fuel pump or low fuel pressure. 5. Incorrect engine timing.	1. Test and replace as needed. (Refer to Appropriate Diagnostic Information) 2. Check and adjust gap as needed. 3. Clean system and replace fuel filter. 4. Test fuel pump and replace as needed. (Refer to Appropriate Diagnostic Information) 5. Check for a skipped timing belt or a loose camshaft sprocket.
ENGINE STALLS OR IDLES ROUGH	1. Idle speed too low. 2. Incorrect fuel mixture. 3. Intake manifold vacuum leakage. 4. Faulty coil(s) or related control circuits.	1. Verify that minimum air flow requirements are being met and ETC (Electronic Throttle Control) and related circuits are operating correctly. (Refer to Appropriate Diagnostic Information) 2. (Refer to Appropriate Diagnostic Information) 3. Isolate the source of the leak. If necessary, perform a visual inspection of the intake manifold gasket, manifold, and vacuum hoses. 4. Test and replace as necessary. (Refer to Appropriate Diagnostic

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		Information)
-	5. Faulty EGR valve or related control circuits.	5. (Refer to appropriate diagnostic information)
-	6. Faulty O2 sensor or related control circuits.	6. (Refer to appropriate diagnostic information)
-	7. Faulty EVAP Solenoid or related control circuits.	7. (Refer to appropriate diagnostic information)
-	8. Faulty MAP sensor or related circuits.	8. (Refer to appropriate diagnostic information)
-	9. Faulty IAT sensor.	9. (Refer to appropriate diagnostic information)
ENGINE LOSS OF POWER	1. Plugged air filter, or air intake restrictions. 2. Dirty or incorrectly gapped plugs. 3. Contamination in fuel system. 4. Faulty fuel pump. 5. Incorrect valve timing. 6. Leaking cylinder head gasket. 7. Low compression. 8. Burned, warped, or pitted valves. 9. Plugged or restricted exhaust system. 10. Faulty coil(s).	1. Replace air filter, or service air intake system as required. 2. Set gap as needed or replace plug(s). 3. Clean system and replace fuel filter. 4. Test and replace as necessary. (Refer to Appropriate Diagnostic Information) 5. Correct valve timing as needed. 6. Replace cylinder head gasket. 7. Test compression of each cylinder. 8. Replace valves. 9. Check exhaust system restriction. Replace parts, as necessary. 10. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
ENGINE MISSES DURING MODERATE ACCELERATION OR DURING CONDITIONS WHEN UNDER LOAD	1. Dirty or incorrectly gapped spark plugs. 2. Contamination in Fuel System. 3. Burned, warped, or pitted valves. 4. Faulty coil(s).	1. Set gap as needed or replace plug(s). 2. Clean fuel system and replace fuel filter. 3. Replace valves. 4. Test and replace as necessary. (Refer to Appropriate Diagnostic Information)
ENGINE MISSES AT HIGH RPM	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.

ENGINE MECHANICAL

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

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	6. Misaligned connecting rods.	6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply. 2. Low oil pressure. 3. Thick/Thin or diluted oil. 4. Excessive bearing clearance. 5. Excessive end play. 6. Crankshaft journal out-of-round or worn. 7. Loose flywheel or torque converter.	1. Check engine oil level. 2. Check engine oil level. Inspect oil pump relief valve and spring. 3. Change oil to correct viscosity. (a.) Change oil and filter. (b.) Run engine to operating temperature. (c.) Change oil and filter again. 4. Measure bearings for correct clearance. Repair as necessary. 5. Check thrust bearing for wear on flanges. 6. Replace crankshaft or grind journals. 7. Tighten to correct torque.
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.	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. Rings fitted too tightly in grooves.	4. Remove rings and check grooves. If groove is not proper width, replace piston.
5. Worn valve guide(s).	5. Replace cylinder head(s).
6. Valve stem seal(s) worn or damaged.	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 power distribution center.
5. Insert compression gauge adaptor Special Tool 8116 or the equivalent, into the #1 spark plug hole in cylinder head. Connect the 0-500 psi (Blue) pressure transducer (Special Tool CH7059) with cable adaptors to the DRBIII®. For Special Tool identification, see **Engine - Special Tools**.
6. Crank engine until maximum pressure is reached on gauge. Record this pressure as #1 cylinder pressure.
7. Repeat the previous step for all remaining cylinders.
8. Compression should not be less than 689 kPa (100 psi) and not vary more than 25 percent from cylinder to cylinder.
9. If one or more cylinders have abnormally low compression pressures, repeat the compression test.
10. If the same cylinder or cylinders repeat an abnormally low reading on the second compression test, it could indicate the existence of a problem in the cylinder in question. **The recommended compression pressures are to be used only as a guide to diagnosing engine problems. An engine should not be disassembled to determine the cause of low compression unless some malfunction is present.**

CYLINDER COMBUSTION PRESSURE LEAKAGE TEST

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

Combustion pressure leakage testing will detect:

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

WARNING: DO NOT REMOVE THE PRESSURE CAP WITH THE SYSTEM HOT AND

UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

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

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

Clean spark plug recesses with compressed air.

Remove the spark plugs.

Remove the oil filler cap.

Remove the air cleaner.

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

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

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

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

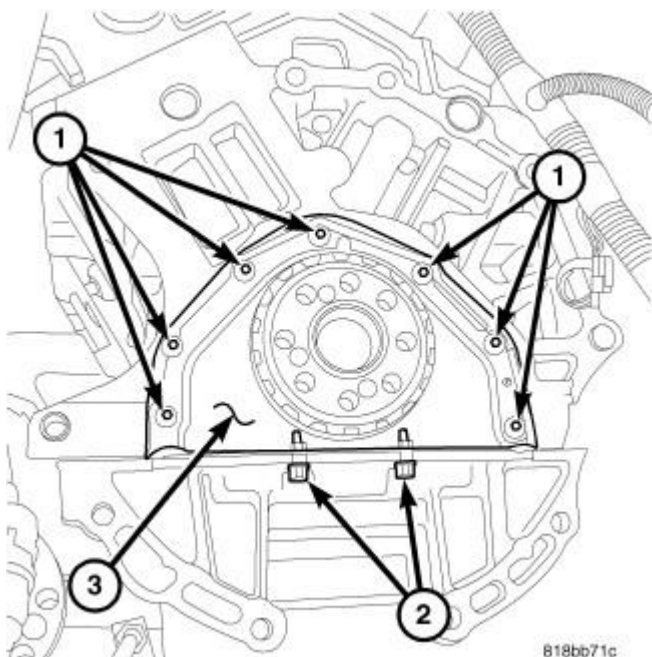
ENGINE OIL LEAK INSPECTION

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.

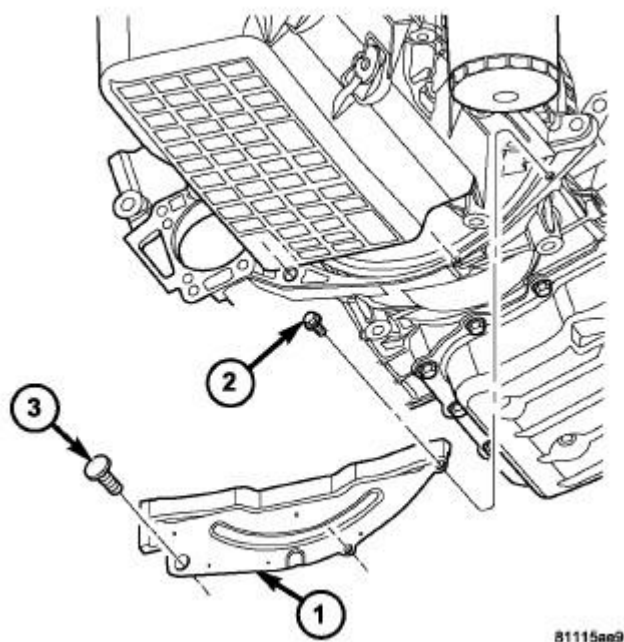


Fig. 6: Torque Converter Dust Shield
Courtesy of CHRYSLER LLC

- | |
|---|
| 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

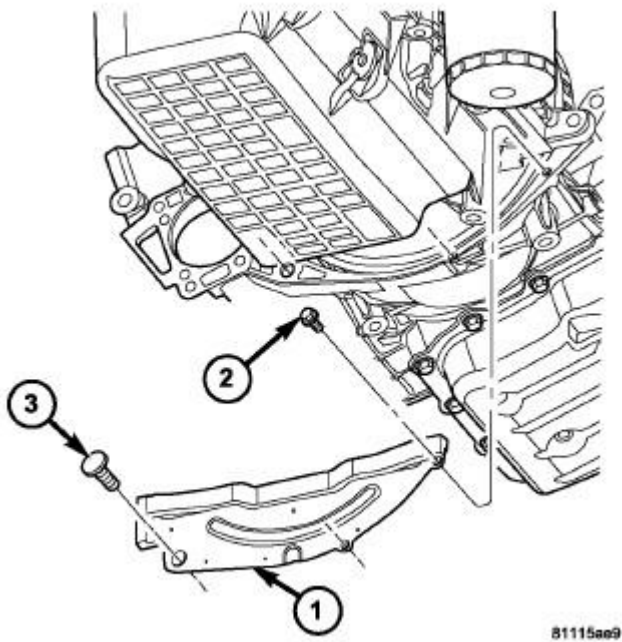


Fig. 7: Torque Converter Dust Shield
Courtesy of CHRYSLER LLC

- 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

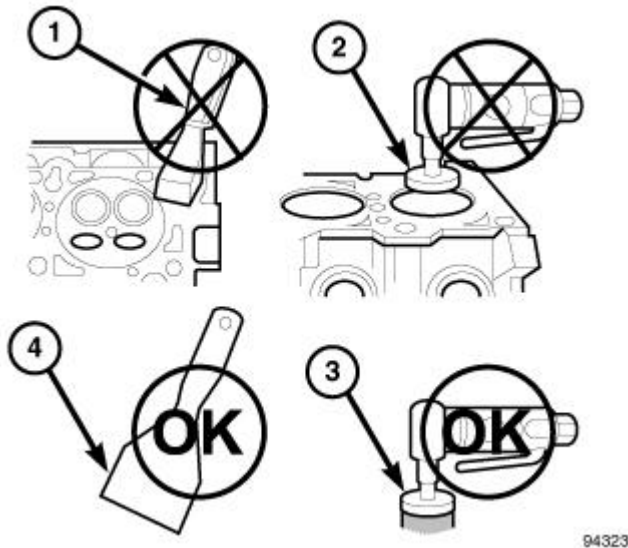


Fig. 8: Proper Tool Usage For Surface Preparation
Courtesy of CHRYSLER LLC

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).

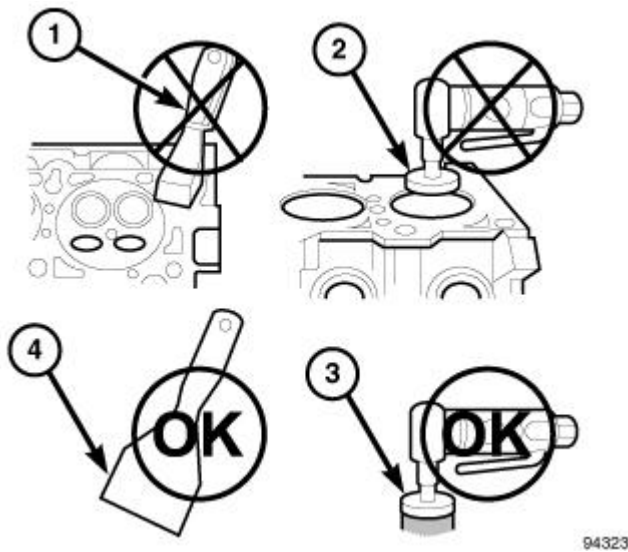


Fig. 9: Proper Tool Usage For Surface Preparation
Courtesy of CHRYSLER LLC

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 and sealers **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 in no more than 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 is used on engines with multi-layer steel (MLS) cylinder head gaskets. This material also will prevent corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or 4oz./16 oz. can w/applicator.

SEALER APPLICATION

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

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

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

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

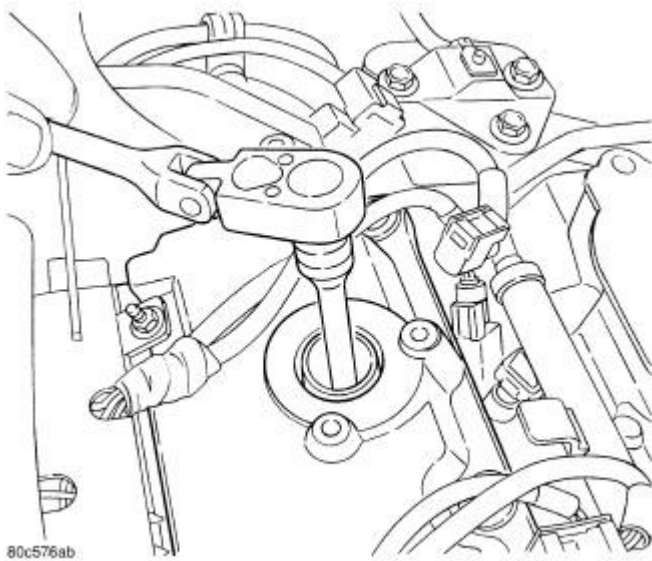


Fig. 10: Removing/Installing Spark Plug
Courtesy of CHRYSLER LLC

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 ensure 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

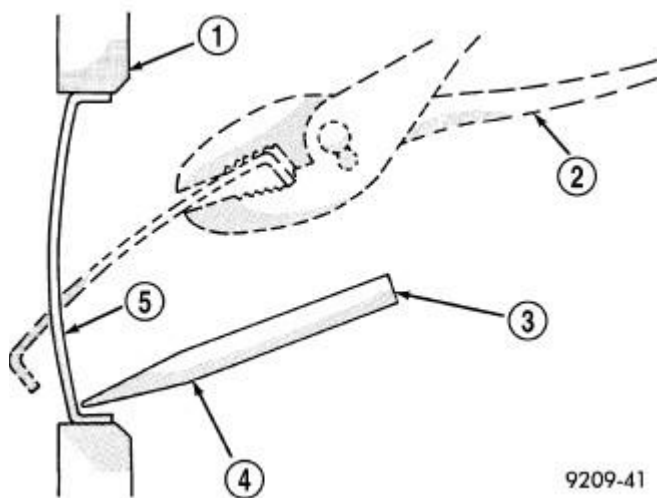


Fig. 11: Core Hole Plug Removal
Courtesy of CHRYSLER LLC

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

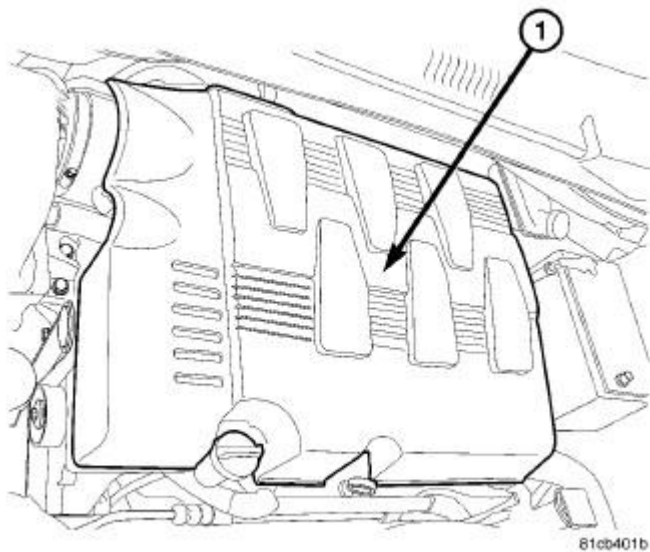


Fig. 12: Engine Cover

Courtesy of CHRYSLER LLC

1 - Engine cover

NOTE: Capture and store any residual fluid drainage, or leakage from ancillary components, in the appropriately marked containers.

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

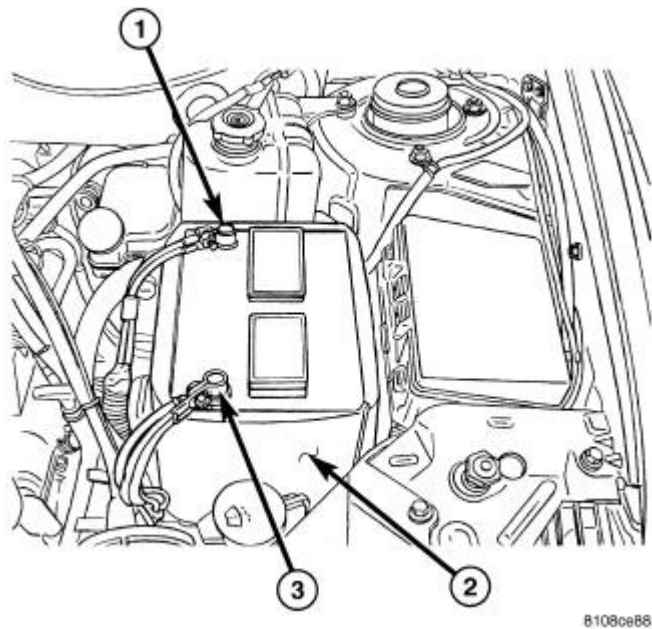


Fig. 13: Battery

Courtesy of CHRYSLER LLC

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

3. Disconnect the positive (1) and negative (3) battery cables.

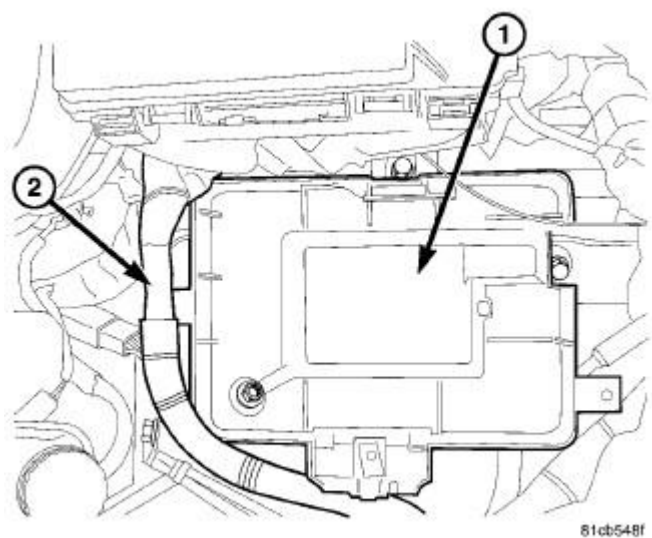


Fig. 14: Battery Tray & Harness Retainer

Courtesy of CHRYSLER LLC

1 - BATTERY TRAY
2 - HARNESS RETAINER

4. Disconnect the harness retainer (2), remove the three battery tray fasteners, and remove the battery tray (1).

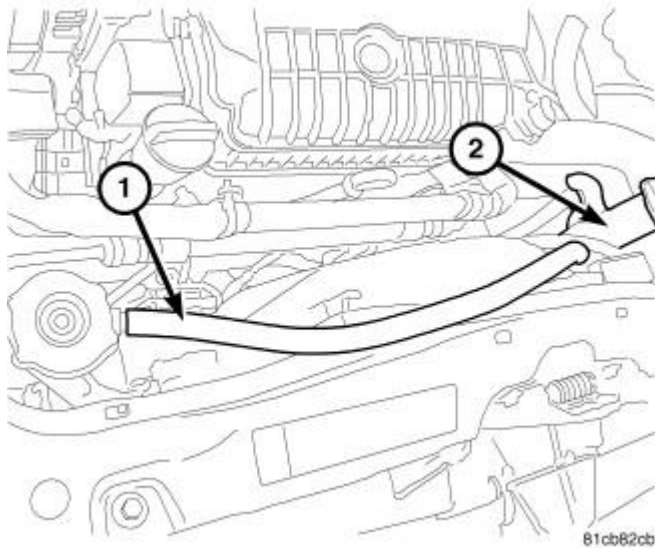


Fig. 15: Coolant Overflow Hose & Bottle
Courtesy of CHRYSLER LLC

1 - COOLANT OVERFLOW HOSE
2 - COOLANT OVERFLOW BOTTLE

5. Disconnect the coolant overflow Line (1) at the radiator fill cap, and remove the coolant overflow bottle (2).
6. Drain the coolant. Refer to **Cooling - Standard Procedure** .

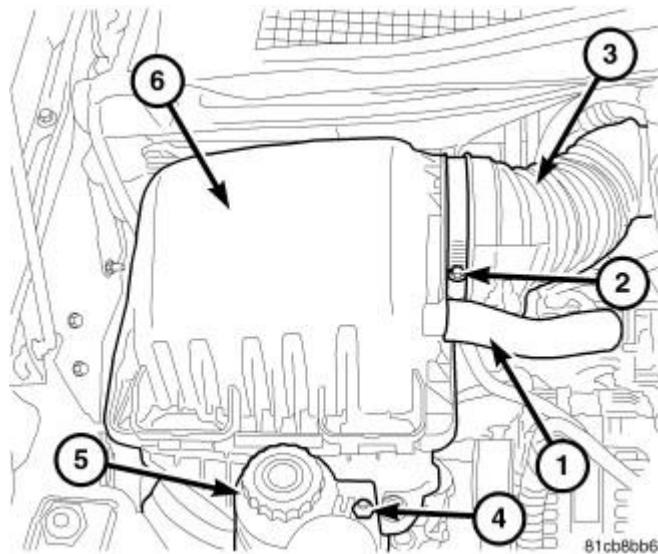


Fig. 16: Air Filter Housing
Courtesy of CHRYSLER LLC

7. Remove the air filter housing (6). See Engine/Air Intake System/BODY, Air Cleaner - Removal.

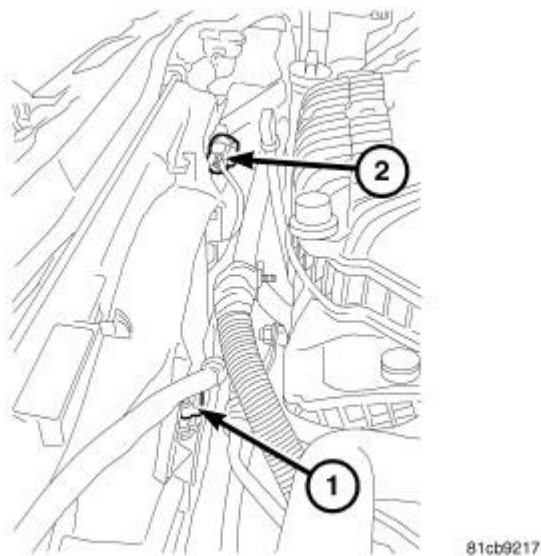


Fig. 17: Left & Right Cooling Fan Harness Connectors
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - LEFT COOLING FAN HARNESS CONNECTOR |
| 2 - RIGHT COOLING FAN HARNESS CONNECTOR |

8. Disconnect the cooling fan harness connectors (1) and (2).

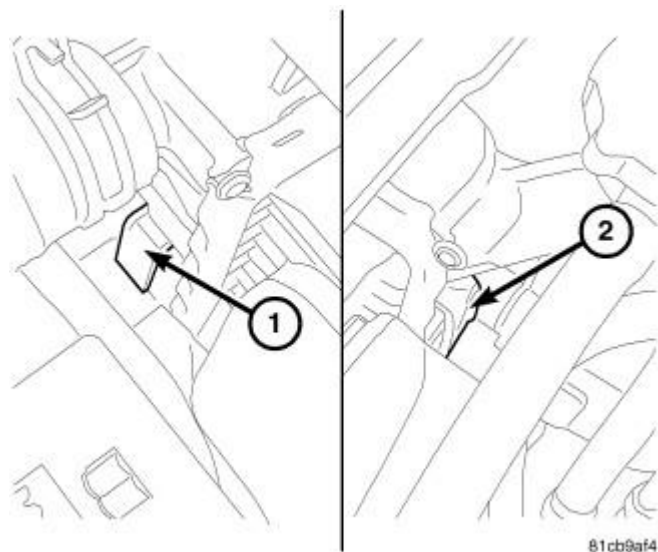


Fig. 18: Left & Right Cooling Fan Clips
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - LEFT COOLING FAN CLIP
2 - RIGHT COOLING FAN CLIP |
|---|

9. Release the left (1) and right (2) cooling fan clips, and remove the cooling fan assembly.

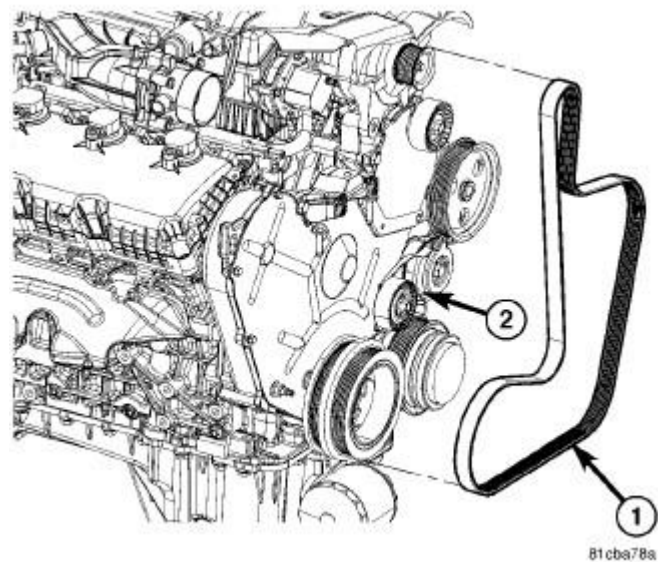


Fig. 19: Accessory Drive Belt & Tensioner
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - ACCESSORY DRIVE BELT
2 - ACCESSORY DRIVE BELT TENSIONER |
|--|

10. Release tension from the accessory drive belt tensioner (2), and remove the accessory drive belt (1). Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal** .

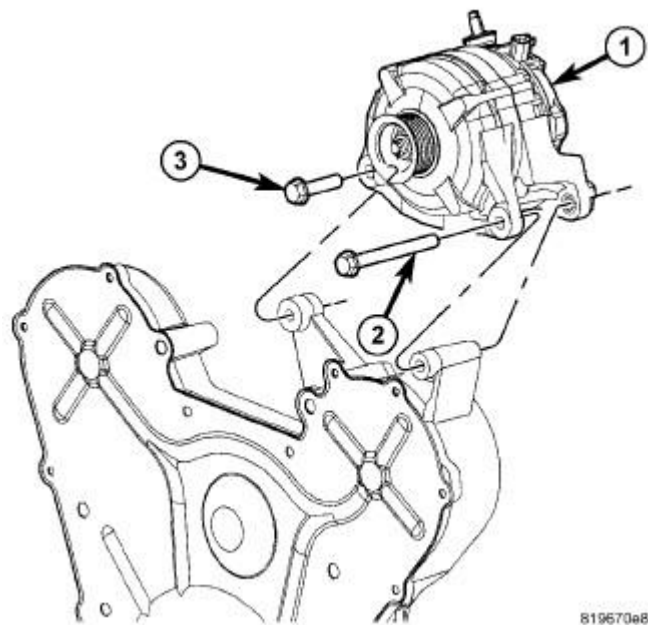


Fig. 20: Generator - 4.0L
Courtesy of CHRYSLER LLC

11. Remove the generator (1). Refer to **Electrical/Charging/GENERATOR - Removal** .

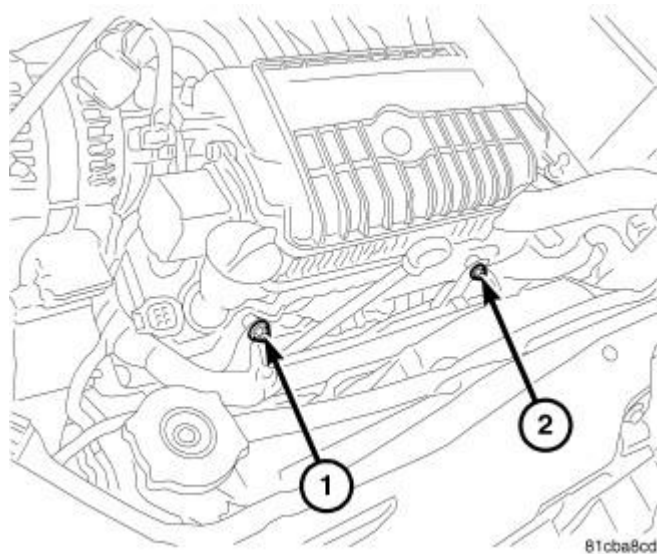


Fig. 21: Power Steering Hose Bracket Retainers
Courtesy of CHRYSLER LLC

1 - POWER STEERING HOSE BRACKET RETAINERS

12. Remove the power steering line bracket retainers (1) and (2).

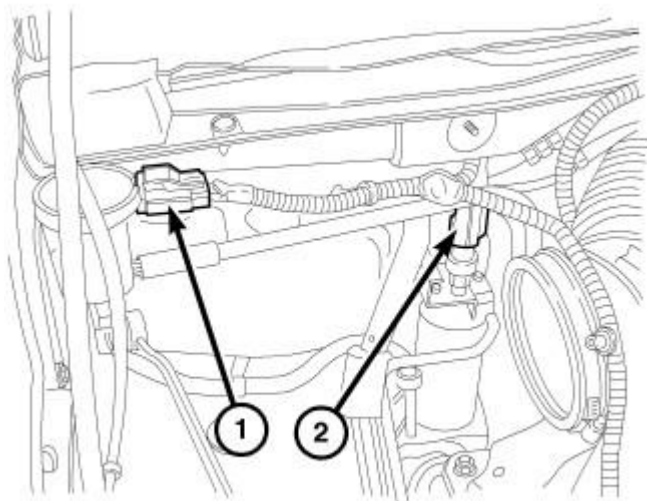


Fig. 22: EVAP Purge Solenoid Harness Connector & A/C Pressure Transducer Harness Connector
Courtesy of CHRYSLER LLC

1 - EVAP PURGE SOLENOID CONNECTOR 2 - A/C PRESSURE TRANSDUCER
--

13. Disconnect the EVAP purge solenoid harness connector (1) and the A/C pressure transducer harness connector (2).

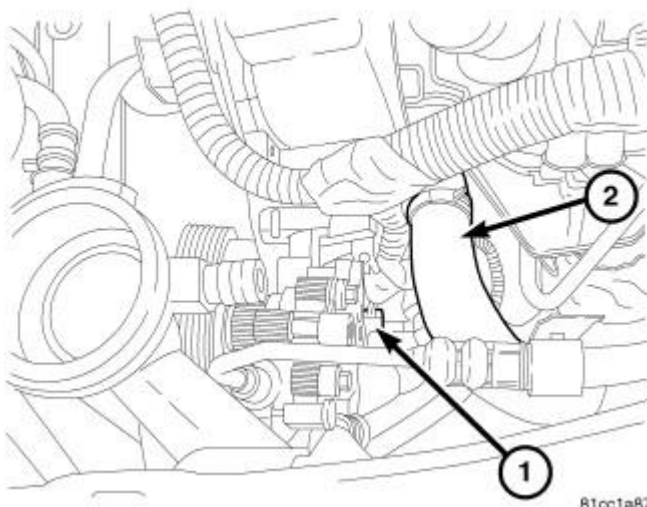


Fig. 23: Harness Retainer & Lower Radiator Hose
Courtesy of CHRYSLER LLC

1 - HARNESS RETAINER

2 - LOWER RADIATOR HOSE

14. Disconnect the harness retainer (1) from the power steering pump.

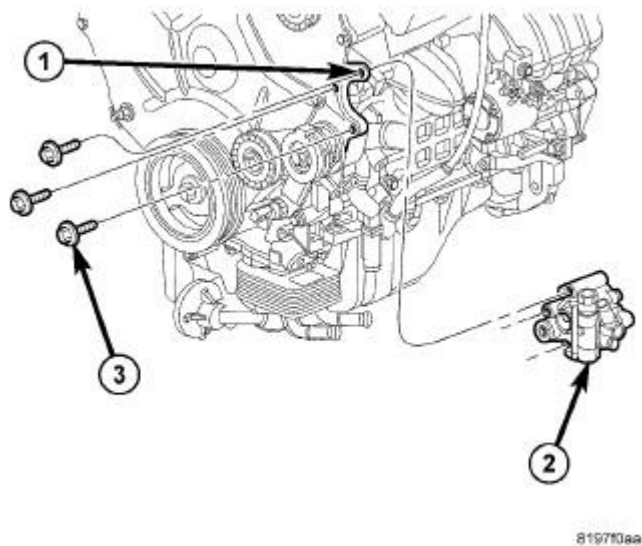


Fig. 24: Power Steering Pump & Bolts
Courtesy of CHRYSLER LLC

15. Remove bolts (3) and reposition the power steering pump (2).

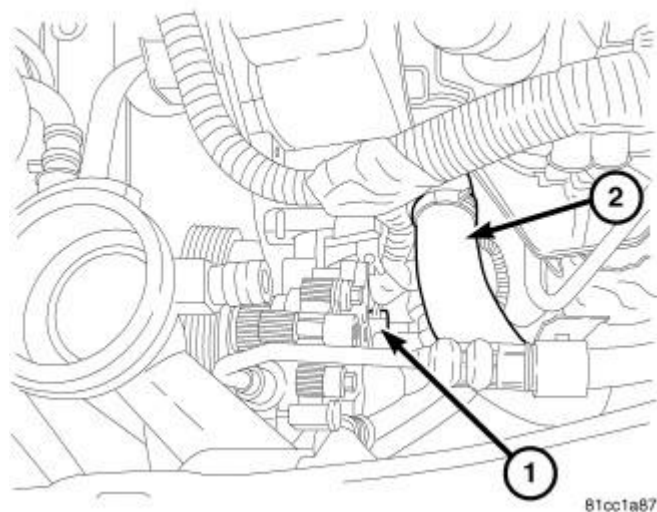


Fig. 25: Harness Retainer & Lower Radiator Hose
Courtesy of CHRYSLER LLC

- 1 - HARNESS RETAINER
2 - LOWER RADIATOR HOSE

16. Disconnect the lower radiator hose (2) from the engine.

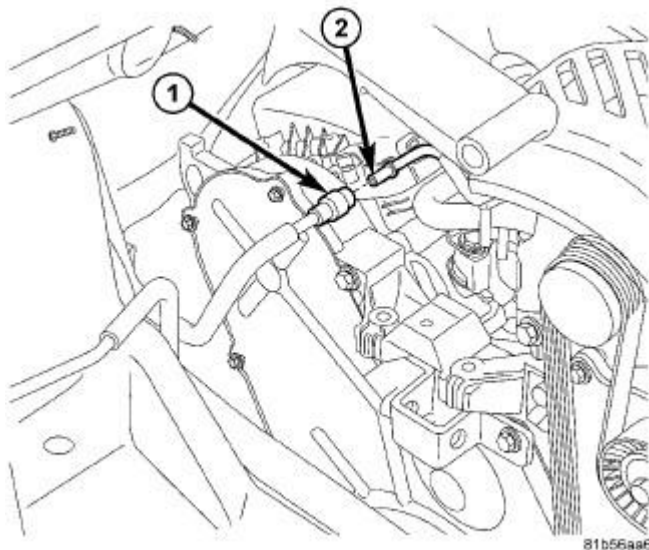


Fig. 26: Fuel Supply Line & Fuel Rail
Courtesy of CHRYSLER LLC

1 - FUEL SUPPLY LINE 2 - FUEL RAIL

17. Disconnect the fuel supply line (1) at the fuel rail (2). Refer to **Fuel System/Fuel Delivery/FITTING, Quick Connect - Standard Procedure**.

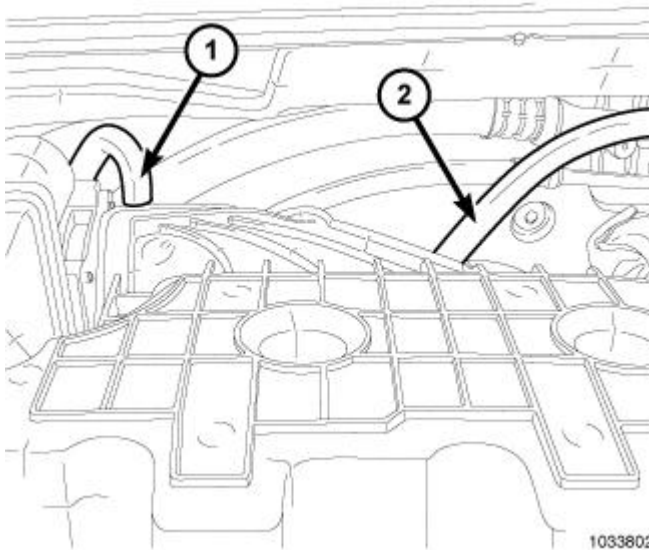


Fig. 27: EVAP Purge Line & Brake Booster Vacuum Hose
Courtesy of CHRYSLER LLC

18. Disconnect the EVAP purge line (1) and brake booster vacuum hose (2) from the upper intake manifold.

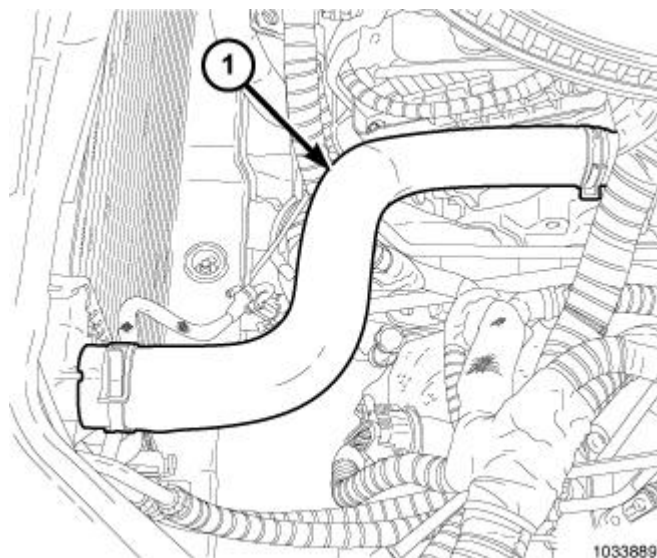


Fig. 28: Upper Radiator Hose
Courtesy of CHRYSLER LLC

19. Remove the upper radiator hose (1).

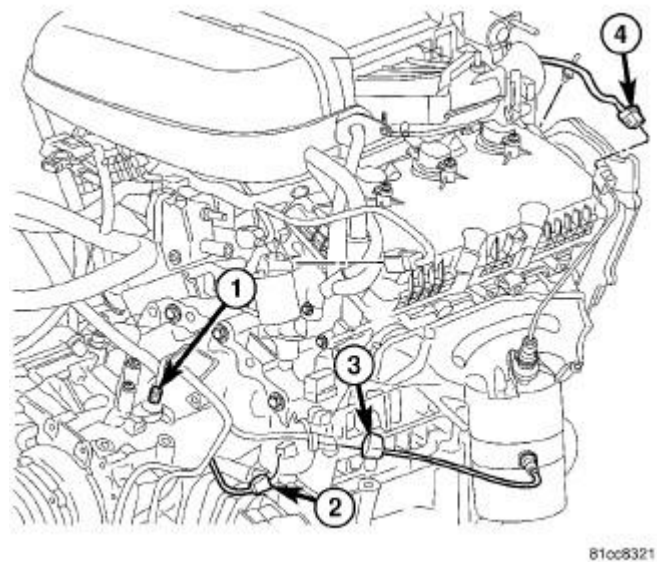


Fig. 29: Input Shaft Speed Sensor, Crankshaft Position Sensor, Downstream O2 Sensor & Upstream O2 Sensor Harness Connectors
Courtesy of CHRYSLER LLC

1 - INPUT SHAFT SPEED SENSOR CONNECTOR
2 - CRANKSHAFT POSITION SENSOR CONNECTOR
3 - DOWNSTREAM O2 SENSOR CONNECTOR

4 - UPSTREAM O2 SENSOR CONNECTOR

20. Disconnect the input shaft speed sensor harness connector (1), the crankshaft position sensor harness connector (2), the downstream O2 sensor harness connector (3), and the upstream O2 sensor harness connector (4) from the rear maniverter.

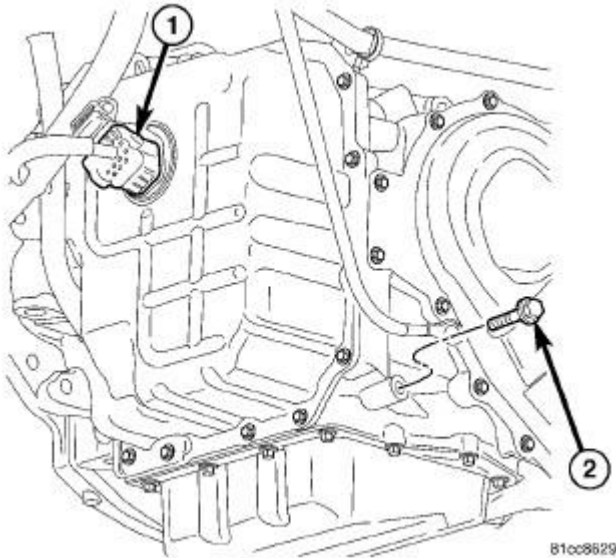


Fig. 30: Solenoid Pack Connector & Ground Bolt
Courtesy of CHRYSLER LLC

1 - SOLENOID PACK CONNECTOR

2 - GROUND BOLT

21. Disconnect the transaxle solenoid pack harness connector (1).

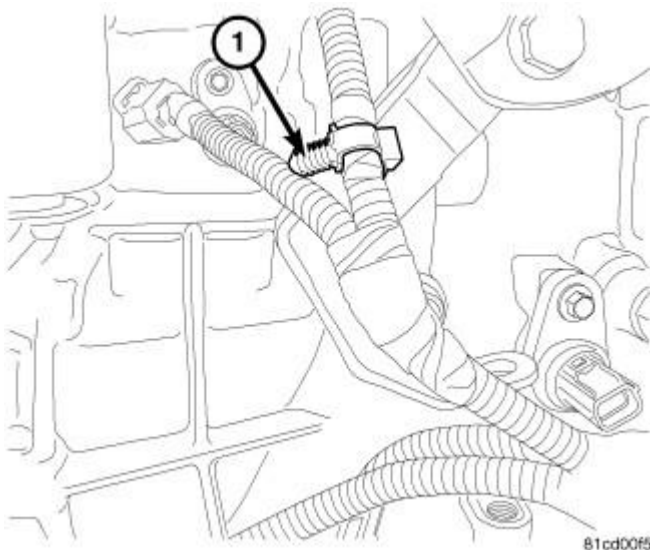


Fig. 31: Transaxle Shifter Bracket Harness Retainer
Courtesy of CHRYSLER LLC

1 - HARNESS RETAINER

22. Disconnect the harness retainer (1) from the transaxle shifter bracket.

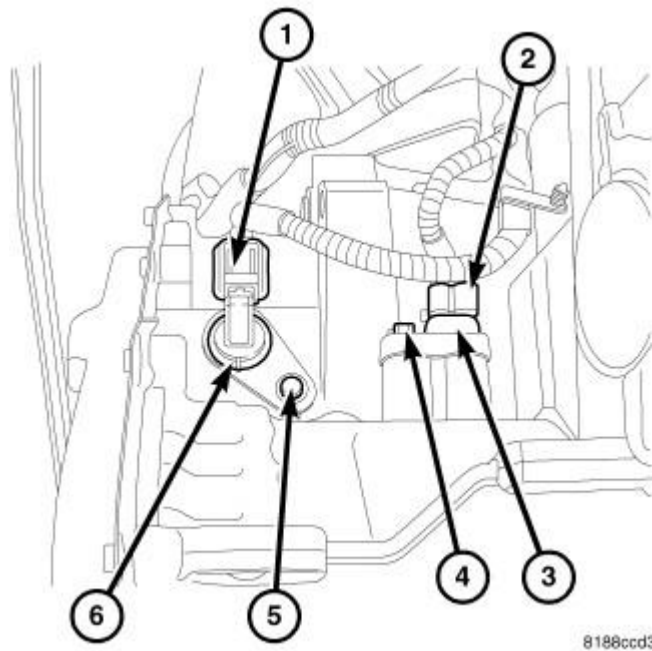


Fig. 32: Output Speed & O2 Sensor Harness Connectors
Courtesy of CHRYSLER LLC

1 - OSS #1
2 - OSS #2

23. Disconnect the output speed sensor harness connectors (1) and (2).
24. Disconnect the downstream O2 sensor harness connector and the upstream O2 sensor harness connector (4) from the front maniverter.

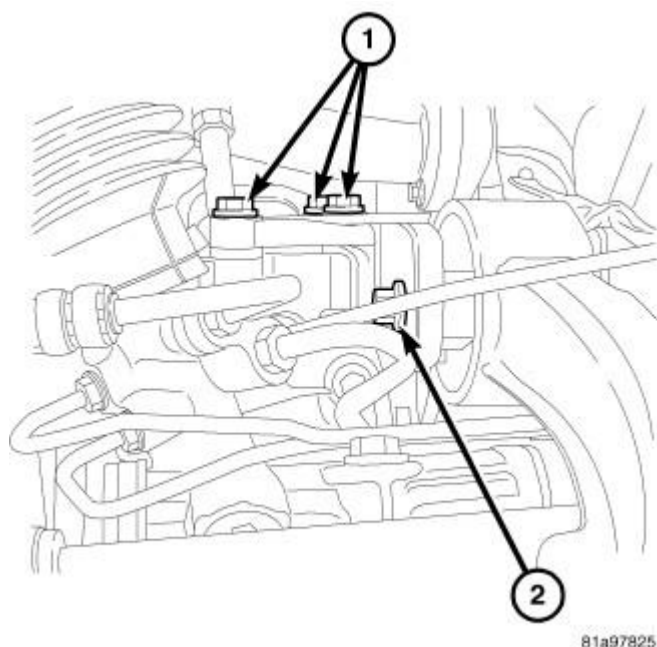


Fig. 33: Rear Transaxle Mount Bracket Bolts
Courtesy of CHRYSLER LLC

1 - REAR TRANS MOUNT BRACKET FASTENERS

25. Remove the three rear transaxle mount bracket bolts (1).

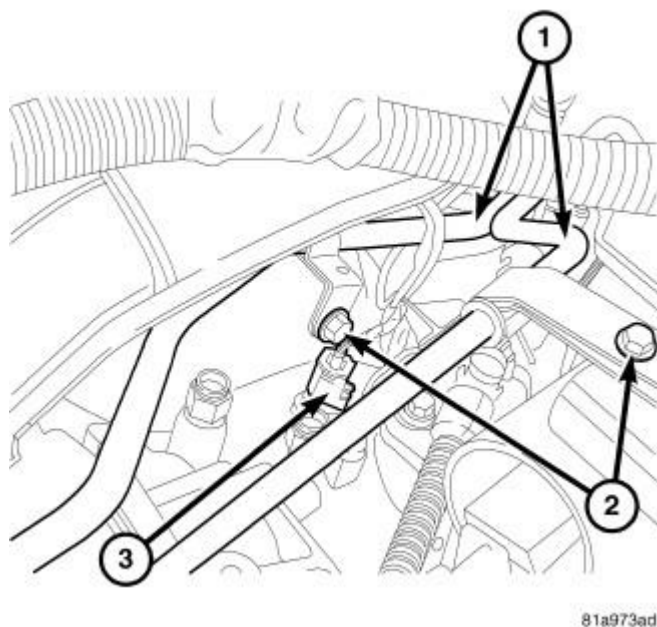
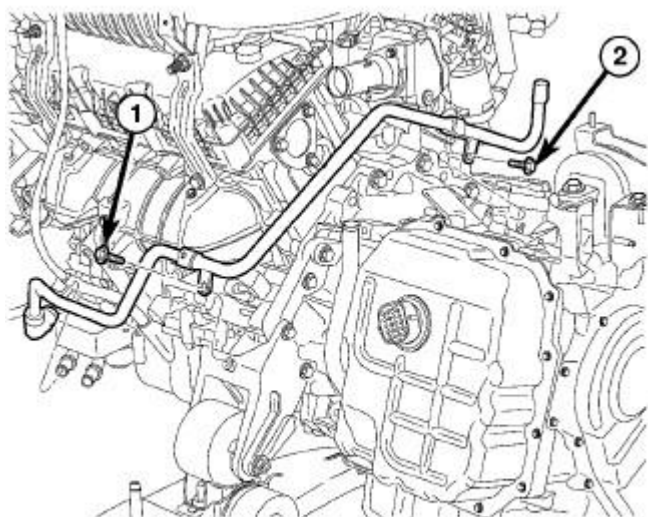


Fig. 34: Heater Hose & Power Steering Hose Bracket Retainers
Courtesy of CHRYSLER LLC

- 1 - HEATER LINES
- 2 - HEATER LINE BRACKET RETAINERS
- 3 - ISS

26. Remove the heater hose and power steering hose bracket retainers (2) from the transaxle bellhousing and the left engine mount.



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Fig. 35: Front & Rear Heater Line Bracket Retainers
Courtesy of CHRYSLER LLC

- 1 - FRONT HEATER LINE BRACKET RETAINER
- 2 - REAR HEATER LINE BRACKET RETAINER

27. Remove the front heater line bracket retainer (1).

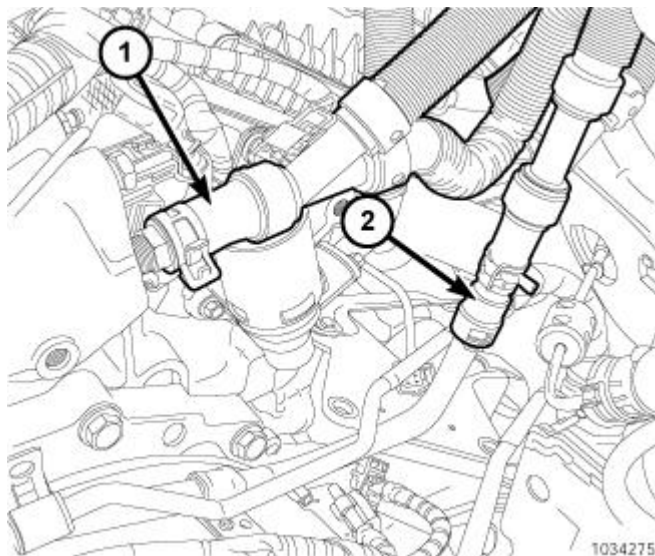


Fig. 36: Heater Hoses

Courtesy of CHRYSLER LLC

28. Disconnect the heater hoses (1) and (2). Refer to **PLUMBING, FRONT** .

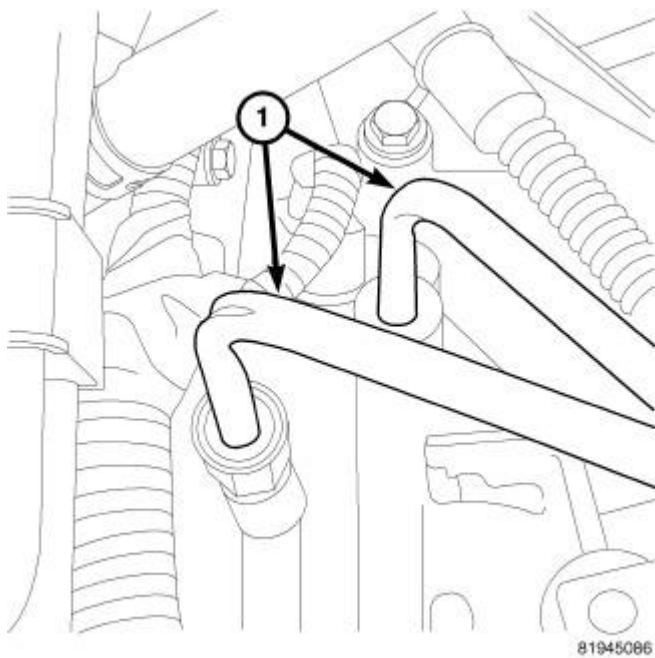


Fig. 37: Oil Cooler Lines

Courtesy of CHRYSLER LLC

1 - COOLER LINES AT TRANS

29. Disconnect oil cooler lines (1) from transaxle using Trans Cooler Line Disconnect 8875A. Refer to **Cooling/Transmission/TUBES AND HOSES, Transmission Oil Cooler - Standard Procedure** .

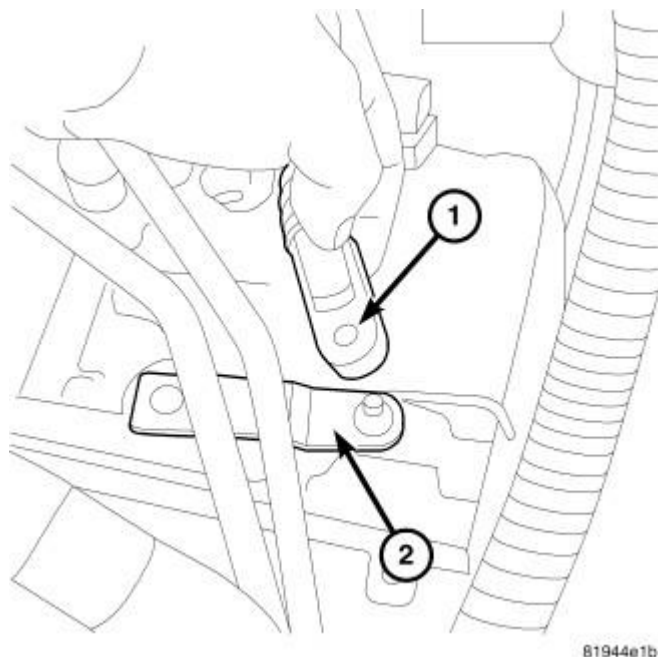


Fig. 38: Shift Cable & Transaxle Manual Valve Lever
Courtesy of CHRYSLER LLC

1 - SHIFT CABLE
2 - MANUAL LEVER

30. Disconnect the shift cable (1) from the transaxle manual valve lever (2).
31. Disconnect the shift cable from the bracket.

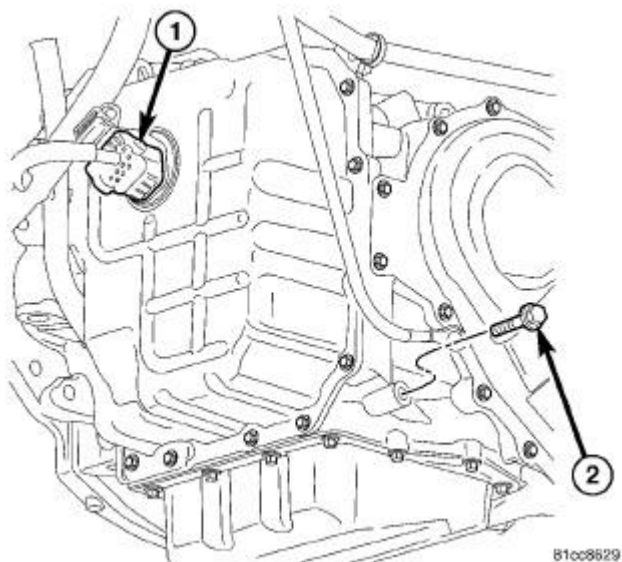


Fig. 39: Solenoid Pack Connector & Ground Bolt
Courtesy of CHRYSLER LLC

32. Raise the vehicle and remove both front tire and wheel assemblies. Refer to **Tires and Wheels - Removal**.
33. Remove the oil filter/oil cooler splash shield and the left front wheelhouse splash shield. Refer to **Body/Exterior/SHIELD, Splash - Removal**.
34. Remove the transaxle ground strap bolt (2).

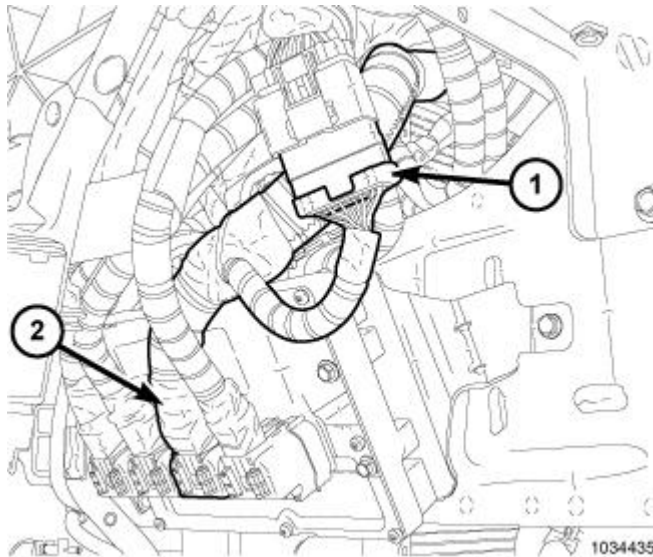


Fig. 40: PCM Harness Connector & Inline Harness Connector
Courtesy of CHRYSLER LLC

35. Disconnect the PCM harness connector (2) and the inline harness connector (1).

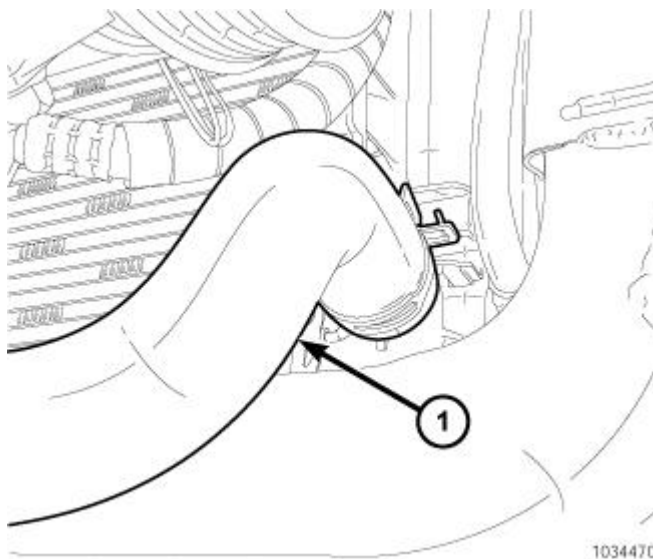


Fig. 41: Lower Radiator Hose
Courtesy of CHRYSLER LLC

36. Remove the lower radiator hose (1) from the radiator.

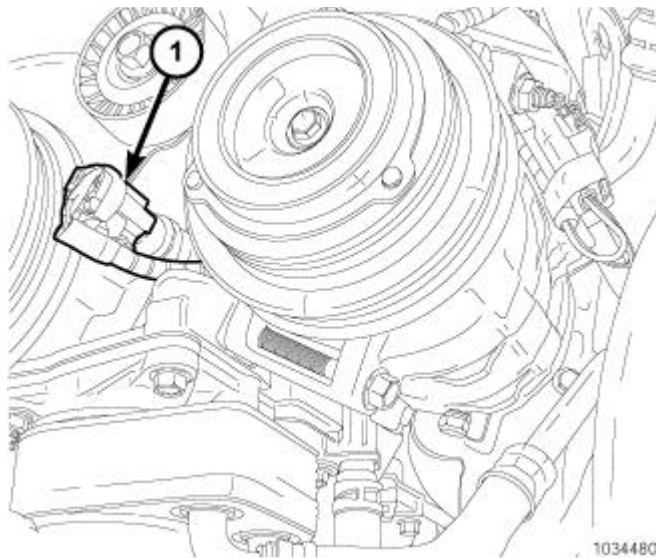


Fig. 42: Oil Pressure Sensor Wire Harness Connector
Courtesy of CHRYSLER LLC

37. Disconnect the wire harness connector (1) from the oil pressure sensor.

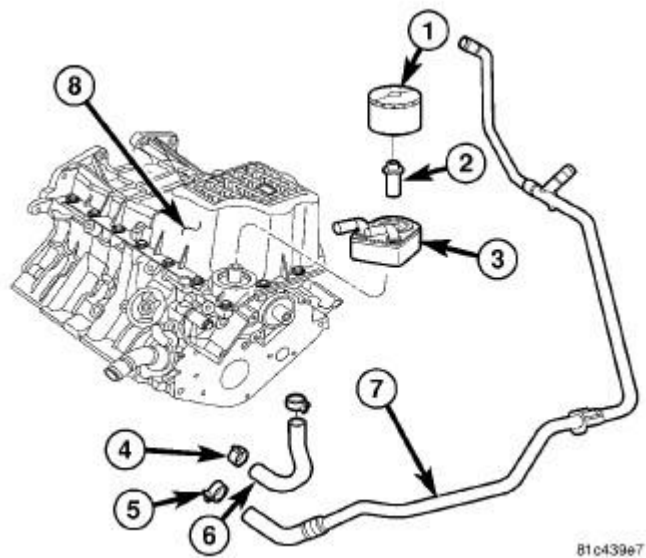
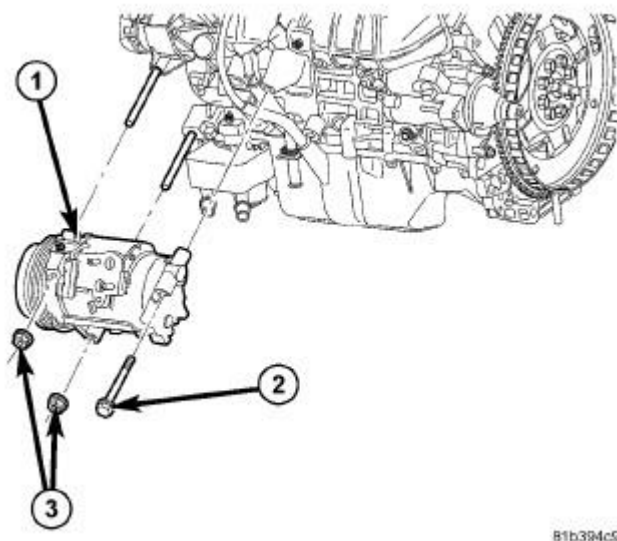


Fig. 43: Engine Oil Cooler and Filter Adapter
Courtesy of CHRYSLER LLC

- | |
|---|
| 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

38. Disconnect the engine oil cooler line (7) from the engine oil cooler (3).



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Fig. 44: A/C Compressor Bolts & Nuts

Courtesy of CHRYSLER LLC

1 - A/C COMPRESSOR

2 - BOLT

3 - NUTS

39. Disconnect the wire harness connector from the A/C compressor clutch coil. Remove one bolt (2), two nuts (3), two studs and reposition the A/C compressor.

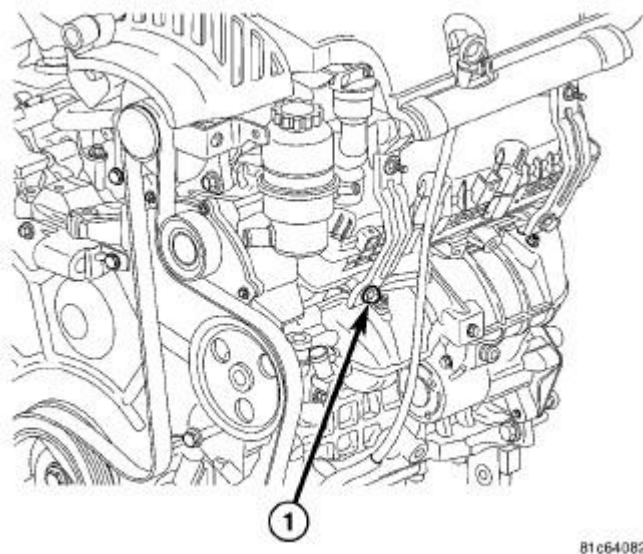


Fig. 45: Identifying Oil Level Indicator Tube Retaining Bolt
Courtesy of CHRYSLER LLC

1 - DIPSTICK TUBE BOLT

40. Remove the oil dipstick tube bolt (1), and remove the oil dipstick tube.

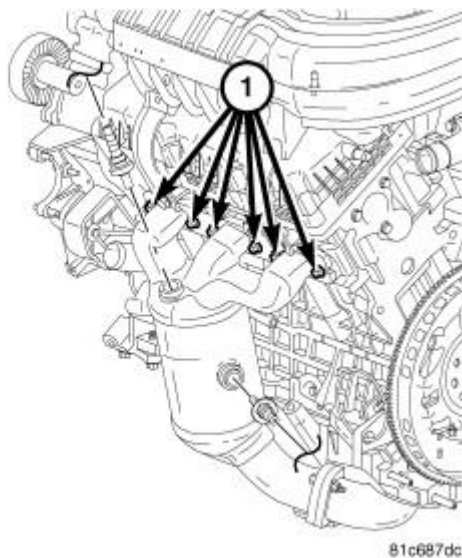


Fig. 46: Identifying Upper Exhaust Maniverter Retaining Bolts
Courtesy of CHRYSLER LLC

41. Remove the front maniverter. See **Engine/Manifolds/MANIFOLD, Exhaust - Removal**.

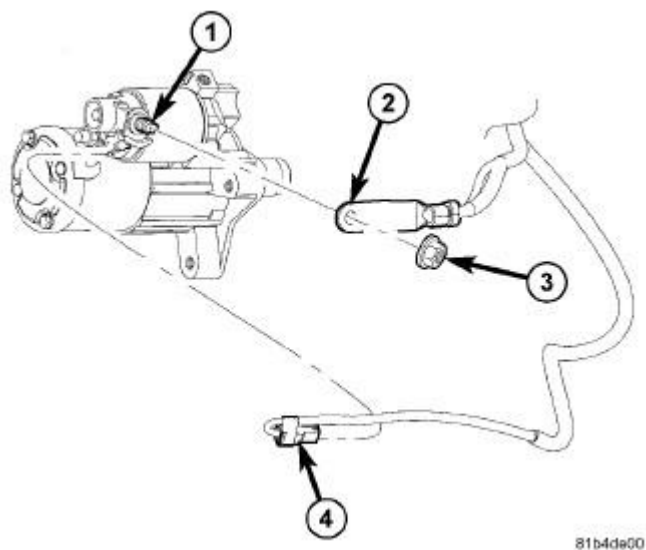


Fig. 47: Identifying Solenoid Nut, Mounting Stud, Electrical Connector & Battery Cable Assembly
Courtesy of CHRYSLER LLC

42. Remove battery cable nut (3) and battery cable (2) from the starter solenoid stud (1). Disconnect electrical connector (4) from the starter solenoid.

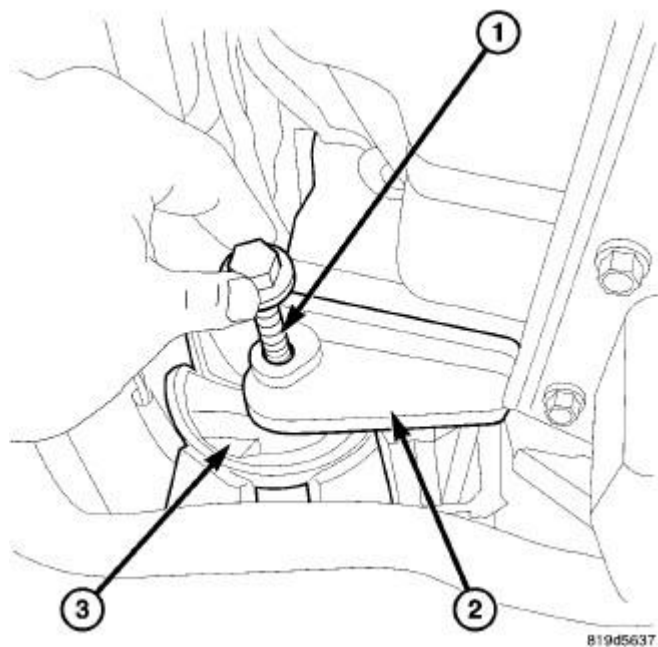


Fig. 48: CROSSMEMBER THROUGH BOLT
Courtesy of CHRYSLER LLC

1 - CROSSMEMBER THROUGH BOLT 2 - FRONT ENGINE MOUNT BRACKET
--

3 - FRONT ENGINE MOUNT SUPPORT

43. Remove the front engine mount through bolt (1).

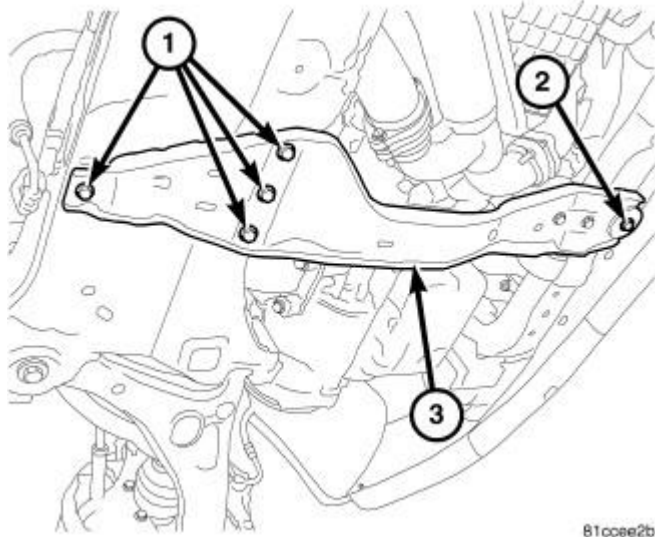


Fig. 49: Front & Rear Crossmember Bolts
Courtesy of CHRYSLER LLC

- | |
|----------------------------|
| 1 - REAR CROSSMEMBER BOLTS |
| 2 - FRONT CROSSMEMBER BOLT |
| 3 - CROSSMEMBER |

44. Remove the four rear crossmember bolts (1), the front crossmember bolt (2), and remove the crossmember (3).

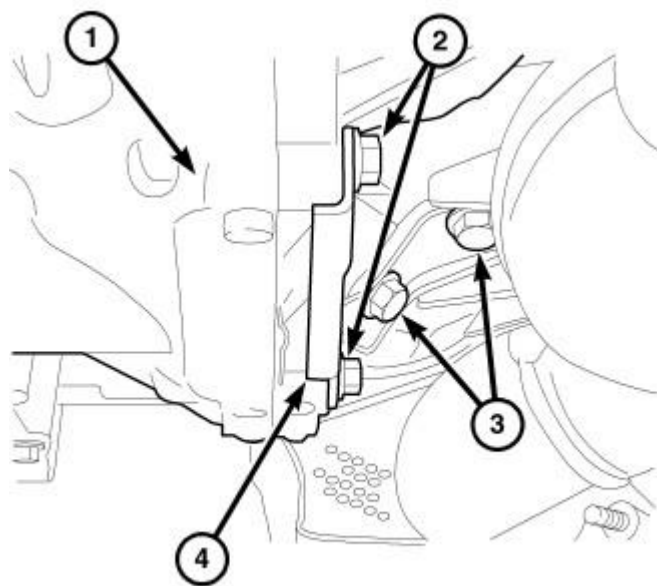


Fig. 50: Identifying Exhaust Bracket & Bolts
 Courtesy of CHRYSLER LLC

1 - TRANSAXLE BELLHOUSING
2 - CROSSUNDER PIPE BRACKET RETAINERS
3 - CROSSUNDER PIPE BRACKET RETAINERS
4 - CROSSUNDER PIPE BRACKET

45. Remove the crossunder pipe. See **Engine/Manifolds/MANIFOLD, Exhaust - Removal**.
46. Remove the crossunder pipe bracket (4) from the bottom of the transaxle bellhousing (1).

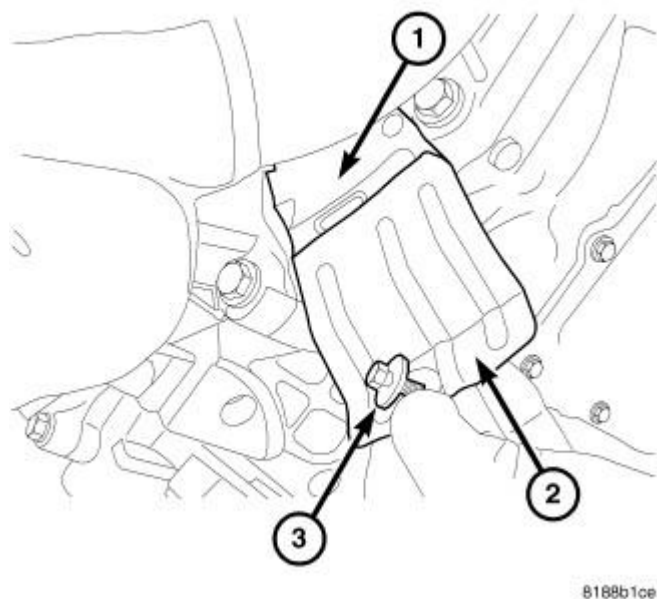


Fig. 51: DUST SHIELD
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - TORQUE CONVERTER ACCESS (62TE) |
| 2 - TORQUE CONVERTER ACCESS COVER (62TE) |
| 3 - TORQUE CONVERTER ACCESS COVER BOLT (62TE) |

47. Remove the bolt (3) and the torque converter access cover (2).

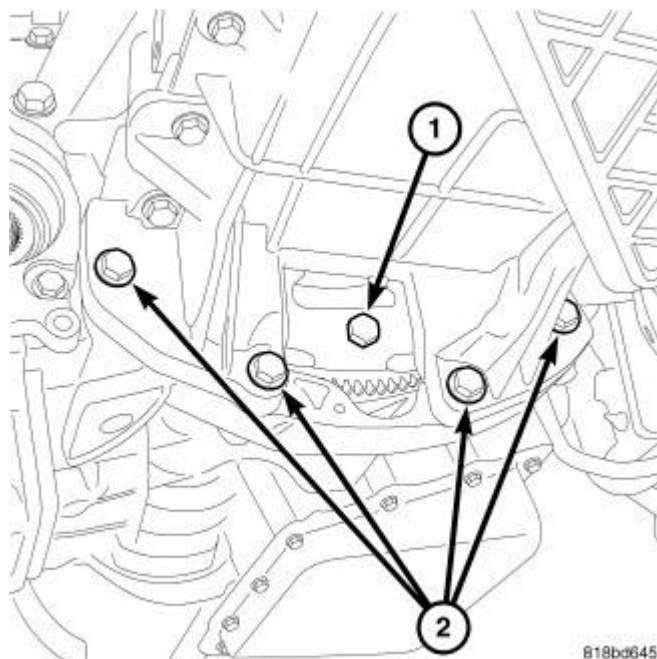
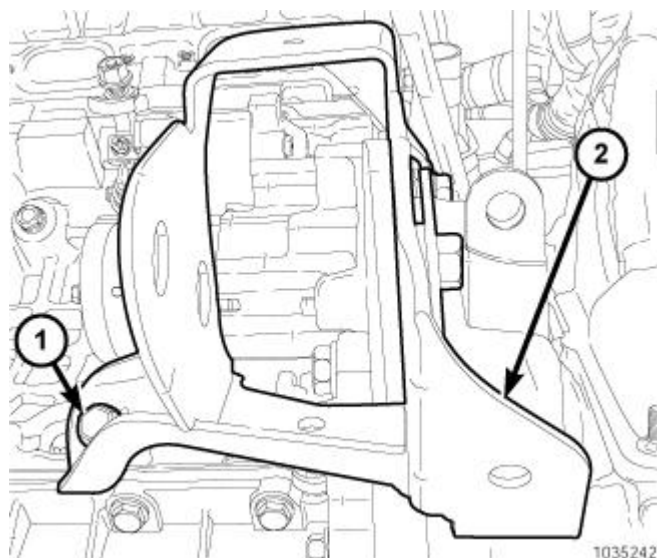


Fig. 52: TORQUE CONVERTER BOLTS

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - TORQUE CONVERTER BOLT
2 - LOWER TRANSAXLE BELLHOUSING BOLTS |
|--|

48. Remove the torque converter-to-driveplate bolts (1). Upon removing bolts, some driveplates have a tight-tolerance (slotted) bolt hole. If present, mark this location (driveplate and converter) with paint for re-alignment during installation.
49. Remove the lower transaxle bellhousing bolts (2).

**Fig. 53: Front Engine Mount Bracket Bolts**

Courtesy of CHRYSLER LLC

50. Remove three bolts (1) and the front engine mount bracket (2).

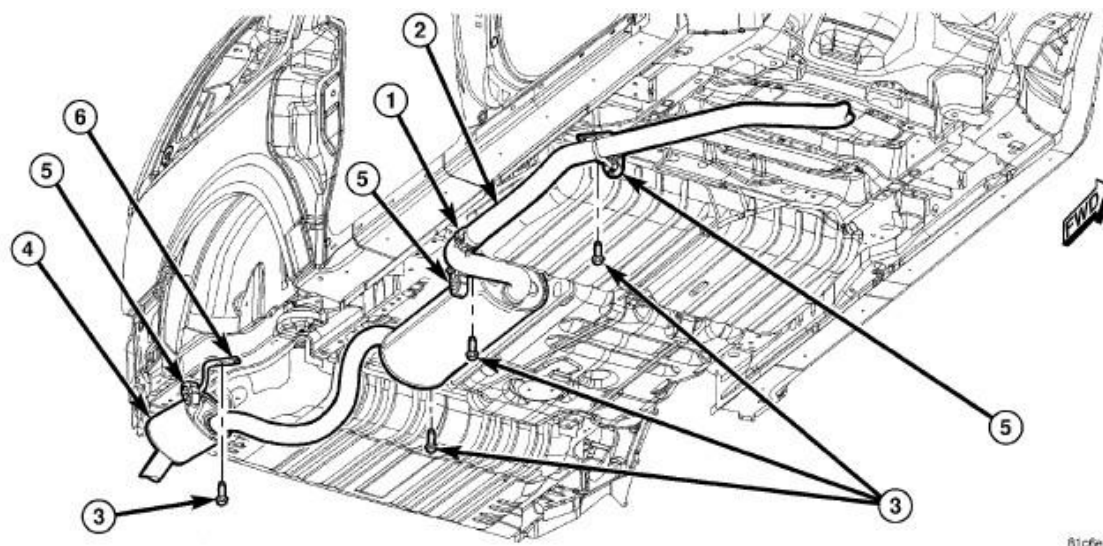


Fig. 54: Muffler/Resonator Assembly
Courtesy of CHRYSLER LLC

51. Remove the front exhaust pipe (2). Refer to **Exhaust System/MUFFLER, Exhaust - Removal**.

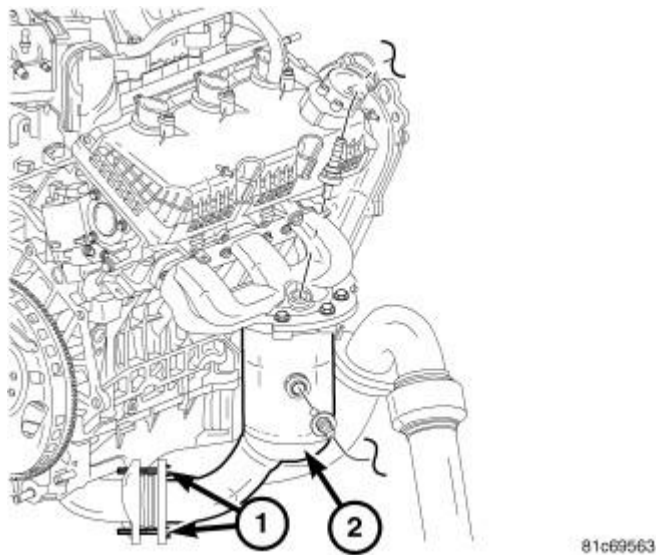


Fig. 55: Rear Maniverter Lower Bolts
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - REAR MANIVERTER FASTENERS
2 - REAR MANIVERTER</p> |
|--|

52. Remove the rear maniverter (2). See **Engine/Manifolds/MANIFOLD, Exhaust - Removal**.

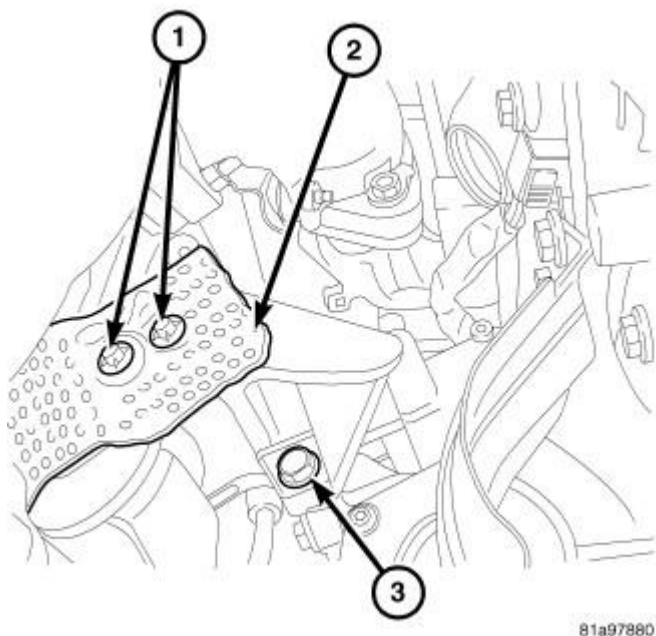


Fig. 56: HEAT SHIELD AT REAR MOUNT

Courtesy of CHRYSLER LLC

1 - REAR ENGINE MOUNT HEAT SHIELD FASTENERS

2 - REAR ENGINE MOUNT HEAT SHIELD

3 - REAR ENGINE MOUNT FASTENER

53. Remove the Fasteners (1), and remove the rear engine mount heat shield (2).
54. Remove rear transaxle mount bracket bolt (3).

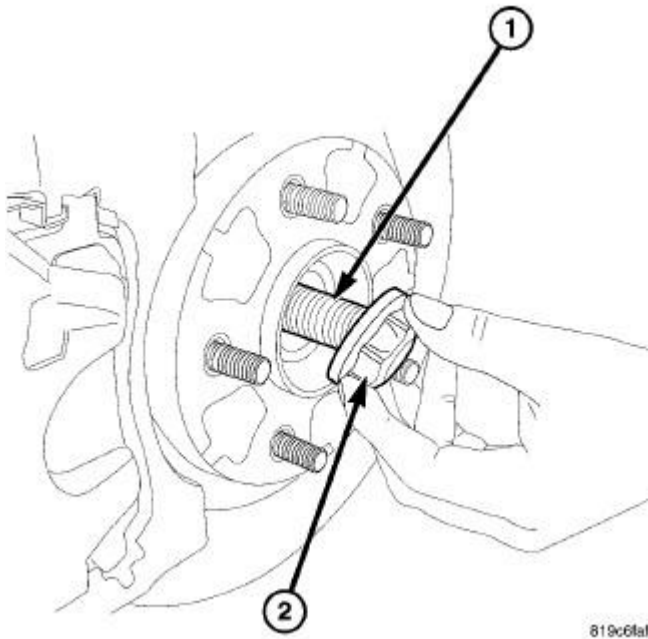


Fig. 57: View Of Nut & Halfshaft

Courtesy of CHRYSLER LLC

55. Remove the right and left axle halfshafts. Refer to **Differential and Driveline/Half Shaft - Removal** .

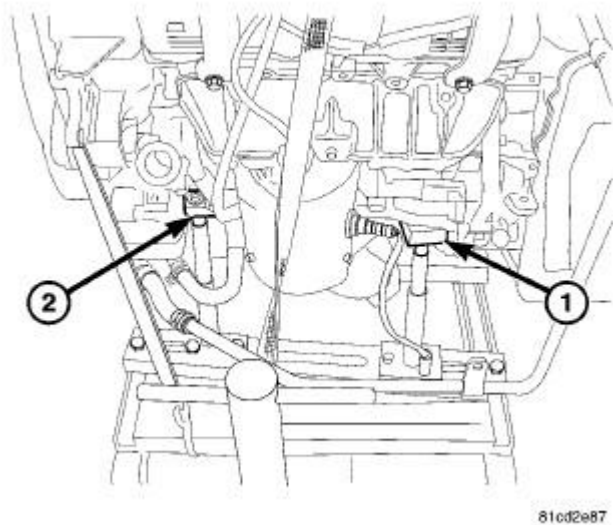


Fig. 58: Front Engine Fixture Brackets
Courtesy of CHRYSLER LLC

1 - 8130 ADAPTER
2 - ENGINE CRADLE POST

56. Position Power Train Dolly 6135 and Engine Support Cradle 6710A under the engine.
57. Align the front right engine cradle post (2) with the lift point hole in the engine block.
58. Align the front left engine cradle post and Engine Support Bracket 8130 (1) with the lift point hole in the engine block.

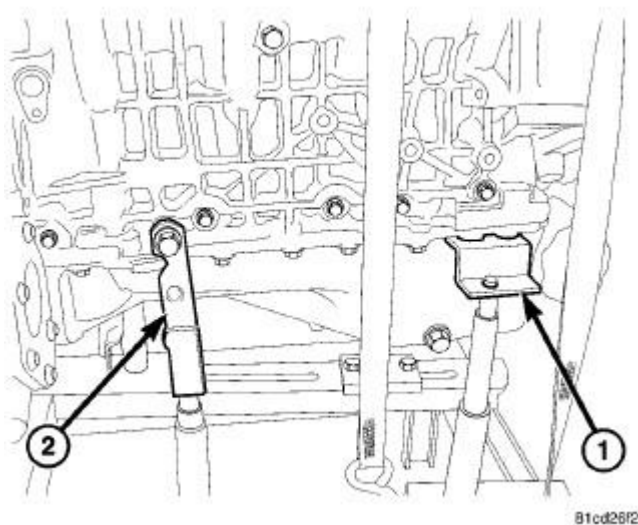


Fig. 59: Rear Engine Fixture Brackets
Courtesy of CHRYSLER LLC

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

59. Install Power Train Dolly Adapter 10107-1 (2) to the engine block, and align the left rear engine cradle post with the hole in the adapter.
60. Install Power Train Dolly Adapter 10107-2 (1) to the engine block, and align the right rear engine cradle post with the hole in the support bracket.
61. Install safety straps 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.

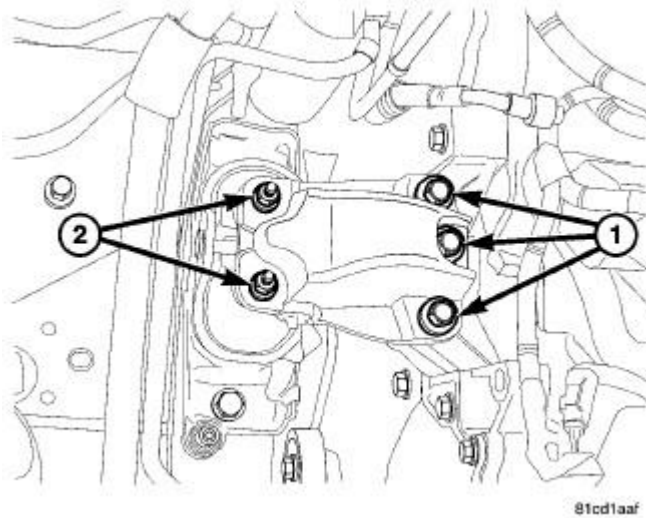


Fig. 60: Identifying Right Engine Mount-To-Engine Fasteners
Courtesy of CHRYSLER LLC

62. Remove the right engine mount-to-engine fasteners (1).

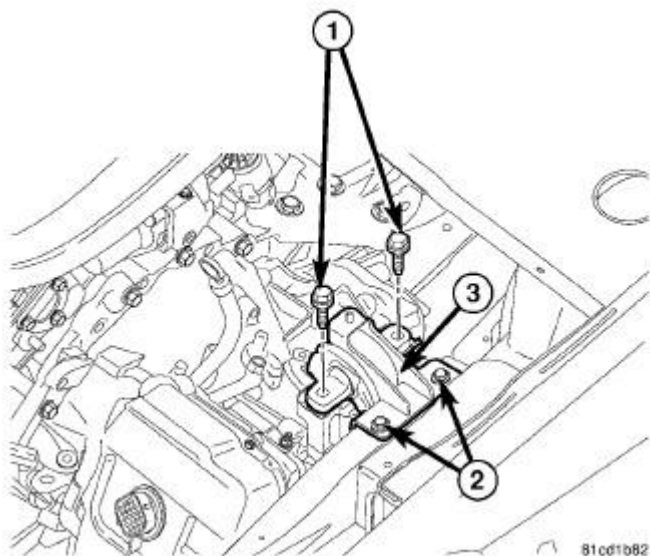


Fig. 61: Identifying Left Engine Mount-To-Engine Fasteners
 Courtesy of CHRYSLER LLC

63. Remove the left engine mount-to-engine fasteners (1).
64. Raise the vehicle body off of the powertrain.
65. Support the transaxle with a suitable lifting device.
66. Remove the remaining transaxle bellhousing bolts, and separate transaxle from engine assembly.

INSTALLATION

INSTALLATION

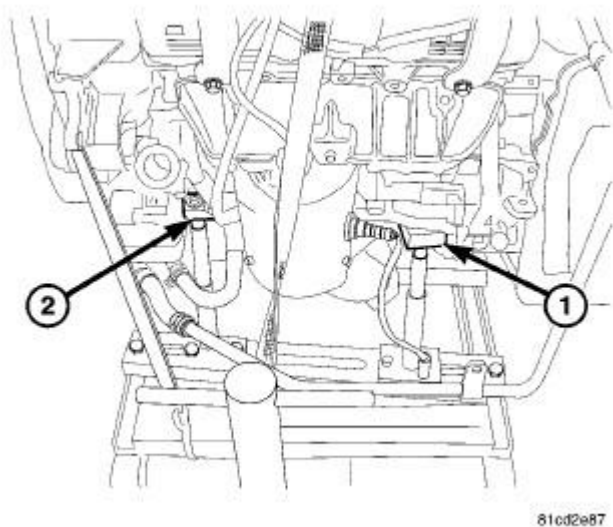


Fig. 62: Front Engine Fixture Brackets

Courtesy of CHRYSLER LLC

1 - 8130 ADAPTER

2 - ENGINE CRADLE POST

1. Position Power Train Dolly 6135 and Engine Support Cradle 6710A under the engine.
2. Align the front right engine cradle post (2) with the lift point hole in the engine block.
3. Align the front left engine cradle post and Engine Support Bracket 8130 (1) with the lift point hole in the engine block.

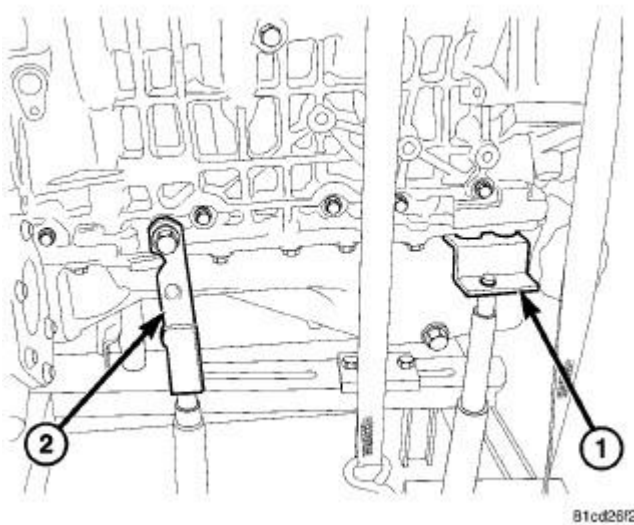


Fig. 63: Rear Engine Fixture Brackets

Courtesy of CHRYSLER LLC

1 - 10107-2 ADAPTER

2 - 10107-1 ADAPTER

4. Install Power Train Dolly Adapter 10107-1 (2) to the engine block, and align the left rear engine cradle post with the hole in the adapter.
5. Install Power Train Dolly Adapter 10107-2 (1) to the engine block, and align the right rear engine cradle post with the hole in the support bracket.
6. Install safety straps so that they securely hold the engine assembly in the engine cradle. Tighten the fasteners at the base of each engine cradle post, and verify that the engine cradle posts are engaged in the lifting points.
7. Install the transaxle to the engine assembly, and install the upper transaxle bolts. Tighten to 95 N.m (70 ft. lbs.)
8. Position the powertrain assembly below vehicle body, and carefully lower the vehicle body onto the powertrain assembly.

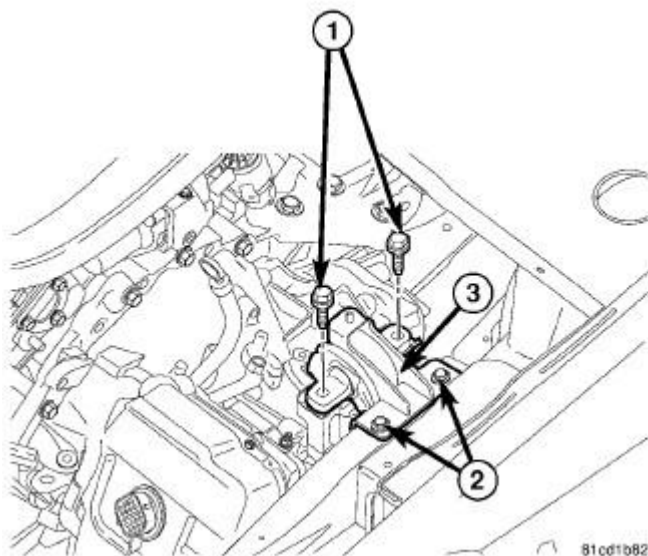


Fig. 64: Identifying Left Engine Mount-To-Engine Fasteners
Courtesy of CHRYSLER LLC

9. Install the left side transaxle mount bolts (1). Tighten transaxle mount bolts to 100 N.m (74 ft. lbs.).

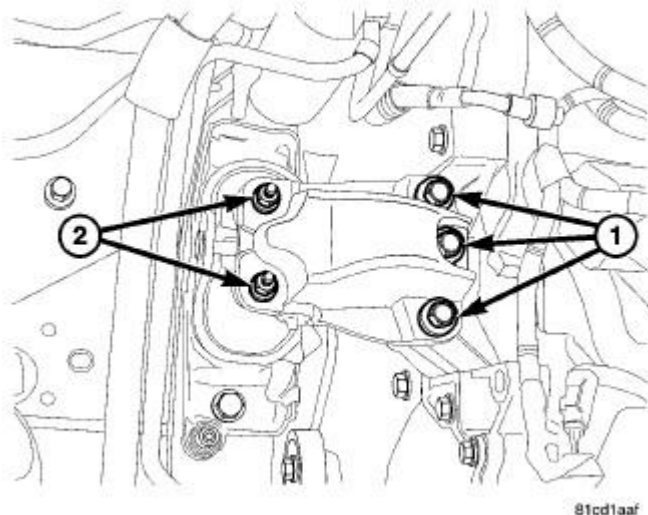


Fig. 65: Identifying Right Engine Mount-To-Engine Fasteners
Courtesy of CHRYSLER LLC

10. Install the right engine mount-to-engine fasteners (1). Tighten to 100 N.m (74 ft. lbs.).

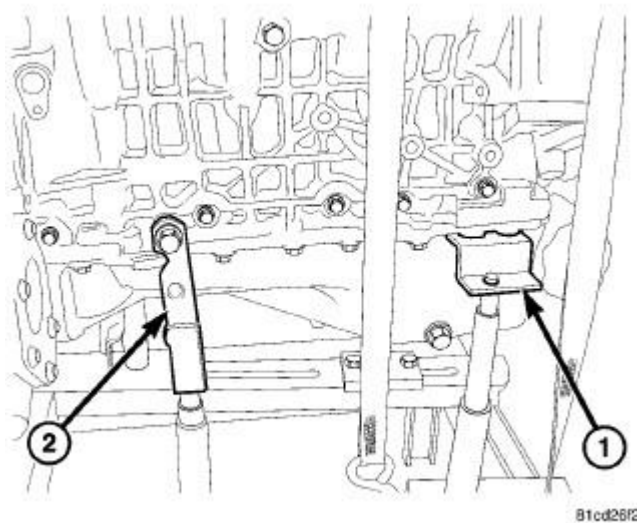


Fig. 66: Rear Engine Fixture Brackets
Courtesy of CHRYSLER LLC

11. Remove safety straps and lift vehicle and engine off of engine support cradle.
12. Remove Support Bracket 8130, Power Train Dolly Adapters 10107-1 (2) and 10107-2 (1) from engine.

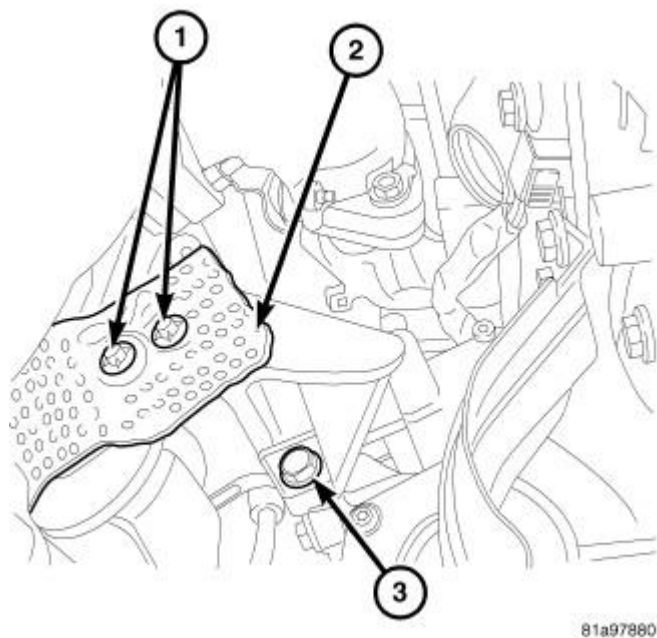


Fig. 67: HEAT SHIELD AT REAR MOUNT
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - REAR ENGINE MOUNT HEAT SHIELD FASTENERS |
| 2 - REAR ENGINE MOUNT HEAT SHIELD |

3 - REAR ENGINE MOUNT FASTENER

13. Install the rear transaxle mount through bolt (3). Tighten to 54 N.m (40 ft. lbs.).
14. Install the rear Engine Mount Heat Shield (2), and the fasteners (1). Tighten fasteners to 11 N.m (100 in. lbs.).

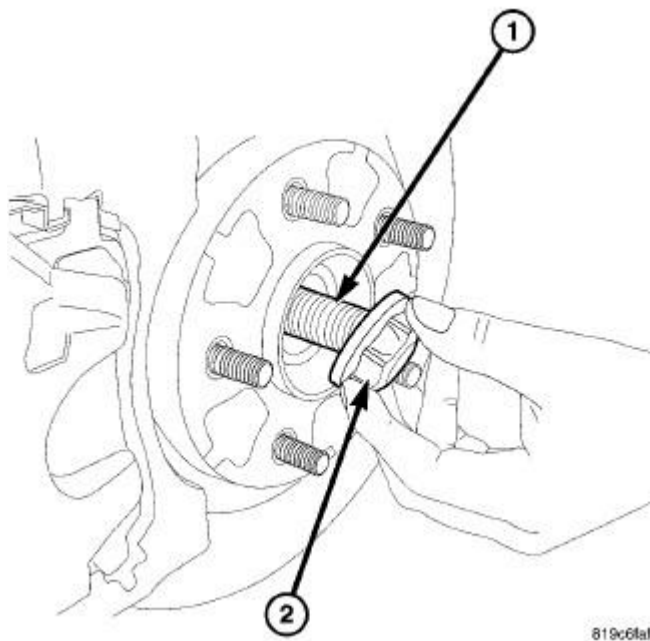


Fig. 68: View Of Nut & Halfshaft
Courtesy of CHRYSLER LLC

15. Install the right and left axle halfshafts. Refer to **Differential and Driveline/Half Shaft - Installation** .

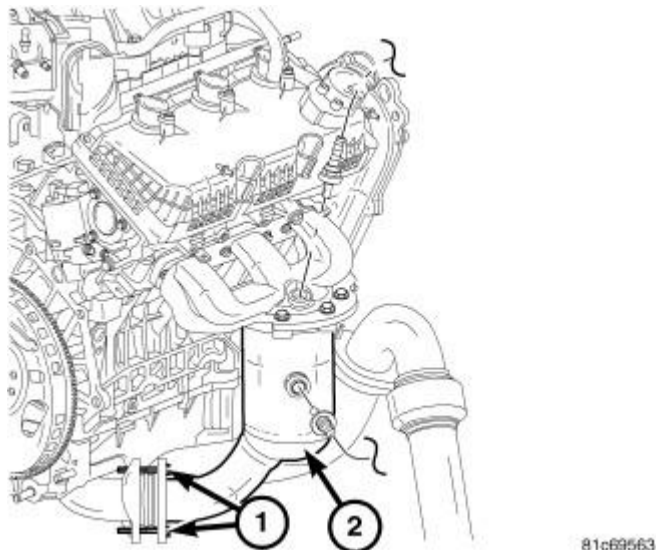


Fig. 69: Rear Maniverter Lower Bolts

Courtesy of CHRYSLER LLC

- 1 - REAR MANIVERTER FASTENERS
- 2 - REAR MANIVERTER

16. Install the rear maniverter (2). See Engine/Manifolds/MANIFOLD, Exhaust - Installation.

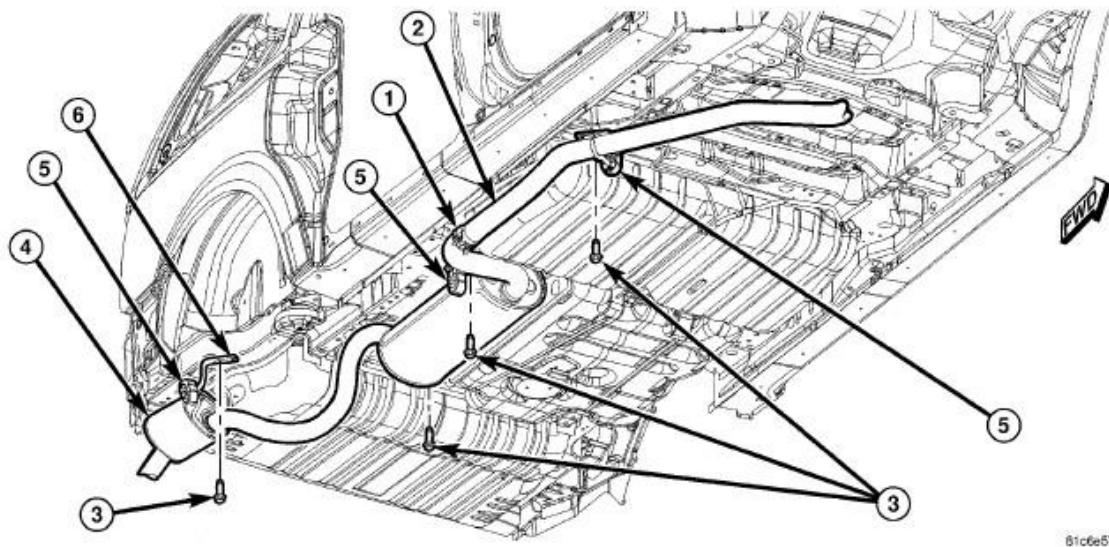


Fig. 70: Muffler/Resonator Assembly
Courtesy of CHRYSLER LLC

17. Install the front exhaust pipe (2). Refer to Exhaust System/MUFFLER, Exhaust - Installation.

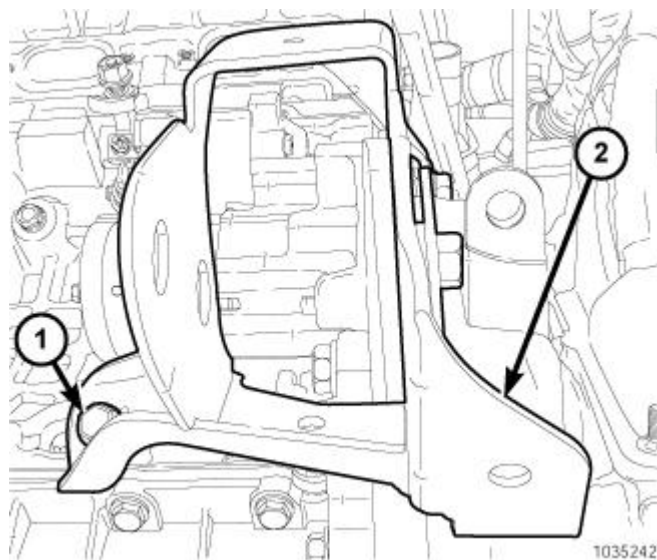


Fig. 71: Front Engine Mount Bracket Bolts
Courtesy of CHRYSLER LLC

18. Install the front engine mount bracket (2).

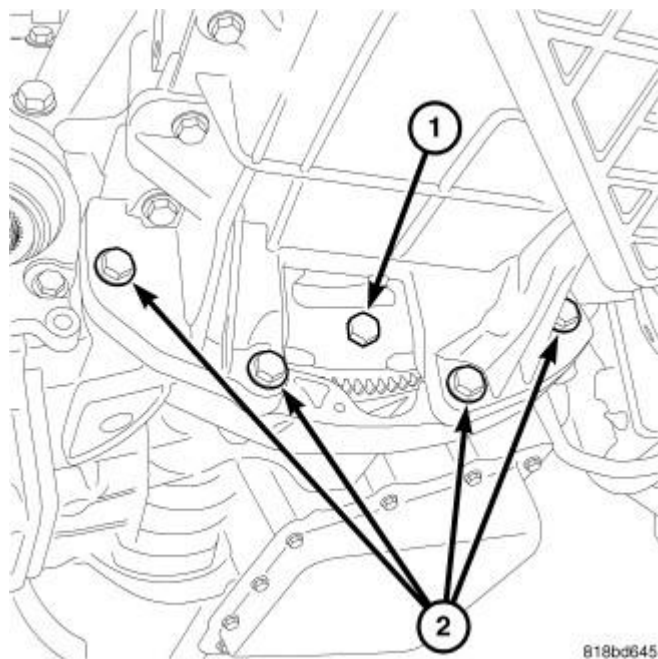


Fig. 72: TORQUE CONVERTER BOLTS

Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - TORQUE CONVERTER BOLT</p> <p>2 - LOWER TRANSAXLE BELLHOUSING BOLTS</p> |
|---|

19. If the driveplate has a tight-tolerance (slotted) bolt hole that was marked during removal, realign with the marked hole on the driveplate, then install the torque converter-to-driveplate bolts (1). Tighten the torque converter-to-driveplate bolts to 88 N.m (65 ft. lbs.)

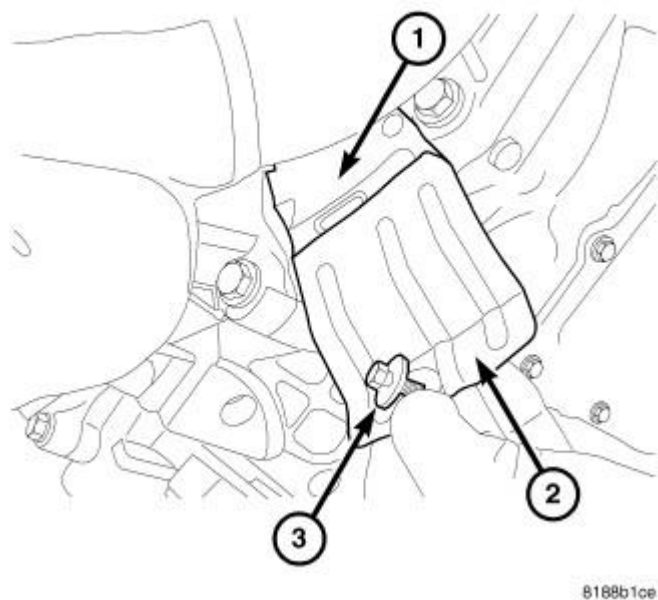
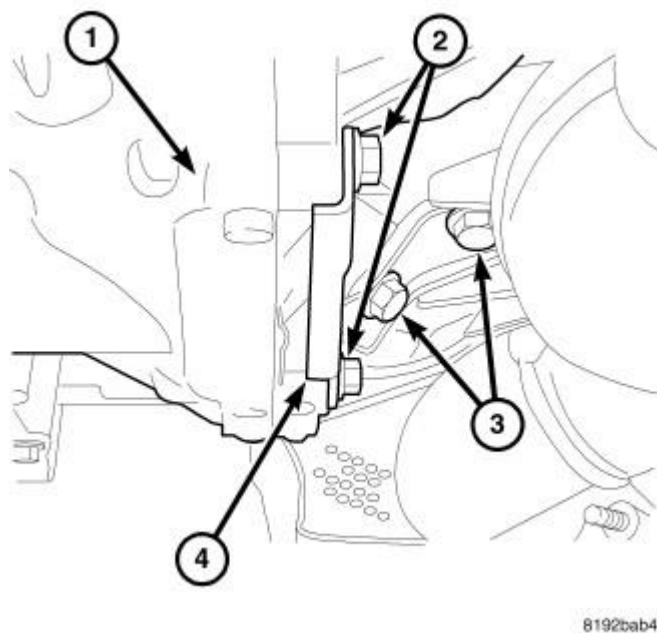


Fig. 73: DUST SHIELD

Courtesy of CHRYSLER LLC

1 - TORQUE CONVERTER ACCESS (62TE)
2 - TORQUE CONVERTER ACCESS COVER (62TE)
3 - TORQUE CONVERTER ACCESS COVER BOLT (62TE)

20. Install the torque converter access cover (2).

**Fig. 74: Identifying Exhaust Bracket & Bolts**

Courtesy of CHRYSLER LLC

1 - TRANSAXLE BELLHOUSING
2 - CROSSUNDER PIPE BRACKET RETAINERS
3 - CROSSUNDER PIPE BRACKET RETAINERS
4 - CROSSUNDER PIPE BRACKET

21. Install the crossunder pipe bracket (4). Tighten bolts (2) to 28 N.m (250 in. lbs.).

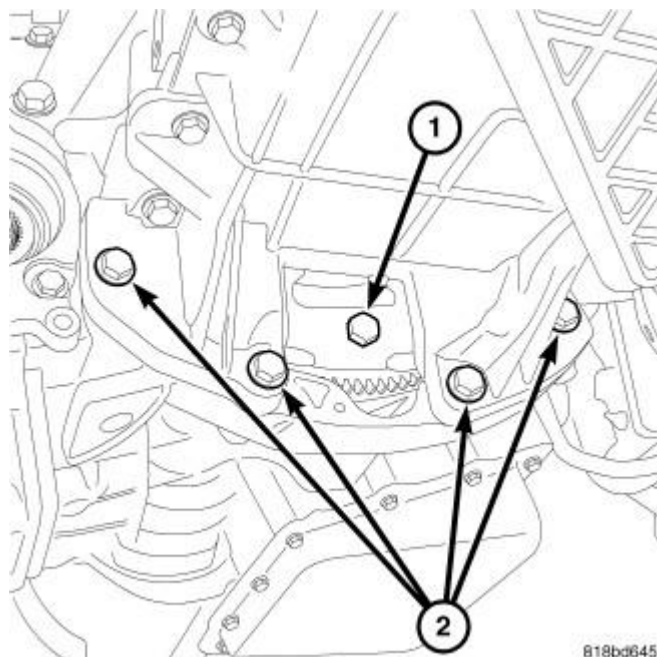


Fig. 75: Identifying Torque Converter-To-Driveplate Bolts
Courtesy of CHRYSLER LLC

22. Install the remaining lower transaxle bellhousing bolts (2). Tighten to 28 N.m (250 in. lbs.).
23. Install the crossunder pipe. See **Engine/Manifolds/MANIFOLD, Exhaust - Installation**.

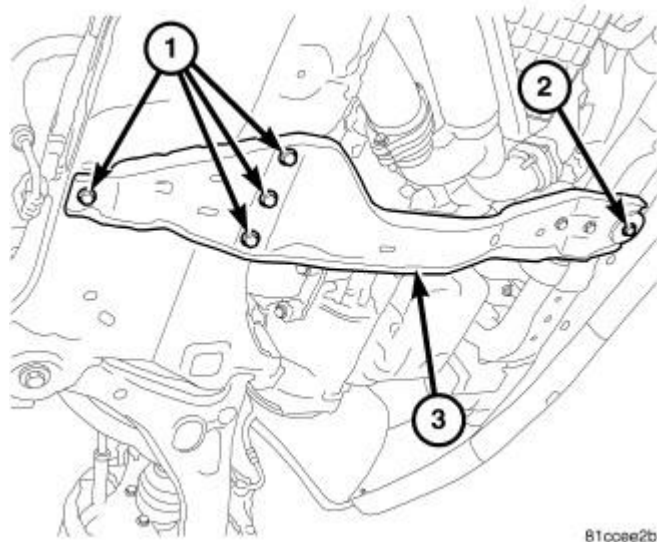


Fig. 76: Front & Rear Crossmember Bolts
Courtesy of CHRYSLER LLC

- | |
|----------------------------|
| 1 - REAR CROSSMEMBER BOLTS |
| 2 - FRONT CROSSMEMBER BOLT |
| 3 - CROSSMEMBER |

24. Install the crossmember (3), the four rear crossmember bolts (1), and the front crossmember bolt (2). Tighten the front crossmember bolt (2) to 108 N.m (80 ft. lbs.). Tighten the four rear crossmember bolts (1) to 55 N.m (40 ft. lbs.).

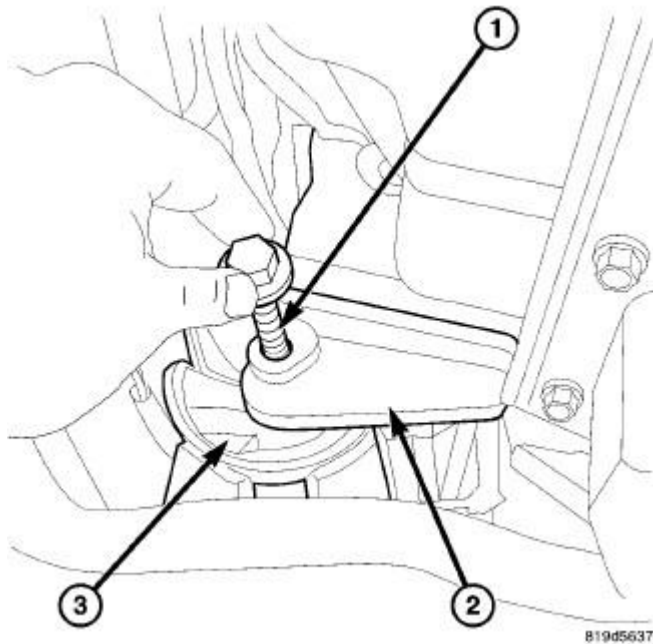


Fig. 77: CROSSMEMBER THROUGH BOLT
Courtesy of CHRYSLER LLC

1 - CROSSMEMBER THROUGH BOLT
2 - FRONT ENGINE MOUNT BRACKET
3 - FRONT ENGINE MOUNT SUPPORT

25. Install the front engine mount through bolt (1). Tighten to 54 N.m (40 ft. lbs.).

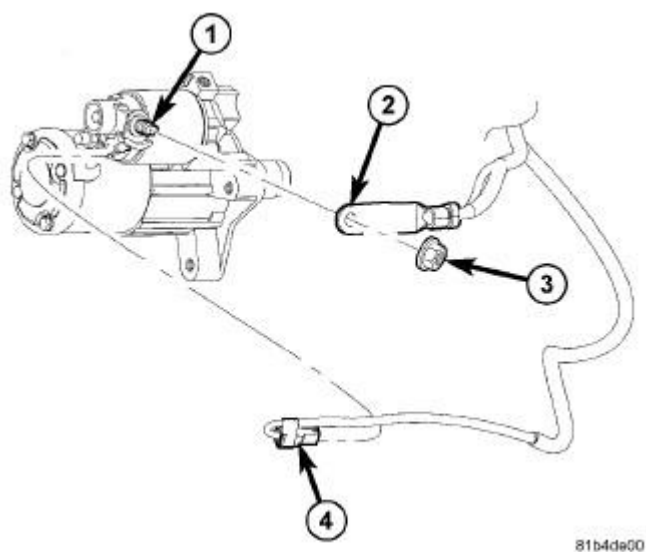


Fig. 78: Identifying Solenoid Nut, Mounting Stud, Electrical Connector & Battery Cable Assembly
 Courtesy of CHRYSLER LLC

26. Install battery cable (2) and nut (3) to the starter solenoid stud (1). Tighten nut to 14.5 N.m (128 in. lbs.). Connect electrical connector (4) to starter solenoid.

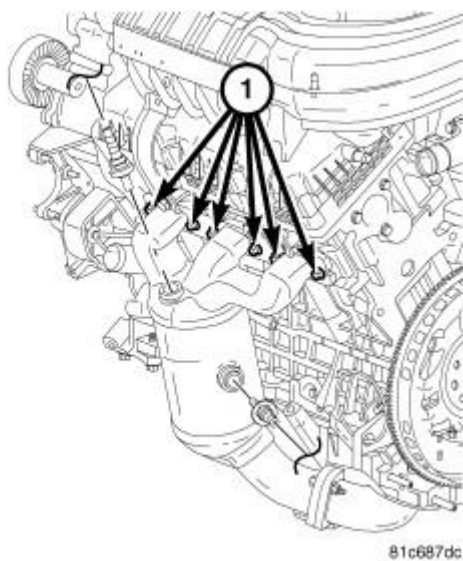
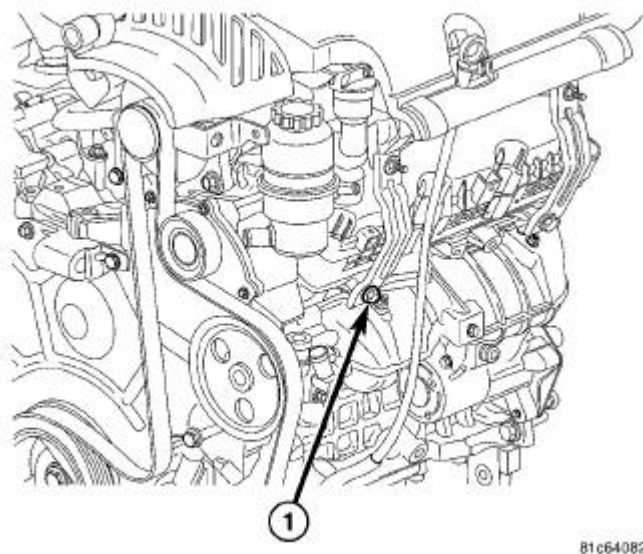


Fig. 79: Identifying Upper Exhaust Maniverter Retaining Bolts
 Courtesy of CHRYSLER LLC

27. Install front maniverter. See **Engine/Manifolds/MANIFOLD, Exhaust - Installation.**

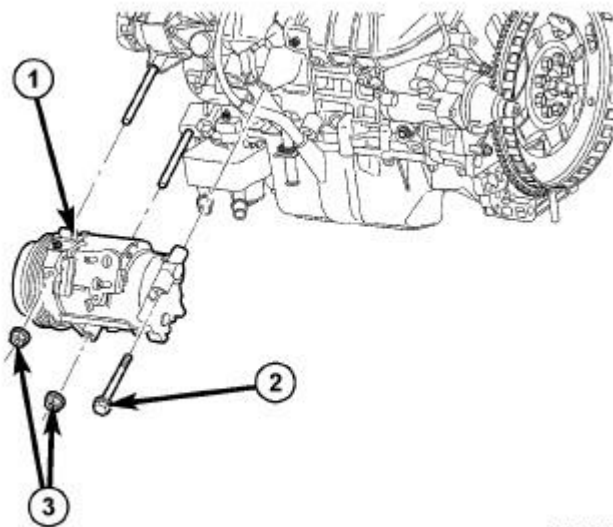


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Fig. 80: Identifying Oil Level Indicator Tube Retaining Bolt
Courtesy of CHRYSLER LLC

1 - DIPSTICK TUBE BOLT

28. Install the oil dipstick tube, and install oil dipstick tube bolt (1).



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Fig. 81: A/C Compressor Bolts & Nuts
Courtesy of CHRYSLER LLC

1 -A/C COMPRESSOR
2 - BOLT
3 - NUTS

29. Position the A/C compressor onto the engine. Install and tighten the bolt (2) and nuts (3) in the following sequence:
- Install bolt and hand tighten.
 - Install nuts and hand tighten.
 - Tightened upper nut to 23 N.m (17 ft. lbs.).
 - Tightened lower nut to 23 N.m (17 ft. lbs.).
 - Tightened rear bolt to 23 N.m (17 ft. lbs.).

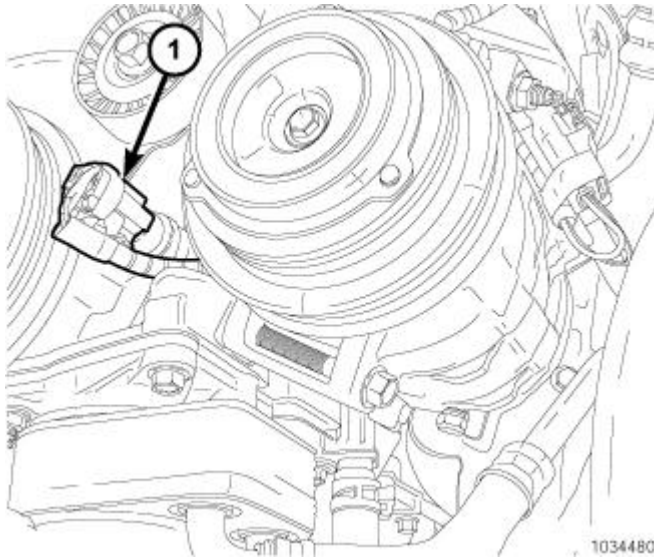


Fig. 82: Oil Pressure Sensor Wire Harness Connector
Courtesy of CHRYSLER LLC

30. Reconnect the wire harness connector to the A/C compressor clutch coil.
31. Reconnect the wire harness connector (1) to the oil pressure sensor.

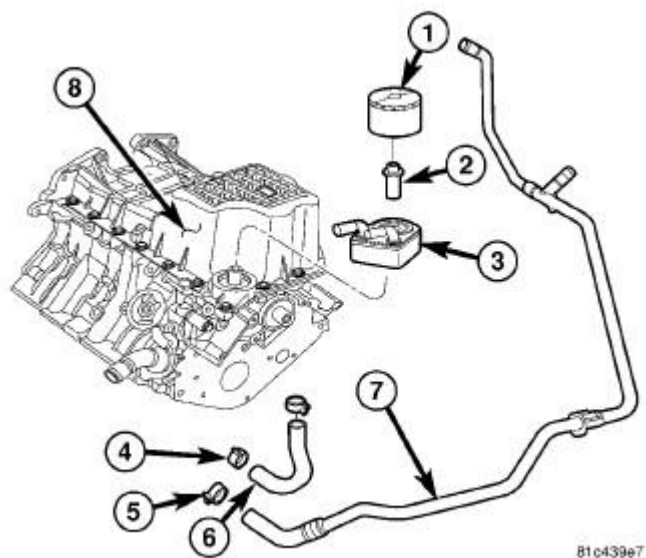


Fig. 83: Engine Oil Cooler and Filter Adapter
Courtesy of CHRYSLER LLC

- 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

32. Reconnect the engine oil cooler line (7) to the engine oil cooler (3).

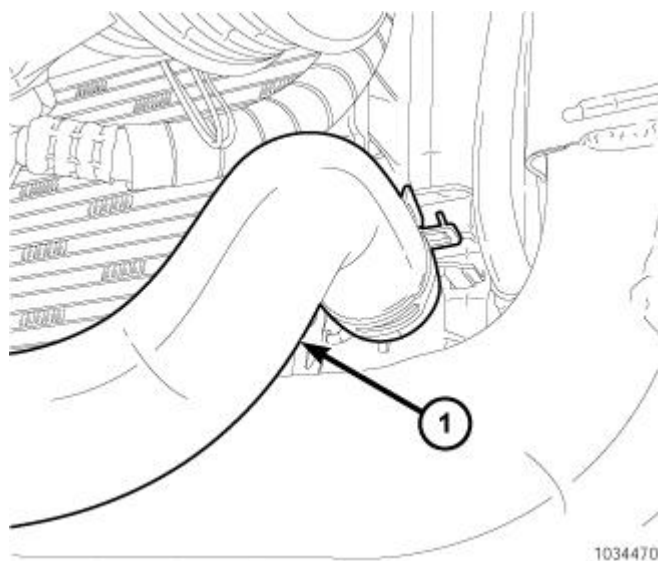


Fig. 84: Lower Radiator Hose

Courtesy of CHRYSLER LLC

33. Install the lower radiator hose to the radiator.

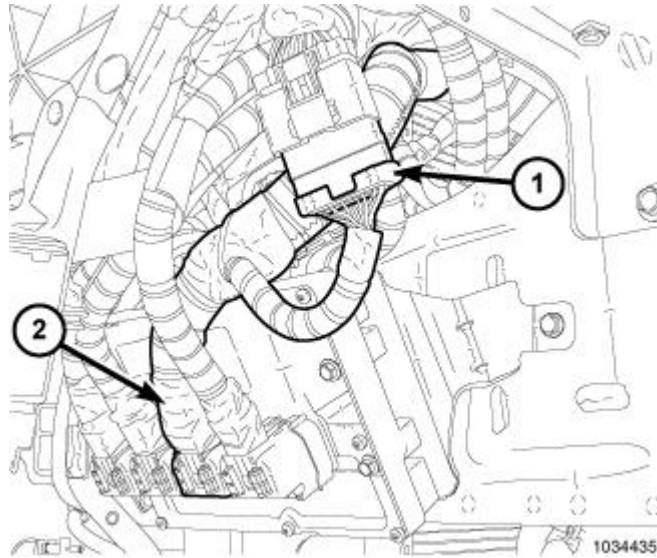


Fig. 85: PCM Harness Connector & Inline Harness Connector
Courtesy of CHRYSLER LLC

34. Reconnect the PCM harness connector (2) and the inline harness connector (1).

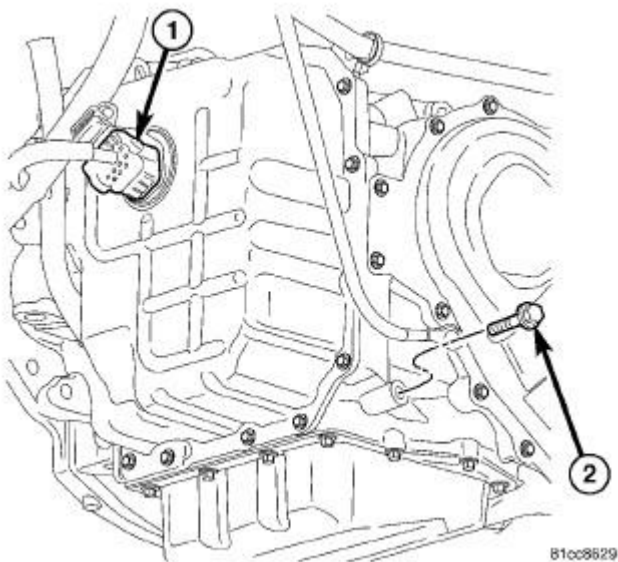


Fig. 86: Solenoid Pack Connector & Ground Bolt
Courtesy of CHRYSLER LLC

35. Install the transaxle ground strap and secure with the transaxle ground strap bolt (2).
36. Install the oil filter/oil cooler splash shield and the left front wheelhouse splash shield. Refer to **Body/Exterior/SHIELD, Splash - Installation** .

37. Install the front tire and wheel assemblies. Refer to **Tires and Wheels - Installation** .

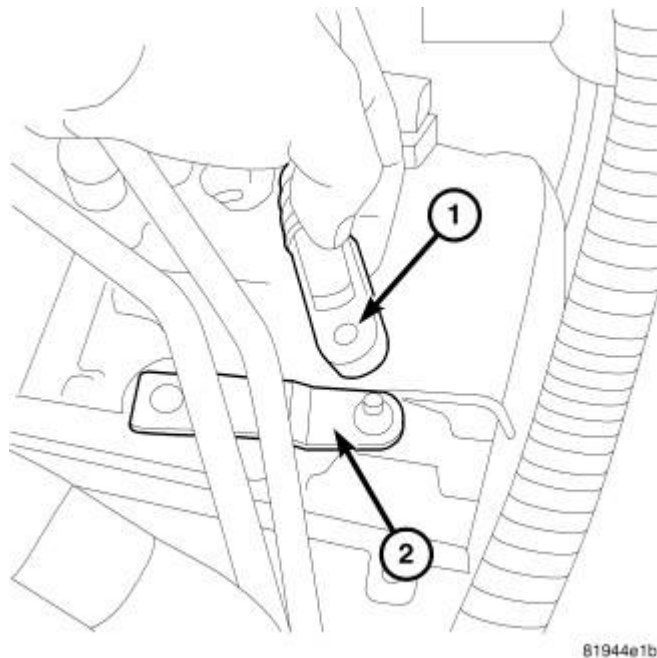


Fig. 87: Shift Cable & Transaxle Manual Valve Lever
Courtesy of CHRYSLER LLC

1 - SHIFT CABLE 2 - MANUAL LEVER

38. Reconnect the shift cable to the bracket.
39. Reconnect the shift cable (1) to the transaxle manual valve lever (2).

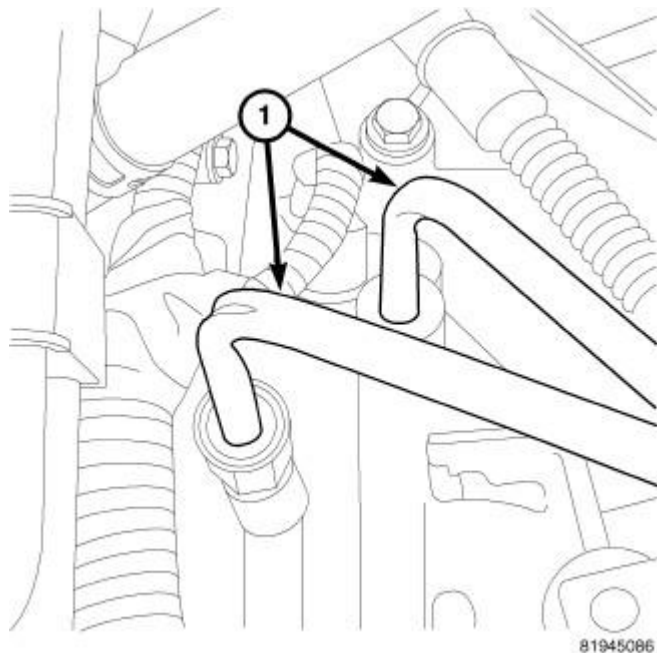


Fig. 88: Oil Cooler Lines
Courtesy of CHRYSLER LLC

1 - COOLER LINES AT TRANS

40. Reconnect oil cooler lines (1) to the transaxle. Refer to **Cooling/Transmission/TUBES AND HOSES, Transmission Oil Cooler - Standard Procedure** .

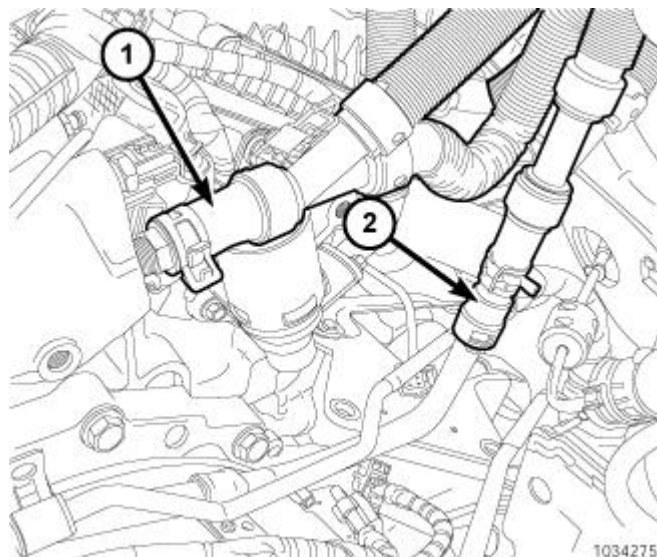


Fig. 89: Heater Hoses
Courtesy of CHRYSLER LLC

41. Reconnect the heater hoses (1) and (2).

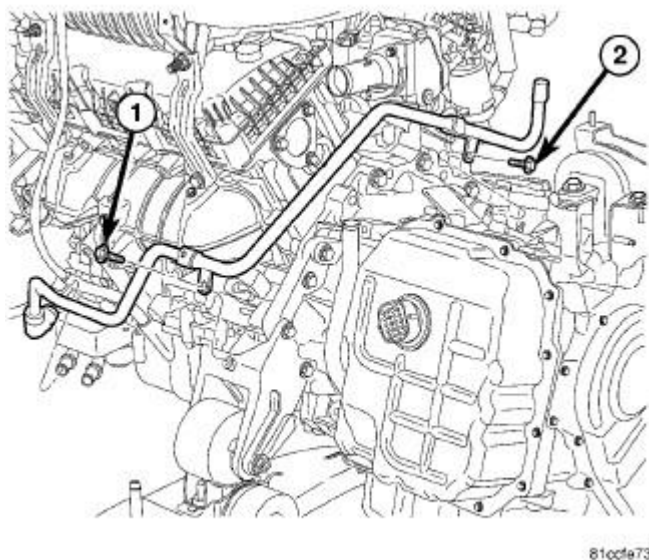


Fig. 90: Front & Rear Heater Line Bracket Retainers
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - FRONT HEATER LINE BRACKET RETAINER |
| 2 - REAR HEATER LINE BRACKET RETAINER |

42. Install the front heater line bracket retainer (1).

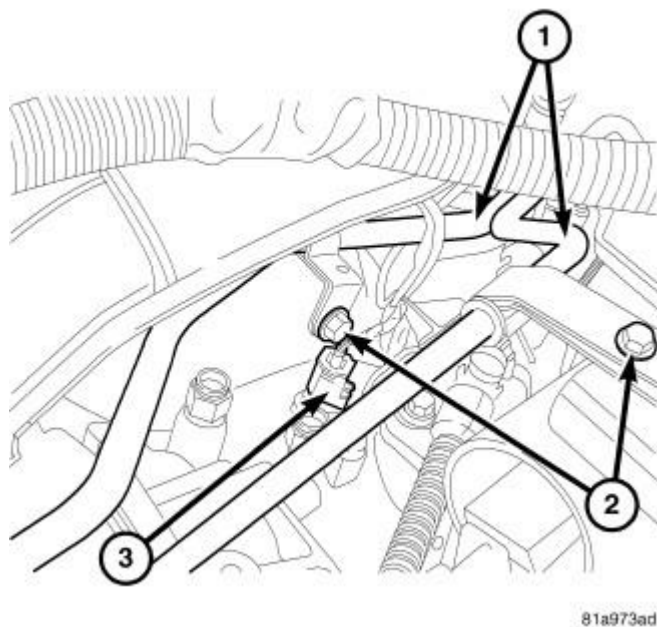


Fig. 91: Heater Hose & Power Steering Hose Bracket Retainers
Courtesy of CHRYSLER LLC

- | |
|------------------|
| 1 - HEATER LINES |
|------------------|

2 - HEATER LINE BRACKET RETAINERS**3 - ISS**

43. Install the heater hose and power steering hose bracket retainers (2) to the transaxle bellhousing and the left engine mount.

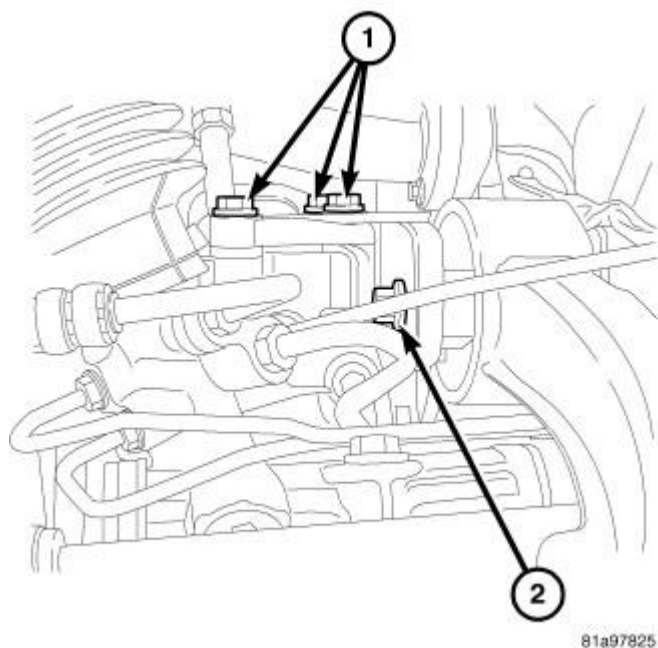


Fig. 92: Rear Transaxle Mount Bracket Bolts
Courtesy of CHRYSLER LLC

1 - REAR TRANS MOUNT BRACKET FASTENERS

44. Install the three rear transaxle mount bracket bolts (1). Tighten to 102 N.m (75 ft. lbs.).

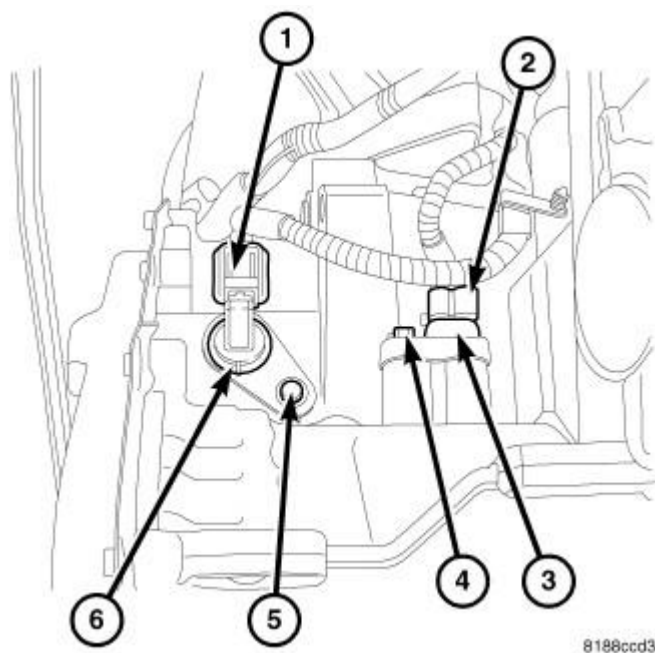


Fig. 93: Output Speed & O2 Sensor Harness Connectors
Courtesy of CHRYSLER LLC

- | |
|--------------------------|
| 1 - OSS #1
2 - OSS #2 |
|--------------------------|

45. Reconnect the output speed sensor harness connectors (1) and (2).

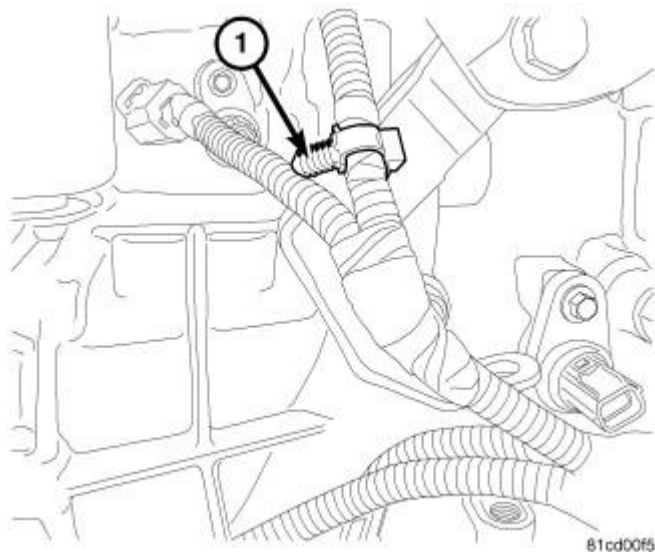


Fig. 94: Transaxle Shifter Bracket Harness Retainer
Courtesy of CHRYSLER LLC

- | |
|----------------------|
| 1 - HARNESS RETAINER |
|----------------------|

46. Reconnect the harness retainer (1) to the transaxle shifter bracket.

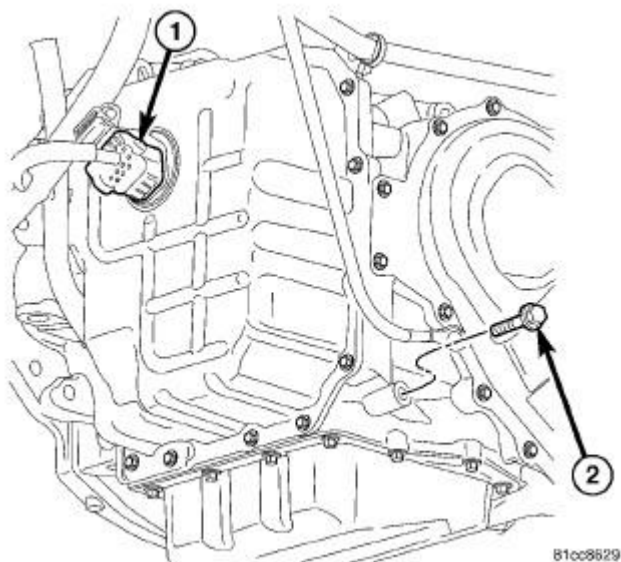


Fig. 95: Solenoid Pack Connector & Ground Bolt
Courtesy of CHRYSLER LLC

- | |
|-----------------------------|
| 1 - SOLENOID PACK CONNECTOR |
| 2 - GROUND BOLT |

47. Reconnect the transaxle solenoid pack harness connector (1).

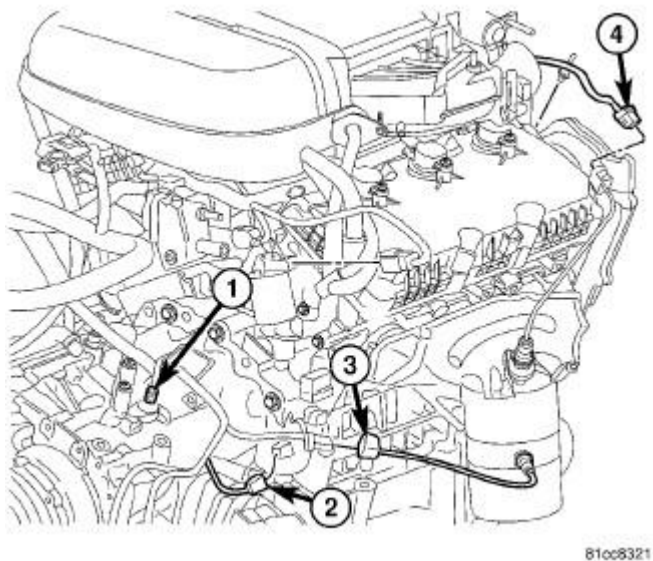


Fig. 96: Input Shaft Speed Sensor, Crankshaft Position Sensor, Downstream O2 Sensor & Upstream O2 Sensor Harness Connectors
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - INPUT SHAFT SPEED SENSOR CONNECTOR |
| 2 - CRANKSHAFT POSITION SENSOR CONNECTOR |
| 3 - DOWNSTREAM O2 SENSOR CONNECTOR |
| 4 - UPSTREAM O2 SENSOR CONNECTOR |

48. Reconnect the input shaft speed sensor harness connector (1), the crankshaft position sensor harness connector (2), the downstream O2 sensor harness connector (3), and the upstream O2 sensor harness connector (4) from the rear maniverter.

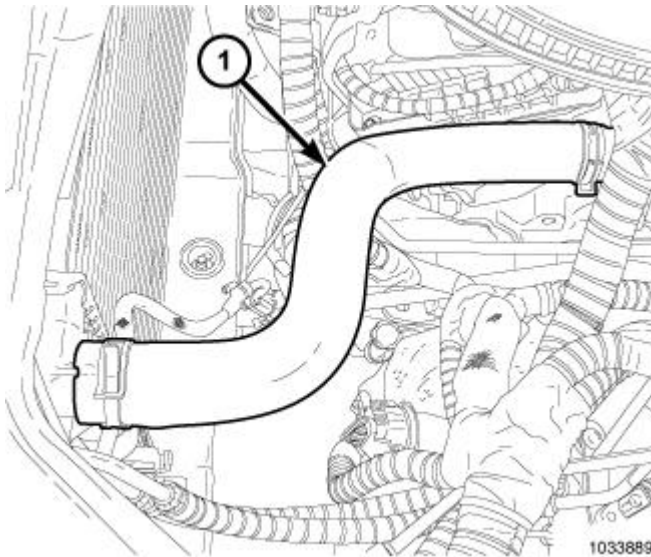


Fig. 97: Upper Radiator Hose
Courtesy of CHRYSLER LLC

49. Install the upper radiator hose (1).

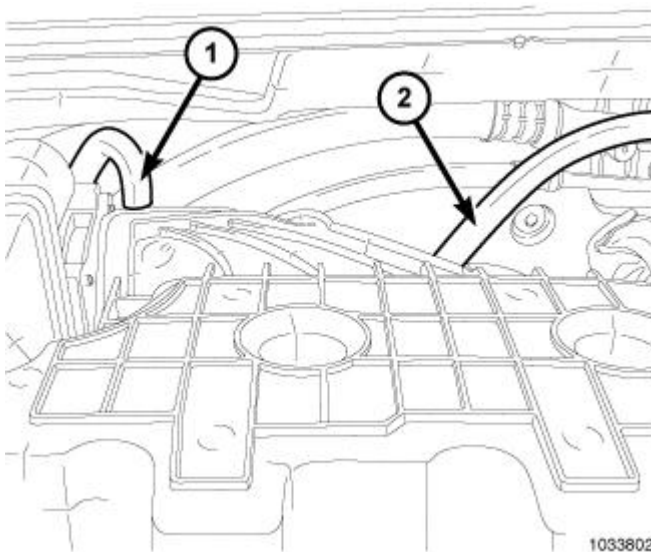


Fig. 98: EVAP Purge Line & Brake Booster Vacuum Hose
Courtesy of CHRYSLER LLC

50. Reconnect the EVAP purge line (1) and the brake booster vacuum hose to the upper intake manifold.

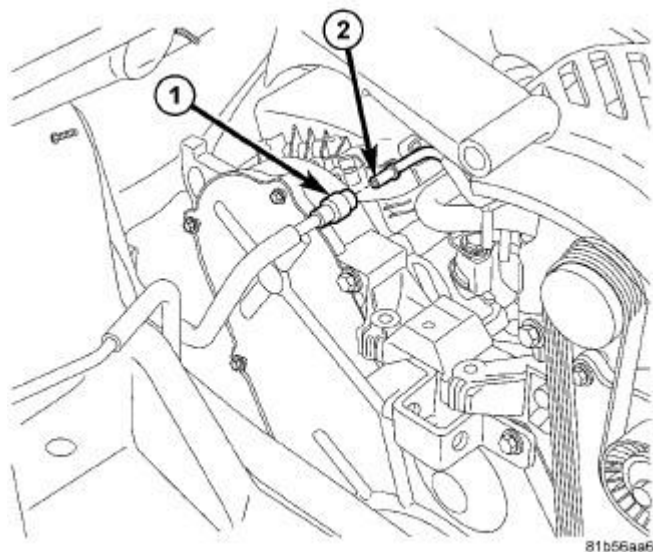


Fig. 99: Fuel Supply Line & Fuel Rail
Courtesy of CHRYSLER LLC

1 - FUEL SUPPLY LINE 2 - FUEL RAIL

51. Reconnect the fuel supply line (1) at the fuel rail (2). Refer to **Fuel System/Fuel Delivery/FITTING, Quick Connect - Standard Procedure**.

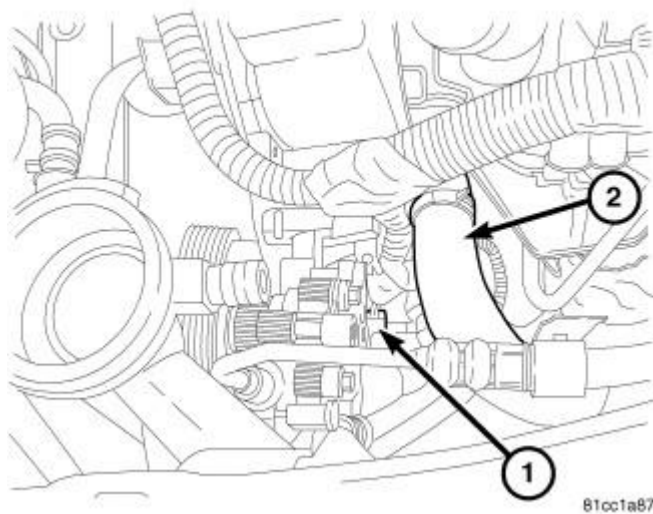


Fig. 100: Harness Retainer & Lower Radiator Hose
Courtesy of CHRYSLER LLC

- 1 - HARNESS RETAINER
- 2 - LOWER RADIATOR HOSE

52. Install the lower radiator hose (2) to engine.

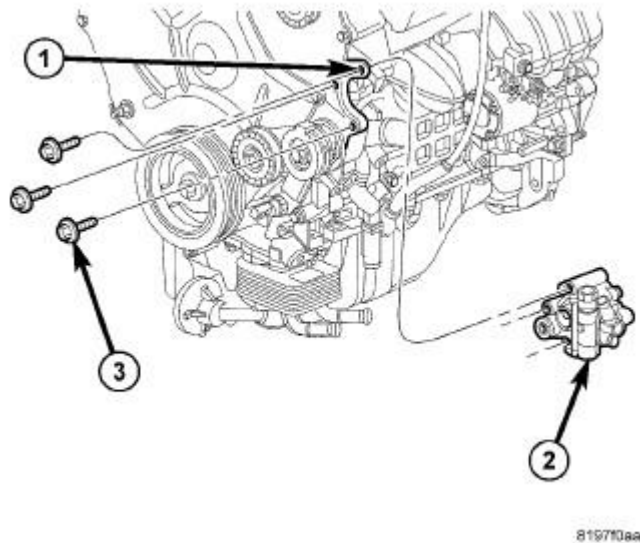


Fig. 101: Power Steering Pump & Bolts
Courtesy of CHRYSLER LLC

53. Reinstall the power steering pump (2) and secure with three power steering pump mounting bolts (3) through pulley (not shown in illustration). Tighten pump mounting bolts to 23 N.m (17 ft. lbs.).

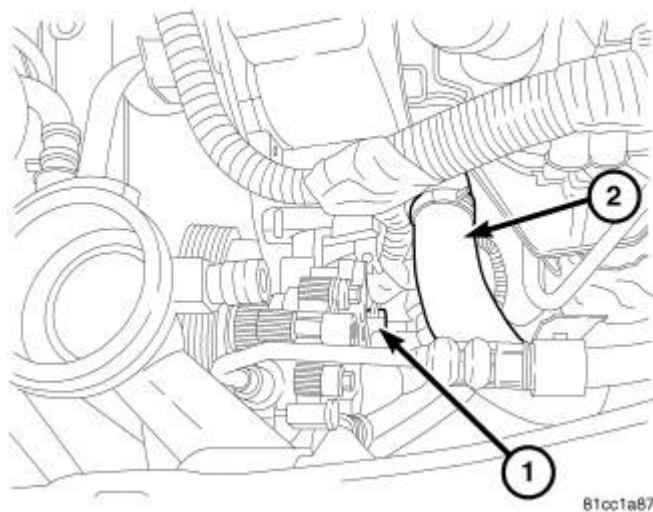
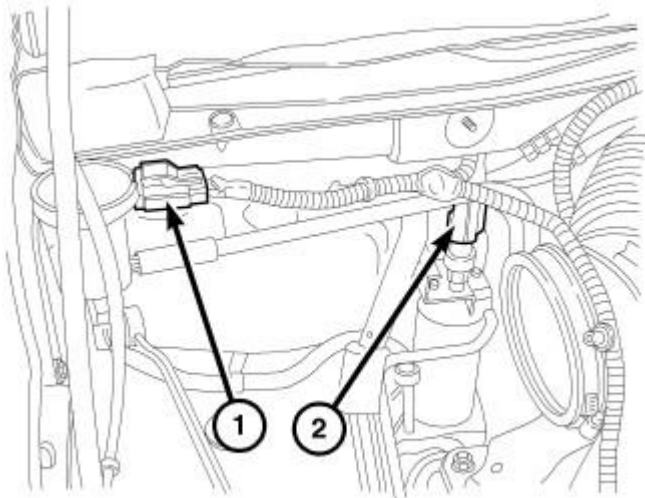


Fig. 102: Harness Retainer & Lower Radiator Hose
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - HARNESS RETAINER
2 - LOWER RADIATOR HOSE |
|---|

54. Reinstall the harness retainer (1) to the power steering pump.



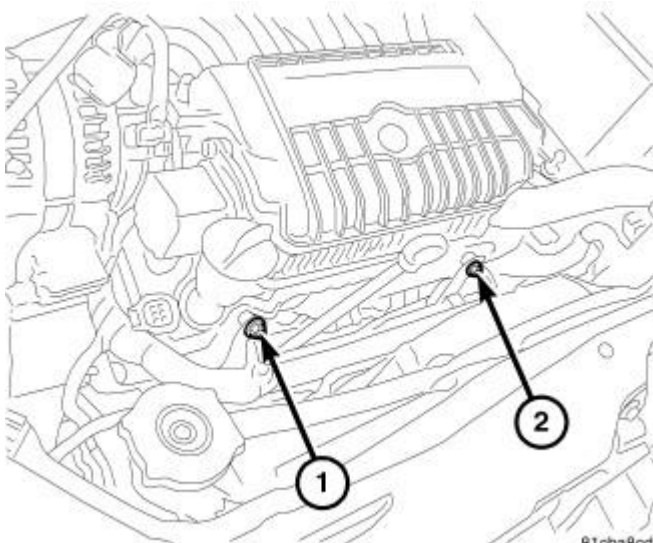
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Fig. 103: EVAP Purge Solenoid Harness Connector & A/C Pressure Transducer Harness Connector

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - EVAP PURGE SOLENOID CONNECTOR
2 - A/C PRESSURE TRANSDUCER |
|--|

55. Reconnect the EVAP purge solenoid harness connector (1) and the A/C pressure transducer harness connector (2).



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Fig. 104: Power Steering Hose Bracket Retainers
Courtesy of CHRYSLER LLC

1 - POWER STEERING HOSE BRACKET RETAINERS

56. Install the power steering line bracket retainers (1) and (2).

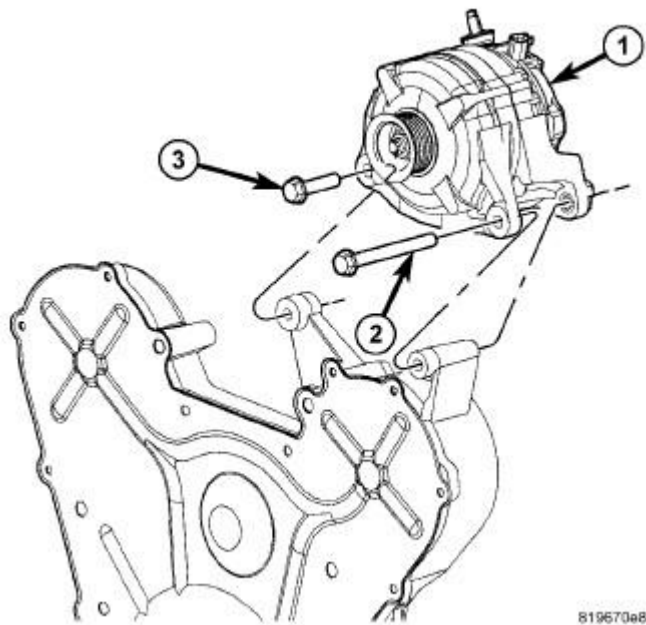


Fig. 105: Generator - 4.0L
Courtesy of CHRYSLER LLC

57. Reinstall the generator (1). Refer to **Electrical/Charging/GENERATOR - Installation** .

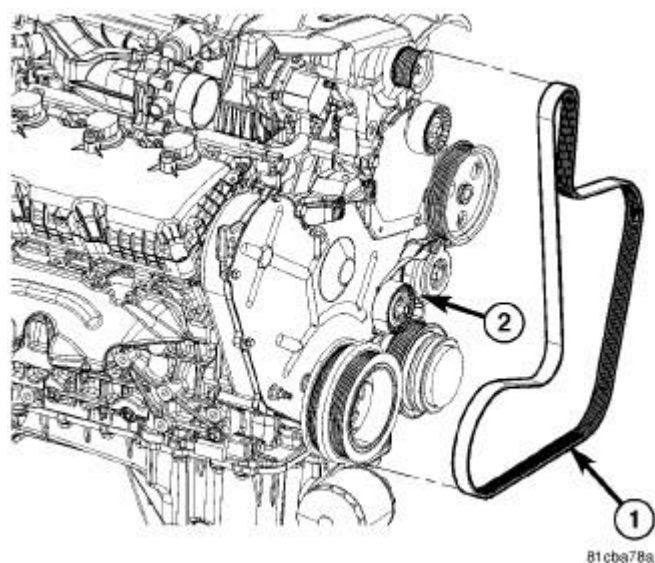


Fig. 106: Accessory Drive Belt & Tensioner
Courtesy of CHRYSLER LLC

- | |
|------------------------------------|
| 1 - ACCESSORY DRIVE BELT |
| 2 - ACCESSORY DRIVE BELT TENSIONER |

58. Reinstall the accessory drive belt (1). Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation** .

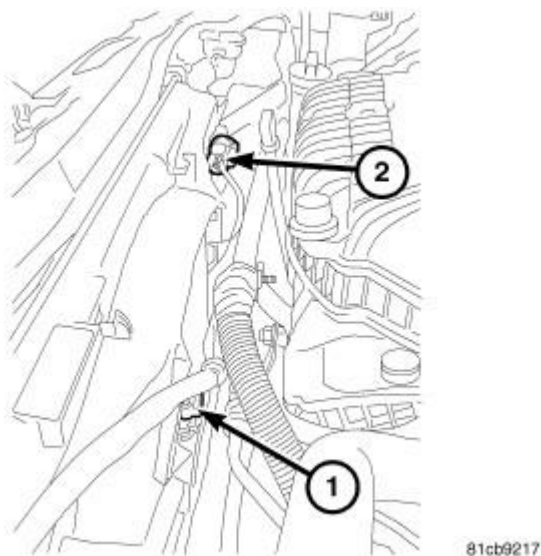


Fig. 107: Left & Right Cooling Fan Harness Connectors
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - LEFT COOLING FAN HARNESS CONNECTOR |
| 2 - RIGHT COOLING FAN HARNESS CONNECTOR |

59. Reinstall the cooling fan assembly.
60. Reconnect the cooling fan harness connectors (1) and (2).

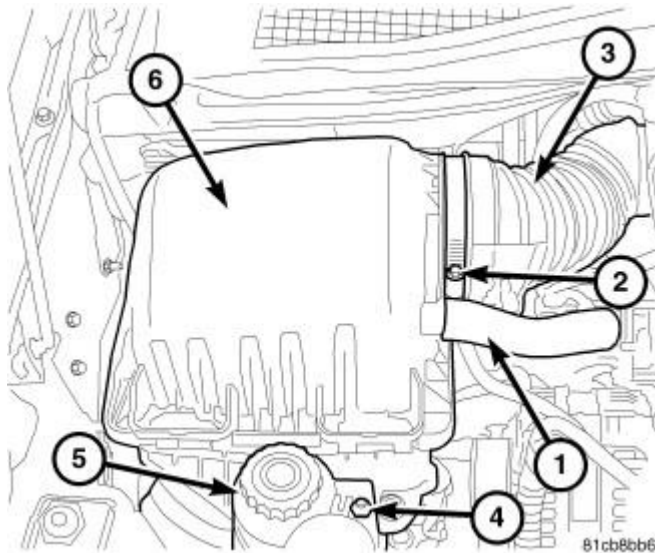


Fig. 108: Air Filter Housing
Courtesy of CHRYSLER LLC

61. Reinstall the air filter housing (6). See **Engine/Air Intake System/BODY, Air Cleaner - Installation.**

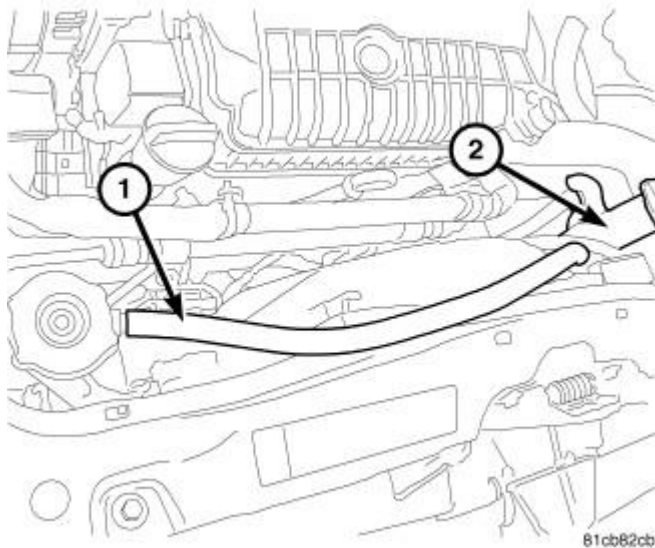


Fig. 109: Coolant Overflow Hose & Bottle
Courtesy of CHRYSLER LLC

1 - COOLANT OVERFLOW HOSE 2 - COOLANT OVERFLOW BOTTLE
--

62. Reinstall the coolant overflow bottle (2), and reconnect the coolant overflow Line (1) at the radiator fill

cap.

63. Refill the cooling system. Refer to **Cooling - Standard Procedure** .

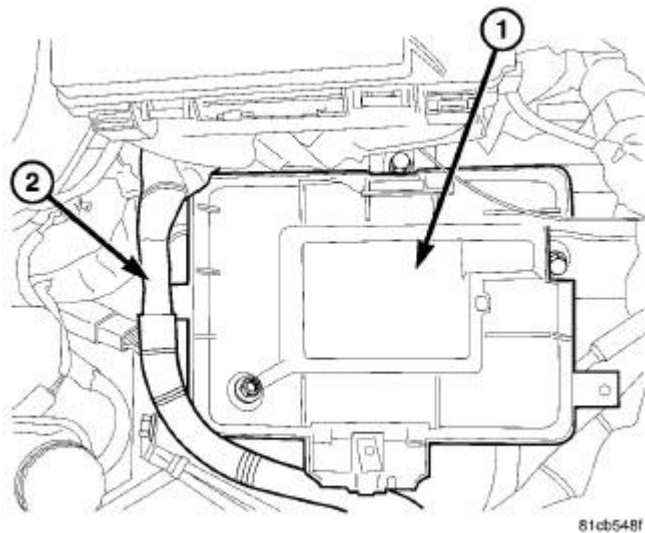


Fig. 110: Battery Tray & Harness Retainer
Courtesy of CHRYSLER LLC

1 - BATTERY TRAY 2 - HARNESS RETAINER
--

64. Reconnect the harness retainer (2), install the three battery tray fasteners, and install the battery tray (1).

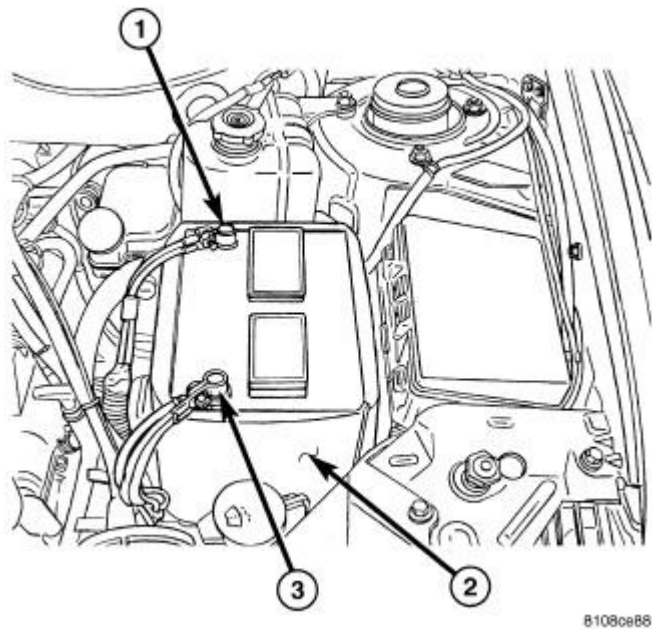


Fig. 111: Battery
Courtesy of CHRYSLER LLC

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

65. Reconnect the positive (1) and negative (3) battery cables. Tighten the cable clamp nuts to 5 N.m (45 in. lbs.). Refer to **Electrical/Battery System/BATTERY - Installation**.
66. Start the engine and inspect for leaks. Verify engine is operating normally.

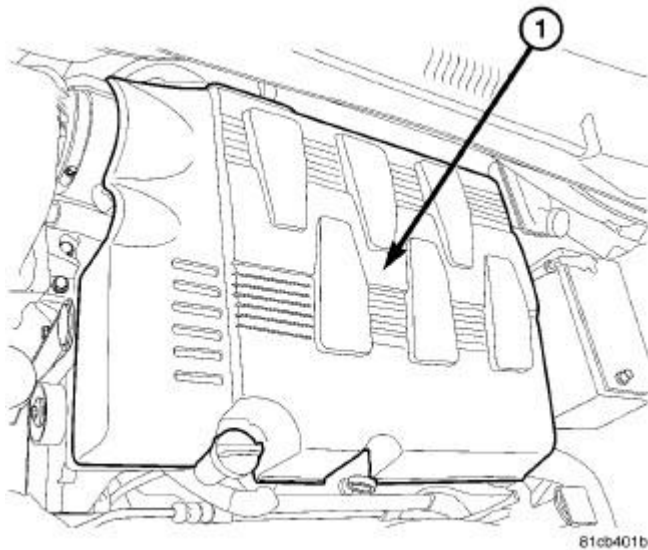


Fig. 112: Engine Cover
Courtesy of CHRYSLER LLC

1 - Engine cover

67. 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

4.0L ENGINE

GENERAL SPECIFICATIONS

DESCRIPTION	SPECIFICATION	
Type	60° SOHC V-6 24-Valve	
Displacement	4.0L	
Firing Order	1-2-3-4-5-6	
Compression Ratio	10.2:1	
Lead Cylinder	#1 Right Bank	
-	Metric	Standard
Displacement	4.0L Liters	244 cu. in.
Bore	96.0 mm	3.780 in.
Stroke	91.0 mm	3.583 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.)	0.006 mm	0.00023 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 Weight - A	374.4-379.4 grams	13.21-13.38 oz.
Piston Weight - B	379.5-384.4 grams	13.38-13.56 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	86.5-86.7 mm	3.406-3.413 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	0.007-0.018 mm	0.0003-0.007 in.
Diameter	21.997-22.000 mm	0.8662-0.8660 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	1.17-1.20 mm	0.0461-0.0472 in.
2nd Compression Ring (Micro-Napier)	1.47-1.49 mm	0.058-0.059 in.
Oil Control (Steel Rails)	0.435-0.490 mm	0.0171-0.0193 in.

CONNECTING RODS

DESCRIPTION	SPECIFICATIONS	
	Metric	Standard
Piston Pin Bore Diameter	22.005-22.012 mm	0.8663-0.8666 in.
Side Clearance (MAX)	0.39 mm	0.0153 in.
Total Weight (Less Bearing)	693 grams	24.445 oz.
Connecting Rod Bore Diameter	60.994-61.006 mm	2.4013-2.4018 in.

CRANKSHAFT MAIN BEARING JOURNALS

DESCRIPTION	SPECIFICATIONS	
	Metric	Standard
Main Journal Diameter	68.987-69.013 mm	2.717-2.716 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
Rod Journal Diameter	57.982-58.002 mm	2.2828-2.2835 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.
Polish Microfinish	0.13 mm Ra max	0.000005 in. Ra max

CAMSHAFT

DESCRIPTION	SPECIFICATIONS	
	Metric	Standard
Bore Diameter	43.038-43.059 mm	1.6944-1.6953 in.

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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	0.05-0.51 mm	0.002-0.020 in.

VALVE TIMING-INTAKE VALVE

DESCRIPTION	SPECIFICATIONS (CRANKSHAFT DEGREES)
Opens	4° BTDC (A) - 1° ATDC (B)
Closes (ABDC)	60° (A) - 65° (B)
Duration	244°
Centerline	118° (A) - 123° (B)

VALVE TIMING-EXHAUST VALVE

DESCRIPTION	SPECIFICATIONS (CRANKSHAFT DEGREES)
Opens (BBDC)	61°
Closes (ATDC)	21°
Duration	262°
Centerline	110°

CYLINDER HEAD

DESCRIPTION	SPECIFICATIONS	
	Metric	Standard
Gasket Thickness (Compressed)	1.50 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	1.4319-1.4421 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.

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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)	9.00 mm	0.3543 in.
Valve Lift-Exhaust (Zero Lash)	7.00 mm	0.2756 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	42.366-43.655 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.)	43.6 mm	1.7165 in.
Free Length-Exhaust- (Approx.)	47.9 mm	1.8858 in.
Spring Force-Intake (Valve Closed)	309-358 N @ 38.0 mm	69.5-80.5 lbs. @ 1.4961 in.
Spring Force-Exhaust (Valve Closed)	355.4-400.8 N @ 38.0 mm	79.9-90.1 lbs. @ 1.496 in.
Spring Force-Exhaust (Valve Open)	646.5-714.5 N @ 31.0 mm	145.3-160.7 lbs. @ 1.2205 in.
Spring Force-Intake (Valve Open)	871.1-943.7 N @ 29.0 mm	195.8-212.2 lbs. @ 1.1417 in.
Number of Coils-Intake	6.5	
Number of Coils-Exhaust	7.5	
Color of Spring (Top of Coils)-Intake-Right Hand Coil Direction	GREY	
Color of Spring (Top of Coils)-Exhaust-Left Hand Coil Direction	BLUE	
Wire Diameter-Intake	4.29-4.35 mm	0.1689-0.1713 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.

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Cover-Out-of-Flat (MAX.)	0.025 mm	0.001 in.
Inner and Outer Rotor Thickness (MIN.)	14.300 mm	0.563 in.
Inner and Outer Rotor Thickness (MAX.)	14.325 mm	0.564 in.
Clearance between Outer Rotor and Body	0.39 mm	0.015 in.
Outer Rotor Diameter (MIN.)	79.997 mm	3.149 in.
Outer Rotor Diameter (MAX.)	80.074 mm	3.153 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	-

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Intake Manifold - Lower	28	-	250
Intake Manifold - Upper	12	-	105
Left Engine Mount to Transaxle	66	50	-
Right Engine Mount to engine	66	50	-
Left Engine Mount to Frame Rail	66	50	-
Right Engine Mount to Frame Rail	66	50	-
Front Crossmember Bolt	66	50	-
Rear crossmember bolts	55	40	-
Rear transaxle bracket bolts	102	75	-
Front engine mount through bolt	54	40	-
Rear engine mount through bolt	54	40	-
Rear engine mount heat shield bolts	11	-	100
Torque converter-to-driveplate bolts	88	65	-
Crossunder Pipe Bracket bolts	28	-	250
Transaxle bellhousing-to-engine upper bolts	95	70	-
Oil Cooler Connector Bolt	66	50	-
Oil Pan	-	-	-
-M6 Bolts	12	-	105
-M8 Bolts	28	-	250
Oil Pan Drain Plug	27	20	-
Oil Filter	16	12	-
M8 Oil Pump to Block-Bolts	28	-	250
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
Rocker Shaft Pedestal Retaining-Bolts	31	-	275
Spark Plugs	28	20	-
Structural Collar	Refer to appropriate service information.		
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	-

SPECIAL TOOLS

SPECIAL TOOLS

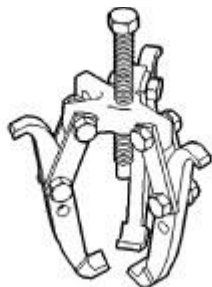


Fig. 113: Puller 1023

Courtesy of CHRYSLER LLC

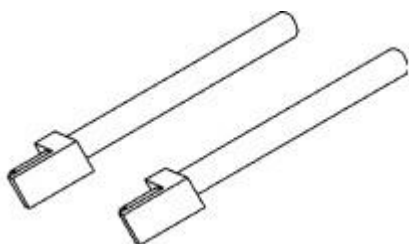


Fig. 114: Connecting Rod Installation Guides 8189

Courtesy of CHRYSLER LLC

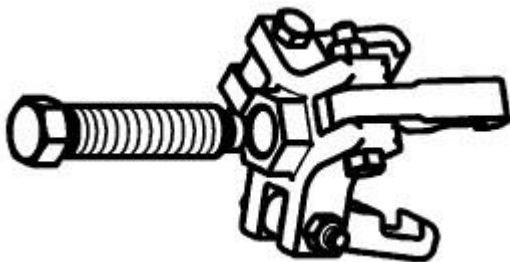


Fig. 115: Puller 8454

Courtesy of CHRYSLER LLC

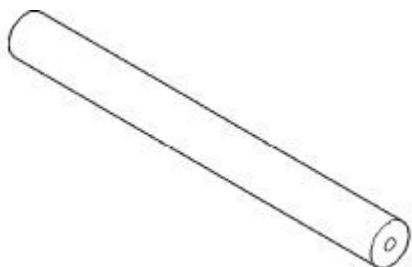


Fig. 116: Vibration Damper Remover Insert 9020 - Crank Sprocket Remover Insert C4685-C2

Courtesy of CHRYSLER LLC

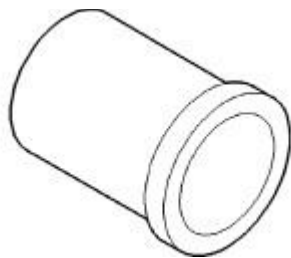


Fig. 117: Camshaft Seal Installer MD-998306

Courtesy of CHRYSLER LLC

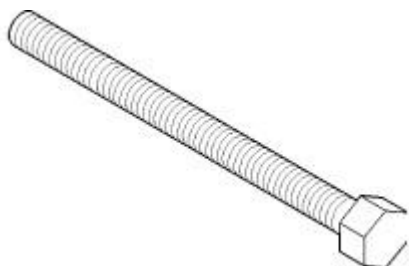


Fig. 118: Crankshaft Damper Installer Bolt C-4685-C1

Courtesy of CHRYSLER LLC

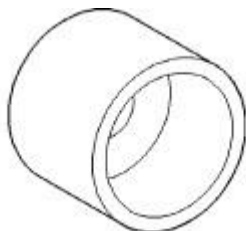


Fig. 119: Crankshaft Damper Installer 6792-1

Courtesy of CHRYSLER LLC

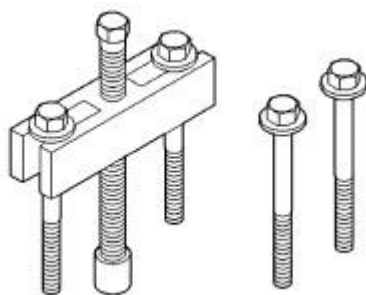


Fig. 120: Gear Puller L-4407A

Courtesy of CHRYSLER LLC

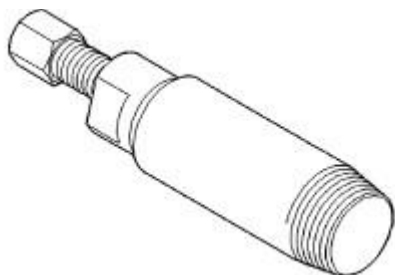


Fig. 121: Front Crankshaft Seal Remover 6341A
Courtesy of CHRYSLER LLC

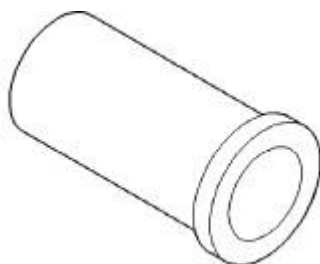


Fig. 122: Driver 6342
Courtesy of CHRYSLER LLC

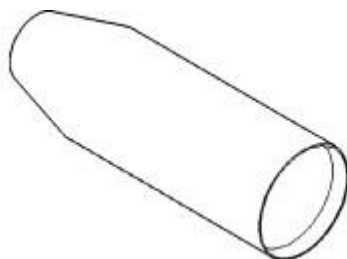


Fig. 123: Crankshaft Seal Protector 6780-2
Courtesy of CHRYSLER LLC

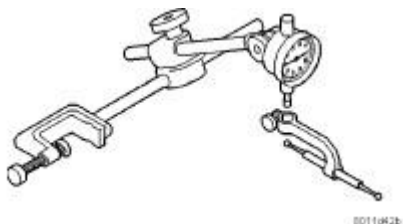


Fig. 124: DIAL INDICATOR C-3339
Courtesy of CHRYSLER LLC



Fig. 125: Valve Spring Compressor C-3422-D
Courtesy of CHRYSLER LLC

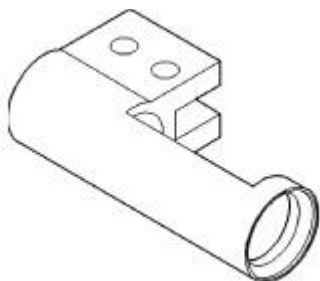


Fig. 126: Spring Compressor Adapter 6526
Courtesy of CHRYSLER LLC



Fig. 127: Valve Spring Tester C-647
Courtesy of CHRYSLER LLC

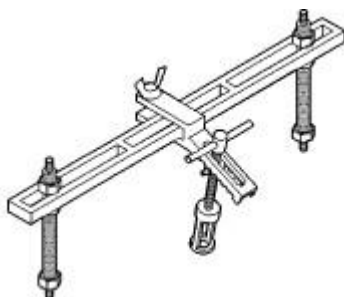


Fig. 128: Valve Spring Compressor MD998772A
Courtesy of CHRYSLER LLC

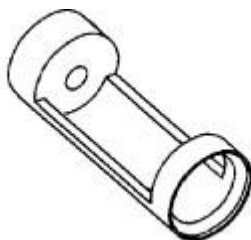


Fig. 129: Valve Spring Adapter 6527
Courtesy of CHRYSLER LLC

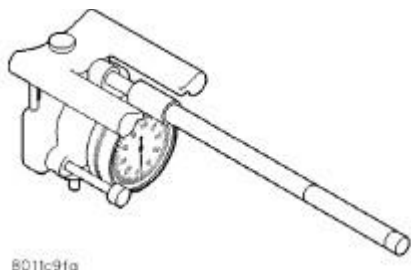


Fig. 130: Indicator, Cylinder Bore C-119
Courtesy of CHRYSLER LLC

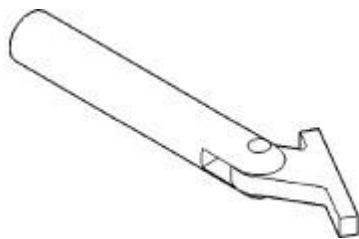


Fig. 131: Crankshaft Main Bearing Remover C-3059
Courtesy of CHRYSLER LLC

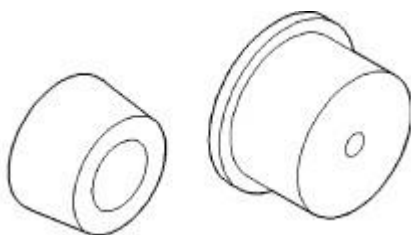


Fig. 132: Rear Crankshaft Oil Seal Installer 6926
Courtesy of CHRYSLER LLC

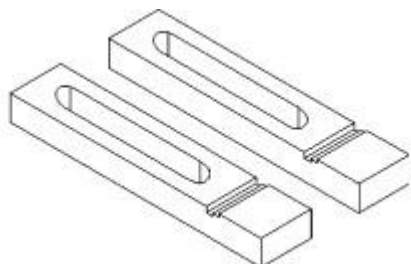


Fig. 133: Crankshaft Real Seal Retainer Alignment Fixture 8225
Courtesy of CHRYSLER LLC

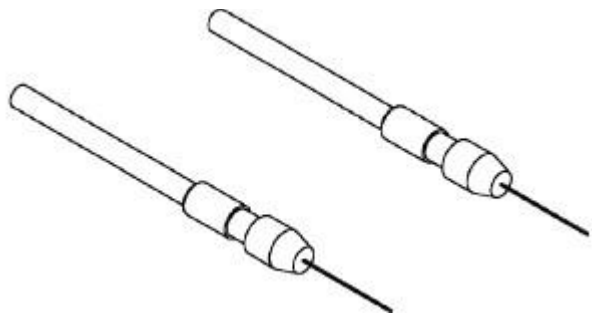


Fig. 134: Release Probe 8351
Courtesy of CHRYSLER LLC

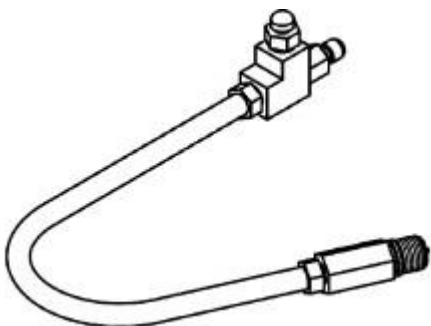


Fig. 135: Cylinder Compression Pressure Adaptor 8116
Courtesy of CHRYSLER LLC

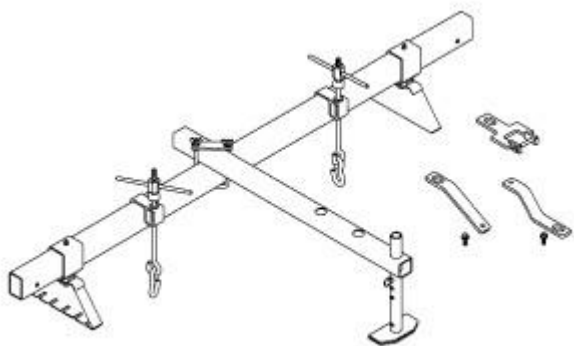


Fig. 136: Driveline Support Fixture 8534B
Courtesy of CHRYSLER LLC

AIR INTAKE SYSTEM

AIR CLEANER

Removal

REMOVAL

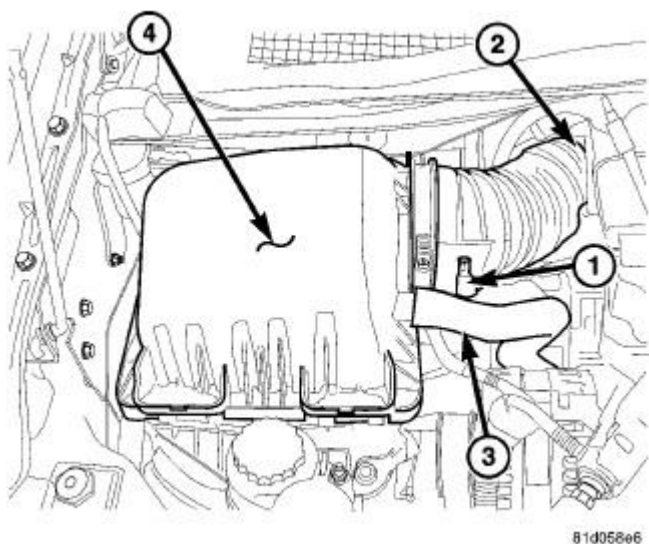


Fig. 137: Identifying Wiring Harness Connector, Throttle Body & Makeup Air Hose
 Courtesy of CHRYSLER LLC

1. Disconnect the intake air temperature sensor (IAT) wiring harness connector (1).
2. Disconnect the air inlet tube at the throttle body (2).
3. Disconnect the makeup air hose (3).
4. Release cover tabs from air box.
5. Lift cover and remove the element.

Installation

INSTALLATION

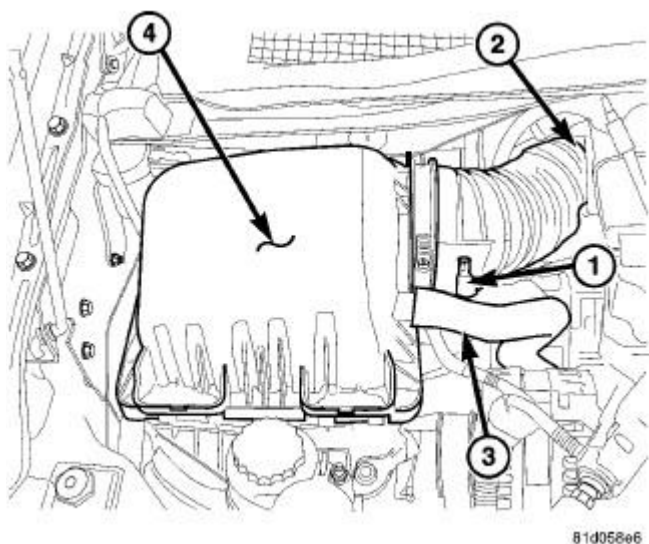


Fig. 138: Identifying Wiring Harness Connector, Throttle Body & Makeup Air Hose
Courtesy of CHRYSLER LLC

1. Install the air filter element into air box.
2. Move cover so that the tabs insert into the air box.
3. Seat cover onto element housing.
4. Reconnect the intake air temperature sensor (IAT) wiring harness connector (1).
5. Reconnect the makeup air hose (3).

BODY, AIR CLEANER

Removal

REMOVAL

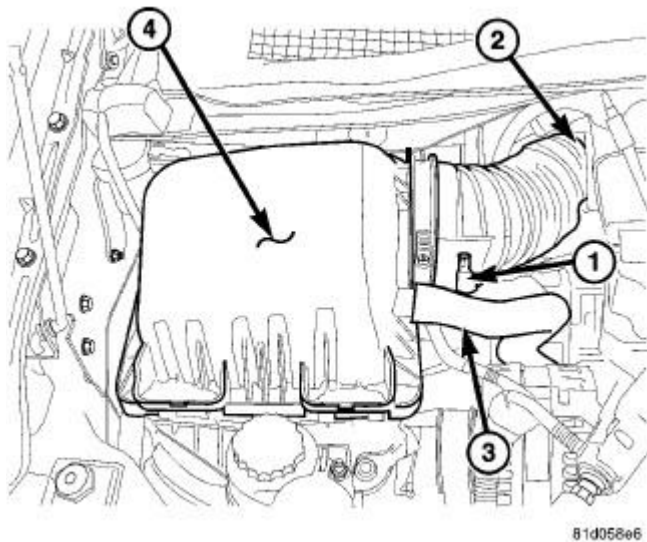
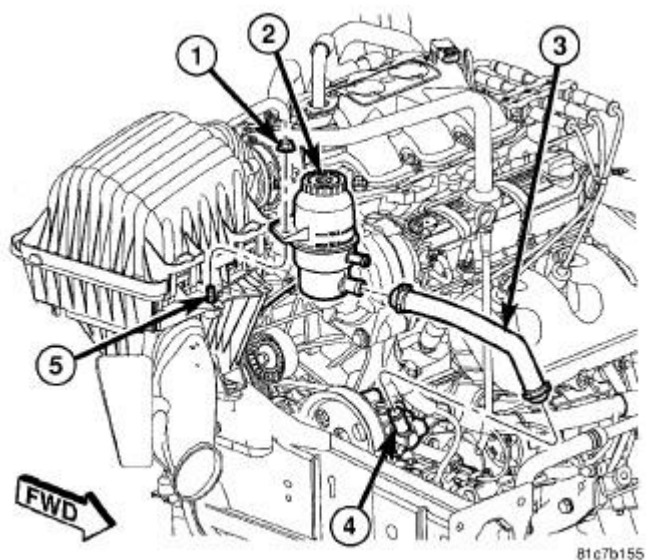


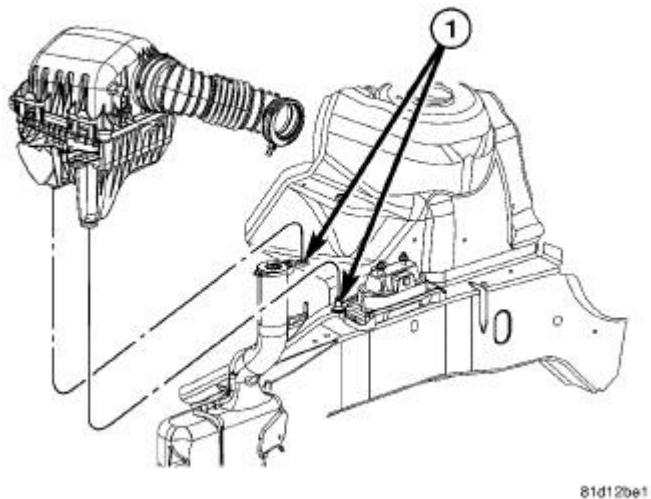
Fig. 139: Identifying Wiring Harness Connector, Throttle Body & Makeup Air Hose
Courtesy of CHRYSLER LLC

1. Disconnect the intake air temperature (IAT) sensor wiring harness connector.
2. Disconnect the makeup air hose (3) at the element housing.
3. Remove the air inlet hose (2) at the throttle body.

**Fig. 140: SUPPLY HOSE AND RESERVOIR MOUNTING**

Courtesy of CHRYSLER LLC

4. Remove the power steering pump reservoir nut (1) and position the power steering reservoir (2) aside.

**Fig. 141: Locating Pins At Air Filter Housing**

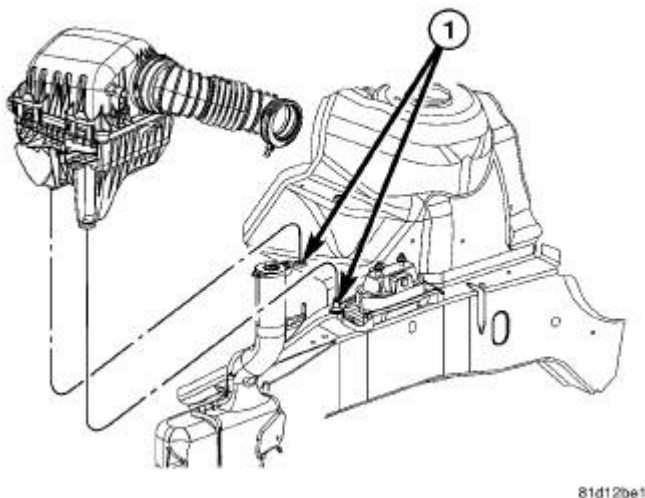
Courtesy of CHRYSLER LLC

1 - Locating Pins

5. Pull housing up and off of the locating pins (1).
6. Remove element housing from vehicle.

Installation

INSTALLATION

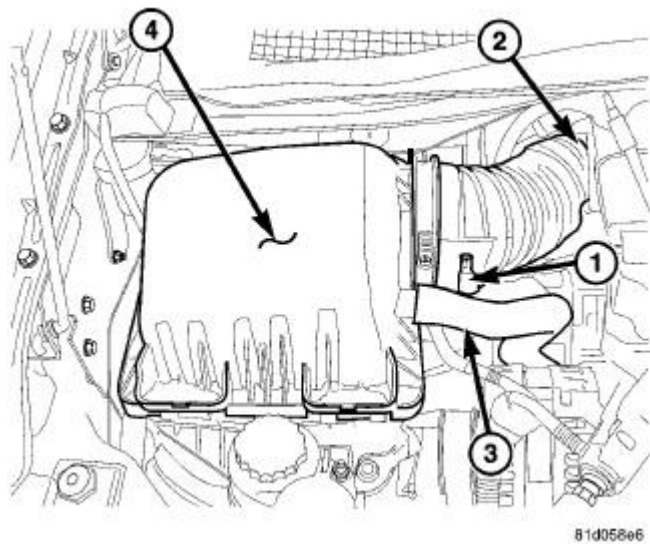


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Fig. 142: Locating Pins At Air Filter Housing
Courtesy of CHRYSLER LLC

1 - Locating Pins

1. Install the housing on the locating pins (1).



81d058e6

Fig. 143: Identifying Wiring Harness Connector, Throttle Body & Makeup Air Hose
Courtesy of CHRYSLER LLC

2. Connect the air inlet hose (2) to the throttle body and tighten clamp.
3. Connect the makeup air hose (3) to housing.

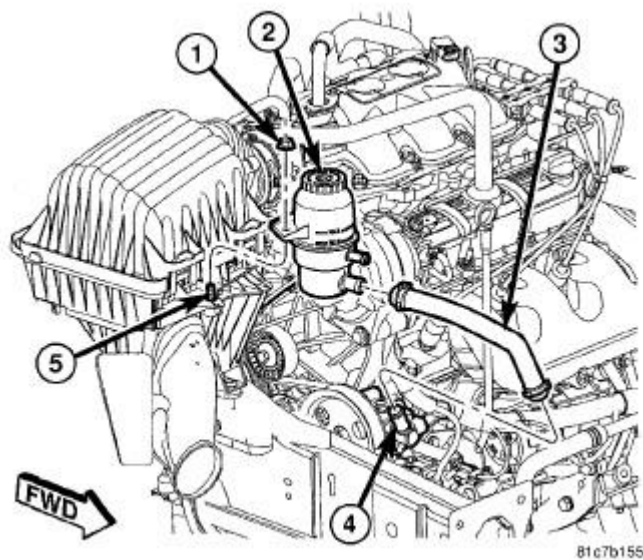


Fig. 144: SUPPLY HOSE AND RESERVOIR MOUNTING
Courtesy of CHRYSLER LLC

4. Position reservoir (2) in place on mounting stud (5).
5. Install reservoir mounting nut (1). Tighten mounting nut to 12 Nm (9 ft. lbs.)
6. Connect the intake air temperature (IAT) sensor wiring harness connector (1).

CYLINDER HEAD

DESCRIPTION

DESCRIPTION

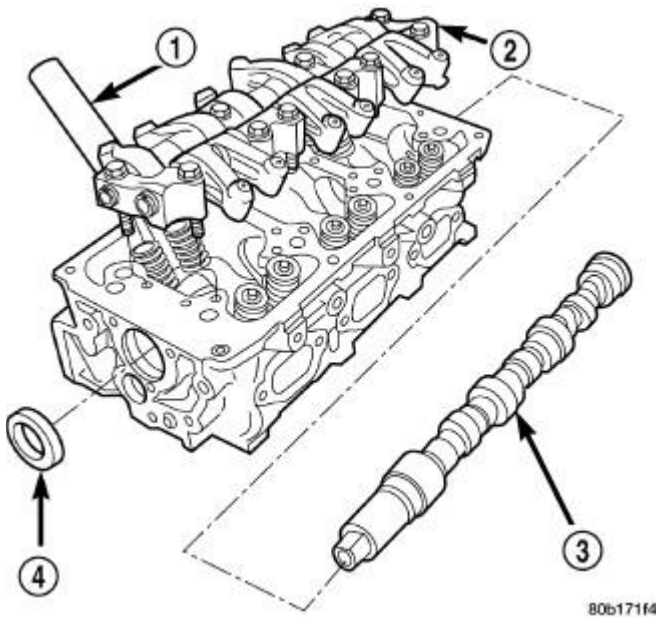


Fig. 145: Spark Plug Tube, Rocker Arm Assembly, Camshaft & Seal
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - SPARK PLUG TUBE
2 - ROCKER ARM ASSEMBLY
3 - CAMSHAFT
4 - SEAL</p> |
|--|

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.

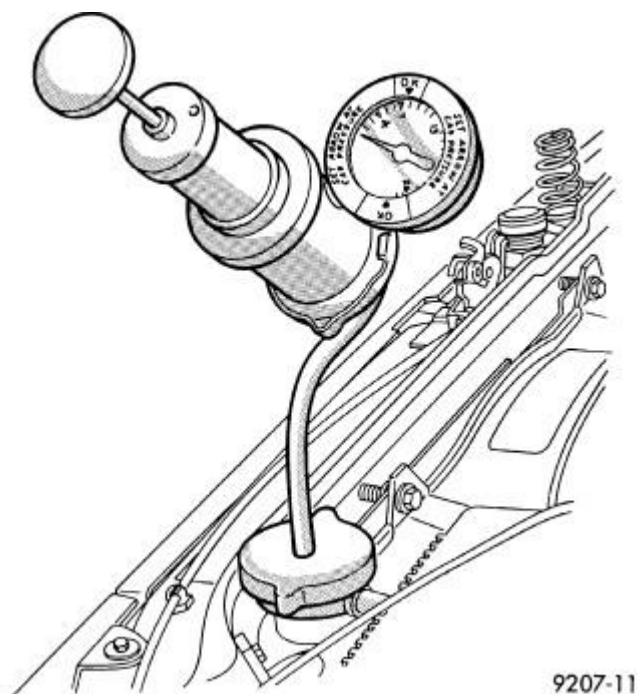
COOLING SYSTEM TESTER METHOD

Fig. 146: Pressure Testing

Courtesy of CHRYSLER LLC

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

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

CHEMICAL TEST METHOD

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

REMOVAL

REMOVAL - CYLINDER HEAD(S)

RIGHT CYLINDER HEAD

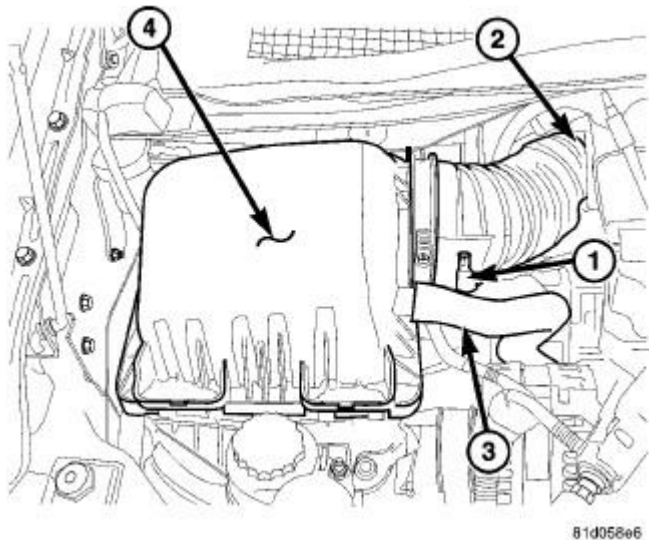


Fig. 147: Identifying Wiring Harness Connector, Throttle Body & Makeup Air Hose
Courtesy of CHRYSLER LLC

1. Perform the fuel system pressure relief procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .
2. Disconnect and isolate the negative battery cable.
3. Drain cooling system. Refer to **Cooling - Standard Procedure** .
4. Remove the engine cover.
5. Remove the air cleaner element housing. See **Engine/Air Intake System/BODY, Air Cleaner -**

Removal.

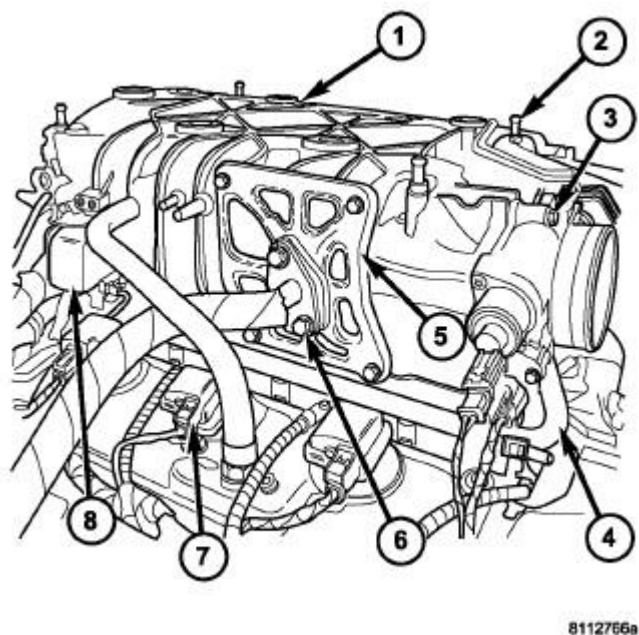


Fig. 148: Upper Intake Manifold - Right
Courtesy of CHRYSLER LLC

6. Remove the upper intake manifold (1) including EGR tube. See **Engine/Manifolds/MANIFOLD, Intake - Removal.**

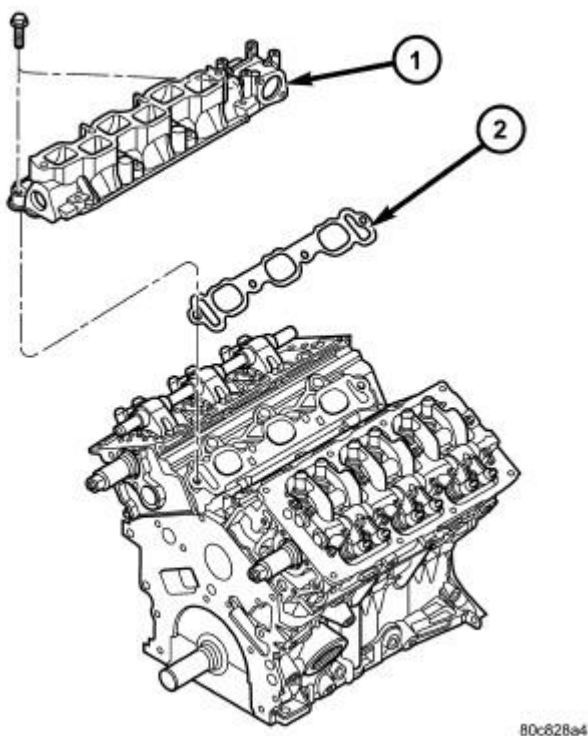


Fig. 149: LOWER INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

7. Remove fuel rail and lower intake manifold (1). See Engine/Manifolds/MANIFOLD, Intake - Removal.

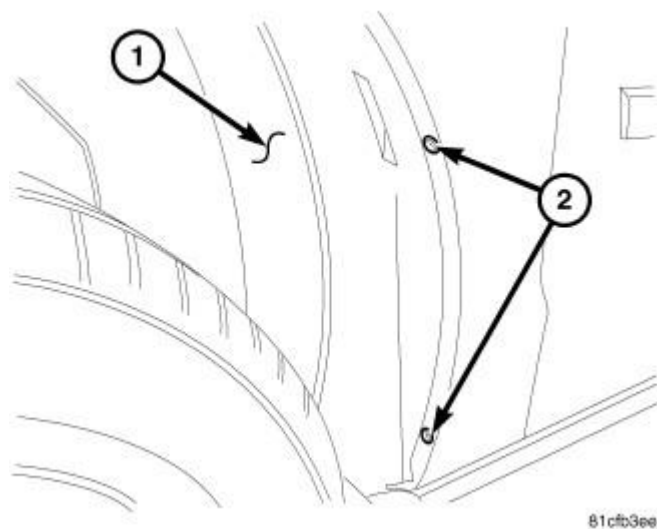


Fig. 150: Splash Shield Screws
Courtesy of CHRYSLER LLC

8. Raise the vehicle. Refer to Vehicle Quick Reference/Hoisting - Standard Procedure.

9. Remove right front tire. Refer to **Tires and Wheels - Removal** .
10. Remove right inner splash shield (1). Refer to **Body/Exterior/SHIELD, Splash - Removal** .

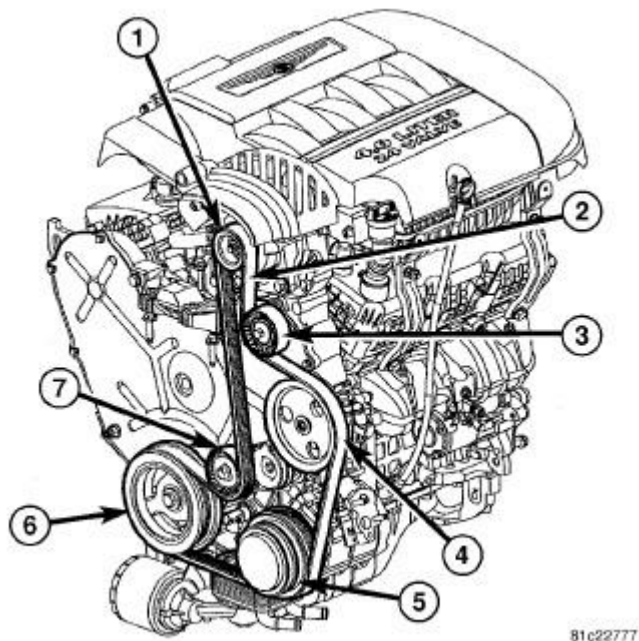


Fig. 151: Accessory Drive Belt - 4.0L
Courtesy of CHRYSLER LLC

11. Remove accessory drive belt (2). Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal** .

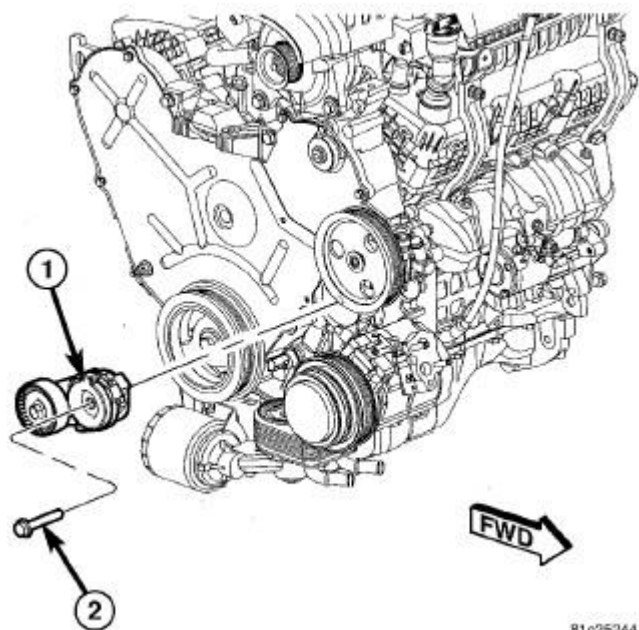


Fig. 152: Accessory Drive Belt Tensioner - 4.0L
Courtesy of CHRYSLER LLC

12. Remove the accessory drive belt tensioner (1).

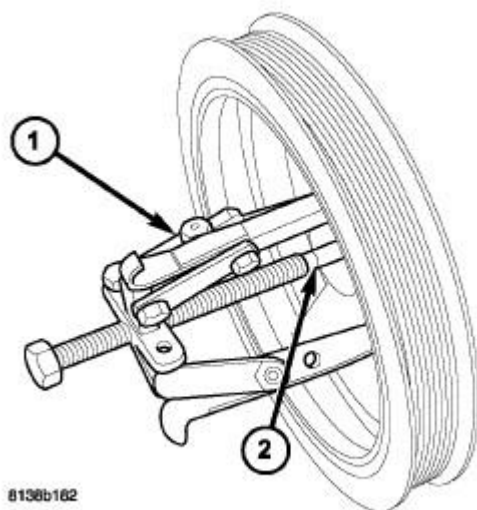


Fig. 153: Removing Crankshaft Damper
Courtesy of CHRYSLER LLC

13. Remove crankshaft damper bolt.
14. Using Puller 1023 (1) and Crankshaft Insert 9020 (2), remove crankshaft damper.

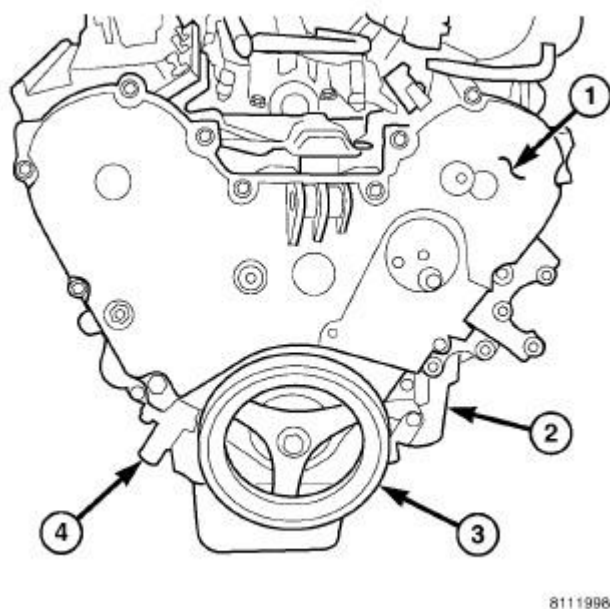


Fig. 154: FRONT TIMING BELT COVER

Courtesy of CHRYSLER LLC

- 1 - FRONT TIMING BELT COVER
- 2 - ENGINE OIL FILTER
- 3 - VIBRATION DAMPER
- 4 - TIMING BELT TENSIONER

15. Remove lower outer timing belt cover bolts.

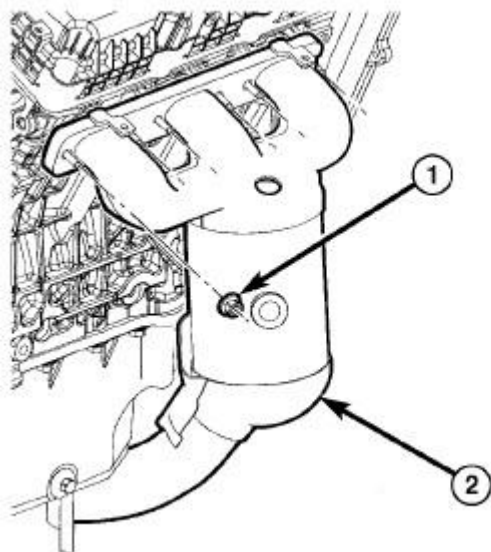


Fig. 155: Identifying Exhaust Maniverter & Fasteners

Courtesy of CHRYSLER LLC

16. Remove right exhaust maniverter (2). See **Engine/Manifolds/MANIFOLD, Exhaust - Removal**.

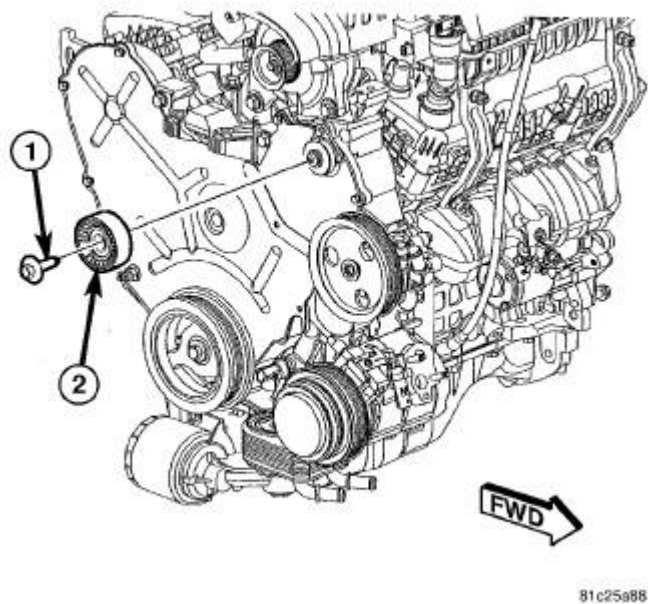


Fig. 156: Idler Pulley - 4.0L
Courtesy of CHRYSLER LLC

17. Lower vehicle.
18. Remove the accessory drive belt idler pulley (2).

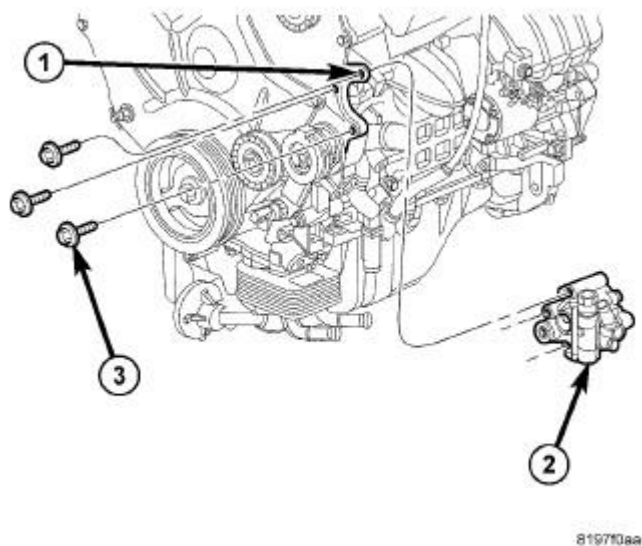


Fig. 157: Identifying Power Steering Pump Mounting And Bolts - 4.0L Engine
Courtesy of CHRYSLER LLC

19. Remove the power steering mounting bolts (3) and set the pump aside. Refer to **Steering/Pump - Removal**.

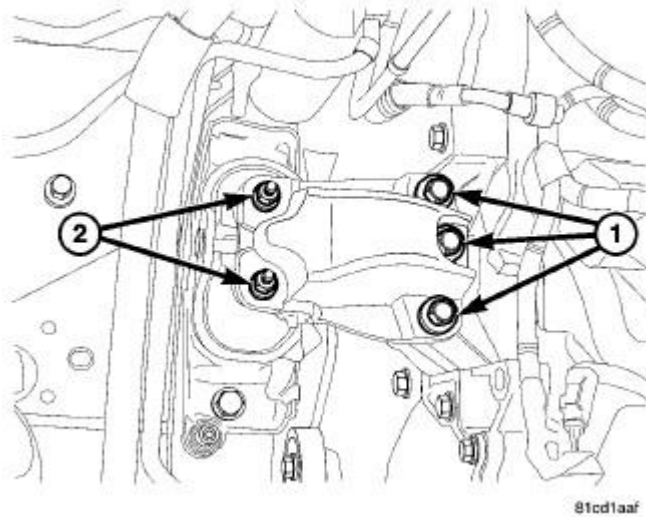


Fig. 158: Identifying Right Engine Mount-To-Engine Fasteners
Courtesy of CHRYSLER LLC

20. Support the engine with a block of wood and the floor jack.
21. Remove the upper engine mount. See **Engine/Engine Mounting/INSULATOR, Engine Mount - Removal**.

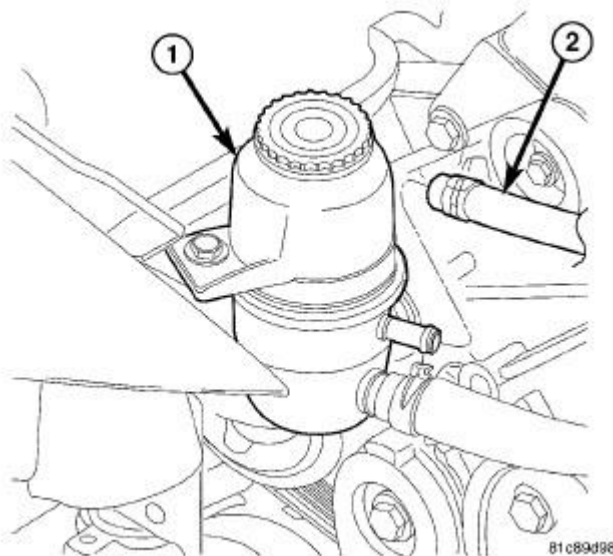
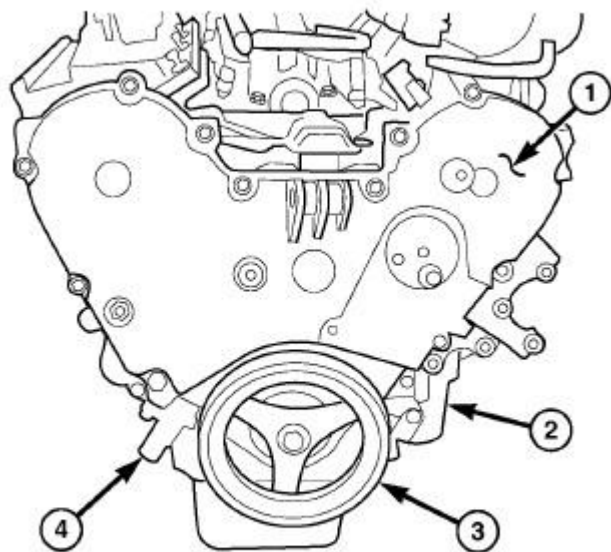


Fig. 159: Identifying Return Hose And Power Steering Fluid Reservoir
Courtesy of CHRYSLER LLC

22. Remove the power steering reservoir bolts and set reservoir (1) aside.



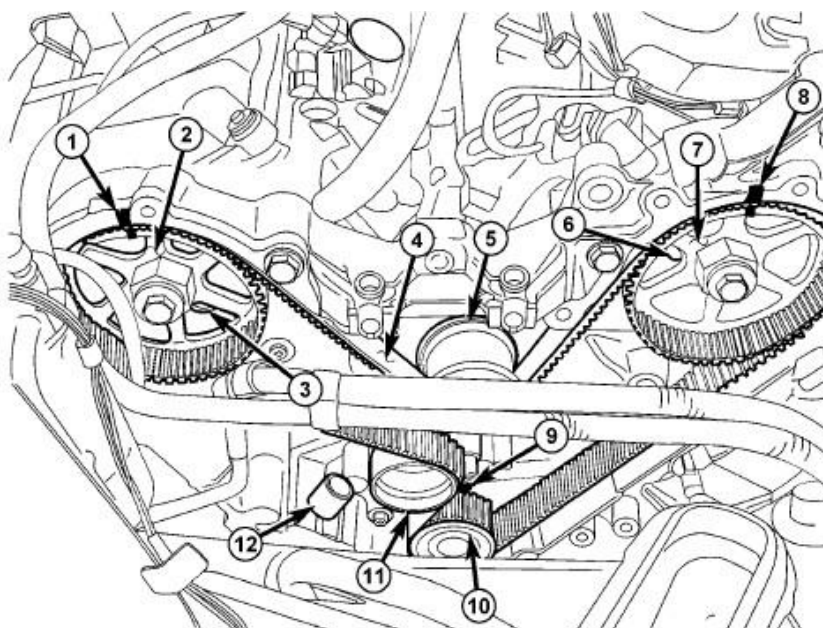
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Fig. 160: FRONT TIMING BELT COVER

Courtesy of CHRYSLER LLC

- | |
|-----------------------------|
| 1 - FRONT TIMING BELT COVER |
| 2 - ENGINE OIL FILTER |
| 3 - VIBRATION DAMPER |
| 4 - TIMING BELT TENSIONER |

23. Remove the remaining outer timing belt cover bolts and cover (1).



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Fig. 161: 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

24. Rotate the engine to TDC and align timing belt marks (1, 8, 9).
25. Remove the timing belt tensioner (12) and reset the tensioner. See **Engine/Valve Timing/TENSIONER, Engine Timing - Removal**.
26. Remove the timing belt (4). Refer to **BELT and SPROCKETS, Timing**.

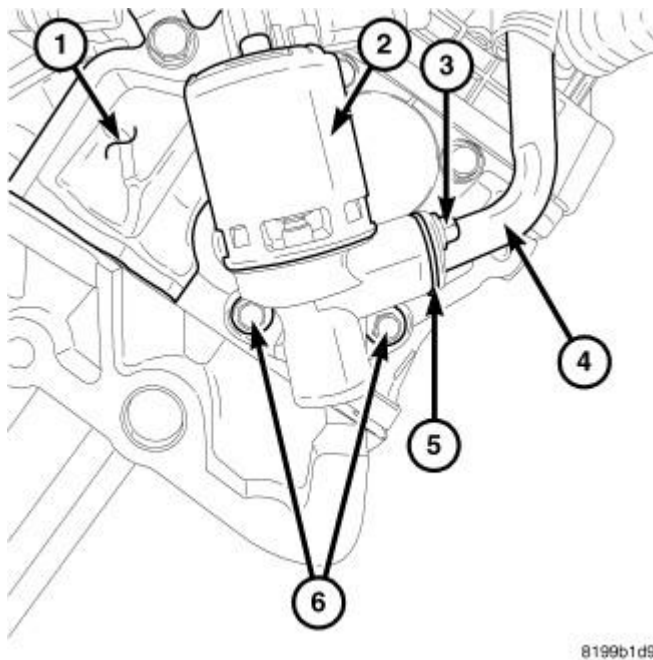
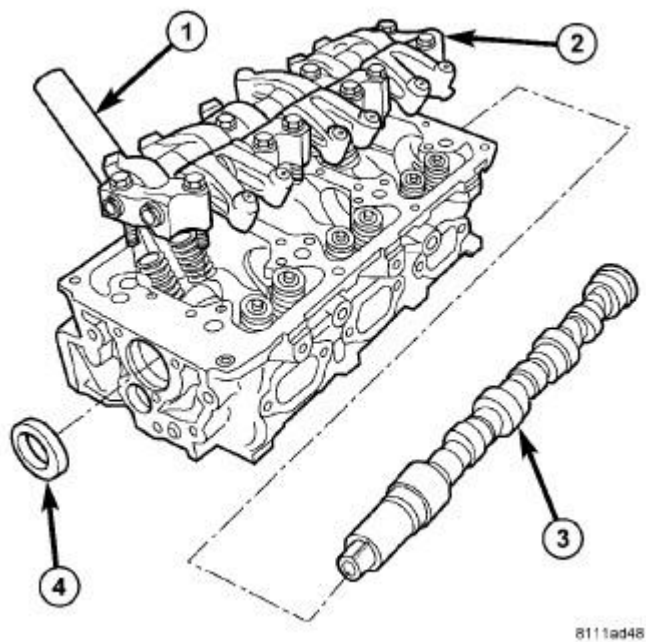


Fig. 162: Removing/Installing EGR Valve/Solenoid - 4.0L

Courtesy of CHRYSLER LLC

27. Remove the right valve cover to cylinder head ground strap.
28. Remove the EGR valve (2) with two bolts (6) and gasket.

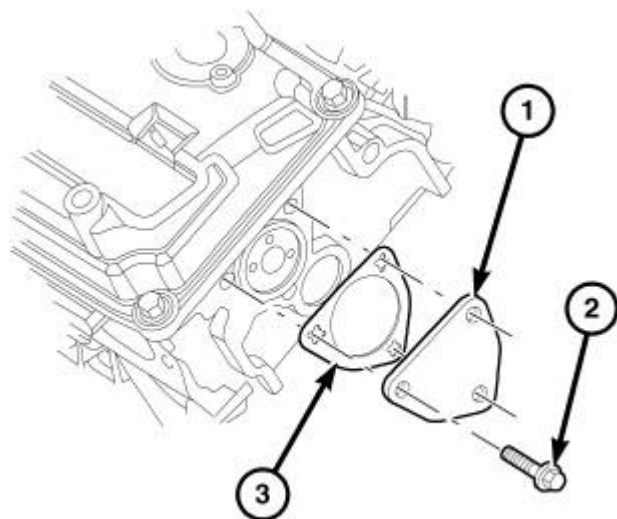


8111ad48

Fig. 163: Camshaft, Rocker Arm Assembly & Cylinder Head
Courtesy of CHRYSLER LLC

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

29. Remove the right cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
30. Remove ten bolts and the right rocker arm assembly (2).

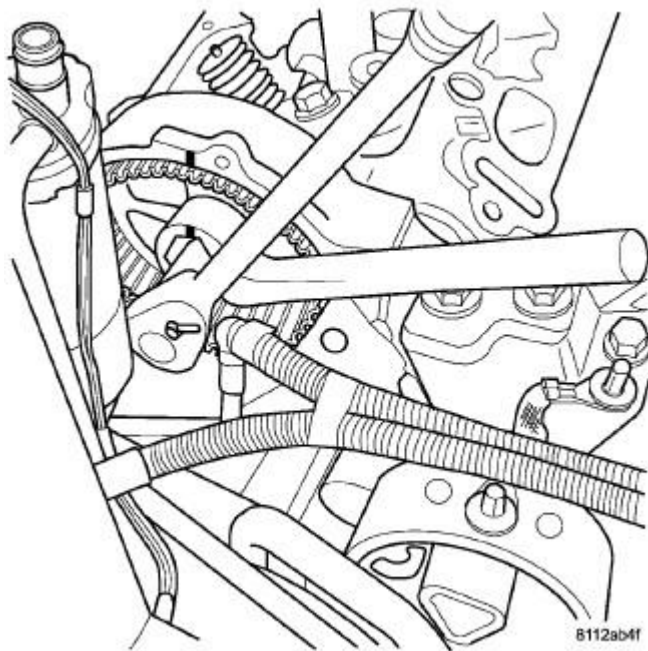


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Fig. 164: Cam Thrust Plate Gasket

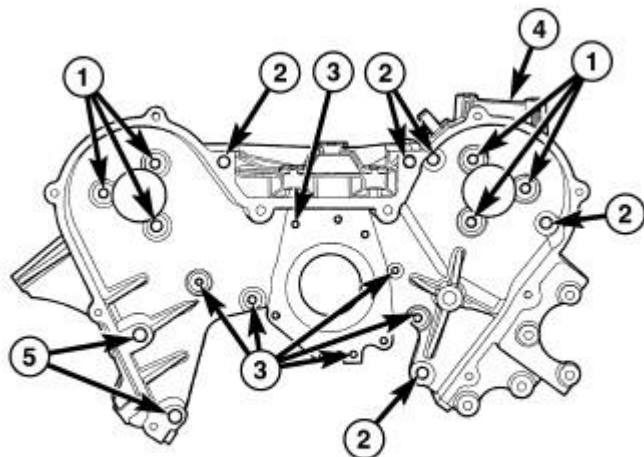
Courtesy of CHRYSLER LLC

31. Remove three bolts (2) and the right rear camshaft thrust plate (1).

**Fig. 165: Identifying Right Camshaft Sprocket**

Courtesy of CHRYSLER LLC

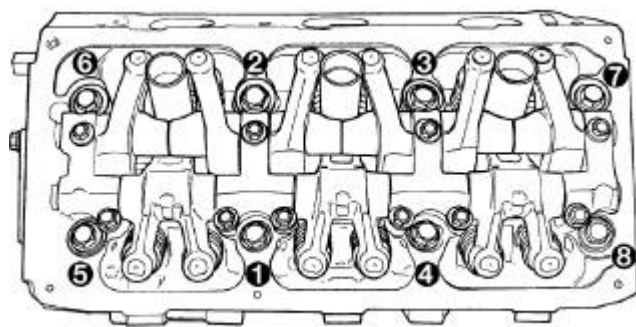
32. Counterhold the cam gear and remove the right cam gear retaining bolt.
33. Push the camshaft out of the back of the cylinder head approximately 3.5 inches and remove the cam gear.



80c78e41

Fig. 166: REAR TIMING BELT COVER FASTENERS
Courtesy of CHRYSLER LLC

34. Remove the three inner timing cover to right cylinder head retaining bolts (1).



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Fig. 167: Cylinder Head Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

35. Remove the cylinder head bolts in REVERSE of the tightening sequence shown in illustration.

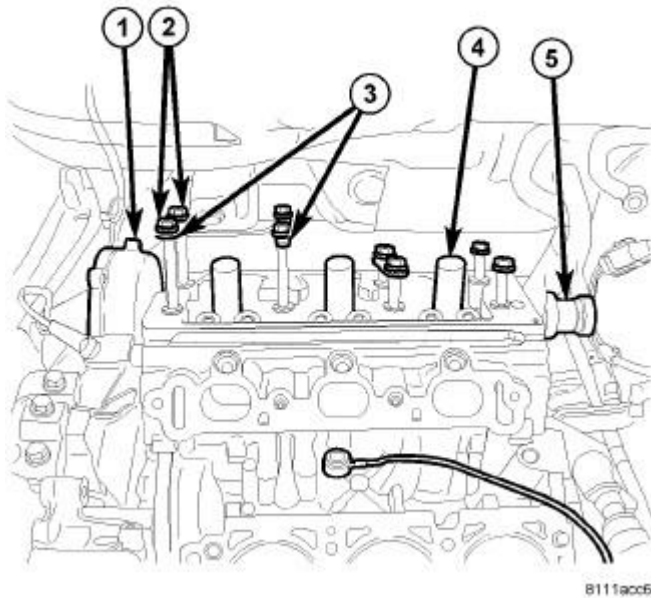


Fig. 168: View Of Right Cylinder Head Components
Courtesy of CHRYSLER LLC

- | |
|---|
| 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 (2) must be loosened, raised and supported with a rubber band (3) before the cylinder head can be removed.

36. Push the camshaft (5) out of the back of the cylinder head approximately 3.5 inches and remove the cylinder head.
37. Clean and inspect all mating surfaces.

LEFT CYLINDER HEAD

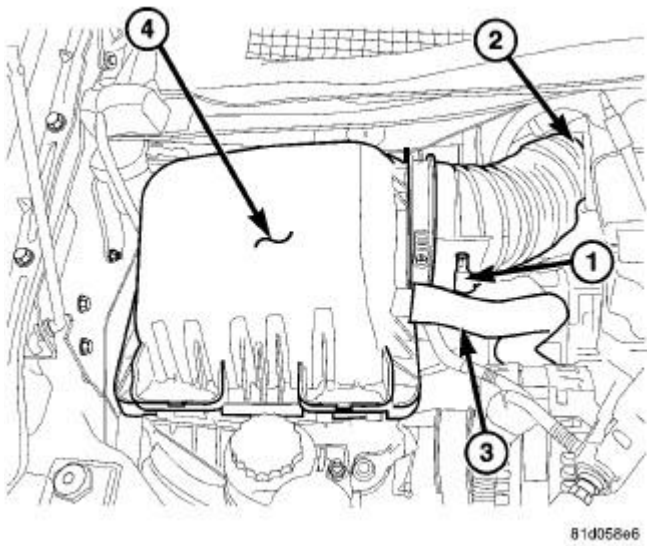
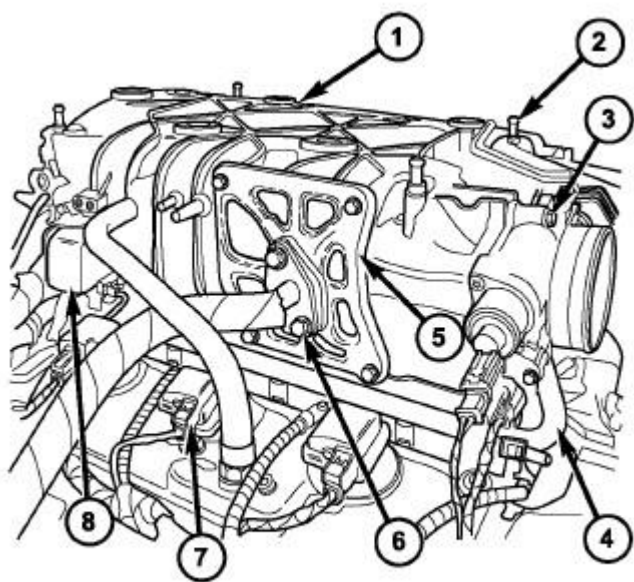


Fig. 169: Identifying Wiring Harness Connector, Throttle Body & Makeup Air Hose
Courtesy of CHRYSLER LLC

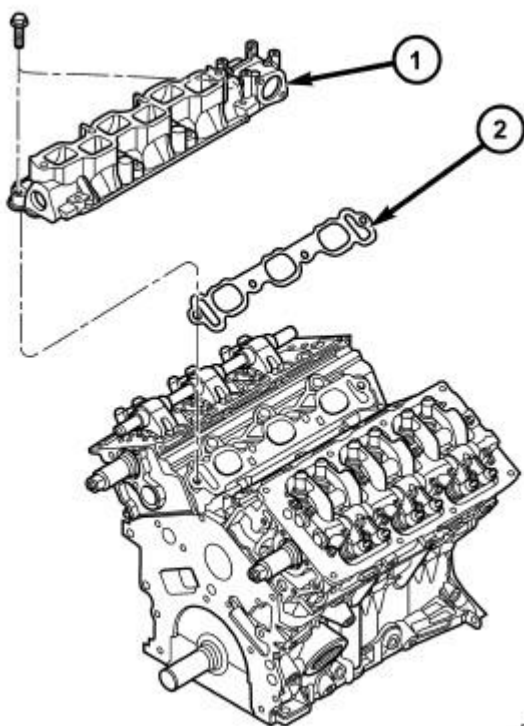
1. Perform the fuel system pressure relief procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .
2. Disconnect and isolate the negative battery cable.
3. Drain cooling system. Refer to **Cooling - Standard Procedure** .
4. Remove the engine cover.
5. Remove the air cleaner element housing. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.



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Fig. 170: Upper Intake Manifold - Right
Courtesy of CHRYSLER LLC

6. Remove the upper intake manifold (1). See [Engine/Manifolds/MANIFOLD, Intake - Removal](#).

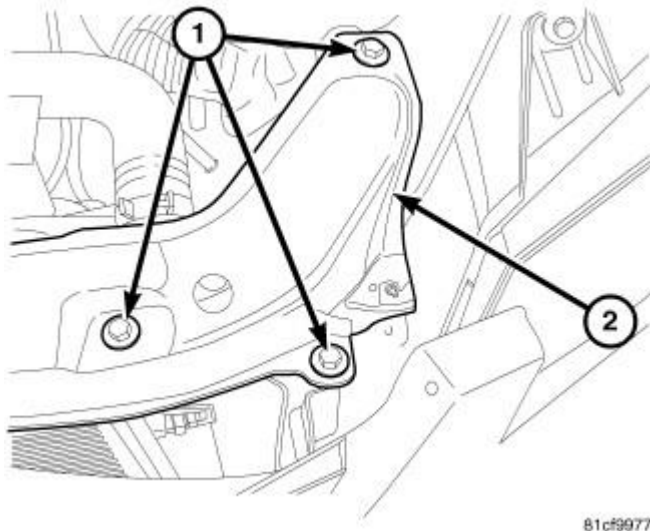


80c828a4

Fig. 171: LOWER INTAKE MANIFOLD

Courtesy of CHRYSLER LLC

7. Remove fuel rail and lower intake manifold (1). See **Engine/Manifolds/MANIFOLD, Intake - Removal**.

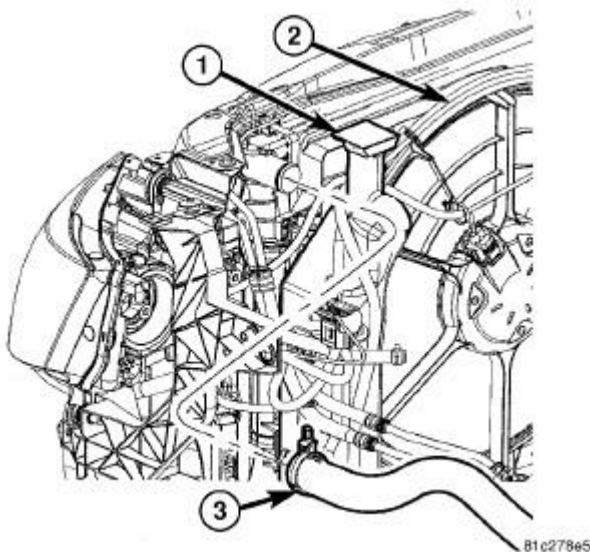


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Fig. 172: CROSSMEMBER BOLTS

Courtesy of CHRYSLER LLC

8. Remove the radiator crossmember (2). Refer to **Body/Exterior/CROSSMEMBER, Radiator - Removal**.



81c278e5

Fig. 173: Coolant Recovery Container, Radiator Fan & Hose

Courtesy of CHRYSLER LLC

- | |
|-----------------------|
| 1 - COOLANT CONTAINER |
| 2 - RADIATOR FAN |
| 3 - RADIATOR HOSE |

9. Remove coolant recovery container (1) and radiator fan assembly (2). Refer to **Cooling/Engine/FAN, Cooling - Removal** .

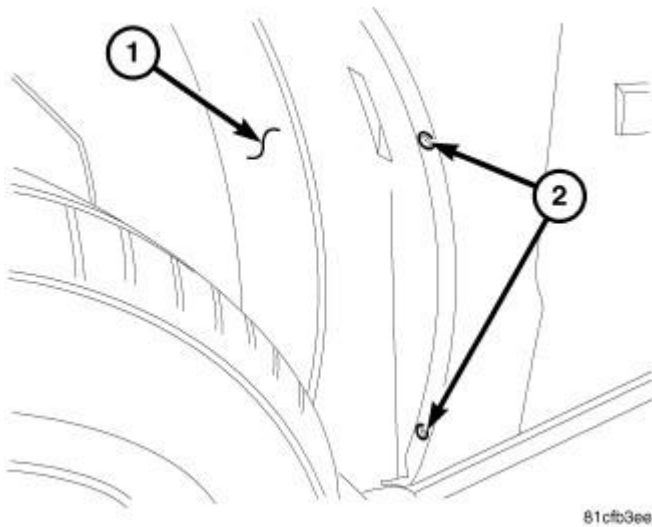


Fig. 174: Splash Shield Screws
 Courtesy of CHRYSLER LLC

10. Raise the vehicle. Refer to **Vehicle Quick Reference/Hoisting - Standard Procedure** .
11. Remove right front tire. Refer to **Tires and Wheels - Removal** .
12. Remove right inner splash shield (1). Refer to **Body/Exterior/SHIELD, Splash - Removal** .

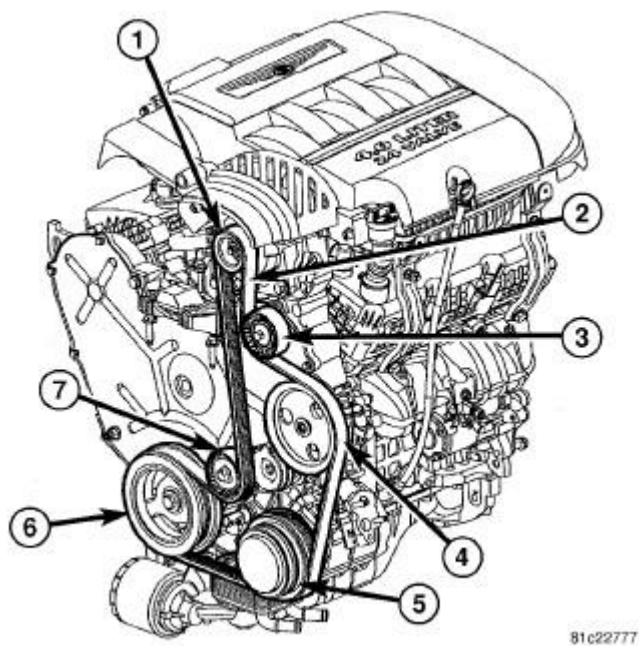


Fig. 175: Accessory Drive Belt - 4.0L
Courtesy of CHRYSLER LLC

13. Remove accessory drive belt (2). Refer to Cooling/Accessory Drive/BELT, Serpentine - Removal.

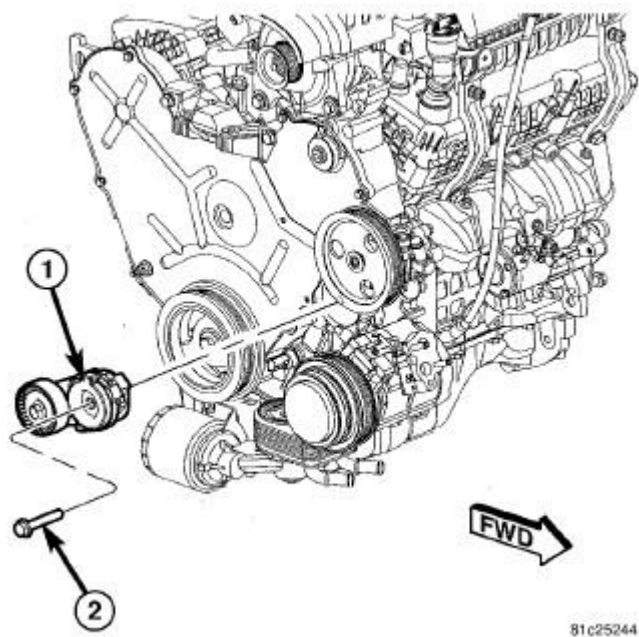


Fig. 176: Accessory Drive Belt Tensioner - 4.0L
Courtesy of CHRYSLER LLC

14. Remove the accessory drive belt tensioner (1).

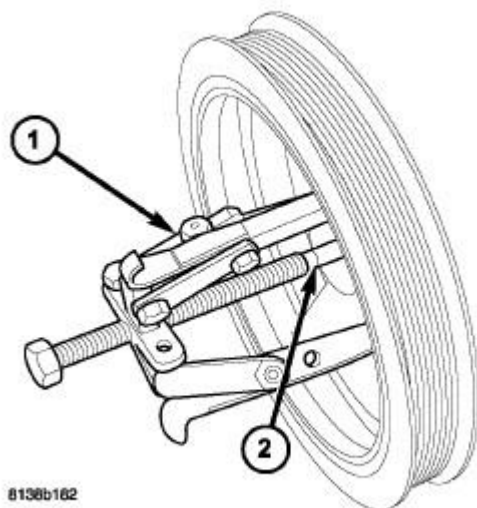


Fig. 177: Removing Crankshaft Damper
Courtesy of CHRYSLER LLC

15. Remove crankshaft damper bolt.
16. Using Puller 1023 (1) and Crankshaft Insert 9020 (2), remove crankshaft damper.

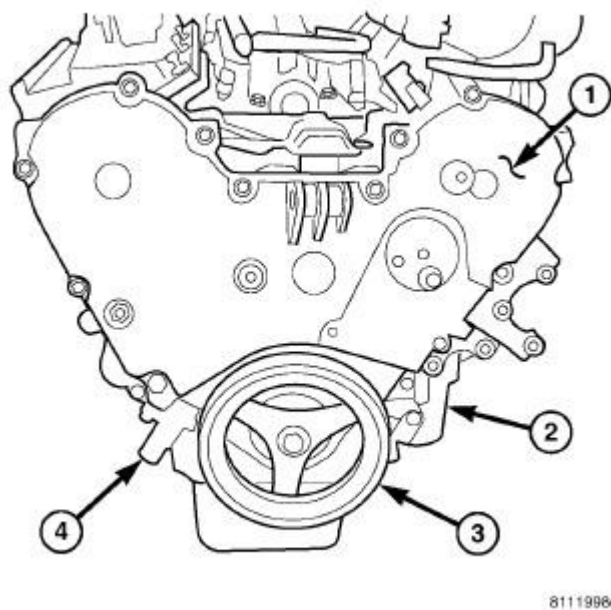


Fig. 178: FRONT TIMING BELT COVER
Courtesy of CHRYSLER LLC

- 1 - FRONT TIMING BELT COVER
- 2 - ENGINE OIL FILTER
- 3 - VIBRATION DAMPER
- 4 - TIMING BELT TENSIONER

17. Remove lower outer timing belt cover bolts.

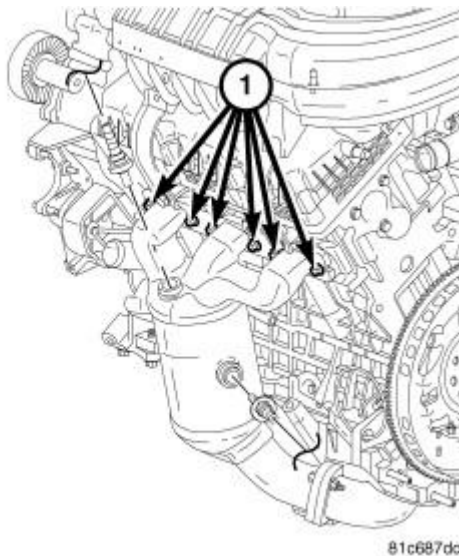


Fig. 179: Identifying Upper Exhaust Maniverter Retaining Bolts
Courtesy of CHRYSLER LLC

18. Remove the left exhaust maniverter. See [Engine/Manifolds/MANIFOLD, Exhaust - Removal](#).

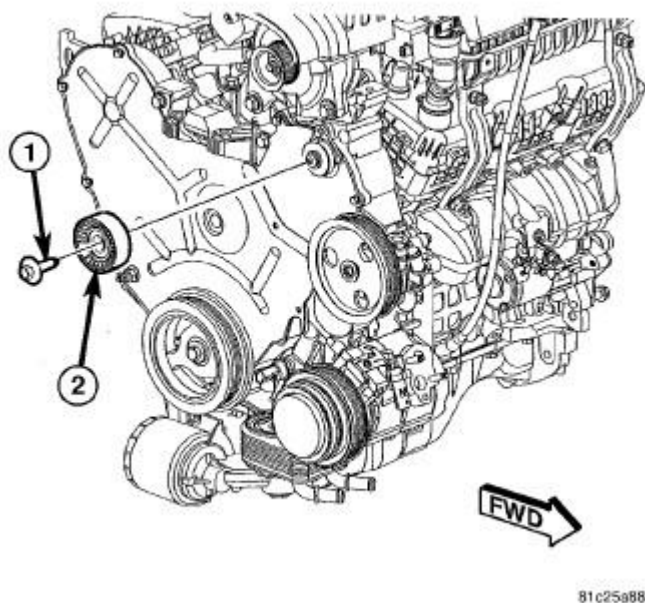


Fig. 180: Idler Pulley - 4.0L

Courtesy of CHRYSLER LLC

19. Lower vehicle.
20. Remove the accessory drive belt idler pulley (2).

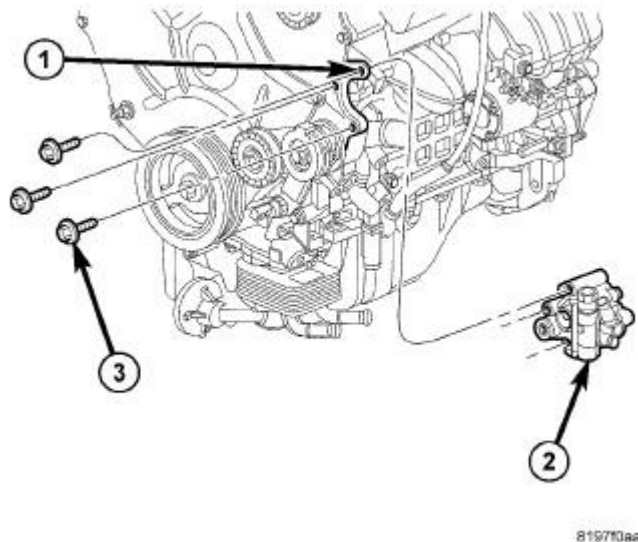


Fig. 181: Identifying Power Steering Pump Mounting And Bolts - 4.0L Engine

Courtesy of CHRYSLER LLC

21. Remove the power steering mounting bolts (3) and set the pump aside. Refer to **Steering/Pump - Removal**.

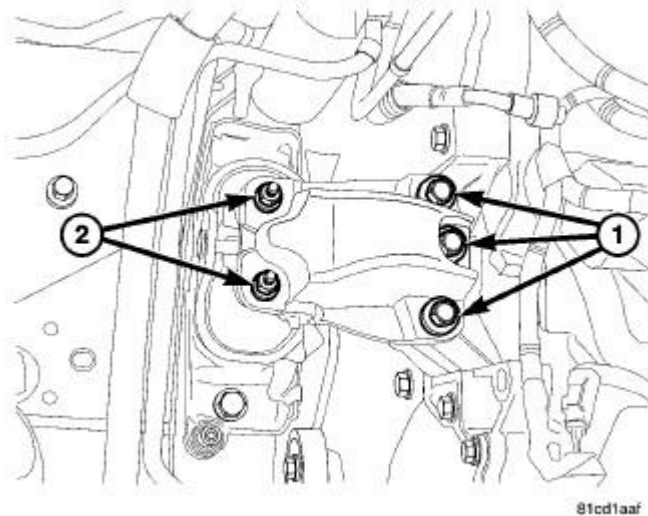


Fig. 182: Identifying Right Engine Mount-To-Engine Fasteners

Courtesy of CHRYSLER LLC

22. Support the engine with a block of wood and the floor jack.
23. Remove the upper engine mount. See **Engine/Engine Mounting/INSULATOR, Engine Mount - Removal**.

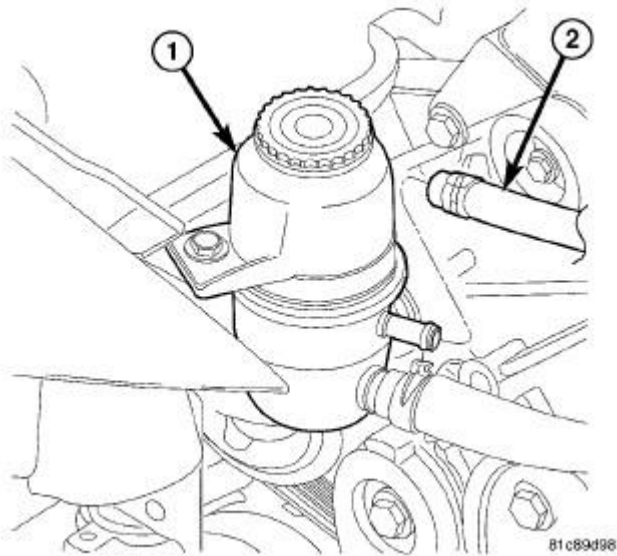


Fig. 183: Identifying Return Hose And Power Steering Fluid Reservoir
Courtesy of CHRYSLER LLC

24. Remove the power steering reservoir bolts and set reservoir (1) aside.

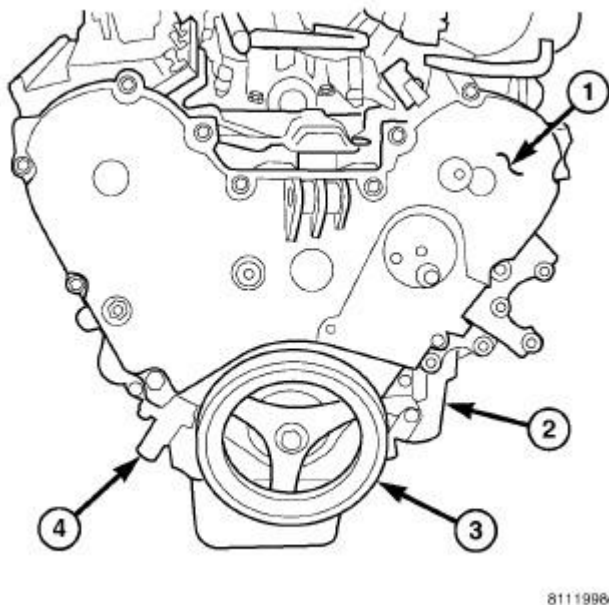
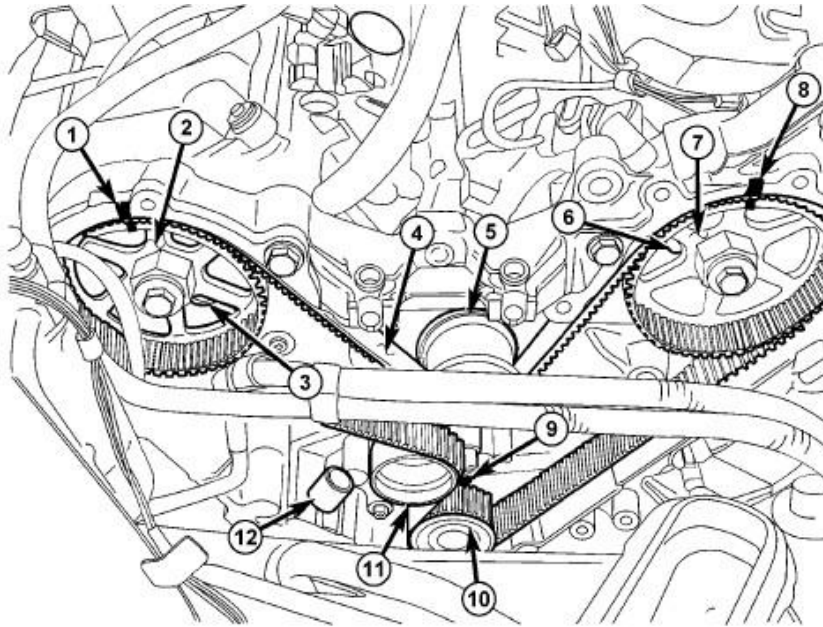


Fig. 184: FRONT TIMING BELT COVER
Courtesy of CHRYSLER LLC

- 1 - FRONT TIMING BELT COVER
- 2 - ENGINE OIL FILTER
- 3 - VIBRATION DAMPER
- 4 - TIMING BELT TENSIONER

25. Remove the remaining outer timing belt cover bolts and cover (1).



8111ae99

Fig. 185: 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 |

26. Rotate the engine to TDC and align timing belt marks (1, 8, 9).
27. Remove the timing belt tensioner (12) and reset the tensioner. See **Engine/Valve Timing/TENSIONER, Engine Timing - Removal**.
28. Remove the timing belt (4). Refer to **BELT and SPROCKETS, Timing**.

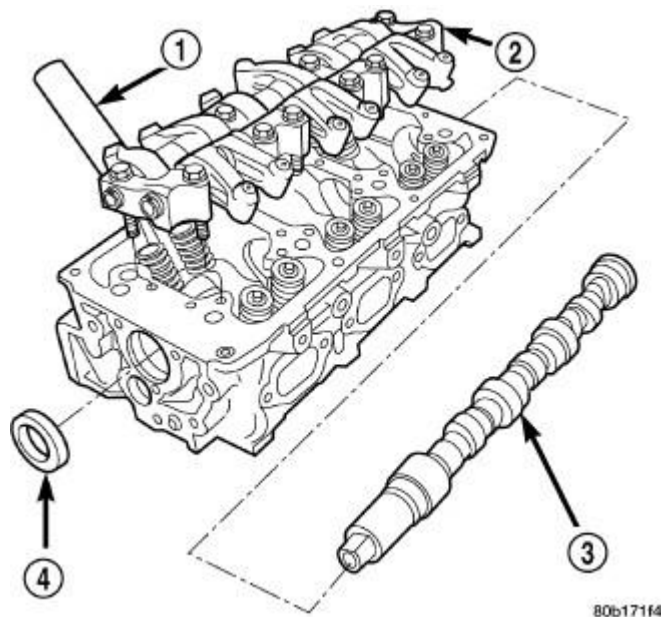


Fig. 186: Cylinder Head, Camshaft, and Rocker Arms
Courtesy of CHRYSLER LLC

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.**
31. Remove ten bolts and left rocker arm assembly (2).

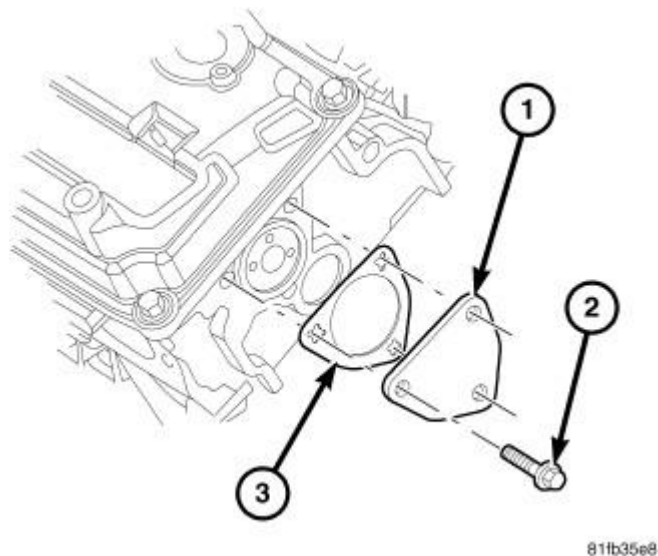


Fig. 187: Cam Thrust Plate Gasket
Courtesy of CHRYSLER LLC

32. Remove three bolts (2) and the left camshaft thrust plate (1).

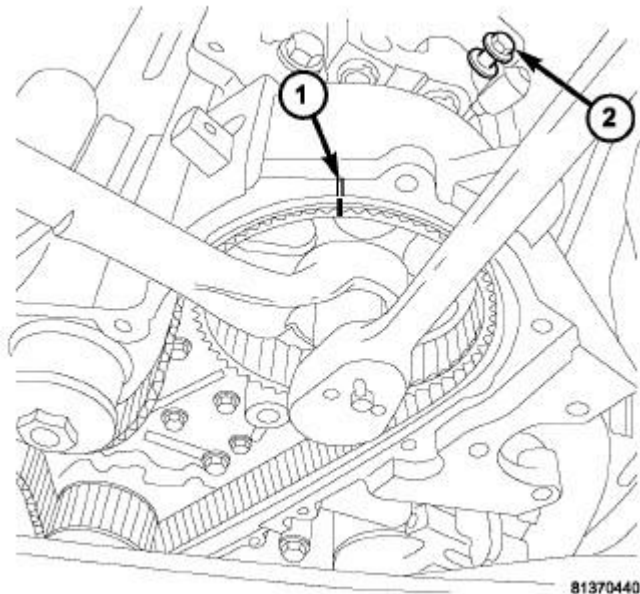


Fig. 188: LEFT CAMSHAFT SPROCKET
Courtesy of CHRYSLER LLC

33. Counterhold the left cam gear and remove the cam gear retaining bolt.
34. Push the camshaft out of the back of the cylinder head approximately 3.5 inches and remove the cam gear.

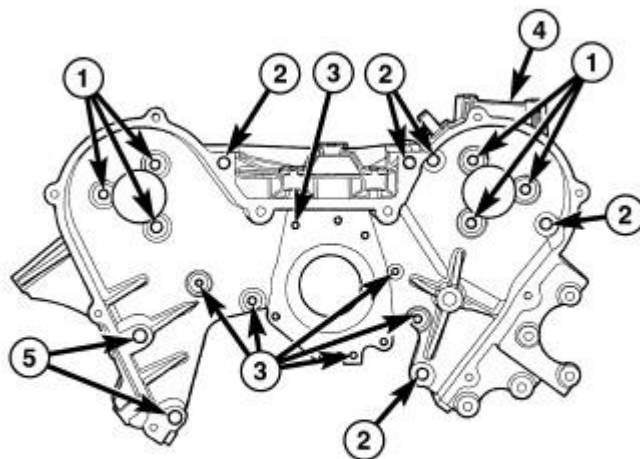


Fig. 189: REAR TIMING BELT COVER FASTENERS

Courtesy of CHRYSLER LLC

35. Remove the four inner timing cover to left cylinder head retaining bolts (1) and (2).

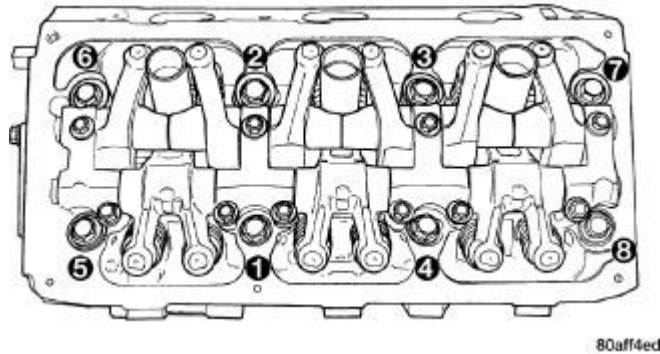


Fig. 190: Cylinder Head Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

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

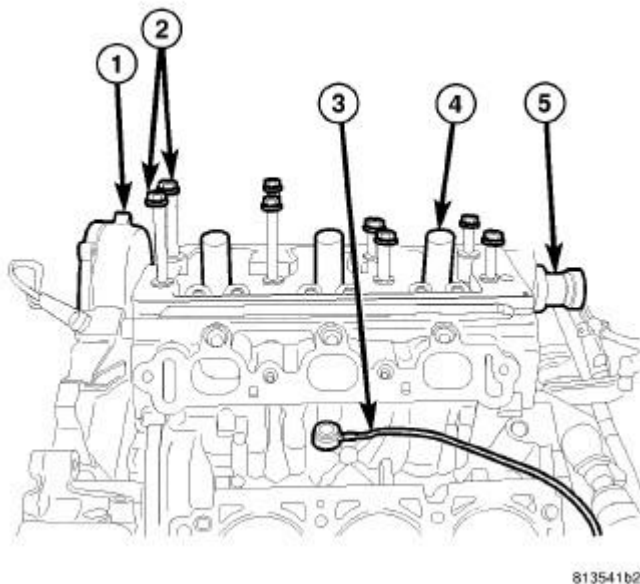


Fig. 191: RIGHT CYLINDER HEAD
Courtesy of CHRYSLER LLC

37. Push the camshaft (5) out of the back of the cylinder head approximately 3.5 inches and remove the cylinder head.
38. 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

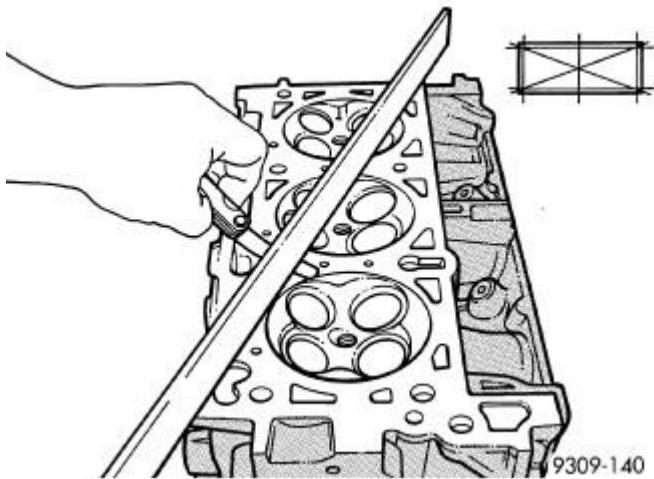


Fig. 192: Checking Cylinder Head Flatness-Typical
Courtesy of CHRYSLER LLC

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

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

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

INSTALLATION

INSTALLATION - CYLINDER HEAD(S)

RIGHT CYLINDER HEAD

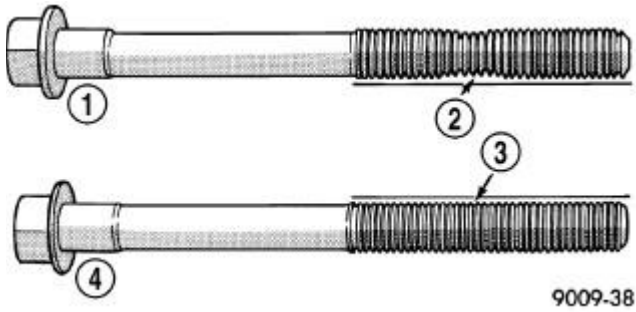


Fig. 193: Check For Stretched Bolts
Courtesy of CHRYSLER LLC

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

CAUTION: The 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.

1. Check cylinder head bolts for necking by holding a scale or straight edge against the threads. If all the threads do not contact the scale (2) the bolt must be replaced.

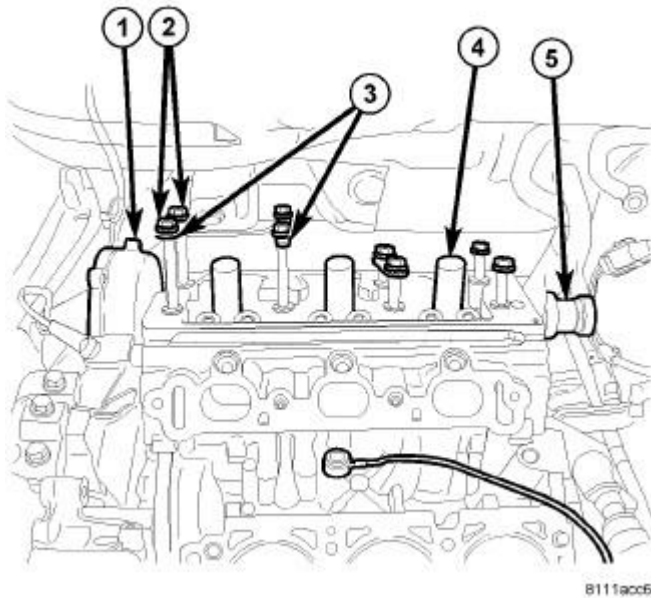


Fig. 194: View Of Right Cylinder Head Components
Courtesy of CHRYSLER LLC

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.

2. Clean sealing surfaces of cylinder head and block. See **Engine - Standard Procedure**.
3. Install camshaft (5) in cylinder head.

CAUTION: THE CYLINDER HEAD GASKETS ARE NOT INTERCHANGEABLE BETWEEN CYLINDER HEADS AND ARE CLEARLY MARKED RIGHT OR LEFT.

CAUTION: Ensure that the correct head gaskets are used and are oriented correctly on cylinder block.

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

4. Insert the front four cylinder head bolts (2) into the cylinder head. Pull the bolts up to the top of their travel and retain with rubber bands (3).
5. Push camshaft (5) out of the back of the cylinder head approximately 3.5 inches. Install head gasket and cylinder head over locating dowels.
6. Install and finger tighten eight head bolts (2).

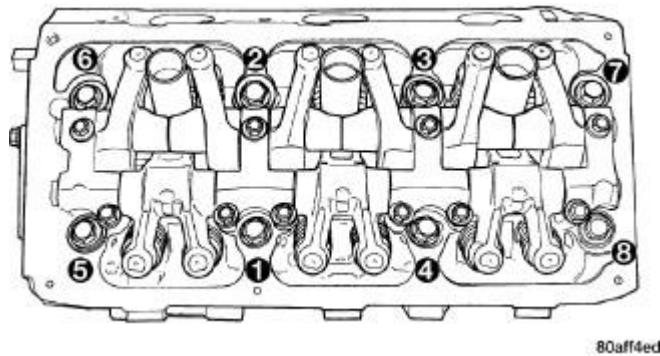


Fig. 195: Cylinder Head Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

7. Tighten the cylinder head bolts in the following sequence, using the 4 step torque-turn method. Tighten according to the following torque values:
 - 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.**
8. Bolt torque after 90° turn should be over 122 N.m (90 ft. lbs.) in the tightening direction. If not, replace the bolt.
9. Install the inner timing cover to cylinder head bolts (1). Tighten bolts to 54 N.m (40 ft. lbs.).

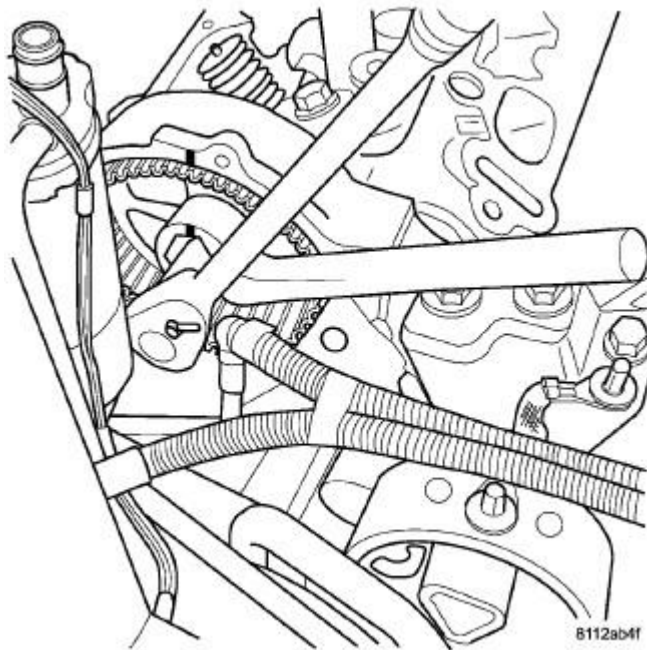


Fig. 196: Identifying Right Camshaft Sprocket
Courtesy of CHRYSLER LLC

CAUTION: The camshaft sprockets are keyed and not interchangeable from side to side because of the camshaft position sensor pick-up.

10. Push the camshaft back into the cylinder head and install the camshaft sprocket.
11. Install **NEW** sprocket attaching bolt into place. The 255 mm (10 in.) bolt is to be installed in the left camshaft and the 213 mm (8 3/8 in.) bolt is to be installed into the right camshaft. Counterhold the camshaft sprocket (2) and tighten the camshaft sprocket bolt to 102 N.m (75 ft. lbs.) plus a 90° turn.

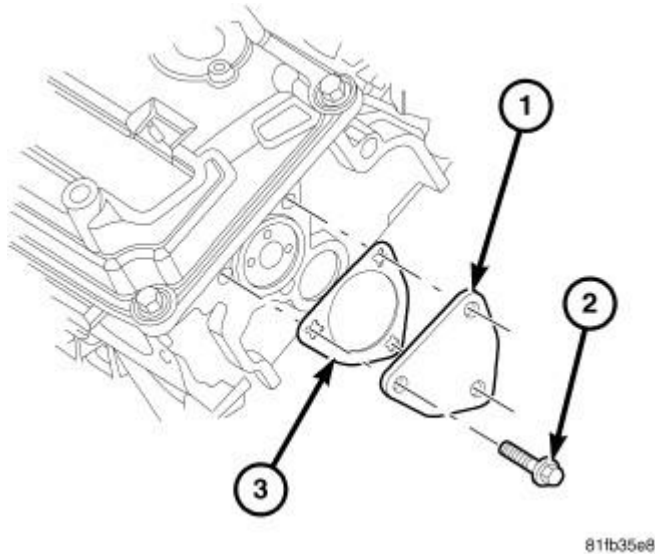


Fig. 197: Cam Thrust Plate Gasket
Courtesy of CHRYSLER LLC

12. Install the camshaft thrust plate (1) and gasket (3). Tighten three bolts (2) to 28 N.m (250 in. lbs.).

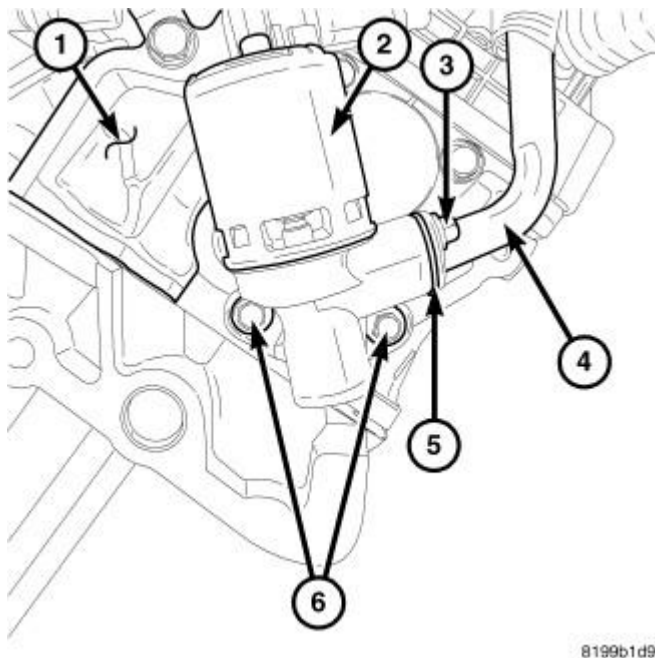
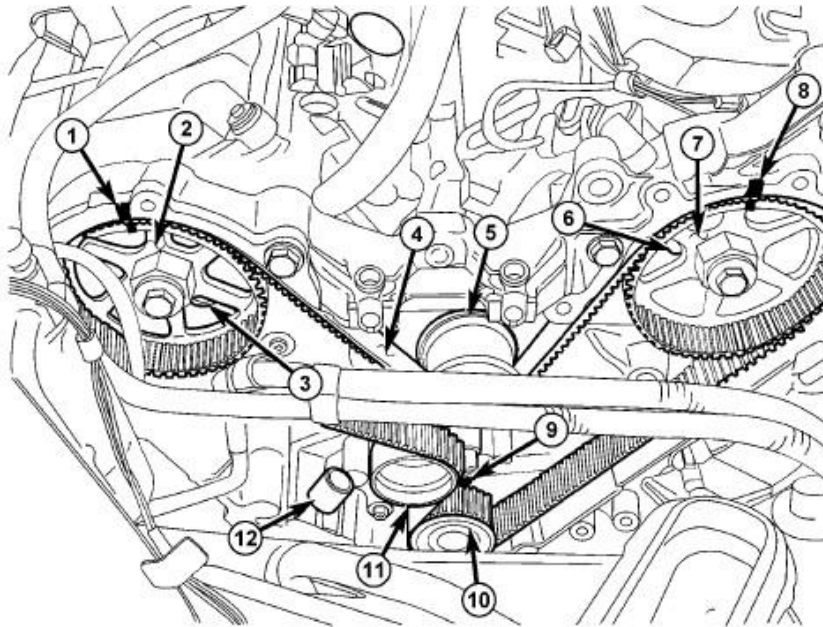


Fig. 198: Removing/Installing EGR Valve/Solenoid - 4.0L
Courtesy of CHRYSLER LLC

13. Install new gasket between EGR solenoid/valve (2) and rear of cylinder head (1).
14. Position EGR solenoid/valve assembly to rear of cylinder head. Install and tighten two mounting bolts (6) to 8 N.m (80 in. lbs.).

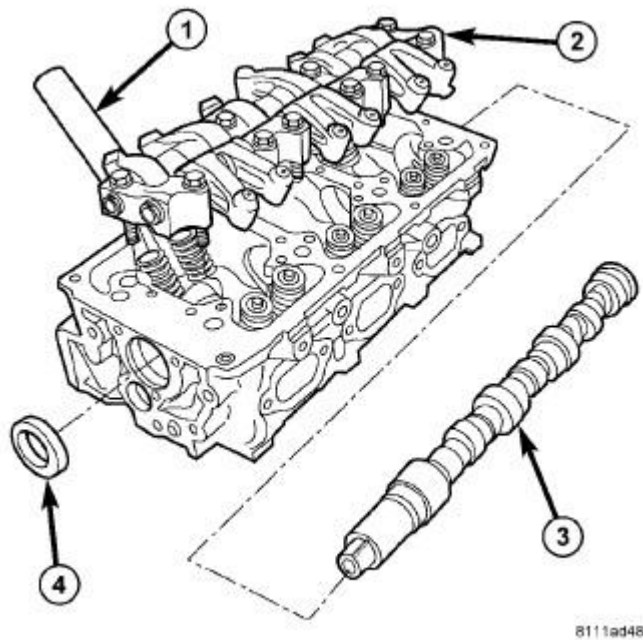


8111ae99

Fig. 199: Identifying Timing Gear Marks
Courtesy of CHRYSLER LLC

15. Rotate the right camshaft gear (2) to align its timing mark (1). Verify that the left camshaft gear (7) timing mark (8) and crankshaft gear (10) timing mark (9) are still aligned.
16. Install the timing belt (4) starting at the crankshaft sprocket (10) going in a counterclockwise direction. Install the belt around the last sprocket. Maintain tension on the belt as it is positioned around the tensioner pulley (11).
17. Holding the tensioner pulley (11) against the belt, install the tensioner (12) into the housing and tighten two bolts to 28 N.m (250 in. lbs.). Each camshaft sprocket mark should remain aligned with the cover marks.
18. When tensioner is in place pull retaining pin to allow the tensioner to extend to the tensioner pulley bracket.
19. Rotate crankshaft sprocket two revolutions and check the timing marks on the camshafts and crankshaft. The marks should line up within their respective locations. If marks do not line up, repeat procedure.

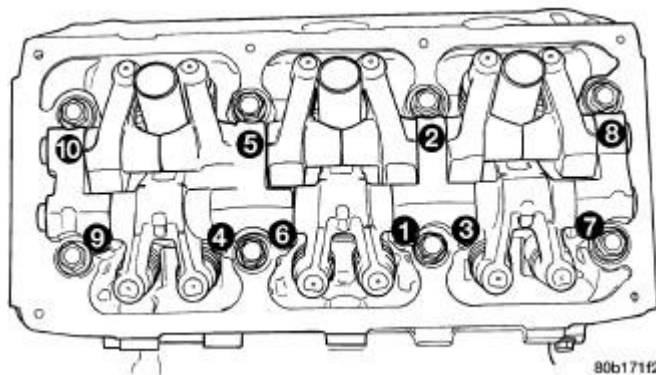
NOTE: With the camshaft gears in these positions the lobes are in a neutral position (no load to the valve). This will allow the rocker arm shaft assembly to be tightened into position with little or no valve spring load on it.



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Fig. 200: CAMSHAFT, ROCKER ARM ASSEMBLY AND CYLINDER HEAD
Courtesy of CHRYSLER LLC

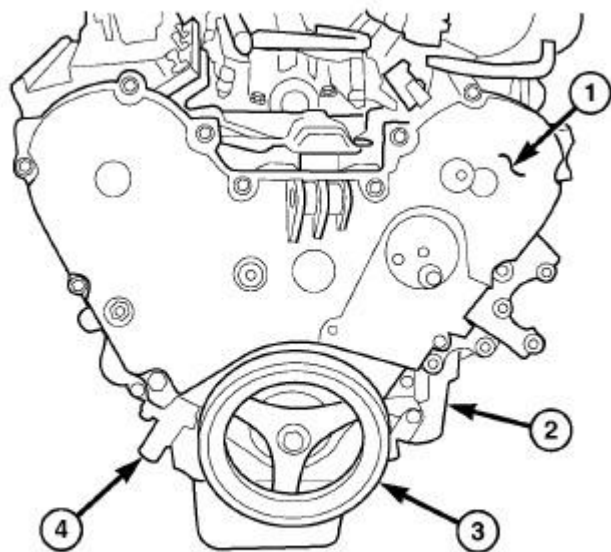
20. Install the rocker arm and shaft assembly (2) and ten bolts making sure that the identification marks face toward the front of engine for left head and toward the rear of the engine for right head.



80b17112

Fig. 201: Rocker Arm/Shaft Assembly Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

21. Tighten the ten rocker arm/shaft assembly bolts in sequence shown in illustration to 31 N.m (275 in. lbs.).
22. Install the right cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.
23. Install the right valve cover to cylinder head ground strap.

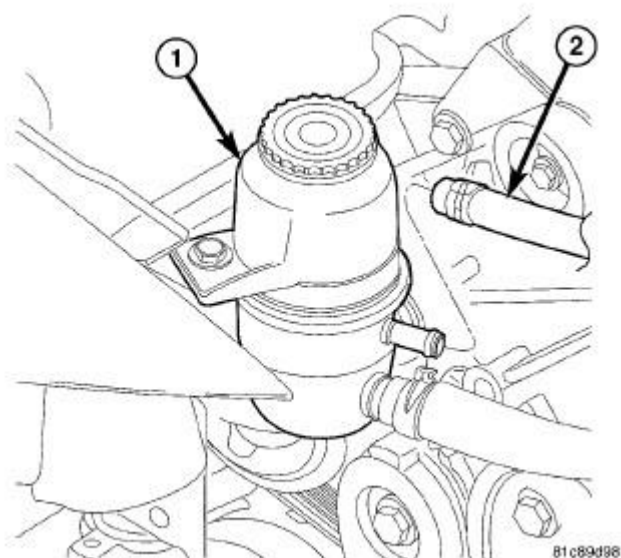


8111996d

Fig. 202: FRONT TIMING BELT COVER

Courtesy of CHRYSLER LLC

24. Install the front timing belt outer covers.
25. Tighten the timing cover bolts as follows:



81c89d88

Fig. 203: Identifying Return Hose And Power Steering Fluid Reservoir

Courtesy of CHRYSLER LLC

- M6 bolts - 12 N.m (105 in. lbs.)
- M8 bolts - 28 N.m (250 in. lbs.)

- M10 bolts - 54 N.m (40 ft. lbs.)

26. Install the power steering reservoir (1). Tighten mounting nut to 12 N.m (9 ft. lbs.).

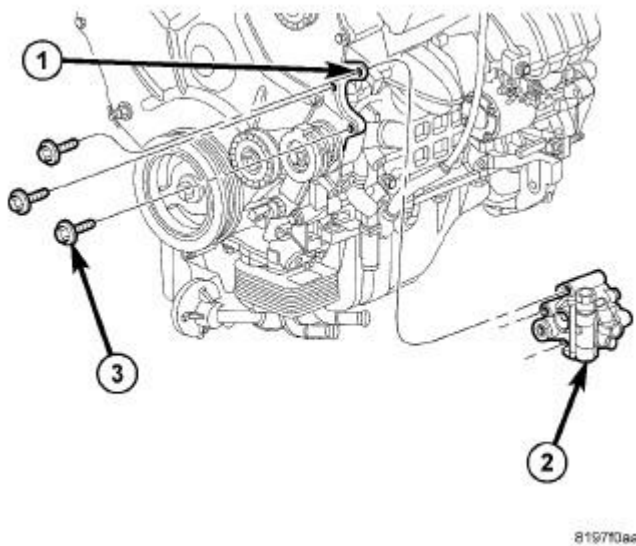


Fig. 204: Identifying Power Steering Pump Mounting And Bolts - 4.0L Engine
Courtesy of CHRYSLER LLC

27. Install the power steering pump (2). Refer to **Steering/Pump/PULLEY, Power Steering Pump - Installation** .

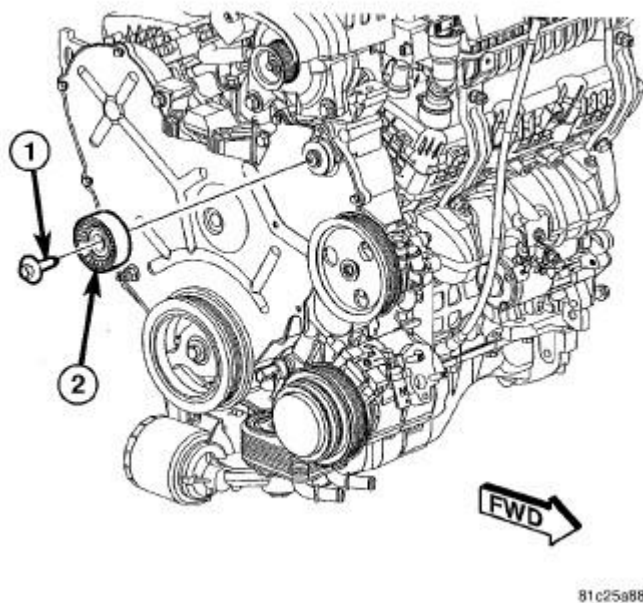


Fig. 205: Idler Pulley - 4.0L
Courtesy of CHRYSLER LLC

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

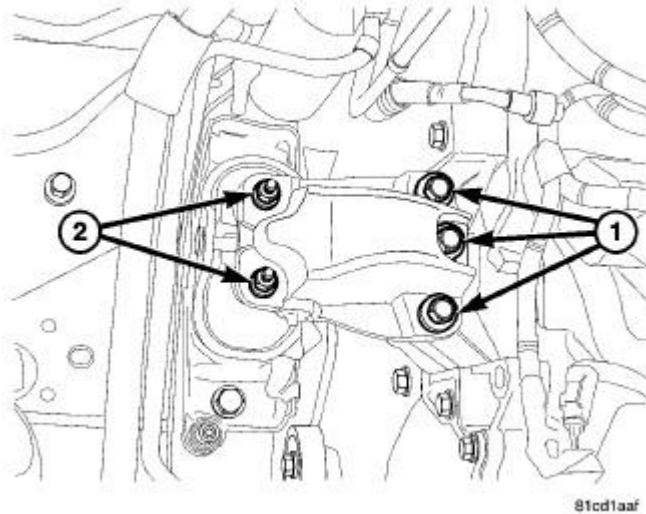


Fig. 206: Identifying Right Engine Mount-To-Engine Fasteners
Courtesy of CHRYSLER LLC

29. Install the upper engine mount. See **Engine/Engine Mounting/INSULATOR, Engine Mount - Installation.**

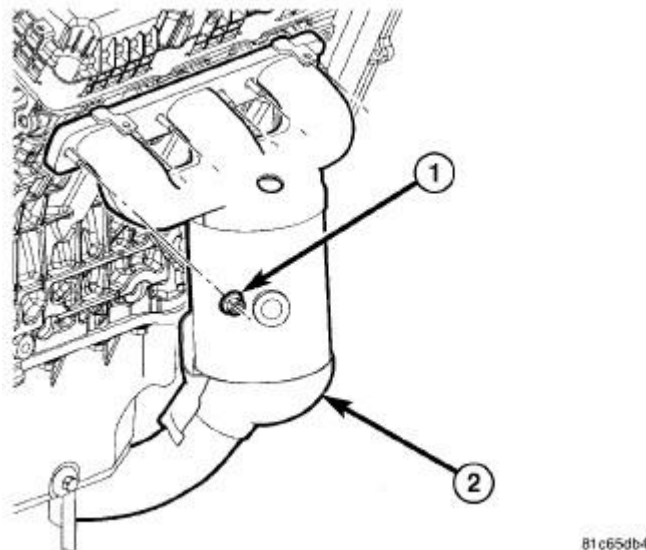


Fig. 207: Identifying Exhaust Maniverter & Fasteners
Courtesy of CHRYSLER LLC

30. Install the right exhaust maniverter (2). See **Engine/Manifolds/MANIFOLD, Exhaust - Installation.**

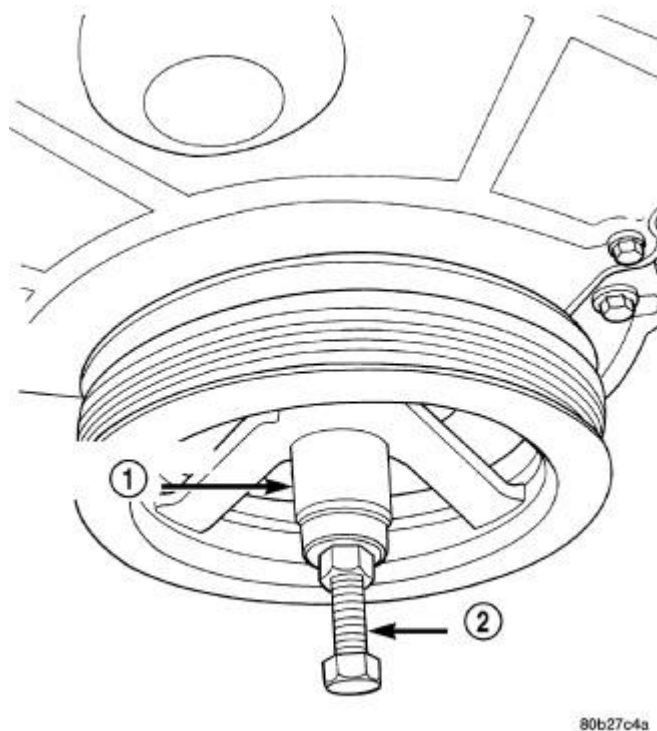


Fig. 208: Crankshaft Damper-Installation
Courtesy of CHRYSLER LLC

31. Install crankshaft damper using Forcing Screw C-4685-C1 (2), with Nut and Thrust Bearing from 6792, and 6792-1 Installer (1).

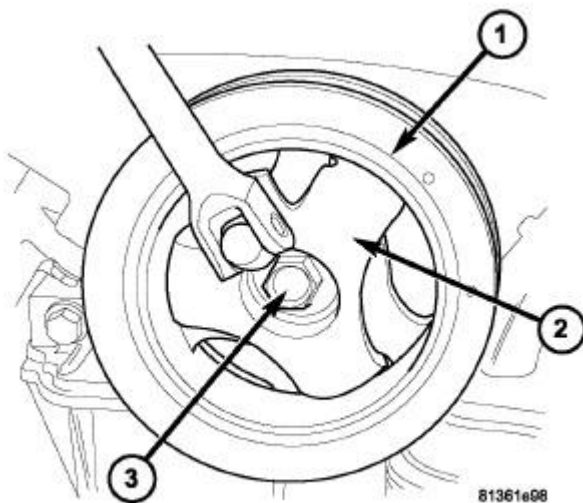


Fig. 209: DAMPER HOLDER
Courtesy of CHRYSLER LLC

32. Install crankshaft damper bolt (3). Tighten bolt to 95 N.m (70 ft. lbs.) while holding damper (1) with Damper Holding Fixture 9365 (2).

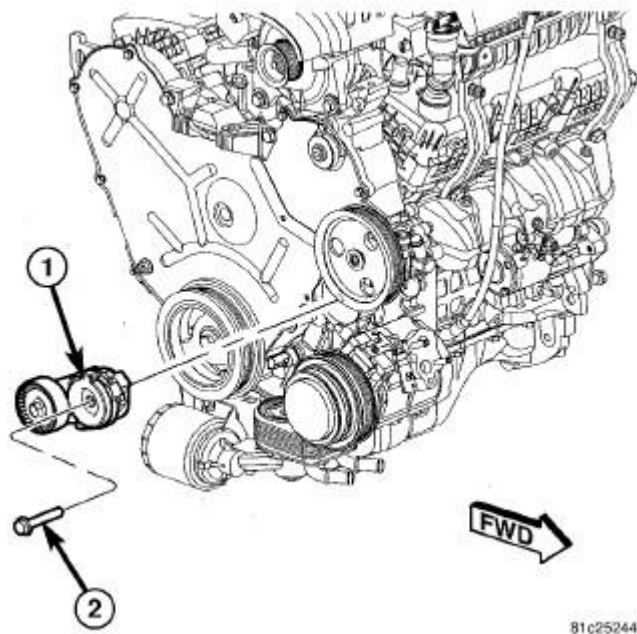


Fig. 210: Accessory Drive Belt Tensioner - 4.0L
Courtesy of CHRYSLER LLC

33. Install the accessory drive belt tensioner (1). Tighten bolt to 61 N.m (45 ft. lbs.).

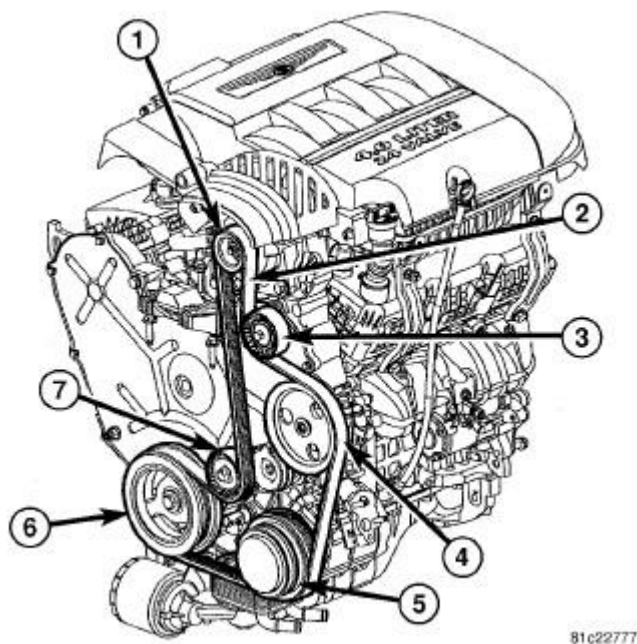


Fig. 211: Accessory Drive Belt - 4.0L

Courtesy of CHRYSLER LLC

34. Install the accessory drive belt (2). Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation** .

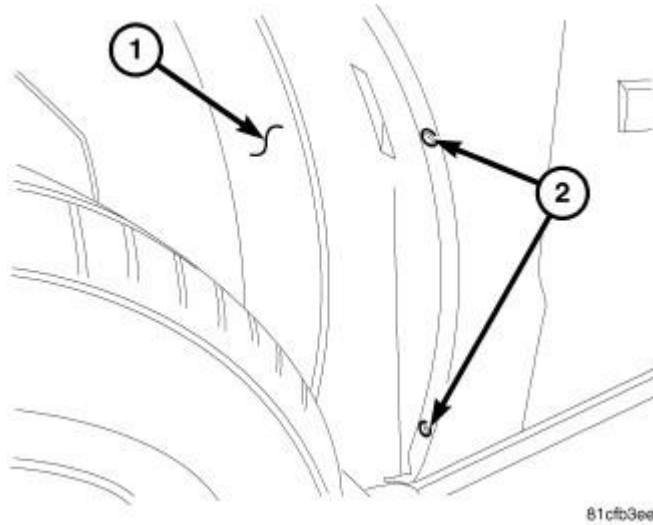


Fig. 212: Splash Shield Screws

Courtesy of CHRYSLER LLC

35. Install the right inner splash shield (1). Refer to **Body/Exterior/SHIELD, Splash - Installation** .
36. Install the right front tire. Refer to **Tires and Wheels - Installation** .
37. Lower the vehicle.

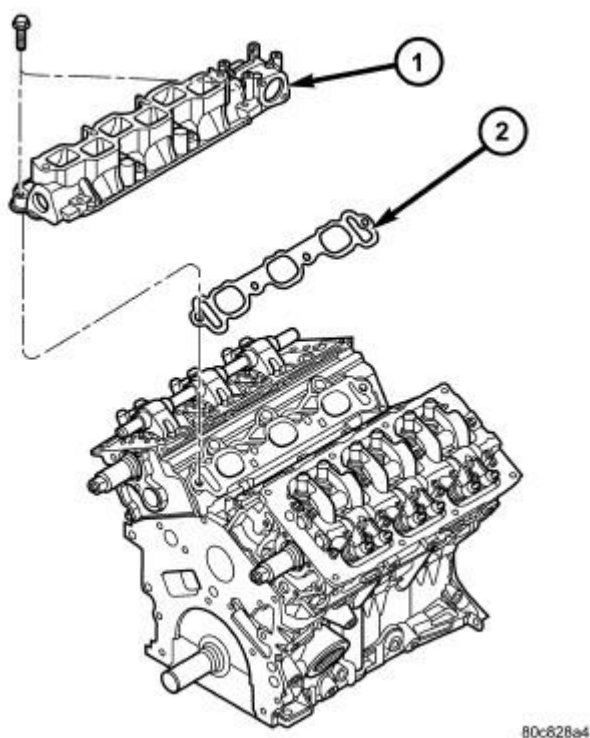


Fig. 213: LOWER INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

38. Install lower intake manifold (1) and fuel rail. See [Engine/Manifolds/MANIFOLD, Intake - Installation](#).

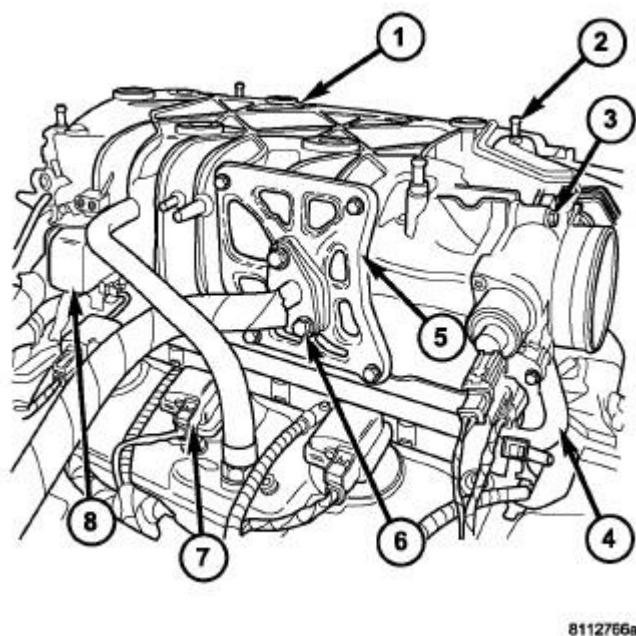


Fig. 214: Upper Intake Manifold - Right
Courtesy of CHRYSLER LLC

39. Install the upper intake manifold (1) including EGR tube. See **Engine/Manifolds/MANIFOLD, Intake - Installation**.

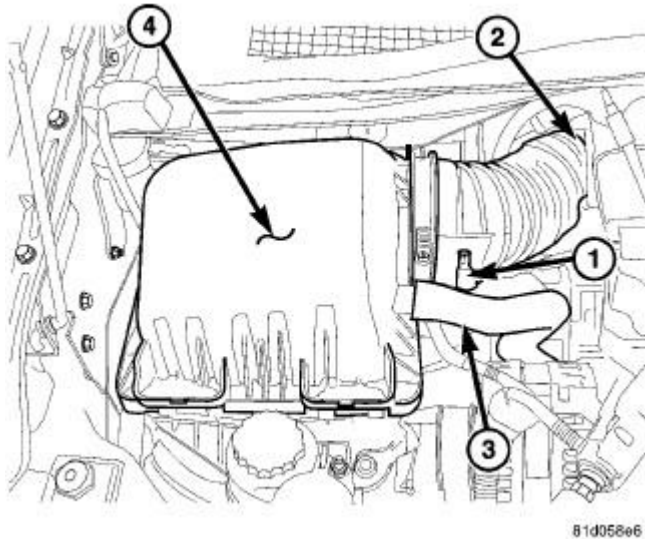


Fig. 215: Identifying Wiring Harness Connector, Throttle Body & Makeup Air Hose
Courtesy of CHRYSLER LLC

40. Install the air cleaner element housing. See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.
41. Install the engine cover.
42. Fill the coolant system. Refer to **Cooling - Standard Procedure**.
43. Connect the negative battery cable. Tighten nut to 4.5 N.m (40 in. lbs.).

LEFT CYLINDER HEAD

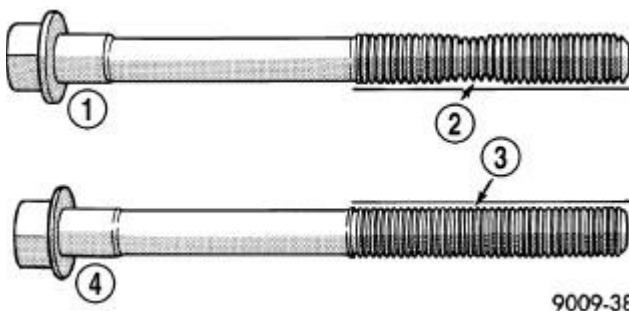


Fig. 216: Check For Stretched Bolts
Courtesy of CHRYSLER LLC

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

CAUTION: The 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.

1. Check cylinder head bolts for necking by holding a scale or straight edge against the threads. If all the threads do not contact the scale (2) the bolt must be replaced.

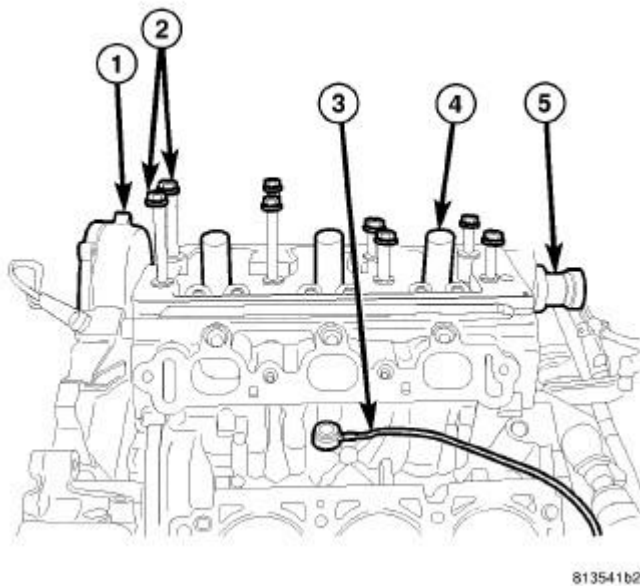


Fig. 217: Right Cylinder Head
Courtesy of CHRYSLER LLC

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.

2. Clean sealing surfaces of cylinder head and block. See Engine - Standard Procedure.
3. Install camshaft (5) in cylinder head.

CAUTION: THE CYLINDER HEAD GASKETS ARE NOT INTERCHANGEABLE BETWEEN CYLINDER HEADS AND ARE CLEARLY MARKED RIGHT OR LEFT.

CAUTION: Ensure that the correct head gaskets are used and are oriented correctly on cylinder block.

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

4. Push camshaft (5) out of the back of the cylinder head approximately 3.5 inches. Install head gasket and cylinder head over locating dowels.
5. Install and finger tighten eight head bolts (2).

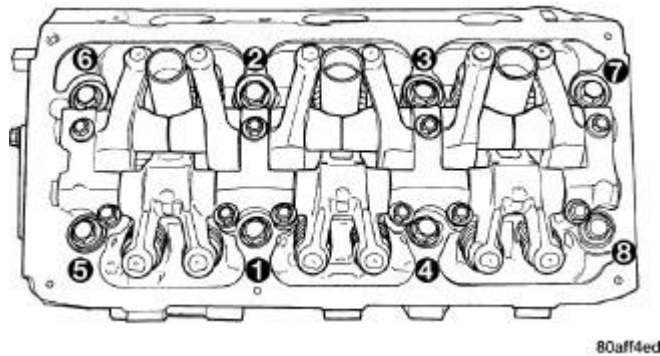


Fig. 218: Cylinder Head Bolt Tightening Sequence

Courtesy of CHRYSLER LLC

6. Tighten the cylinder head bolts in the following sequence, using the 4 step torque-turn method. Tighten according to the following torque values:
 - 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.
8. Install four inner timing cover to cylinder head bolts (1) and (2). Tighten bolts to 54 N.m (40 ft. lbs.).

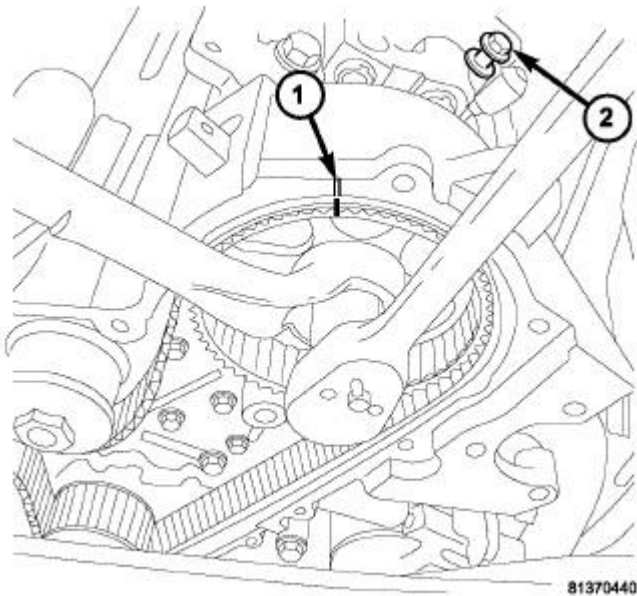


Fig. 219: Left Camshaft Sprocket
Courtesy of CHRYSLER LLC

CAUTION: The camshaft sprockets are keyed and not interchangeable from side to side because of the camshaft position sensor pick-up.

9. Push the camshaft back into the cylinder head and install the camshaft sprocket.
10. Install **NEW** sprocket attaching bolt into place. The 255 mm (10 in.) bolt is to be installed in the left camshaft and the 213 mm (8 3/8 in.) bolt is to be installed into the right camshaft. Counterhold the camshaft sprocket and tighten the camshaft sprocket bolt to 102 N.m (75 ft. lbs.) plus a 90° turn.

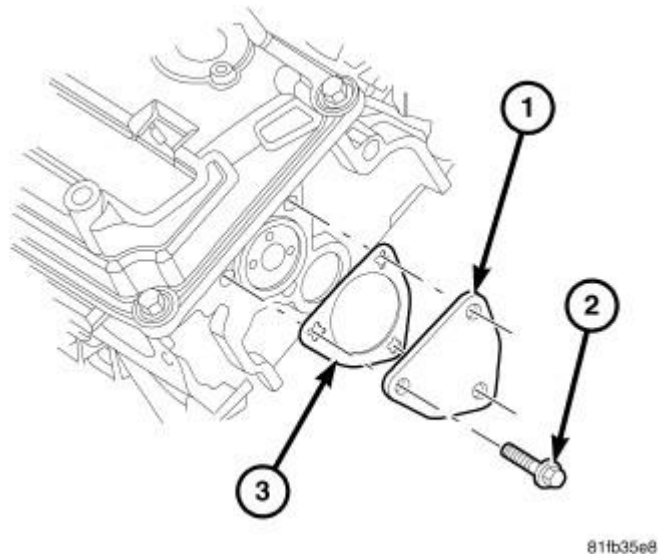
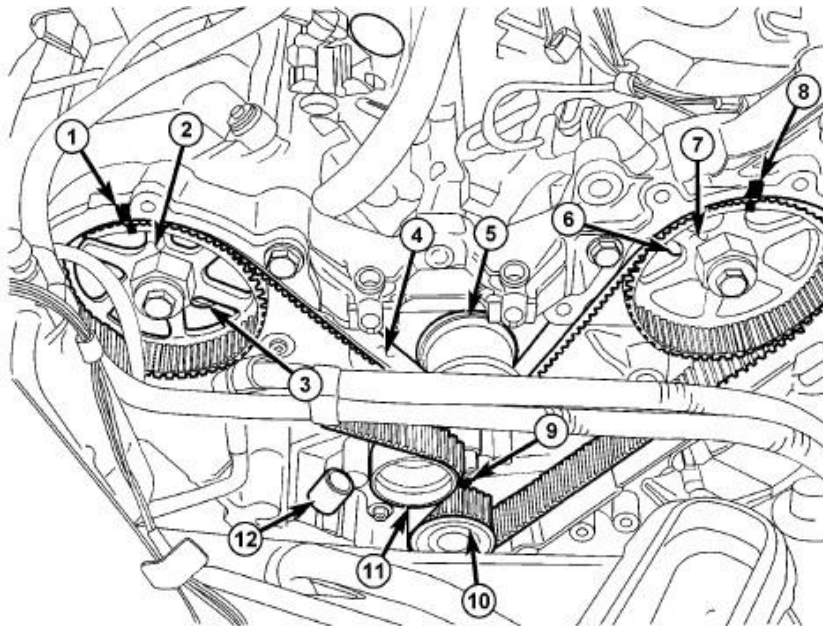


Fig. 220: Cam Thrust Plate Gasket
Courtesy of CHRYSLER LLC

11. Install the camshaft thrust plate (1) and gasket (3). Tighten three bolts (2) to 28 N.m (250 in. lbs.).



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Fig. 221: Identifying Timing Gear Marks
Courtesy of CHRYSLER LLC

12. Rotate the left camshaft gear (7) to align its timing mark (8). Verify that the right camshaft gear (2) timing mark (1) and crankshaft gear (10) timing mark (9) are still aligned.
13. Install the timing belt (4) starting at the crankshaft sprocket (10) going in a counterclockwise direction. Install the belt around the last sprocket. Maintain tension on the belt as it is positioned around the tensioner pulley (11).
14. Holding the tensioner pulley (11) against the belt, install the tensioner into the housing and tighten two bolts to 28 N.m (250 in. lbs.). Each camshaft sprocket mark should remain aligned with the cover marks.
15. When tensioner is in place pull retaining pin to allow the tensioner to extend to the tensioner pulley bracket.
16. Rotate crankshaft sprocket two revolutions and check the timing marks on the camshafts and crankshaft. The marks should line up within their respective locations. If marks do not line up, repeat procedure.

NOTE: With the camshaft gears in these positions the lobes are 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.

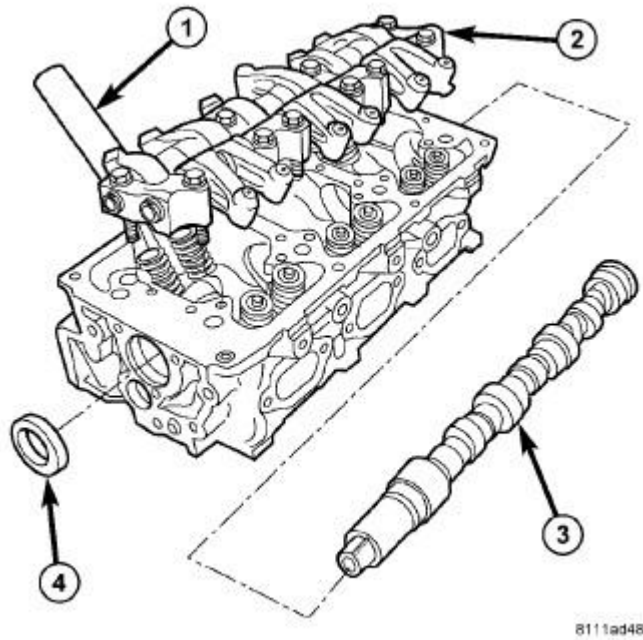


Fig. 222: Camshaft, Rocker Arm Assembly & Cylinder Head
Courtesy of CHRYSLER LLC

17. Install the rocker arm and shaft assembly (2) and ten bolts making sure that the identification marks face toward the front of engine for left head and toward the rear of the engine for right head.

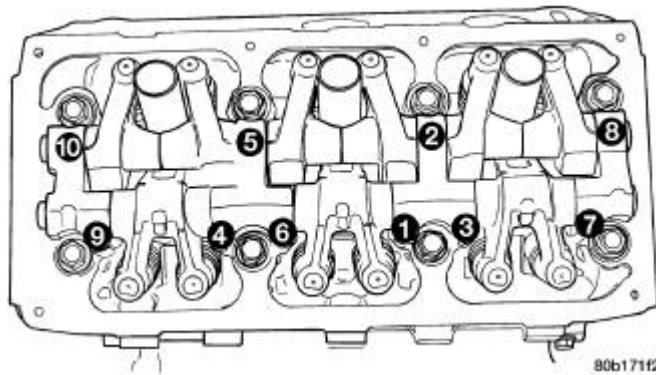
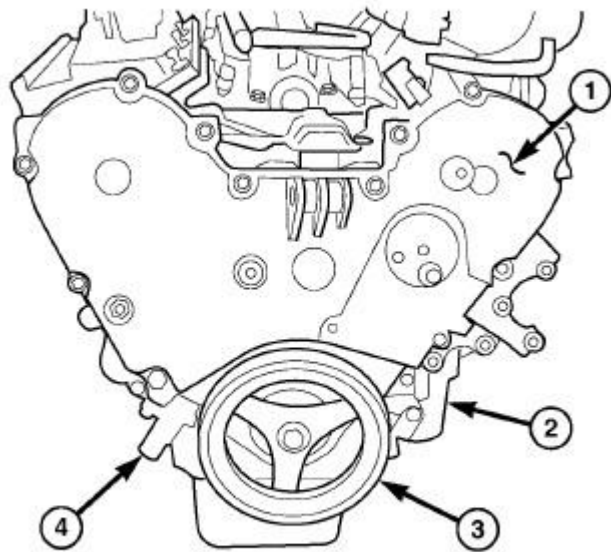


Fig. 223: Rocker Arm/Shaft Assembly Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

18. Tighten the ten rocker arm/shaft assembly bolts in sequence shown in illustration to 31 N.m (275 in. lbs.).
19. Install the left cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.
20. Install the left valve cover to cylinder head ground strap.

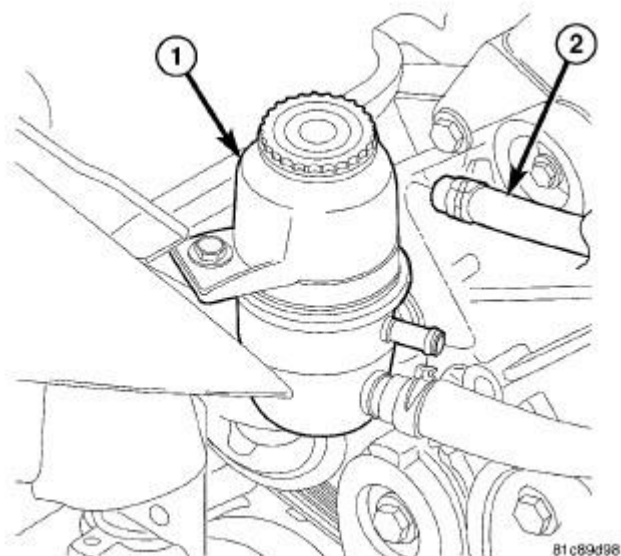


8111996d

Fig. 224: FRONT TIMING BELT COVER

Courtesy of CHRYSLER LLC

21. Install the front timing belt outer covers.
22. Tighten the timing cover bolts as follows:



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Fig. 225: Identifying Return Hose And Power Steering Fluid Reservoir

Courtesy of CHRYSLER LLC

- M6 bolts - 12 N.m (105 in. lbs.)
- M8 bolts - 28 N.m (250 in. lbs.)

- M10 bolts - 54 N.m (40 ft. lbs.)

23. Install the power steering reservoir (1). Tighten mounting nut to 12 N.m (9 ft. lbs.).

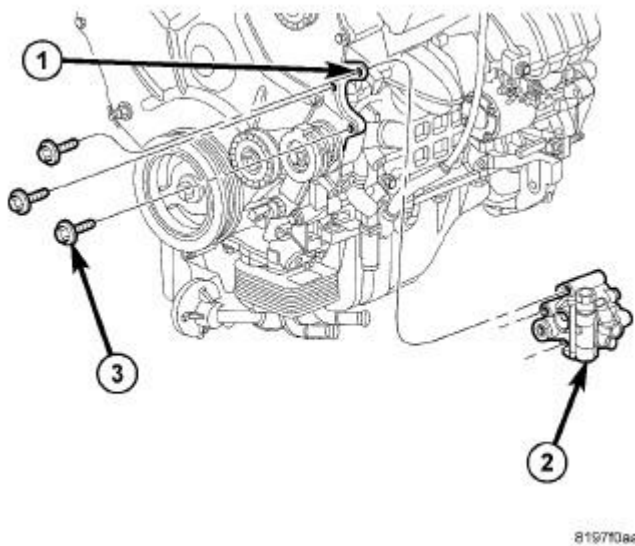


Fig. 226: Identifying Power Steering Pump Mounting And Bolts - 4.0L Engine
Courtesy of CHRYSLER LLC

24. Install the power steering pump (2). Refer to **Steering/Pump/PULLEY, Power Steering Pump - Installation** .

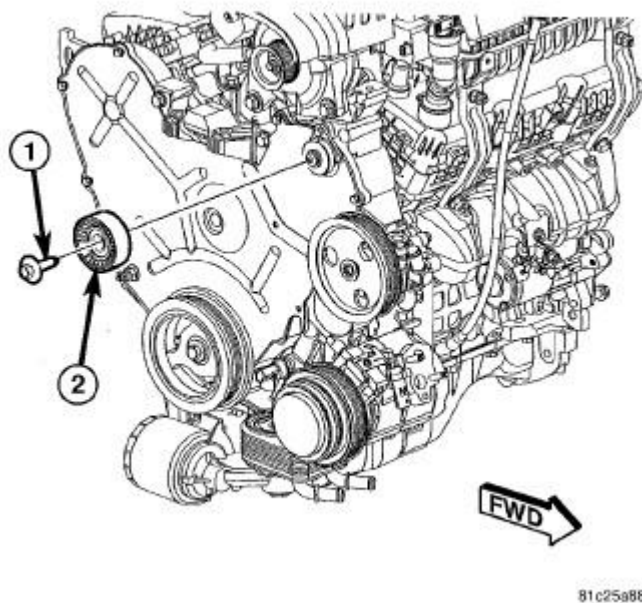


Fig. 227: Idler Pulley - 4.0L
Courtesy of CHRYSLER LLC

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

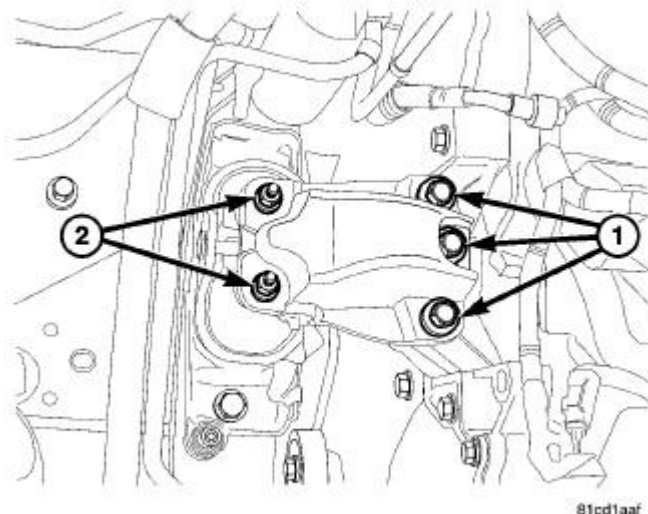


Fig. 228: Identifying Right Engine Mount-To-Engine Fasteners
Courtesy of CHRYSLER LLC

26. Install the upper engine mount. See **Engine/Engine Mounting/INSULATOR, Engine Mount - Installation.**

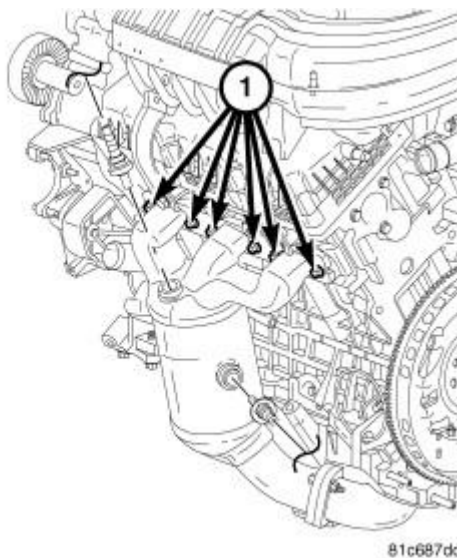


Fig. 229: Identifying Upper Exhaust Maniverter Retaining Bolts
Courtesy of CHRYSLER LLC

27. Install the left exhaust maniverter. See **Engine/Manifolds/MANIFOLD, Exhaust - Installation.**

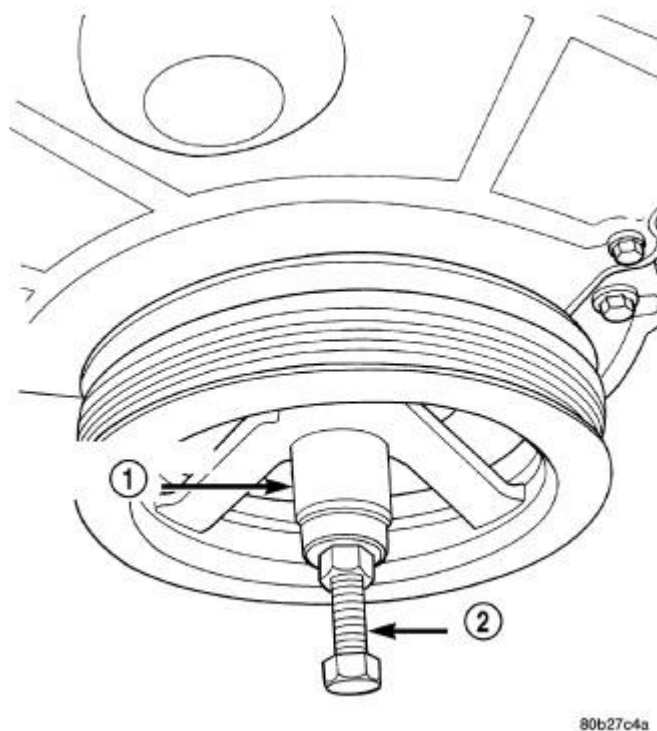


Fig. 230: Crankshaft Damper-Installation
Courtesy of CHRYSLER LLC

28. Install crankshaft damper using Forcing Screw C-4685-C1 (2), with Nut and Thrust Bearing from 6792, and 6792-1 Installer (1).

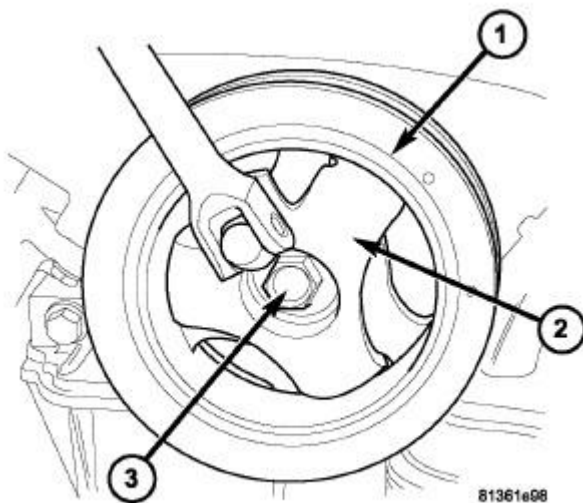


Fig. 231: DAMPER HOLDER
Courtesy of CHRYSLER LLC

29. Install crankshaft damper bolt (3). Tighten bolt to 95 N.m (70 ft. lbs.) while holding damper (1) with Damper Holding Fixture 9365 (2).

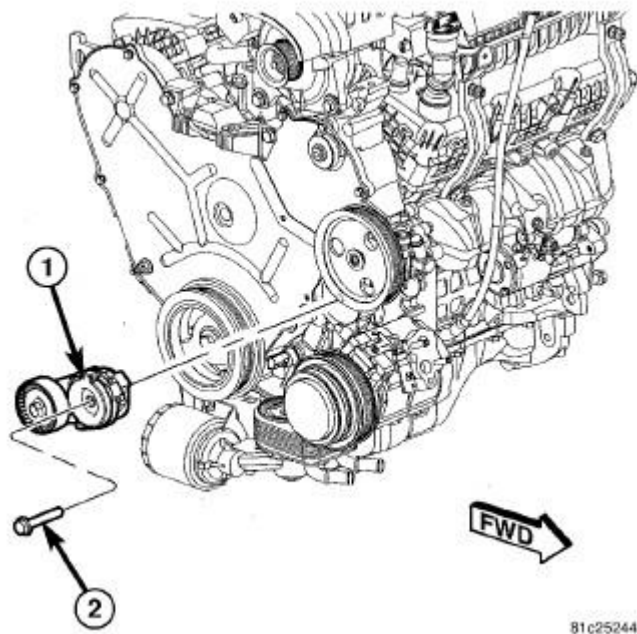


Fig. 232: Accessory Drive Belt Tensioner - 4.0L
Courtesy of CHRYSLER LLC

30. Install the accessory drive belt tensioner (1). Tighten bolt to 61 N.m (45 ft. lbs.).

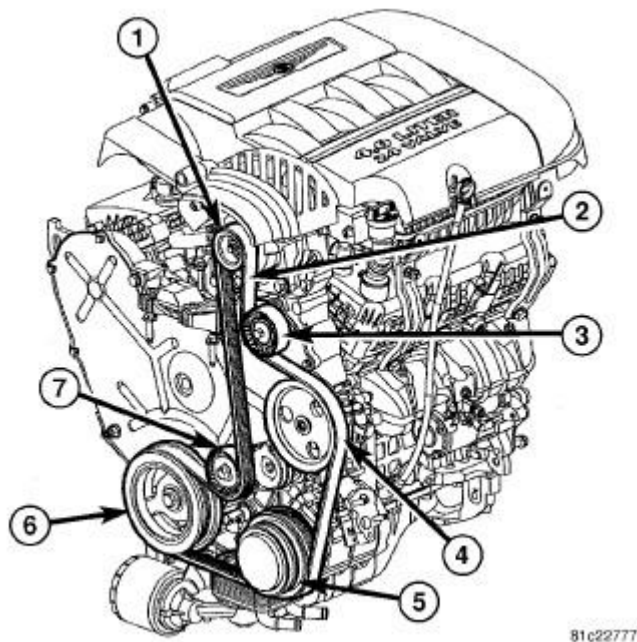


Fig. 233: Accessory Drive Belt - 4.0L
Courtesy of CHRYSLER LLC

31. Install the accessory drive belt (2). Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation** .

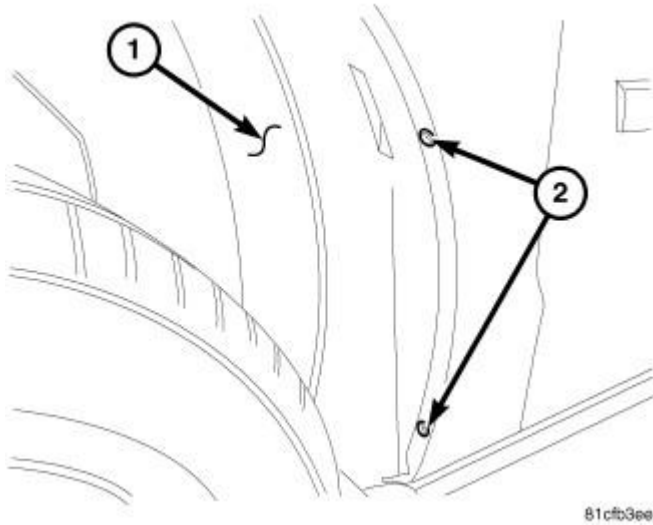


Fig. 234: Splash Shield Screws
Courtesy of CHRYSLER LLC

32. Install the right inner splash shield (1). Refer to **Body/Exterior/SHIELD, Splash - Installation** .
33. Install the right front tire. Refer to **Tires and Wheels - Installation** .
34. Lower the vehicle.

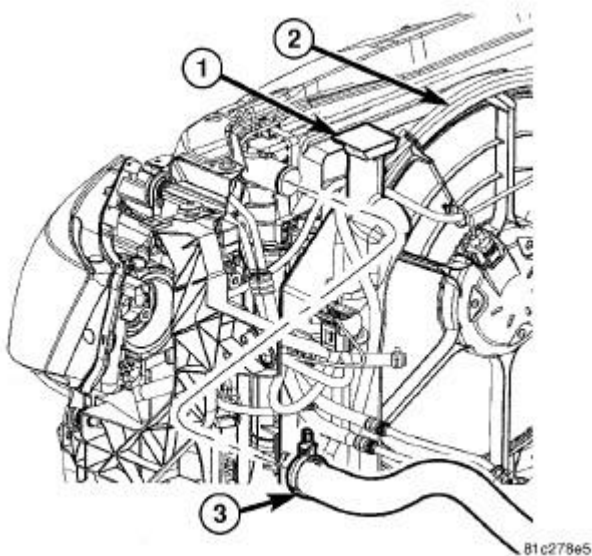
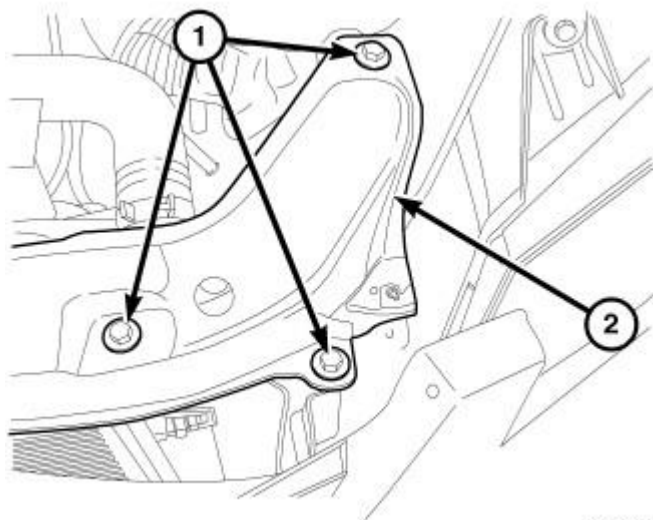


Fig. 235: Coolant Recovery Container, Radiator Fan & Hose
Courtesy of CHRYSLER LLC

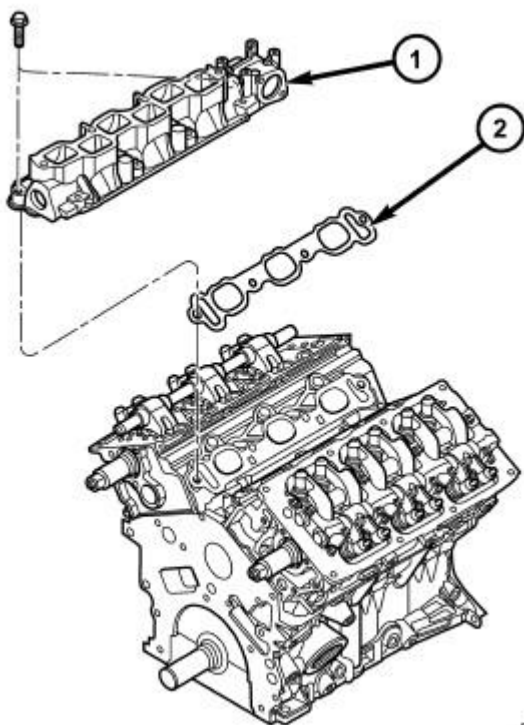
35. Install the coolant recovery container (1) and radiator fan assembly (2). Refer to **Cooling/Engine/FAN, Cooling - Installation** .



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Fig. 236: Crossmember Bolts
Courtesy of CHRYSLER LLC

36. Install the radiator crossmember (2). Refer to **Body/Exterior/CROSSMEMBER, Radiator - Installation** .



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Fig. 237: LOWER INTAKE MANIFOLD

Courtesy of CHRYSLER LLC

37. Install lower intake manifold (1) and fuel rail. See **Engine/Manifolds/MANIFOLD, Intake - Installation**.

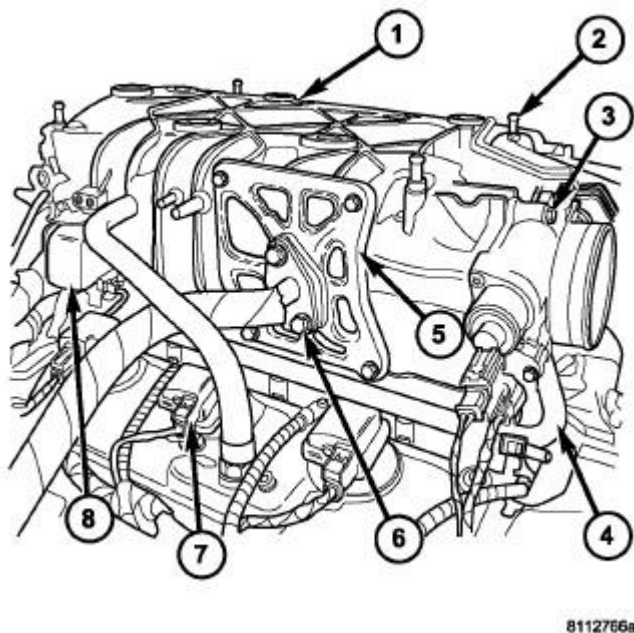


Fig. 238: Upper Intake Manifold - Right

Courtesy of CHRYSLER LLC

38. Install the upper intake manifold (1) including EGR tube. See **Engine/Manifolds/MANIFOLD, Intake - Installation**.

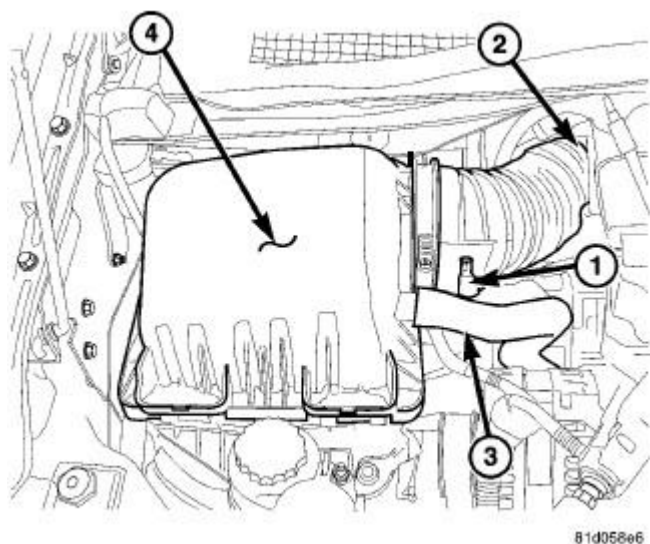


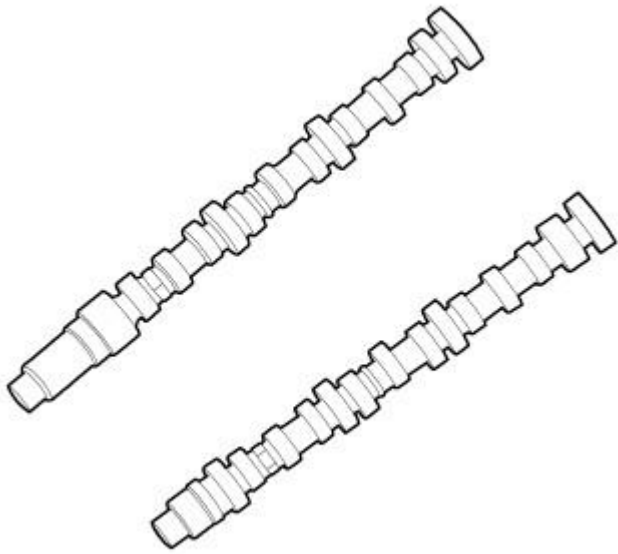
Fig. 239: Identifying Wiring Harness Connector, Throttle Body & Makeup Air Hose
Courtesy of CHRYSLER LLC

39. Install the air cleaner element housing. See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.
40. Install the engine cover.
41. Fill the coolant system. Refer to **Cooling - Standard Procedure** .
42. Connect the negative battery cable. Tighten nut to 4.5 N.m (40 in. lbs.).

CAMSHAFT, ENGINE

Description

DESCRIPTION

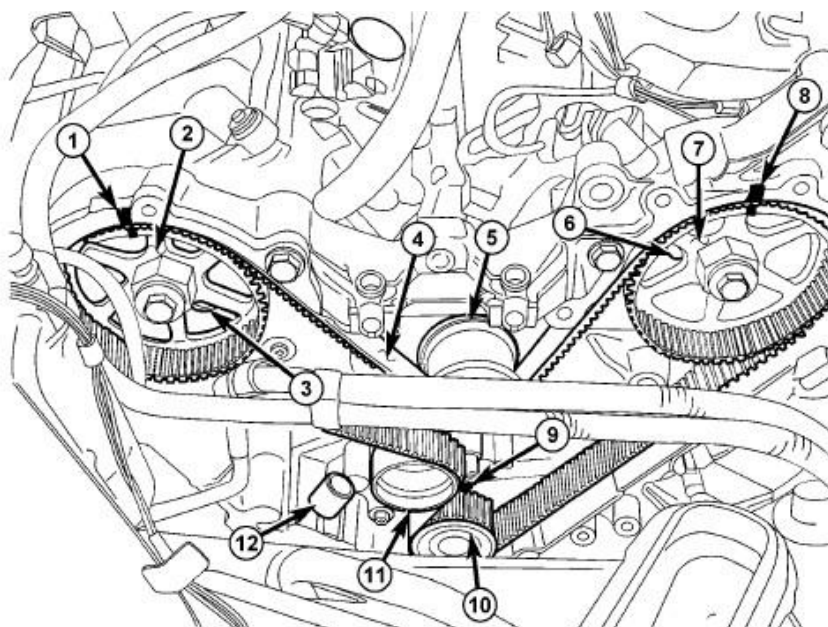


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Fig. 240: CAMSHAFTS**Courtesy of CHRYSLER LLC**

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**



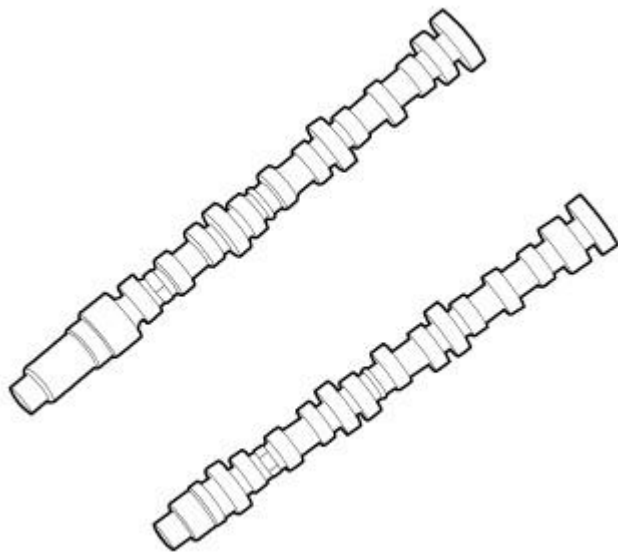
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Fig. 241: TIMING GEAR MARKS

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.



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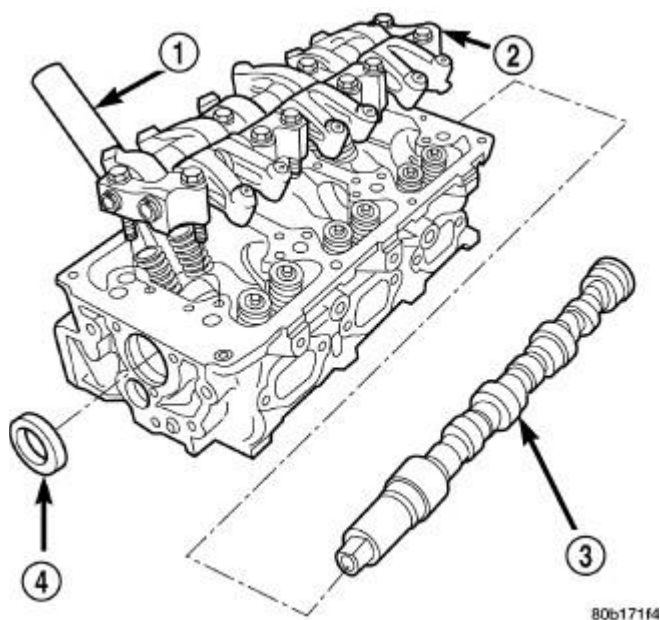
Fig. 242: CAMSHAFTS

Courtesy of CHRYSLER LLC

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

Removal

REMOVAL



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Fig. 243: Cylinder Head, Camshaft, and 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.

1. Remove the cylinder head. See Engine/Cylinder Head - Removal.

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

2. Remove the rocker arms. See Engine/Cylinder Head/ROCKER ARM, Valve - Disassembly.

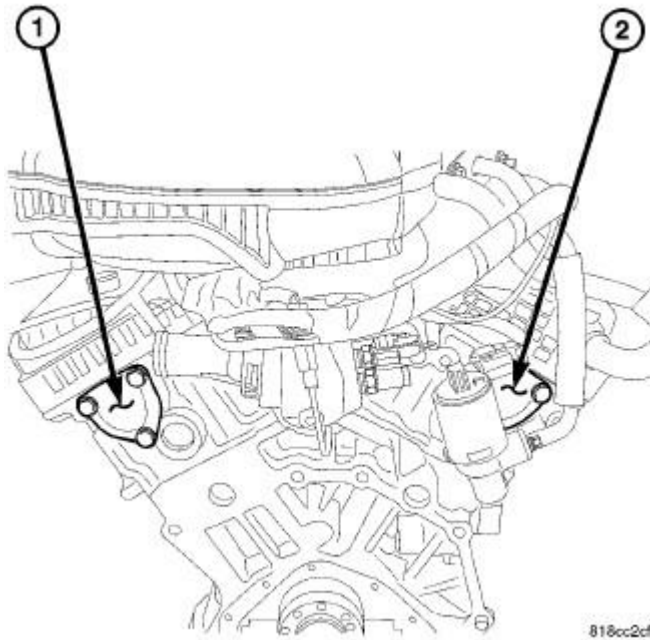


Fig. 244: CAMSHAFT THRUST PLATES
Courtesy of CHRYSLER LLC

3. Remove the camshaft thrust plate.
4. Carefully remove the camshaft from the rear of the cylinder head.

Inspection

INSPECTION

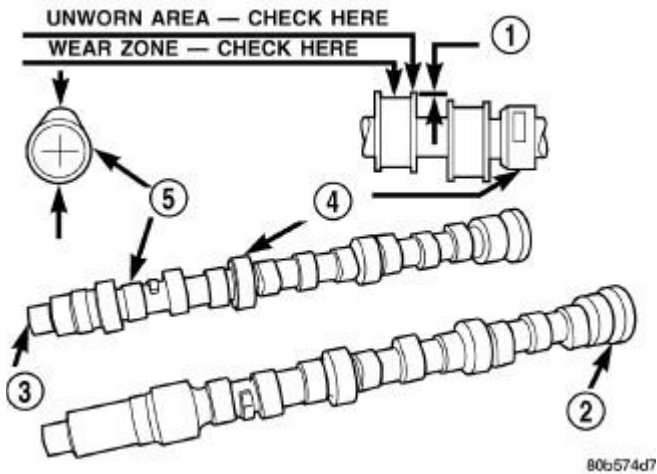


Fig. 245: Camshaft Inspection
Courtesy of CHRYSLER LLC

- 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

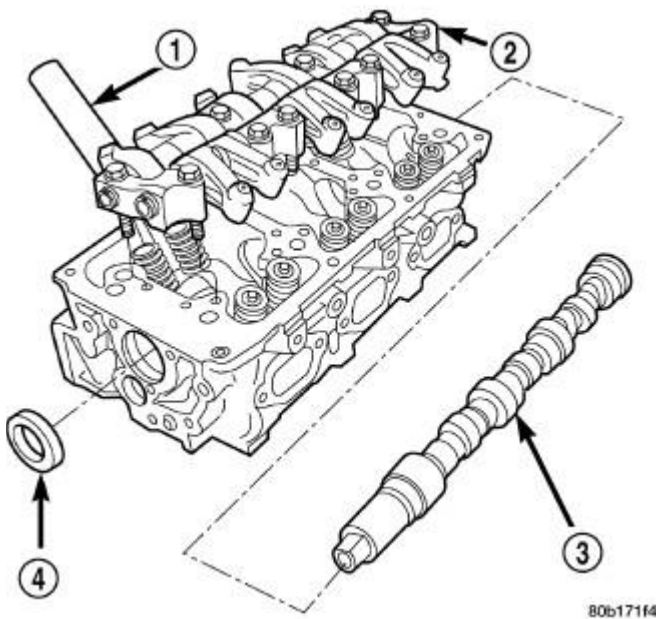


Fig. 246: Spark Plug Tube, Rocker Arm Assembly, Camshaft & Seal
Courtesy of CHRYSLER LLC

- 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.

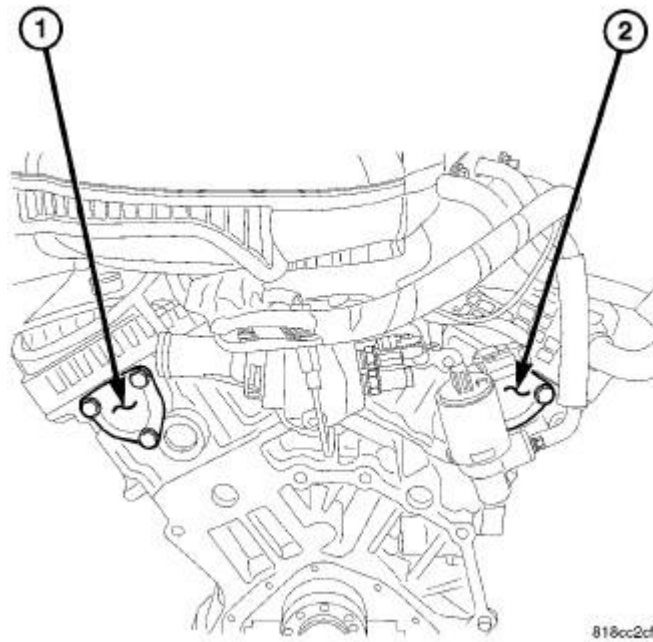


Fig. 247: CAMSHAFT THRUST PLATES

Courtesy of CHRYSLER LLC

2. Install the camshaft thrust plate, using new gasket. Torque fasteners to 28 N.m (250 in. lbs.).
3. Install the rocker arms. See **Engine/Cylinder Head/ROCKER ARM, Valve - Installation.**
4. Install the cylinder head. See **Engine/Cylinder Head - Installation.**

COVER(S), CYLINDER HEAD, LEFT

Removal

REMOVAL

WARNING: DO NOT START OR RUN ENGINE WITH CYLINDER HEAD COVER REMOVED FROM THE ENGINE. DAMAGE OR PERSONAL INJURY MAY OCCUR.

1. Disconnect and isolate the negative battery cable.
2. Remove the upper intake manifold from the engine. See **Engine/Manifolds/MANIFOLD, Intake - Removal.**
3. Cover lower intake manifold with a suitable cover during service.

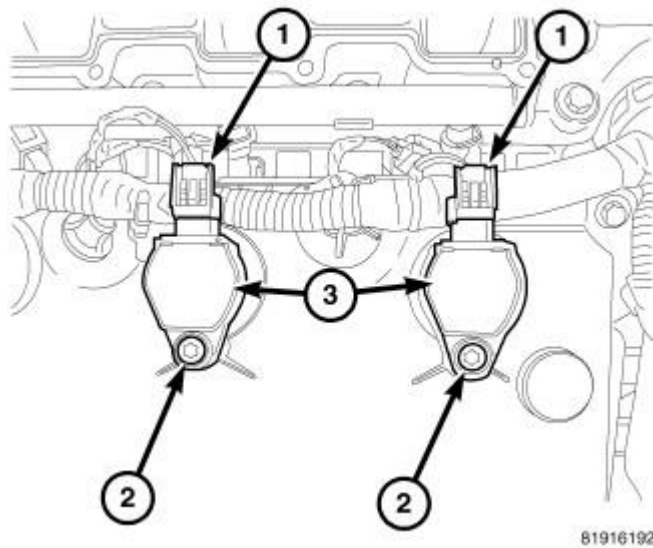


Fig. 248: Ignition Coils

Courtesy of CHRYSLER LLC

1 - ELECTRICAL CONNECTORS	3 - IGNITION COILS
2 - IGNITION COIL RETAINERS	-

4. Disconnect and remove the three ignition coils (3).
5. Remove the upper intake manifold support brackets from the engine.
6. Position the engine wiring harness aside.
7. Completely loosen the cylinder head cover retaining bolts and remove the cylinder head cover.
8. Disconnect the MVA hose from the valve cover assembly (if required).

Installation

INSTALLATION

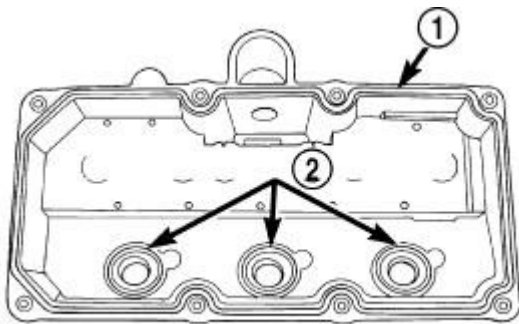


Fig. 249: Cylinder Head Cover Gasket and Spark Plug Tube Seals

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.

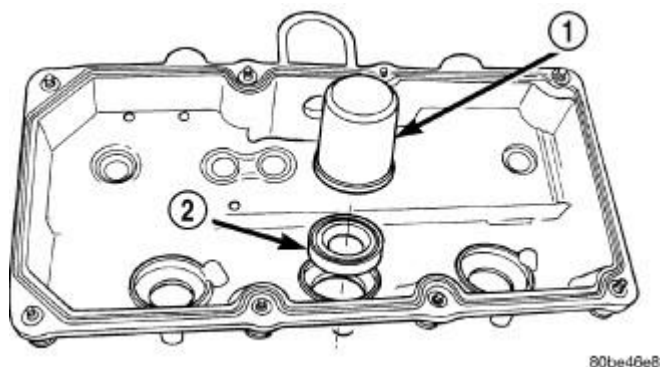


Fig. 250: Spark Plug Tube Seal Installation
Courtesy of CHRYSLER LLC

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

2. To replace spark plug tube seals:
 - a. Using a suitable pry tool, carefully remove tube seals.
 - b. Position new seal with the part number on seal facing cylinder head cover.
 - c. Install seals using Special Tool MD-998306.
3. Install cylinder head cover and bolts. Tighten to 10 N.m (90 in. lbs.).
4. Connect MVA hose (if required).
5. Position the wiring harness on the cylinder head cover.
6. Reclip the wire harness to the christmas tree attachment holes around the perimeter of the valve cover.
7. Install the upper intake manifold support brackets onto the front and rear of the engine.
8. Install the ignition coils. Tighten mounting screws to 6.7 N.m (60 in. lbs.).
9. Connect the ignition coil electrical connectors.
10. Install upper intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Installation**.
11. Connect negative battery cable.

COVER(S), CYLINDER HEAD, RIGHT

Removal

REMOVAL

WARNING: DO NOT START OR RUN ENGINE WITH CYLINDER HEAD COVER REMOVED FROM THE ENGINE. 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 with a suitable cover during service.

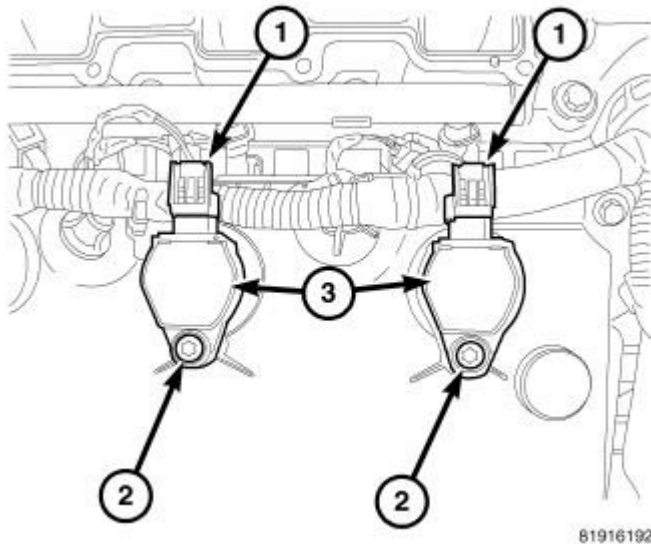


Fig. 251: Ignition Coils
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - ELECTRICAL CONNECTORS</p> <p>2 - IGNITION COILS</p> |
|--|

4. Disconnect and remove the three ignition coils.
5. Unclip the wire harness from the christmas tree attachment holes around the perimeter of the valve cover.
6. Completely loosen the cylinder head cover retaining bolts and remove the cylinder head cover.

Installation

INSTALLATION

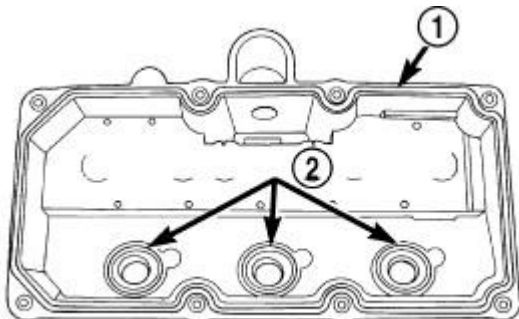


Fig. 252: Cylinder Head Cover Gasket and Spark Plug Tube Seals
Courtesy of CHRYSLER LLC

- | |
|---|
| 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. To replace spark plug tube seals:
 - a. Using a suitable pry tool, carefully remove tube seals.
 - b. Position new seal with the part number on seal facing cylinder head cover.
 - c. Install seals using Special Tool MD-998306 .

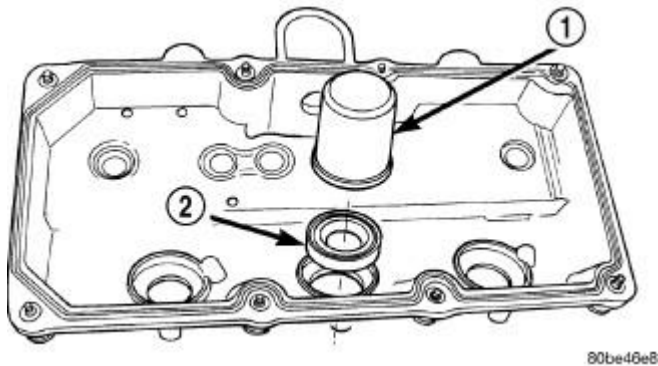


Fig. 253: Spark Plug Tube Seal Installation
Courtesy of CHRYSLER LLC

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

3. Install cylinder head cover bolts and tighten to 10 N.m (90 in. lbs.).
4. Reclip the wire harness to the christmas tree attachment holes around the perimeter of the valve cover. .
5. Install the ignition coils. Tighten mounting screws to 6.7 N.m (60 in. lbs.) .
6. Connect the ignition coil electrical connectors .
7. Install upper intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Installation.**
8. Connect negative battery cable.

ROCKER ARM, VALVE

Description

ROCKER ARM

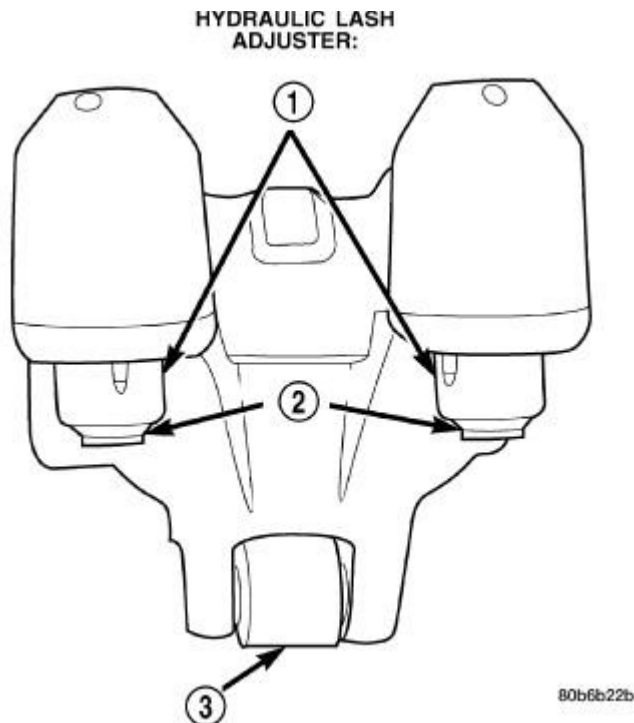


Fig. 254: Rocker Arm Assembly
Courtesy of CHRYSLER LLC

- 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

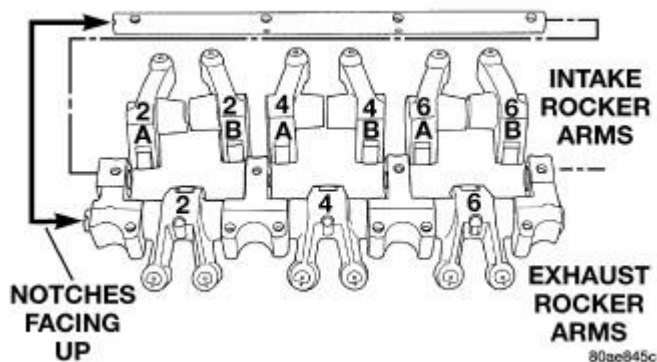


Fig. 255: Rocker Arms & Shafts
Courtesy of CHRYSLER LLC

The rocker arm shafts are tubular steel and are 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 Charts for Possible Causes and Correction of a lash adjuster (tappet) type noise.

LASH ADJUSTER (TAPPET) NOISE CHART (1 OF 2)

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 (2 OF 2)

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

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	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 <u>HYDRAULIC LASH ADJUSTER BLEEDING</u> 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 injected 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 injection.	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**

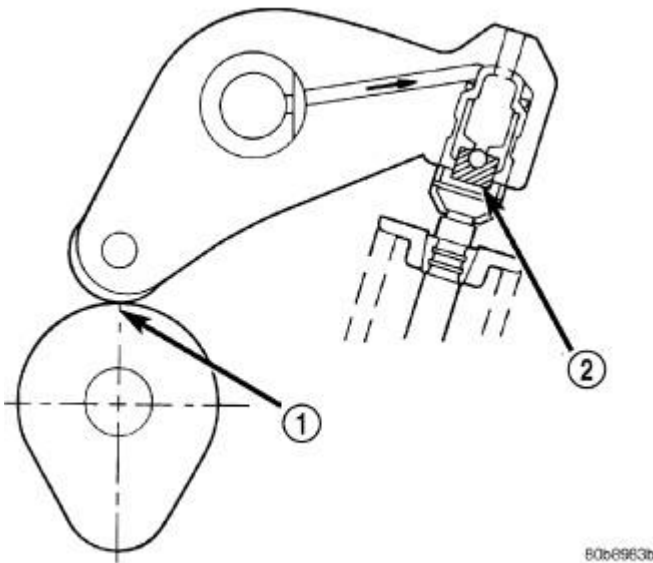


Fig. 256: Rocker Arm Positioned On Base Circle Of Camshaft
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - CAMSHAFT BASE CIRCLE
2 - HIGH-PRESSURE CHAMBER</p> |
|---|

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

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. Ensure the rocker arm is positioned on the base circle of the cam . Rotate engine as necessary.
4. For intake rocker arm positions:
 - a. Adjust Special Tool 8351 Release Probe's gauge pin to extend approximately 20 mm (0.787 in.). Then, carefully insert the release probe gauge pin into the lash adjuster service access hole .
 - b. Gently unseat lash adjuster's internal check ball.
 - c. While the internal check ball is held unseated, press the rocker arm into the valve tip, allowing the lash adjuster to fully collapse. Hold this fully collapsed position for about 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 probe 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).

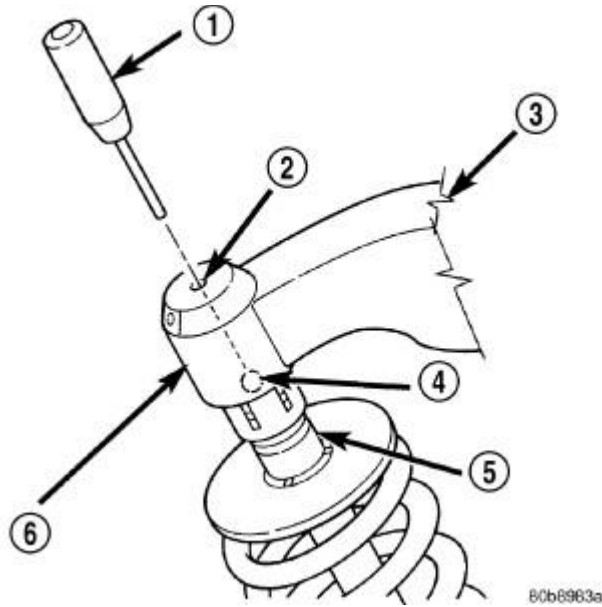


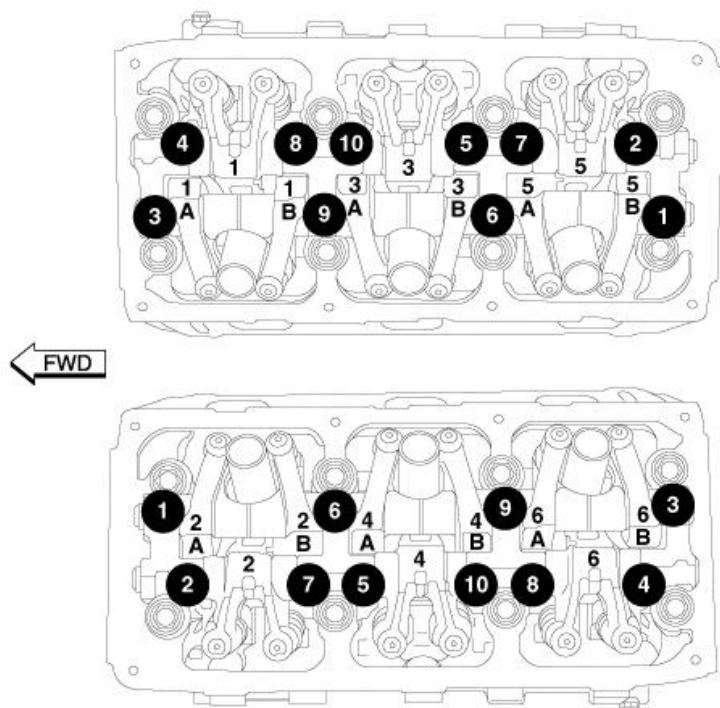
Fig. 257: Purging Air From Lash Adjuster
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - SPECIAL TOOL 8351
 2 - OIL AIR RELIEF SERVICE ACCESS HOLE
 3 - ROCKER ARM ASSY
 4 - INTERNAL CHECK BALL
 5 - VALVE TIP
 6 - HYDRAULIC LASH ADJUSTER WITHIN ROCKER ARM</p> |
|--|

5. For exhaust rocker arm positions:
 - a. Adjust Special Tool 8351 Release Probe gauge pin to extend approximately 20 mm (0.787 in.). Then, using two release probes, carefully insert gauge pins into the lash adjuster service access holes .
 - b. Gently unseat BOTH lash adjuster's internal check ball at the same time.
 - c. While the internal check ball is held unseated, press the rocker arm into the valve tip, allowing the lash adjuster to fully collapse. Hold this fully collapsed position for about 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 probes to allow check balls 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).
6. Install cylinder head cover(s).

Removal

REMOVAL



2557653

Fig. 258: Removing/Installing Rocker Arm Assembly Bolts In 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.

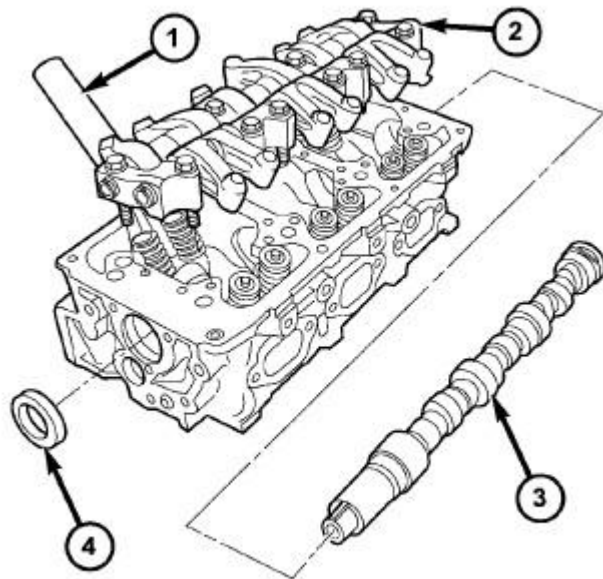


Fig. 259: CYLINDER HEAD, CAMSHAFT AND ROCKER ARM
Courtesy of CHRYSLER LLC

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

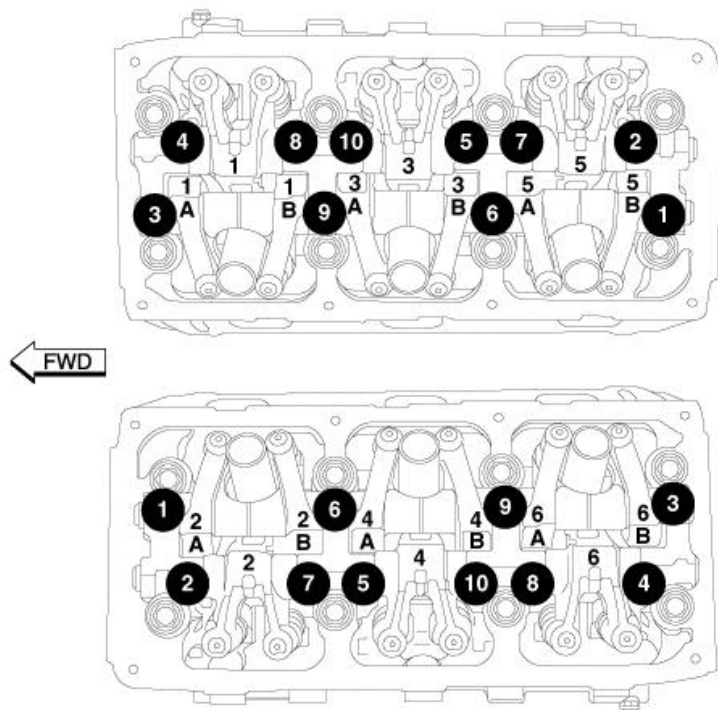
4. Remove the rocker arm assembly (2).

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



2557653

Fig. 260: Removing/Installing Rocker Arm Assembly Bolts In 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**.

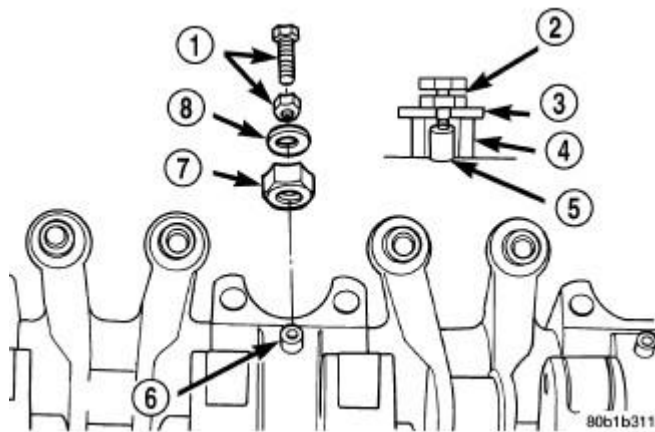
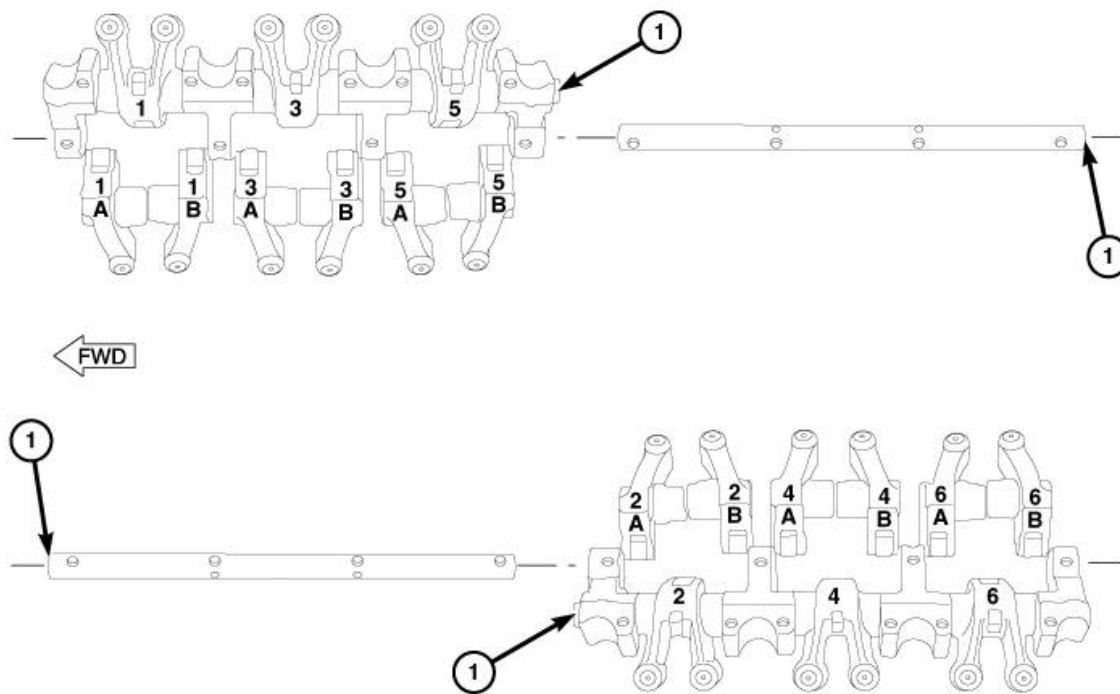


Fig. 261: Rocker Arms and Shaft - Disassembly
Courtesy of CHRYSLER LLC

- 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.



2557761

Fig. 262: Identification Marks
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

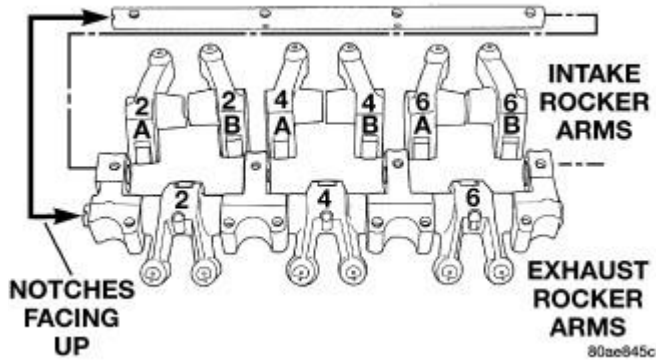


Fig. 263: Rocker Arms & Shafts
 Courtesy of CHRYSLER LLC

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 .

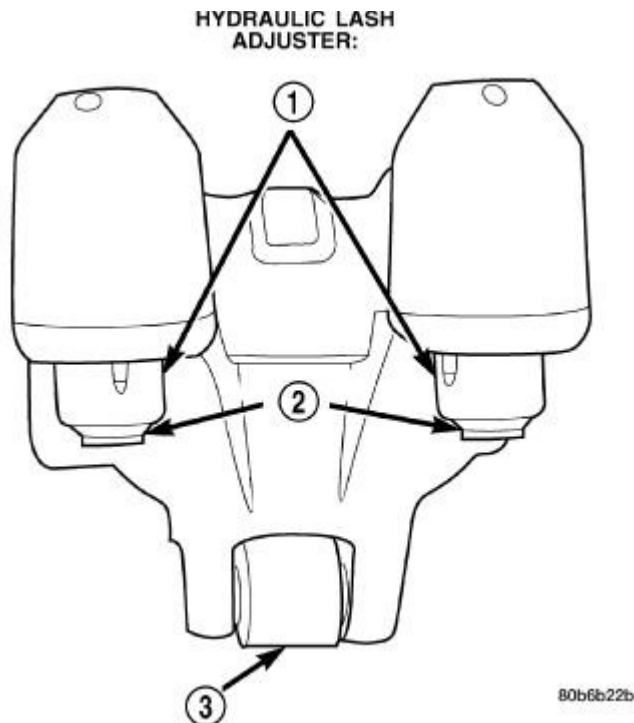


Fig. 264: Rocker Arm Assembly
Courtesy of CHRYSLER LLC

- 1 - RETAINER
- 2 - SWIVEL PAD
- 3 - ROLLER

Check rocker arms for wear or damage :

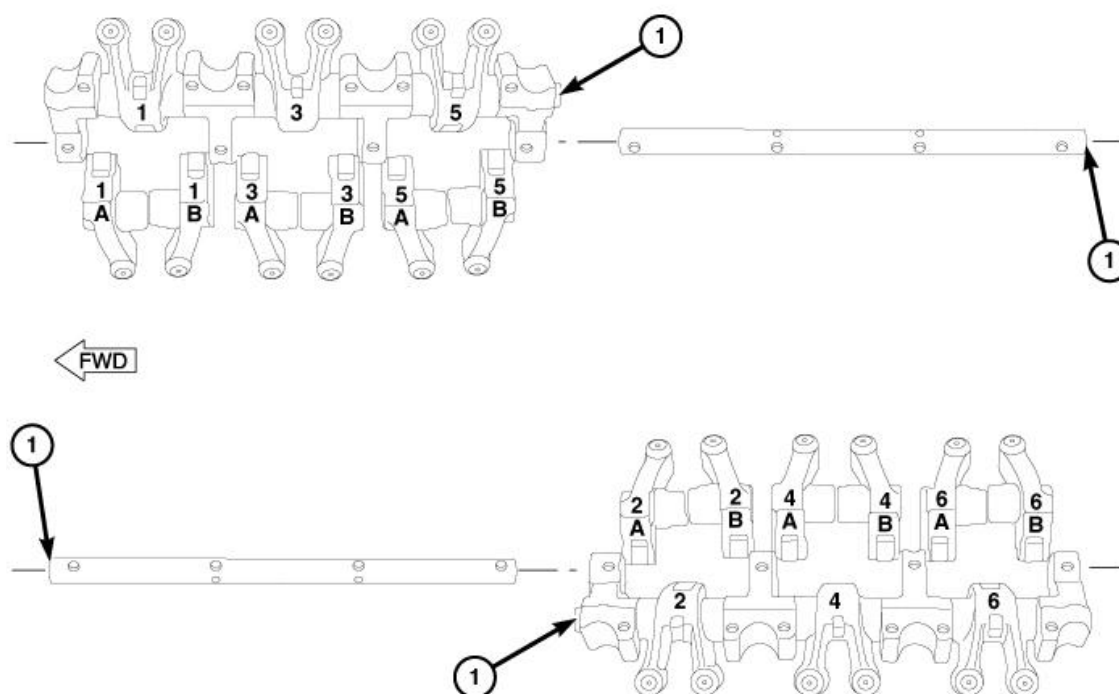
- Roller scuffing or wear
- Shaft bore scuffing or wear
- Swivel pad on lash adjuster missing or broken
- Rocker arm showing signs of fatigue or cracking
- Roller axle protruding from arm

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



2557761

Fig. 265: Identification Marks

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.

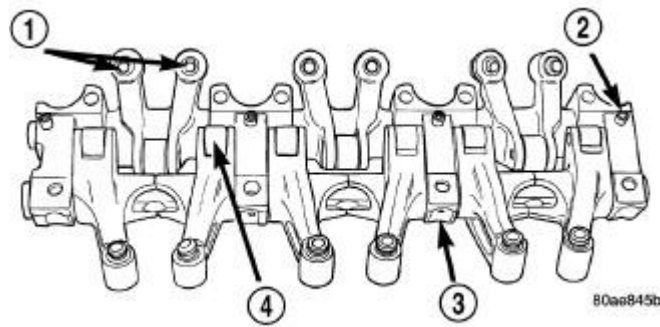


Fig. 266: Assemble Rocker Arms and Shaft
Courtesy of CHRYSLER LLC

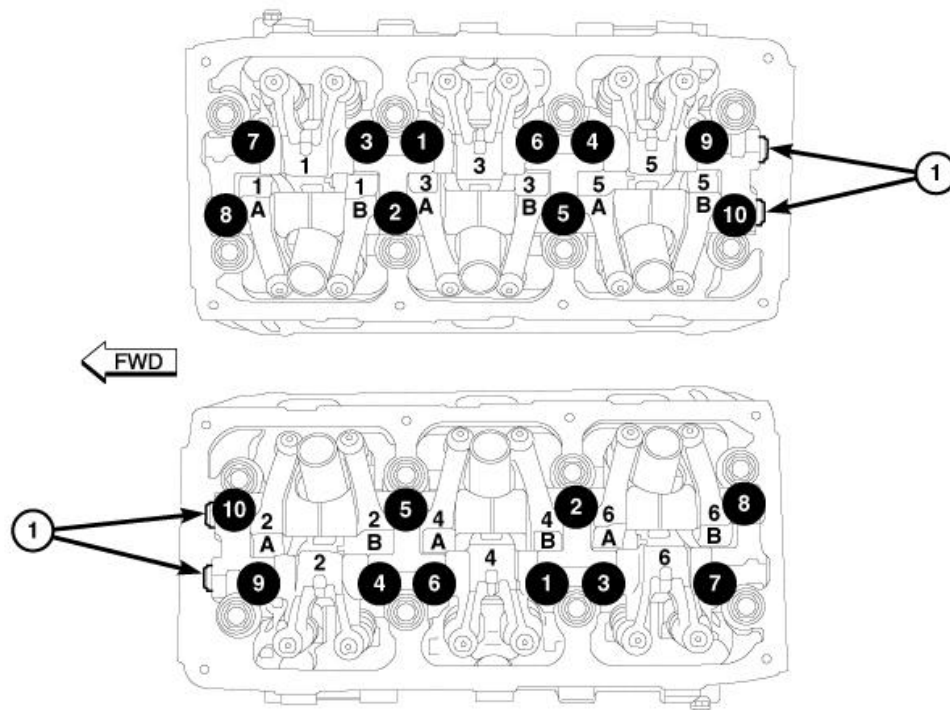
- | |
|---|
| 1 - HYDRAULIC LASH ADJUSTERS
2 - DOWEL PIN
3 - PEDESTAL
4 - ROLLER |
|---|

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



2557845

Fig. 267: Identification Marks (Notches) & Rocker Arm & Shaft Assembly Bolt Tightening Sequence
 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.

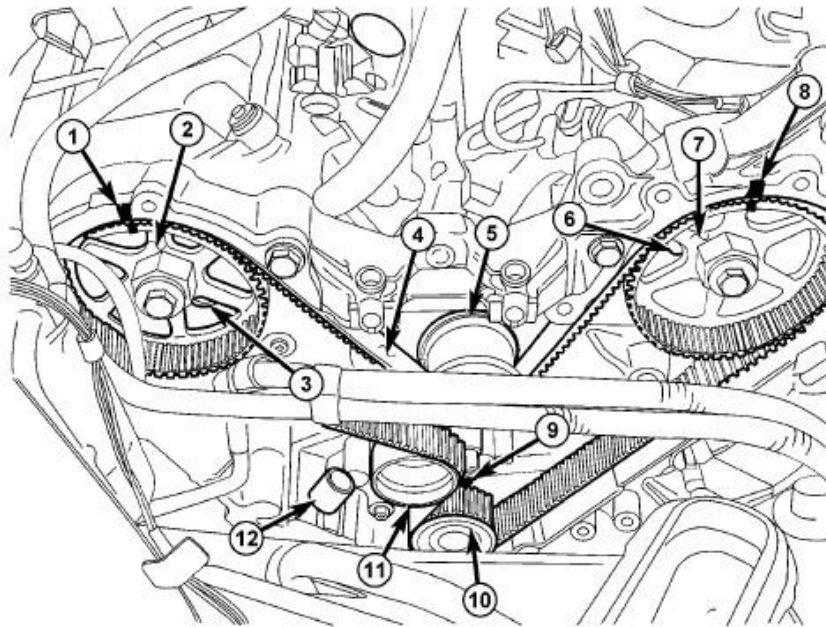
2. Install the rocker arm and shaft assembly making sure that the identification marks (1) face toward the front of engine for left head and toward the rear of the engine for right head.
3. Tighten the rocker arm/shaft assembly bolts in the sequence shown in illustration to 31 N.m (275 in. lbs.).
4.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

SEAL(S), CAMSHAFT

Removal

REMOVAL

RIGHT CYLINDER HEAD



8111ae99

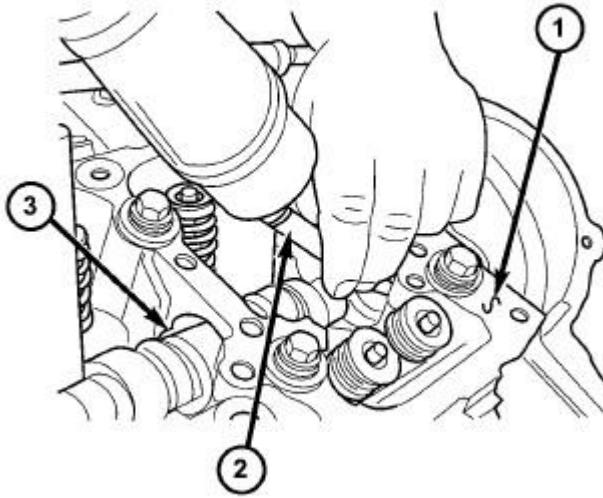
Fig. 268: Timing Gear Marks
Courtesy of CHRYSLER LLC

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

1. Disconnect the negative battery cable.
2. Remove front timing cover and align the camshaft gear and crankshaft gear timing marks to TDC. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal.**
3. Remove timing belt and right camshaft sprocket. Refer to **BELT and SPROCKETS, Timing.**
4. Remove the camshaft thrust plate from the rear of the cylinder head.
5. Remove the cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal.**
6. Remove the rocker arm assembly. See **Engine/Cylinder Head/ROCKER ARM, Valve - Removal.**
7. Maneuver the camshaft rearward and out of the cylinder head approximately 3.5 inches .

NOTE: Care must be taken not to damage the cylinder head to seal or camshaft journal surfaces when removing the camshaft seal.

8. Using an appropriate driver carefully remove camshaft oil seal .



81121/82

Fig. 269: Cylinder Head, Drift & Camshaft
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - CYLINDER HEAD
2 - DRIFT
3 - CAMSHAFT |
|--|

LEFT CYLINDER HEAD

1. Disconnect the negative battery cable.
2. Drain cooling system. Refer to **Cooling - Standard Procedure** .
3. Remove front timing cover and align the camshaft gear and crankshaft gear timing marks to TDC. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.
4. Remove the rear timing cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.
5. Remove the cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
6. Remove the rocker arm assembly. See **Engine/Cylinder Head/ROCKER ARM, Valve - Removal**.

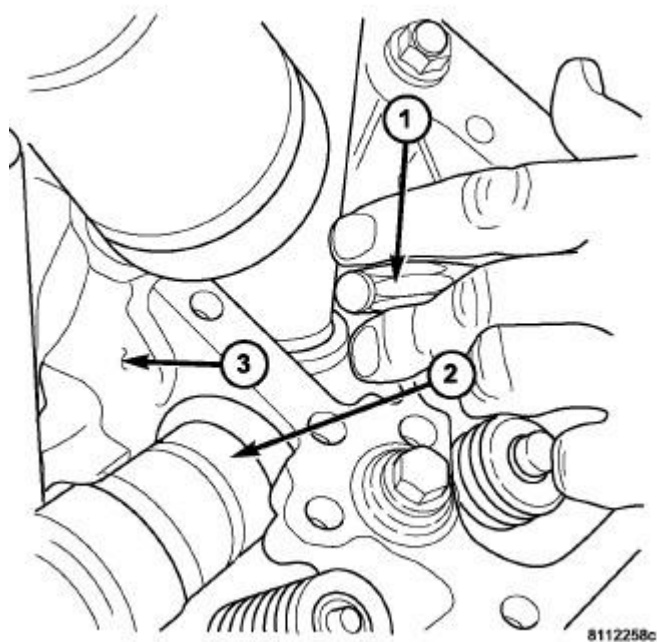


Fig. 270: Drift, Camshaft & Cylinder Head
Courtesy of CHRYSLER LLC

1 - DRIFT 2 - CAMSHAFT 3 - CYLINDER HEAD
--

7. Remove the camshaft thrust plate from the rear of the cylinder head.
8. Maneuver the camshaft rearward and out of the cylinder head approximately 3.5 inches

NOTE: Care must be taken not to damage the cylinder head to seal or camshaft journal surfaces when removing the camshaft seal.

9. Using an appropriate driver carefully remove camshaft oil seal .

Installation

INSTALLATION

RIGHT CYLINDER HEAD

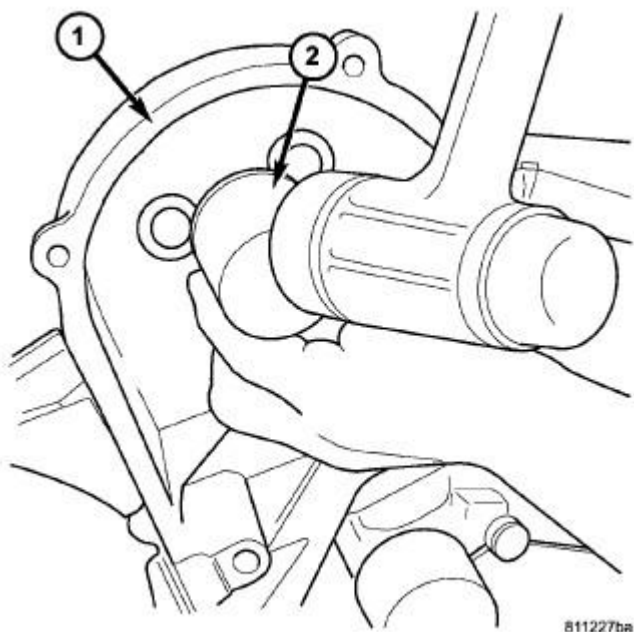
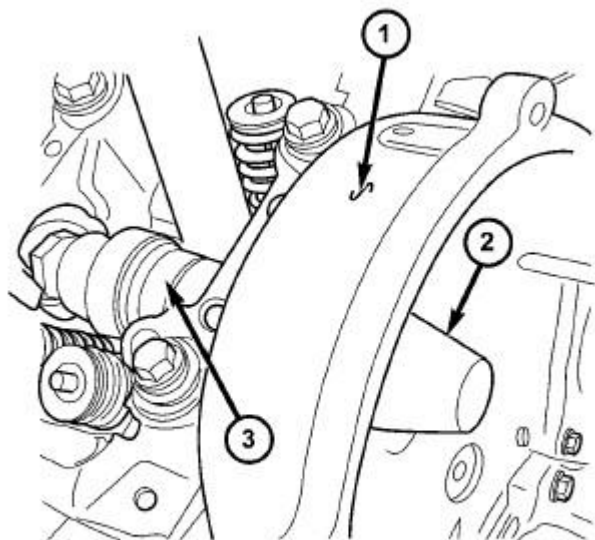


Fig. 271: Rear Timing Cover & Special Tool 6788
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - REAR TIMING COVER
2 - SPECIAL TOOL 6788 |
|--|

1. Position the camshaft seal into the cylinder head .
2. Using special tool MD-998306 tap the seal into place .
3. Apply light coat of clean engine oil to the camshaft oil seal lip and Special Tool 6788 Seal Protector Sleeve.
4. Install oil seal Special Tool 6788 Seal Protector Sleeve onto the camshaft .



8112283b

Fig. 272: Rear Timing Cover, Special Tool 6788 & Camshaft
Courtesy of CHRYSLER LLC

1 - REAR TIMING COVER 2 - SPECIAL TOOL 6788 3 - CAMSHAFT
--

5. Slide the camshaft forward, inserting the seal protector through the camshaft seal until the camshaft seats .
6. Remove Special Tool 6788 from the camshaft.
7. Install the camshaft thrust plate with new gasket, to the rear of the cylinder head.
8. Install camshaft sprocket and timing belt. Refer to **BELT and SPROCKETS, Timing.**

LEFT CYLINDER HEAD

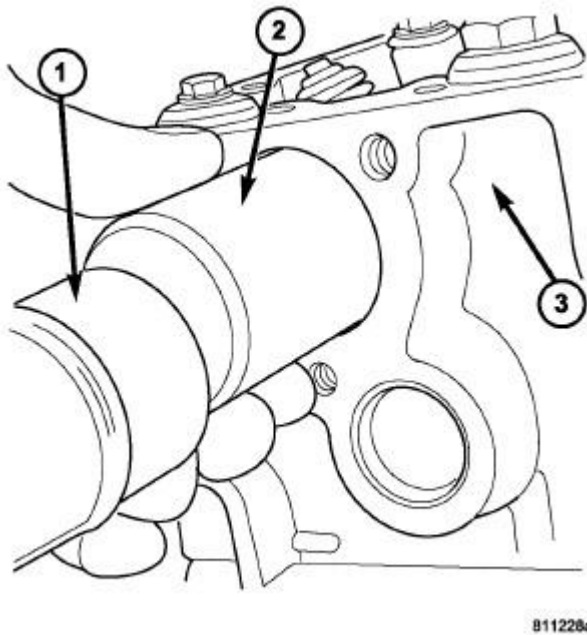


Fig. 273: Cylinder Head & MD-998306
Courtesy of CHRYSLER LLC

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

1. Position the camshaft seal into the cylinder head
2. Using special tool MD-998306 tap the seal into place .
3. Apply light coat of engine oil to the camshaft oil seal lip and Special Tool 6788 Seal Protector Sleeve.
4. Install oil seal Special Tool 6788 Seal Protector Sleeve onto the camshaft
5. Slide the camshaft forward, inserting the seal protector through the camshaft seal until the camshaft seats .

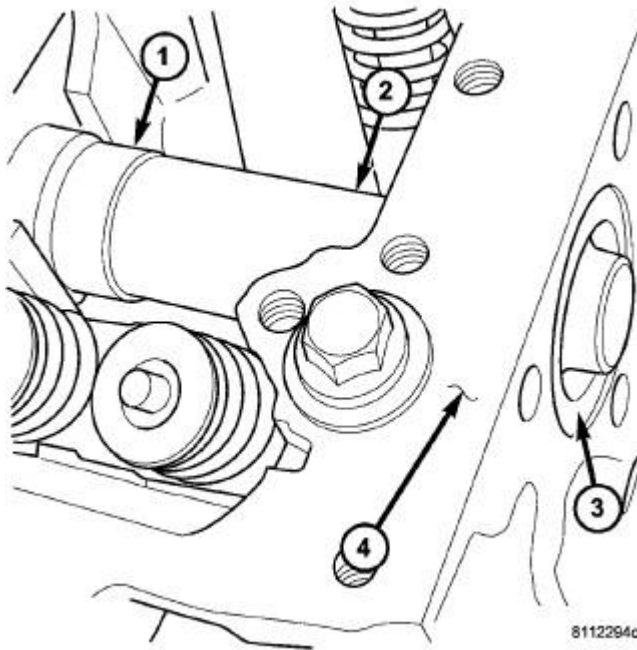


Fig. 274: Camshaft, Special Tool 6788, Camshaft Seal & Cylinder Head
 Courtesy of CHRYSLER LLC

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

6. Remove Special Tool 6788 from the camshaft.
7. Install the camshaft thrust plate with new gasket, to the rear of the cylinder head.
8. Install rear timing belt cover. See Engine/Valve Timing/COVER(S), Engine Timing - Installation.
9. Install the camshaft gear and align the timing marks.
10. Install the timing belt. Refer to BELT and SPROCKETS, Timing.
11. Install the rocker arm assembly.
12. Install the cylinder head cover.
13. Install the front timing belt cover. See Engine/Valve Timing/COVER(S), Engine Timing - Installation.
14. Install the vibration damper. See Engine/Engine Block/DAMPER, Vibration - Installation.
15. Fill cooling system. Refer to Cooling - Standard Procedure.
16. Connect the negative battery cable.

SEAL(S), VALVE GUIDE

Removal

REMOVAL

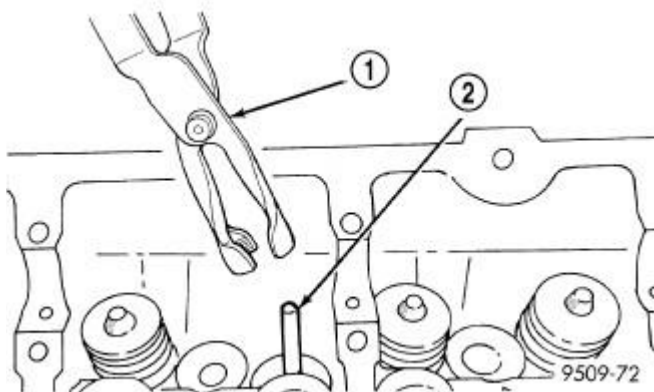


Fig. 275: Valve Stem Seal - Removal

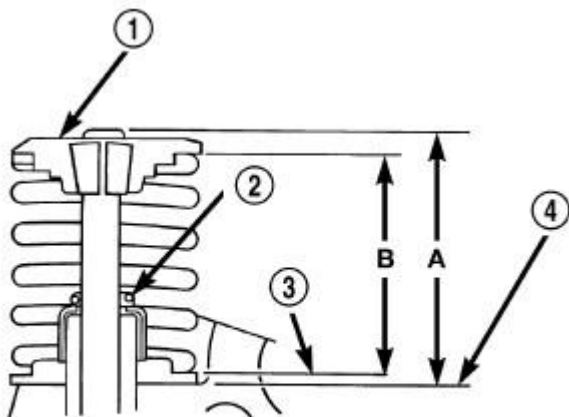
Courtesy of CHRYSLER LLC

- 1 - VALVE SEAL TOOL
- 2 - VALVE STEM

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

Installation

INSTALLATION



80570e02

Fig. 276: Checking Valve Tip Height and 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

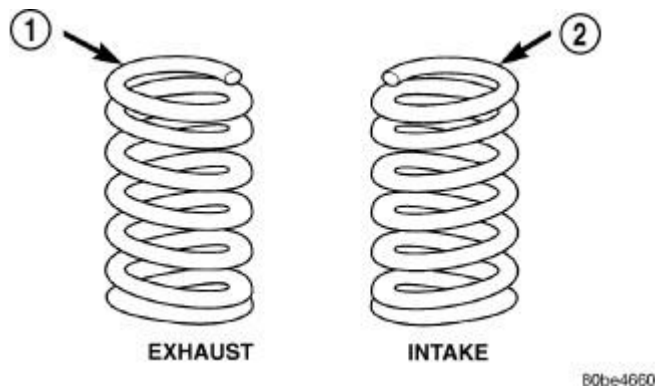


Fig. 277: Valve Spring Identification

Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - YELLOW OR WHITE DYE</p> <p>2 - ORANGE DYE</p> |
|--|

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

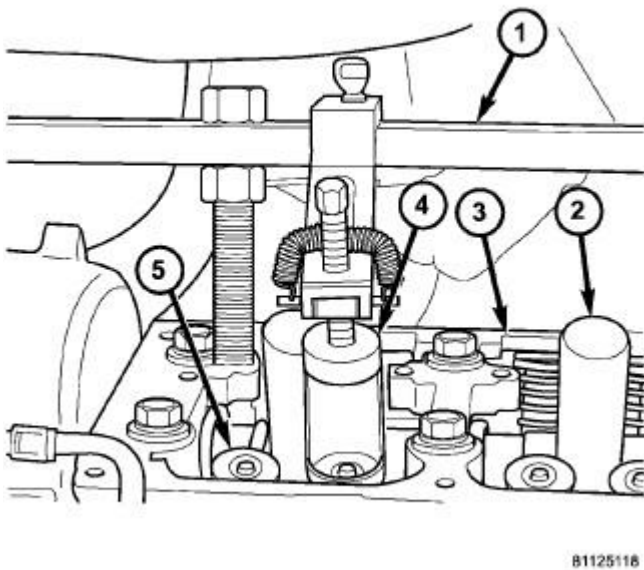
OPERATION

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

81125118

Fig. 278: Valve Spring Removal/Installation
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

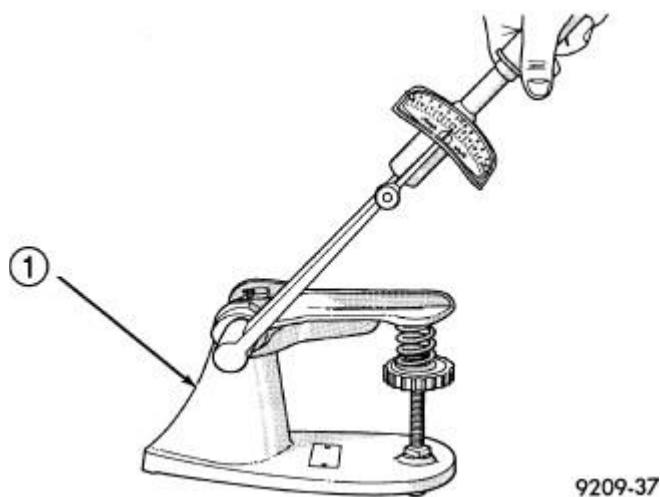


Fig. 279: Testing Valve Spring
Courtesy of CHRYSLER LLC

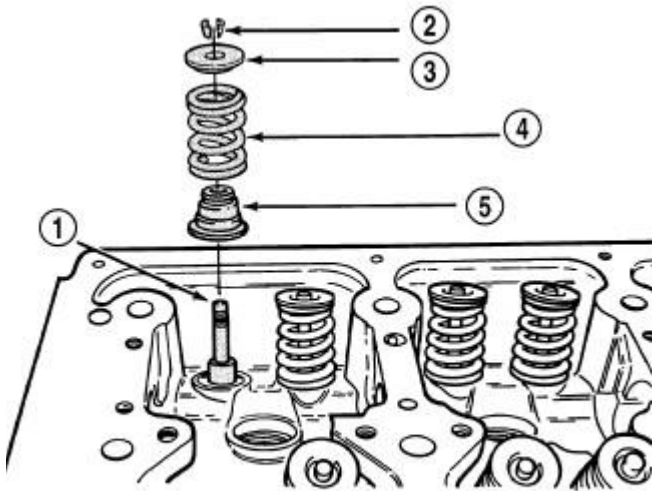
1 - SPECIAL TOOL C-647

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. See Engine - Specifications. Replace

springs that do not meet specifications.

Installation

CYLINDER HEAD OFF

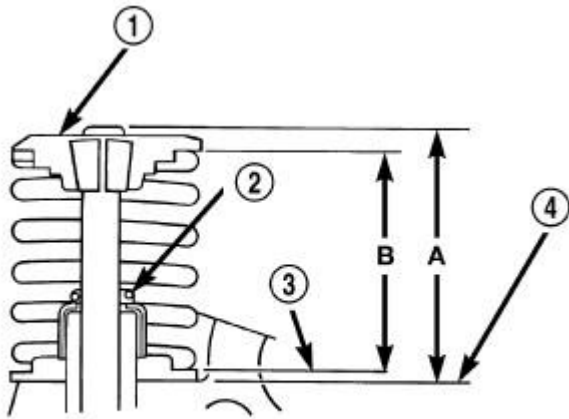


9309-150

Fig. 280: Valve Seal and 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.



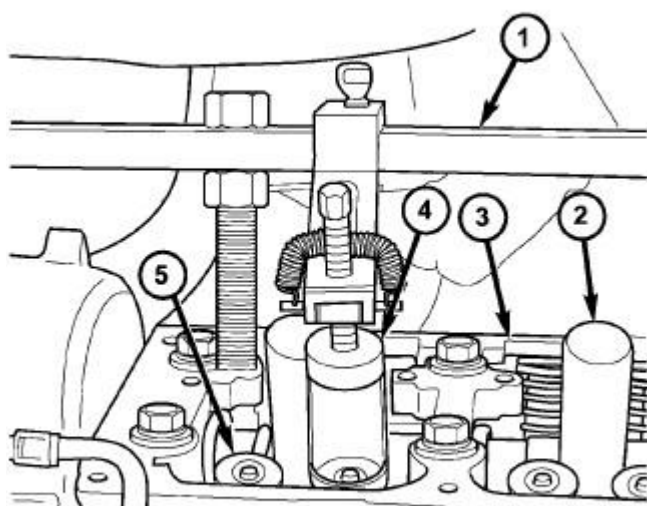
80570e02

Fig. 281: Checking Valve Tip Height and 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



81125118

Fig. 282: Valve Spring Removal/Installation

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

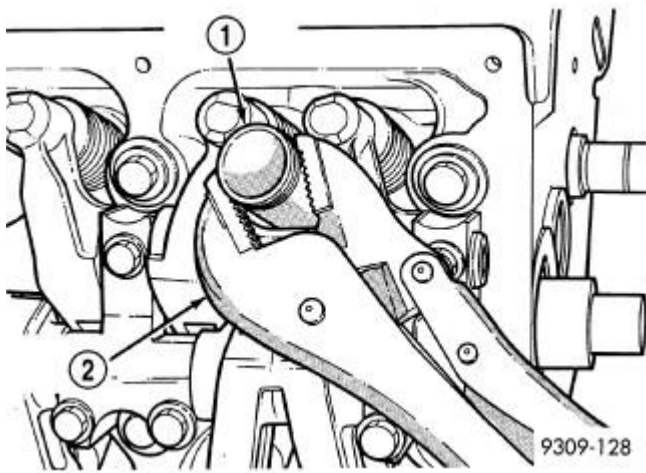


Fig. 283: Servicing Spark Plug Tubes
Courtesy of CHRYSLER LLC

- | |
|---|
| 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 from the cylinder head and discard tube.
3. Clean area around spark plug with Mopar® Parts Cleaner or equivalent.

Installation

INSTALLATION

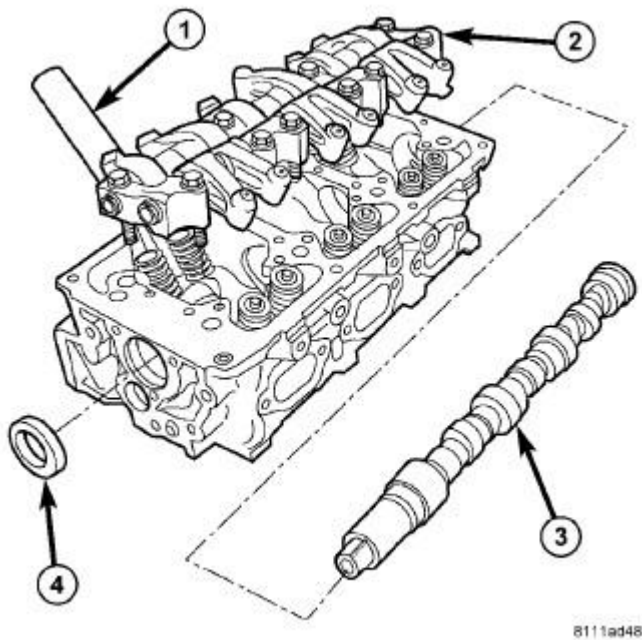


Fig. 284: Spark Plug Tube, Rocker Arm Assembly, Camshaft & Seal
Courtesy of CHRYSLER LLC

- 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

The valve face and valve seat angles are shown in illustration .

VALVES

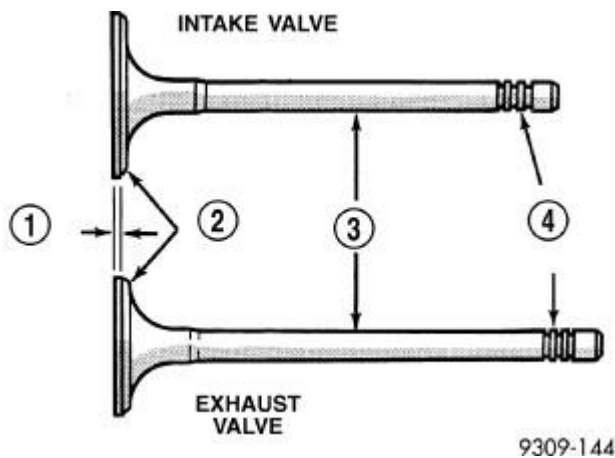


Fig. 285: Intake & Exhaust Valves
Courtesy of CHRYSLER LLC

- | |
|--|
| 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 reseating 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.

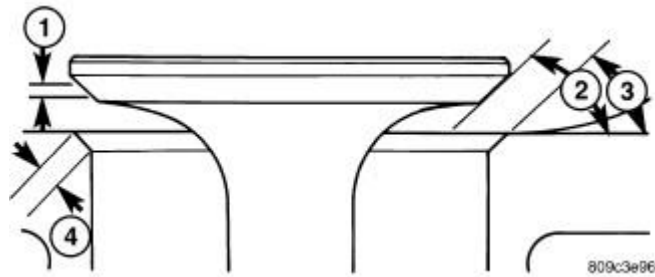


Fig. 286: Valve Face & Seat
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - SEAT WIDTH
2 - FACE ANGLE
3 - SEAT ANGLE
4 - SEAT CONTACT AREA</p> |
|---|

- 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 cylinder head must be replaced.

- 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

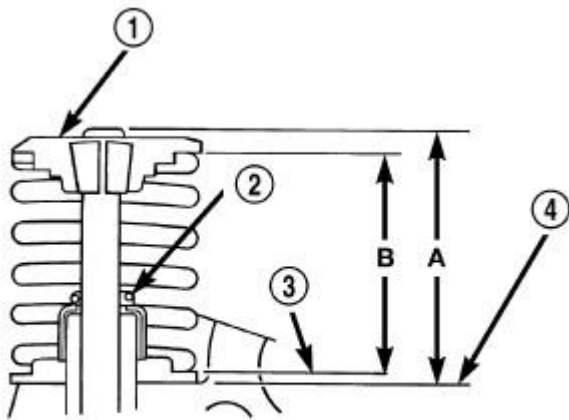
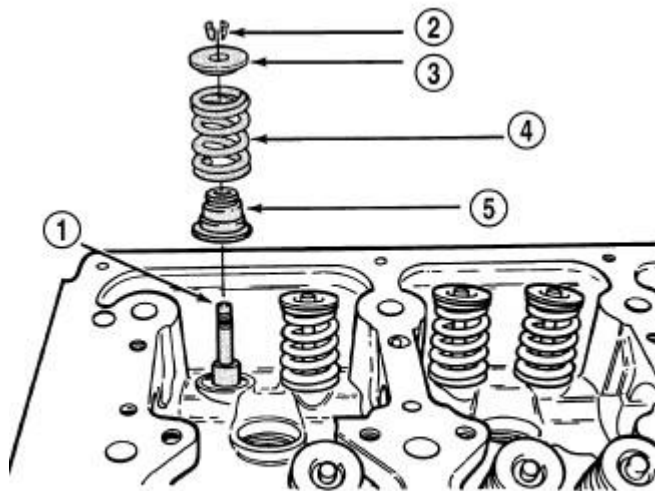


Fig. 287: Checking Valve Tip Height and Valve Spring Installed Height

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 them in 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.

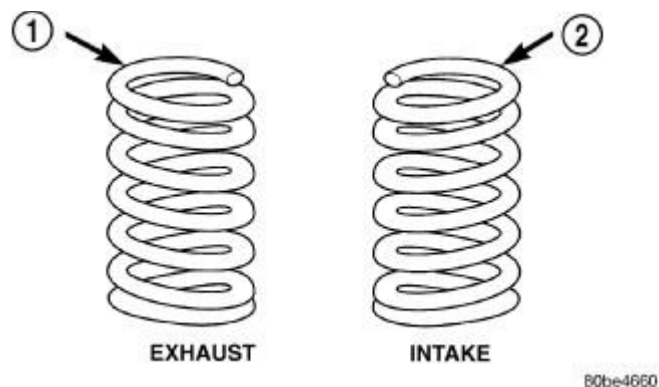


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Fig. 288: Valve Seal and Spring-Installation
Courtesy of CHRYSLER LLC

- 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 rubber 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. 289: 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**

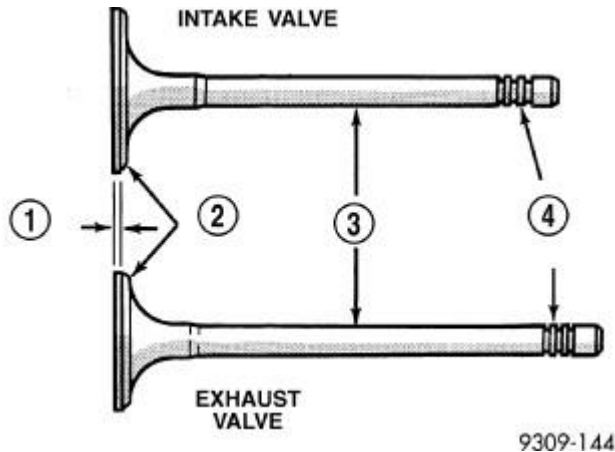


Fig. 290: Intake & Exhaust Valves
Courtesy of CHRYSLER LLC

- 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

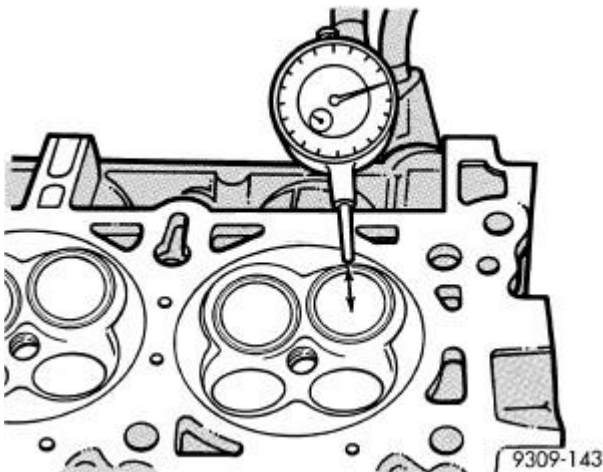


Fig. 291: Measuring Valve Guide Wear
Courtesy of CHRYSLER LLC

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

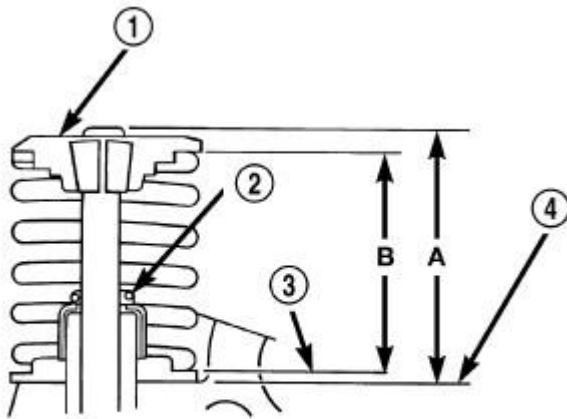
be used to hold valve in place.

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. 292: Checking Valve Tip Height and Valve Spring Installed Height
Courtesy of CHRYSLER LLC

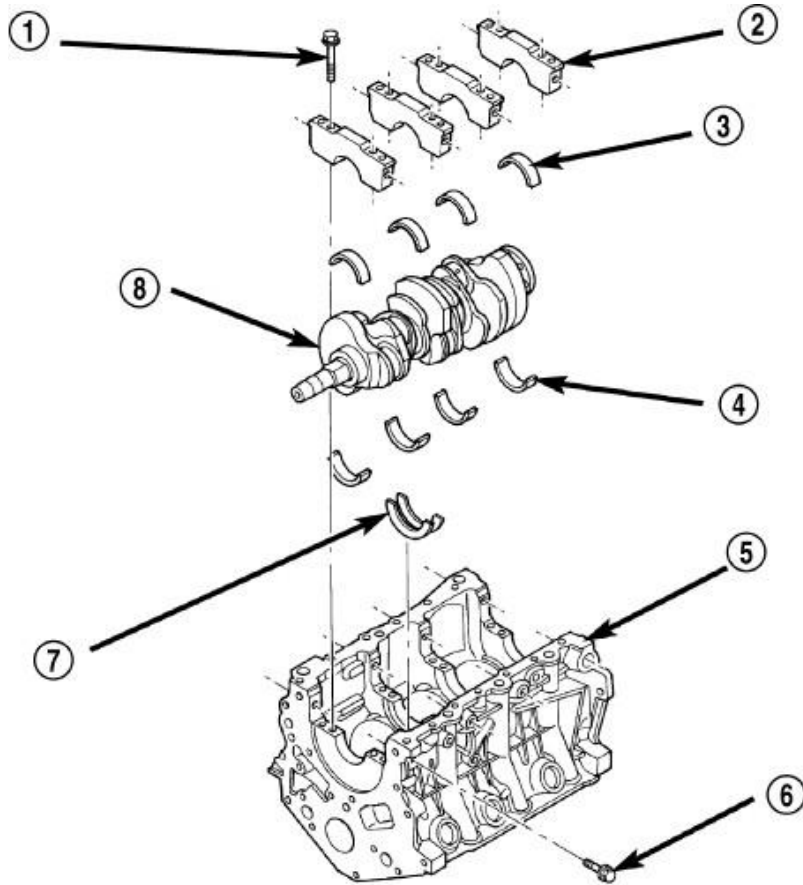
- 1 - SPRING RETAINER
- 2 - GARTER SPRING
- 3 - VALVE SPRING SEAT TOP
- 4 - CYLINDER HEAD SURFACE

1. Coat valve stems with clean engine oil and insert them in 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



80bdcd82

Fig. 293: Cylinder Block & Crankshaft
Courtesy of CHRYSLER LLC

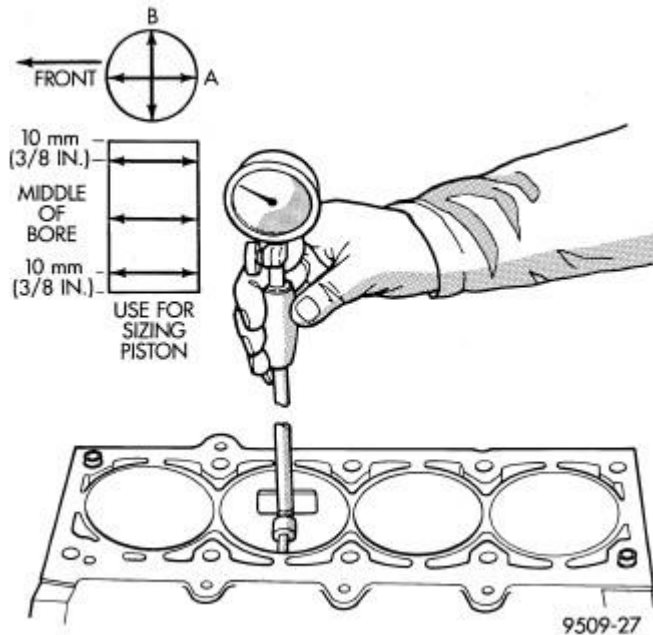
1 - MAIN CAP BOLT - VERTICAL	5 - CYLINDER BLOCK
2 - MAIN CAP	6 - MAIN CAP BOLT - HORIZONTAL
3 - MAIN BEARING - LOWER	7 - CRANKSHAFT THRUST WASHER
4 - MAIN BEARING - UPPER	8 - CRANKSHAFT

The cylinder block 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****Fig. 294: Cylinder Bore Measurement**

Courtesy of CHRYSLER LLC

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

CYLINDER BORE

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

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

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

BEARING(S), CONNECTING ROD

Standard Procedure

CONNECTING RODS AND BEARINGS

CONNECTING ROD BEARINGS

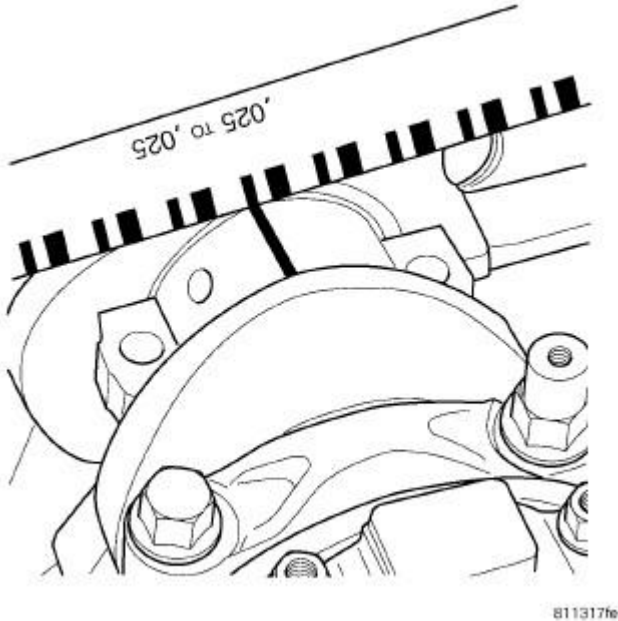


Fig. 295: CONNECTING ROD BEARING CLEARANCE
Courtesy of CHRYSLER LLC

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. See **Engine - Specifications**.

SELECT FIT ROD BEARINGS

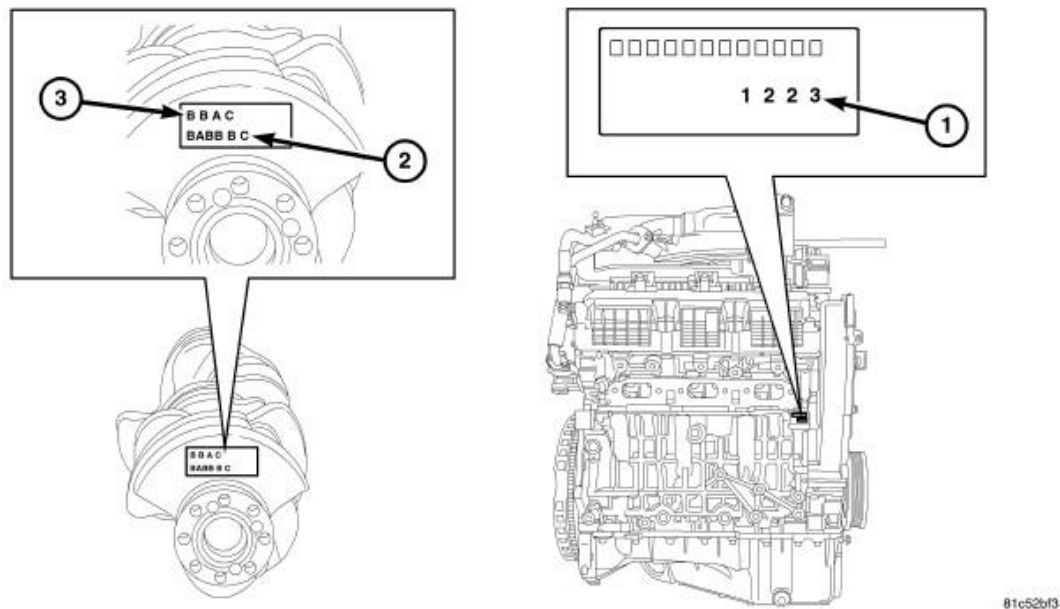


Fig. 296: Main Bearing & Rod Bearing Codes
Courtesy of CHRYSLER LLC

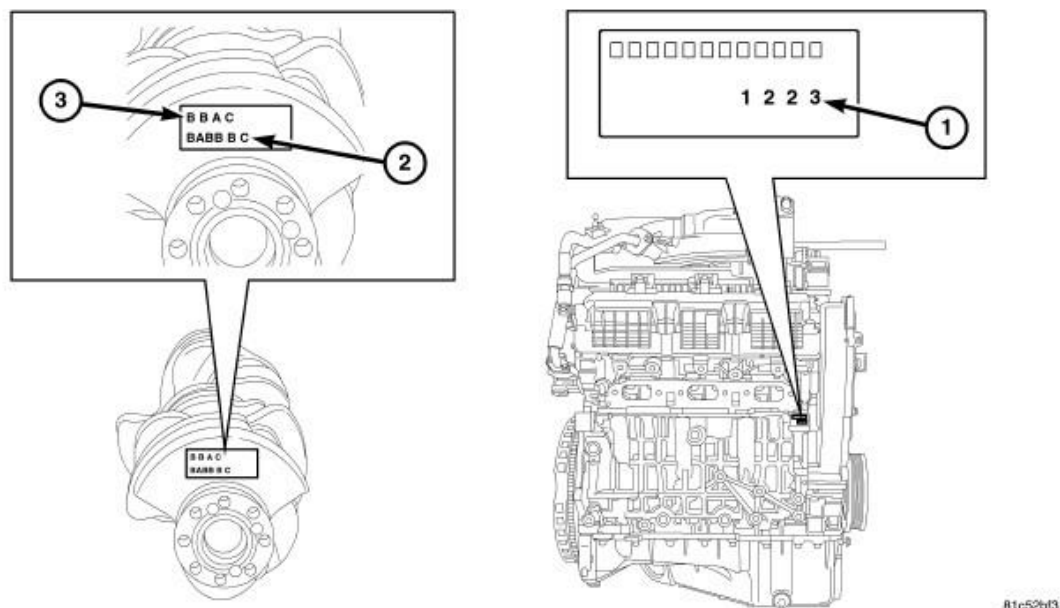
- 1 - Engine Block Main Bearing Codes
- 2 - Rod Bearing Codes
- 3 - Crank Main Bearing Code

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



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Fig. 297: Main Bearing & Rod Bearing 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 (2), 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.

ROD BEARING SELECTION DATA EXAMPLES

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.

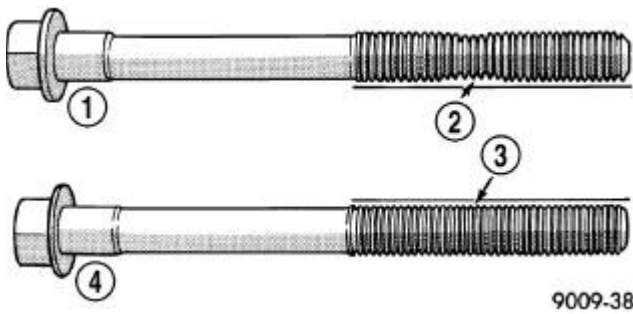


Fig. 298: Check for Stretched Bolts
Courtesy of CHRYSLER LLC

- 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

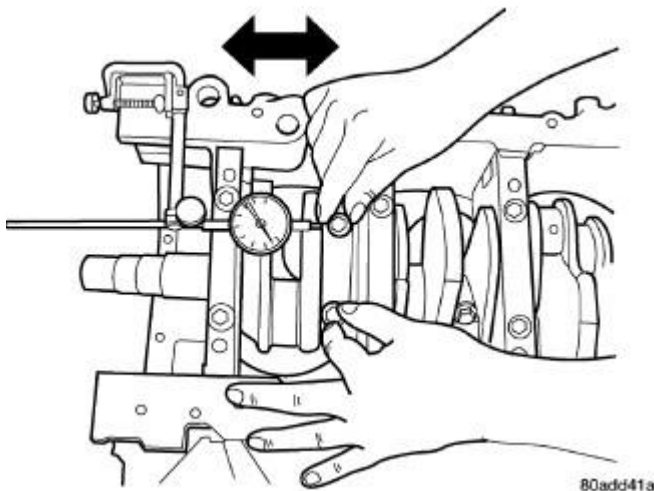


Fig. 299: Connecting Rod Side Clearance Measuring
Courtesy of CHRYSLER LLC

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

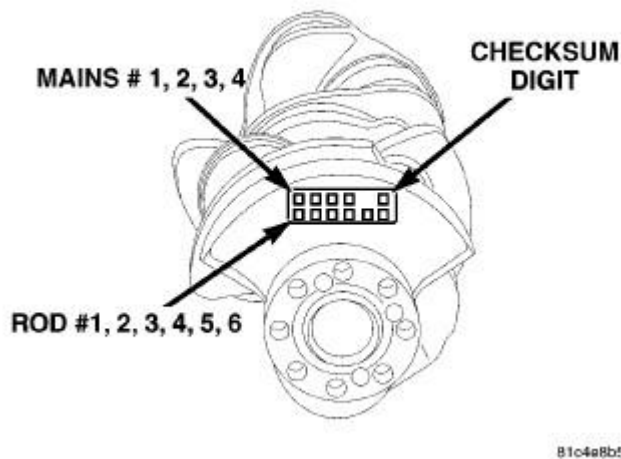


Fig. 300: Crankshaft Main Journal Grade Marking Location-Rear Of Block
Courtesy of CHRYSLER LLC

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.

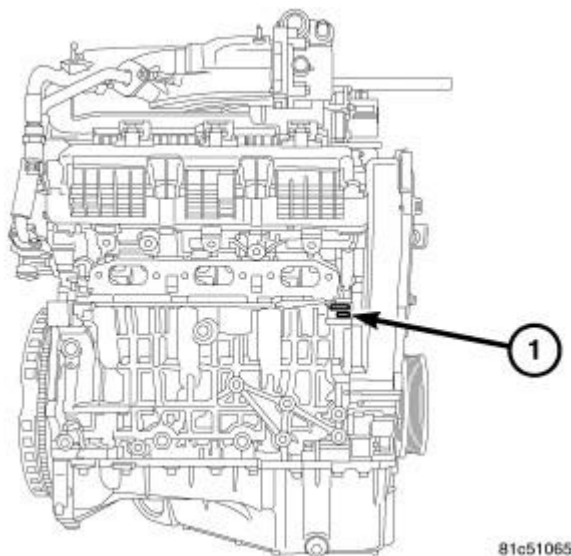


Fig. 301: Cylinder Block Main Bearing Bore Grade Codes
 Courtesy of CHRYSLER LLC

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.

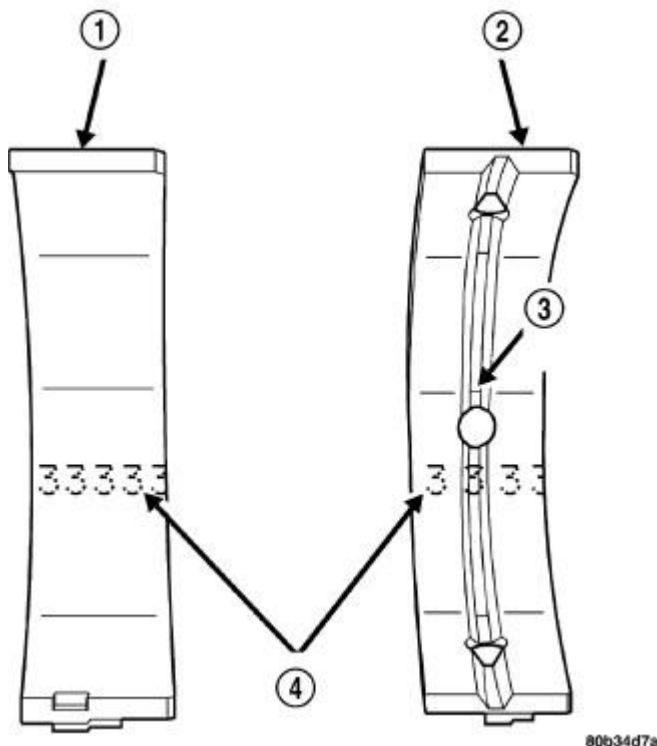


Fig. 302: Main Bearing Grade Marks
 Courtesy of CHRYSLER LLC

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

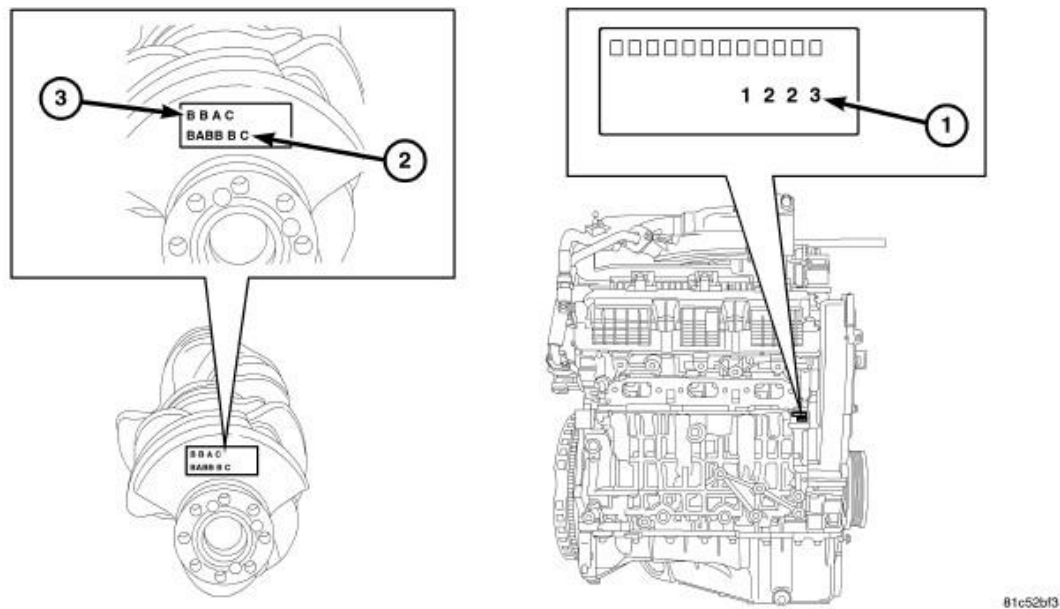


Fig. 303: Main Bearing & Rod Bearing Codes

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

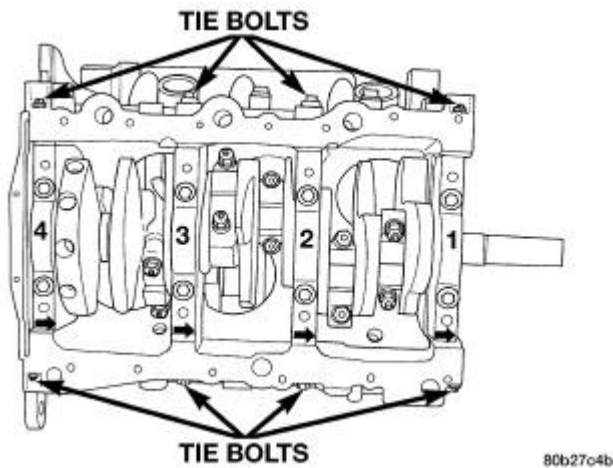


Fig. 304: Main Bearing Cap Identification
Courtesy of CHRYSLER LLC

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.

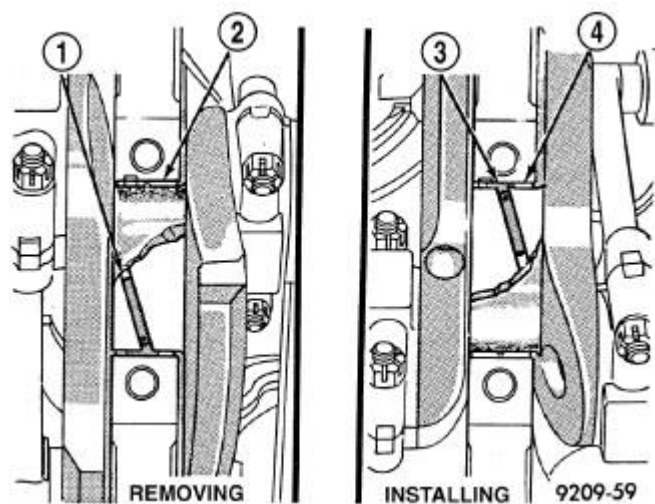


Fig. 305: Removing and Installing Upper Main Bearing With Special Tool C-3059A
Courtesy of CHRYSLER LLC

- | |
|--------------------------|
| 1 - SPECIAL TOOL C-3059A |
| 2 - BEARING |
| 3 - SPECIAL TOOL C-3059A |
| 4 - BEARING |

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

Installation

INSTALLATION

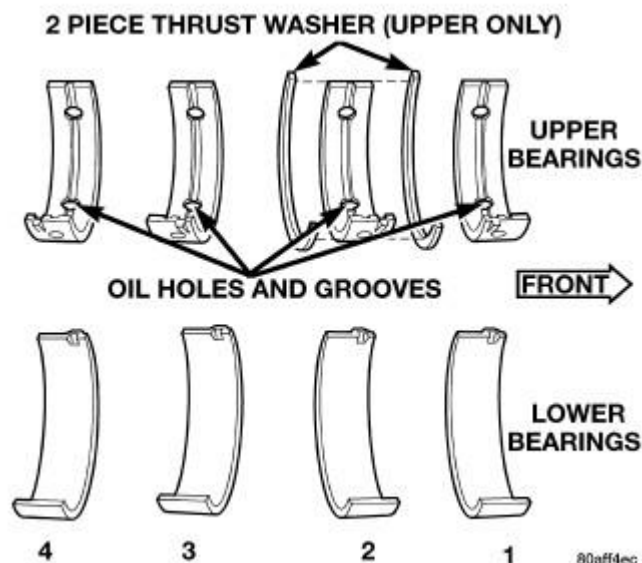


Fig. 306: Main Bearing Identification

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.

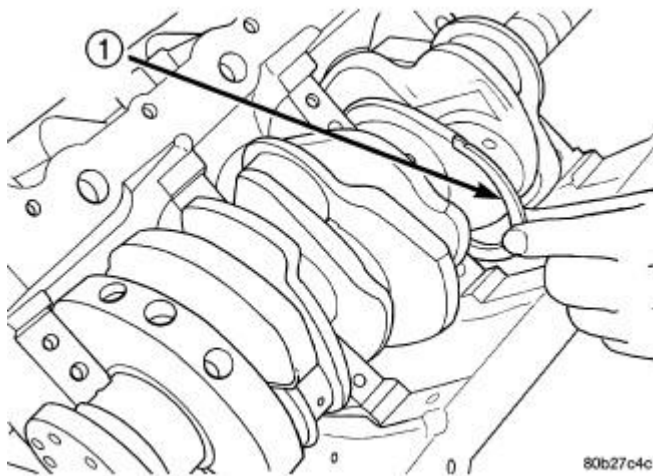
NOTE: Only one main bearing should be selectively fitted while all other main bearing caps are properly tightened.

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.
5. For installing thrust washers 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 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.

**Fig. 307: Thrust Washer Installation**

Courtesy of CHRYSLER LLC**1 - FRONT THRUST WASHER**

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**

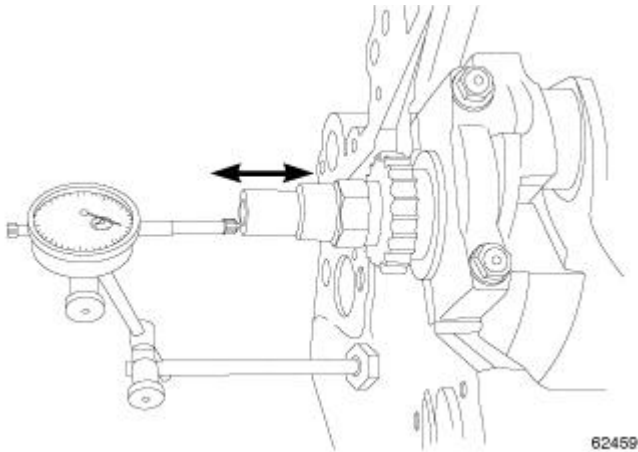


Fig. 308: Measuring Crankshaft End Play
Courtesy of CHRYSLER LLC

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

Removal

REMOVAL

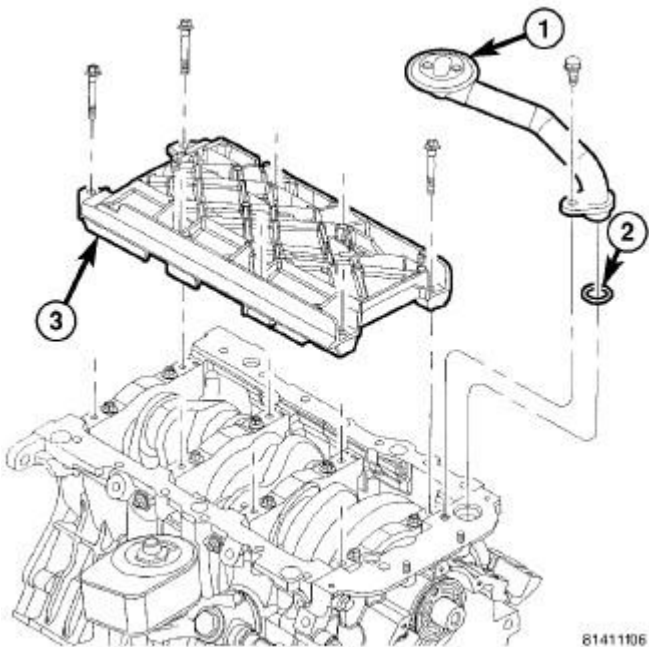


Fig. 309: Oil Pick Up Tube & Windage Tray
Courtesy of CHRYSLER LLC

- 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, tensioner and crankshaft sprocket.
6. Tap dowel pin out of crankshaft.
7. Remove oil pump assembly. See Engine/Lubrication/PUMP, Engine Oil - Removal.

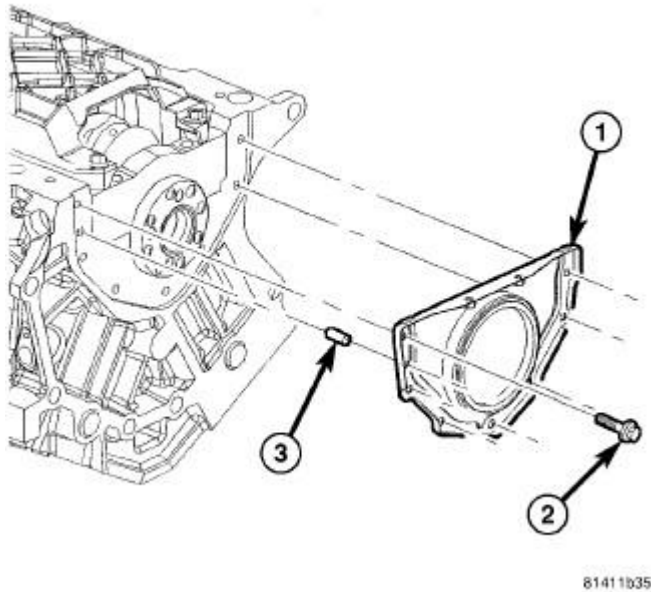


Fig. 310: REAR CRANKSHAFT OIL SEAL AND RETAINER
Courtesy of CHRYSLER LLC

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

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

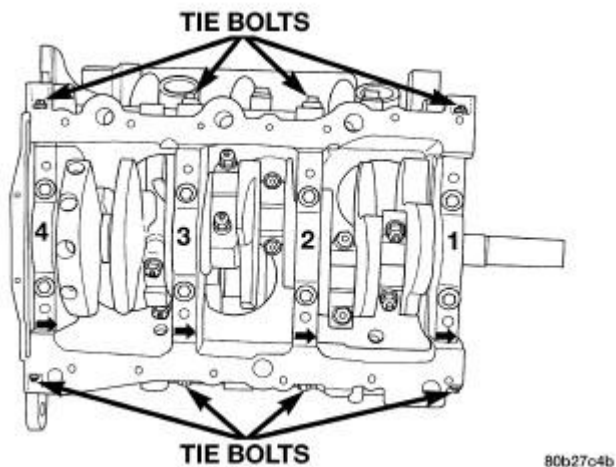
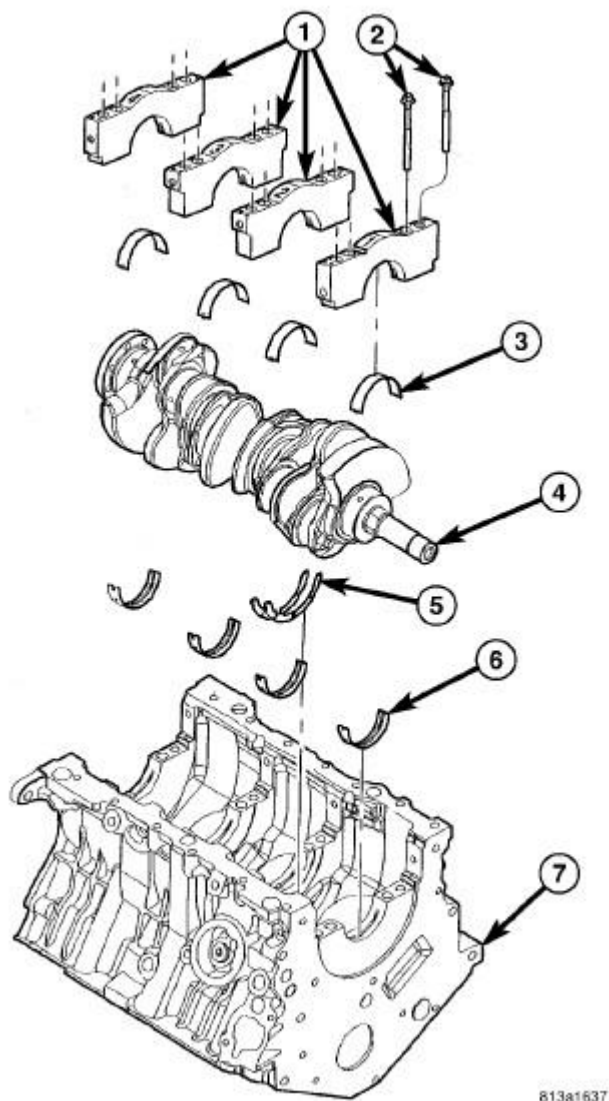


Fig. 311: Main Bearing Cap Identification

Courtesy of CHRYSLER LLC

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

9. 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.
10. 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.



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Fig. 312: Cylinder Block & Crankshaft
Courtesy of CHRYSLER LLC

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

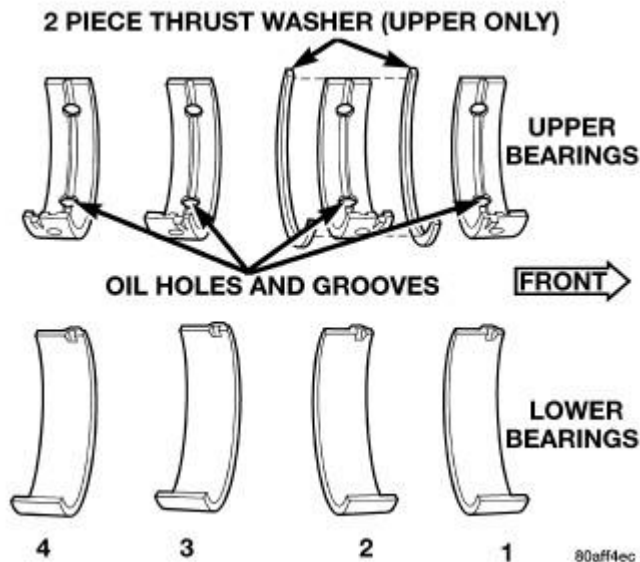
Installation**INSTALLATION**

Fig. 313: 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.

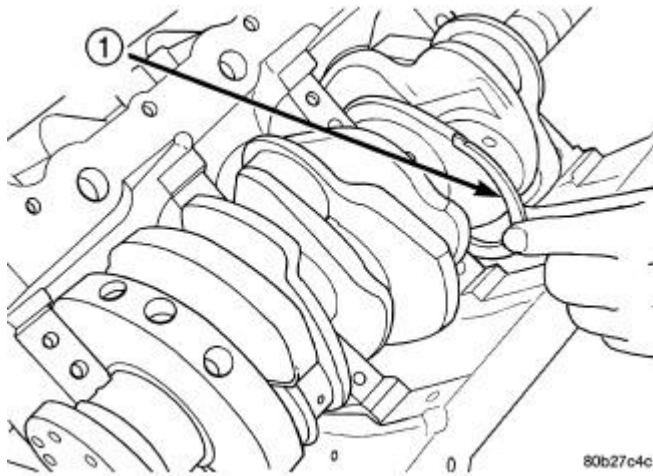


Fig. 314: Thrust Washer Installation
 Courtesy of CHRYSLER LLC

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.

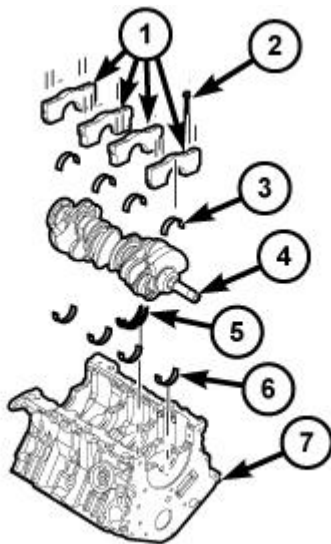


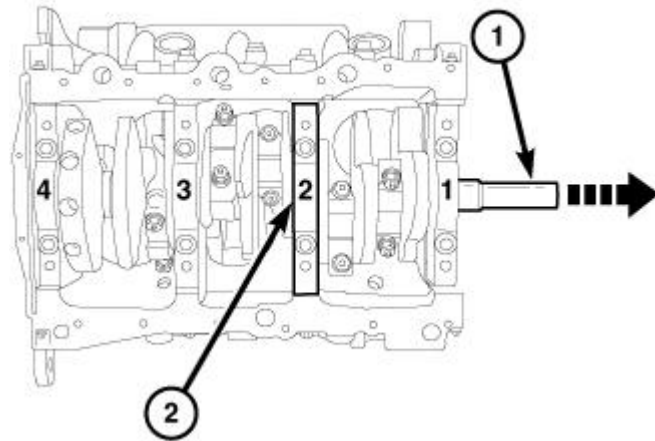
Fig. 315: Lower Main Bearings Into Main Bearing Caps
 Courtesy of CHRYSLER LLC

5. Install lower main bearings (3) into 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.

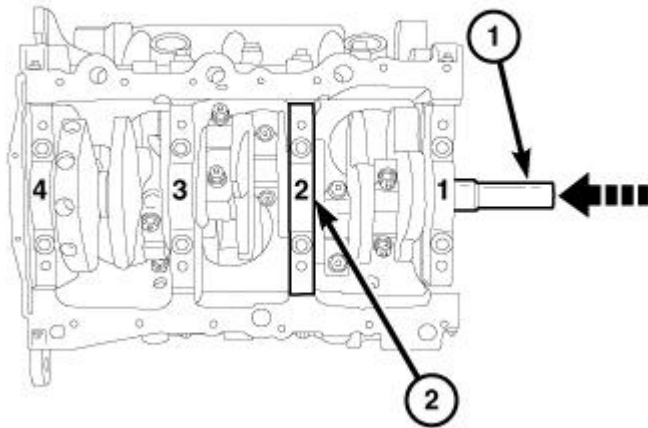


885545

Fig. 316: Moving Crankshaft Forward
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.

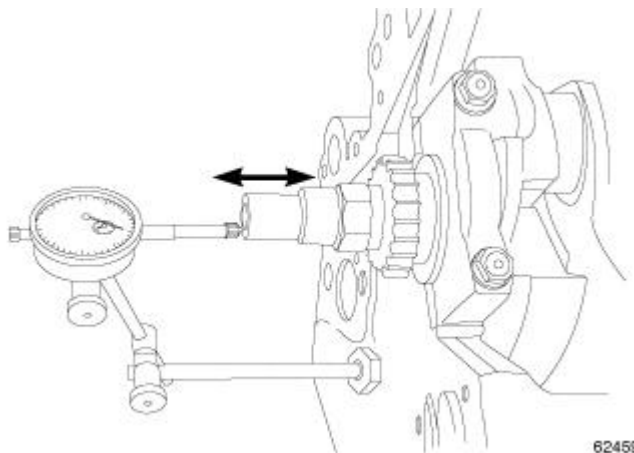


886083

Fig. 317: Moving Crankshaft Rearward

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.



62459

Fig. 318: Measuring Crankshaft End Play

Courtesy of CHRYSLER LLC

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

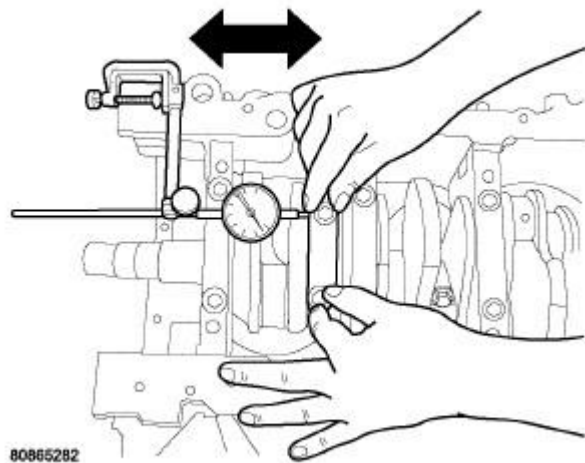


Fig. 319: Measuring Connecting Rod Side Clearance
Courtesy of CHRYSLER LLC

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

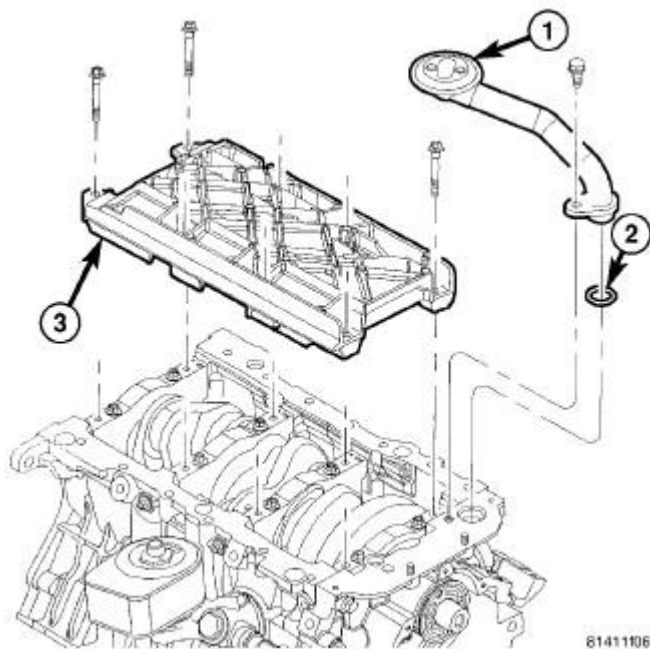


Fig. 320: Oil Pick Up Tube & Windage Tray
Courtesy of CHRYSLER LLC

- 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.).

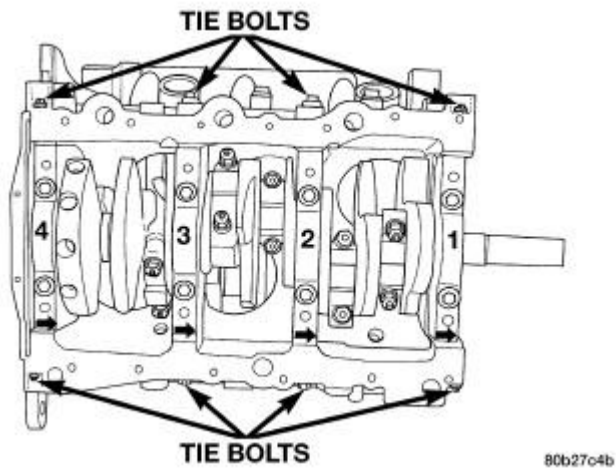


Fig. 321: Main Bearing Cap Identification
Courtesy of CHRYSLER LLC

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

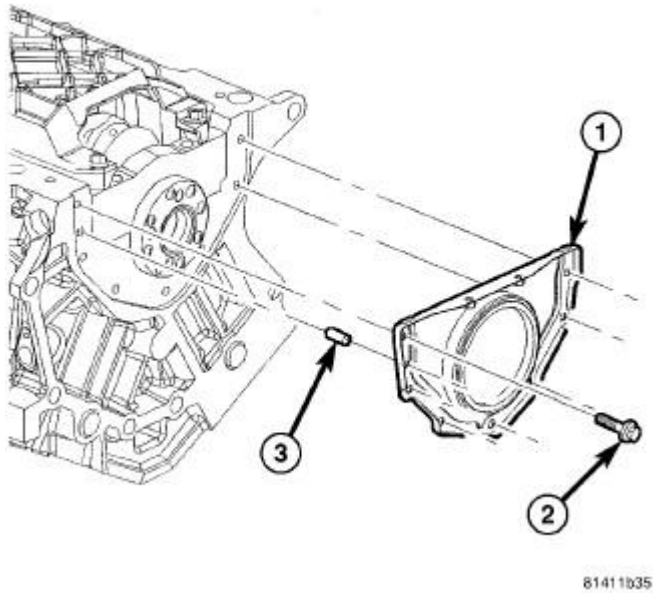


Fig. 322: REAR CRANKSHAFT OIL SEAL AND RETAINER
Courtesy of CHRYSLER LLC

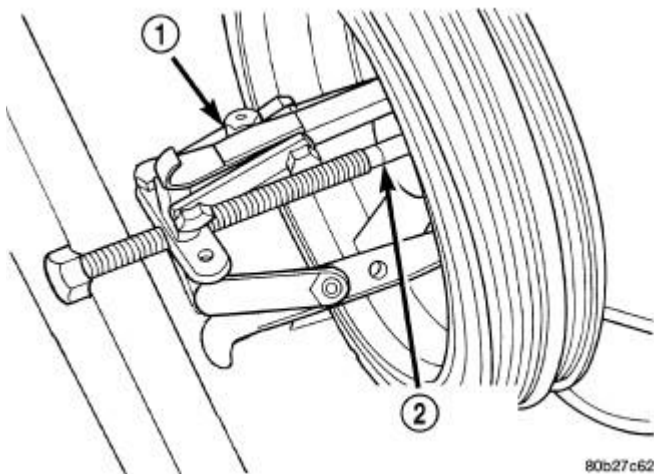
- | |
|--|
| 1 - REAR OIL SEAL AND RETAINER ASSEMBLY
2 - BOLT
3 - ALIGNMENT DOWEL |
|--|

20. Install rear crankshaft oil seal retainer and oil seal (1).
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, timing belt and tensioner.
24. Install front timing belt cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Installation**.
25. Install oil pan. See **Engine/Lubrication/PAN, Oil - Installation**.
26. Install engine assembly. See **Engine - Installation**.
27. Fill engine crankcase with proper amount of oil.

DAMPER, VIBRATION

Removal

REMOVAL

**Fig. 323: Crankshaft Damper-Removal****Courtesy of CHRYSLER LLC**

1. Disconnect negative battery cable.
2. Raise vehicle on hoist.
3. Remove the right front wheel and accessory drive belt splash shield.
4. Remove accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal** .
5. Remove vibration damper bolt.
6. Use Special Tool 1023 puller (1) , and insert 9020 (2), remove crankshaft damper.

Installation**INSTALLATION**

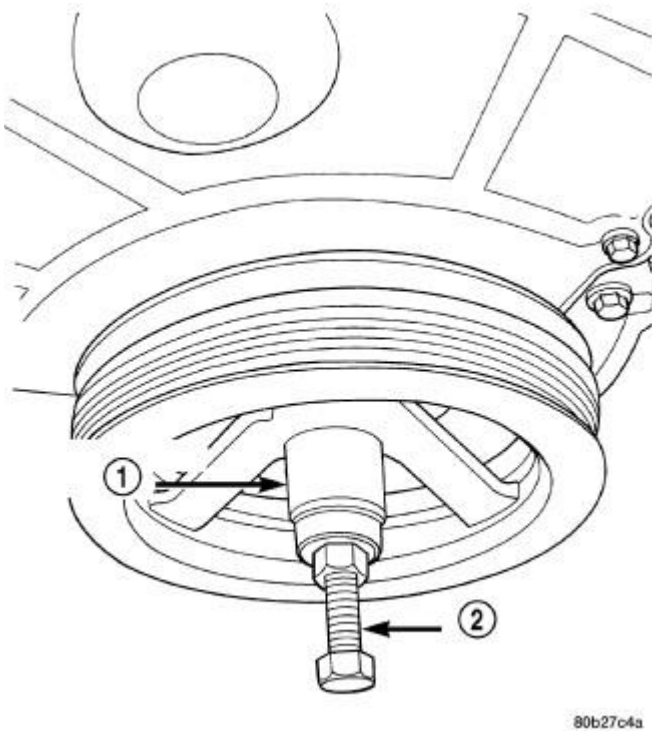


Fig. 324: Crankshaft Damper-Installation
 Courtesy of CHRYSLER LLC

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 accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation** .
4. Install the accessory drive belt splash shield and right front wheel.
5. Lower vehicle.
6. Connect negative battery cable.

FLEXPLATE

Removal

REMOVAL

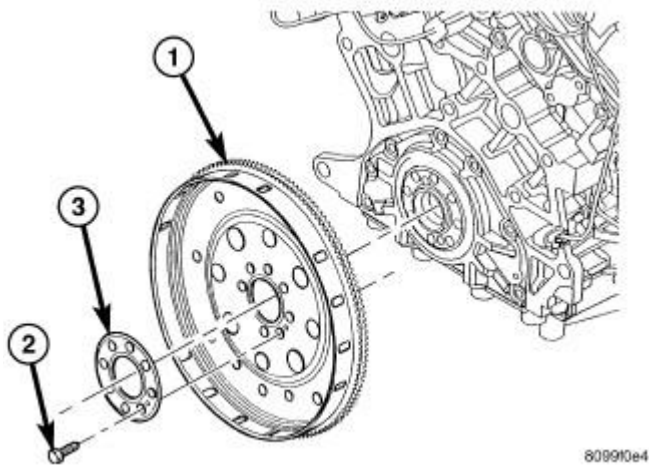


Fig. 325: FLEX PLATE

Courtesy of CHRYSLER LLC

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

Installation

INSTALLATION

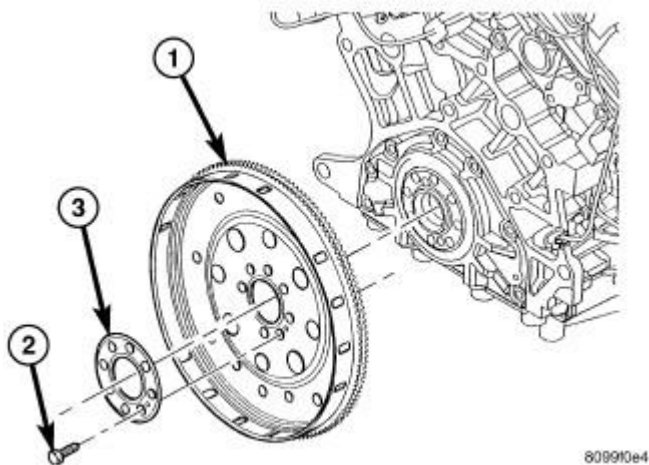


Fig. 326: FLEX PLATE

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 **INSTALLATION** for 41TE transaxle or **Transmission and Transfer Case/Automatic - 62TE - Installation** .

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

RETAINER, CRANKSHAFT REAR OIL SEAL

Removal

REMOVAL

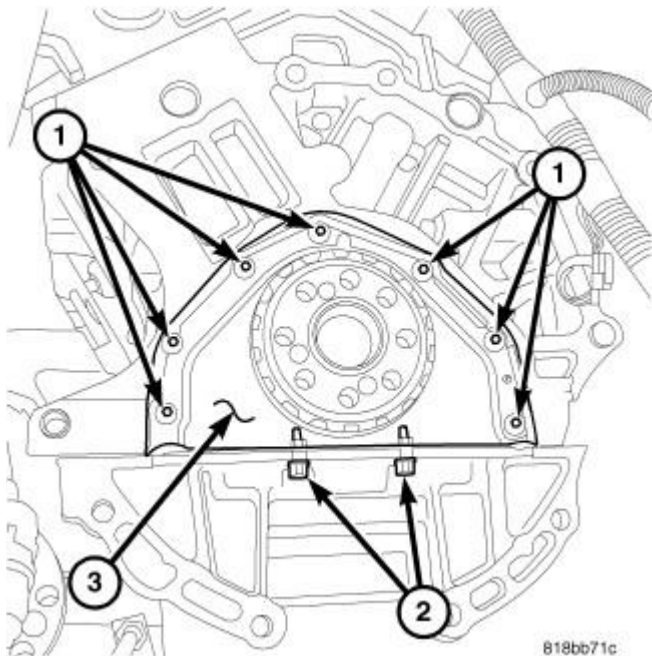


Fig. 327: REAR MAIN

Courtesy of CHRYSLER LLC

1. Remove the transmission. Refer to **Transmission and Transfer Case/Automatic - 41TE - Removal** or **REMOVAL** for 62TE transaxle.
2. Remove the flex plate. See **Engine/Engine Block/FLEXPLATE - Removal**.
3. Remove the 7 upper bolts (1) holding the rear main seal carrier (3) to the engine block.
4. Remove 2 lower nuts (2) holding the rear main seal carrier (1) to the engine block
5. Remove the rear main seal carrier (1) from the engine block and oil pan.
6. Clean sealant residue from the engine block and oil pan.

NOTE: Seal retainer gasket is bonded to the retainer and must be replaced as an assembly.

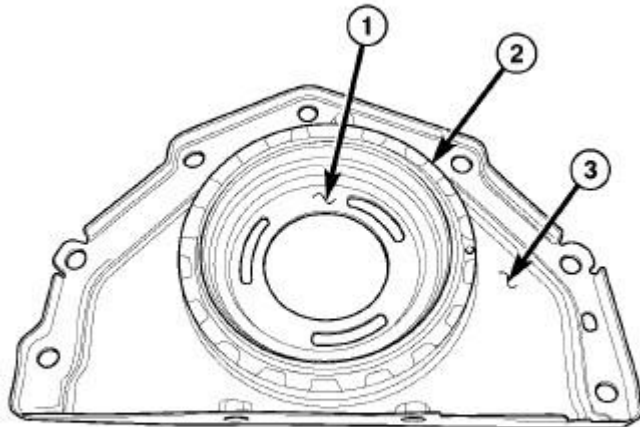
Installation

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.



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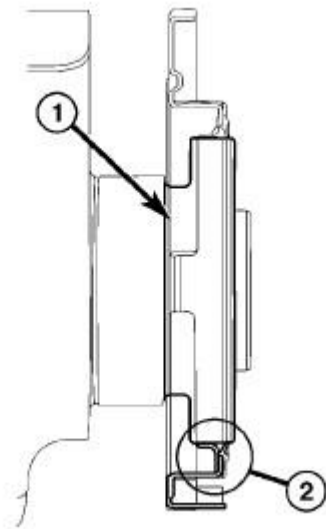
Fig. 328: CRANKSHAFT OIL SEAL - REAR
Courtesy of CHRYSLER LLC

- | |
|--|
| 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).

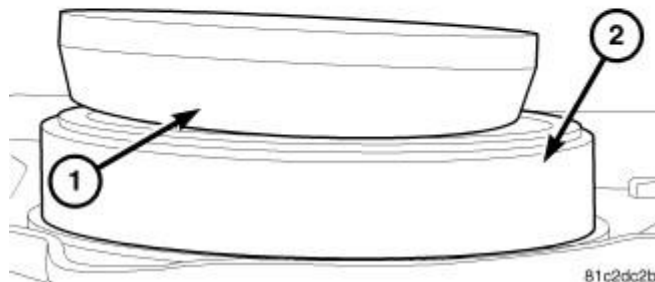


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Fig. 329: REAR SEAL INSTALLED

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.



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Fig. 330: Identifying Tapered End Of Rear Crankshaft Oil Seal
Courtesy of CHRYSLER LLC

- 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.

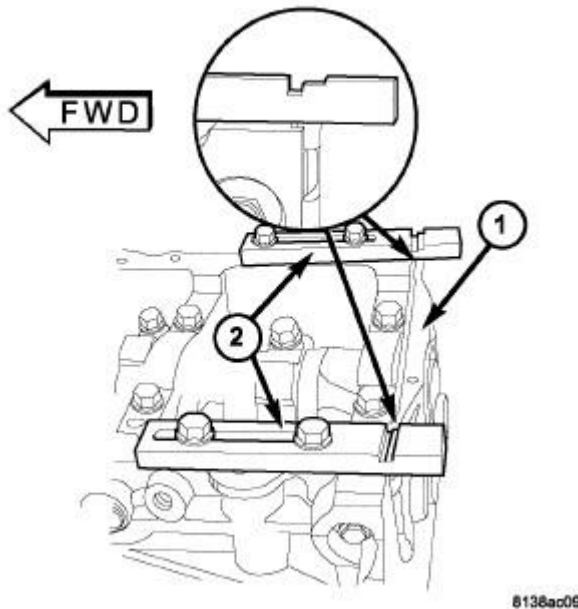


Fig. 331: REAR CRANKSHAFT SEAL RETAINER ALIGNMENT
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - SEAL RETAINER
2 - SPECIAL TOOLS 8225 |
|---|

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

- 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.

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

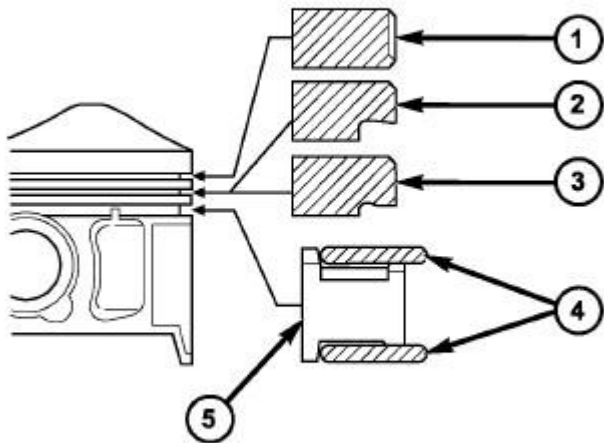
NOTE: Make sure that the seal flange is flush with the block oil pan sealing surface.

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



811B109

Fig. 332: PISTON RINGS

Courtesy of CHRYSLER LLC

The piston rings include a moly-filled top ring with a symmetrical barrel face. The intermediate piston ring 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

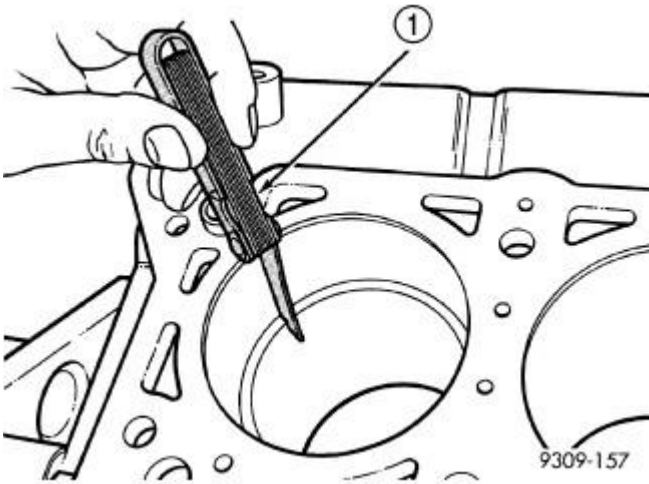


Fig. 333: CHECK GAP ON PISTON RINGS

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**.

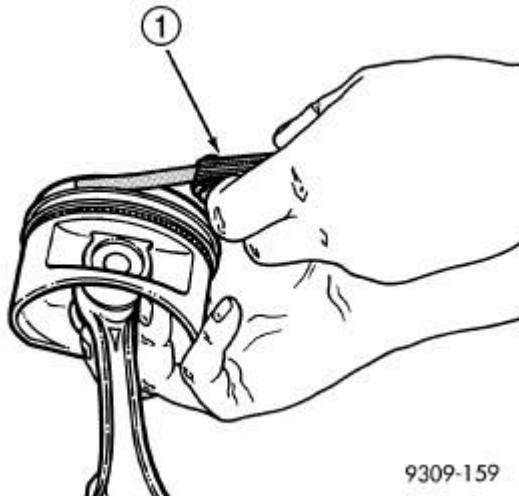


Fig. 334: MEASURING PISTON RING SIDE CLEARANCE

Courtesy of CHRYSLER LLC

1 - FEELER GAUGE

2. Check piston ring to groove clearance: . For clearance specifications, see **Engine - Specifications**.

Removal

REMOVAL

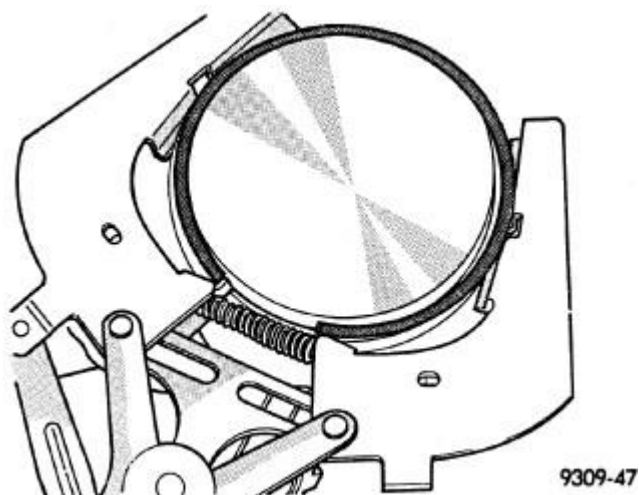
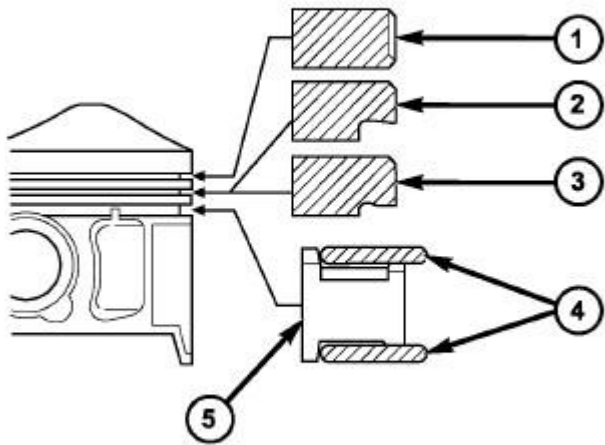


Fig. 335: UPPER AND INTERMEDIATE RINGS
Courtesy of CHRYSLER LLC

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



811B108

Fig. 336: 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**.
2. 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** .
 - Oil ring expander.
 - Lower oil ring side rail.
 - Upper oil ring side rail.
 - No. 2 Intermediate piston ring.
 - No. 1 Upper piston ring.
3. 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. **Do not use a piston ring expander during this step .**

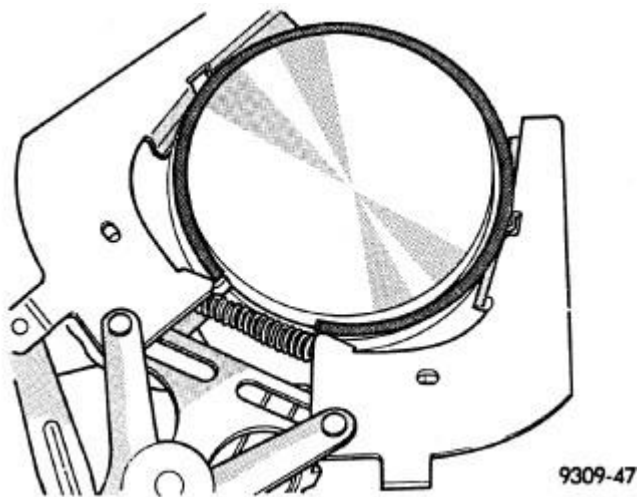
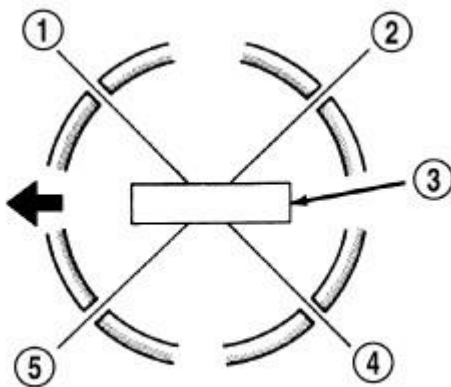


Fig. 337: UPPER AND INTERMEDIATE RINGS
Courtesy of CHRYSLER LLC

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.**

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



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Fig. 338: PISTON RING END GAP POSITION
Courtesy of CHRYSLER LLC

6. Position piston ring end gaps.
7. 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

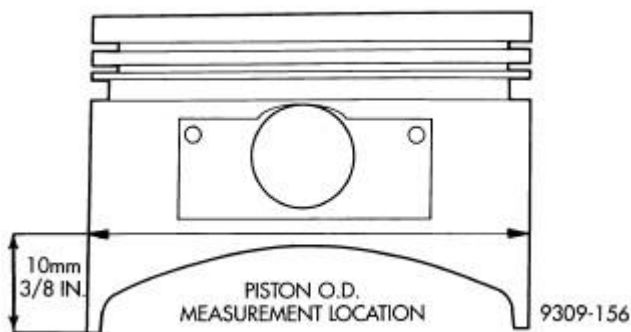


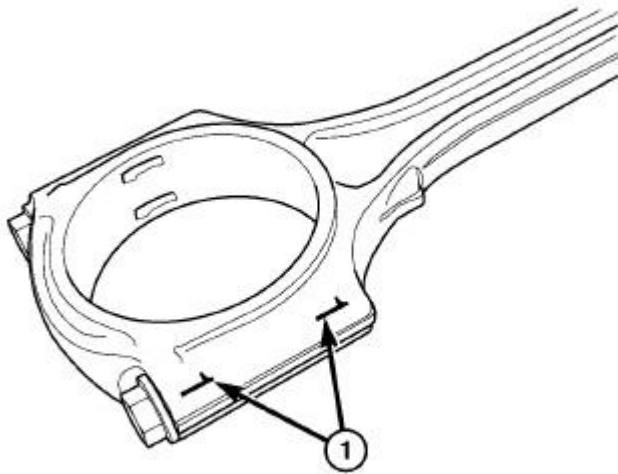
Fig. 339: Piston Measurements
Courtesy of CHRYSLER LLC

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 shown in illustration. 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



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Fig. 340: 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, if necessary .
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

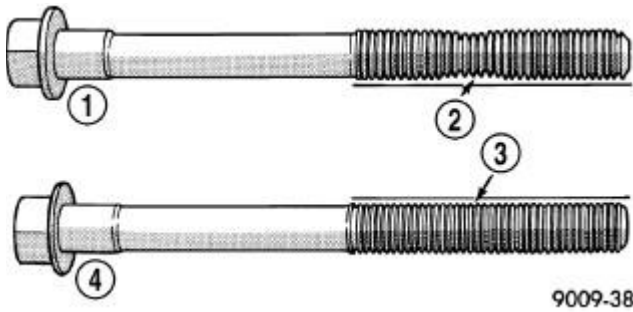


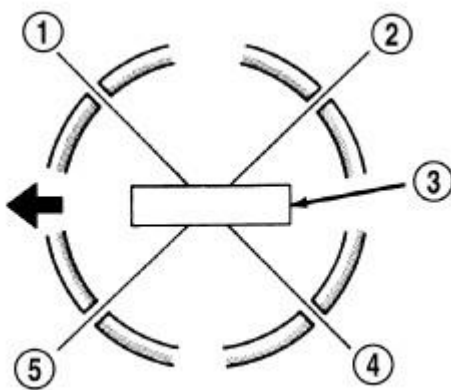
Fig. 341: Check for Stretched Bolts
Courtesy of CHRYSLER LLC

- 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, 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 .
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 .



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Fig. 342: 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

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.**

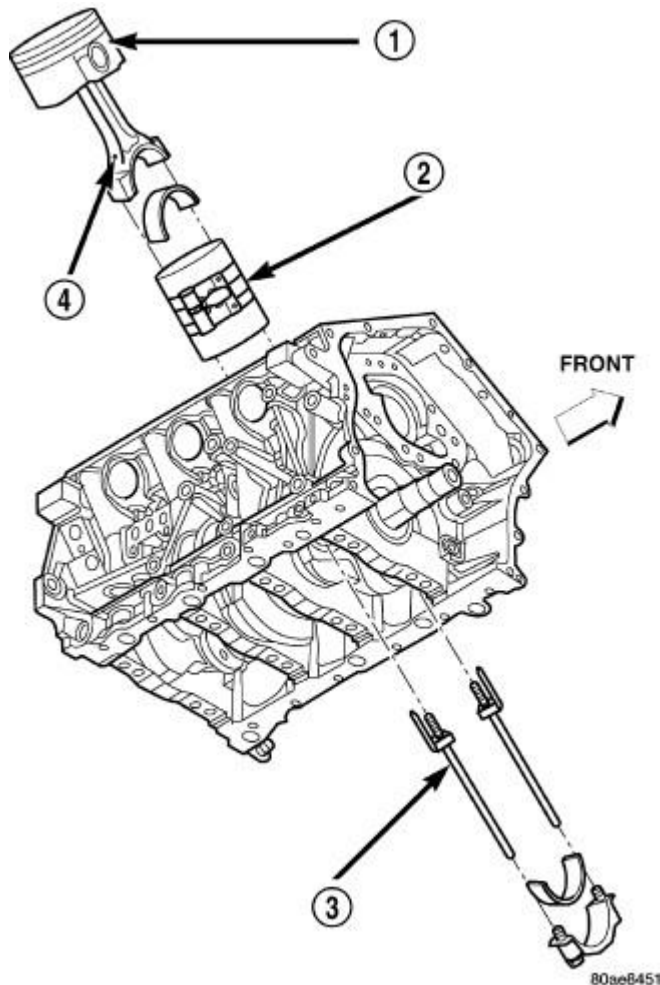


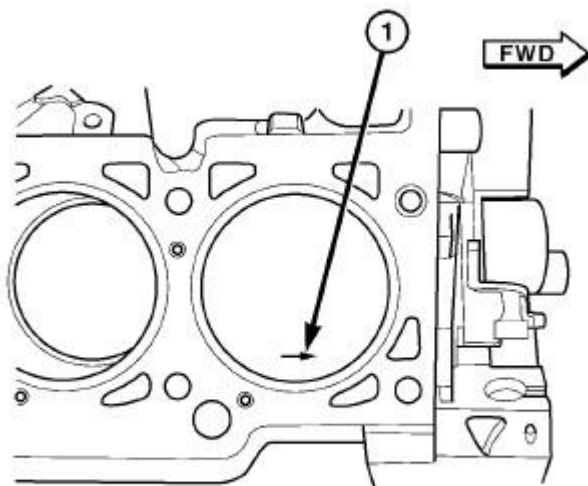
Fig. 343: Piston and Connecting Rod
Courtesy of CHRYSLER LLC

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

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.

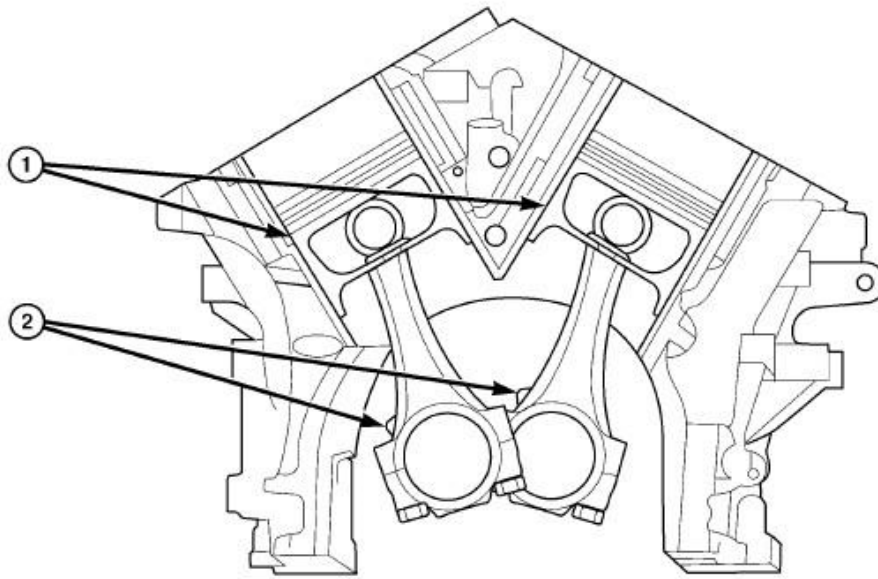
7. The arrow on top of piston must be pointing toward front of engine and oil squirt hole on connecting rod faces the major thrust (right) side of the cylinder bore .



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Fig. 344: PISTON ORIENTATION
Courtesy of CHRYSLER LLC

1 - ARROW FACES FRONT OF ENGINE



B11326b1

Fig. 345: PISTON AND CONNECTING ROD POSITIONING
Courtesy of CHRYSLER LLC

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

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

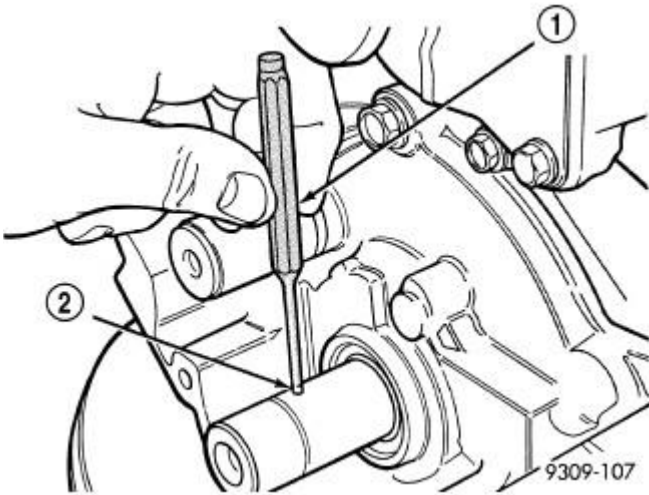


Fig. 346: Crankshaft Sprocket Dowel Pin-Removal/Installation
Courtesy of CHRYSLER LLC

1. Remove the crankshaft sprocket. Refer to **BELT and SPROCKETS, Timing**.
2. Tap the dowel pin (2) out of the crankshaft.

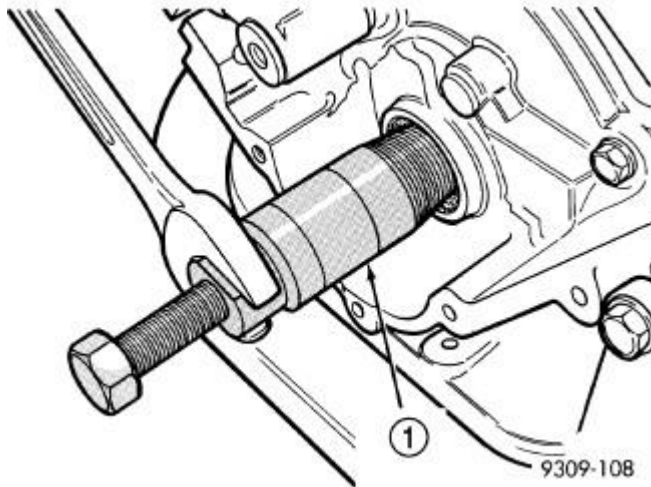


Fig. 347: Crankshaft Oil Seal with Special Tool 6341A-Removal
Courtesy of CHRYSLER LLC

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

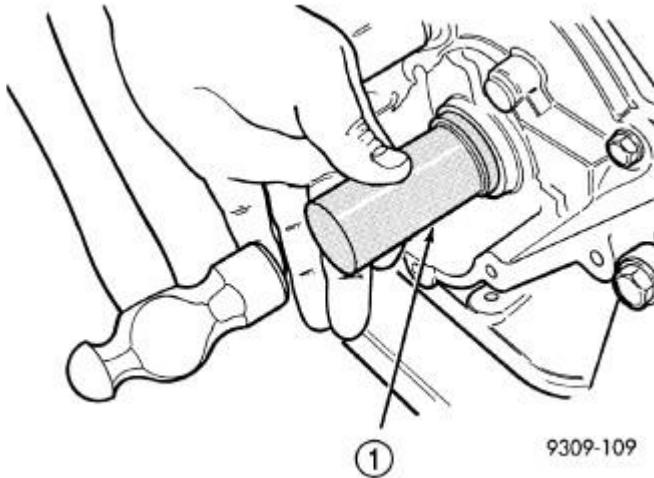


Fig. 348: Crankshaft Oil Seal with Special Tool 6342-Installation
Courtesy of CHRYSLER LLC

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. Refer to **BELT and SPROCKETS, Timing**.

ENGINE MOUNTING

DESCRIPTION

DESCRIPTION

There are four engine mounts that consist of brackets molded into position with a rubber material. When installed, the engine mounts isolate the vehicle body from powertrain vibration. The right and left side mounts laterally support the powertrain assembly, while the front and rear mounts prevent engine torque from rotating the powertrain assembly toward the front or rear of the engine compartment.

BRACKET, ENGINE MOUNT, FRONT

Removal

REMOVAL

1. Raise and support vehicle. Refer to **Vehicle Quick Reference/Hoisting - Standard Procedure** .

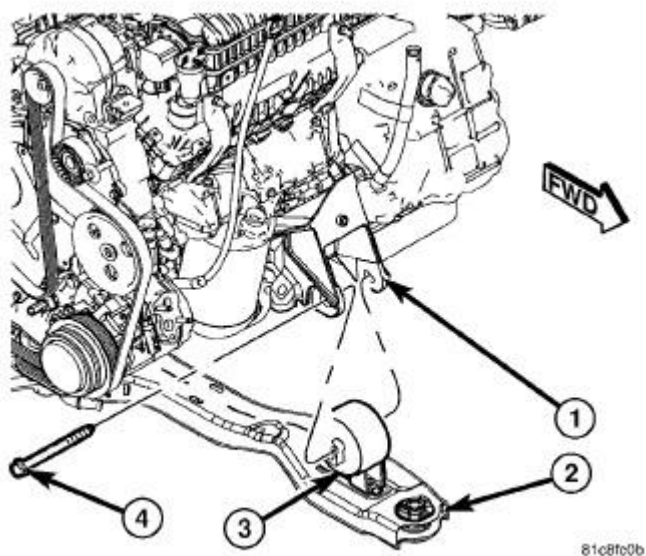


Fig. 349: Front Engine Mount Through Bolt
Courtesy of CHRYSLER LLC

2. Remove front engine mount through bolt (4).

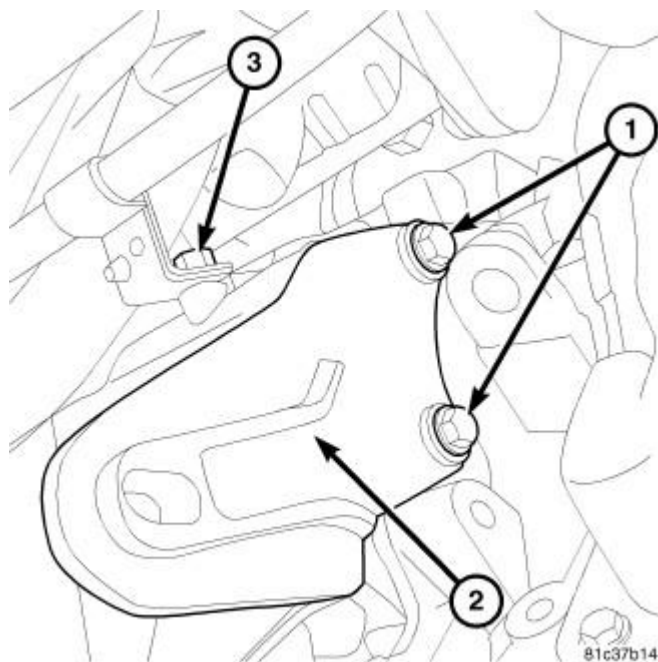


Fig. 350: Hose Bracket Retainer & Front Mount Bracket Bolts
Courtesy of CHRYSLER LLC

3. Remove hose bracket retainer (3), and remove the retainers (1) from the left side of the front engine mount.

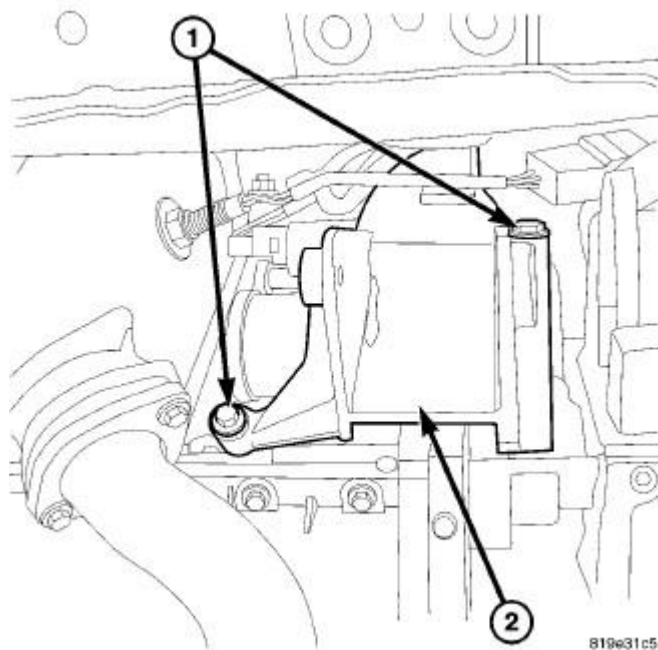


Fig. 351: Front Engine Mount & Retainers
Courtesy of CHRYSLER LLC

4. Remove the retainers (1) from the front engine mount, and remove the front engine mount (2).

Installation

INSTALLATION

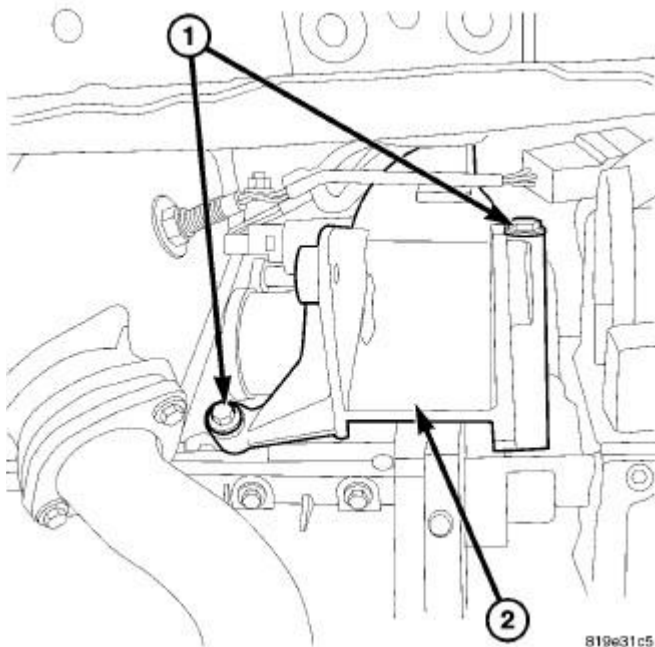
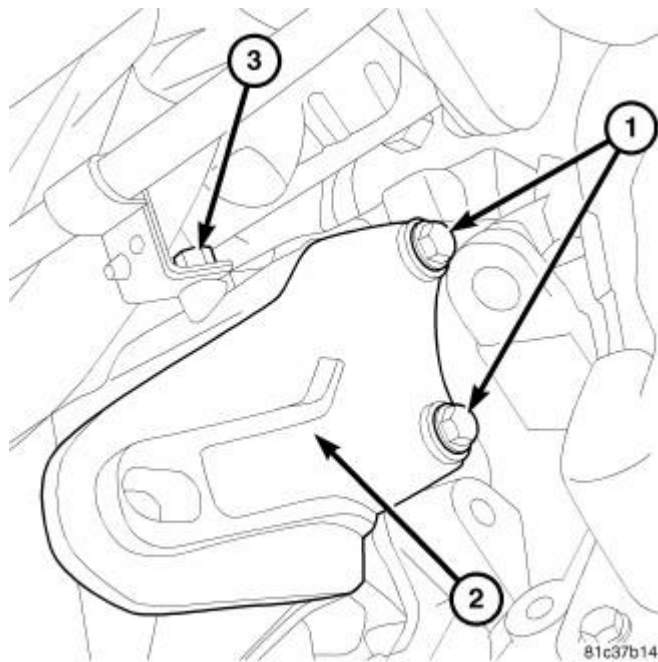


Fig. 352: Front Engine Mount & Retainers

Courtesy of CHRYSLER LLC

1. Install the front engine mount (2), and the front retainers (1). Do not tighten at this time.

**Fig. 353: Hose Bracket Retainer & Front Mount Bracket Bolts**

Courtesy of CHRYSLER LLC

2. Install the hose bracket, the hose bracket retainer (3).
3. Install the front mount bracket bolts (1) and tighten to 100 N.m (74 ft. lbs.).

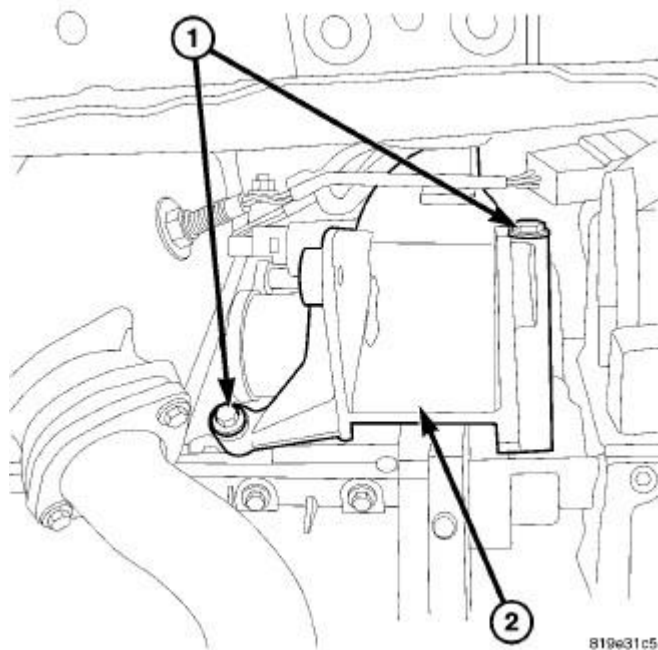


Fig. 354: Front Engine Mount & Retainers
Courtesy of CHRYSLER LLC

4. Install the front mount bracket bolts (1) and tighten to 100 N.m (74 ft. lbs.).

BRACKET, ENGINE MOUNT, REAR

Removal

REMOVAL

1. Raise the vehicle on the hoist.

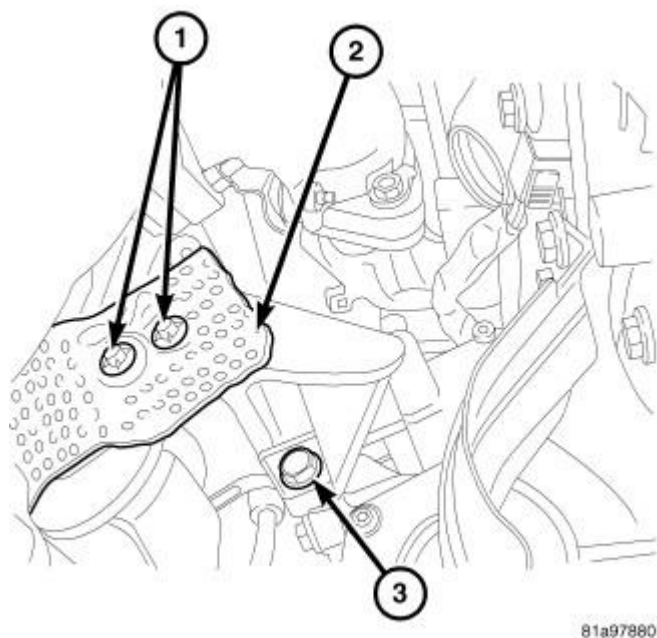


Fig. 355: Rear Engine Mount Heat Shield
Courtesy of CHRYSLER LLC

2. Remove the rear engine mount heat shield (2).

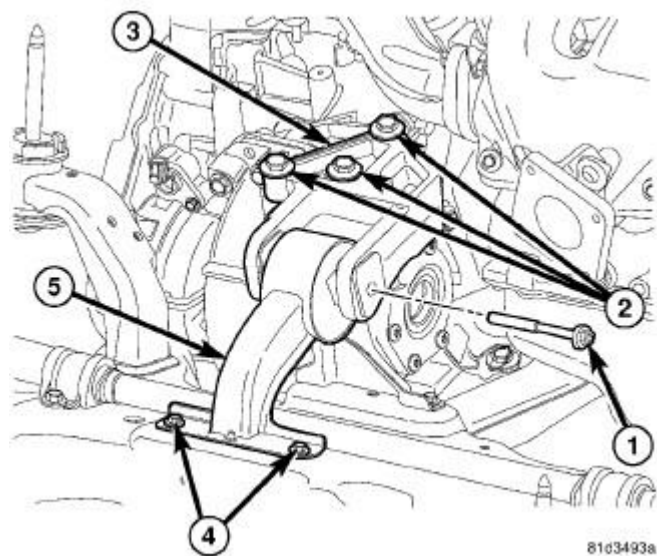


Fig. 356: Rear Engine Mount
Courtesy of CHRYSLER LLC

- | |
|-------------------------------------|
| 1 - Rear engine mount through bolt |
| 2 - Rear engine mount support bolts |
| 3 - Rear engine mount support |
| 4 - Rear engine mount bolts |

5 - Rear engine mount

3. Remove the rear engine mount through bolt (1).
4. Remove the rear engine mount support fasteners (2).
5. Remove the rear engine mount support.

Installation

INSTALLATION

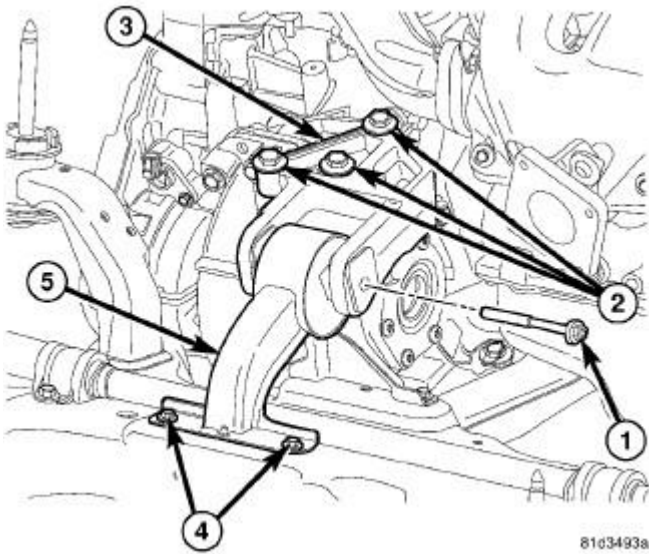


Fig. 357: Rear Engine Mount
Courtesy of CHRYSLER LLC

- | |
|-------------------------------------|
| 1 - Rear engine mount through bolt |
| 2 - Rear engine mount support bolts |
| 3 - Rear engine mount support |
| 4 - Rear engine mount bolts |
| 5 - Rear engine mount |

1. Install the rear engine mount support (3).
2. Install the rear engine mount support fasteners (2), and tighten to 100 N.m (74 ft. lbs.).

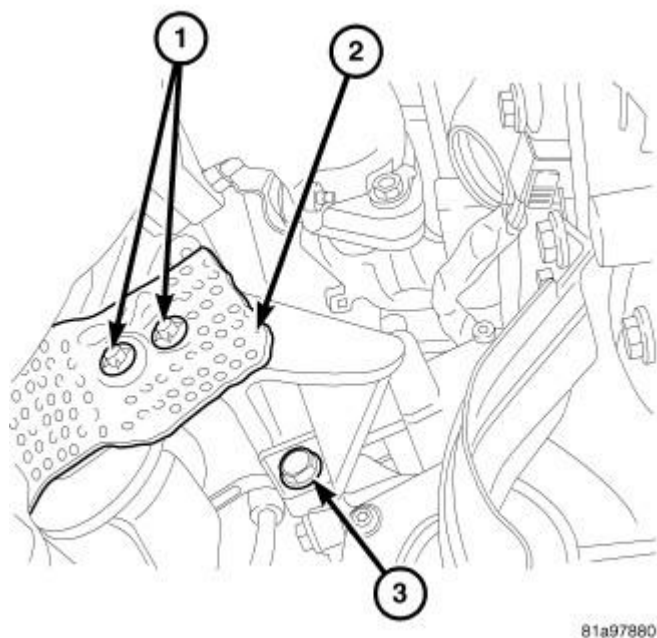


Fig. 358: Rear Engine Mount Heat Shield
Courtesy of CHRYSLER LLC

3. Install the rear engine mount through bolt (1), and tighten to 50 N.m (37 ft. lbs.).
4. Install the rear engine mount heat shield (2).

INSULATOR, ENGINE MOUNT, REAR

Removal

REMOVAL

1. Raise and support vehicle.

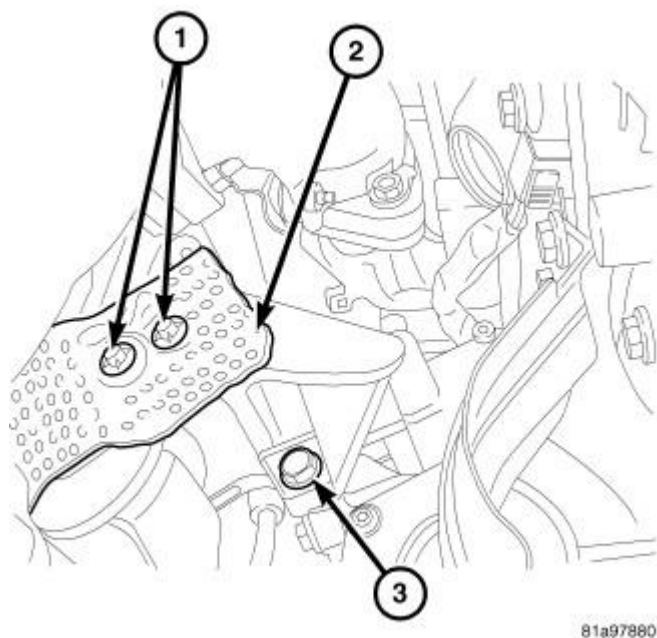


Fig. 359: Rear Engine Mount Heat Shield
Courtesy of CHRYSLER LLC

2. Remove the rear engine mount heat shield.

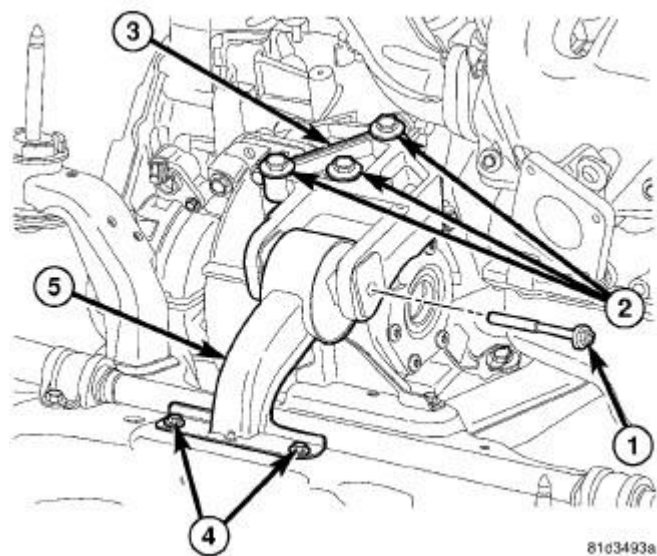


Fig. 360: Rear Engine Mount
Courtesy of CHRYSLER LLC

- | |
|-------------------------------------|
| 1 - Rear engine mount through bolt |
| 2 - Rear engine mount support bolts |
| 3 - Rear engine mount support |
| 4 - Rear engine mount bolts |

5 - Rear engine mount

3. Remove the rear engine mount through bolt (1).
4. Remove the rear engine mount bolts (4), and remove the rear engine mount.

Installation

INSTALLATION

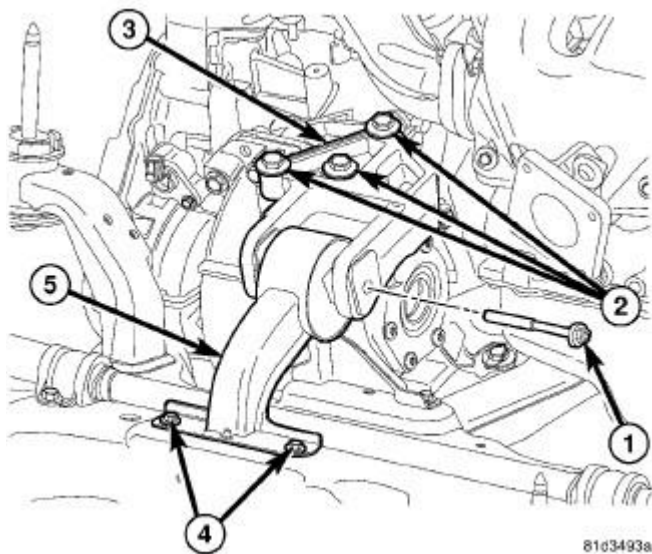


Fig. 361: Rear Engine Mount
Courtesy of CHRYSLER LLC

- | |
|-------------------------------------|
| 1 - Rear engine mount through bolt |
| 2 - Rear engine mount support bolts |
| 3 - Rear engine mount support |
| 4 - Rear engine mount bolts |
| 5 - Rear engine mount |

1. Install the rear engine mount (5).
2. Install the rear engine mount bolts (4), and tighten to 100 N.m (74 ft. lbs.).

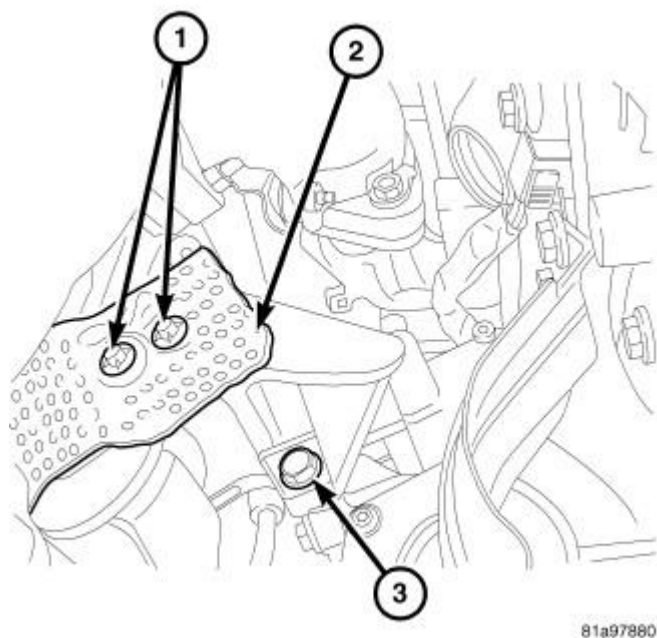


Fig. 362: Rear Engine Mount Heat Shield
Courtesy of CHRYSLER LLC

3. Install the rear engine mount through bolt (3), and tighten to 100 N.m (74 ft. lbs.).
4. Install the heat shield (2).

INSULATOR, ENGINE MOUNT, LEFT

Removal

REMOVAL

1. Disconnect the negative battery cable.

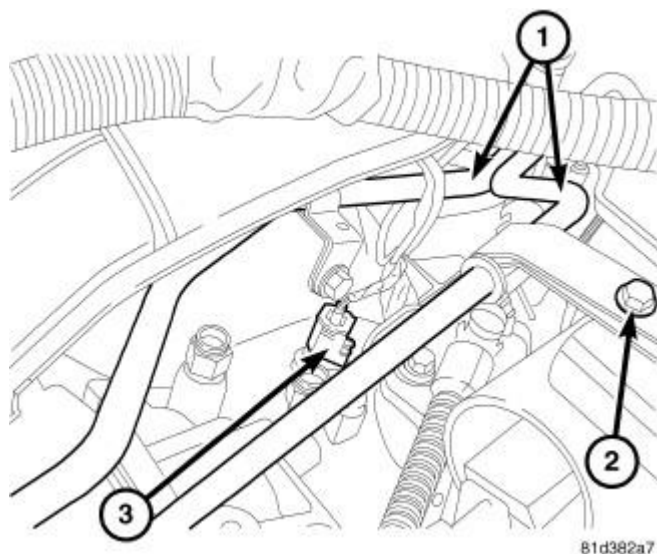


Fig. 363: Heater Line Retainer Bracket Fastener
Courtesy of CHRYSLER LLC

2. Remove the heater line retainer bracket fastener (2).
3. Use a suitable lifting device to support the left side of the powertrain assembly.

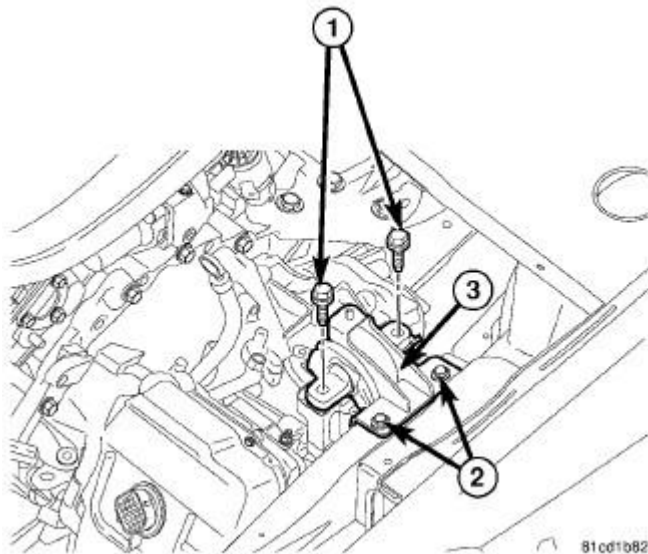


Fig. 364: Identifying Left Engine Mount-To-Engine Fasteners
Courtesy of CHRYSLER LLC

4. Remove the left engine mount bolts (1).

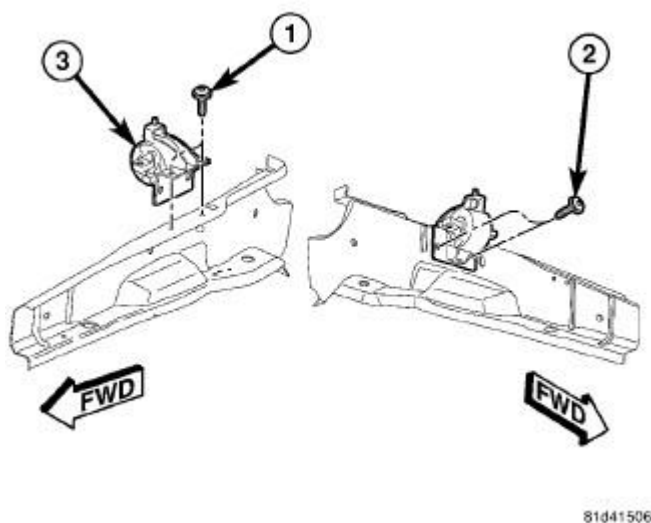


Fig. 365: Upper & Lower Left Engine Mount Bolts
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - upper left engine mount-to-frame rail bolts |
| 2 - lower left engine mount-to-frame rail bolts |
| 3 - left engine mount |

5. Remove the upper left engine mount-to-frame rail bolts (1), and the lower left engine mount-to-frame rail bolts (2).
6. Remove the left engine mount (3).

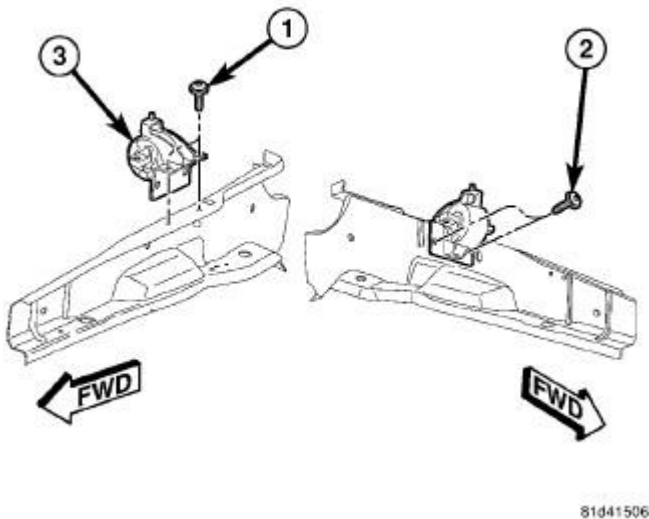
Installation**INSTALLATION**

Fig. 366: Upper & Lower Left Engine Mount Bolts
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - upper left engine mount-to-frame rail bolts |
| 2 - lower left engine mount-to-frame rail bolts |
| 3 - left engine mount |

1. Install the left engine mount (3).
2. Install the upper (1), and lower (2) left engine mount bolts. Tighten the left engine mount bolts to tighten to 50 N.m (37 ft. lbs.).

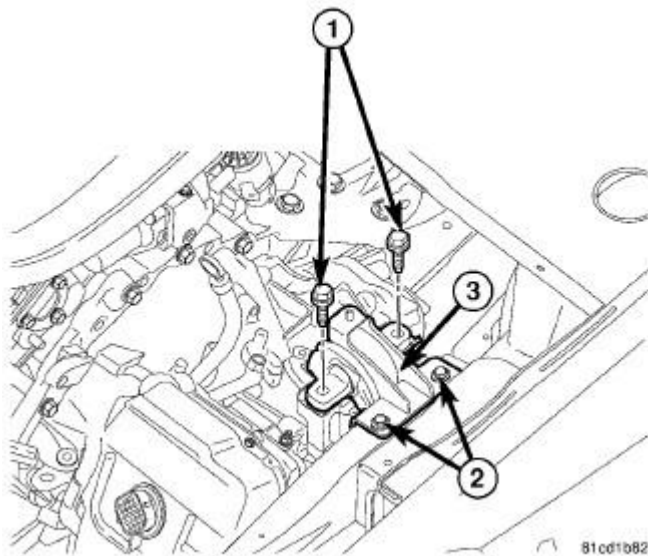


Fig. 367: Identifying Left Engine Mount-To-Engine Fasteners
 Courtesy of CHRYSLER LLC

3. Install the left engine mount bolts (1). Tighten to 95 Nm (70 lb. ft).

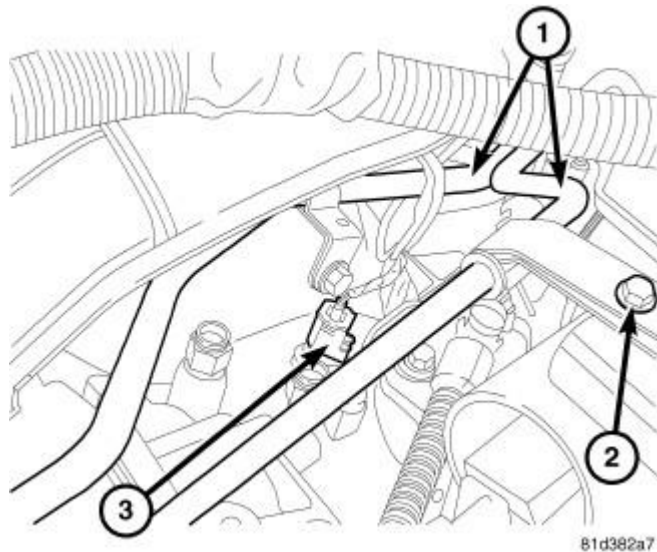


Fig. 368: Heater Line Retainer Bracket Fastener
 Courtesy of CHRYSLER LLC

4. Reposition the heater line bracket, and install the heater line bracket fastener (2).
5. Reconnect the negative battery cable.

INSULATOR, ENGINE MOUNT, RIGHT

Removal

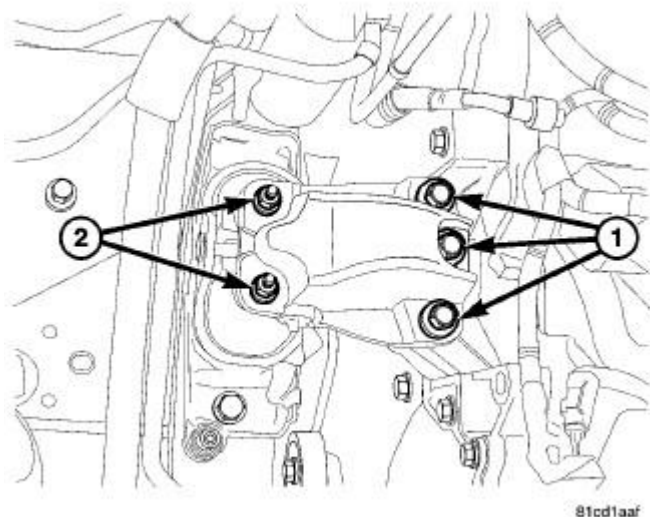
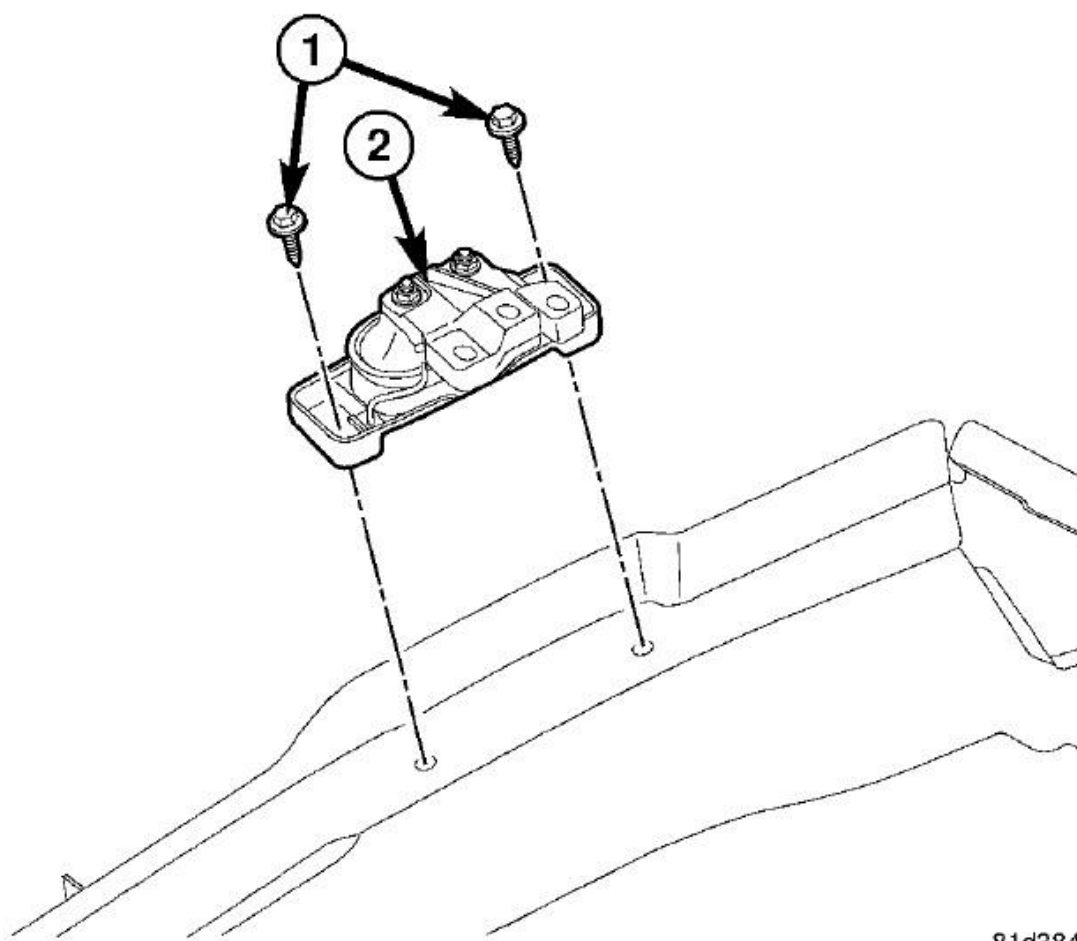
REMOVAL

Fig. 369: Identifying Right Engine Mount-To-Engine Fasteners
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the air filter box.
3. Use a suitable lifting device to support the engine weight.
4. Remove the engine mount plate fasteners (1) and (2), and remove the engine mount plate.



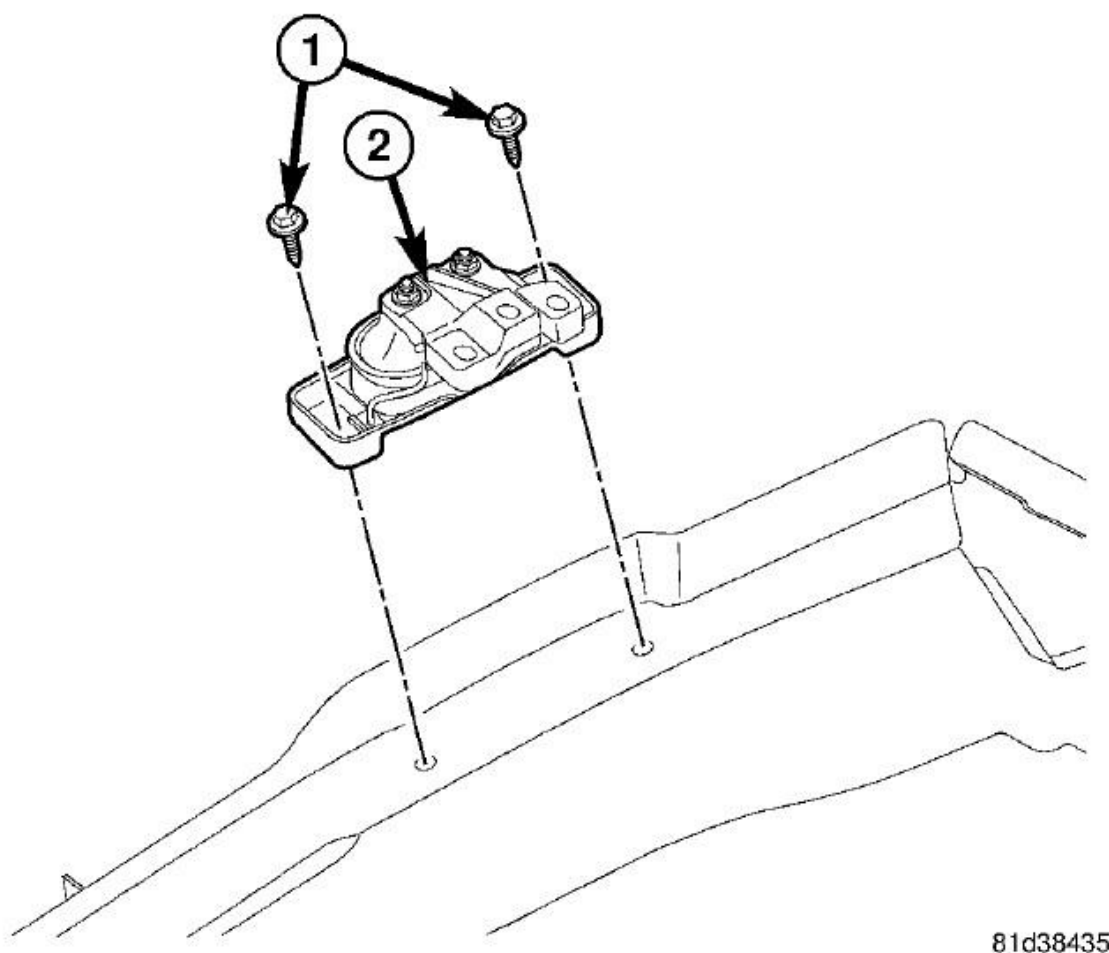
81d38435

Fig. 370: Right Mount Bracket Bolts
Courtesy of CHRYSLER LLC

5. Remove the right mount bracket bolts (1), and the right mount bracket.

Installation

INSTALLATION



81d38435

Fig. 371: Right Mount Bracket Bolts
Courtesy of CHRYSLER LLC

1. Install the right mount bracket (2).
2. Install the right mount bracket bolts (1). Tighten bolts to 54 N.m (40 lbs. ft.).

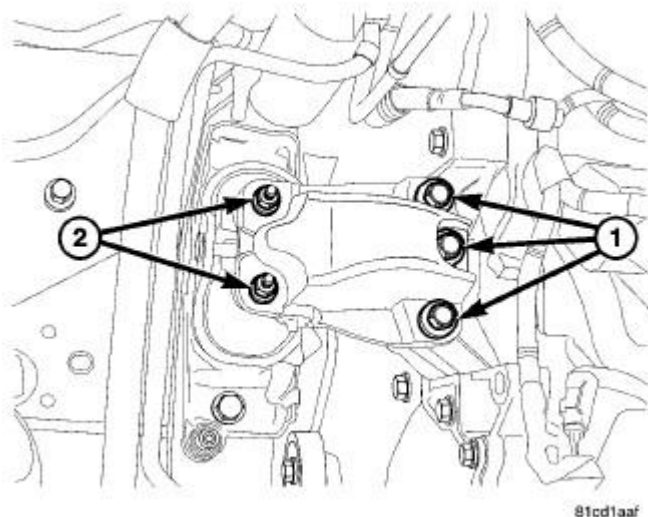


Fig. 372: Identifying Right Engine Mount-To-Engine Fasteners
Courtesy of CHRYSLER LLC

3. Install the engine mount plate.
4. Install the engine mount plate. Tighten bolts to 54 N.m (40 lbs. ft.).
5. Install the air filter box.
6. Connect the negative battery cable.

INSULATOR, ENGINE MOUNT, FRONT

Removal

REMOVAL

1. Raise vehicle.

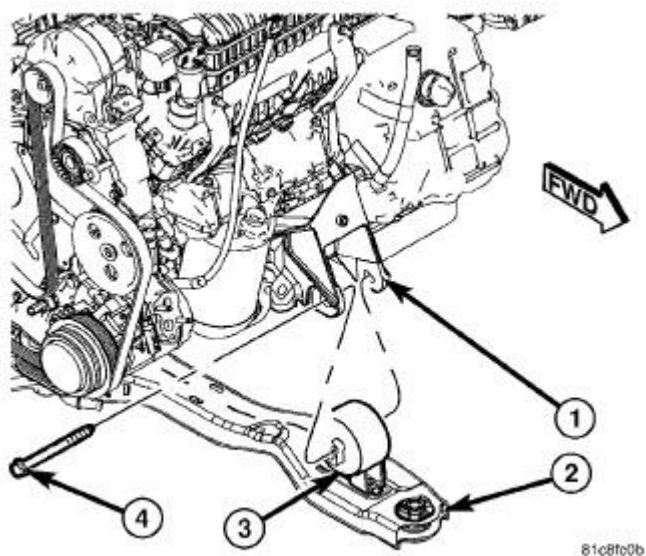


Fig. 373: Front Engine Mount Through Bolt
Courtesy of CHRYSLER LLC

2. Remove the front engine mount through bolt (4).

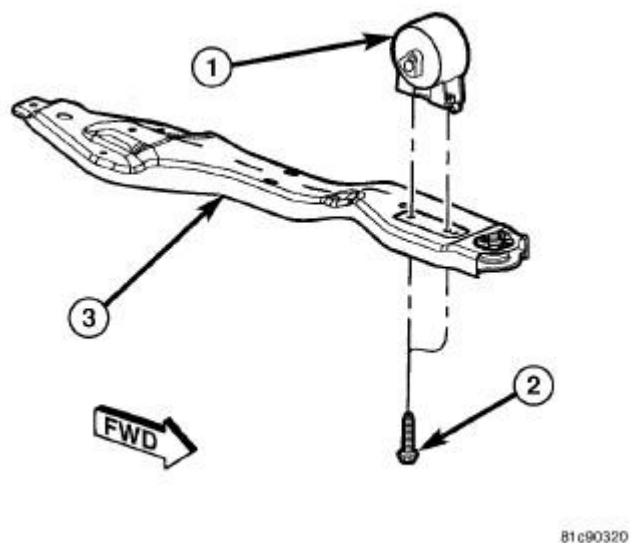


Fig. 374: Front Engine Mount Bolts
Courtesy of CHRYSLER LLC

3. Remove the two front engine mount bolts (2), and remove the front engine mount (1).

Installation

INSTALLATION

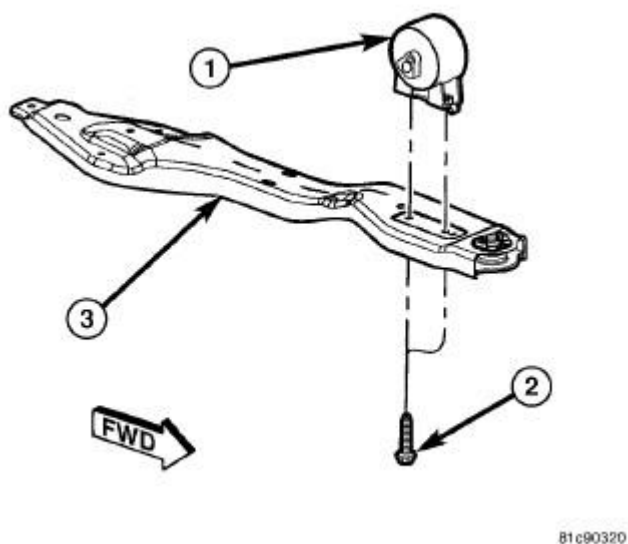


Fig. 375: Front Engine Mount Bolts
Courtesy of CHRYSLER LLC

1. Install front engine mount (1) on crossmember (3). Install mounting bolts (1) and tighten to 50 N.m (37 ft. lbs.).

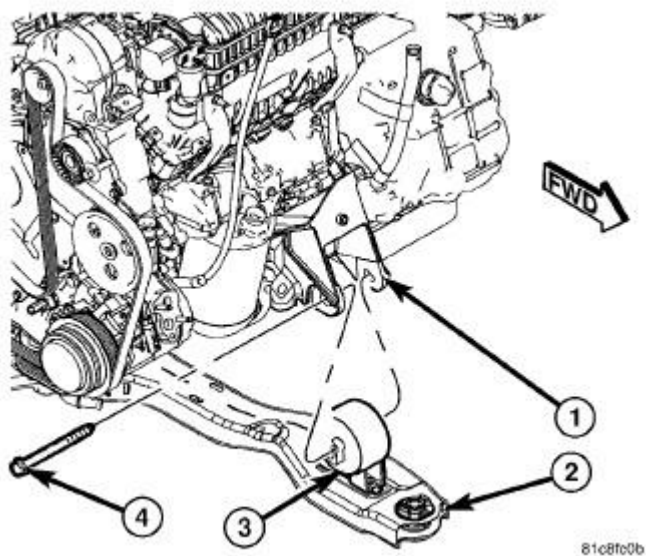


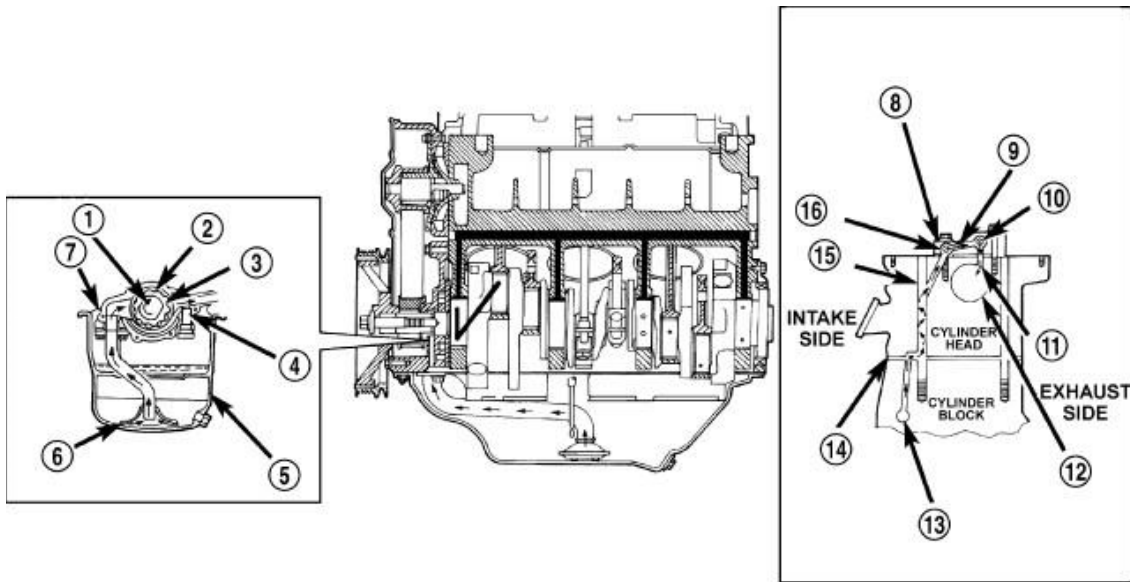
Fig. 376: Front Engine Mount Through Bolt
Courtesy of CHRYSLER LLC

2. Install front engine mount through bolt (5). Tighten bolt to 54 N.m (40 ft. lbs.).

LUBRICATION

DESCRIPTION

DESCRIPTION



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Fig. 377: Oil Lubrication System

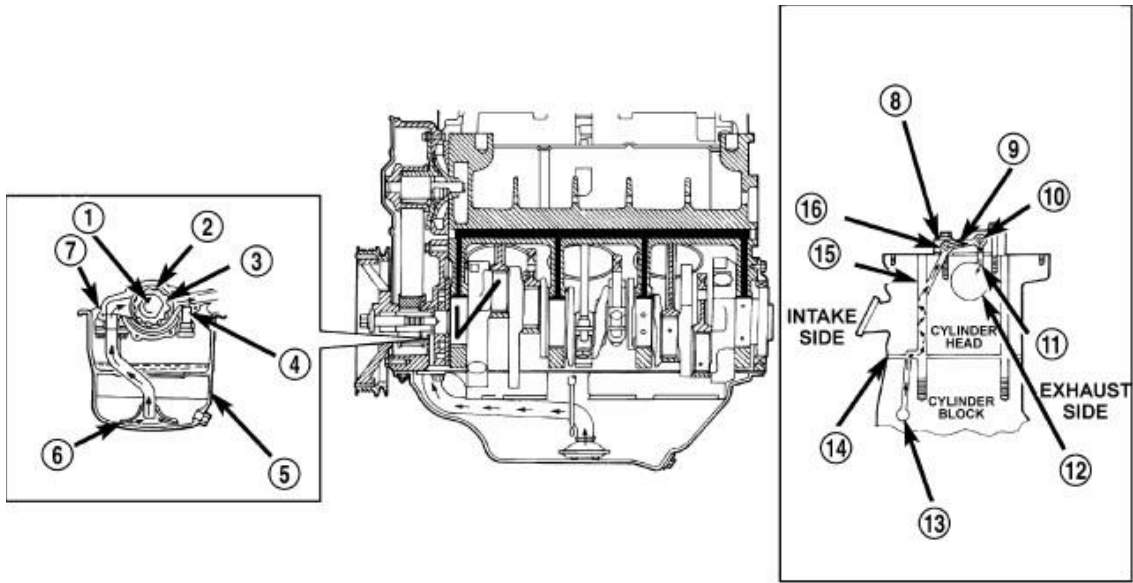
Courtesy of CHRYSLER LLC

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



80a53b64

Fig. 378: 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

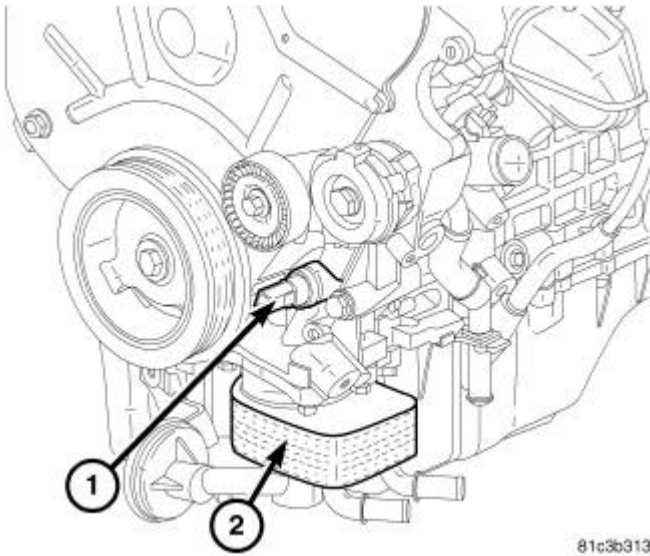


Fig. 379: Oil Pressure Switch & Engine Oil Cooler Location
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - Oil pressure switch
2 - Engine Oil Cooler |
|--|

Check oil pressure using a gauge at oil pressure switch location (1).

1. Remove the oil pressure switch (1). 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**.

ADAPTER, OIL FILTER

Removal

REMOVAL

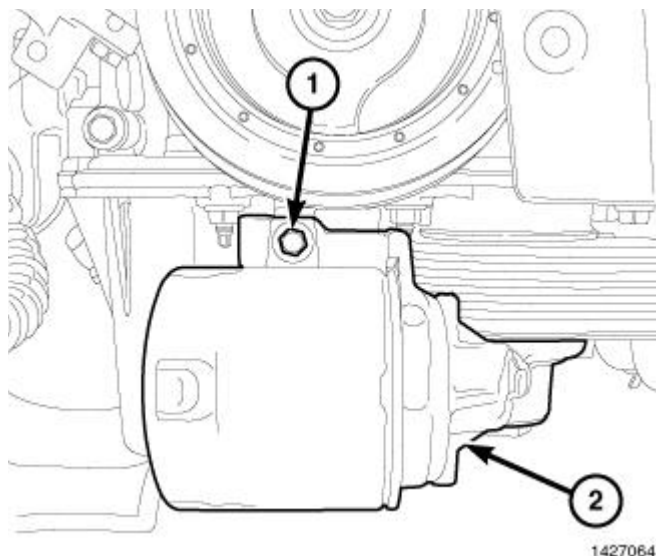


Fig. 380: Oil Filter Housing Support Bolt
Courtesy of CHRYSLER LLC

1. Raise and support the vehicle. Refer to Vehicle Quick Reference/Hoisting - Standard Procedure .
2. Drain engine oil. See Engine/Lubrication/OIL - Standard Procedure.
3. Remove the support bolt (1) from the oil filter housing (2).

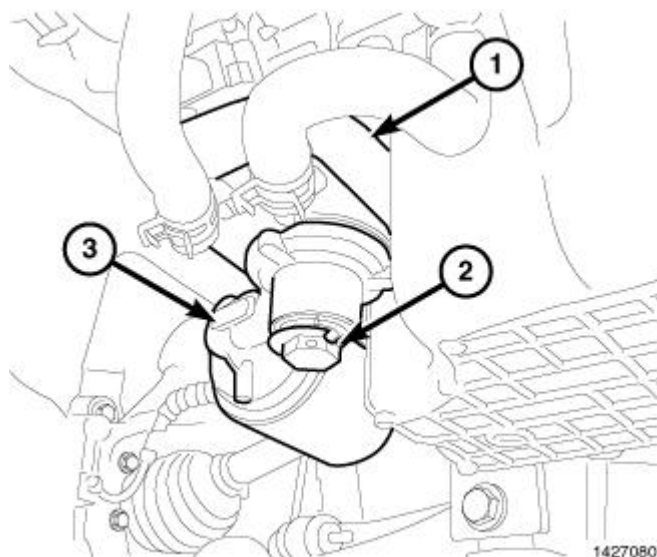


Fig. 381: Oil Cooler, Oil Filter Housing Bolt & Oil Filter Housing With Oil Filter
Courtesy of CHRYSLER LLC

4. Remove bolt (2) from oil filter housing and remove oil filter housing with oil filter (3) from oil cooler (1).

Installation

INSTALLATION

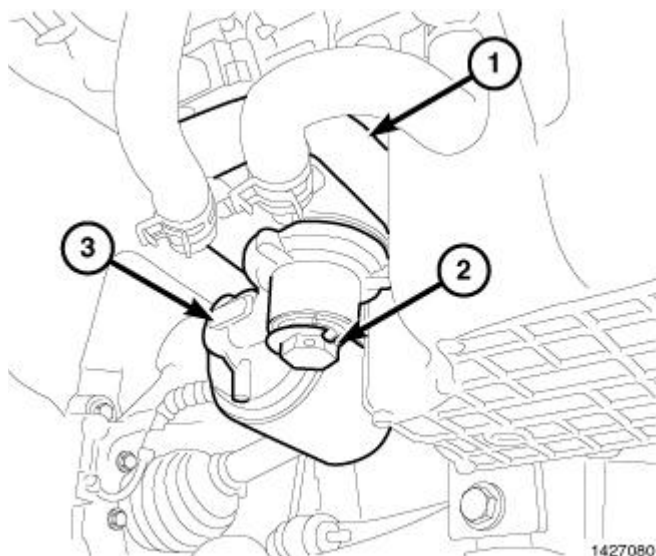


Fig. 382: Oil Cooler, Oil Filter Housing Bolt & Oil Filter Housing With Oil Filter
Courtesy of CHRYSLER LLC

1. Position oil filter adaptor with oil filter adapter gasket to oil cooler (1). Install bolt (2) finger tight.

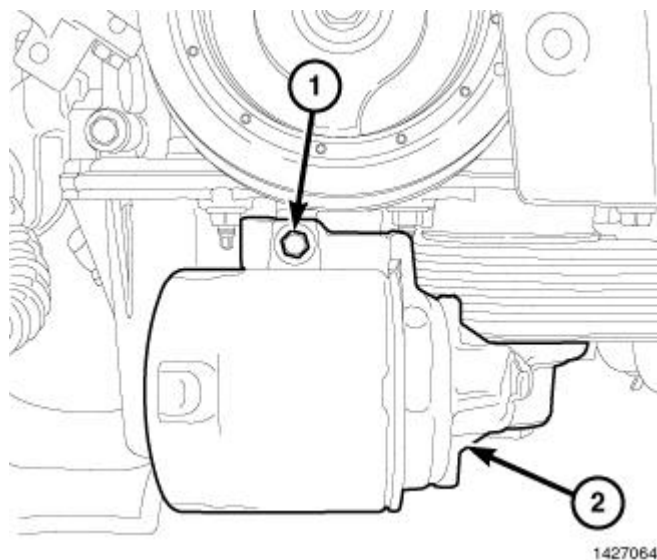


Fig. 383: Oil Filter Housing Support Bolt
Courtesy of CHRYSLER LLC

2. Install the oil filter housing support bolt (1) and tighten to 8 N.m (70 in. lbs.).

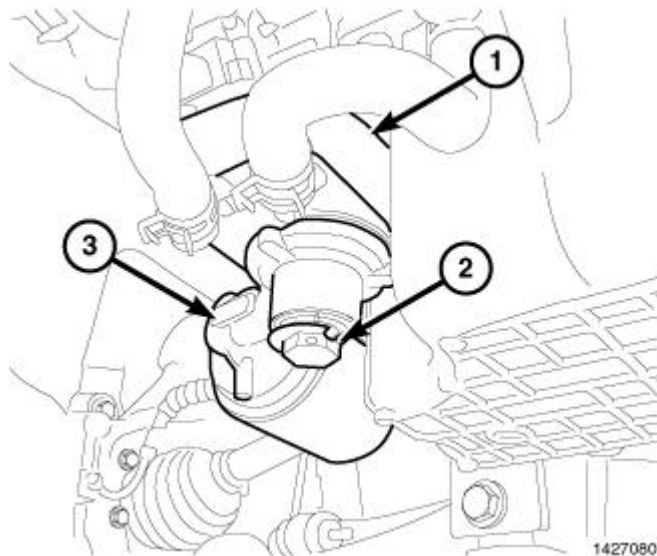


Fig. 384: Oil Cooler, Oil Filter Housing Bolt & Oil Filter Housing With Oil Filter
Courtesy of CHRYSLER LLC

3. Tighten the previously installed oil filter adapter bolt (2) to 54 N.m (40 ft. lbs.).
4. Install oil filter. See **Engine/Lubrication/ADAPTER, Oil Filter - Installation**.
5. Fill engine crankcase with proper oil to correct level. See **Engine/Lubrication/OIL - Standard Procedure**.
6. Start engine and check for leaks.

COOLER, OIL

Description

DESCRIPTION

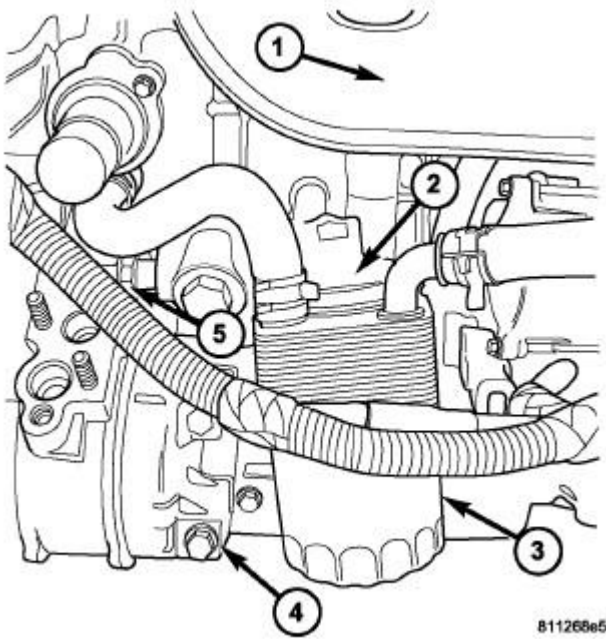


Fig. 385: Engine Oil Filter & Cooler
Courtesy of CHRYSLER LLC

- 1 - EXHAUST MANIFOLD
- 2 - ENGINE OIL COOLER
- 3 - ENGINE OIL FILTER
- 4 - AIR CONDITIONING COMPRESSOR
- 5 - OIL PRESSURE SENDING UNIT

The engine oil cooler is a coolant-to-oil type and is mounted between the oil filter and the oil pan.

Operation

OPERATION

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

Removal

REMOVAL

1. Drain cooling system. Refer to **Cooling - Standard Procedure**.
2. Raise vehicle on hoist.

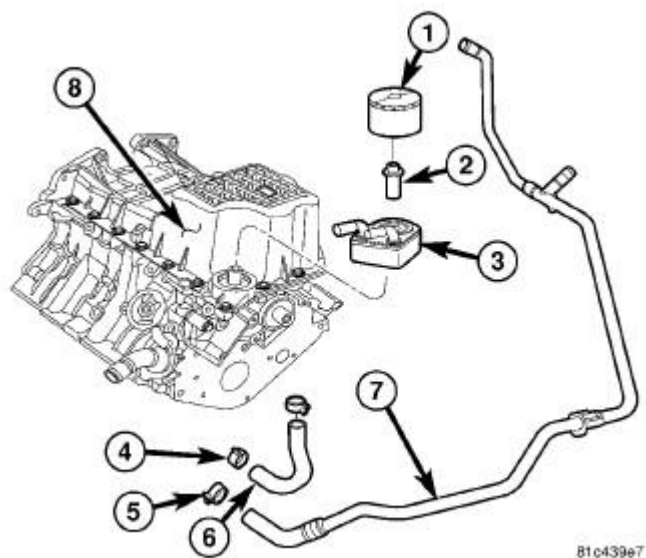


Fig. 386: Engine Oil Cooler & Filter Adapter
Courtesy of CHRYSLER LLC

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

3. Disconnect coolant inlet hose (7) and coolant outlet hose (6) from oil cooler.
4. Remove oil filter (1).
5. Remove oil filter connector (2) center of oil cooler.
6. Remove oil cooler (3).

Installation

INSTALLATION

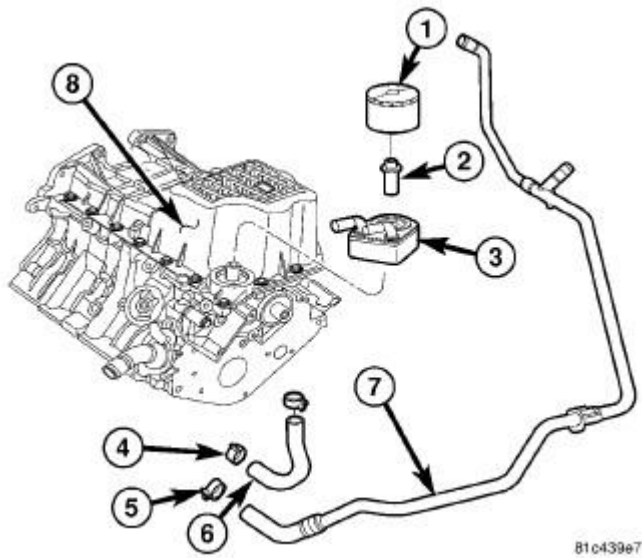


Fig. 387: Engine Oil Cooler & Filter Adapter
Courtesy of CHRYSLER LLC

- 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

1. Lubricate seal and position oil cooler (3) so that the notch of the oil cooler is aligned to the notch on oil pan (8).

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

2. Install oil cooler attaching fastener and tighten to 54 N.m (40 ft. lbs.).
3. Install oil filter (1).
4. Connect inlet coolant hose (7) and outlet coolant hose (6) to oil cooler (3).
5. Fill cooling system. Refer to Cooling - Standard Procedure .

FILTER, ENGINE OIL

Removal

REMOVAL

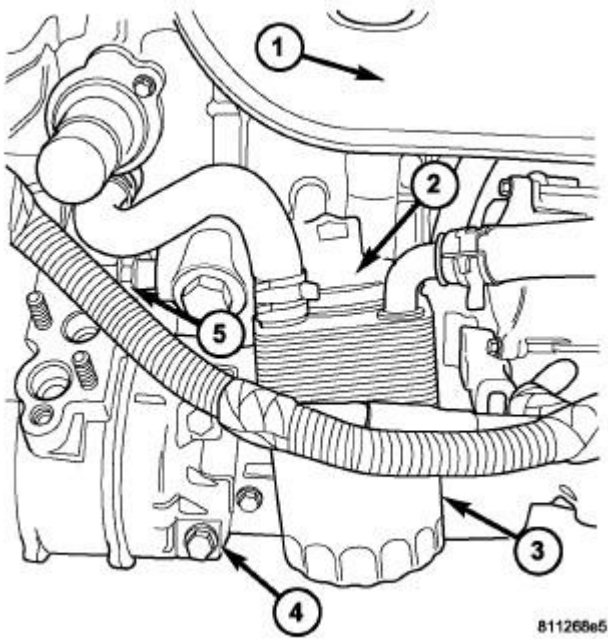


Fig. 388: Engine Oil Filter & Cooler
Courtesy of CHRYSLER LLC

- 1 - EXHAUST MANIFOLD
- 2 - ENGINE OIL COOLER
- 3 - ENGINE OIL FILTER
- 4 - AIR CONDITIONING COMPRESSOR
- 5 - OIL PRESSURE SENDING UNIT

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 from base and discard.

Installation

INSTALLATION

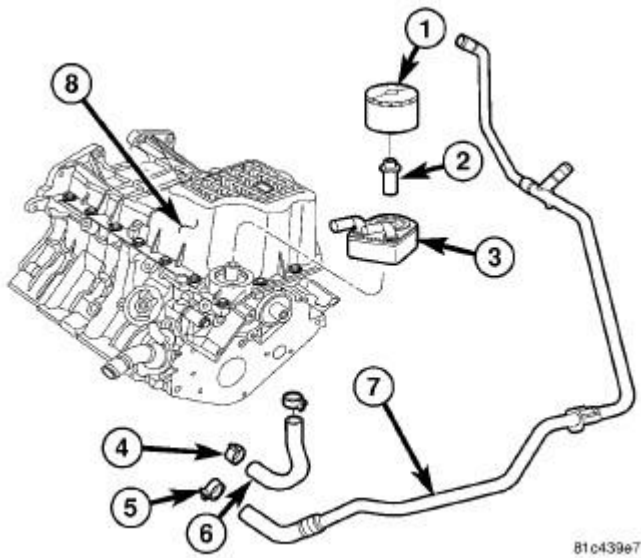


Fig. 389: Engine Oil Cooler & Filter Adapter
Courtesy of CHRYSLER LLC

- 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

1. Wipe base clean, then inspect gasket contact surface.
2. Lubricate gasket of new filter with clean engine oil.
3. Install and tighten filter (1) 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

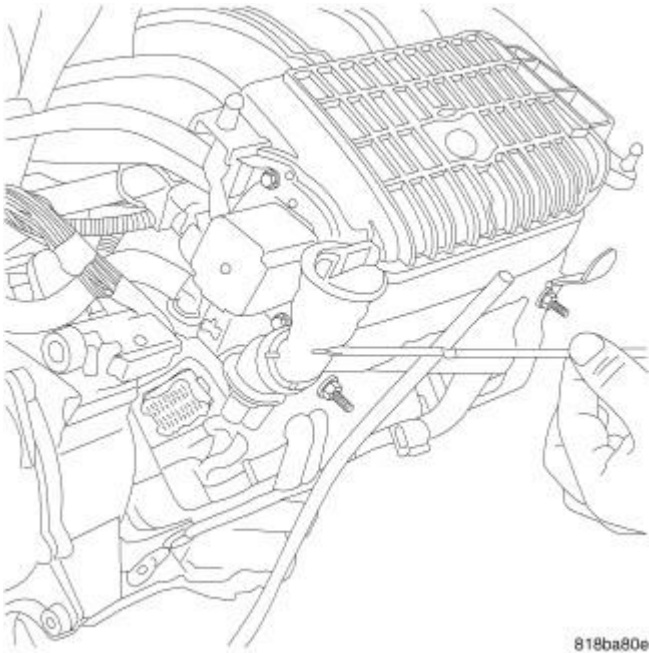
Description

DESCRIPTION

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

Standard Procedure

ENGINE OIL LEVEL CHECK

**Fig. 390: OIL LEVEL**

Courtesy of CHRYSLER LLC

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

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

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

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.

4. Raise vehicle on hoist.
5. Place a suitable drain pan under crankcase drain.
6. Remove oil pan drain plug 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.
8. Install drain plug in crankcase. Torque oil pan drain plug to 27 N.m (20 ft. lbs.).
9. Install new oil filter.
10. Lower vehicle.
11. Fill crankcase with specified amount and type of engine oil. Refer to **Vehicle Quick Reference/Capacities and Recommended Fluids - Description** . Refer to **Vehicle Quick Reference/Capacities and Recommended Fluids - Specifications** .
12. Install oil fill cap.
13. Start engine and inspect for leaks.
14. Stop engine and inspect oil level (2).

OIL FILTER SPECIFICATION

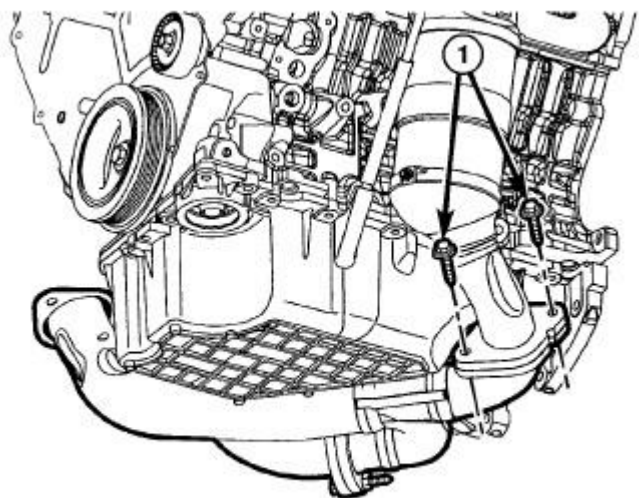
All engines are equipped with a high quality full-flow, disposable type oil filter. When replacing oil filter, use a Mopar® filter or equivalent.

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**

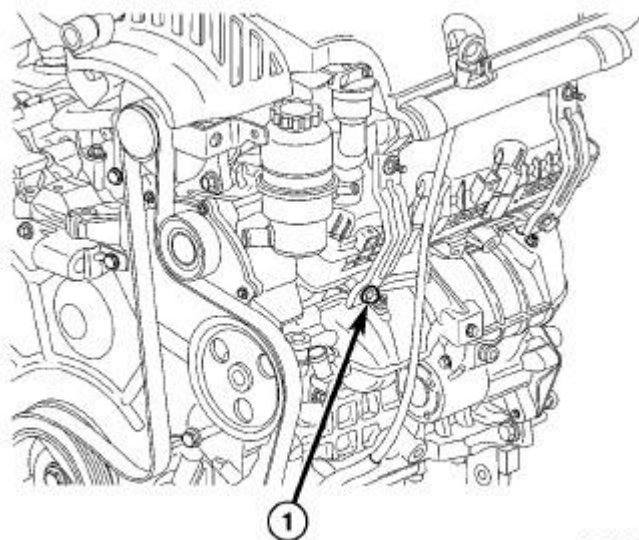
1. Disconnect and isolate the negative battery cable.



81c63c36

Fig. 391: Front Maniverter-To-Crossunder Bolts
Courtesy of CHRYSLER LLC

2. Remove the crossunder pipe. Refer to **Exhaust System/PIPE, Exhaust Crossunder - Removal** .



81c64082

Fig. 392: Identifying Oil Level Indicator Tube Retaining Bolt
Courtesy of CHRYSLER LLC

3. Remove the oil dipstick tube bolt (1) and remove the oil dipstick tube.

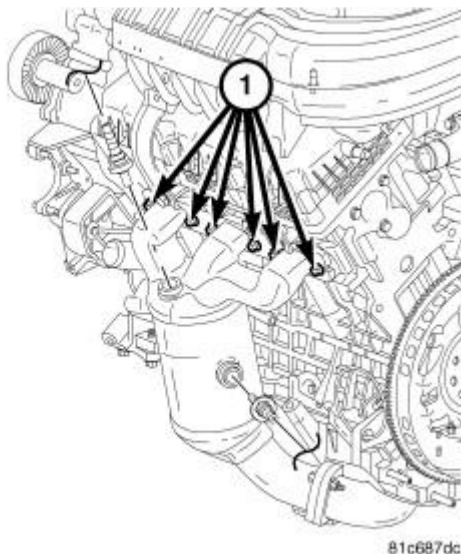


Fig. 393: Identifying Upper Exhaust Maniferter Retaining Bolts
Courtesy of CHRYSLER LLC

4. Remove the front maniferter. See **Engine/Manifolds/MANIFOLD, Exhaust - Removal**.

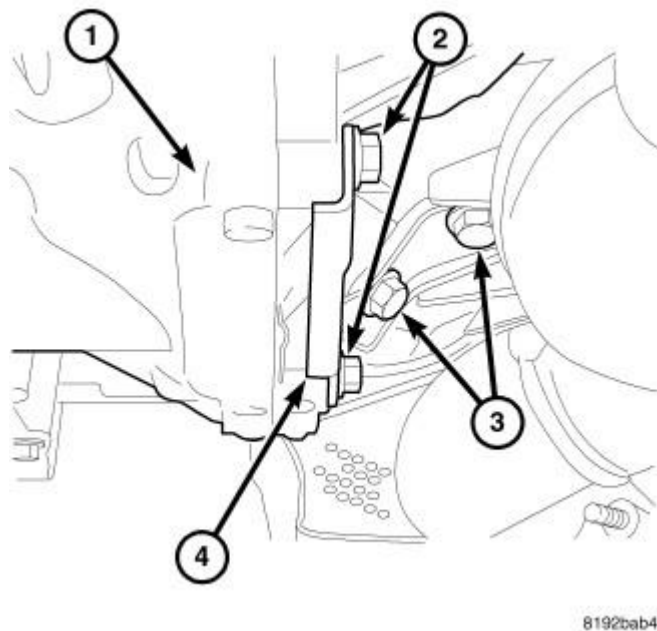


Fig. 394: Identifying Exhaust Bracket & Bolts
Courtesy of CHRYSLER LLC

5. Raise and support the vehicle. Refer to **Vehicle Quick Reference/Hoisting - Standard Procedure**.
6. Remove the crossunder pipe bracket (4) from the bottom of the transaxle bellhousing (1).

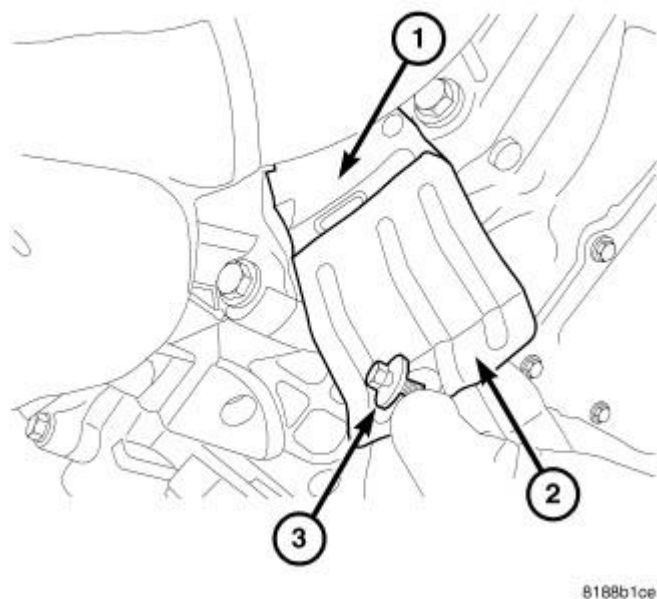


Fig. 395: Identifying Dust Shield & Bolt
Courtesy of CHRYSLER LLC

7. Remove the bolt (3) and the torque converter access cover (2).
8. Drain engine oil. See **Engine/Lubrication/OIL - Standard Procedure**.

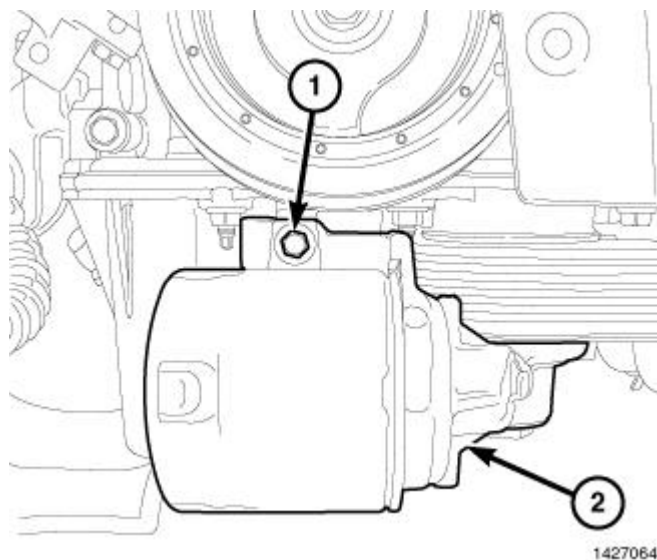


Fig. 396: Oil Filter Housing Support Bolt
Courtesy of CHRYSLER LLC

9. Remove the support bolt (1) from the oil filter housing (2).

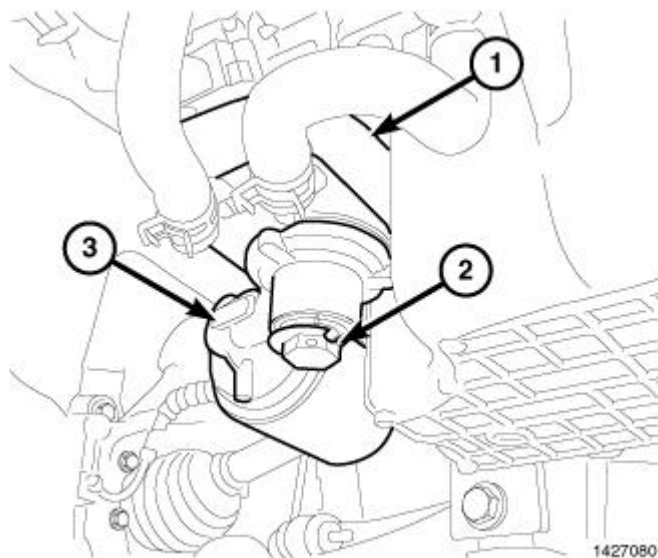


Fig. 397: Oil Cooler, Oil Filter Housing Bolt & Oil Filter Housing With Oil Filter
Courtesy of CHRYSLER LLC

10. Remove bolt (2) from oil filter housing and remove oil filter housing with oil filter (3) from oil cooler (1).

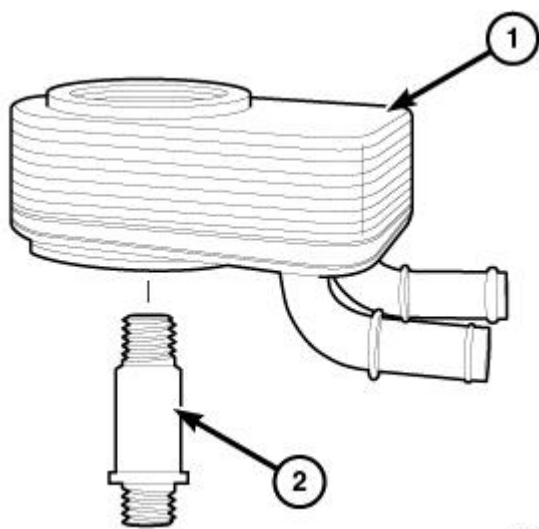


Fig. 398: Oil Cooler Connector Bolt
Courtesy of CHRYSLER LLC

11. Remove oil cooler connector bolt (2) and reposition oil cooler (1).

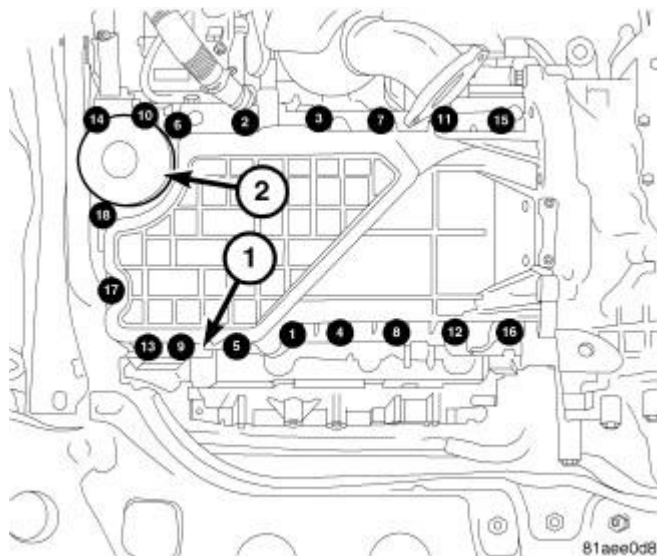


Fig. 399: Identifying Oil Pan Loosening/Tightening Sequence
Courtesy of CHRYSLER LLC

12. Remove oil pan fasteners. Remove 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

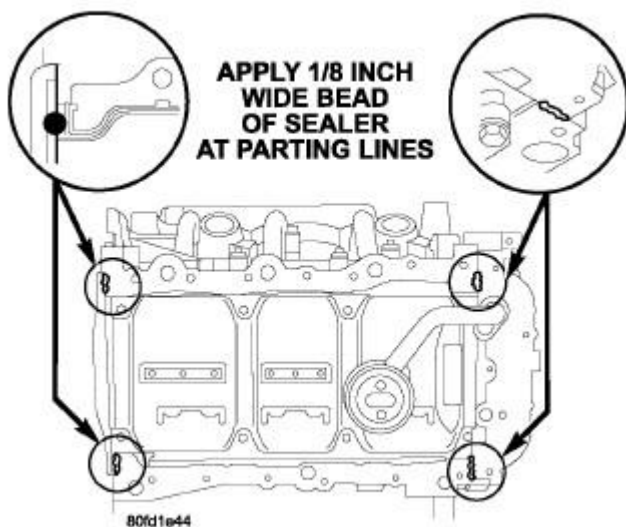


Fig. 400: Oil Pan Sealing - Typical

Courtesy of CHRYSLER LLC

1. Clean oil pan and all gasket surfaces. See Engine - Standard Procedure.
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.

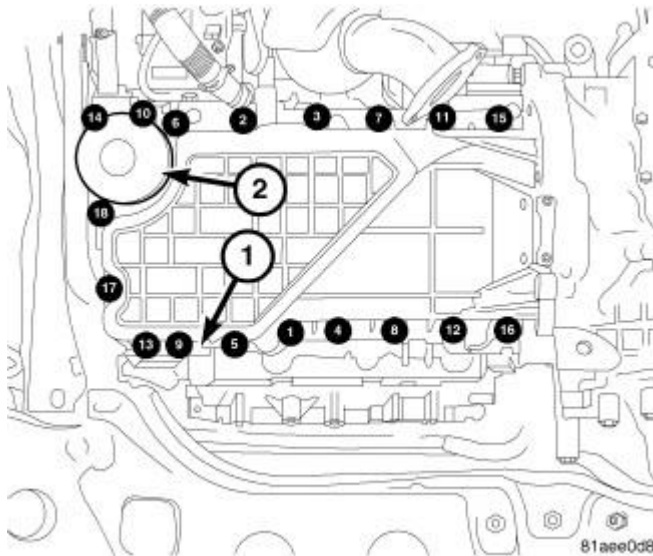


Fig. 401: Identifying Oil Pan Loosening/Tightening Sequence
Courtesy of CHRYSLER LLC

4. Install oil pan and tighten oil pan bolts and nuts to 28 N.m (21 ft. lbs.).

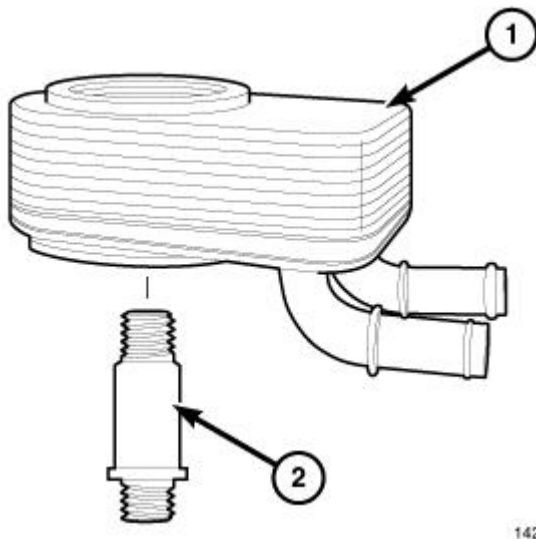


Fig. 402: Oil Cooler Connector Bolt
Courtesy of CHRYSLER LLC

5. Position oil cooler (1) to engine block. Install oil cooler connector bolt (2) and tighten to 54 N.m (40 ft.

lbs.).

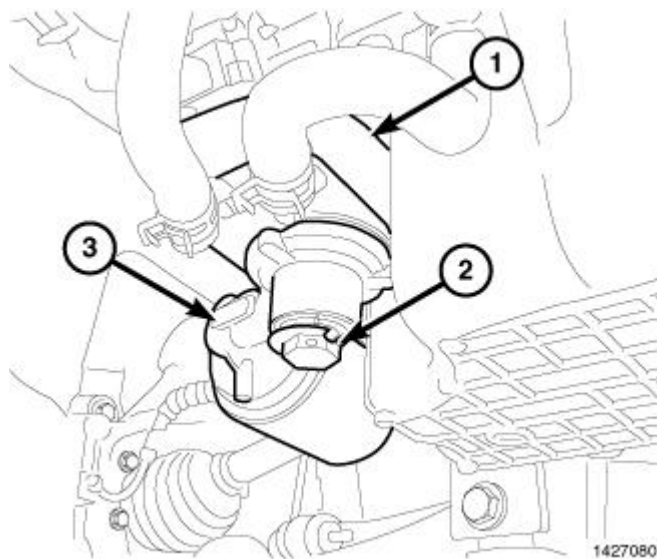


Fig. 403: Oil Cooler, Oil Filter Housing Bolt & Oil Filter Housing With Oil Filter
Courtesy of CHRYSLER LLC

6. Position oil filter adaptor and oil filter (3) to oil cooler (1). Install bolt (2) finger tight.

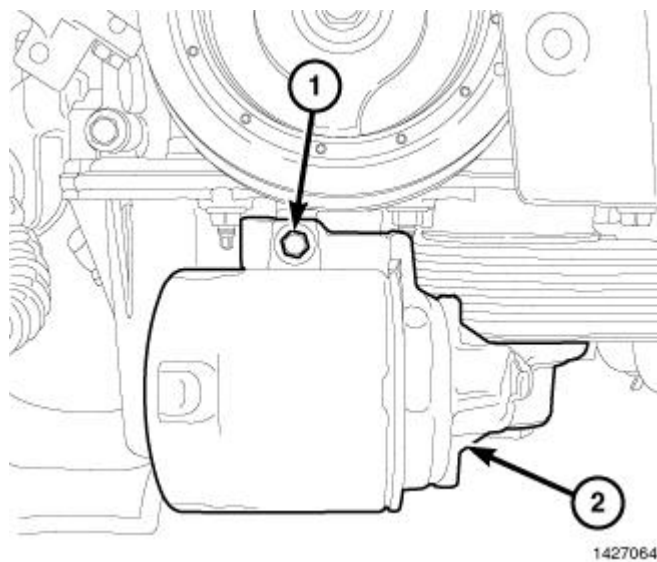


Fig. 404: Oil Filter Housing Support Bolt
Courtesy of CHRYSLER LLC

7. Install the oil filter housing support bolt (1) and tighten to 8 N.m (70 in. lbs.).

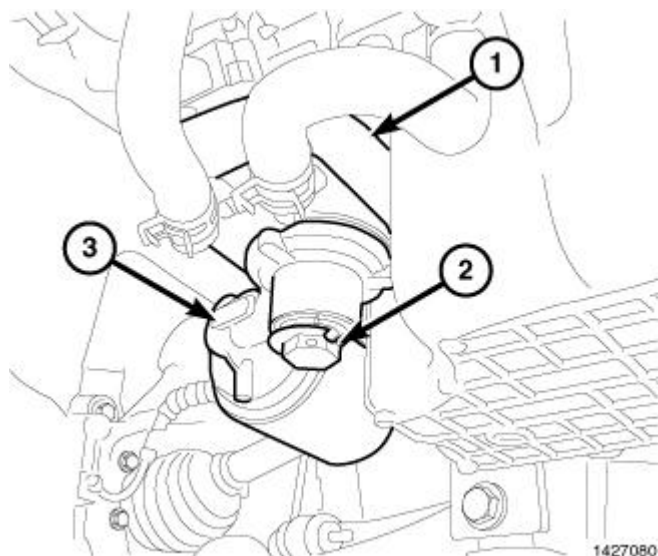


Fig. 405: Oil Cooler, Oil Filter Housing Bolt & Oil Filter Housing With Oil Filter
Courtesy of CHRYSLER LLC

8. Tighten the previously installed oil filter adapter bolt (2) to 54 N.m (40 ft. lbs.).

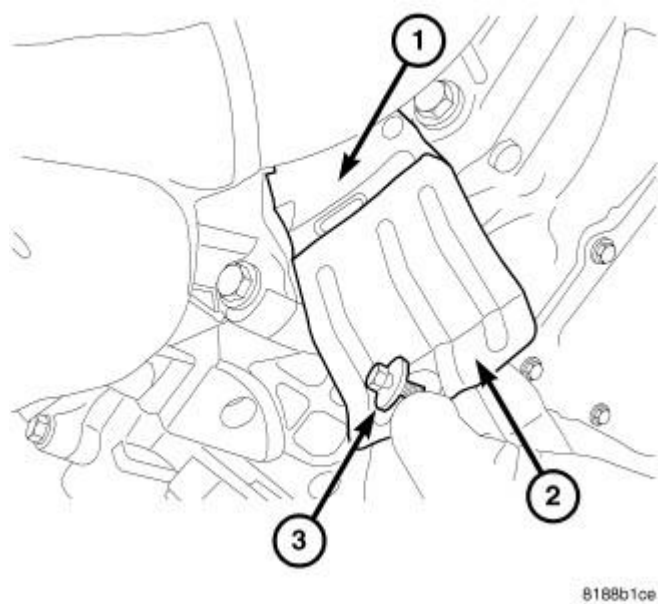
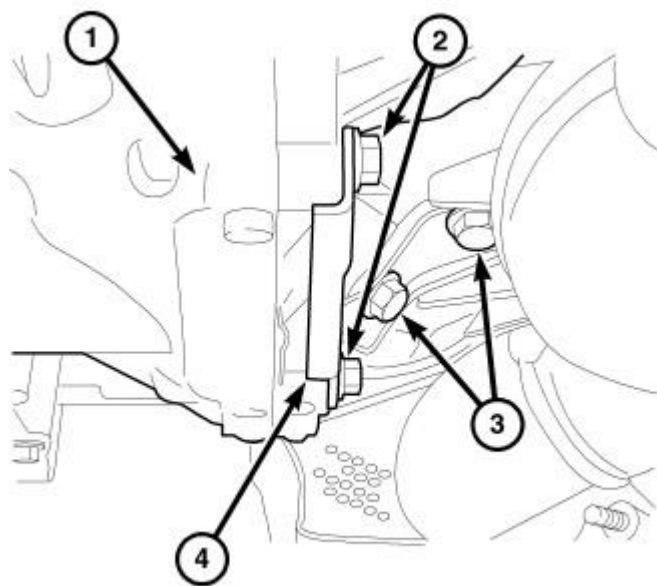


Fig. 406: Identifying Dust Shield & Bolt
Courtesy of CHRYSLER LLC

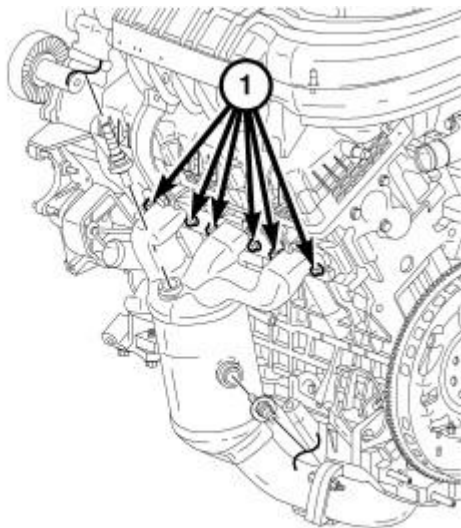
9. Install torque converter access cover (2).



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Fig. 407: Identifying Exhaust Bracket & Bolts
 Courtesy of CHRYSLER LLC

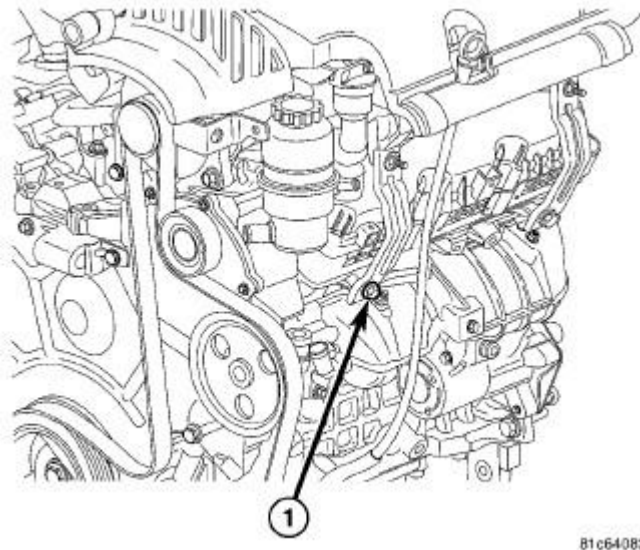
10. Install the crossunder pipe bracket (4). Tighten bolts (2) to 28 N.m (21 ft. lbs.).



81c687dc

Fig. 408: Identifying Upper Exhaust Manifold Retaining Bolts
 Courtesy of CHRYSLER LLC

11. Install the front manifold. See **Engine/Manifolds/MANIFOLD, Exhaust - Installation.**



81c64082

Fig. 409: Identifying Oil Level Indicator Tube Retaining Bolt
Courtesy of CHRYSLER LLC

12. Install the oil dipstick tube and install oil dipstick tube bolt (1).
13. Install the crossunder pipe. Refer to **Exhaust System/PIPE, Exhaust Crossunder - Installation** .
14. Fill engine crankcase with proper oil to correct level. See **Engine/Lubrication/OIL - Standard Procedure**.
15. Reconnect negative battery cable.
16. Start engine and check for leaks.

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.

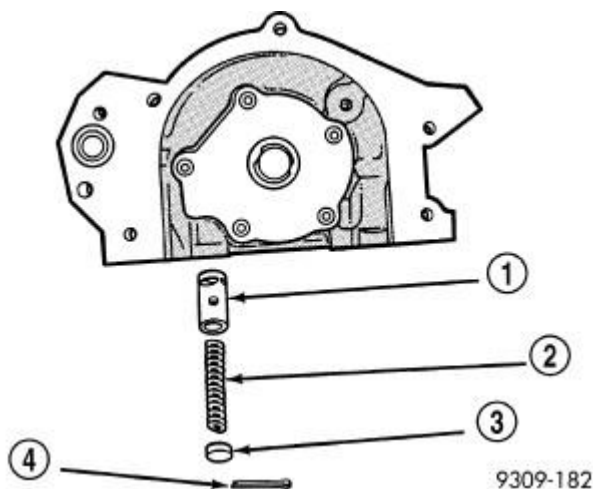
Disassembly**DISASSEMBLY**

Fig. 410: 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, proceed as follows:
2. Drill a 3.175 mm (1/8 inch.) hole into the relief valve retainer cap and insert a self-threading sheet metal screw into cap.
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 and remove spring 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.

3. Lay a straightedge across the pump cover surface . If a 0.025 mm (0.001 in.) feeler gauge can be inserted between cover and straight edge, cover should be replaced.

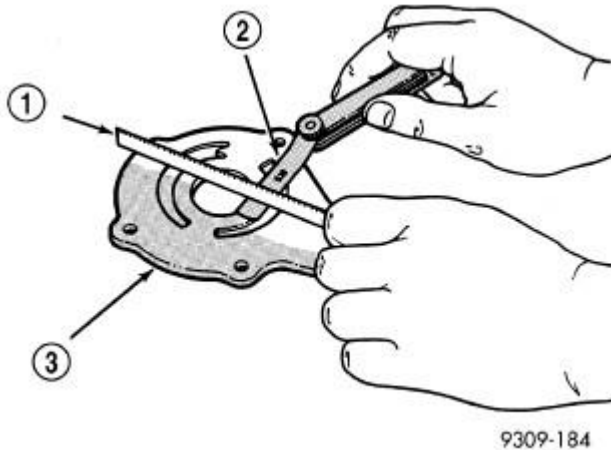


Fig. 411: Checking Oil Pump Cover Flatness
Courtesy of CHRYSLER LLC

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

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.

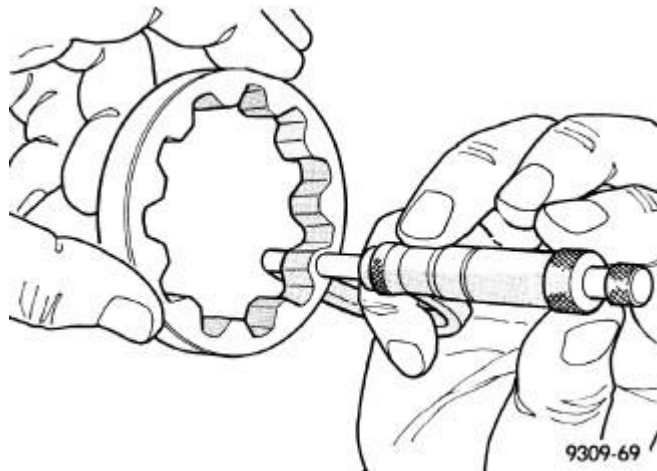
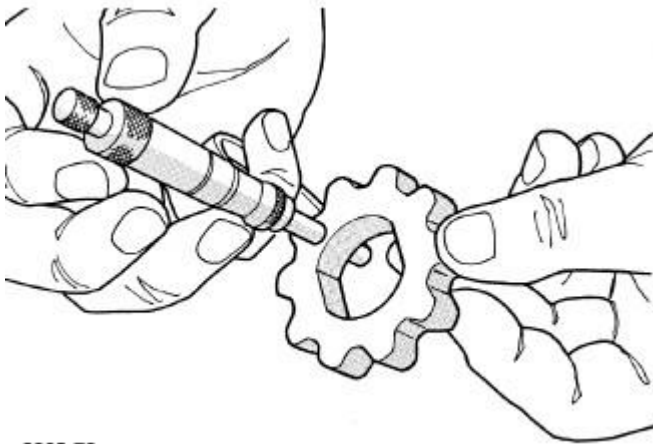


Fig. 412: Measuring Outer Rotor Thickness
Courtesy of CHRYSLER LLC

5. If inner rotor measures 14.299 mm (0.563 in.) or less replace inner rotor .

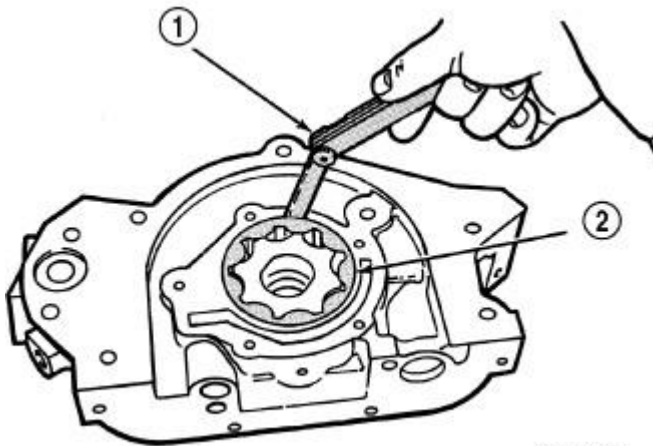


9309-70

Fig. 413: Measuring Inner Rotor Thickness

Courtesy of CHRYSLER LLC

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.



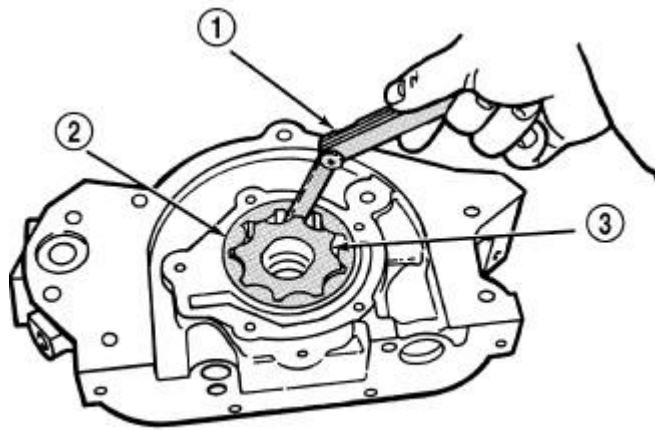
9309-187

Fig. 414: Measuring Outer Rotor Clearance in Housing

Courtesy of CHRYSLER LLC

- | |
|-------------------------------------|
| 1 - FEELER GAUGE
2 - OUTER ROTOR |
|-------------------------------------|

7. Install inner rotor into body. If clearance between inner and outer rotors is 0.20 mm (0.008 inch.) or more, replace both rotors.

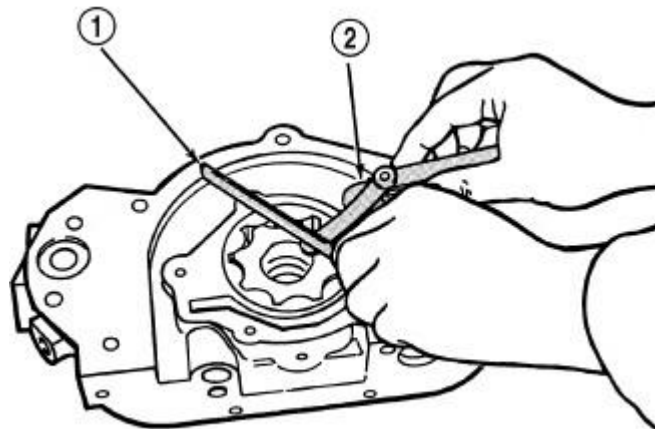


9309-188

Fig. 415: Measuring Clearance Between Rotors
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - FEELER GAUGE
2 - OUTER ROTOR
3 - INNER ROTOR</p> |
|---|

- 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.



9309-189

Fig. 416: Measuring Clearance Over Rotors
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - STRAIGHT EDGE
2 - FEELER GAUGES</p> |
|--|

- 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.

10. The relief valve spring 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.

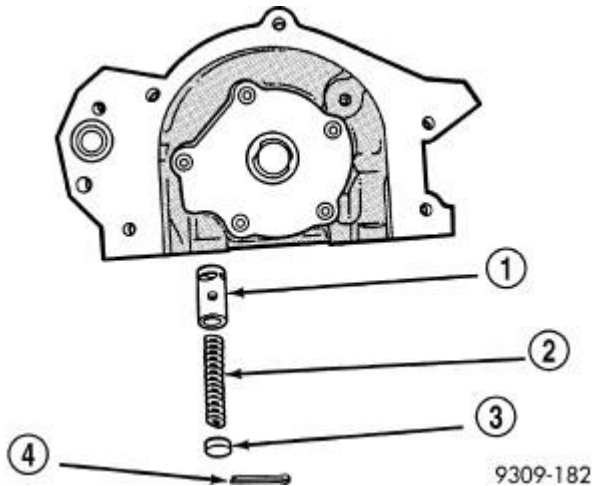


Fig. 417: Oil Pressure Relief Valve
Courtesy of CHRYSLER LLC

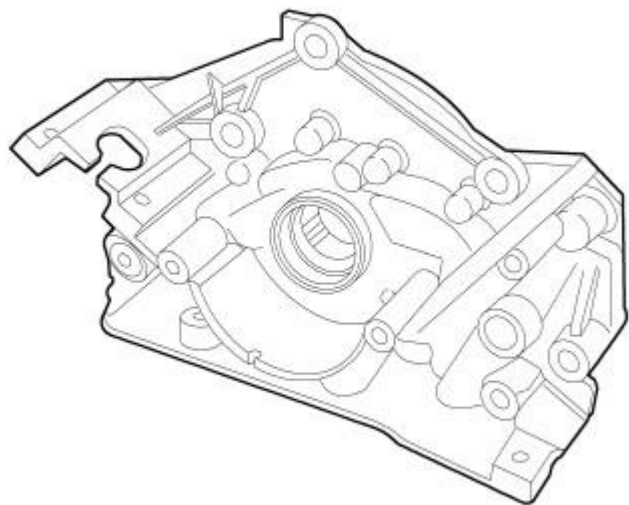
- | |
|--|
| <p>1 - RELIEF VALVE
2 - SPRING
3 - RETAINER CAP
4 - COTTER PIN</p> |
|--|

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.



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Fig. 418: Oil Pump

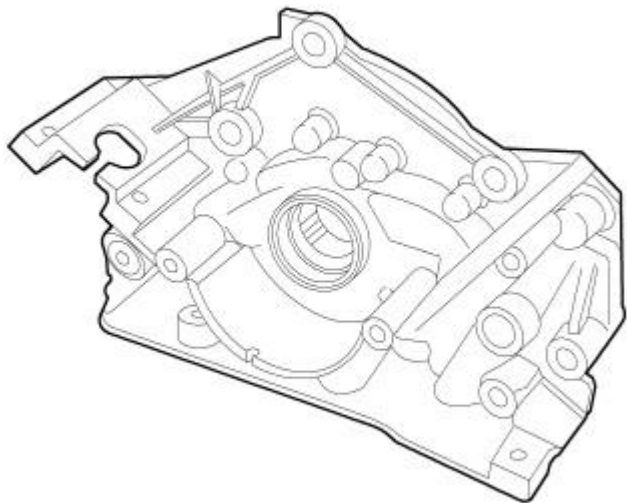
Courtesy of CHRYSLER LLC

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 .



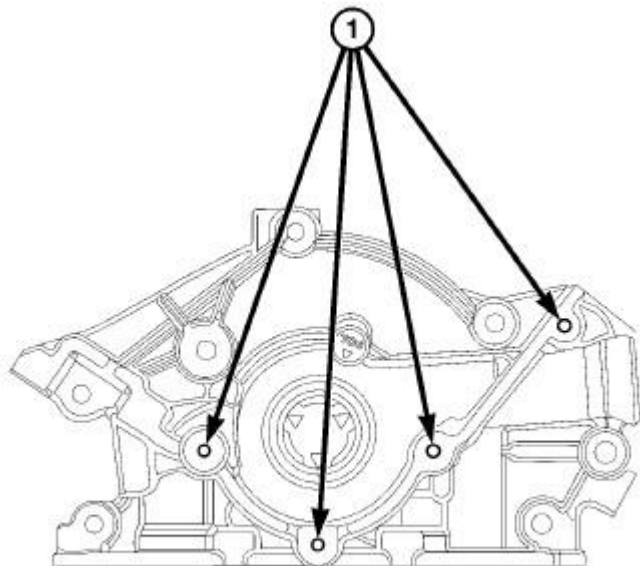
81803a12

Fig. 419: 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.)



8140c22d

Fig. 420: 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. Refer to **BELT and SPROCKETS, Timing**.
8. Install timing belt. Refer to **BELT and SPROCKETS, Timing**.
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

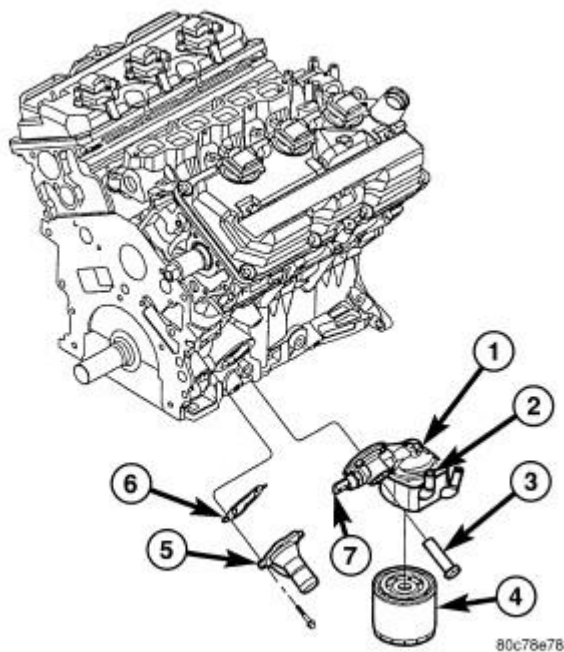


Fig. 421: Engine Oil Cooler & Filter Adapter
Courtesy of CHRYSLER LLC

- 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

1. Raise vehicle on hoist.
2. Position an oil collecting container under switch location.
3. Disconnect electrical connector.
4. Unscrew oil pressure switch from oil pump .

Installation

INSTALLATION

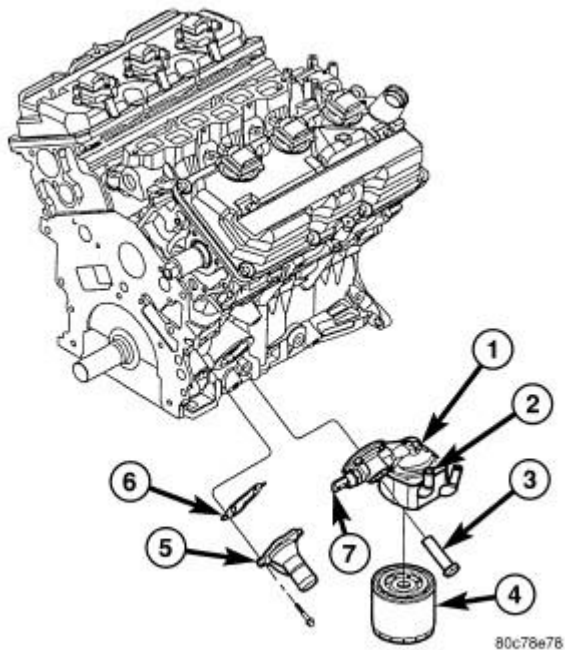


Fig. 422: Engine Oil Cooler & Filter Adapter
Courtesy of CHRYSLER LLC

- 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

1. Apply Mopar® Thread Sealant to the switch threads.
2. Install oil pressure switch to fitting .
3. Connect electrical connector.
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

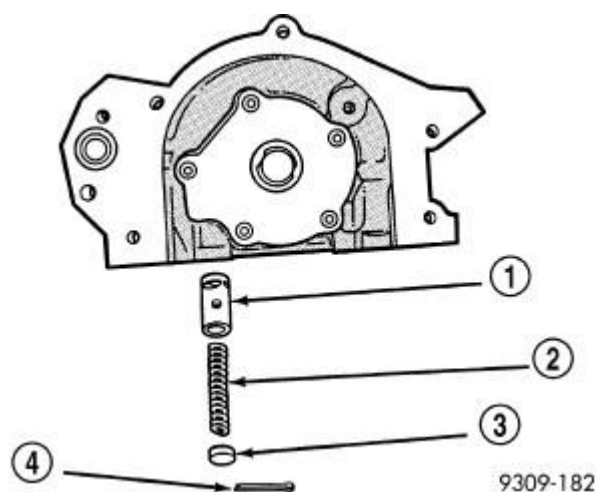


Fig. 423: Oil Pressure Relief Valve
Courtesy of CHRYSLER LLC

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

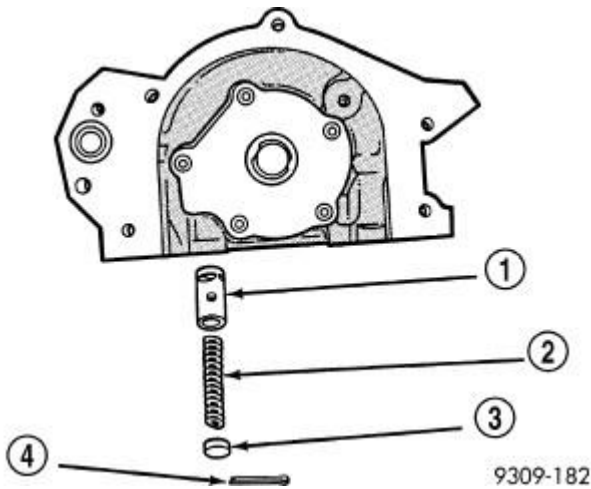


Fig. 424: Oil Pressure Relief Valve
Courtesy of CHRYSLER LLC

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

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

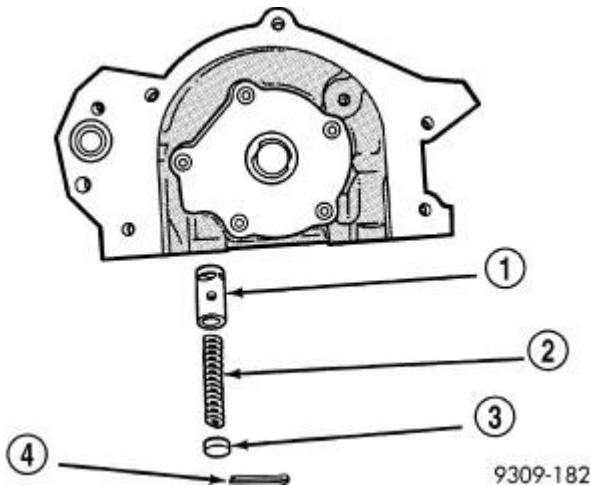


Fig. 425: Oil Pressure Relief Valve
Courtesy of CHRYSLER LLC

- 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 illustration , or engine damage may occur.

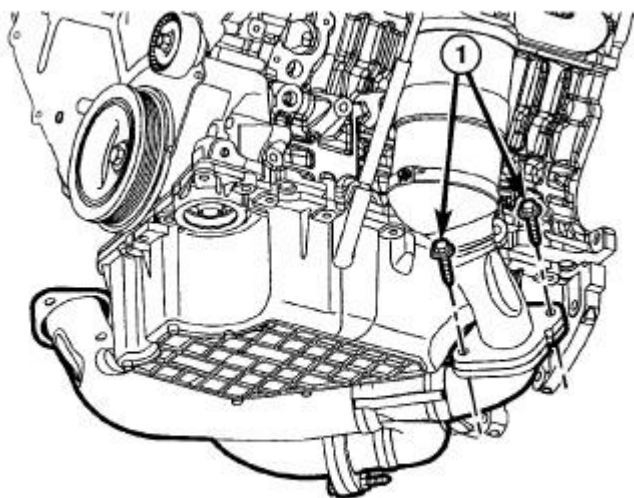
2. Install valve (1), spring (2) and retainer cap.
3. Install new cotter pin (4).
4. Install the oil pan. See Engine/Lubrication/PAN, Oil - Installation.

MANIFOLDS

MANIFOLD, EXHAUST, CROSSUNDER

Removal

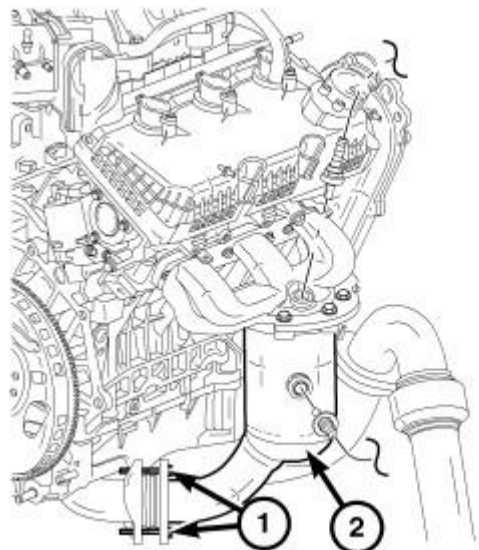
REMOVAL



81c63c36

Fig. 426: Front Maniverter-To-Crossunder Bolts
Courtesy of CHRYSLER LLC

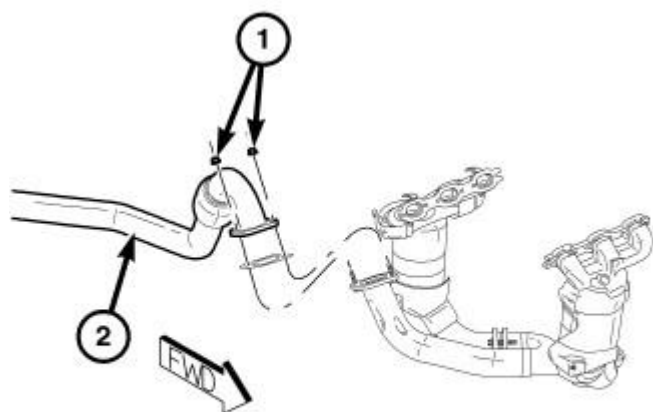
1. Remove the front maniverter-to-crossunder fasteners (1).



81c69563

Fig. 427: Rear Maniverter-To-Crossunder Lower Bolts
Courtesy of CHRYSLER LLC

2. Remove the rear maniverter-to-crossunder fasteners (1).

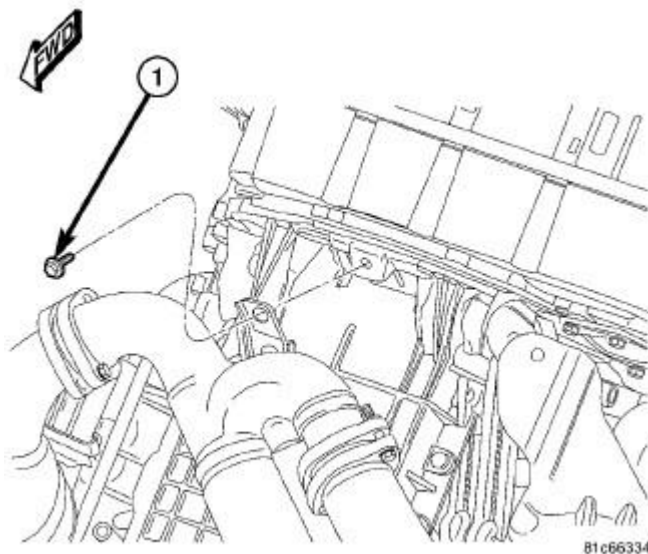


81c695a6

Fig. 428: Exhaust-To-Crossunder Bolts

Courtesy of CHRYSLER LLC

3. Remove the exhaust-to-crossunder fasteners (1).



81c66334

Fig. 429: Crossunder Bracket Bolt

Courtesy of CHRYSLER LLC

4. Remove the crossunder bracket fastener (1), and the crossunder pipe.

Installation

INSTALLATION

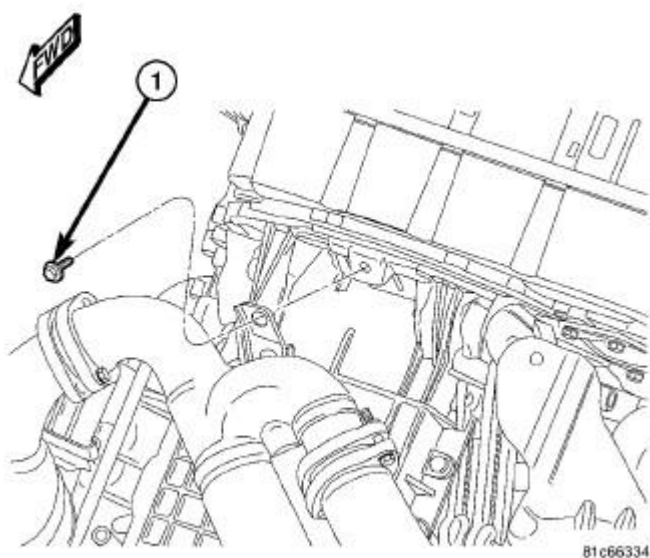


Fig. 430: Crossunder Bracket Bolt
Courtesy of CHRYSLER LLC

1. Install the crossunder pipe, then loosely install the crossunder bracket fastener (1).

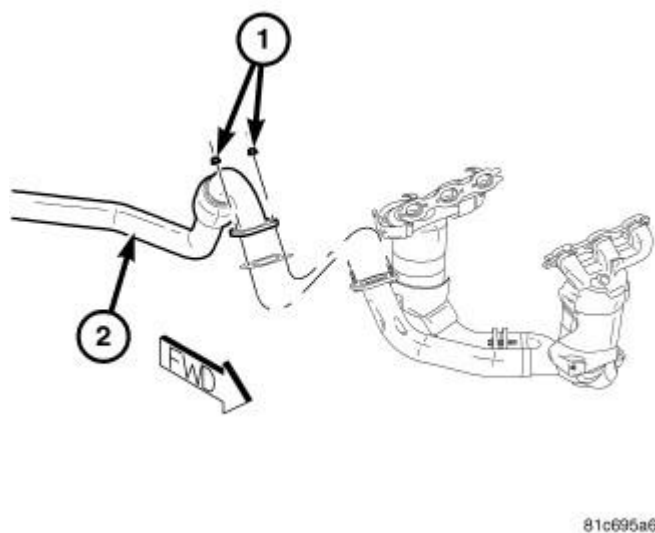


Fig. 431: Exhaust-To-Crossunder Bolts
Courtesy of CHRYSLER LLC

2. Install the exhaust pipe, then loosely install the exhaust-to-crossunder fasteners (1).

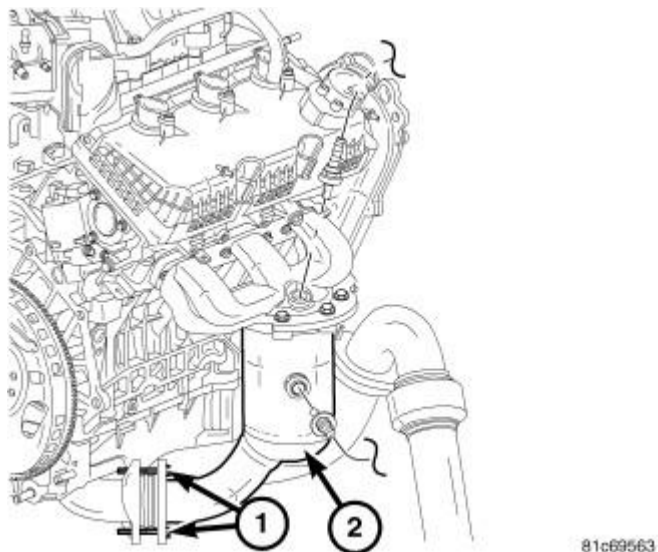


Fig. 432: Rear Maniverter-To-Crossunder Lower Bolts
Courtesy of CHRYSLER LLC

3. Loosely install the rear maniverter-to-crossunder fasteners (1).

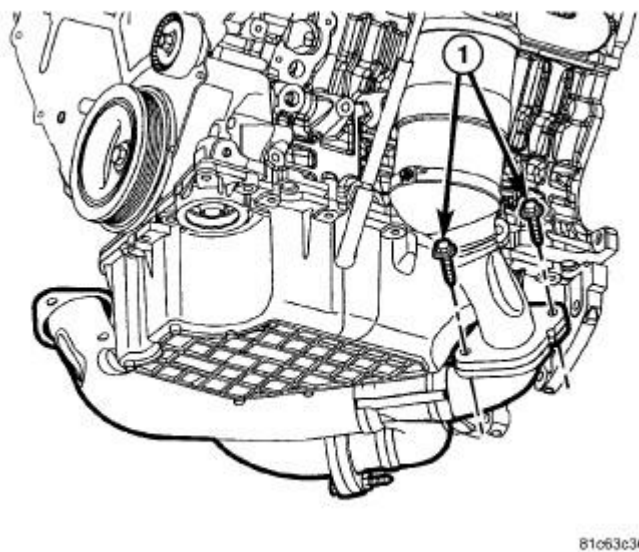


Fig. 433: Front Maniverter-To-Crossunder Bolts
Courtesy of CHRYSLER LLC

4. Loosely install the front maniverter-to-crossunder fasteners (1).

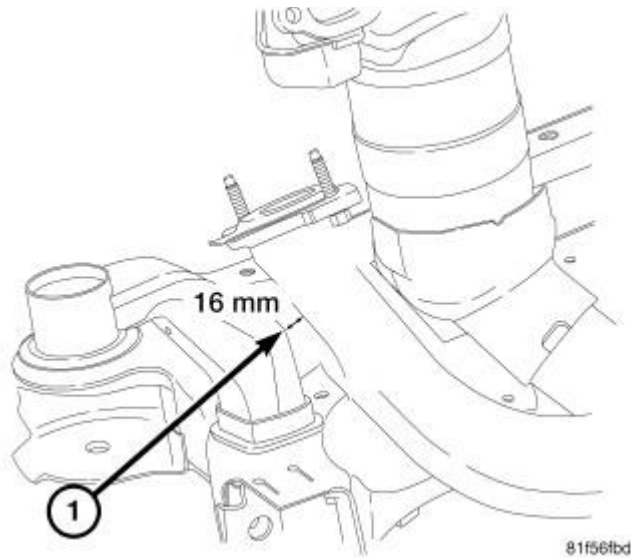


Fig. 434: Crossunder Pipe Clearance
Courtesy of CHRYSLER LLC

1 - 16 mm (0.63 in.)

NOTE: Verify that there is at least 16 mm (0.62 in.) of clearance between the indentation in the crossunder pipe near the extension pipe flange and the fore-aft crossmember. Otherwise, the crossunder pipe can contact the fore-aft crossmember due to engine torquing, causing a noise/vibration during acceleration.

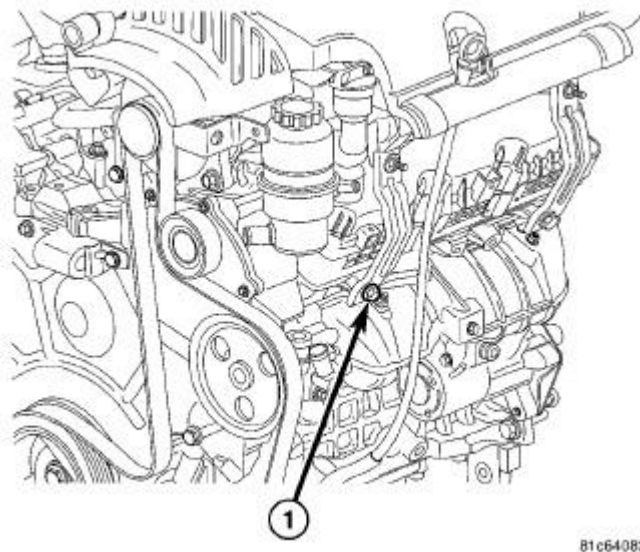
5. Tighten bolts connecting crossunder pipe to maniverters to 28 Nm (250 in.-lbs.).
6. Tighten the exhaust-to-crossunder fasteners to 30 N.m (22 ft. lbs.).
7. Tighten the crossunder bracket bolt to 28 Nm (250 in.-lbs.)

MANIFOLD, EXHAUST, LEFT

Removal

REMOVAL

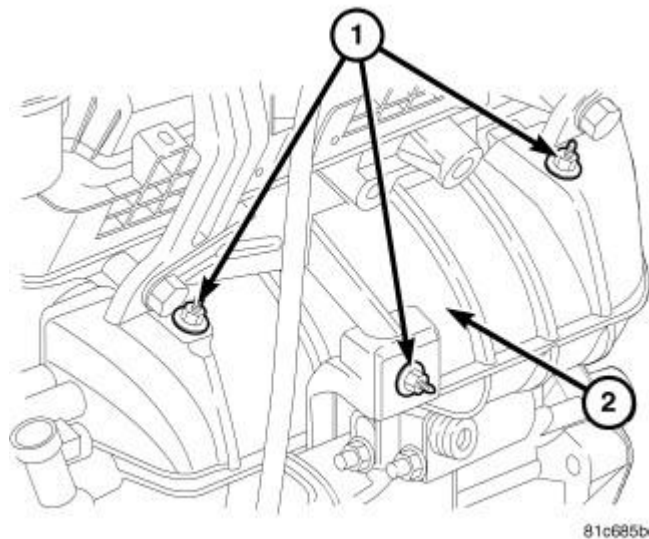
1. Disconnect and isolate the negative battery cable.
2. Remove the radiator cooling fan assembly.



81c64082

Fig. 435: Oil Level Indicator Tube Retaining Bolt
Courtesy of CHRYSLER LLC

3. Loosen the oil level indicator tube retaining bolt (1) and position oil level indicator tube and the dipstick out of the way.
4. Disconnect the upstream oxygen sensor harness connector.
5. Disconnect the downstream oxygen sensor harness connector.



81c685bd

Fig. 436: Upper Heat Shield
Courtesy of CHRYSLER LLC

6. Remove the 3 upper heat shield retainers (1), then remove the upper heat shield (2).

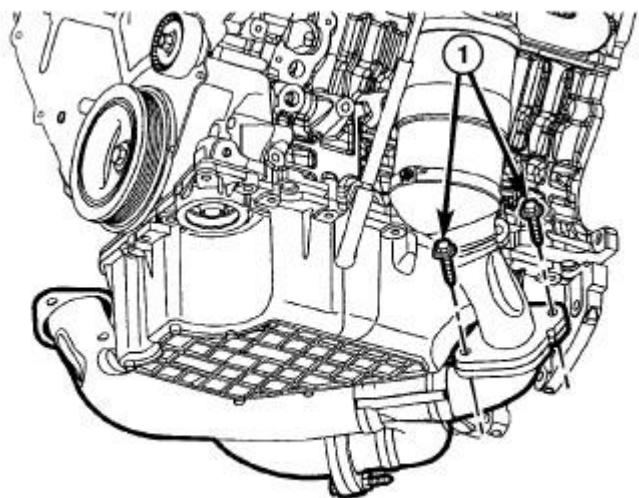


Fig. 437: Front Maniverter-To-Crossunder Bolts
Courtesy of CHRYSLER LLC

7. Remove the lower exhaust manifold crossover pipe retaining bolts (1).

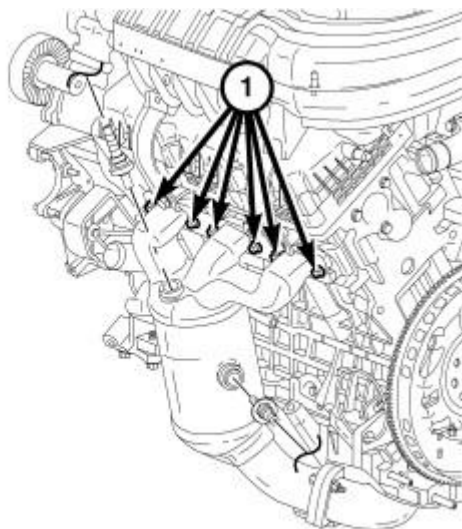
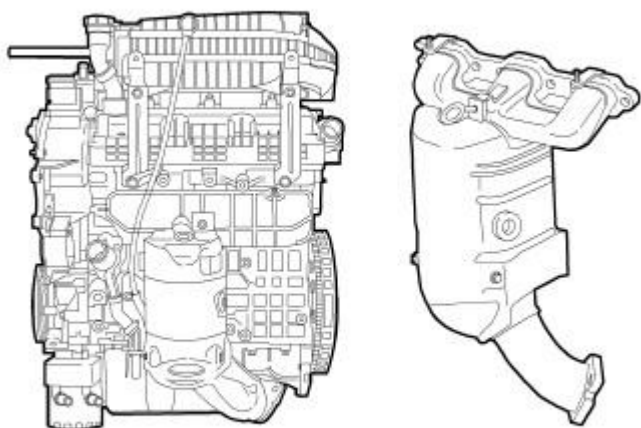


Fig. 438: Identifying Upper Exhaust Maniverter Retaining Bolts
Courtesy of CHRYSLER LLC

8. Remove the upper exhaust maniverter retaining bolts (1), and the exhaust maniverter.

Inspection

INSPECTION



81809930,

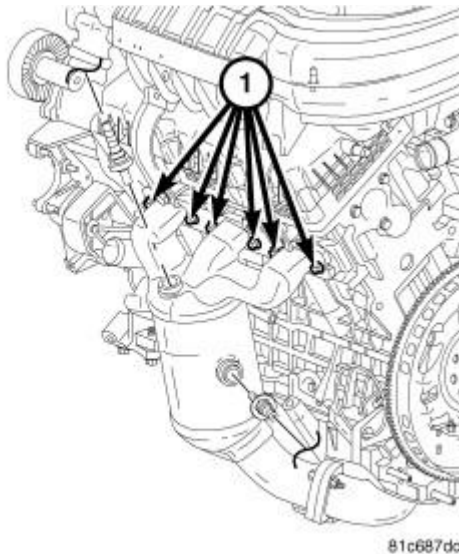
Fig. 439: LEFT MANIVERTER
Courtesy of CHRYSLER LLC

1. Inspect exhaust manifolds for damage or cracks.
2. Check manifold 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

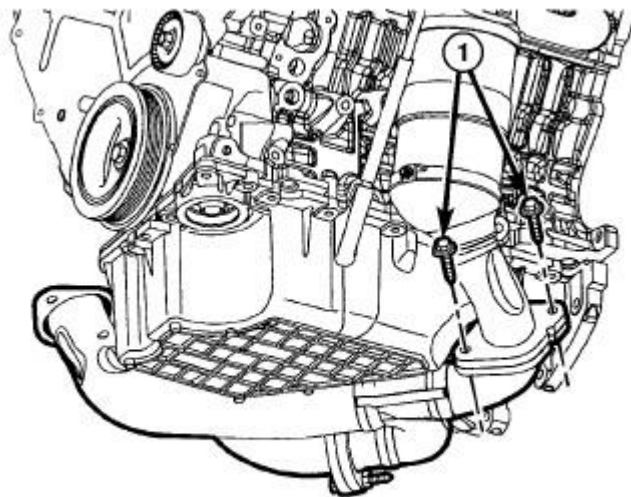
1. Clean all rear maniverter gasket mounting surfaces.



81c687dc

Fig. 440: Identifying Upper Exhaust Maniverter Retaining Bolts
Courtesy of CHRYSLER LLC

2. Position the exhaust manifold and new gasket on the cylinder head. Install the fasteners (1). Tighten bolts starting at the center working outward to 28 N.m (250 in. lbs.).



81c63c36

Fig. 441: Front Maniverter-To-Crossunder Bolts
Courtesy of CHRYSLER LLC

3. Install the lower exhaust manifold-to-crossunder pipe fasteners. Tighten fasteners to 28 N.m (250 in. lbs.).

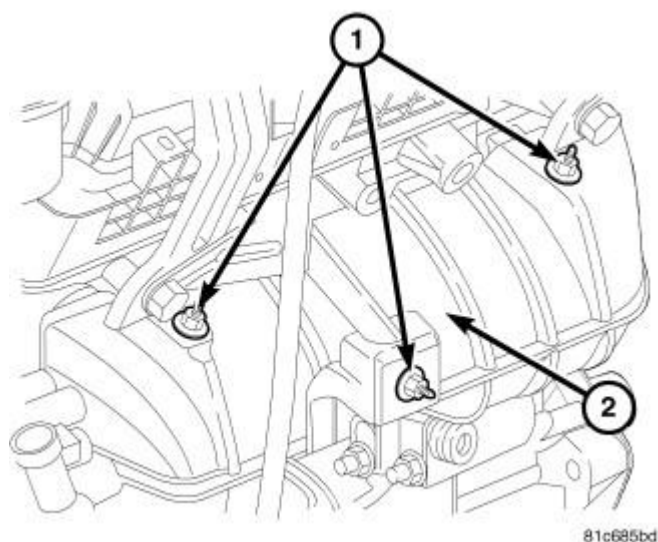


Fig. 442: Upper Heat Shield
Courtesy of CHRYSLER LLC

4. Install the exhaust maniverter upper heatshield (3) and the fasteners (1) and (3). Tighten fasteners to 12 N.m (105 in. lbs.).
5. If installing a new maniverter, transfer the O2 sensors from the existing front maniverter.
6. Reconnect the O2 sensor harness connectors.

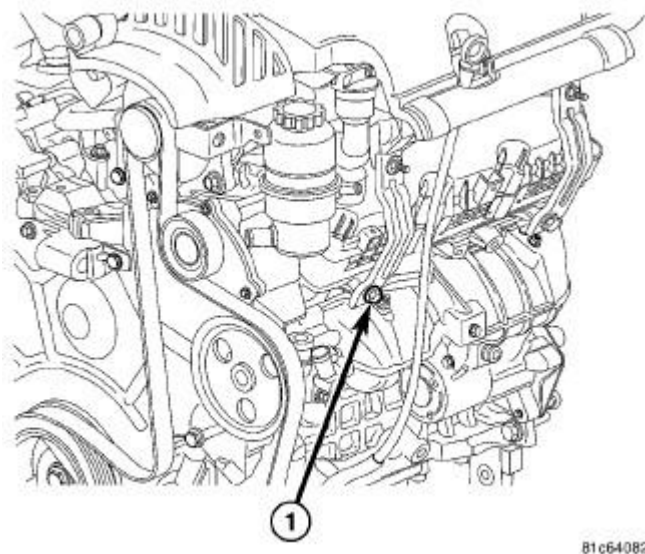
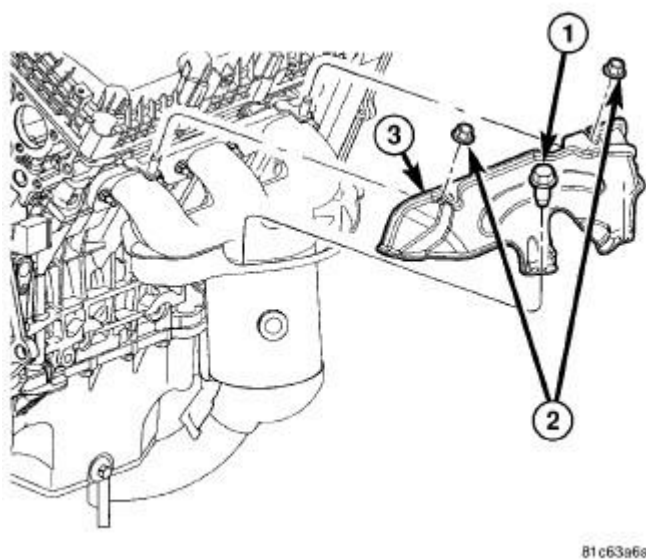


Fig. 443: Oil Level Indicator Tube Retaining Bolt
Courtesy of CHRYSLER LLC

7. Reposition the oil dipstick tube and install the retaining bolt (1).
8. Install the radiator cooling fan assembly.
9. Connect the negative battery cable.

MANIFOLD, EXHAUST, RIGHT**Removal****REMOVAL**

1. Disconnect the negative battery cable.
2. Raise and support the vehicle.
3. Disconnect the upstream oxygen sensor electrical connector.

**Fig. 444: Rear Maniverter Heat Shield****Courtesy of CHRYSLER LLC**

4. Disconnect the downstream oxygen sensor electrical connector.
5. Remove the rear maniverter heat shield fasteners (1) and (2), and remove the rear maniverter heat shield (3).

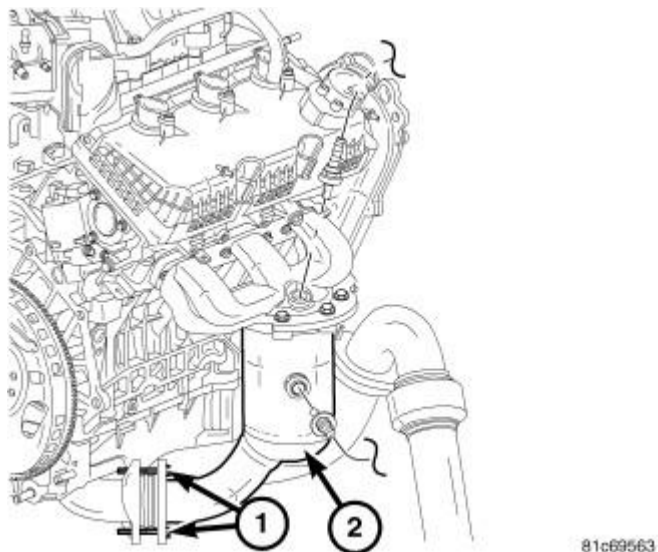


Fig. 445: Lower Exhaust Maniverter-To-Crossunder Pipe Bolts
Courtesy of CHRYSLER LLC

6. Remove the lower exhaust maniverter-to-crossunder pipe bolts (1).

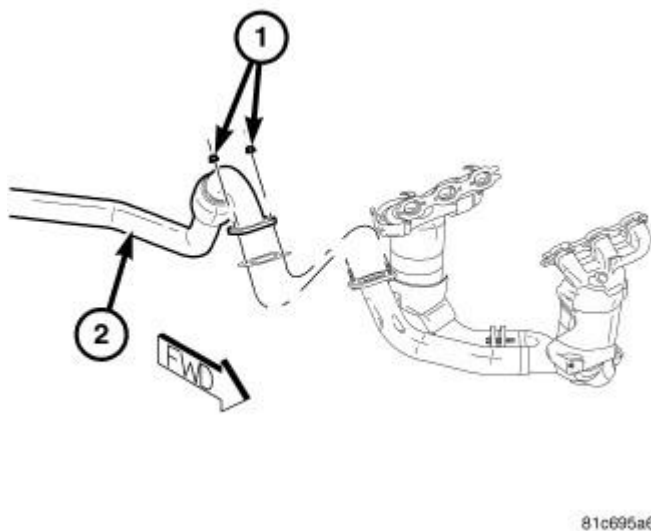


Fig. 446: Exhaust Manifold Flange Retaining Fasteners
Courtesy of CHRYSLER LLC

7. Remove the exhaust manifold inlet flange retaining fasteners (1) and disconnect the exhaust system hangers from the pipe assembly.

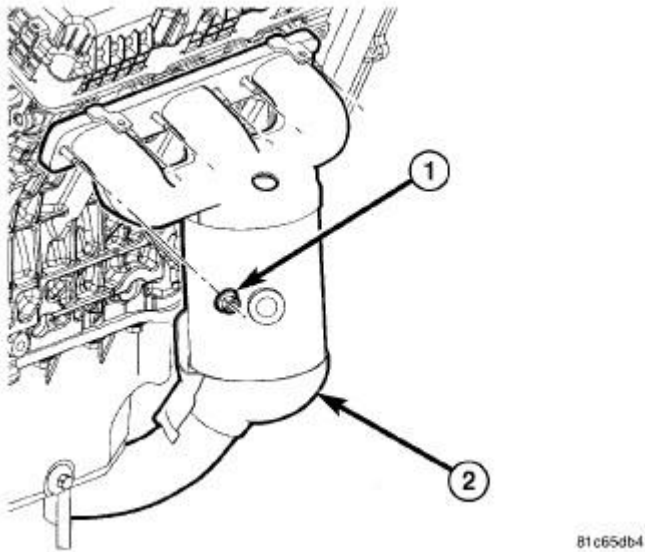


Fig. 447: Identifying Exhaust Maniverter & Fasteners
Courtesy of CHRYSLER LLC

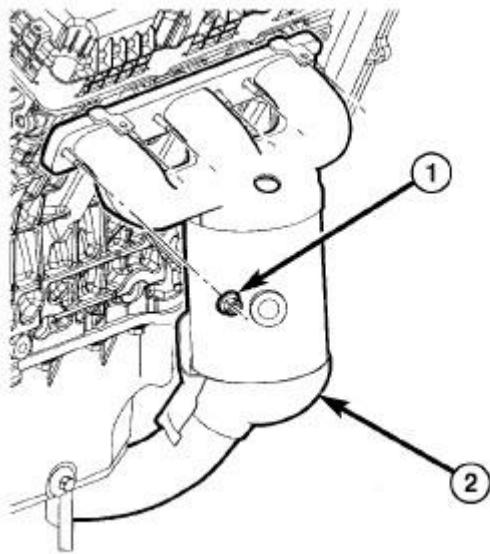
NOTE: Be careful when removing the rear exhaust maniverter fasteners. The rear exhaust maniverter fasteners may be locked onto the studs in the cylinder head.

8. Remove the rear exhaust maniverter fasteners (1).
9. Remove the rear exhaust maniverter (2).

Installation

INSTALLATION

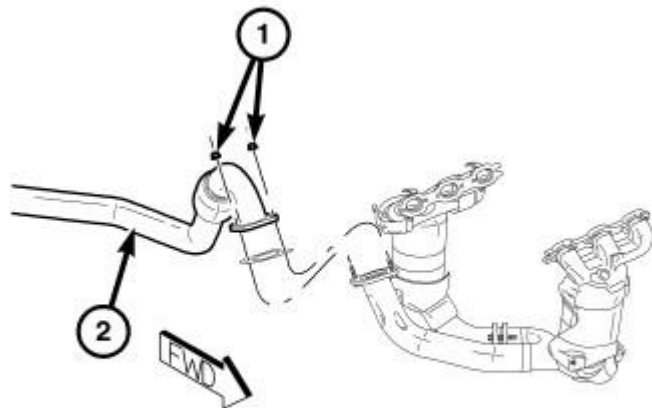
1. Clean gasket surfaces.
2. Replace any damaged studs, or reinstall any studs that came out during removal. Tighten studs to 20 in. lbs.
3. Position the exhaust manifold and new gasket on the studs in the cylinder head.



81c65db4

Fig. 448: Identifying Exhaust Maniverter & Fasteners
Courtesy of CHRYSLER LLC

4. Position the exhaust manifold and new gasket on the studs in the cylinder head. Tighten rear maniverter fasteners starting at the center working outward to 23 N.m (200 in. lbs.).



81c695a6

Fig. 449: Exhaust Manifold Flange Retaining Fasteners
Courtesy of CHRYSLER LLC

5. Install exhaust system. Connect the exhaust system hangers from the pipe assembly and install the three exhaust manifold flange retaining fasteners (1). Tighten the fasteners to 30 N.m (22 ft. lbs.).

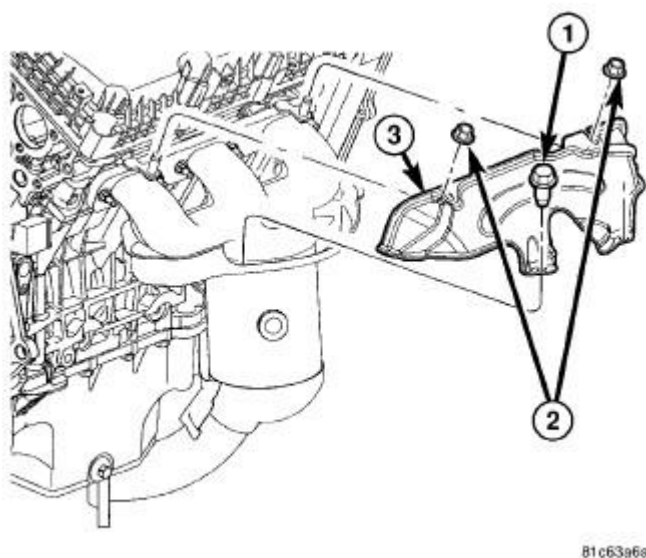


Fig. 450: Rear Maniverter Heat Shield
Courtesy of CHRYSLER LLC

6. Install the rear maniverter heat shield (3), and install the rear maniverter heat shield fasteners (1) and (2). Tighten the rear maniverter heat shield bolts to 12 Nm (105 in. lbs.).

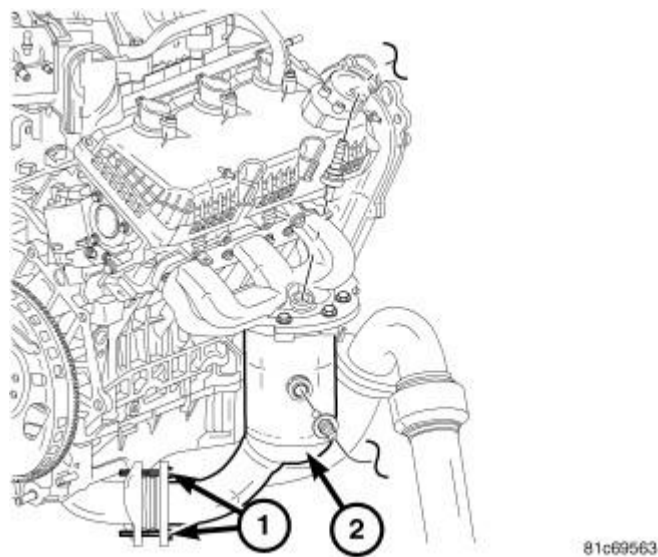


Fig. 451: Lower Exhaust Maniverter-To-Crossunder Pipe Bolts
Courtesy of CHRYSLER LLC

7. Install the lower exhaust maniverter-to-crossunder pipe bolts (1). Tighten to 28 Nm (250 in.-lbs.).
8. If installing a new maniverter, transfer the existing oxygen sensors from the original maniverter.
9. Connect the downstream oxygen sensor electrical connector.
10. Connect the upstream oxygen sensor electrical connector.
11. Connect the negative battery cable.

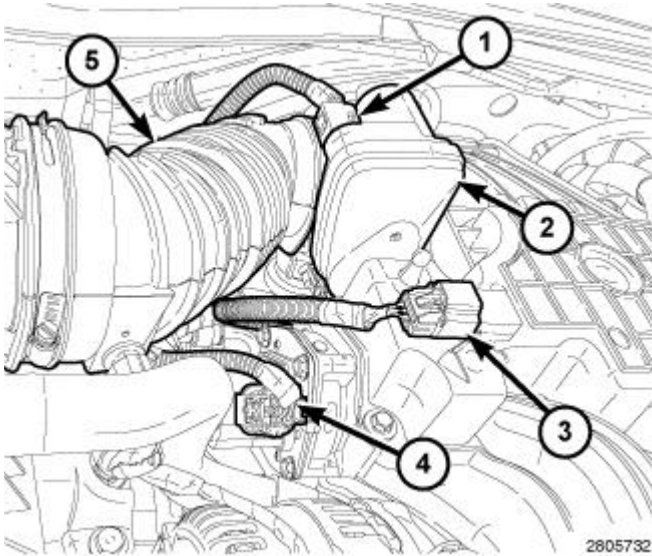
MANIFOLD, INTAKE**Removal****UPPER INTAKE MANIFOLD**

Fig. 452: Electronic Throttle Control, MAP Sensor, Short Runner Valve Solenoid, Air Inlet Hose & Throttle Body

Courtesy of CHRYSLER LLC

1. Disconnect and isolate the negative battery cable.
2. Remove the engine cover.
3. Disconnect the following electrical connectors:
 - Electronic Throttle Control (ETC) (1)
 - Manifold Absolute Pressure (MAP) sensor (3)
 - Short runner valve solenoid (4)
4. Loosen the clamp and disconnect the air inlet hose (5) from the throttle body (2).

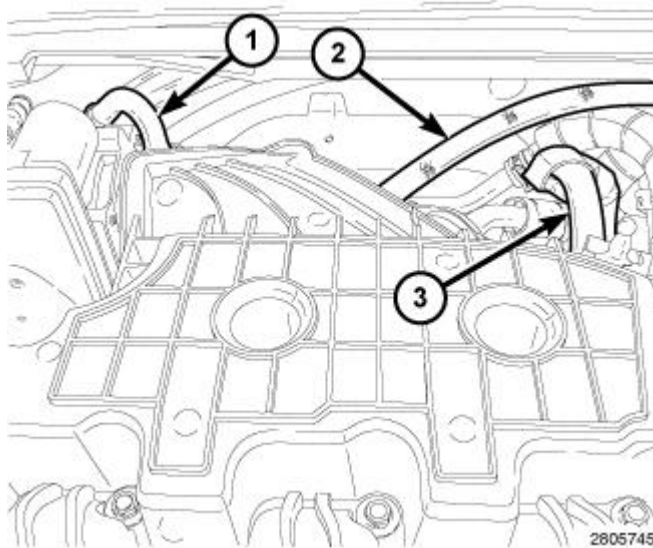


Fig. 453: Vacuum Hoses At Upper Intake Manifold
Courtesy of CHRYSLER LLC

5. Disconnect the following vacuum hoses from the upper intake manifold:

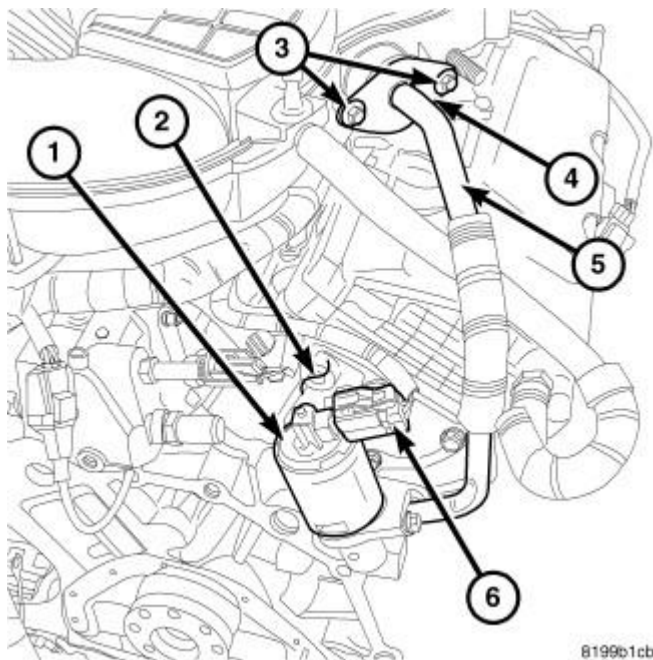
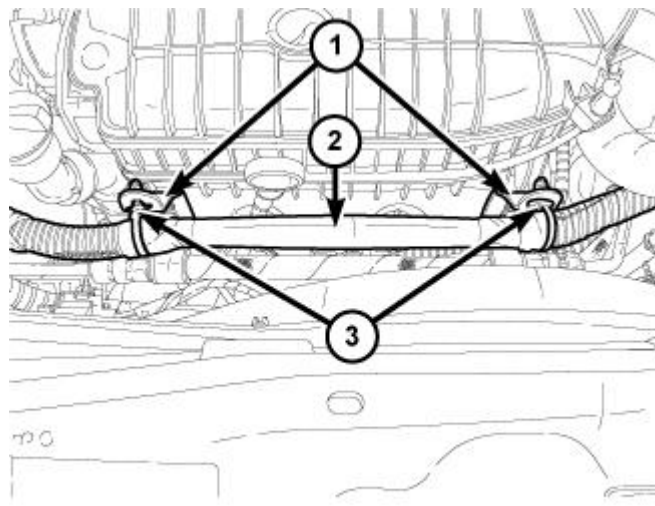


Fig. 454: Identifying EGR Valve, Right Cylinder Head, Flange Mounting Bolts, Exhaust Gas Routing Tube & Electrical Connector
Courtesy of CHRYSLER LLC

- Positive Crankcase Ventilation (PCV) valve (3)
- EVAP purge solenoid (1)
- Power brake booster (2)

6. Remove the EGR tube (5). Refer to **Emissions Control/Exhaust Gas Recirculation/VALVE, Exhaust**

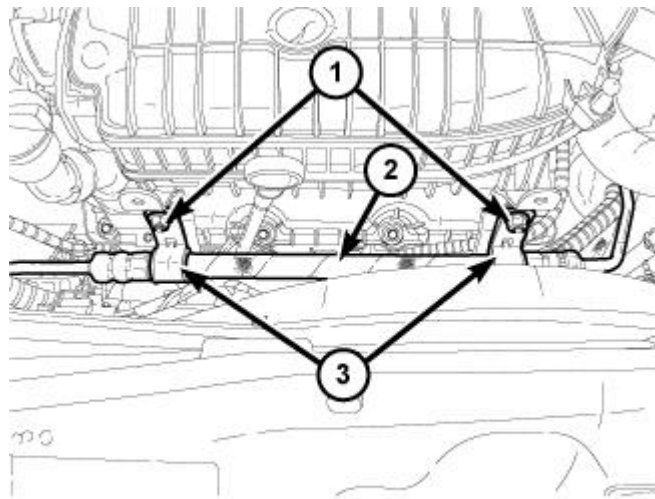
Gas Recirculation (EGR) - Removal .



2805755

Fig. 455: Support Brackets, Wire Harness & Retainers
 Courtesy of CHRYSLER LLC

7. Disengage two wire harness retainers (3) from the intake manifold support brackets (1) and reposition the wire harness (2).



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Fig. 456: Power Steering Hose, Support Brackets & Nuts
 Courtesy of CHRYSLER LLC

8. Remove two nuts (1) from the power steering hose support brackets (3) and reposition the power steering hose (2).

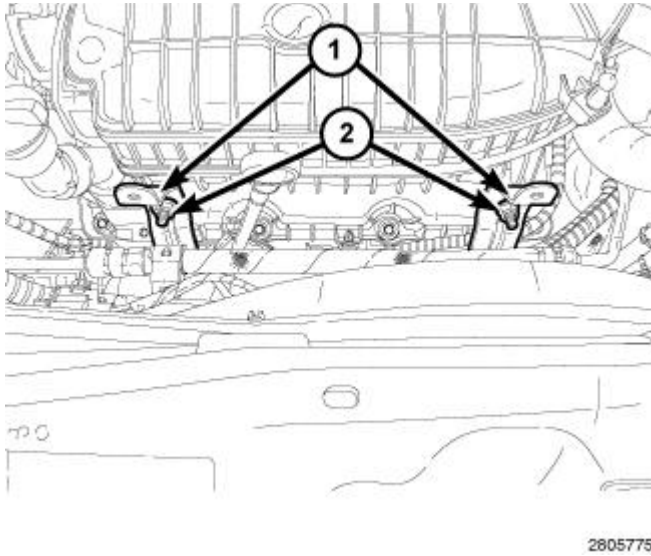


Fig. 457: Support Brackets Studs
Courtesy of CHRYSLER LLC

9. Remove two studs (2) from the intake manifold support brackets (1).

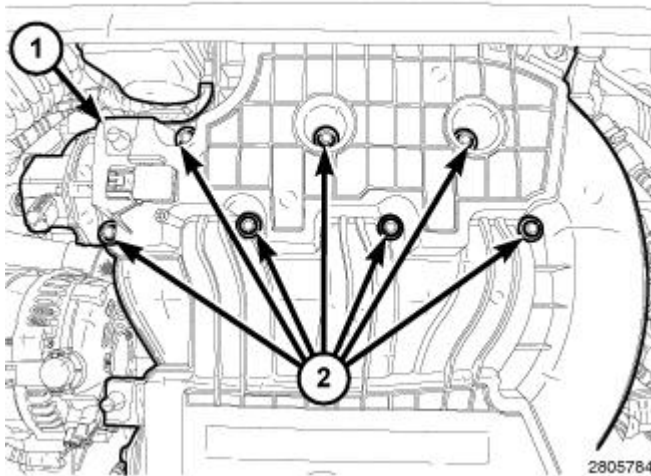


Fig. 458: Upper Intake Manifold & Retaining Bolts
Courtesy of CHRYSLER LLC

10. Remove the seven upper intake manifold retaining bolts (2) and remove the upper intake manifold (1).
11. Cover the open intake ports to prevent debris from entering the engine.
12. If required, remove the throttle body. Refer to **Fuel System/Fuel Injection/THROTTLE BODY - Removal**.
13. If required, remove the MAP sensor. Refer to **Fuel System/Fuel Injection/SENSOR, Manifold Air Pressure (MAP) - Removal**.
14. If required, remove the short runner valve solenoid. Refer to **Fuel System/Fuel Injection/SOLENOID,**

Short Runner Valve - Removal .**LOWER INTAKE MANIFOLD**

1. Perform fuel pressure release procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .
2. Drain the cooling system. Refer to **Cooling - Standard Procedure** .
3. Disconnect the upper radiator hose from the thermostat housing.
4. Remove the upper intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Removal**.
5. Reposition power steering fluid reservoir and bracket.
6. Disconnect the electrical connectors to fuel injectors and coolant temperature sensor.
7. Disconnect heater hose from intake manifold.
8. Disconnect the coolant container hose at thermostat housing.
9. Disconnect the fuel supply hose from fuel rail. Refer to **FUEL SYSTEM** .
10. Remove the bolts attaching fuel rail.
11. Remove fuel rail and injectors as an assembly.

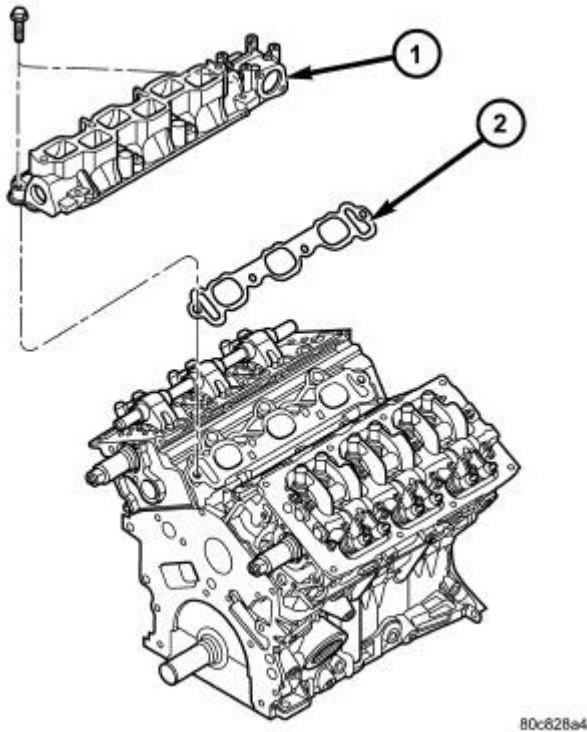


Fig. 459: LOWER INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

1 - LOWER INTAKE MANIFOLD 2 - GASKET

12. Remove bolts attaching lower intake (1) and remove intake manifold.

Installation

LOWER INTAKE MANIFOLD

1. Clean all sealing surfaces.

NOTE: Make sure the extruded holes in the gasket are installed in the recessed holes in the cylinder head.

2. Position new gaskets and intake manifold on cylinder head surfaces.

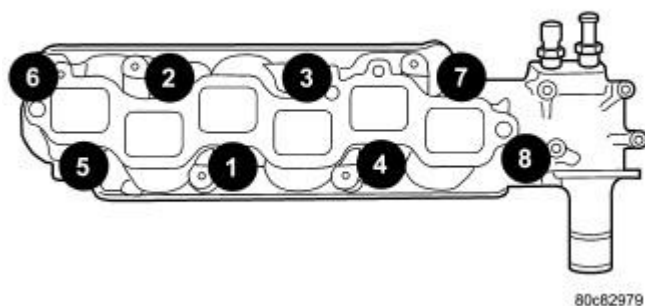


Fig. 460: Intake Manifold Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

3. Install intake manifold bolts and 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. Refer to **FUEL SYSTEM**.
6. Connect heater hose to intake manifold.
7. Connect coolant container to thermostat housing.
8. Connect electrical connectors to fuel injectors and coolant temperature sensor.
9. Install power steering fluid reservoir and bracket.
10. Install upper intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Installation**.
11. Connect the upper radiator hose to the thermostat housing.
12. Fill the cooling system. Refer to **Cooling - Standard Procedure**.

UPPER INTAKE MANIFOLD

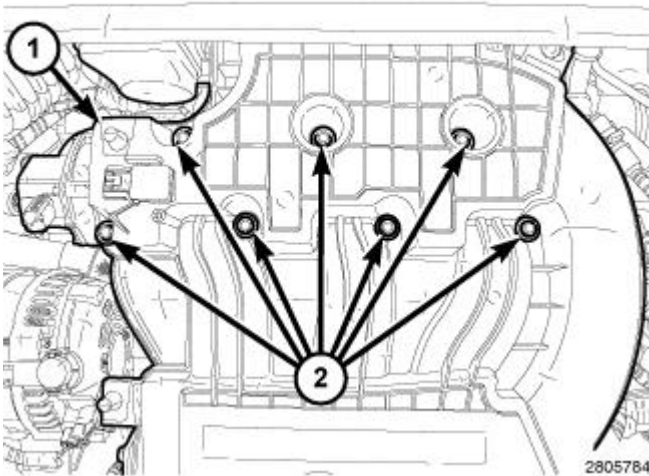


Fig. 461: Upper Intake Manifold & Retaining Bolts
Courtesy of CHRYSLER LLC

1. Clean and inspect the intake manifold gasket sealing surfaces. Install a new intake manifold gasket.
2. If removed, install the throttle body to the upper intake manifold. Refer to **Fuel System/Fuel Injection/THROTTLE BODY - Installation**.
3. If removed, install the Manifold Air Pressure (MAP) sensor to the upper intake manifold. Refer to **Fuel System/Fuel Injection/SENSOR, Manifold Air Pressure (MAP) - Installation**.
4. If removed, install the short runner valve solenoid to the upper intake manifold. Refer to **Fuel System/Fuel Injection/SOLENOID, Short Runner Valve - Installation**.
5. Install the upper intake manifold (1) and hand start the seven attaching bolts (2).
6. Tighten the bolts (2) gradually starting in the center working outward to 12 N.m (105 in. lbs.).

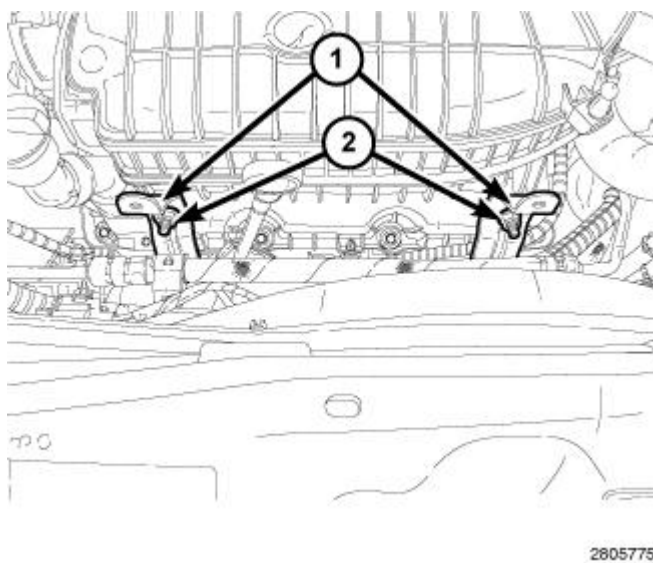
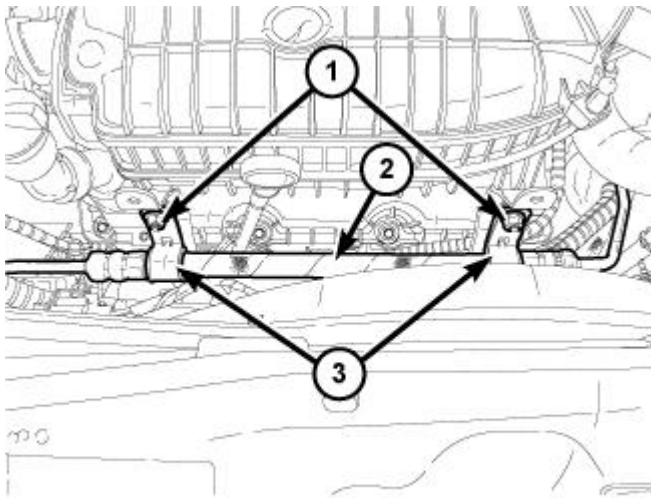


Fig. 462: Support Brackets Studs
Courtesy of CHRYSLER LLC

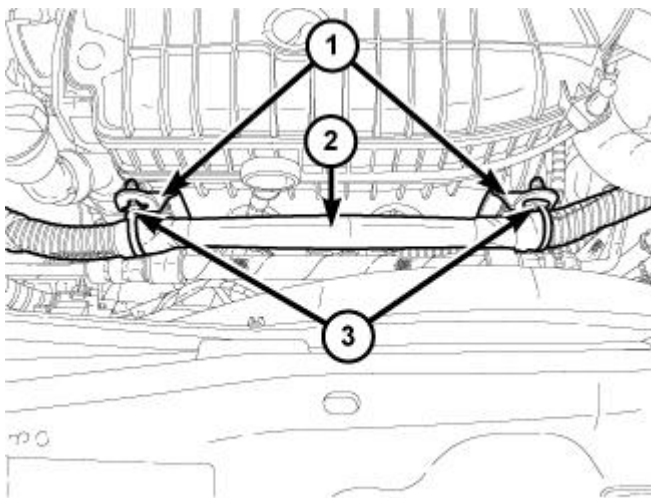
7. Install two studs (2) to the intake manifold support brackets (1). Tighten the studs to 12 N.m (105 in. lbs.).



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Fig. 463: Power Steering Hose, Support Brackets & Nuts
Courtesy of CHRYSLER LLC

8. Position the power steering hose support brackets (3) on the studs. Install two nuts (1) and tighten to 12 N.m (105 in. lbs.).



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Fig. 464: Support Brackets, Wire Harness & Retainers
Courtesy of CHRYSLER LLC

9. Engage two wire harness retainers (3) to the intake manifold support brackets (1).

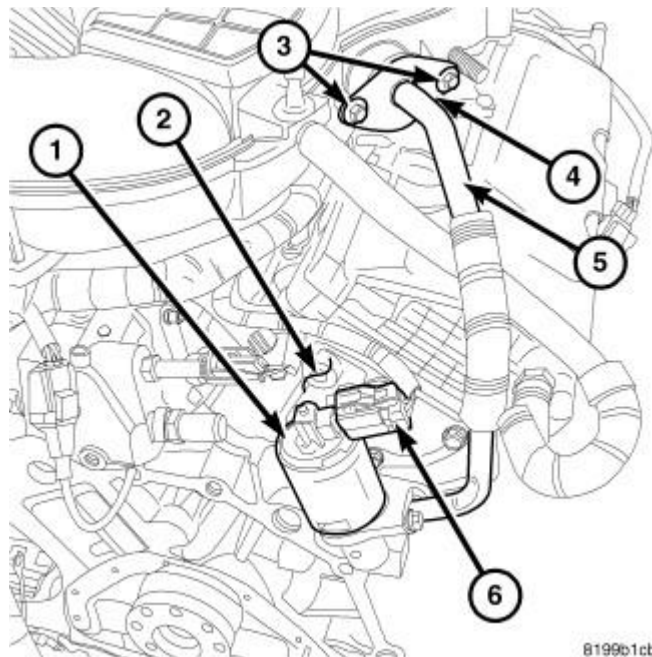


Fig. 465: Identifying EGR Valve, Right Cylinder Head, Flange Mounting Bolts, Exhaust Gas Routing Tube & Electrical Connector
Courtesy of CHRYSLER LLC

10. Install the EGR tube (5). Refer to Emissions Control/Exhaust Gas Recirculation/TUBE, Exhaust Gas Recirculation (EGR) - Installation .

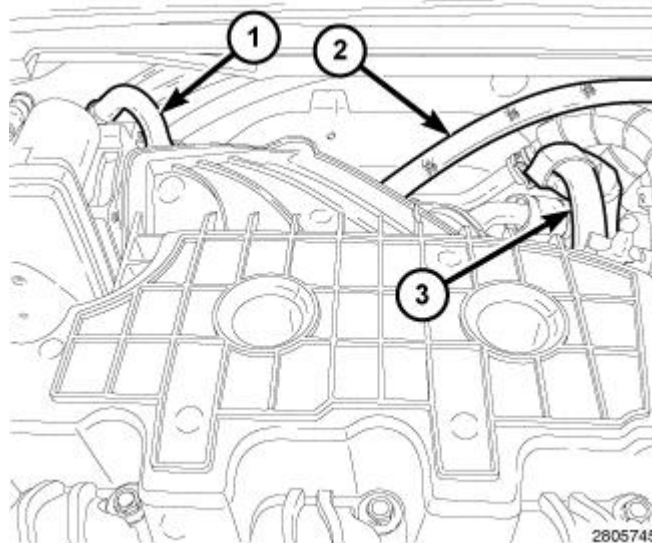


Fig. 466: Vacuum Hoses At Upper Intake Manifold
Courtesy of CHRYSLER LLC

11. Connect the following vacuum hoses to the upper intake manifold:

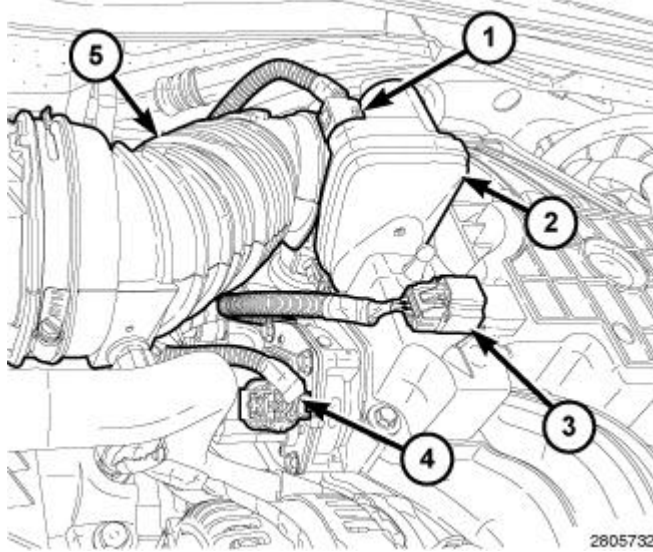


Fig. 467: Electronic Throttle Control, MAP Sensor, Short Runner Valve Solenoid, Air Inlet Hose & Throttle Body

Courtesy of CHRYSLER LLC

- Positive Crankcase Ventilation (PCV) valve (3)
 - EVAP purge solenoid (1)
 - Power brake booster (2)
12. Connect the air inlet hose (5) to the throttle body (2).
 13. Connect the following electrical connectors:
 - Electronic Throttle Control (ETC) (1)
 - Manifold Absolute Pressure (MAP) sensor (3)
 - Short runner valve solenoid (4)
 14. Install the engine cover.
 15. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).

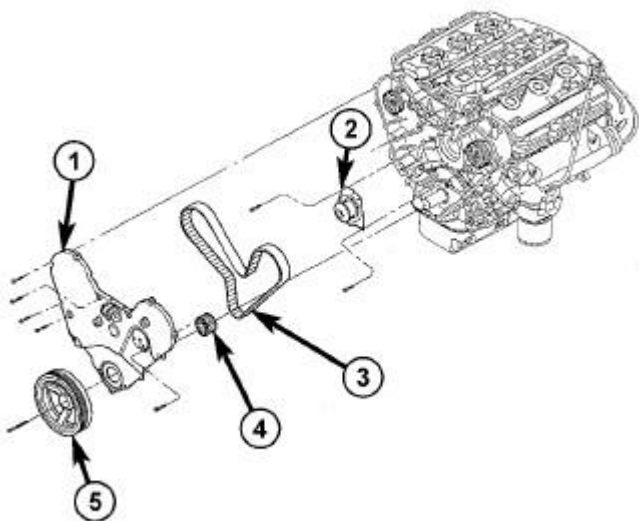
VALVE TIMING

DESCRIPTION

DESCRIPTION

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.



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Fig. 468: TIMING DRIVE SYSTEM

Courtesy of CHRYSLER LLC

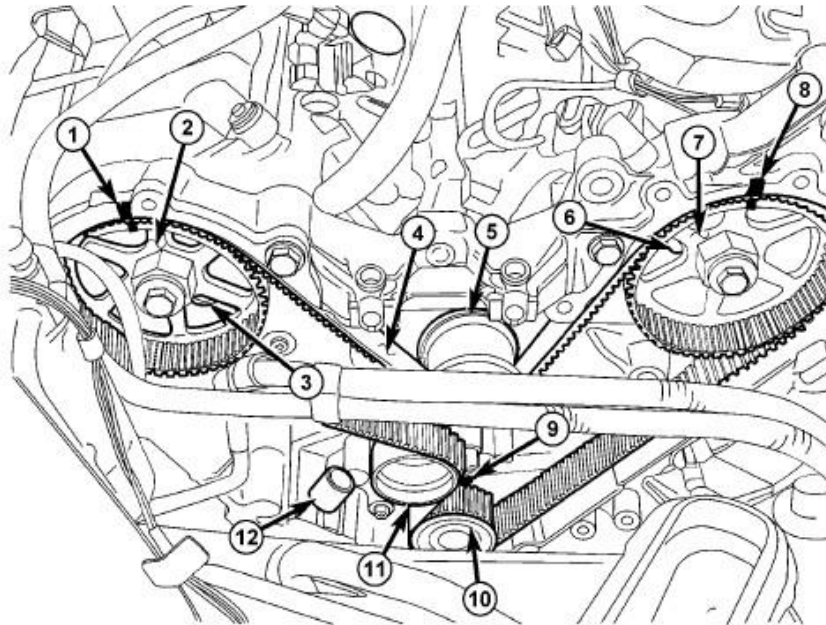
- 1 - FRONT TIMING COVER
- 2 - WATER PUMP
- 3 - TIMING BELT
- 4 - CRANKSHAFT SPROCKET
- 5 - CRANKSHAFT DAMPER

BELT AND SPROCKETS, TIMING

Removal

TIMING BELT

TIMING VERIFICATION



8111ae99

Fig. 469: 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 with the TDC mark on the oil pump (9). Check to determine if the camshaft sprocket timing marks are aligned with the marks on the inner timing cover (1) and (8). It may take an additional full revolution of the crankshaft before the camshaft sprocket marks (1) and (8) are aligned.

CAUTION: The 4.0L is NOT a freewheeling engine. Therefore, loosen the valve train rocker assemblies before servicing the timing drive.

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 and loosen the rocker arm assemblies.
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 (1) and (8) on the rear timing belt cover.
7. Remove the timing belt tensioner (12) and remove timing belt.

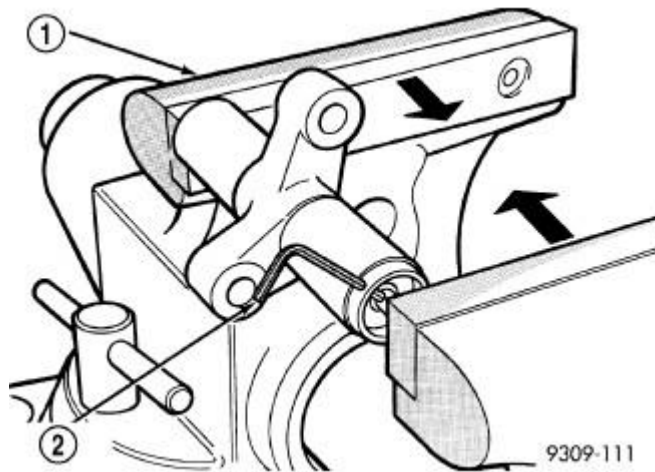


Fig. 470: Vise & Locking Pin
Courtesy of CHRYSLER LLC

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 4.0L 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 .

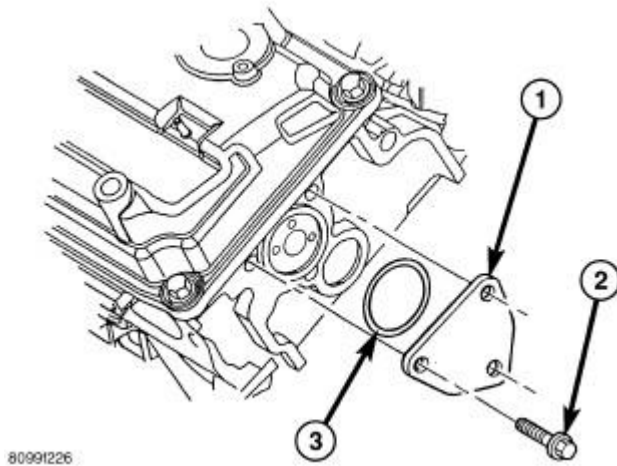


Fig. 471: CAMSHAFT THRUST PLATE
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - CAMSHAFT THRUST PLATE
2 - BOLT
3 - O-RING |
|---|

6. Remove the right cylinder head cover.
7. Remove the right rocker arm assembly.
8. Remove the timing belt tensioner and timing belt.

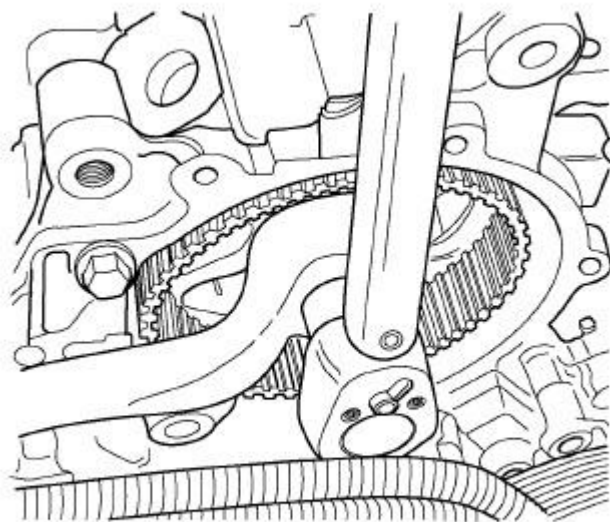
CAUTION: The right camshaft must be pushed rearward approximately 3 1/2 inches to remove the camshaft gear retaining bolt and gear. Care must be taken not to scratch or nick the camshaft or cylinder head journals when moving camshaft.

9. Hold camshaft sprockets with 36 mm (1 7/16 in.) box end wrench.

10. Loosen and remove the camshaft gear retaining bolt and washer. The right bolt is 213 mm (8 3/8 in.) long and the left bolt is 255 mm (10.0 in.) long.

NOTE: **The camshaft timing gears are keyed to the camshaft.**

11. Remove the camshaft sprockets.



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Fig. 472: LEFT CAMSHAFT SPROCKET
Courtesy of CHRYSLER LLC

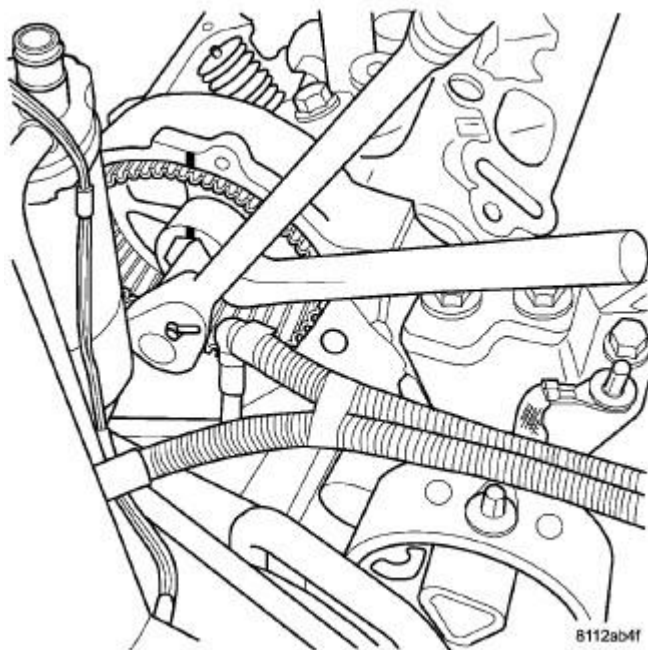


Fig. 473: RIGHT CAMSHAFT SPROCKET
Courtesy of CHRYSLER LLC

CRANKSHAFT SPROCKET

1. Remove the timing belt. Refer to **BELT and SPROCKETS, Timing.**
2. Remove crankshaft sprocket using Special Tool L-4407A .

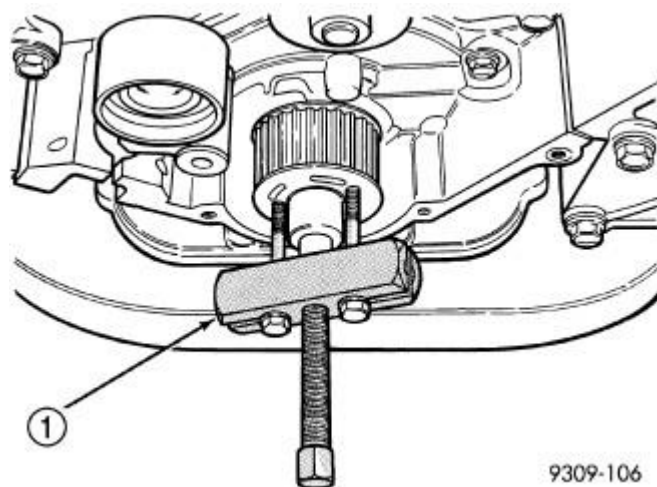
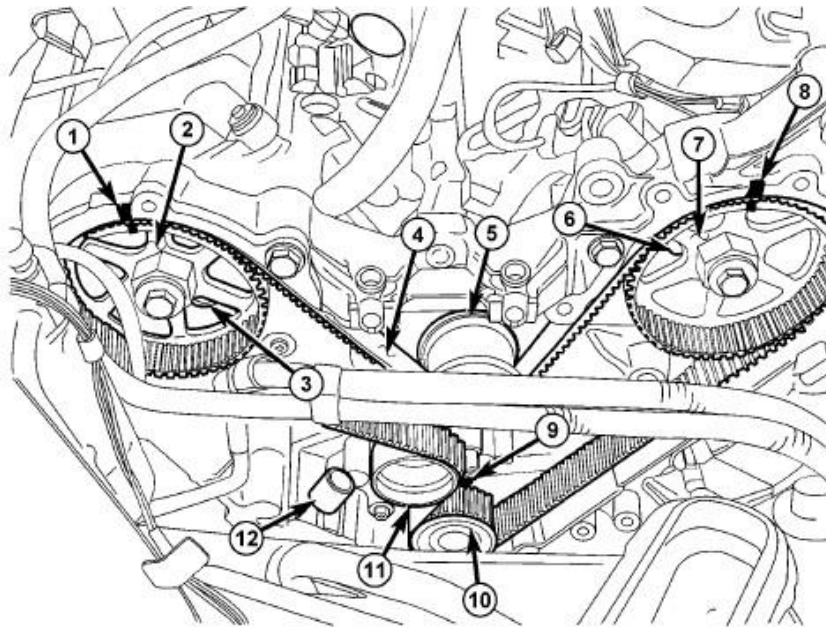


Fig. 474: CRANKSHAFT SPROCKET - REMOVAL
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL L-4407A

Inspection

TIMING VERIFICATION



8111ae99

Fig. 475: 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

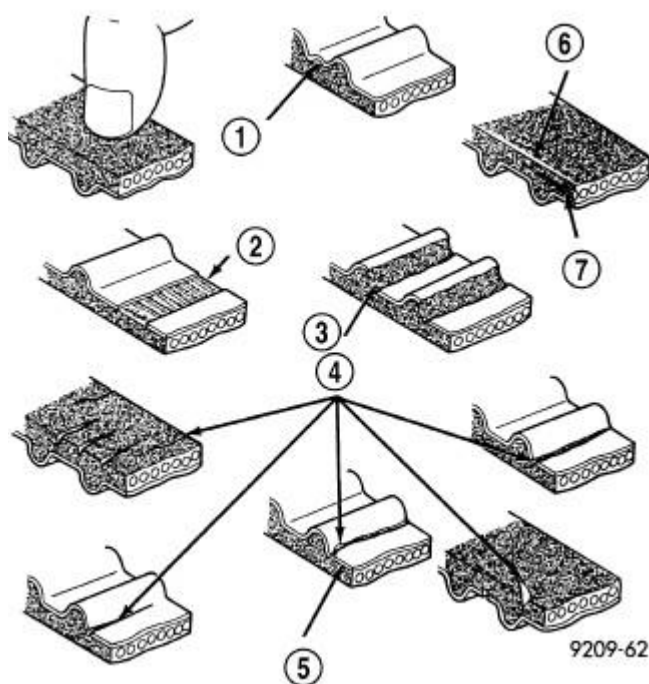


Fig. 476: TIMING BELT INSPECTION

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

CAUTION: To ensure proper installation depth of crankshaft sprocket, Special Tool 6641 must be used.

1. Install crankshaft sprocket using Special Tools 6641 and C-4685-C1 .

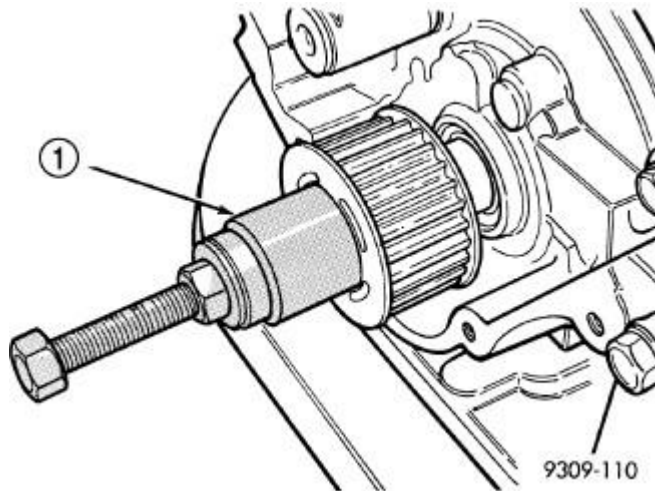


Fig. 477: CRANKSHAFT SPROCKET INSTALLATION
Courtesy of CHRYSLER LLC

1 - INSTALL WITH SPECIAL TOOL 6641 WITH 12 mm
SCREW C-4685-C1 AND THRUST BEARING AND
WASHER

2. Install timing belt. Refer to **BELT and SPROCKETS, Timing.**

CAMSHAFT SPROCKETS

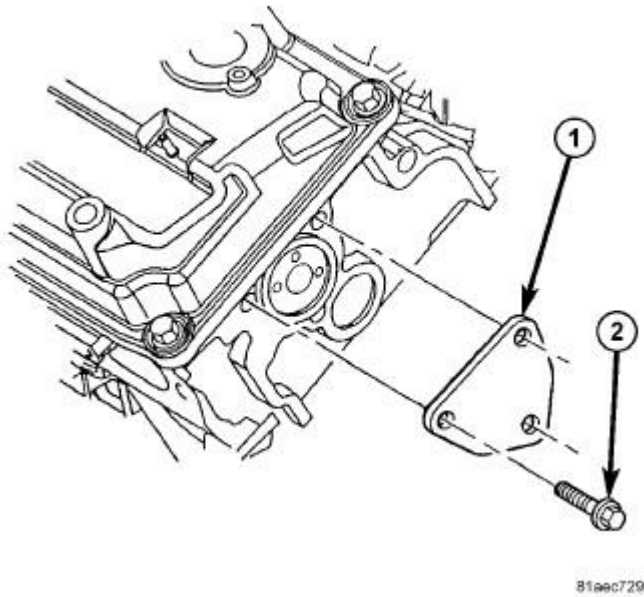


Fig. 478: Camshaft Thrust Plate
Courtesy of CHRYSLER LLC

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.).

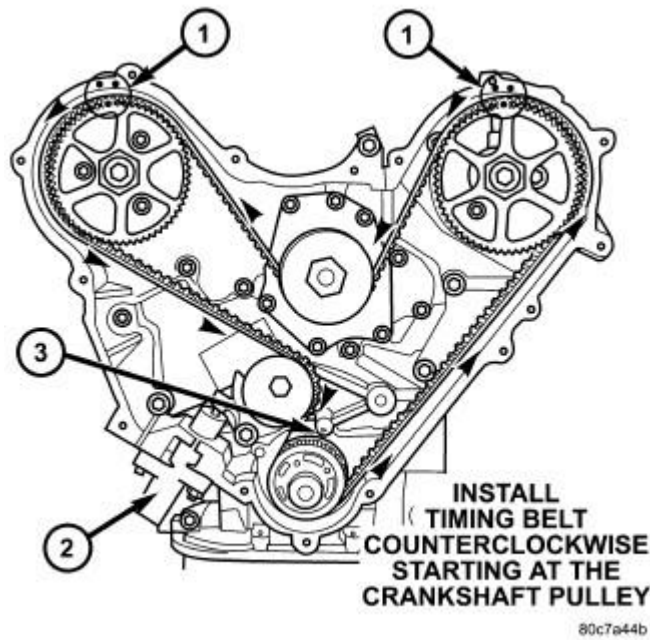


Fig. 479: TIMING BELT INSTALLATION

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.

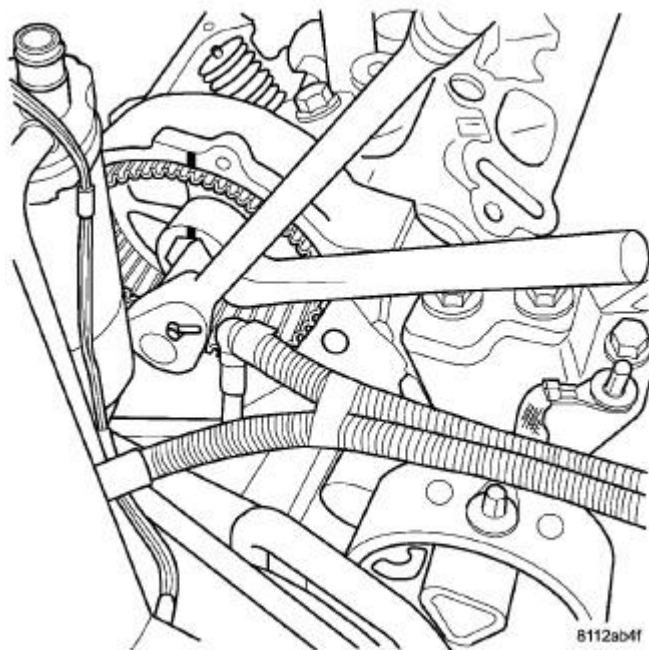


Fig. 480: RIGHT CAMSHAFT SPROCKET
Courtesy of CHRYSLER LLC

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.

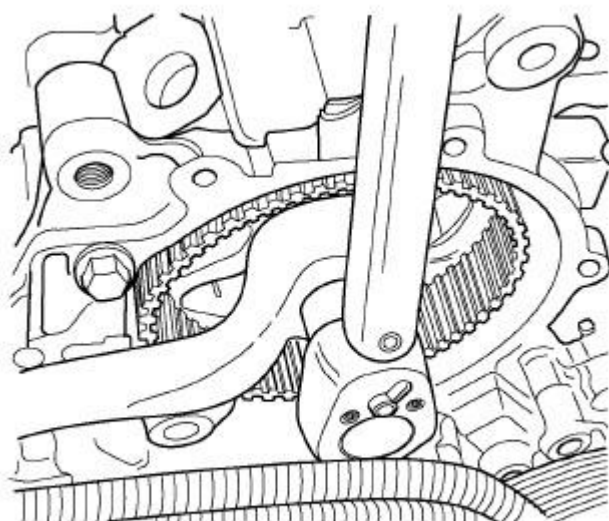


Fig. 481: LEFT CAMSHAFT SPROCKET
Courtesy of CHRYSLER LLC

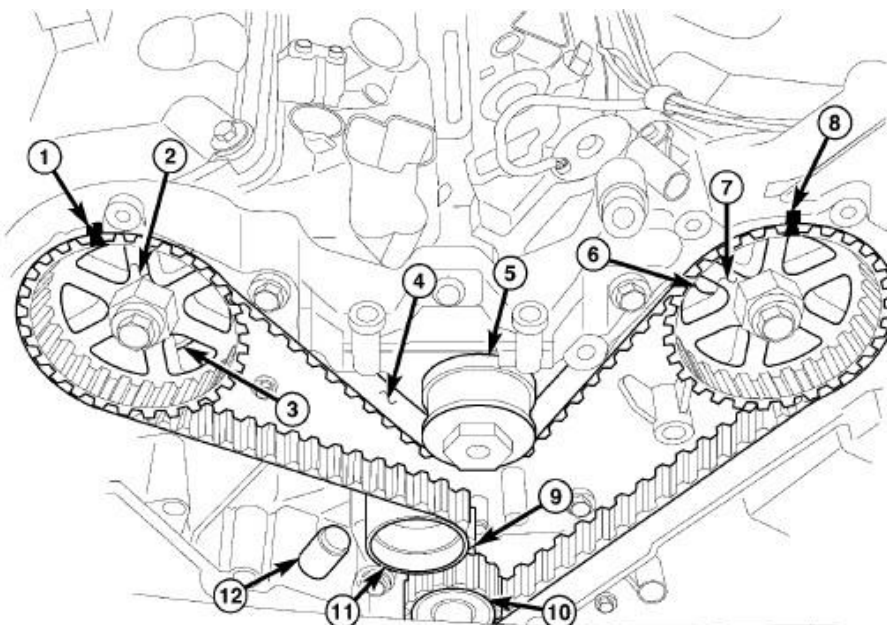
8. Hold the left camshaft sprocket hex with a 36 mm (1 7/16 in.) wrench and tighten the left camshaft bolts to 102 N.m (75 ft. lbs.) +90° turn.
9. Install the rocker arm assemblies and cylinder head covers. See Engine/Cylinder Head/ROCKER ARM, Valve - Installation.
10. Install the front timing belt cover. 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).



8136#76

Fig. 482: 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.).

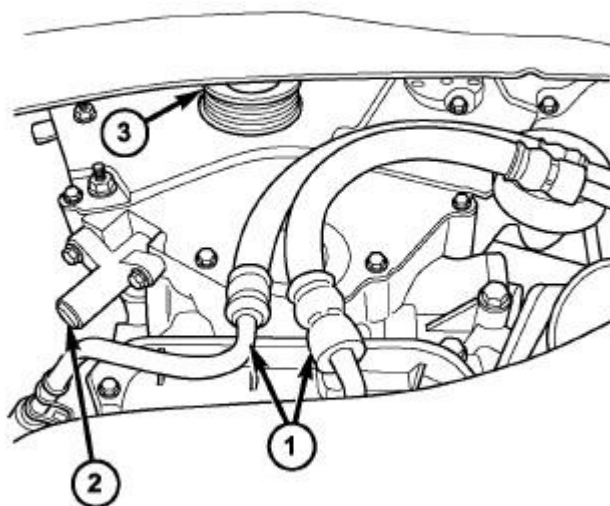
NOTE: The Cam/Crank Variation Relearn procedure must be performed anytime there has been a repair/replacement made to a powertrain system, for example: flywheel, valvetrain, camshaft and/or crankshaft sensors or components. Refer to **DTC-Based Diagnostics/MODULE, Powertrain Control (PCM) - Standard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

COVER(S), ENGINE TIMING, FRONT

Removal

REMOVAL

1. Perform fuel pressure release procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .
2. Disconnect negative battery cable.
3. Raise vehicle on hoist.
4. Remove accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal** .



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Fig. 483: LOWER TIMING BELT FRONT COVER

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - POWER STEERING HOSE
2 - TIMING BELT TENSIONER
3 - IDLER PULLEY |
|--|

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**.

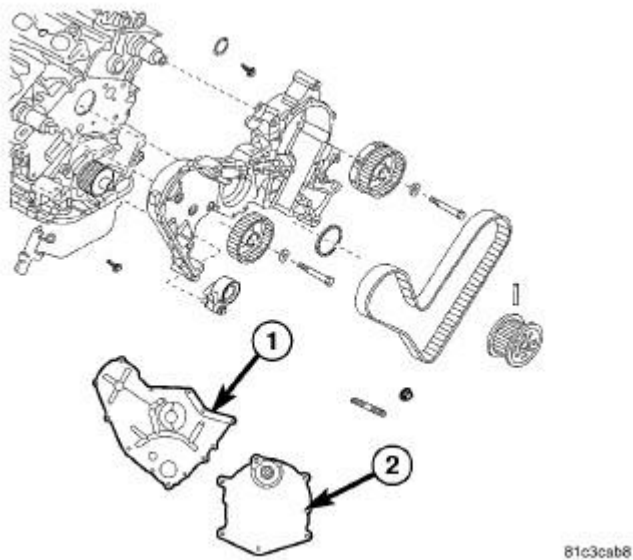
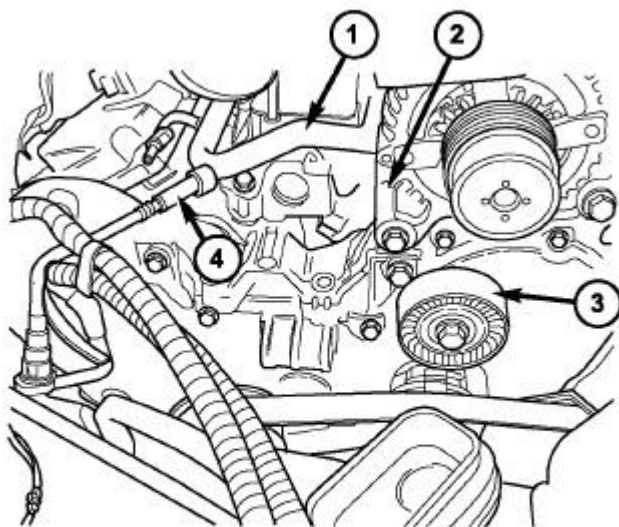


Fig. 484: Lower & Upper Timing Belt Covers
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - Lower Timing Belt Cover
2 - Upper Timing Belt Cover |
|--|

8. Remove the lower front timing belt cover fasteners and the lower timing belt cover (1).
9. Lower the vehicle.
10. Support the engine with a floor jack.
11. Remove the air cleaner housing. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.
12. Remove the front engine mount. See **Engine/Engine Mounting/INSULATOR, Engine Mount - Removal**.

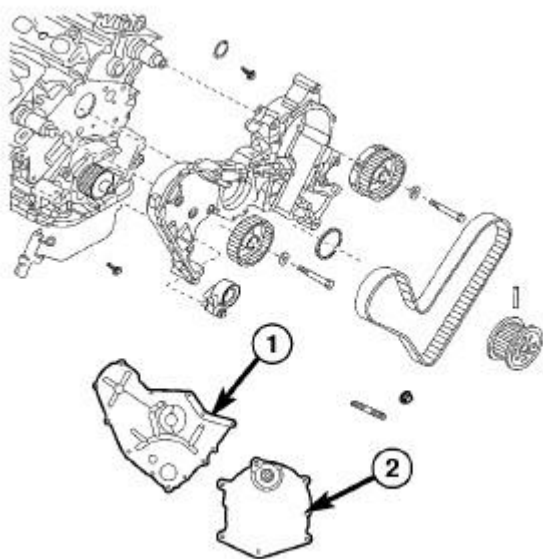


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Fig. 485: UPPER TIMING BELT FRONT COVER
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - FUEL RAIL
2 - GENERATOR
3 - IDLER PULLEY
4 - FUEL SUPPLY LINE |
|--|

13. Disconnect the fuel supply line (4) at the fuel rail (1).



81c3cab8

Fig. 486: Lower & Upper Timing Belt Covers
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - Lower Timing Belt Cover
2 - Upper Timing Belt Cover |
|--|

14. Remove the upper timing belt cover bolts and remove front upper timing belt cover. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.

Installation**INSTALLATION**

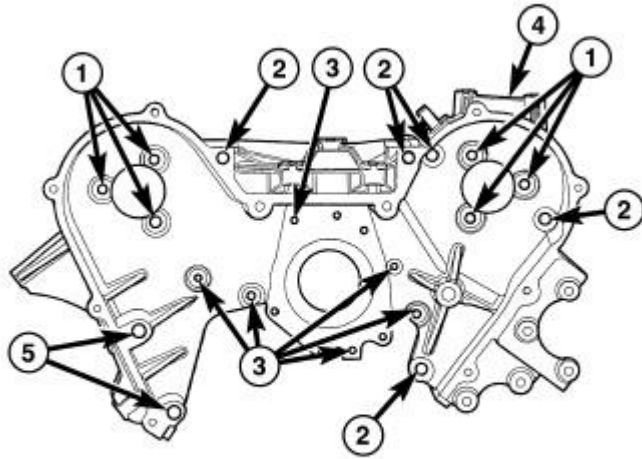
NOTE: The timing cover bolts and both holes to the engine block must be thoroughly cleaned and free of oil residue before assembly. IN ADDITION add thread sealant to the timing cover bolts that mount to the oil pump. See **Engine/Lubrication/PUMP, Engine Oil - Installation**.

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. Install the air cleaner housing. See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.
5. Remove floor jack and raise vehicle.
6. Install power steering pump fasteners. Tighten bolts to 23 N.m (200 lbs. in.).
7. Install crankshaft damper. See **Engine/Engine Block/DAMPER, Vibration - Installation**.
8. Install accessory drive belt tensioner. Torque fastener to 28 N.m (250 in. lbs.).
9. Install accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation** .
10. Lower vehicle.
11. Connect negative battery cable.

COVER(S), ENGINE TIMING, REAR**Removal****REMOVAL**

1. Perform fuel pressure release procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .
2. Disconnect the negative battery cable.
3. Remove timing belt. Refer to **BELT and SPROCKETS, Timing**.
4. Remove camshaft sprockets. Refer to **BELT and SPROCKETS, Timing**.
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.



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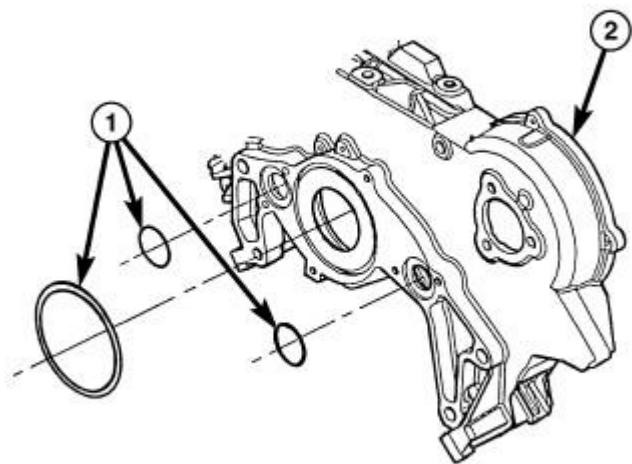
Fig. 487: REAR TIMING BELT COVER FASTENERS
Courtesy of CHRYSLER LLC

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

Installation

INSTALLATION

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 .



80c78e55

Fig. 488: REAR TIMING BELT COVER SEALS
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - REAR TIMING BELT COVER SEALS
2 - REAR TIMING BELT COVER |
|--|

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. Refer to **BELT and SPROCKETS, Timing**.
5. Install timing belt. Refer to **BELT and SPROCKETS, Timing**.

TENSIONER, ENGINE TIMING

Removal

TENSIONER

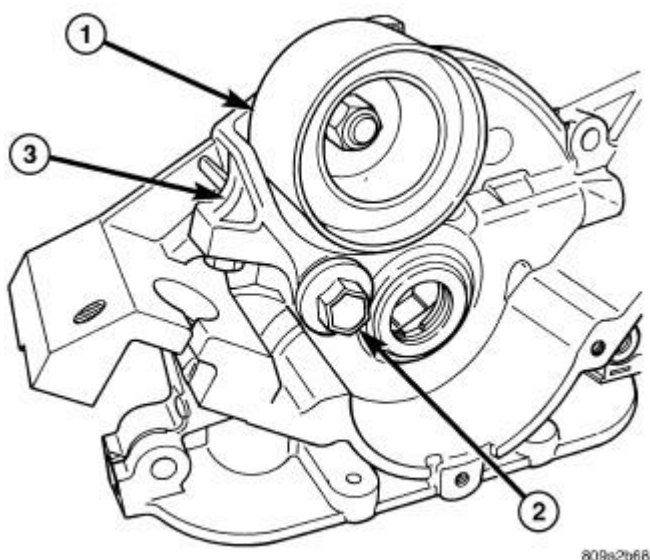


Fig. 489: TENSIONER PULLEY

Courtesy of CHRYSLER LLC

- 1 - TENSIONER PULLEY
- 2 - PIVOT BOLT
- 3 - TENSIONER BRACKET

1. For timing belt tensioner removal procedure, refer to **BELT and SPROCKETS, Timing**.

TENSIONER PULLEY ASSEMBLY

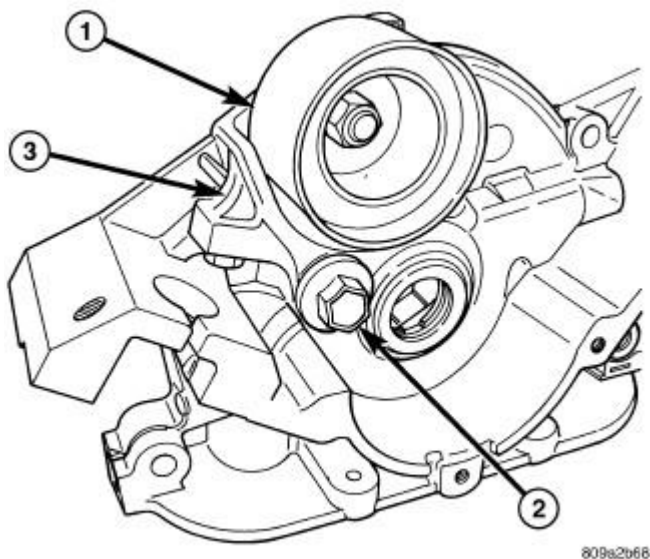


Fig. 490: TENSIONER PULLEY

Courtesy of CHRYSLER LLC

- 1 - TENSIONER PULLEY
- 2 - PIVOT BOLT
- 3 - TENSIONER BRACKET

1. Remove the timing belt. Refer to **BELT and SPROCKETS, Timing**.
2. Remove the timing belt tensioner pulley and bracket assembly by unscrewing the pivot bolt from the oil pump housing .

Inspection

TENSIONER

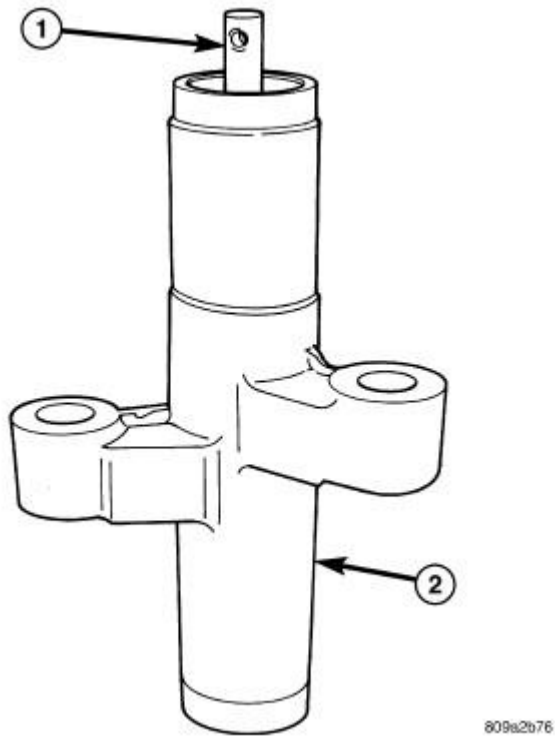


Fig. 491: TENSIONER
Courtesy of CHRYSLER LLC

- 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

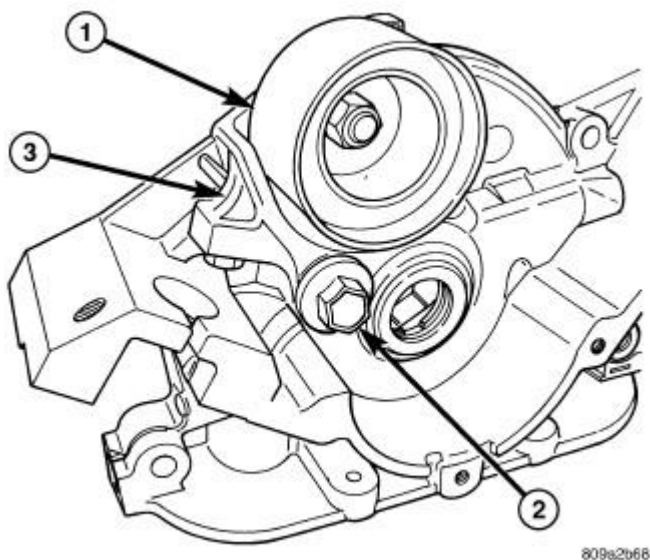


Fig. 492: TENSIONER PULLEY

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

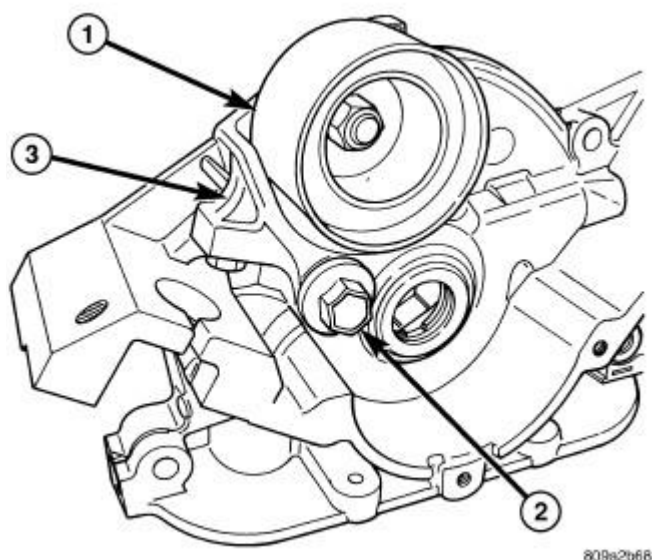


Fig. 493: TENSIONER PULLEY

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. Refer to **BELT and SPROCKETS, Timing.**

TENSIONER

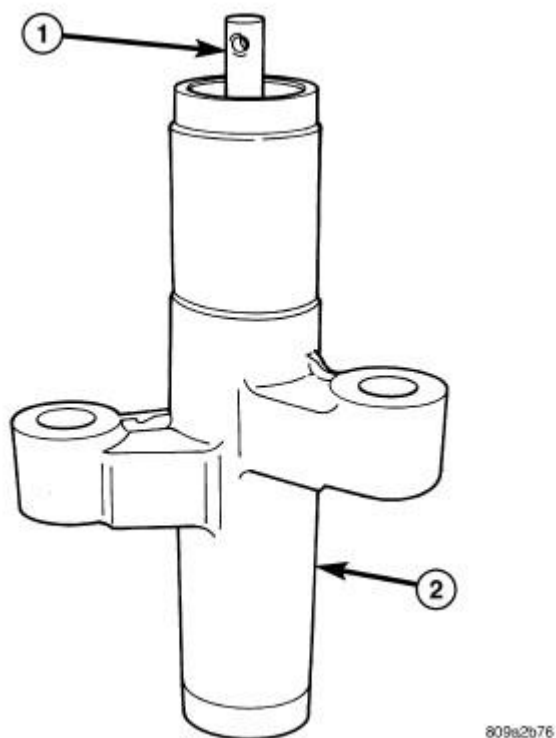


Fig. 494: TENSIONER

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - PLUNGER (EXTENDED POSITION)
2 - TENSIONER HOUSING |
|--|

1. For timing belt tensioner installation procedure, refer to **BELT and SPROCKETS, Timing.**