

2014 ENGINE**8.4L - Service Information - Viper****DESCRIPTION****DESCRIPTION**

The engine is an 8.4 Liter (512 CID), 10-cylinder, 90° V-type, lightweight, single-cam, overhead valve engine. This engine is designed for premium unleaded fuel only.

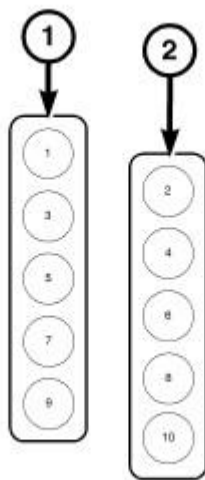


Fig. 1: Cylinder Identification

Courtesy of CHRYSLER GROUP, LLC

The crankshaft is forged steel. The cylinder block and cylinder heads are aluminum. The firing order is 1-10-9-4-3-6-5-8-7-2. The cylinders are numbered from front to rear as shown in illustration.

The left bank (1) is also referred to as bank 1. The right bank (2) is also referred to as bank 2.

VEHICLE IDENTIFICATION NUMBER

This number is located on the rear of the cylinder block just below the right cylinder head.

ENGINE SERIAL NUMBER

This number is located on the lower right front of the cylinder block near the oil pressure sensor.

STANDARD PROCEDURE**DUST COVERS AND CAPS**

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

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

FORM-IN-PLACE GASKETS AND SEALERS

NOTE: All sealants mentioned below are not used on every engine; they are listed as general reference guide. See appropriate Service Information for specific sealer usage.

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin of 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. Clean surfaces with Mopar® brake parts cleaner prior to sealer application. After the sealer is applied, assemble the parts within 10 minutes.

Numerous types of form-in-place gasket materials are used in the engine area. Mopar® Sealant RTV Silicone Rubber Adhesive, MOPAR® Silicone Rubber RTV, Mopar® ATF-RTV and Mopar® Gasket Maker gasket materials, each have different properties and cannot be used in place of the other.

MOPAR® SEALANT RTV SILICONE RUBBER ADHESIVE 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® SILICONE RUBBER RTV is used to seal components exposed to engine oil, gear lubricant, and coolant. This material is a specially designed gray silicone rubber RTV that retains adhesion and sealing properties when exposed to engine oil, gear lubricant and coolant. Excellent adhesion even on oily surfaces, withstands temperatures to 330° C (626° F). 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 specially 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® 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. It can be used on threaded and machined parts under all temperatures. This material also prevents corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or in a 4 oz. or 6 oz. can with applicator.

SEALER APPLICATION

Apply 1 mm (0.040 in.) diameter or less of Mopar® Gasket Maker material to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Tighten the components in place within 15 minutes. Use a locating dowel during assembly to prevent smearing material off the location.

Apply Mopar® RTV or ATF-RTV gasket material in a continuous bead approximately 3 mm (0.120 in.) in diameter. For corner sealing and "T-Joint" locations and waffle pad area, a 0.635 mm (0.025 in.) drop is placed in the center of the gasket contact area. Remove uncured sealant with a shop towel. Tighten the components in place while the sealant is still wet to the touch (within 10 minutes). Use a locating dowel during assembly to prevent smearing material off the location.

ENGINE GASKET SURFACE PREPARATION

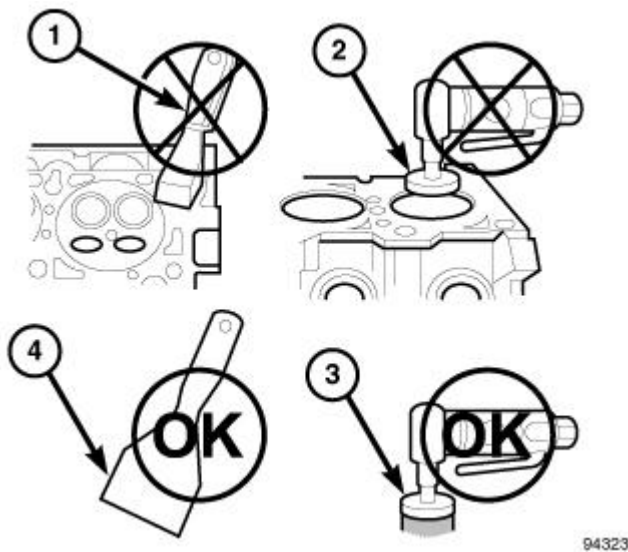


Fig. 2: Proper Tool Usage For Surface Preparation
Courtesy of CHRYSLER GROUP, LLC

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

Never use the following to clean gasket surfaces:

- Metal scraper (1).
- High speed power tool with an abrasive pad or paper to clean the cylinder block and head (2).

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.
- High speed power tool with 3M Roloc™ Bristle Disc (white or yellow) (3).
- Plastic or wood scraper (4).

HYDROSTATIC LOCKED ENGINE

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

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

1. Inspect the air cleaner, induction system and the intake manifold to ensure the system is dry and clear of foreign material.
2. Remove the battery negative cable.
3. Blow out the spark plug recessed area with compressed air.
4. 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.
5. With all the spark plugs removed, rotate the engine crankshaft using a breaker bar and socket.
6. Identify the fluid in the cylinder(s) (i.e., coolant, fuel, oil or other).
7. Make sure all the fluid has been removed from the cylinders. Inspect the engine for damage (i.e., connecting rods, pistons, valves, etc.)
8. If the fluid is fuel, replace the fuel and exhaust system components as necessary (including damaged or soaked catalytic converters).
9. Repair engine or components as necessary to prevent this problem from re-occurring.

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

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

DIAGNOSIS AND TESTING

INTRODUCTION

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

maintenance.

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

Refer to **ENGINE DIAGNOSIS - MECHANICAL** and **ENGINE DIAGNOSIS - PERFORMANCE** for possible causes and corrections of malfunctions. Refer to the appropriate Diagnostic Information for fuel system diagnosis.

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

- Cylinder Compression Pressure Test: **CYLINDER COMPRESSION PRESSURE TEST**
- Cylinder Combustion Pressure Leakage Test: **CYLINDER COMBUSTION PRESSURE LEAKAGE TEST**
- Cylinder Head Gasket Failure Diagnosis: **CYLINDER HEAD GASKET FAILURE DIAGNOSIS**
- Intake Manifold Leakage Diagnosis: **INTAKE MANIFOLD LEAKS**
- Hydraulic Tappet Noise Diagnosis: **HYDRAULIC TAPPET NOISE DIAGNOSIS**
- Engine Oil Leak Inspection: **ENGINE OIL LEAK INSPECTION**

ENGINE DIAGNOSIS - PERFORMANCE

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE WILL NOT CRANK	1. Weak or discharged battery.	1. Charge or replace battery as necessary. Refer to <u>DIAGNOSIS AND TESTING</u> . Check charging system. Refer to the appropriate Diagnostic Information for charging system diagnosis.
	2. Corroded or loose battery connections.	2. Clean/tighten battery/starter connections.
	3. Faulty starter or related circuits.	3. Check starting system. Refer to <u>DIAGNOSIS AND TESTING</u> .
	4. Seized accessory drive component.	4. Remove accessory drive belt and attempt to start engine. If engine cranks, repair/replace seized component.
	5. Engine internal mechanical failure or hydrostatic lock.	5. Refer to <u>ENGINE DIAGNOSIS - MECHANICAL</u> .
ENGINE CRANKS BUT WILL NOT START	1. No spark.	1. Check for spark. Refer to the appropriate Diagnostic Information for ignition system diagnosis.
	2. No fuel.	2. Perform fuel pressure test. Refer to the appropriate Diagnostic Information for fuel system diagnosis.

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	3. Low or no engine compression.	3. Perform cylinder compression test. Refer to <u>CYLINDER COMPRESSION PRESSURE TEST.</u>
	4. Incorrect valve timing.	4. Correct valve timing.
ENGINE LOSS OF POWER	1. Worn or incorrect gapped spark plugs.	1. Replace spark plugs or set gap.
	2. Dirt or water in fuel system.	2. Clean system and replace fuel filter.
	3. Faulty fuel pump.	3. Replace fuel pump.
	4. Check for fault Codes	4. Repair Fault Code Per <u>DTC INDEX</u>
	5. Incorrect valve timing.	5. Correct valve timing.
	6. Blown cylinder head gasket (s).	6. Replace cylinder head gasket(s).
	7. Low compression.	7. Test cylinder compression. Refer to <u>DIAGNOSIS AND TESTING.</u>
	8. Burned, warped, or pitted valves.	8. Install new valve seal or reface valves and seats or replace cylinder heads as necessary.
	9. Plugged or restricted exhaust.	9. Replace parts as necessary.
	10. Faulty ignition cables.	10. Replace ignition cables as necessary.
	11. Faulty coil(s).	11. Check for fault codes, test and replace as necessary.
	12. Plugged air filter.	12. Replace air filter.
	13. Variable valve timing system failure.	13. Check variable valve timing operation and check for fault codes.
ENGINE STALLS OR ROUGH IDLE	1. Carbon buildup on throttle plate.	1. Remove throttle body and de-carbon.
	2. Worn or incorrectly gapped spark plugs.	2. Replace spark plugs or set gap.
	3. Faulty or crossed ignition cables.	3. Check for correct firing order or replace ignition cables as necessary.
	4. Faulty coil(s).	4. Check for fault codes, test and replace as necessary
	5. Intake manifold vacuum leak.	5. Inspect intake manifold gasket and vacuum hoses. Replace as necessary.
	6. Incorrect variable valve timing.	6. Check variable valve timing operation, check for fault codes.
ENGINE MISSES ON ACCELERATION	1. Worn or incorrectly gapped spark plugs.	1. Replace spark plugs or set gap.
	2. Faulty ignition cables.	2. Replace ignition cables as necessary.
	3. Dirt or water in fuel system.	3. Clean system and replace fuel filter.
	4. Burned, warped, or pitted valves.	4. Install new valve seal or reface valves and seats or replace cylinder heads as necessary.

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5. Faulty coil(s).

5. Check for fault codes, test and replace as necessary.

ENGINE DIAGNOSIS - MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE NOISE	1. Worn accessory drive belt	1. Check for damage and/or alignment. Refer to <u>BELT, SERPENTINE, DIAGNOSIS AND TESTING</u> .
	2. Worn coolant pump	2. Check for possible coolant leak. If OK, Check the pulley and input shaft for wear. Replace as necessary.
	3. Worn generator	3. Check the pulley for wear. Spin the armature. Replace as necessary.
	4. Idler/Tensioner pulley	4. Check pulleys. Verify bearing noise. Replace as necessary.
	5. Power steering pump	5. Check the pulley and input shaft for wear. Replace as necessary.
	6. Flywheel/Flexplate	6. Check for wear or possible cracking. Check bolts. repair as necessary.
NOISY VALVES	1. High or low oil level in crankcase.	1. Check for correct oil level. Adjust oil level by draining or adding as needed.
	2. Thin or diluted oil.	2. Change oil and filter.
	3. Low oil pressure.	3. Check engine oil level. If OK, perform oil pressure test. Refer to <u>LUBRICATION, DIAGNOSIS AND TESTING</u> .
	4. Dirt in tappets/lash adjusters.	4. Clean/replace hydraulic tappets/lash adjusters.
	5. Bent push rod(s).	5. Replace push rod(s) as necessary.
	6. Worn rocker arms.	6. Replace worn rocker arms and inspect oil supply to rocker arms.
	7. Worn tappets/lash adjusters.	7. Replace hydraulic tappets/hydraulic lash adjusters.
	8. Worn valve guides.	8. Replace cylinder heads as necessary.
	9. Excessive runout of valve seats on valve faces.	9. Grind valve seats and valves.
	10. Broken valve springs.	10. Install new spring. Check installed height and correct as necessary.
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. Check engine oil level.
	2. Low oil pressure.	2. Check engine oil level. If OK,

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		perform oil pressure test. Inspect oil pump relief cartridge. assembly. Refer to <u>LUBRICATION, DIAGNOSIS AND TESTING.</u>
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Measure bearings for correct clearance. Repair as necessary.
	5. Connecting rod journal out-of-round.	5. Replace crankshaft.
	6. Misaligned connecting rods.	6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply.	1. Check engine oil level.
	2. Low oil pressure.	2. Check engine oil level. If OK, perform oil pressure test. Inspect oil pump relief cartridge. assembly. Refer to <u>LUBRICATION, DIAGNOSIS AND TESTING.</u>
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Measure bearings for correct clearance. Repair as necessary.
	5. Excessive end play.	5. Check No. 3 bearing for wear on flanges.
	6. Crankshaft journal out-of-round and/or worn.	6. Replace crankshaft.
	7. Loose flywheel.	7. Inspect crankshaft, flywheel, and bolts for damage. Tighten bolts to correct torque.
OIL PRESSURE DROP	1. Low oil level.	1. Check oil level and fill if necessary.
	2. Faulty oil pressure sending unit.	2. Replace sending unit.
	3. Clogged oil filter.	3. Diagnose debris source and correct as necessary. Install new oil filter. Inspect oil cooler and lines for debris, replace as necessary.
	4. Worn oil pump.	4. Replace worn gerotor cartridge assembly or oil pump assembly.
	5. Thin or diluted oil.	5. Change oil to correct viscosity.
	6. Excessive bearing clearance.	6. Measure bearings for correct clearance.
	7. Oil pump relief valve stuck.	7. Remove relief valve. Refer to <u>VALVE, OIL PRESSURE RELIEF, INSPECTION.</u> Replace as necessary.
	8. Oil pump pick up tube restricted, cracked, or damaged.	8. Remove oil pan and inspect oil pump pick up tube. Clean or replace as necessary.
	9. Oil pump cover loose, warped, or cracked.	9. Inspect/tighten cover screws or install new oil pump, if necessary.

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OIL LEAKS	1. Misaligned or deteriorated gaskets.	1. Replace gaskets.
	2. Loose fastener, broken or porous component.	2. Tighten, repair or replace component.
	3. Check oil cooler line quick connections fittings.	3. Repair as necessary.
EXCESSIVE OIL CONSUMPTION, EXCESSIVE SMOKE, OR SPARK PLUGS OIL FOULED	1. PCV system malfunction.	1. Check and repair PCV system as necessary.
	2. Defective valve stem seal(s).	2. Repair or replace seal(s).
	3. Worn or broken piston rings.	3. Hone cylinder bores. Check specifications. Install new rings. Replace cylinder block as necessary.
	4. Scuffed pistons/cylinder walls.	4. Hone cylinder bores. Check specifications. Install new pistons. Replace cylinder block as necessary.
	5. Carbon in oil control ring groove.	5. Remove rings and de-carbon piston.
	6. Worn valve guides.	6. Replace cylinder head assembly and valves as necessary.
	7. Piston rings fitted too tightly in grooves.	7. Remove piston rings. Check ring end gap and side clearance. Replace as necessary.

CYLINDER COMPRESSION PRESSURE TEST

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

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

1. Check the engine oil level and add oil if necessary.
2. Drive the vehicle until the 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 the Auto Shut Down (ASD) relay from the Power Distribution Center (PDC).
4. Disconnect the ignition cables from the spark plugs.

NOTE: Blow out the spark plug wells with compressed air prior to removing the spark plugs.

5. Remove all the spark plugs from engine. As the spark plugs are being removed, check the electrodes for abnormal firing indicators; fouled, hot, oily, etc. Record the cylinder number of the spark plug for future reference.
6. Be sure the throttle blade is fully open during the compression check. Throttle blades can be blocked open with a small piece of wood.

7. Insert the compression gauge adaptor Special Tool (special tool #8116, Adapter, Pressure PEP) or the equivalent, into the No. 1 spark plug hole in cylinder head. Connect the 0-500 psi (Blue) pressure transducer (special tool #CH7059, Pressure Transducer, Rpl.) with cable adaptors to the scan tool. For Special Tool identification. Refer to **SPECIAL TOOLS**.
8. Place the transmission in neutral and crank the engine until the maximum pressure is reached on the gauge. Record this pressure as No. 1 cylinder pressure.
9. Repeat the previous step for all remaining cylinders.
10. Compression should not be less than 860 kPa (125 psi) and not vary more than 20 percent from cylinder to cylinder.
11. If one or more cylinders have abnormally low compression pressures, repeat the compression test.
12. 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 the 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 COOLING SYSTEM PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

1. Check the coolant level and fill as required. DO NOT install the radiator cap.
2. Start and operate the engine until it attains normal operating temperature.
3. Turn the engine OFF.
4. Remove the spark plugs.
5. Remove the oil filler cap.
6. Remove the air cleaner hose.
7. **Calibrate the tester according to the manufacturer's instructions.** The shop air source for testing should maintain a regulated air pressure at 552 kPa (80 psi).
8. Perform the test procedures on each cylinder according to the tester manufacturer's instructions. Set the piston of the cylinder to be tested at TDC compression.
9. During the testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

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

FOR EXAMPLE: Input air at 552 kPa (80 psi), the primary gauge factory set at 207 kPa (30 psi) input pressure. The secondary gauge should have no more than 176 kPa (25.5 psi) loss, when connected to the cylinder.

CYLINDER HEAD GASKET FAILURE DIAGNOSIS

A cylinder head gasket leak can be located between adjacent cylinders, between a cylinder and the adjacent water jacket, or an external coolant leak may be present.

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**. An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50-70% reduction in compression pressure. Cylinders adjacent to each other will both have low compression.

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 the thermostat opens.

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

COOLING SYSTEM TESTER METHOD

WARNING: WITH THE 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 THE PRESSURE TO EXCEED 138 kPa (20 psi).

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

CHEMICAL TEST METHOD

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

INTAKE MANIFOLD LEAKS

An intake manifold air leak is characterized by lower than normal manifold vacuum, high or rough idle, or engine misfire, possible whistle.

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

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

HYDRAULIC TAPPET NOISE DIAGNOSIS**PRELIMINARY STEPS TO CHECKING THE HYDRAULIC TAPPETS**

Before disassembling any part of the engine to correct tappet noise, check engine oil level and oil pressure.

1. Check the engine oil level.
 - **Oil Level Check: stop engine after reaching normal operating temperature**
 - The oil level should never be above the FULL mark on dipstick, or below the ADD mark. Either of these two conditions could be responsible for noisy tappets. Allow 5 minutes to stabilize oil level; check dipstick.
2. Remove the oil pressure sensor.
3. Install a reliable oil pressure gauge at the oil pressure sensor location.

NOTE: The oil pressure should be 206.8 - 551.6 kPa (30 - 80 psi) at 2000 RPM.

OIL LEVEL TOO HIGH

If the oil level is above the FULL mark on the dipstick, it is possible for the connecting rods to dip into the oil while the engine is running and create foam. Foam in the oil pan would be fed to the hydraulic tappets by the oil

pump causing them to become soft and allow valves to seat noisily.

OIL LEVEL TOO LOW

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

VALVE TRAIN NOISE DIAGNOSIS

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

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

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

ENGINE OIL LEAK INSPECTION

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

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

2. 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.

3. Gradually apply air pressure from 6.89 kPa (1 psi) to 17.23 kPa (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.
4. 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. Connect the PCV hoses. 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 oil pan location; remove the tube and O-ring. Clean and install new O-ring.

INSPECTION FOR REAR SEAL AREA LEAKS

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

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

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove clutch housing inspection 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 or leakage from flywheel bolts.
 - b. Where leakage tends to run straight down, possible causes are a porous block, oil gallery cup plug or rear crankshaft seal retainer gasket leak. Oil pan rear gasket or T-joint area. See appropriate repair procedures for these items.
4. If no leaks are detected, pressurize the crankcase as previously described.

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

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

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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.

SPECIFICATIONS

ENGINE

GENERAL SPECIFICATIONS

DESCRIPTION	SPECIFICATION	
Type	90° V - 10	
Number of Cylinders	10	
Firing Order	1-10-9-4-3-6-5-8-7-2	
Compression Ratio	10.2:1	
Brake Horsepower	640@6200 RPM	
Torque	600 ft. lbs. @5000 RPM	
Crankshaft	Forged Steel	
Cylinder Block	Aluminum Alloy with Interference Fit Cast Iron Liners	
Cylinder Head	Cast Aluminum Alloy	
Camshaft	Steel	
Main Bearing Caps	Nodular Iron	
Connecting Rods	Powdered Metal Cracked Cap	
Pistons	Forged Aluminum Alloy	
	Metric	Standard
Displacement	8.4L	512 cu. in.
Bore	103 mm	4.055 in.
Stroke	100.584 mm	3.96 in.
Engine Weight (Approx.)	273 Kilograms	601 Lbs.

CYLINDER BLOCK

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Camshaft Bore Diameter		
1	60.000 - 60.025 mm	2.3621 - 2.3631 in.
2-6	56.273 - 56.298 mm	2.2154 - 2.2164 in.
Cylinder Bore Diameter	102.993 - 103.007 mm	4.05484 - 4.05539 in.

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Out of Round (Max.)	0.008 mm	0.0003 in.
Taper (Max.)	0.015 mm	0.0006 in.
Tappet Bore Diameter	21.41 - 21.44 mm	0.843 - 0.844 in.
Block Length	708.63 mm	27.898 in.
Deck Height	240.792 mm	9.48 in.
Main Bearing Bore	81.087 - 81.100 mm	3.1923 - 3.1929 in.

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Connecting Rod Journal Diameter	53.993 - 54.008 mm	2.1261 - 2.1263 in.
Out-of-Round (Max.)	0.005 mm	0.0002 in.
Taper (Max.)	0.005 mm	0.0002 in.
End Play	0.101 - 0.228 mm	0.0040 - 0.0090 in.
Wear Limit	0.280 mm	0.011 in.
Main Bearing Clearance 1-6	0.0381 - 0.0635 mm	0.0015 - 0.0025 in.
Wear Limit	0.075 mm	0.003 in.

MAIN BEARING JOURNALS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Diameter	76.233 - 76.253 mm	3.0013 - 3.0021 in.
Out of Round (Max.)	0.005 mm	0.0002 in.

CONNECTING RODS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bearing Clearance	0.0381 - 0.0559 mm	0.0015 - 0.0022 in.
Wear Limit	0.080 mm	0.0031 in.
Piston Pin Diameter Bore	25.010 - 25.020 mm	0.9846 - 0.9850 in.
Wear Limit	25.040 mm	0.9858 in.
Side Clearance (Two Rods)	0.071 - 0.369 mm	0.0028 - 0.0145 in.
Total Weight (Less Bearing)	649.7 grams	22.92 oz.

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Piston Size (over coating)	102.976-103.008 mm	4.0542-4.0551 in.
Weight	431.5 - 441.5 grams	15.22 - 15.57 oz.
Piston Length	55.0 mm	2.165 in.
Piston Pin Diameter Bore	25.009 - 25.015 mm	0.9846 - 0.9848 in.

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Piston Pin Bore Offset	0.800 mm	0.031 in.
Piston Ring Groove Inner Diameter No. 1	93.10 - 93.30 mm	3.665 - 3.673 in.
Piston Ring Groove Inner Diameter No. 2	91.60 - 91.80 mm	3.6063 - 3.6142 in.
Piston Ring Groove Inner Diameter No. 3	95.80 - 96.00 mm	3.7717 - 3.7795 in.

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance in Piston	0.006 - 0.015 mm	0.00023 - 0.00059 in.
Wear Limit	0.020 mm	0.0007
Clearance in Connecting Rod	0.007 - 0.020 mm	0.00027 - 0.00079 in.
Wear Limit	0.025 mm	0.0009
Diameter	25.000 - 25.003 mm	0.9842 - 0.9843 in.
Length	65.00 mm	2.559 in.
End Play	0.10 - 0.25 mm	0.0004 - 0.0100 in.

PISTON RING

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Piston Ring End Gap		
Top Compression Ring	0.30 - 0.45 mm	0.0118 - 0.0177 in.
Second Compression Ring	0.65 - 0.90 mm	0.0256 - 0.0354 in.
Oil Control (Steel Rails)	0.20 - 0.71 mm	0.00787 - 0.02795 in.
Wear Limit - Top Compression Ring	0.68 mm	0.027 in.
Wear Limit - 2nd Compression Ring	1.50 mm	0.059 in.
Wear Limit - Oil Control Steel Rails	1.50 mm	0.059 in.
Piston Ring Side Clearance		
Top Compression Ring	0.020 - 0.068 mm	0.00078 - 0.00267 in.
2nd Compression Ring	0.020 - 0.058 mm	0.00078 - 0.00228 in.
Oil Rings	0.012 - 0.178 mm	0.0005 - 0.0070 in.
Wear Limit - Top and 2nd Ring	.080 mm	0.003 in.
Wear Limit Oil Ring Pack	0.200 mm	0.0078 in.
Piston Ring Width		
Compression Rings	1.472 - 1.490 mm	0.05795 - 0.05866 in.
Oil Rings	0.447 - 0.490 mm	0.0176 - 0.0193 in.

CAMSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard

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Lift		
Intake	8.51 mm	0.335 in.
Exhaust	8.01 mm	0.315 in.
Journal Diameter		
Journal No. 1	59.970 - 59.942 mm	2.325 - 2.359 in.
Journal No. 2 - 6	56.205 - 56.225 mm	2.213 - 2.213 in.
Bore Diameter		
Bore Diameter No. 1	60.00 - 60.025 mm	2.3621 - 2.3631 in.
Bore Diameter No. 2-6	56.273 - 56.298 mm	2.2154 - 2.2164 in.
Diametrical Clearance	0.030 - 0.083 mm	0.001 - 0.003 in.
Wear Limit	0.127 mm	0.005 in.
End Play	0.127 - 0.381 mm	0.005 - 0.015 in.
Valve Timing-Exhaust Valve with VVT in lock pin position		
Closes (ATC)	36.5°	-
Opens (BBC)	88.5°	-
Duration	305.0°	-
Valve Timing-Intake Valve		
Closes (BTDC)	86.5°	-
Opens	23.5°	-
Duration	297.0°	-
Valve Overlap	60.0°	-
Lobe Center Line		
Intake	131° ATDC	-
Exhaust - In lock pin position	140° BTDC	-

HYDRAULIC TAPPETS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Body Diameter	21.387 - 21.405 mm	0.8420 - 0.8427 in.
Clearance in Block	0.005 - 0.053 mm	0.0002 - 0.0021 in.
Plunger Travel (Dry)	4.22 mm	0.166 in.
Push Rod Length (Overall)	194.028 mm	7.6388 in.

CYLINDER HEAD

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Gasket Thickness (Compressed)	1.113 mm	0.0438 in.
Flatness	0.019 mm	0.00075 in.

CYLINDER HEAD VALVE SEAT

SPECIFICATION	
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2014 Dodge Viper GTS

2014 ENGINE 8.4L - Service Information - Viper

DESCRIPTION	Metric	Standard
Seat Angle	44.75° - 45.25°	-
Runout (Max.)	0.038 mm	0.002 in.
Width (Finish) Intake and Exhaust	1.02 - 1.52 mm	0.040 - 0.060 in.
Guide Bore Diameter (Std.)	7.95 - 7.98 mm	0.313 - 0.314 in.

VALVES

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Face Angle	44° - 44.5°	-
Back Cut Angle	30°	-
Stem Diameter-Intake and Exhaust	7.934 - 7.954 mm	0.3123 - 0.3131 in.
Head Diameter-Intake	52.67 - 52.93 mm	2.0736 - 02.0838 in.
Head Diameter-Exhaust	40.76 - 41.02 mm	1.6047 - 1.6149 in.
Length-Intake (Over All)	140.44 mm	5.5291 in.
Length-Exhaust (Over All)	141.52 mm	5.5716 in.
Valve Margin-Intake	1.01 mm	0.0397 in.
Valve Margin-Exhaust	2.00 mm	0.0787 in.
Lift-Intake (Zero Lash)	14.40 mm	0.5659 in.
Lift-Exhaust (Zero Lash)	13.59 mm	0.5350 in.
Valve Stem Tip Height (from spring pocket)	54.636 mm	2.1510 in.
Stem-to-Guide Clearance-Intake and Exhaust	0.021 - 0.063 mm	0.0008 - 0.0024 in.
Max. Allowable-Intake (Rocking Method)	0.50 mm	0.0196 in.
Max. Allowable-Exhaust (Rocking Method)	0.70 mm	0.0275 in.

VALVE SPRING

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Free Length - Spring	58.04 mm	2.285 in.
Spring Tension (Valve Closed)	489.41 ± 24.5 N @ 48.01 mm	110 ± 5.5 lbs. @ 1.890 in.
Service Limit	441 N min.	99 lbs. min.
Spring Tension (Valve Open)	1428 ± 70.1 N @ 33.6 mm	321 ± 15.7 lbs. @ 1.322 in.
Number of Coils - Spring	7.7	-
Wire Diameter (Ovate)	4.394 x 5.493 mm	0.1729 x 0.2162 in.
Installed Height (Spring Seat to Bottom of Retainer)	48.01 mm	1.890 in.

LUBRICATION

2014 Dodge Viper GTS

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DESCRIPTION	SPECIFICATION	
	Metric	Standard
At Curb Idle Speed* (Minimum with engine at operating temperature)	68.9 kPa	10 psi
At 3000 RPM	310 - 517 kPa	45 - 75 psi
CAUTION: *If pressure is ZERO at curb idle, DO NOT run engine at 4000 RPM.		

OIL PUMP

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance Over Rotors (Max.)	0.077 mm	0.003 in.
Cover Out-Of-Flat (Max.)	0.076 mm	0.003 in.
Inner Rotor Thickness (Min.)	15.937 mm	0.627 in.
Clearance (Max.)	0.19 mm	0.007 in.
Diameter (Min.)	82.45 mm	3.246 in.
Outer Thickness (Min.)	15.937 mm	0.627 in.
Tip Clearance Between Rotors (Max)	0.150 mm	0.0068 in.

TORQUE

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.	
A/C Compressor Mounting Bolts	24	17	-	
A/C Compressor Bracket Bolts	29	21	-	
A/C Line Support to Oil Pan	9	-	80	
Accessory Drive Idler Pulley	54	40	-	
Accessory Drive Belt Tensioner	41	30	-	
Air Cleaner Cover Bolts	9	-	80	
Bell Housing Bolts	54	40	-	
Camshaft Position Sensor Bolt	6	-	53	
Camshaft Drive Plate Bolts				
	Center Bolt - m10	80	59	-
	Outer Bolts - m6	12	-	106
Camshaft Sprocket/Phaser Bolt	165	122	-	
Camshaft Thrust Plate Bolts	13	-	115	
Capacitor Bolt	12	-	106	
Coil Cover Bolts	6	-	53	
Connecting Rod Cap Bolts	45 + 45°	33 + 45°	-	
Coolant Temperature Sensor	20	15	-	
Crankshaft Main Bearing Cap Bolts	Refer to <u>CRANKSHAFT, INSTALLATION.</u>			
Crankshaft Oil Scraper Nuts	28	21	-	

2014 Dodge Viper GTS

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Crankshaft Position Sensor	9	-	80
Crankshaft Position Sensor Heat Shield Nut	7	-	62
Crankshaft Pulley Bolts	20	15	-
Crankshaft Vibration Damper Bolt	339	250	-
Cylinder Head Bolts	Refer to <u>CYLINDER HEAD, INSTALLATION.</u>		
Cylinder Head Cover Bolts	11	-	97
Cylinder Head Cover Baffle Bolts	10	-	89
Engine Ground at Alternator Bolt	12	-	106
Exhaust Manifold Bolts	29	21	-
Exhaust Pipe V-Band Clamp	11	-	97
Engine Mount to Frame Bolts	61	45	-
Engine Mount to Bracket Bolts	61	45	-
Engine Mount Insulator Nut	102	75	-
Flywheel Bolts	75	55	-
Fuel Rail Bolts	10	-	89
Generator Mounting Bolts	47	35	-
Ground Strap at Right Side Engine Mount to Frame Nut	7	-	62
Ignition Coil Bolts	5	-	44
Inspection Cover Bolts	9	-	80
Intake Manifold Bolts	12	-	106
Oil Cooler Mounting Bolts	5	-	44
Oil Control Valve Bolts	12	-	106
Oil Cooler Line Fittings	25	18	-
Oil Pan Bolts			
Oil Pan to Rear Seal Adapter - M6	12	-	106
Oil Pan to Block and Front Cover - M8	28	21	-
Oil Pan Baffle Bolts	12	-	105
Oil Pan Drain Plug	27	20	-
Oil Pressure Relief Valve Cartridge	25	18	-
Oil Pump Cover Bolts	12	-	105
Oil Pump Swinging Pick-up Assembly	28	21	-
Oil Pump Pick-up Pivot Bolt	14	-	124
Oil Pump - Up Tube Bolts	28	21	-
Oil Filter	18	13	-
Oil Pressure Sensor	9	-	80
Oil Temperature Sensor	20	15	-
Up Stream Oxygen Sensors	68	50	-
Power Steering Pump Mounting Bolts	24	18	-
Crankshaft Rear Oil Seal Retainer Bolts	12	-	106
Rocker Arm Bolts	32	24	-

2014 Dodge Viper GTS

2014 ENGINE 8.4L - Service Information - Viper

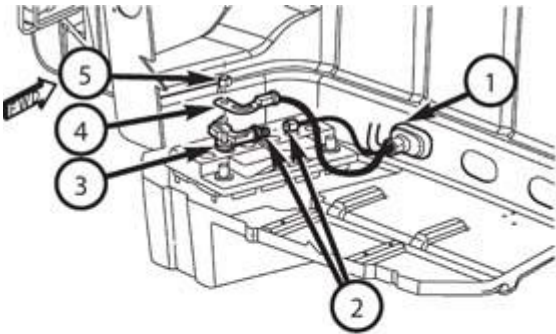
Spark Plugs	19	14	-
Starter Mounting Bolts	54	40	-
Transmission Mounting Bracket Bolts	33	24	-
Transmission Mount to Mounting Bracket Bolts	33	24	-
Transmission Mount to Cross-Member Bolts	54	40	-
Thermostat Housing Bolts	12	-	106
Throttle Body Bolts	9	-	80
Timing Chain Cover Bolts	28	21	-
Water Pump Mounting Bolts	12	-	106

REMOVAL

REMOVAL

CAUTION: If the original engine has experienced a catastrophic failure or an individual failure with the piston, cylinder bore, engine block, valve or valve seat, the intake manifold **MUST** be replaced with a new manifold.

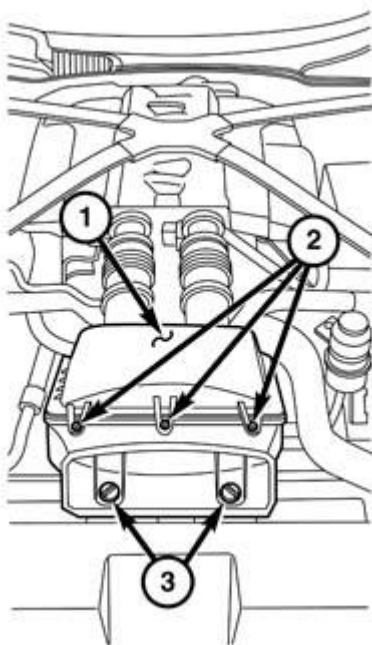
NOTE: When removing engine, care should be taken not damage the finish on the intake manifold, coil covers, and head covers.



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Fig. 3: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable
Courtesy of CHRYSLER GROUP, LLC

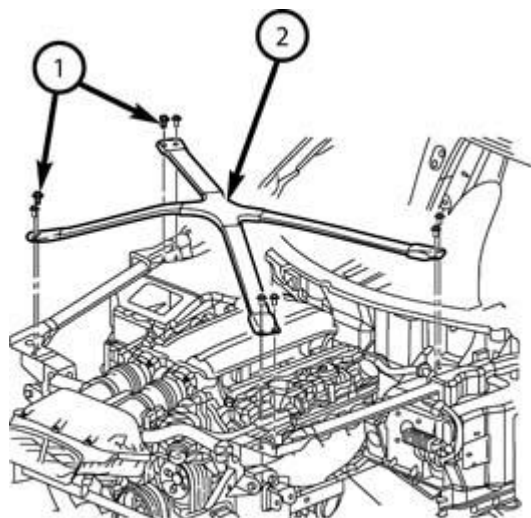
1. Perform fuel pressure release procedure. Refer to **FUEL DELIVERY, STANDARD PROCEDURE**.
2. Open trunk lid. Disconnect battery negative cable (4).
3. Remove hood. Refer to **HOOD** /REMOVAL.



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Fig. 4: Air Cleaner Housing, Cover Screws & Housing Retainers
Courtesy of CHRYSLER GROUP, LLC

4. Remove air cleaner housing (1). Refer to **BODY, AIR CLEANER, REMOVAL**.
5. Drain cooling system. Refer to **STANDARD PROCEDURE**.
6. Discharge air conditioning system using a suitable refrigerant recovery machine. Refer to **PLUMBING, STANDARD PROCEDURE**.



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Fig. 5: Cross Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

7. Remove the cross support brace (2).

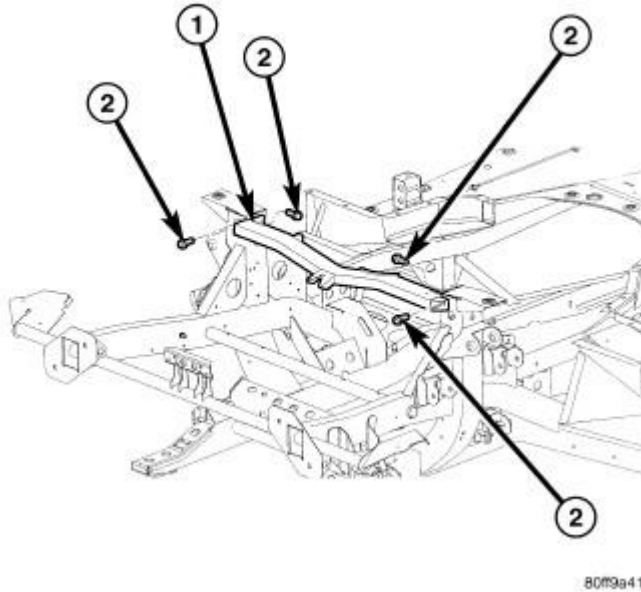


Fig. 6: Front Strut Tower To Tower Brace
Courtesy of CHRYSLER GROUP, LLC

8. Remove front strut tower brace retaining bolts (2) and remove brace (1).

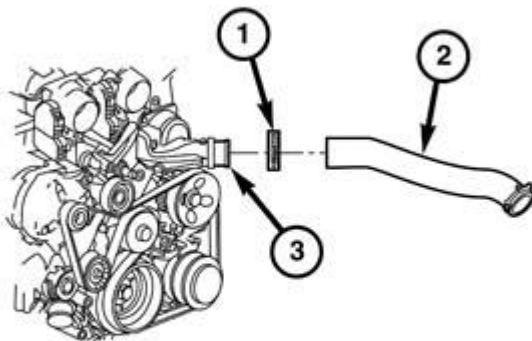


Fig. 7: Upper Radiator Hose, Clamp & Housing

Courtesy of CHRYSLER GROUP, LLC

9. Remove upper radiator hose from the engine.

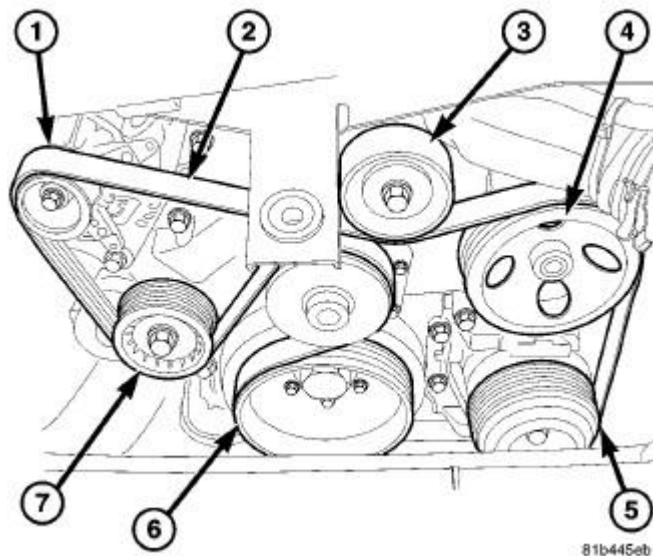


Fig. 8: View Of Accessory Drive Belt - 8.4L
Courtesy of CHRYSLER GROUP, LLC

10. Remove accessory drive belt (2). Refer to **BELT, SERPENTINE, REMOVAL** .

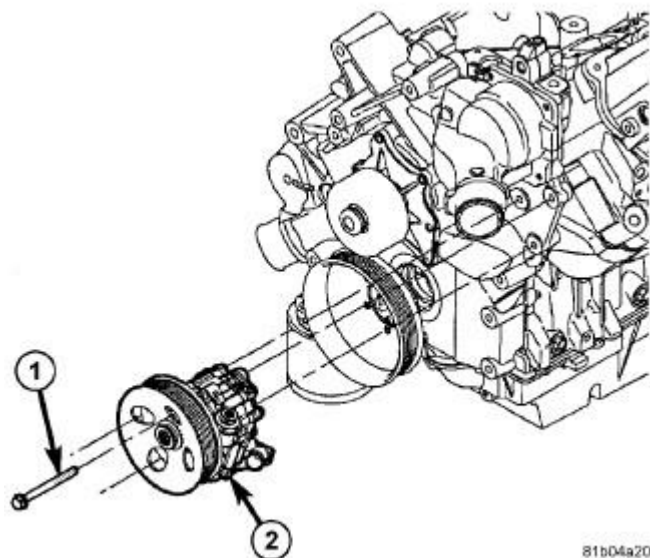


Fig. 9: Pump Mounting
Courtesy of CHRYSLER GROUP, LLC

11. Remove the power steering pump (2) and position aside. **Do not disconnect lines.**
12. Remove the power steering reservoir.

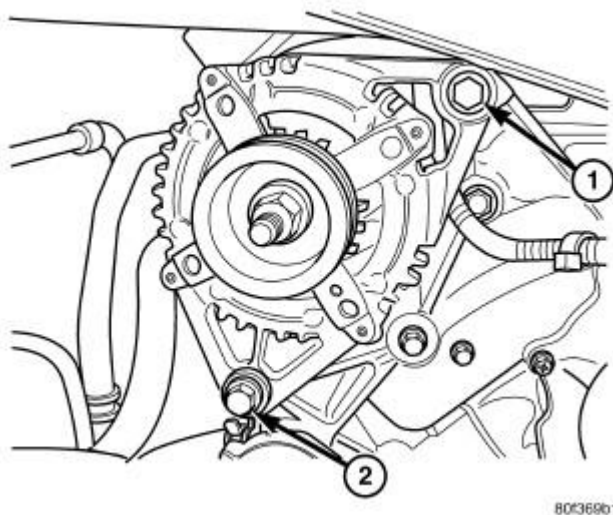
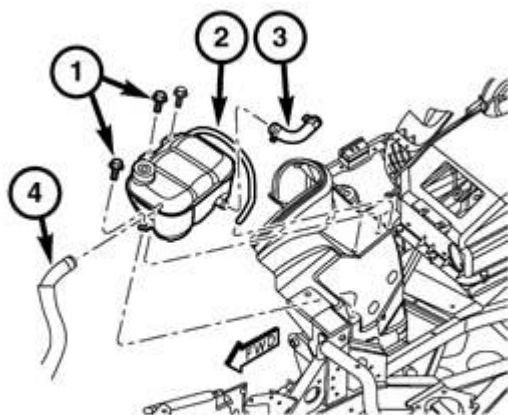


Fig. 10: Identifying Mounting Bolts

Courtesy of CHRYSLER GROUP, LLC

13. Disconnect and remove generator (1).
14. Disconnect heater hoses from engine.

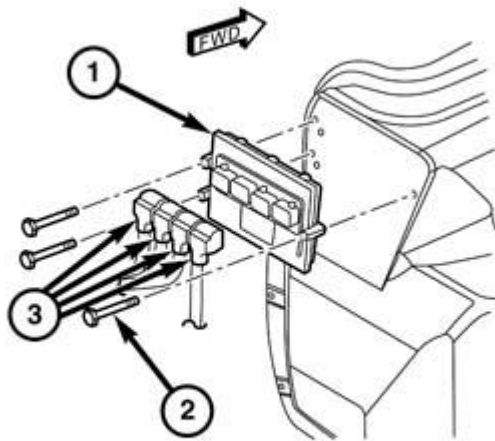


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Fig. 11: Coolant Reservoir Inlet Hose & Coolant Reservoir

Courtesy of CHRYSLER GROUP, LLC

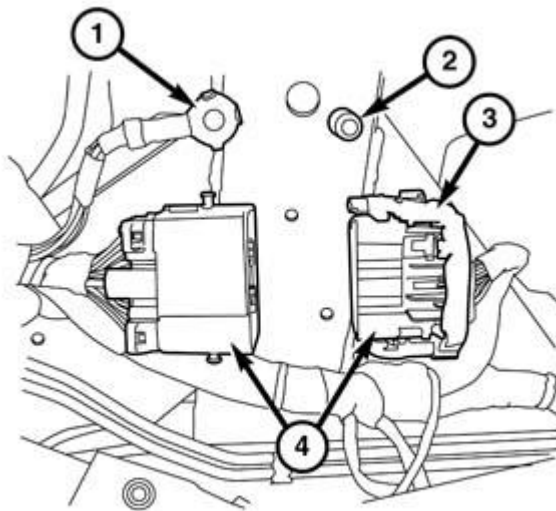
15. Disconnect coolant reservoir inlet hose (5) from coolant reservoir.



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Fig. 12: PCM, Mounting Bolts & Left Side Inner Fender Support
 Courtesy of CHRYSLER GROUP, LLC

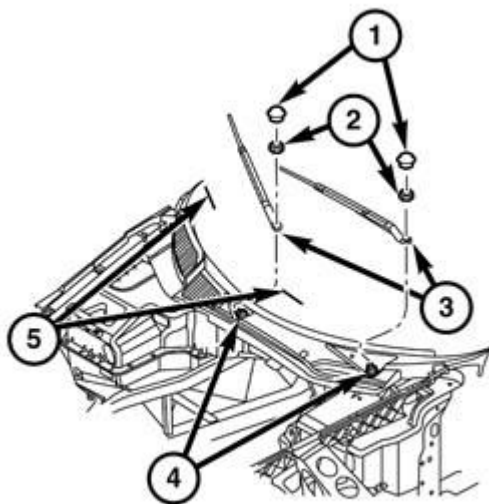
16. Disconnect PCM (1) engine electrical connectors (3).



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Fig. 13: Ground Wire, Stud & Engine Harness
 Courtesy of CHRYSLER GROUP, LLC

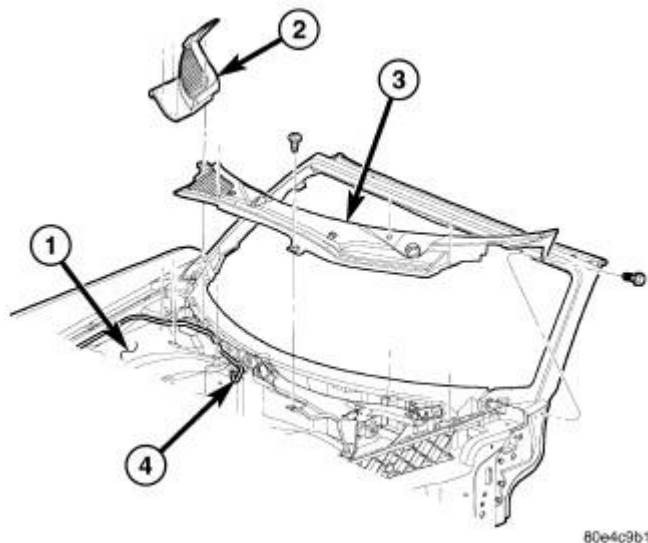
17. Remove the ground wire (1) from stud (2) at left side frame rail.
18. Disconnect the engine harness (4).



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Fig. 14: Windshield Wiper Arms, Nut Cap, Nut, Pivot Shaft & Wiper Alignment Line
 Courtesy of CHRYSLER GROUP, LLC

19. Remove windshield wiper arms. Refer to **ARM, WIPER, REMOVAL** .



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Fig. 15: Cowl Screen Panel
 Courtesy of CHRYSLER GROUP, LLC

20. Remove cowl cover (3). Refer to **COVER, COWL PANEL, REMOVAL** .

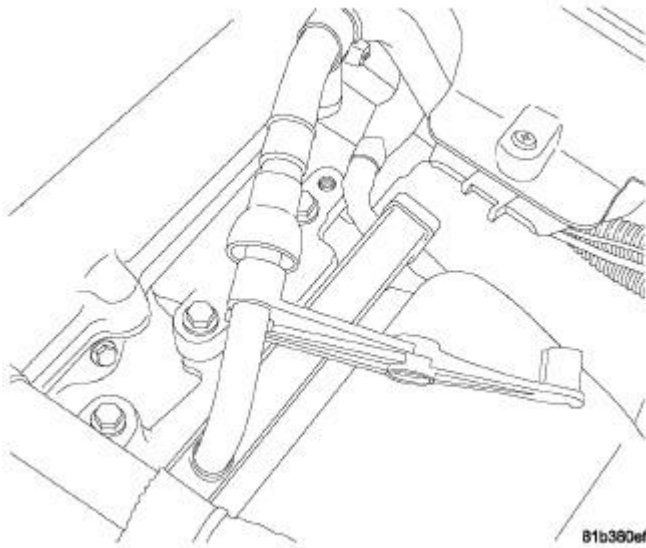


Fig. 16: Fuel Line Disconnect Tool
Courtesy of CHRYSLER GROUP, LLC

21. Disconnect the fuel line.
22. Disconnect the brake booster vacuum supply hose at the intake manifold.

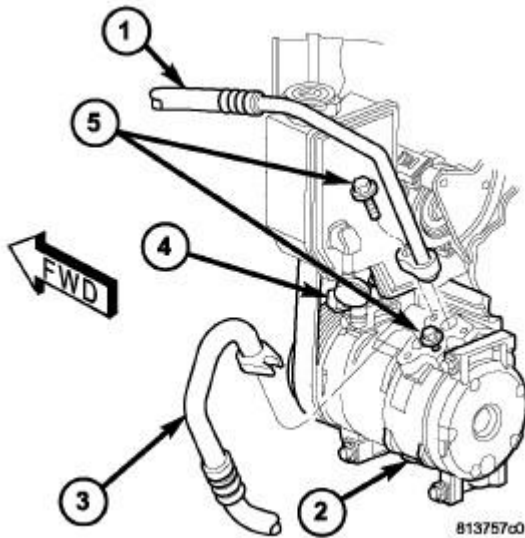


Fig. 17: Compressor Refrigerant Lines
Courtesy of CHRYSLER GROUP, LLC

23. Remove the bolts (5) that secure the A/C suction line (1) and the A/C discharge line (3) to the A/C compressor (2). Plug holes in A/C compressor to prevent debris from entering A/C compressor.

24. Disconnect A/C clutch electrical connector (4).

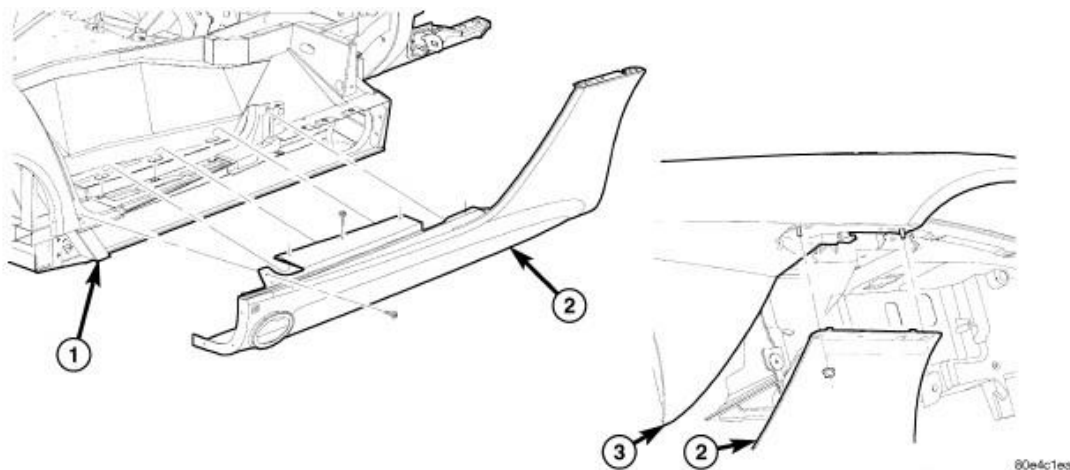
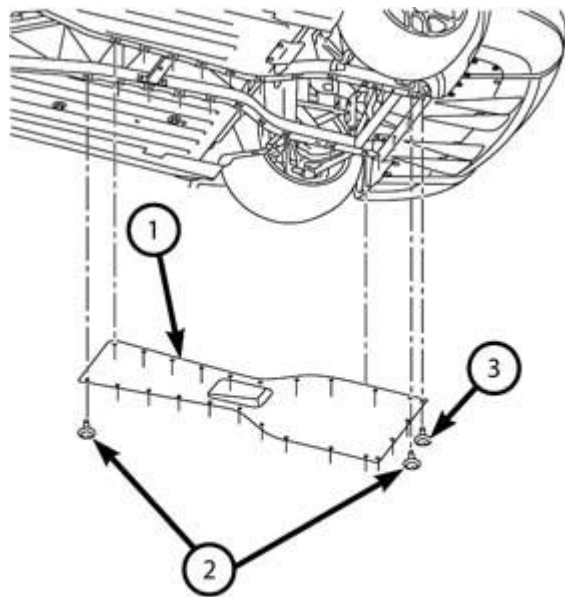


Fig. 18: Sill Panel

Courtesy of CHRYSLER GROUP, LLC

25. Remove left and right side sill panels. Refer to PANEL, TRIM SILL, REMOVAL .
26. Raise the vehicle on hoist.

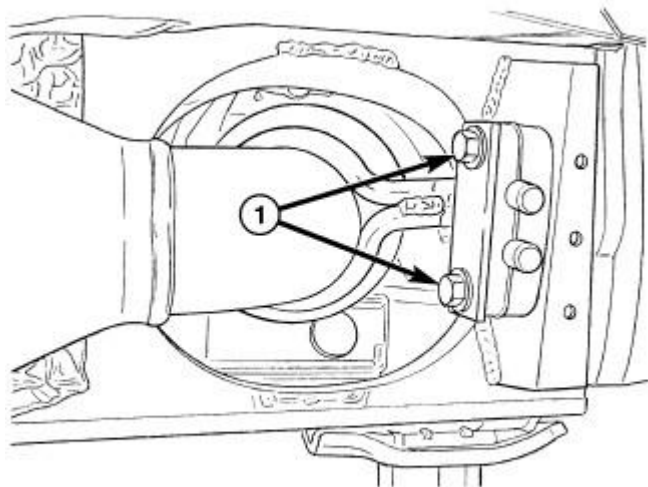


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Fig. 19: Center Belly Pan And Fasteners

Courtesy of CHRYSLER GROUP, LLC

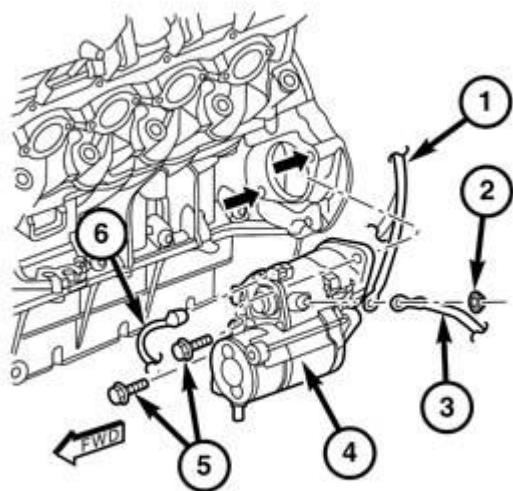
27. Remove the under body belly pan.



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Fig. 20: Catalytic Converter Support Hanger Bracket Bolts
 Courtesy of CHRYSLER GROUP, LLC

28. Disconnect exhaust system at left and right exhaust manifolds. **Do not reuse V-band clamps.**
29. Remove left and right catalytic converter support hanger bracket bolts (1). Position catalytic converters away from manifolds.

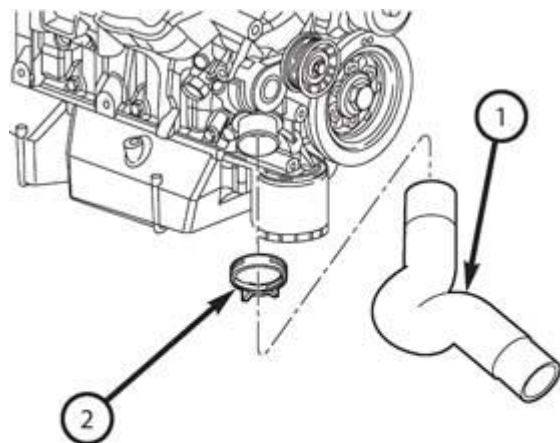


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Fig. 21: Removing & Installing Starter

Courtesy of CHRYSLER GROUP, LLC

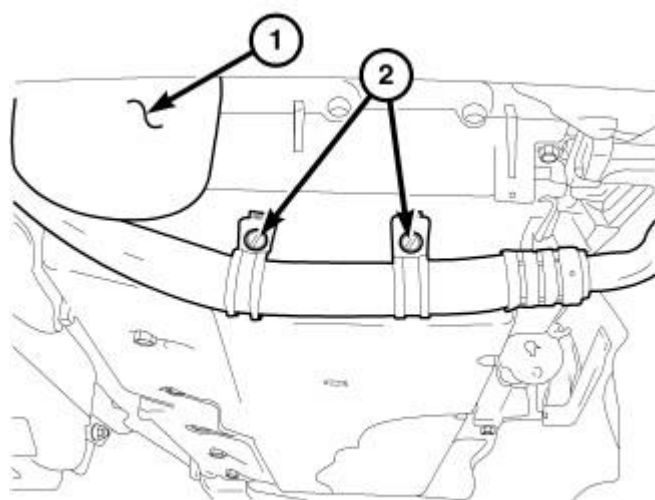
30. Disconnect the starter solenoid electrical connector (6).
31. Remove the starter positive cable (1 and 3).
32. Remove the starter (4).



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Fig. 22: Lower Radiator Hose & Clamp
Courtesy of CHRYSLER GROUP, LLC

33. Remove lower radiator hose.



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Fig. 23: A/C Line
Courtesy of CHRYSLER GROUP, LLC

34. Remove the bolts (2) securing A/C line to the oil pan.

35. Remove oil level indicator and tube.

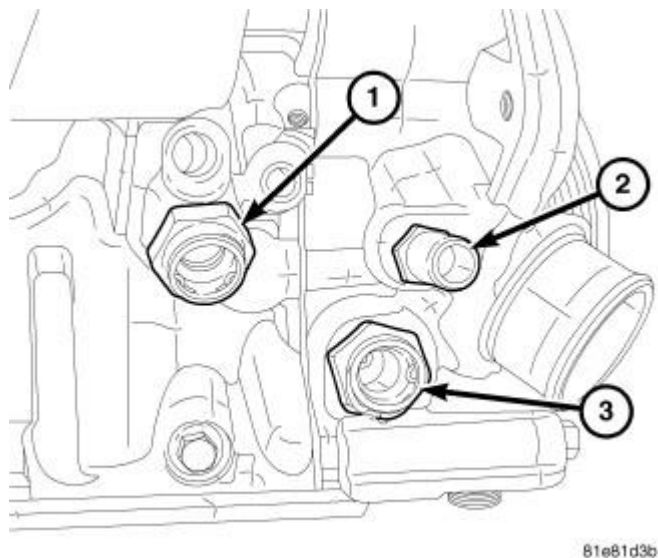


Fig. 24: Quick Connect Fittings
Courtesy of CHRYSLER GROUP, LLC

36. Using (special tool #9005, Disconnect Tool), disconnect the oil cooler lines from the engine at the fittings (1 and 3). Refer to **COOLER AND LINES, OIL, STANDARD PROCEDURES**.

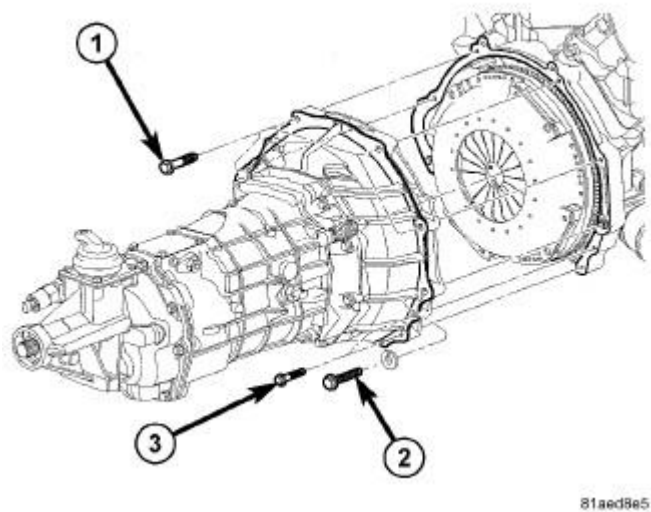
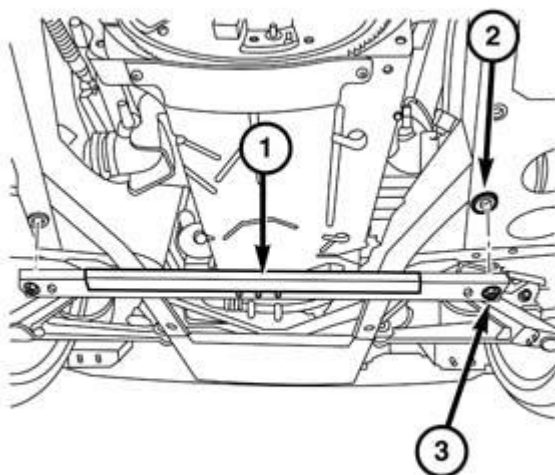


Fig. 25: Transmission Bolts
Courtesy of CHRYSLER GROUP, LLC

37. Using a suitable jack stand. Support the engine.
38. Remove transmission. Refer to **REMOVAL**.

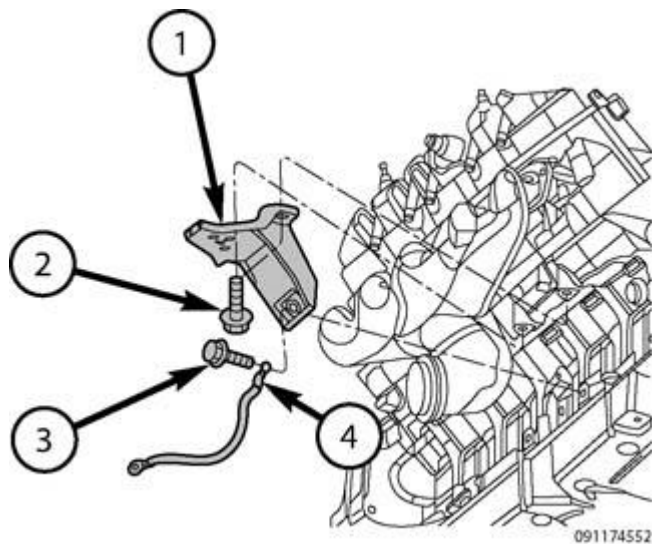
CAUTION: The engine must be supported by a brace at the rear of the engine. Do not allow the engine to rest on the spark plug and exhaust flange or damage may occur.



0912002135

Fig. 26: Engine Support Brace
Courtesy of CHRYSLER GROUP, LLC

39. Install a brace (1) to support the rear of the engine.



091174552

Fig. 27: Ground Strap, Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

40. Disconnect ground strap (4) from right side engine mount bracket (1).

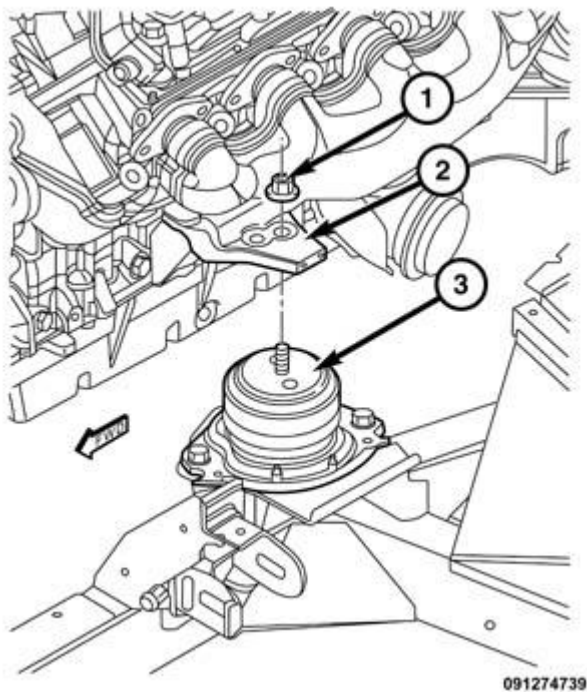


Fig. 28: Engine Mount, Bracket & Nut
Courtesy of CHRYSLER GROUP, LLC

41. Remove left and right engine mount (3) to engine mount bracket nuts (1).
42. Lower vehicle.

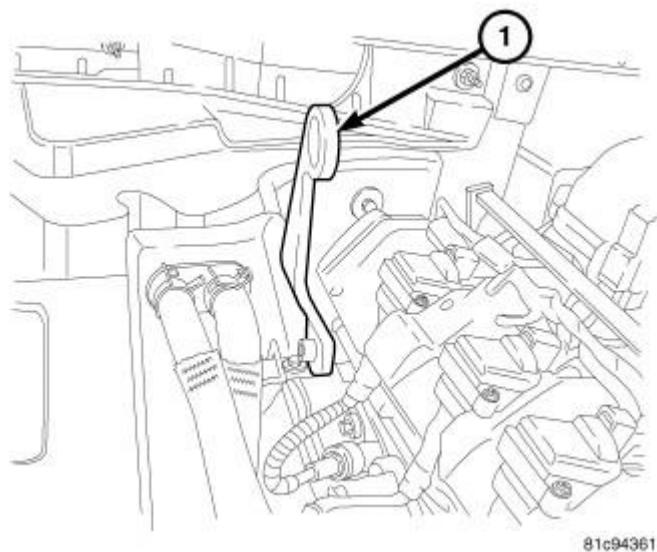


Fig. 29: Rear Lift Bracket
Courtesy of CHRYSLER GROUP, LLC

43. Install Engine Lifting (special tool #10034-2, Bracket, Rear) (1) to right rear cylinder head boss.

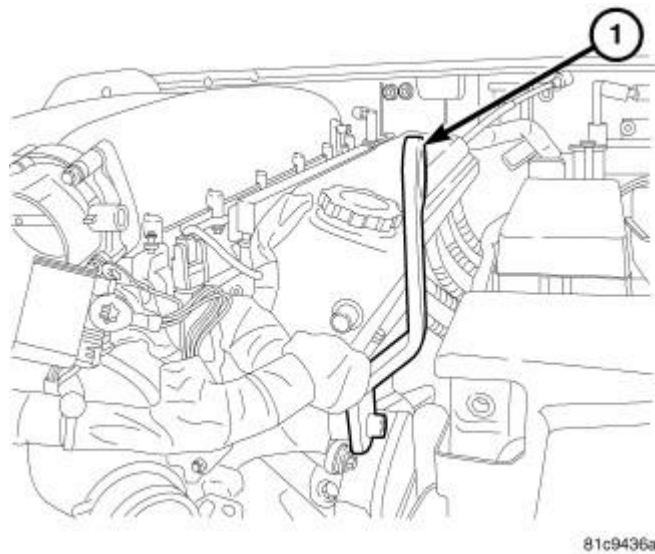


Fig. 30: Front Engine Lift Bracket
Courtesy of CHRYSLER GROUP, LLC

44. Install Engine Lifting (special tool #10034-1, Bracket, Front) (1) to left front cylinder head boss.
45. Attach an appropriate chain to engine lifting brackets. Remove engine with an engine hoist.

INSTALLATION

INSTALLATION

CAUTION: If the original engine has experienced a catastrophic failure or an individual failure with the piston, cylinder bore, engine block, valve or valve seat, the intake manifold **MUST** be replaced with a new manifold.

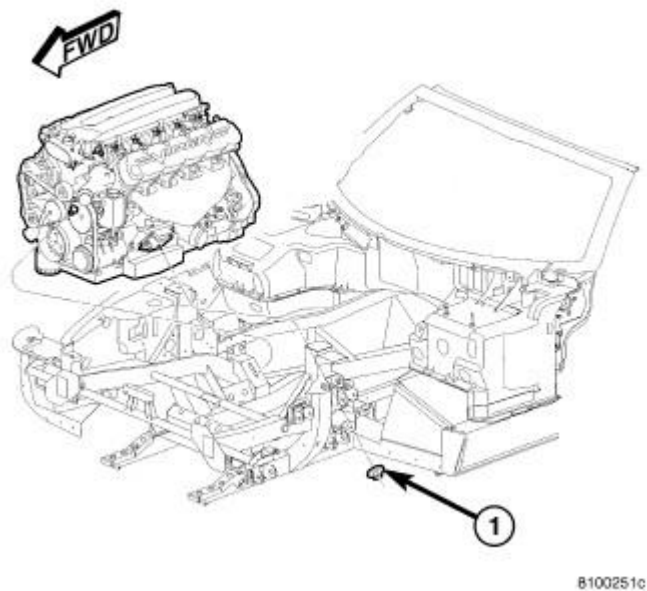


Fig. 31: Engine Mount To Frame Nuts
Courtesy of CHRYSLER GROUP, LLC

1. Attach engine hoist and lower the engine into engine compartment.
2. Remove engine hoist.
3. Raise vehicle on hoist.

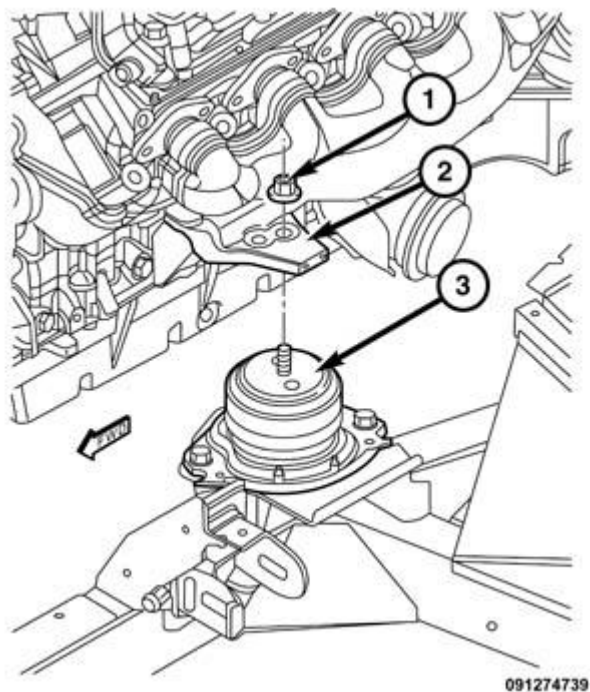


Fig. 32: Engine Mount, Bracket & Nut

Courtesy of CHRYSLER GROUP, LLC

4. Align left and right engine mounts (3) and install engine mount isolator nuts (1) and tighten to 102 N.m (75 ft. lbs.).

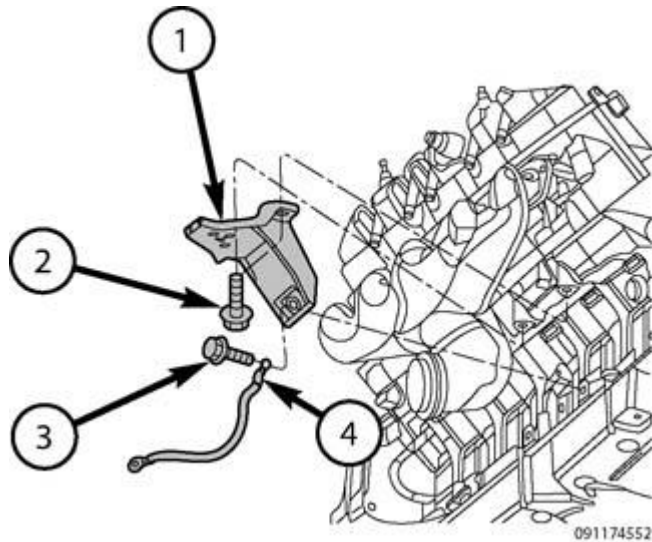


Fig. 33: Ground Strap, Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

5. Install the ground strap (4) to right side engine mount bracket (1).
6. Install a suitable jack stand to support the engine.
7. Remove the brace used to support the rear of the engine.

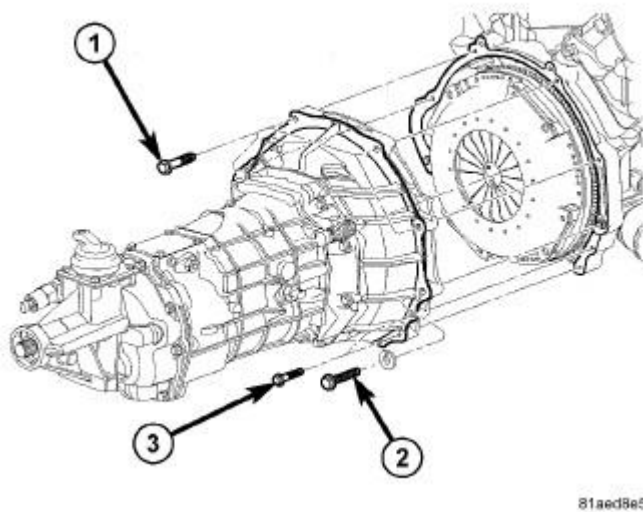


Fig. 34: Transmission Bolts
Courtesy of CHRYSLER GROUP, LLC

8. Install transmission. Refer to **INSTALLATION** .

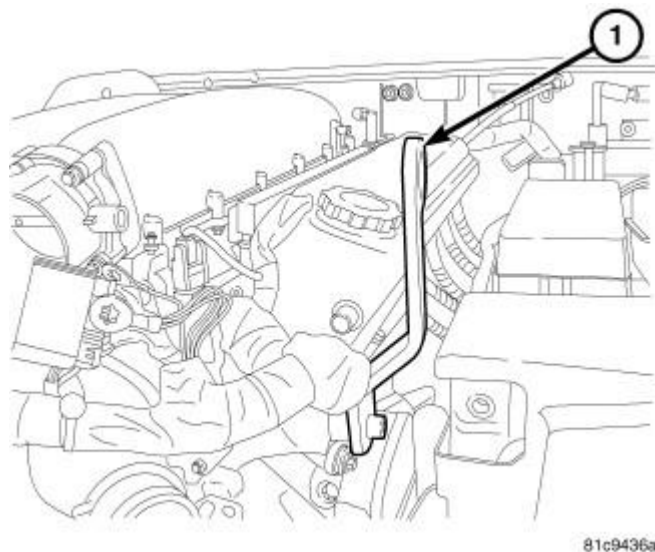


Fig. 35: Front Engine Lift Bracket
Courtesy of CHRYSLER GROUP, LLC

9. Remove (special tool #10034-1, Bracket, Front) engine lift bracket (1).

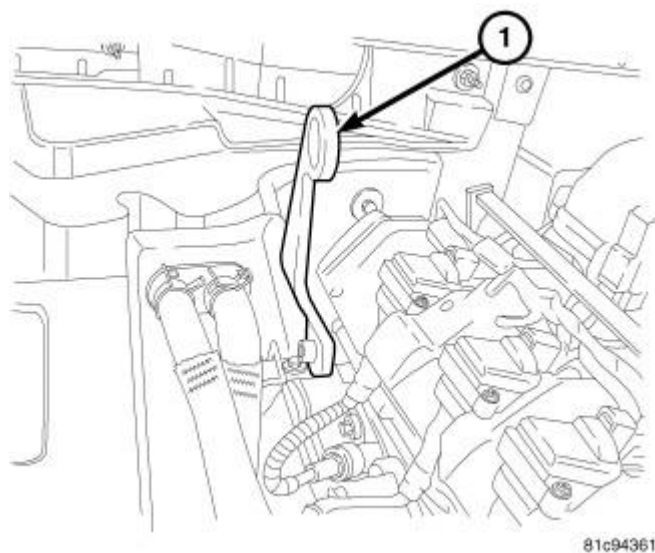
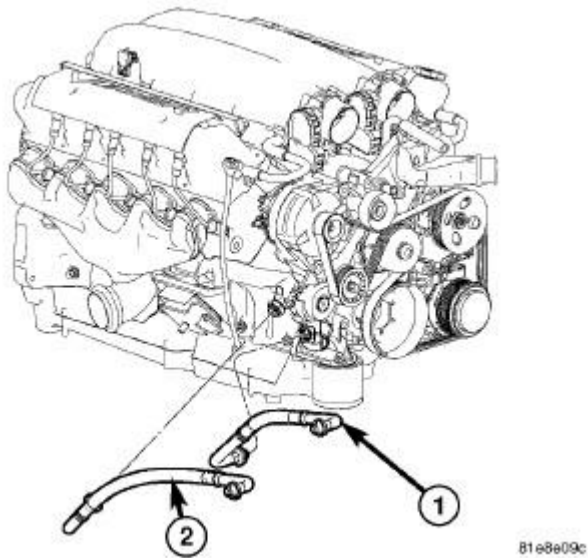


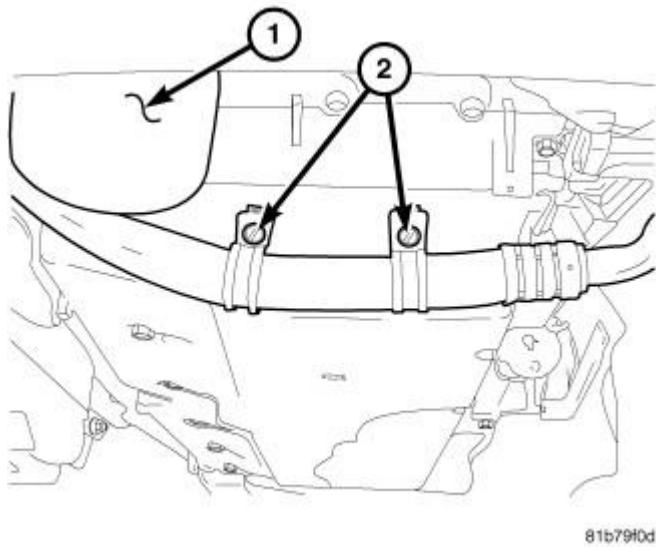
Fig. 36: Rear Lift Bracket
Courtesy of CHRYSLER GROUP, LLC

10. Remove engine lift (special tool #10034-2, Bracket, Rear) (1).

**Fig. 37: Oil Cooler Lines**

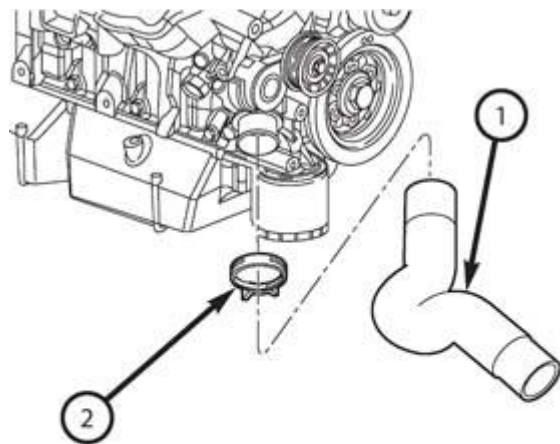
Courtesy of CHRYSLER GROUP, LLC

11. Connect the oil cooler lines (1 and 2) to engine. Refer to **COOLER AND LINES, OIL, STANDARD PROCEDURES**.

**Fig. 38: A/C Line**

Courtesy of CHRYSLER GROUP, LLC

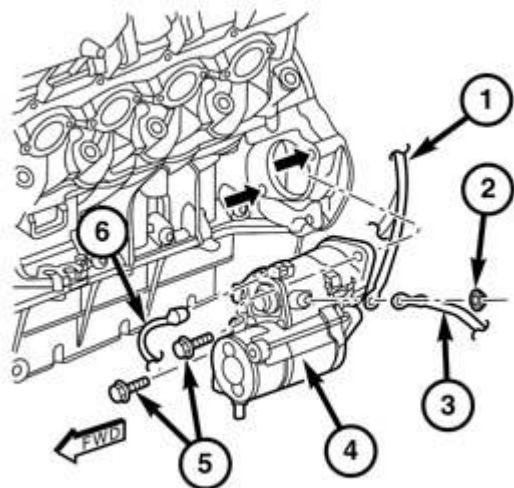
12. Install the bolts (2) securing A/C line to oil pan. Tighten the bolts (2) to 9 N.m (80 in. lbs.).
13. Install the oil level indicator tube and indicator.
14. Install **NEW** oil filter (1).
15. Install the up stream oxygen sensors in the exhaust manifolds.



091274749

Fig. 39: Lower Radiator Hose & Clamp
Courtesy of CHRYSLER GROUP, LLC

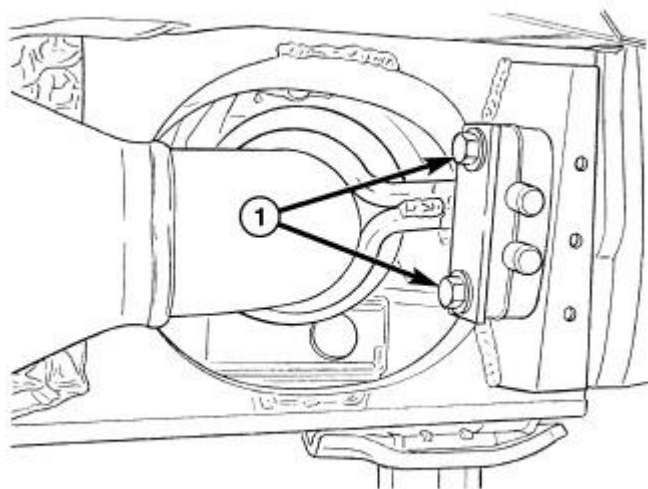
16. Install lower radiator hose.



0805002156

Fig. 40: Removing & Installing Starter
Courtesy of CHRYSLER GROUP, LLC

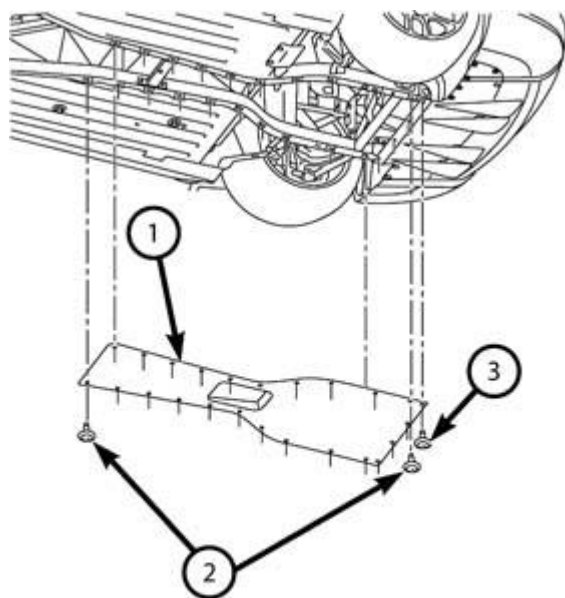
17. Install the starter (4). Tighten the bolts (5) to 54 N.m (40 ft. lbs.).
18. Position the positive cables onto the post. Tighten the nut (2) to 14 N.m (124 in. lbs.).
19. Connect the starter solenoid electrical connector (6).



81002528

Fig. 41: Catalytic Converter Support Hanger Bracket Bolts
 Courtesy of CHRYSLER GROUP, LLC

20. Connect exhaust system at left and right exhaust manifolds using **NEW** V-Band clamps. Tighten V-Band clamps to 11 N.m (97 in. lbs.).
21. Install left and right catalytic converter support hanger bracket bolts (1). Tighten bolts to 28 N.m (21 ft. lbs.).



130574591

Fig. 42: Center Belly Pan And Fasteners
Courtesy of CHRYSLER GROUP, LLC

22. Install under body belly pan (1). Tighten the bolts to 25 N.m (18 ft. lbs.).
23. Lower vehicle.

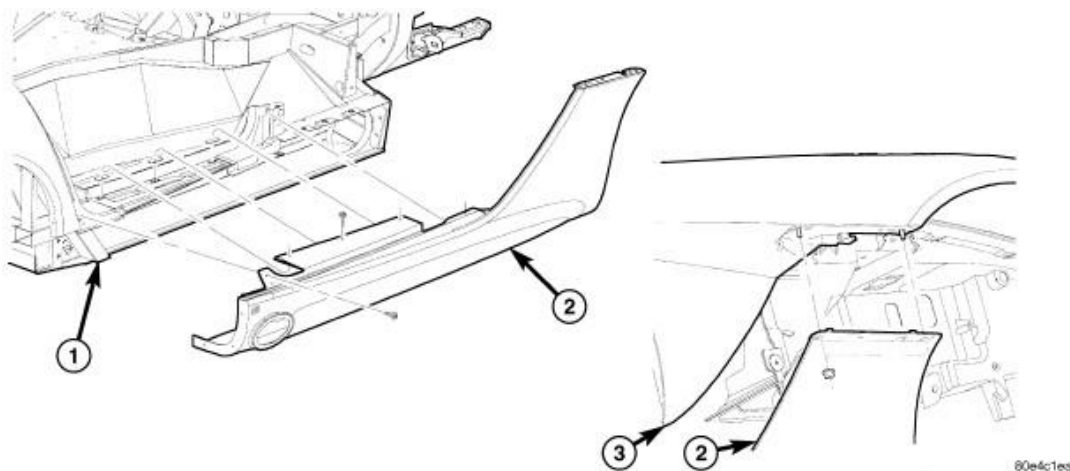


Fig. 43: Sill Panel
Courtesy of CHRYSLER GROUP, LLC

24. Install left and right side sill panels. Refer to PANEL, TRIM SILL, INSTALLATION .

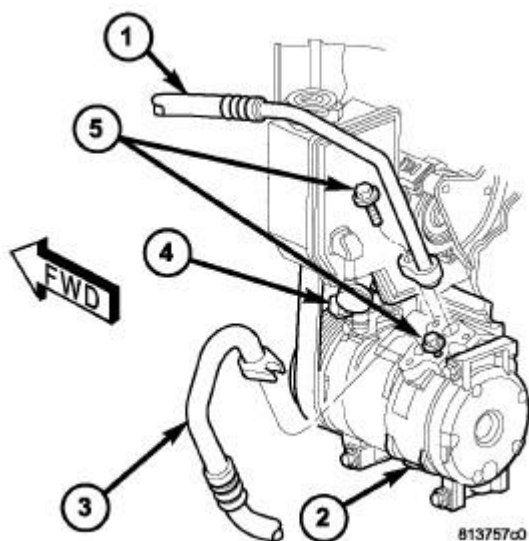
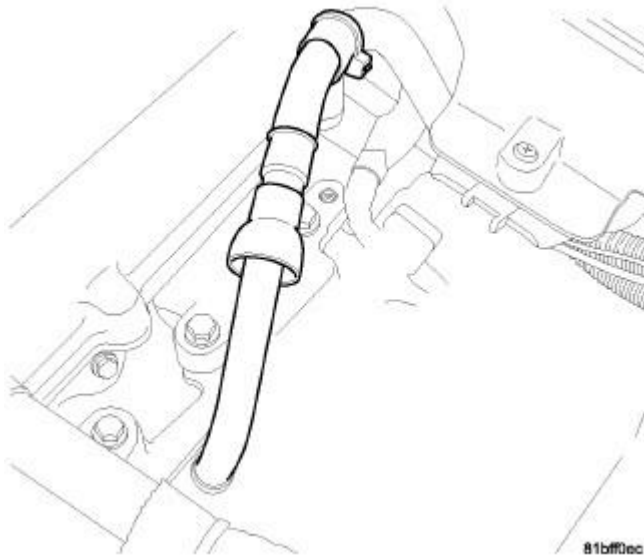


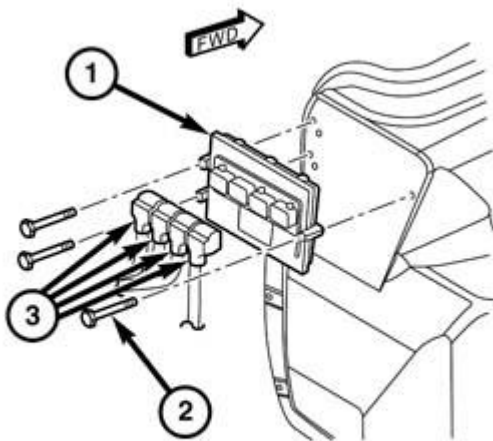
Fig. 44: Compressor Refrigerant Lines
Courtesy of CHRYSLER GROUP, LLC

25. Connect A/C clutch electrical connector.
26. Connect A/C lines to A/C compressor.

**Fig. 45: Fuel Line Connect**

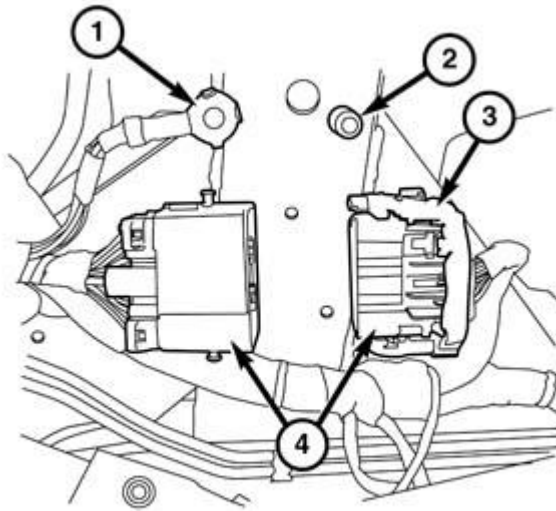
Courtesy of CHRYSLER GROUP, LLC

27. Connect the fuel line to the fuel rail.
28. Connect brake booster vacuum hose.

**Fig. 46: PCM, Mounting Bolts & Left Side Inner Fender Support**

Courtesy of CHRYSLER GROUP, LLC

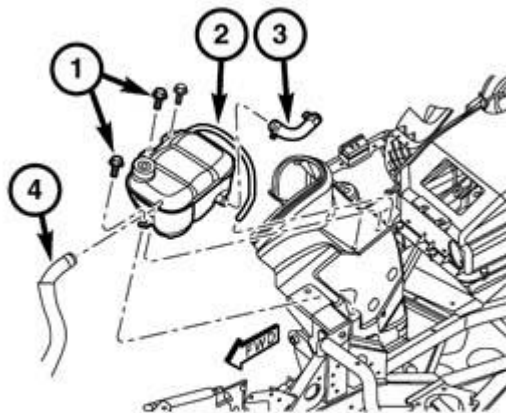
29. Connect PCM connectors (3).



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Fig. 47: Ground Wire, Stud & Engine Harness
Courtesy of CHRYSLER GROUP, LLC

30. Connect the engine wiring harness connector (4) and ground wire (1) to the stud (2) at left side frame rail. Tighten the nut to 14 N.m (124 in. lbs.).



0909001910

Fig. 48: Coolant Reservoir Inlet Hose & Coolant Reservoir
Courtesy of CHRYSLER GROUP, LLC

31. Connect coolant reservoir inlet hose (5) to coolant reservoir.
32. Connect heater hoses to engine.

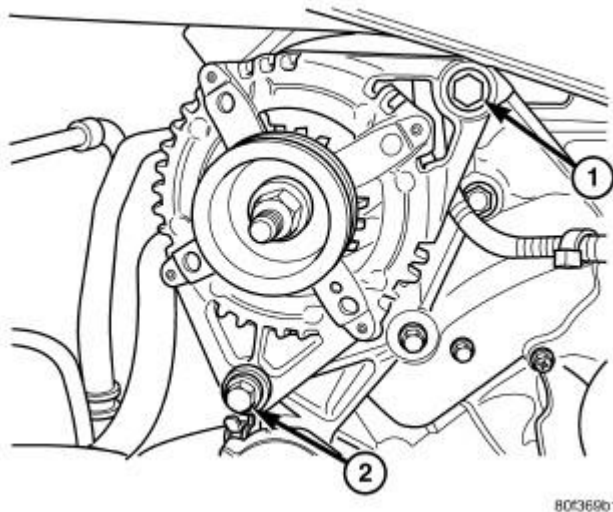


Fig. 49: Identifying Mounting Bolts
Courtesy of CHRYSLER GROUP, LLC

33. Install the generator. Tighten the bolts (1 and 2) to 47 N.m (35 ft. lbs.).

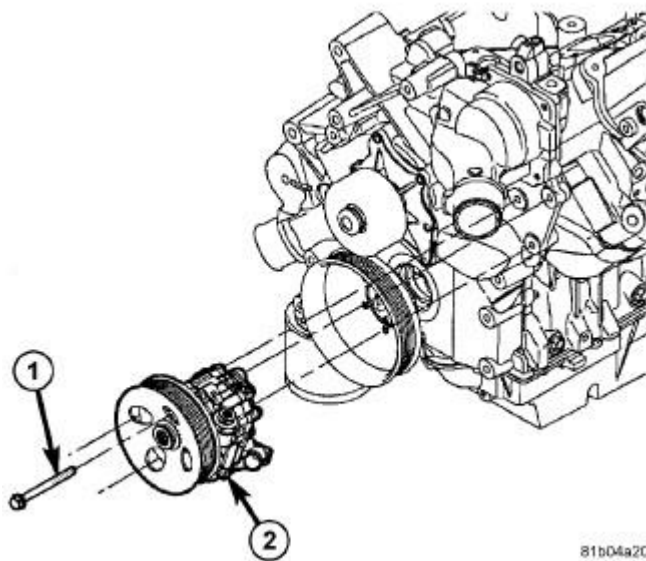


Fig. 50: Pump Mounting
Courtesy of CHRYSLER GROUP, LLC

34. Install the power steering pump (2). Tighten the bolts (1) to 24 N.m (18 ft. lbs.).
35. Install the power steering reservoir.

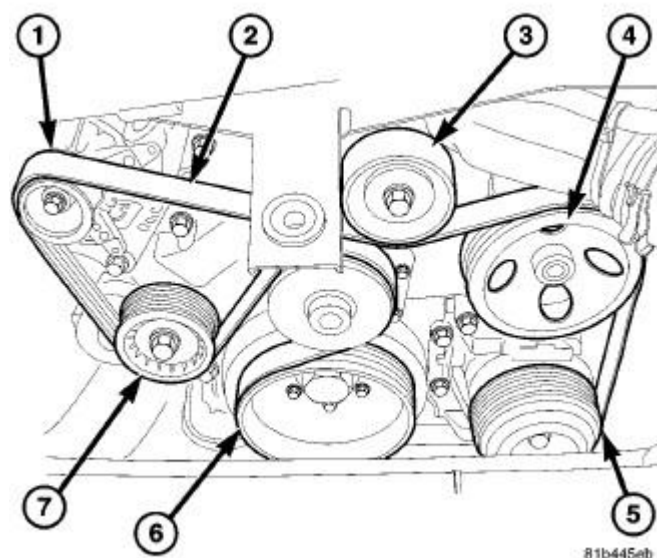
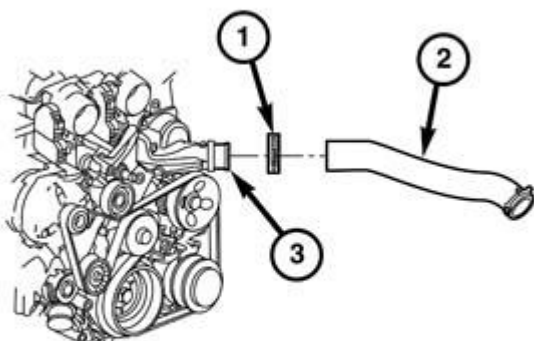


Fig. 51: View Of Accessory Drive Belt - 8.4L
Courtesy of CHRYSLER GROUP, LLC

36. Install accessory drive belt. Refer to **BELT, SERPENTINE, INSTALLATION** .



0805002154

Fig. 52: Upper Radiator Hose, Clamp & Housing
Courtesy of CHRYSLER GROUP, LLC

37. Install upper radiator hose.

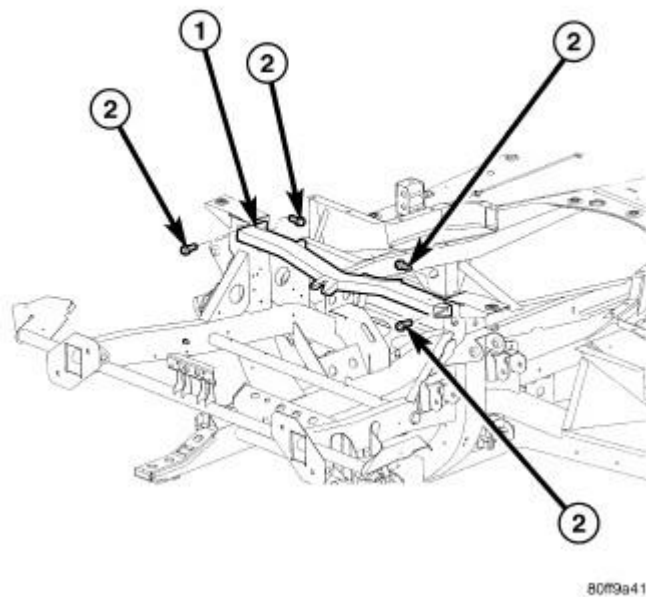


Fig. 53: Front Strut Tower To Tower Brace
Courtesy of CHRYSLER GROUP, LLC

38. Install front strut tower brace (1) and install strut tower brace retaining bolts (2).

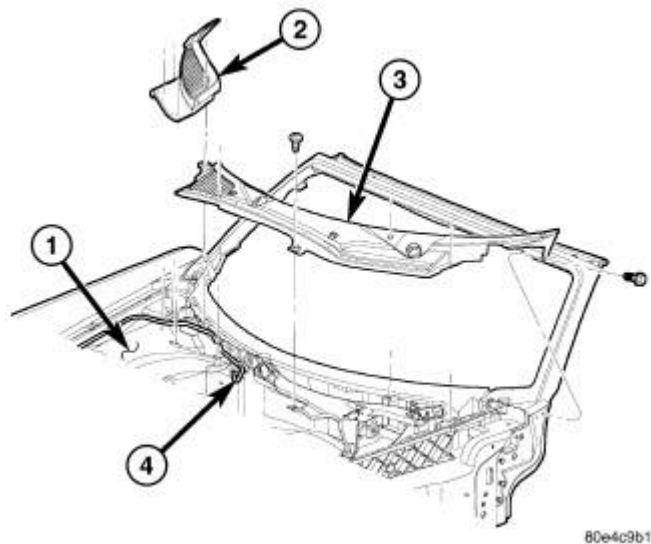
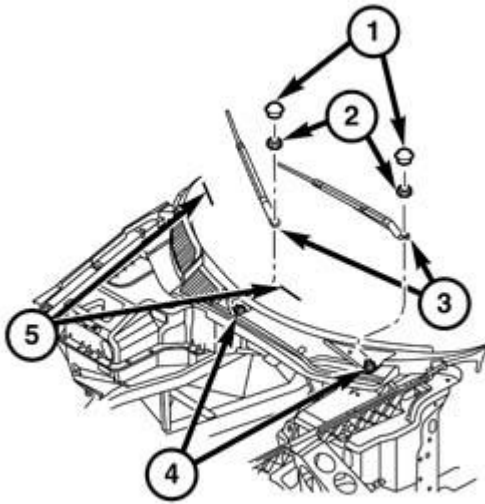


Fig. 54: Cowl Screen Panel
Courtesy of CHRYSLER GROUP, LLC

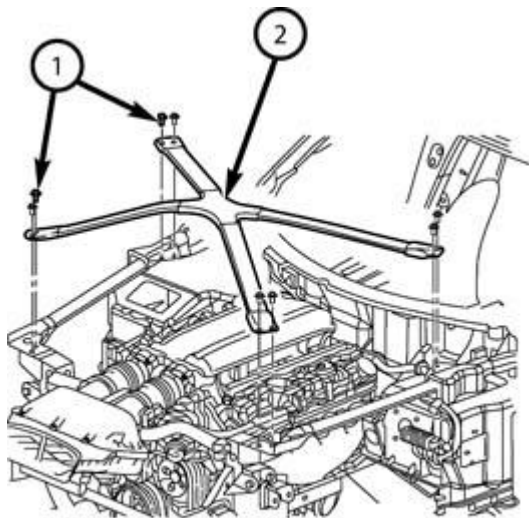
39. Install cowl cover (3). Refer to **COVER, COWL PANEL, INSTALLATION** .



083373986

Fig. 55: Windshield Wiper Arms, Nut Cap, Nut, Pivot Shaft & Wiper Alignment Line
 Courtesy of CHRYSLER GROUP, LLC

40. Install windshield wiper arms. Refer to **ARM, WIPER, INSTALLATION** .
41. Evacuate and recharge air conditioning system. Refer to **PLUMBING, STANDARD PROCEDURE** .
42. Fill cooling system. Refer to **STANDARD PROCEDURE** .
43. Fill engine crankcase with proper oil to correct level. Refer to **CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS** .

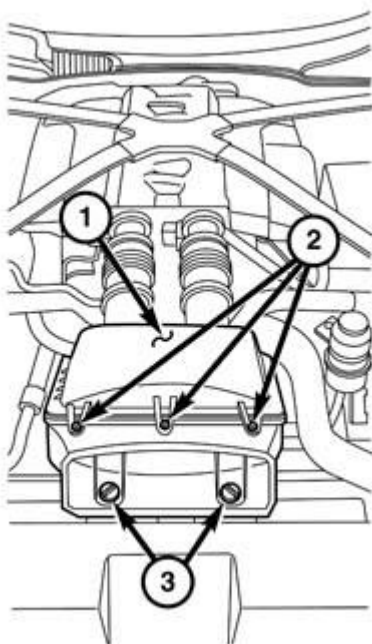


091174557

Fig. 56: Cross Support Brace & Bolts

Courtesy of CHRYSLER GROUP, LLC

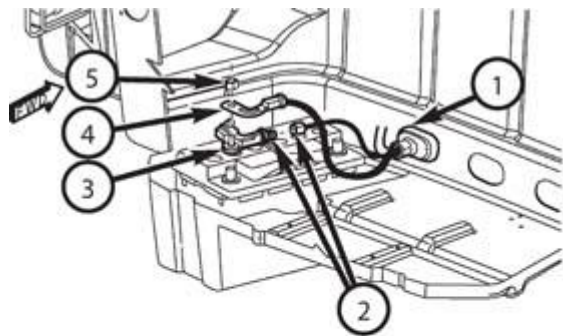
44. Install the cross brace. Tighten bolts to 20 N.m (15 ft. lbs.).



0909001912

Fig. 57: Air Cleaner Housing, Cover Screws & Housing Retainers
 Courtesy of CHRYSLER GROUP, LLC

45. Install air cleaner housing (1) assembly. Refer to **BODY, AIR CLEANER, INSTALLATION**.



080874297

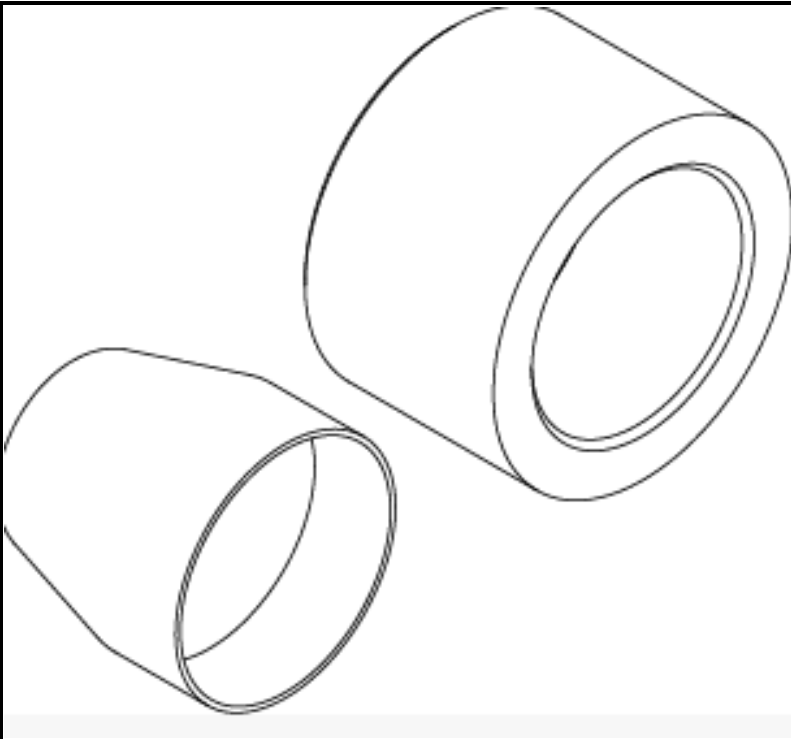
Fig. 58: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable
 Courtesy of CHRYSLER GROUP, LLC

46. Install hood (Refer to **HOOD** /INSTALLATION).

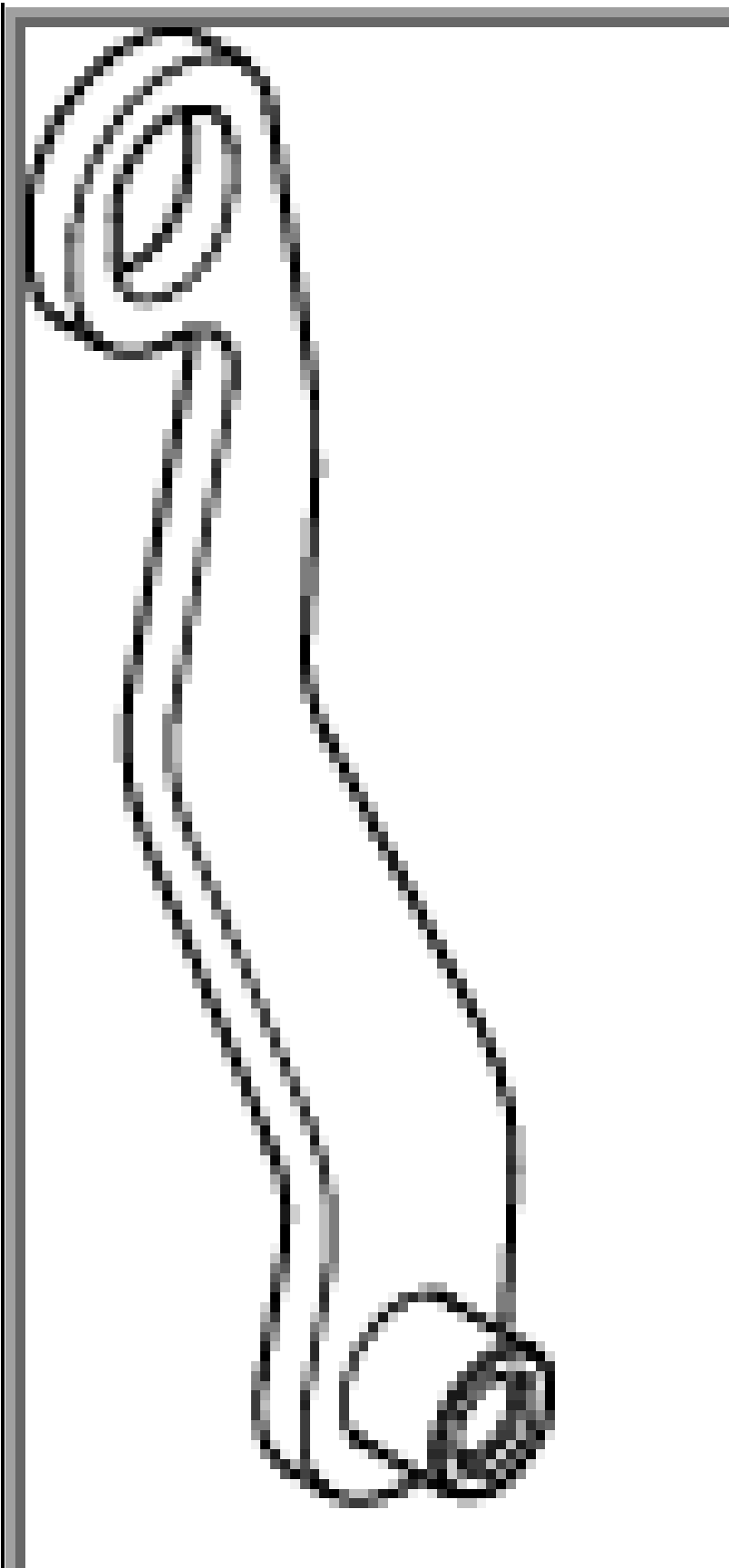
47. Connect battery negative cable (4). Tighten the nut to 16 N.m (15 ft. lbs.).
48. Start engine and check for leaks.

SPECIAL TOOLS

SPECIAL TOOLS



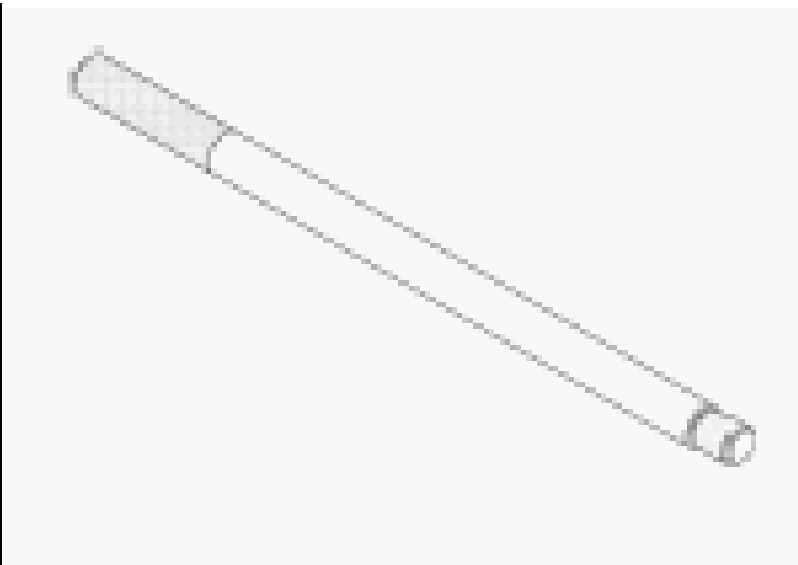
10030 - Installer, Seal
(Originally Shipped In Kit Number(s)
10044.)



10034-1 - Bracket, Front
(Originally Shipped In Kit Number(s).)

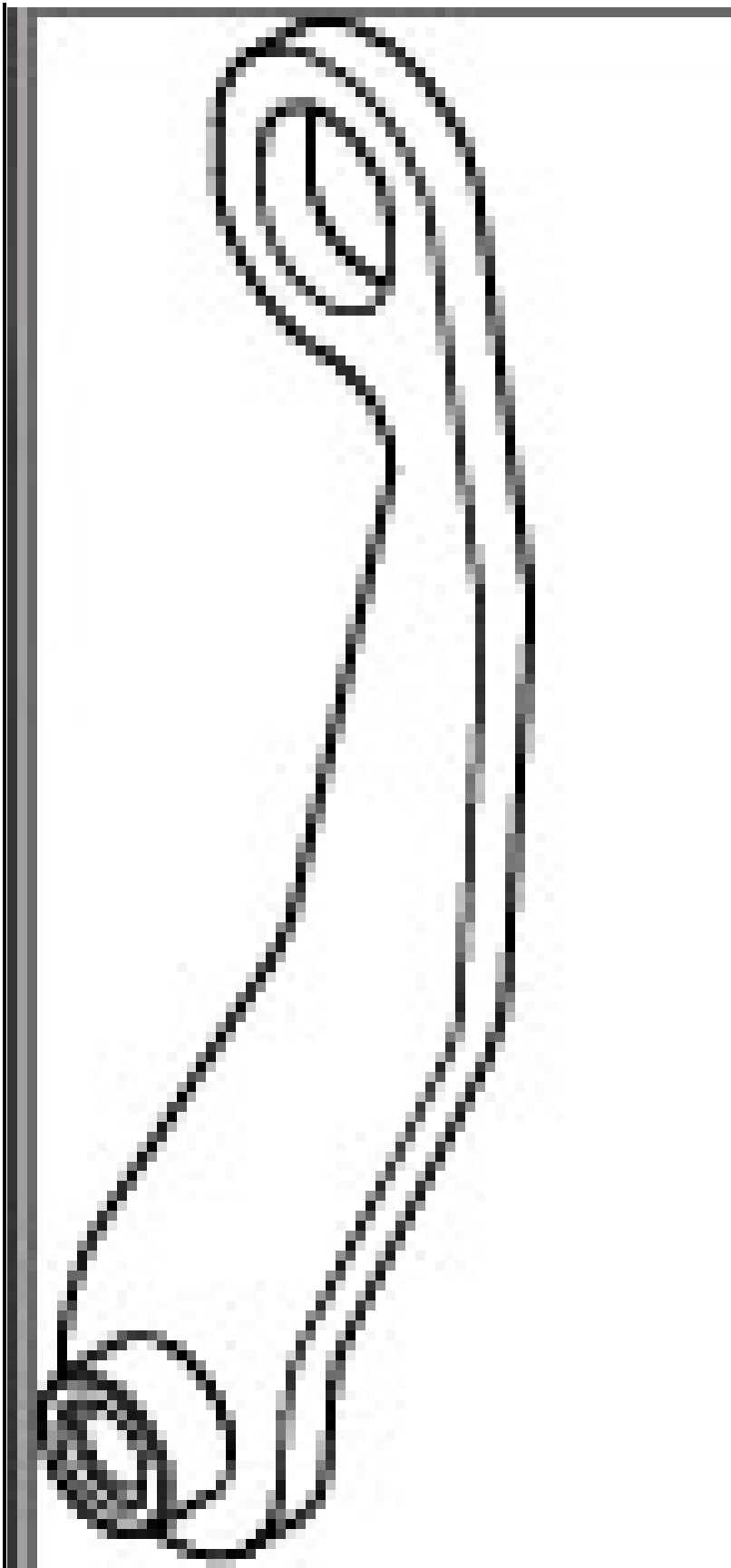
2014 Dodge Viper GTS

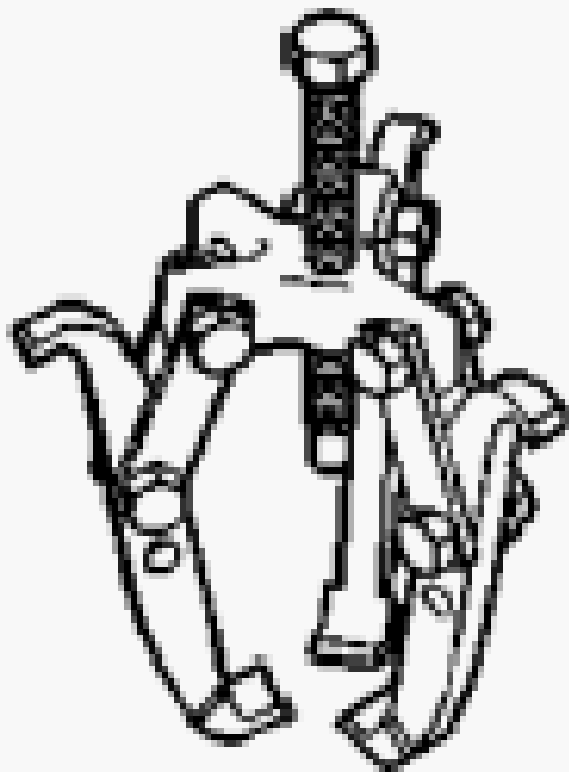
2014 ENGINE 8.4L - Service Information - Viper



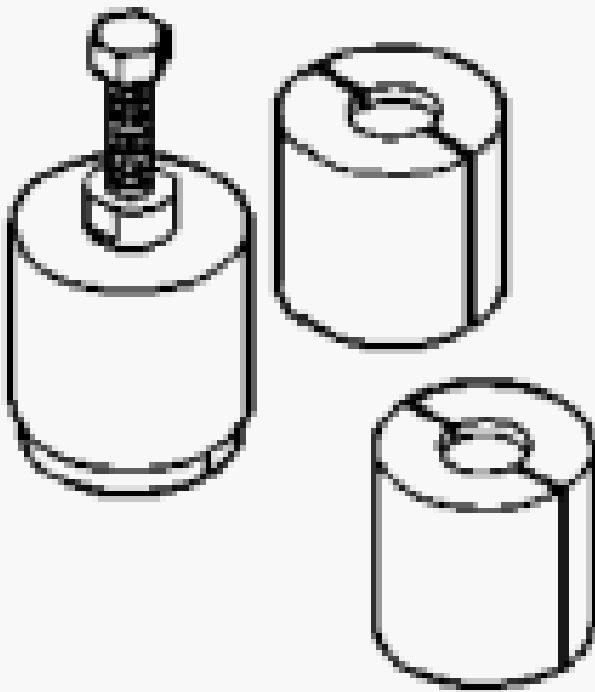
10132 - Handle, Camshaft
(Originally Shipped In Kit Number(s)
10131, 10132.)

10034-2 - Bracket, Rear
(Originally Shipped In Kit Number(s).)





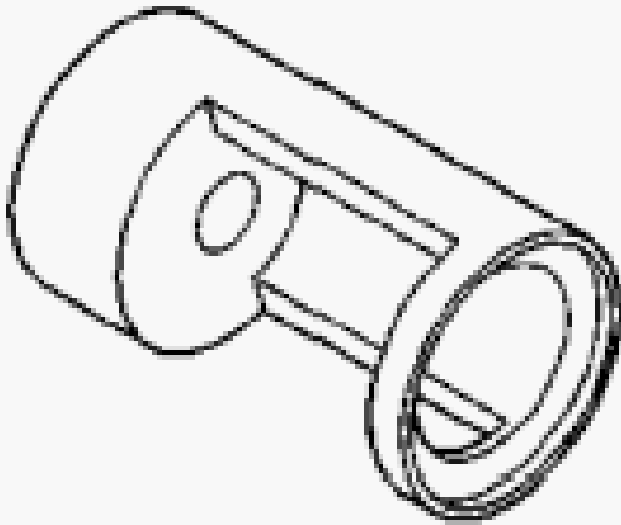
10368 - Set, Universal Protective Cap



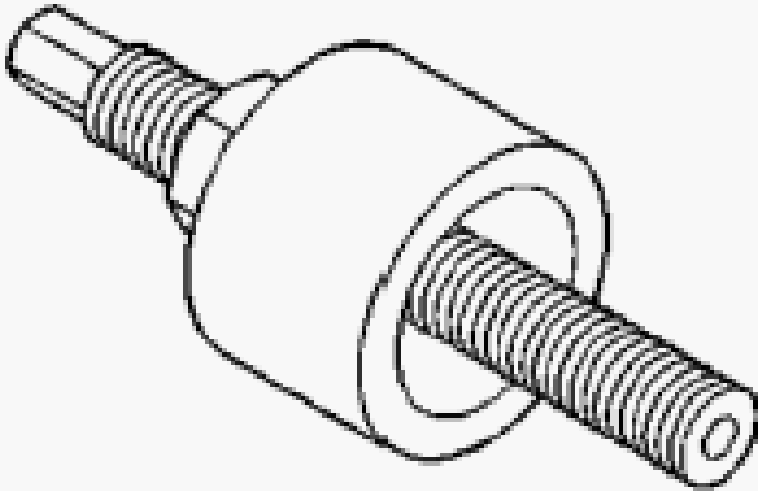
5048 - Puller, Bearing
(Originally Shipped In Kit Number(s)
6303, 6672.)

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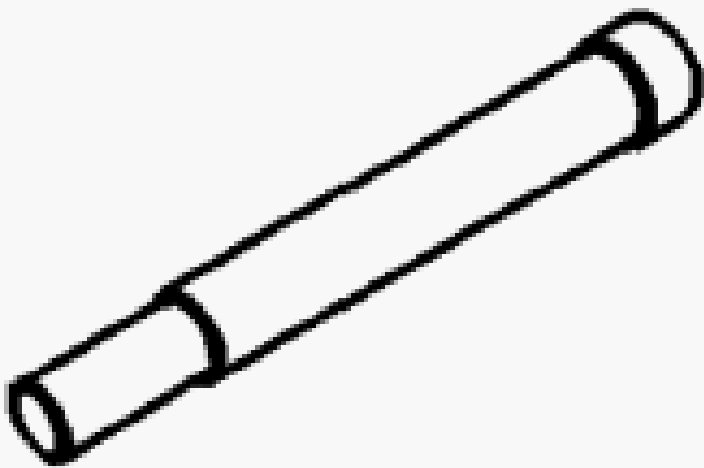
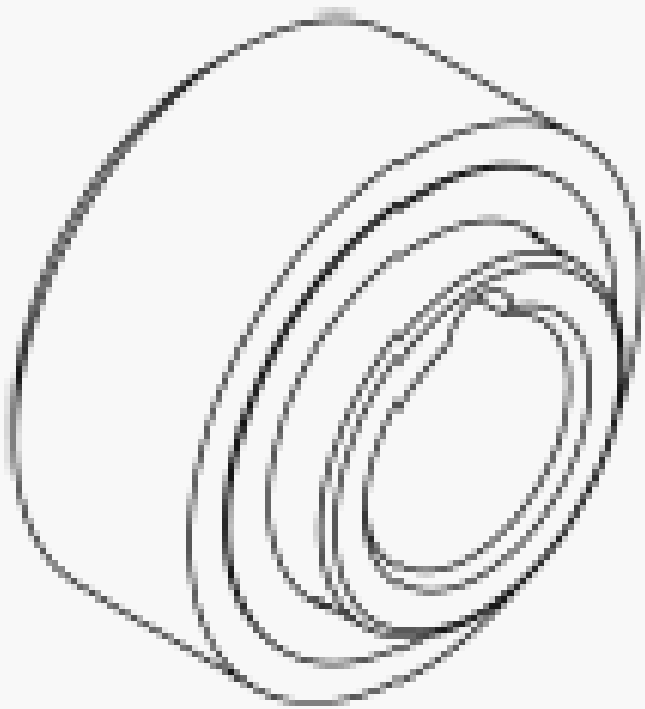


6885 - Adapter, Valve Spring
(Originally Shipped In Kit Number(s)
6893A, 6894, 6895, 6897, 6898.)

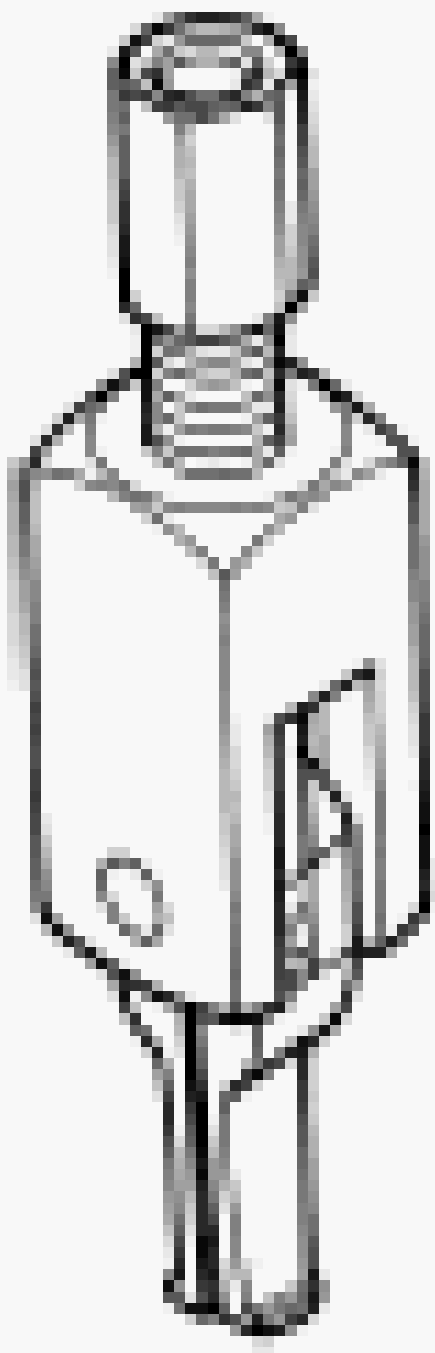


7700 - Tester, Cooling System
(Originally Shipped In Kit Number(s)
7700-A.)

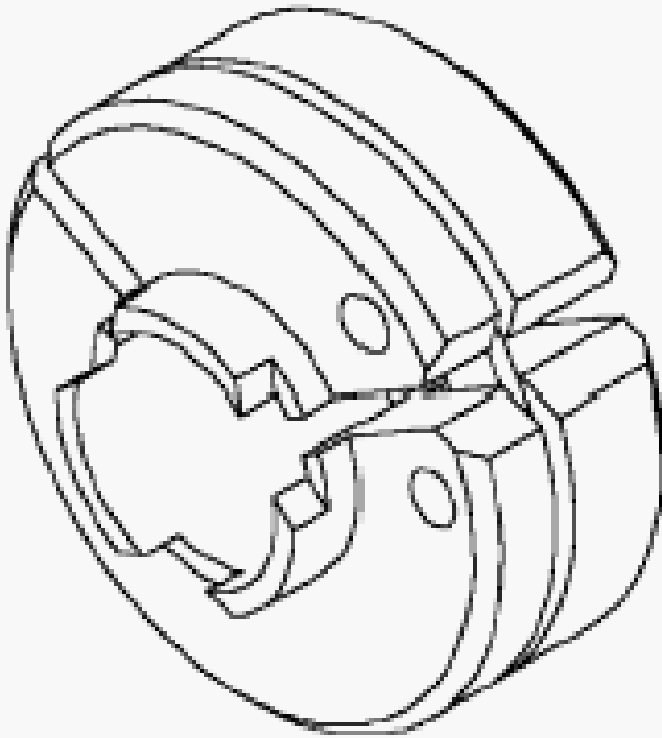
8116 - Adapter, Pressure PEP
(Originally Shipped In Kit Number(s)
8201, 8201CC, 8204, 8204CC.)



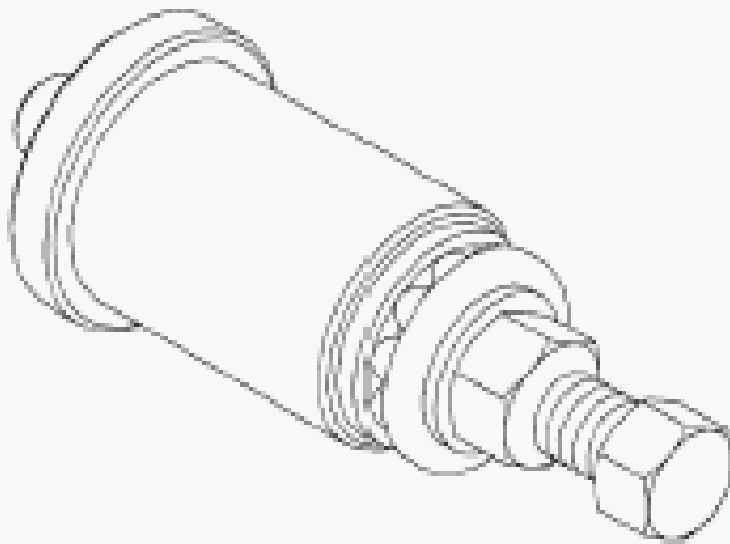
8194 - Insert, Crankshaft
(Originally Shipped In Kit Number(s)
8180, 8263.)



8990 - Remover, Seal
(Originally Shipped In Kit Number(s)
8887.)



9005 - Disconnect Tool
(Originally Shipped In Kit Number(s)
8846, 8846A, 8846A-SRT, 8846-SRT,
9073, 9074.)

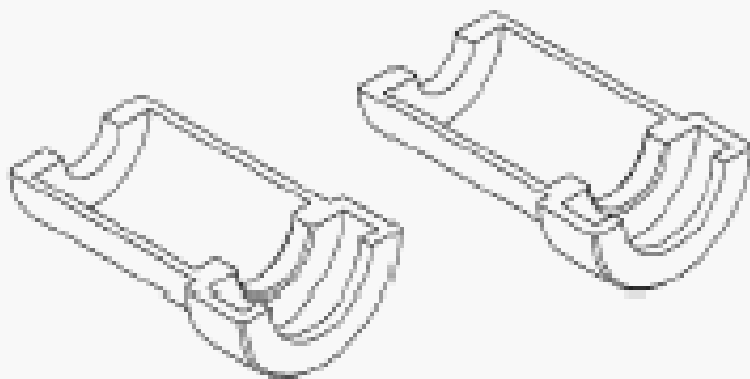


9055B - Installer, Crankshaft
Sprocket/Gear
(Originally Shipped In Kit Number(s).)

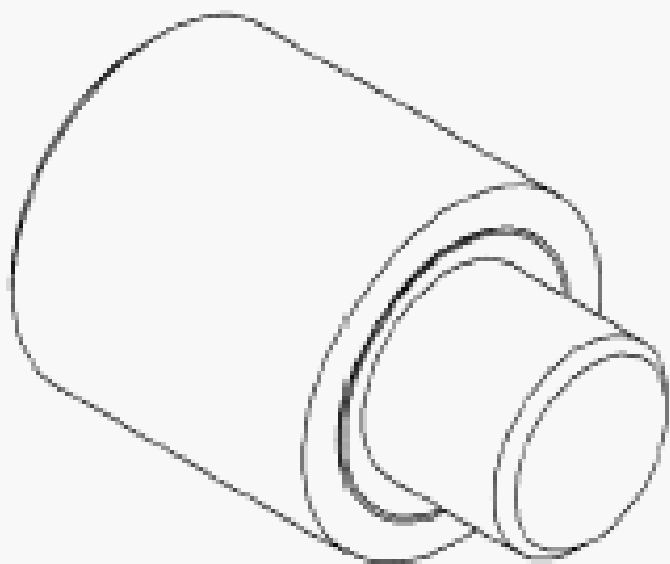
9056A - Remover, Crankshaft Sprocket
(Originally Shipped In Kit Number(s)
9687.)

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9058 - Installer, Pilot Bearing
(Originally Shipped In Kit Number(s)
8846, 8846A, 9073, 9074.)



9060A - Installer/Guide, Seal
(Originally Shipped In Kit Number(s)
9782.)

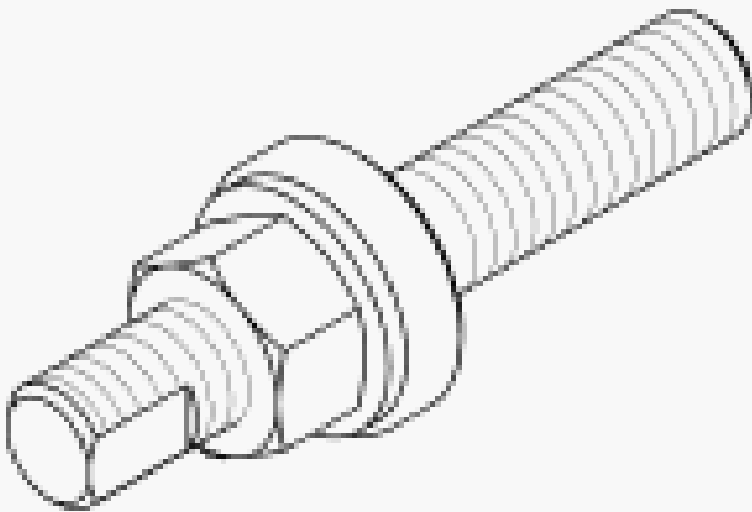


9781 - Installer, Crankshaft Rear Oil Seal
(Originally Shipped In Kit Number(s))

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9782.)

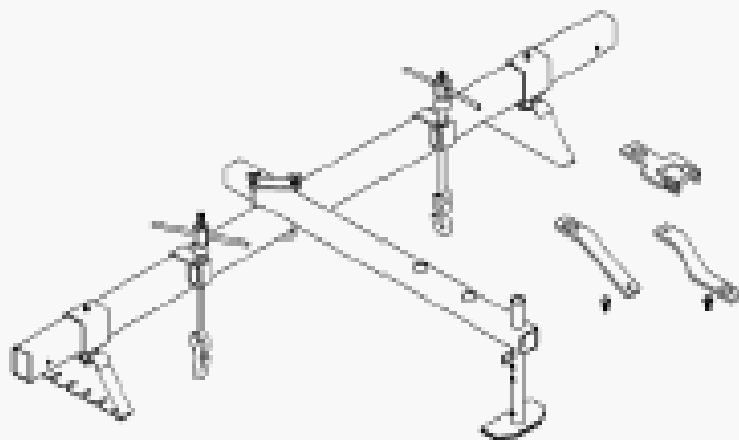
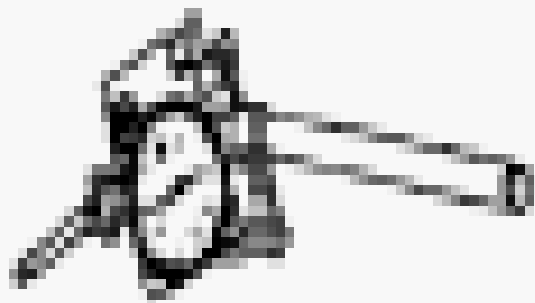


9943 - Installer, Crankshaft Damper
(Originally Shipped In Kit Number(s)
9961.)

C-119 - Cylinder Indicator

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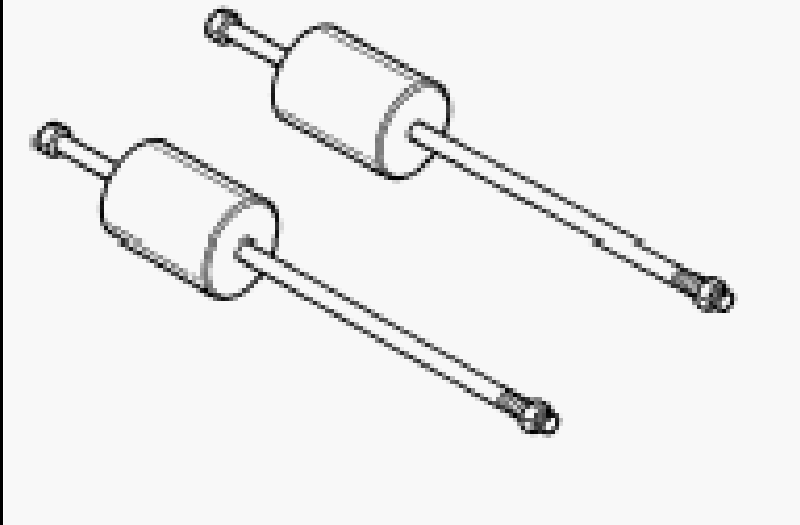
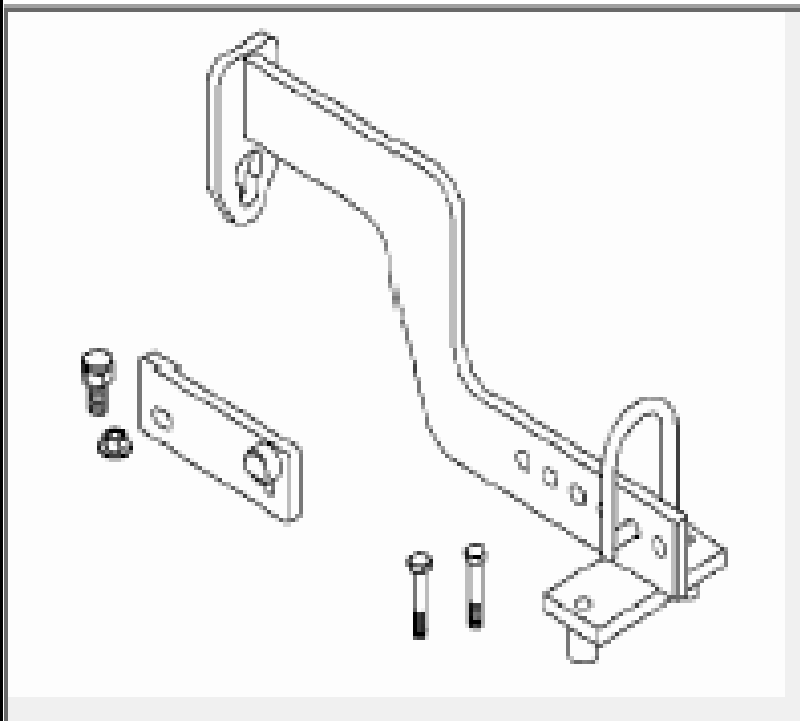


C-3339A - Set, Dial Indicator
(Originally Shipped In Kit Number(s)
9202.)

C-3685-A - Bloc-Chek Kit

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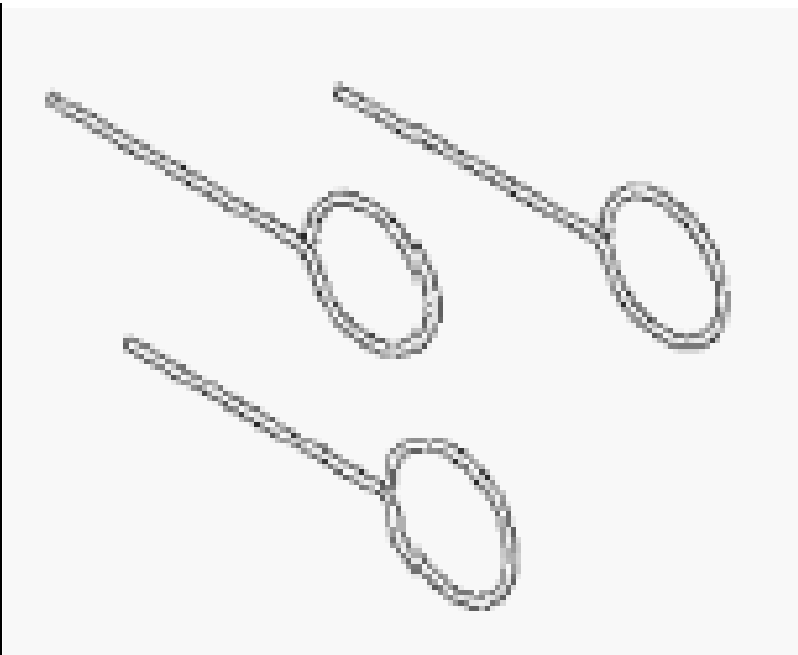


C-3752 - Slide Hammers
(Originally Shipped In Kit Number(s)
9202, 9202A-CAN, 9202-CAN, 9202CC.)

C-4171 - Driver Handle, Universal
(Originally Shipped In Kit Number(s)
9202, 9202A-CAN, 9202CC, 9299,
9299CC, 9299CC, 9300A-CAN.)

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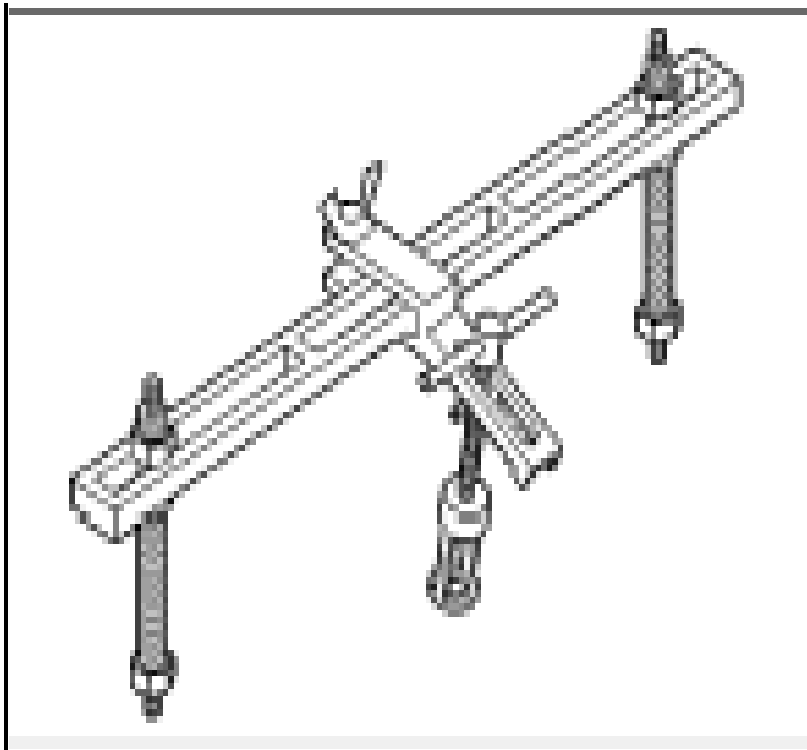


C-647 - Spring Tester

MD998772A - Compressor, Valve Spring

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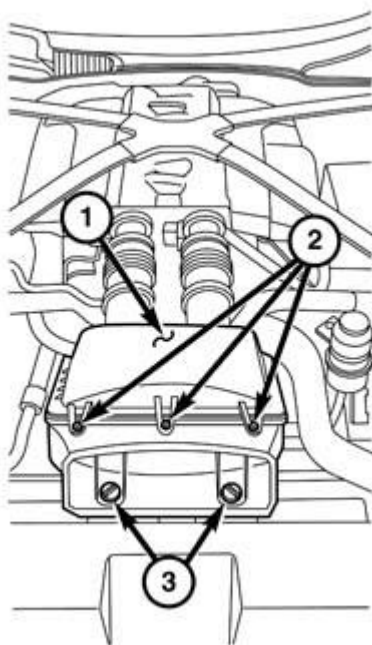
(Originally Shipped In Kit Number(s)
8678, 8853, 8854.)

AIR INTAKE SYSTEM

AIR CLEANER

REMOVAL

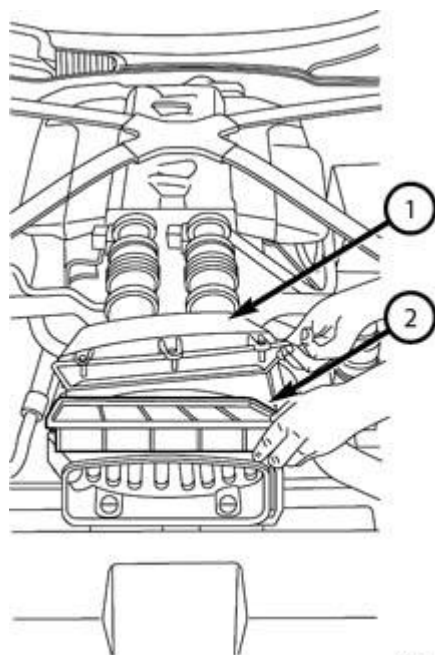
REMOVAL



0909001912

Fig. 59: Air Cleaner Housing, Cover Screws & Housing Retainers
Courtesy of CHRYSLER GROUP, LLC

1. Unscrew the air cleaner cover screws (2).



0909001911

Fig. 60: Air Cleaner Cover & Air Filter Element
Courtesy of CHRYSLER GROUP, LLC

2. Raise the air cleaner cover.

3. Pull the air filter element (2) out of the housing.
4. Clean out the inside of the air cleaner housing.

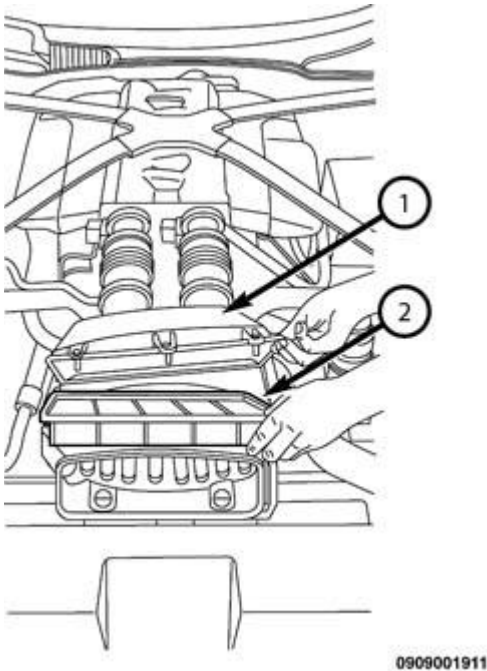
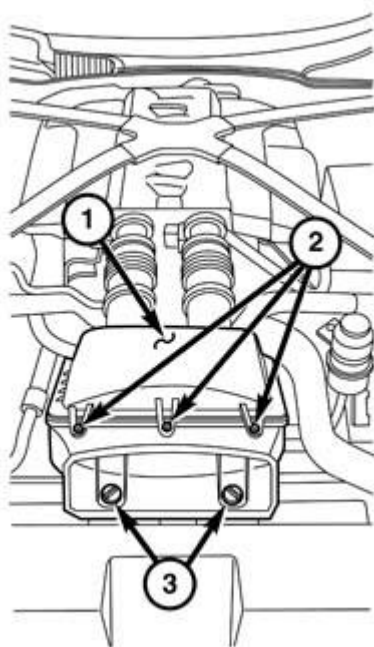
INSTALLATION**INSTALLATION**

Fig. 61: Air Cleaner Cover & Air Filter Element
Courtesy of CHRYSLER GROUP, LLC

1. Install the air filter element (2) in the housing.
2. Install the air cleaner housing cover (1).



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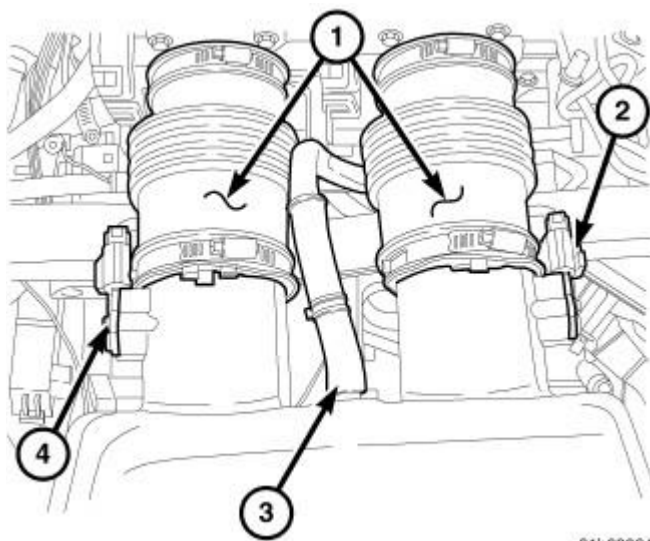
Fig. 62: Air Cleaner Housing, Cover Screws & Housing Retainers
Courtesy of CHRYSLER GROUP, LLC

3. Install air cleaner cover screws (2) tighten to 8 N.m (70 in. lbs.).

BODY, AIR CLEANER

REMOVAL

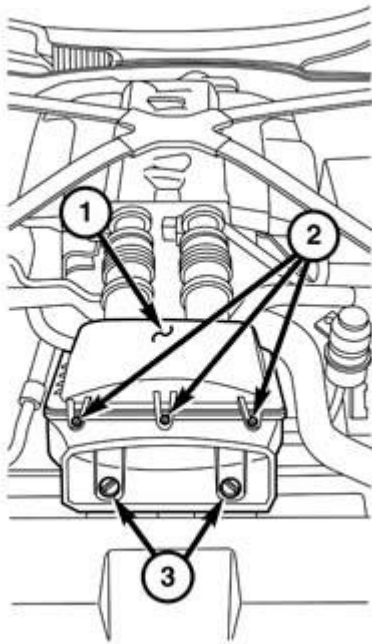
REMOVAL



81b60064

Fig. 63: Air Inlet Hoses
Courtesy of CHRYSLER GROUP, LLC

1. Remove make up air hose (3).
2. Disconnect mass air flow/intake air temperature sensors electrical connectors (2, 4).
3. Remove clean air hoses (1) from throttle bodies.



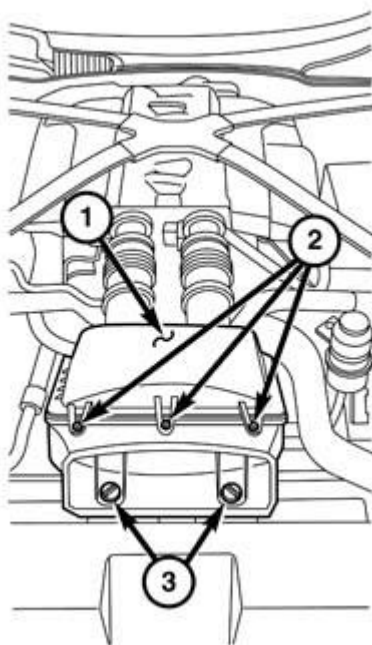
0909001912

Fig. 64: Air Cleaner Housing, Cover Screws & Housing Retainers
Courtesy of CHRYSLER GROUP, LLC

4. Remove air cleaner housing retainers (3).
5. Remove air cleaner housing (1).

INSTALLATION

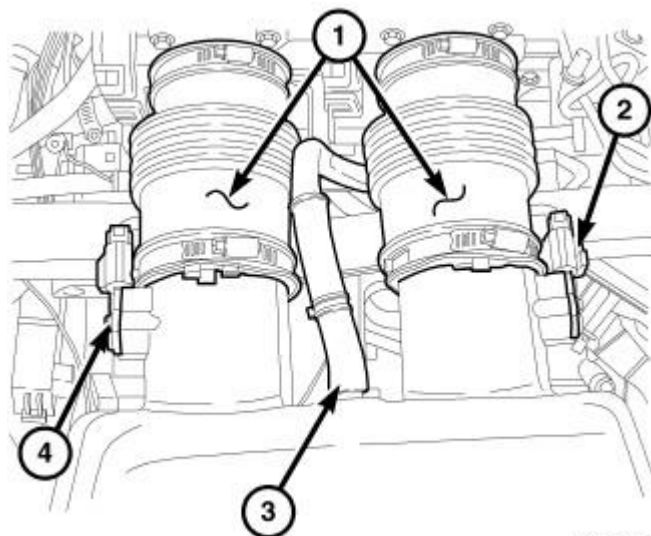
INSTALLATION



0909001912

Fig. 65: Air Cleaner Housing, Cover Screws & Housing Retainers
Courtesy of CHRYSLER GROUP, LLC

1. Position air cleaner housing (1) in place.
2. Install the 2 front mounting screws (3).



81b60064

Fig. 66: Air Inlet Hoses
Courtesy of CHRYSLER GROUP, LLC

3. Connect clean air hoses (1) to throttle bodies.
4. Insert rear support into grommet.

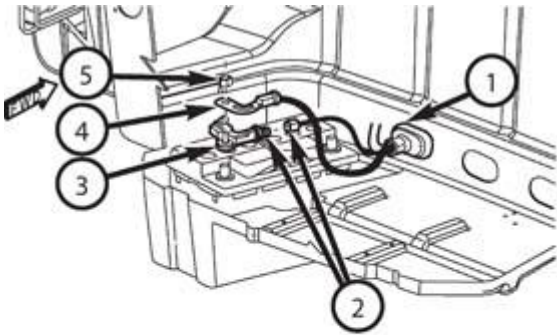
5. Connect make up air hose (3).
6. Connect the mass air flow/intake air temperature sensor electrical connectors (2, 4).

CYLINDER HEAD

REMOVAL

REMOVAL

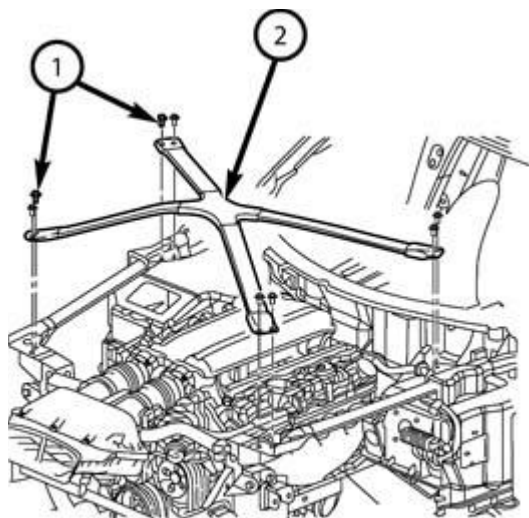
NOTE: Care must be taken to protect the intake manifold and cylinder head covers powder coating from scrapes and abrasions. This procedure covers either the left or right cylinder head.



080874297

Fig. 67: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable
Courtesy of CHRYSLER GROUP, LLC

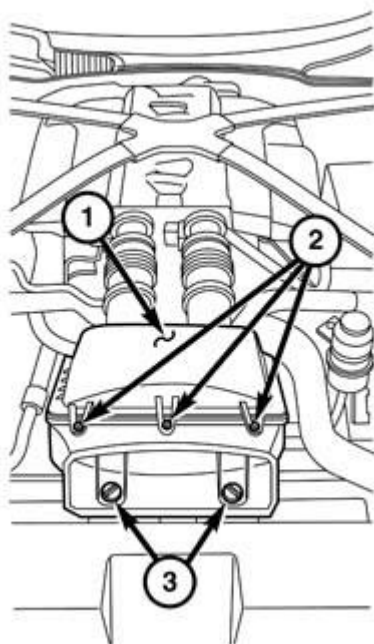
Open trunk lid. Remove battery cover. Disconnect negative battery cable (4).



091174557

Fig. 68: Cross Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Release the fuel pressure. Refer to **FUEL DELIVERY, STANDARD PROCEDURE**.
2. Remove the cross strut (2).

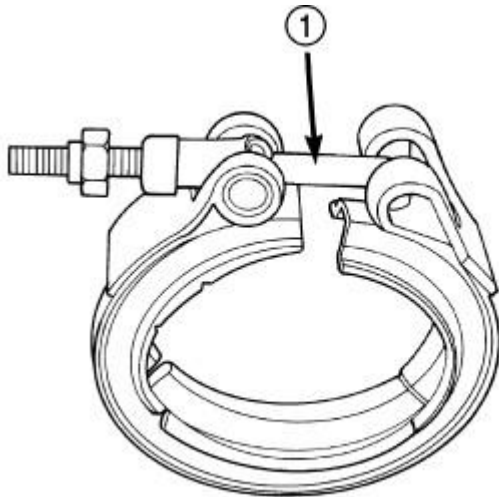


0909001912

Fig. 69: Air Cleaner Housing, Cover Screws & Housing Retainers
Courtesy of CHRYSLER GROUP, LLC

3. Remove the air cleaner housing (1). Refer to **BODY, AIR CLEANER, REMOVAL**.

4. Drain the cooling system. Refer to STANDARD PROCEDURE .
5. Raise and support the vehicle. Refer to HOISTING, STANDARD PROCEDURE .



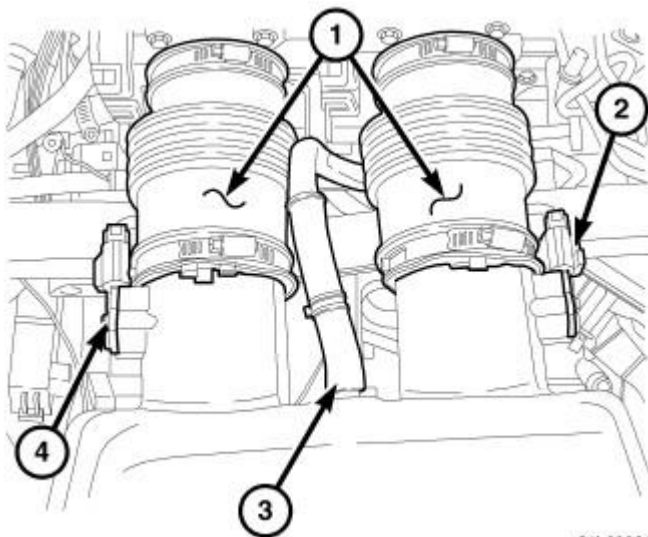
80ab8850

Fig. 70: V-Band Clamp
Courtesy of CHRYSLER GROUP, LLC

6. Remove the V-band clamp (1) from the exhaust pipe to exhaust manifold connection and discard.

NOTE: Do not reuse V-Band clamp.

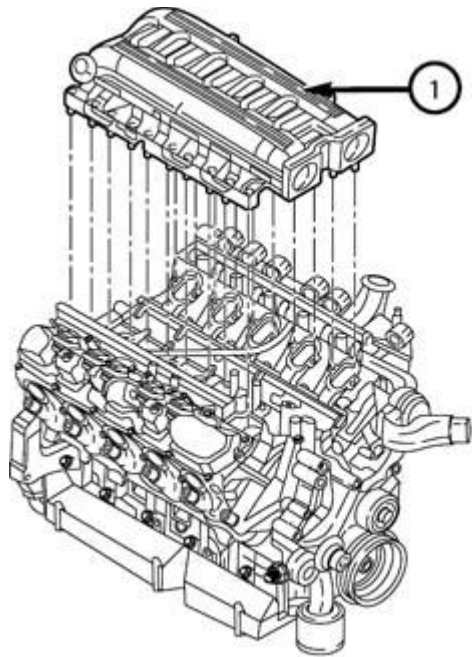
7. Lower the vehicle.



81b60064

Fig. 71: Air Inlet Hoses
Courtesy of CHRYSLER GROUP, LLC

8. Remove air inlet hoses (1) from throttle bodies.

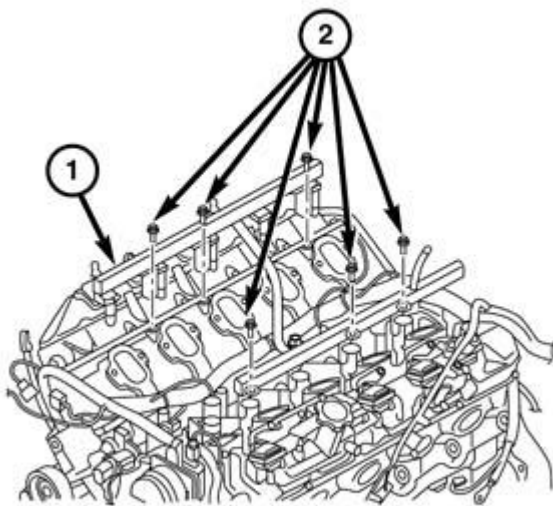


091174562

Fig. 72: Intake Manifold

Courtesy of CHRYSLER GROUP, LLC

9. Remove intake manifold (1). Refer to **MANIFOLD, INTAKE, REMOVAL**.



0708001923

Fig. 73: Fuel Rail

Courtesy of CHRYSLER GROUP, LLC

10. Remove fuel rail (1).

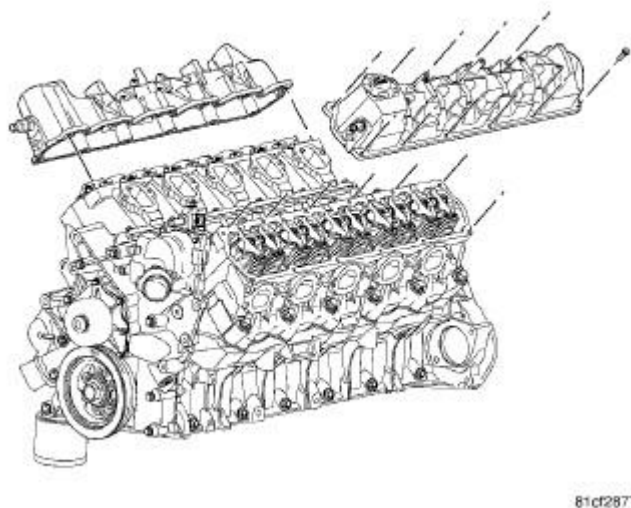


Fig. 74: Valve Cover Removal

Courtesy of CHRYSLER GROUP, LLC

11. Remove the cylinder head covers. Refer to **COVER(S), CYLINDER HEAD, REMOVAL**.

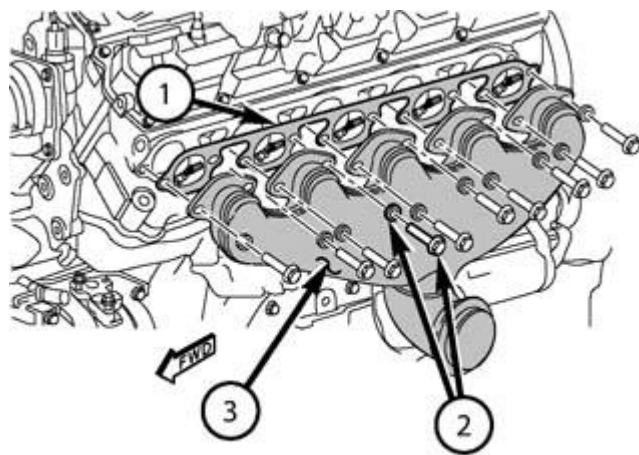
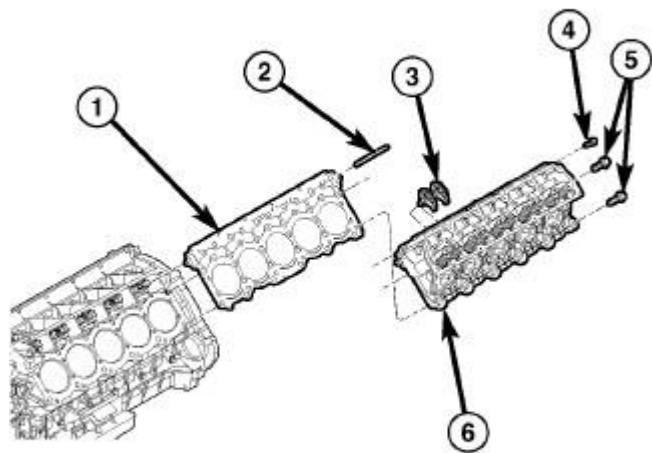


Fig. 75: Removing & Installing Exhaust Manifolds & Gaskets

Courtesy of CHRYSLER GROUP, LLC

12. Remove exhaust manifold(s) (3) and gasket(s) (1). Refer to **MANIFOLD, EXHAUST, REMOVAL**.



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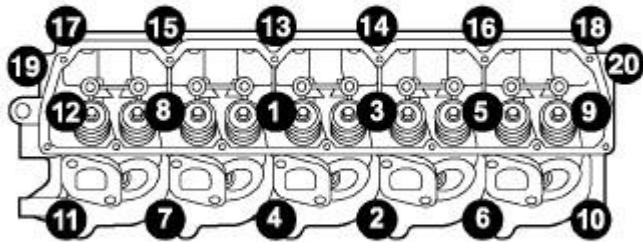
Fig. 76: Identifying Cylinder Head & Gasket

Courtesy of CHRYSLER GROUP, LLC

NOTE: If rocker arms and push rods are to be reused, identify each component to ensure installation in original locations.

NOTE: When removing the rocker arms do not remove the bolt from the rocker arm, this maintains proper rocker arm trunnion alignment.

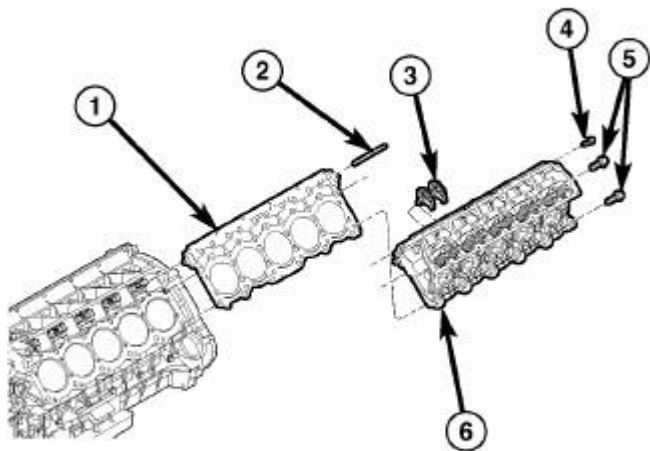
13. Remove the rocker arm assemblies (3).
14. Remove push rods (2).



80132718

Fig. 77: Cylinder Head Bolt Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

15. Remove the head bolts 1 - 12 and discard. Remove bolts 13 - 20 from the cylinder head(s).



81012420

Fig. 78: Identifying Cylinder Head & Gasket
Courtesy of CHRYSLER GROUP, LLC

16. Remove cylinder head(s) (6) and gasket(s) (1).
17. Remove cylinder head gasket(s) (1) and discard.

CLEANING

CLEANING

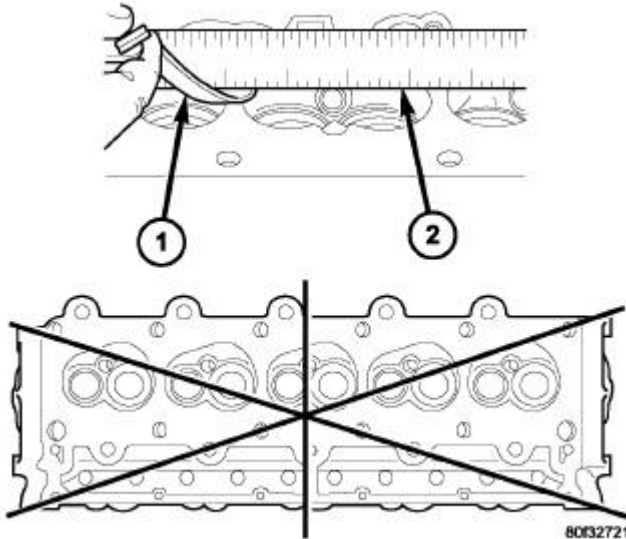


Fig. 79: Checking Cylinder Head For Warpage
Courtesy of CHRYSLER GROUP, LLC

- | |
|---------------------------------------|
| 1 - FEELER GAUGE
2 - STRAIGHT EDGE |
|---------------------------------------|

1. Before cleaning, check for leaks, damage and cracks.
2. Clean cylinder head and oil passages.
3. Check cylinder head for flatness.
4. Inspect all surfaces with a straightedge (2) if there is any reason to suspect leakage. If out-of-flatness exceeds 0.019 mm (0.00075 in.) times the span length in inches in any direction, either replace head or lightly machine the head surface. As an example, if a 12.0 inch span is 1.0 mm (0.004 in.) out-of-flat, allowable is $12 \times 0.019 \text{ mm (0.00075 in.)}$ equals 0.22 mm (0.009 in.). This amount of out-of-flat is acceptable. *Maximum of 0.2 mm (0.008 in.) for grinding is permitted.

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

INSTALLATION

INSTALLATION

CAUTION: If the original engine has experienced a catastrophic failure or an individual failure with the piston, cylinder bore, engine block, valve or valve seat, the intake manifold MUST be replaced with a new manifold.

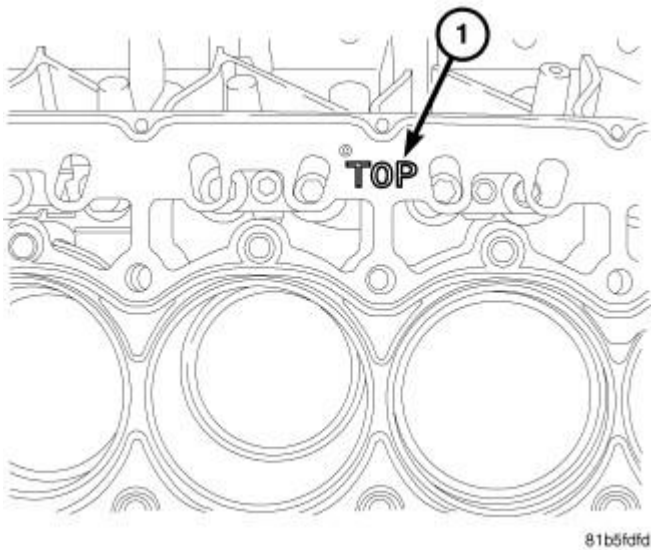


Fig. 80: Head Gasket

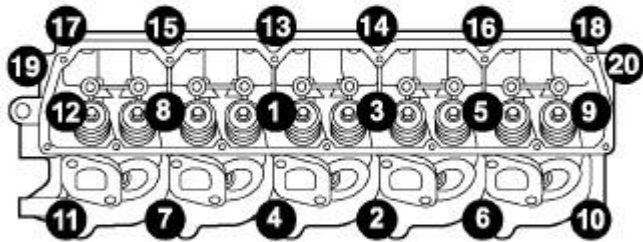
Courtesy of CHRYSLER GROUP, LLC

CAUTION: The cylinder head gaskets are not interchangeable between the left and right sides. They are marked with an "L" and "R" to indicate the left or right side and they are marked "TOP" to indicate which side goes up.

NOTE: This procedure covers either the left or right cylinder head.

NOTE: Make sure there is no oil or coolant in the cylinder head bolt holes.

1. Clean all surfaces of engine block and cylinder heads. Refer to **STANDARD PROCEDURE**.
2. Install new cylinder head gasket(s) on the engine block with markings (1) upward. Assure all coolant passages and bolt holes align properly.

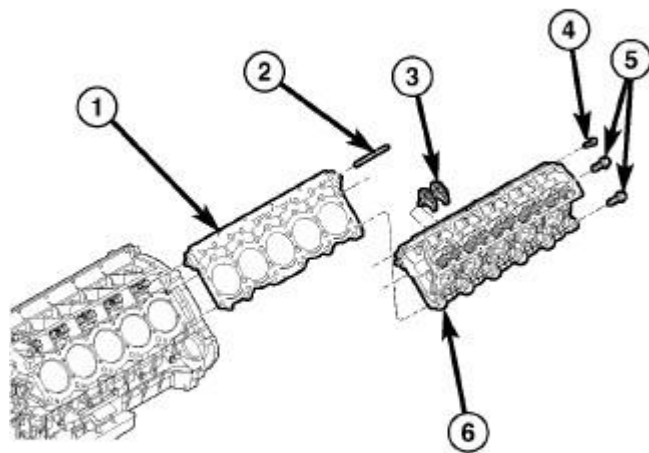


80132718

Fig. 81: Cylinder Head Bolt Tightening Sequence

Courtesy of CHRYSLER GROUP, LLC

3. Install cylinder head(s) over dowel pins. Install **new** cylinder head bolts 1-12. Tighten cylinder head bolts 1-12 in the sequence shown in illustration in using a three step tightening sequence:
 - a. First to 35 N.m (26 ft. lbs.).
 - b. Second to 52 N.m (38 ft. lbs.).
 - c. Third rotate an additional 90°.
4. After cylinder head bolts 1-12 have been tightened to specifications, install and tighten cylinder head tappet gallery bolts 13 - 20 in sequence shown in illustration to 11 N.m (95 in. lbs.).



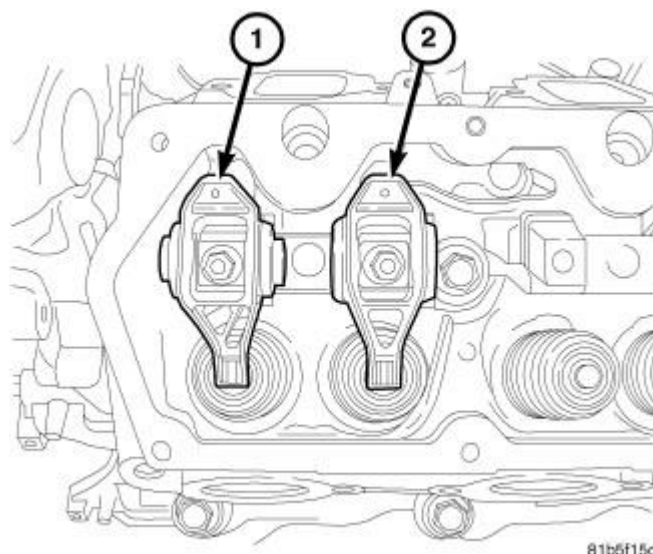
81012420

Fig. 82: Identifying Cylinder Head & Gasket
Courtesy of CHRYSLER GROUP, LLC

5. Inspect the push rod (2) tips for wear and straightness. Replace worn or bent push rods as necessary.

NOTE: Install push rods and rocker arms one at a time. This will minimize the possibility of dropping a push rod inside the engine.

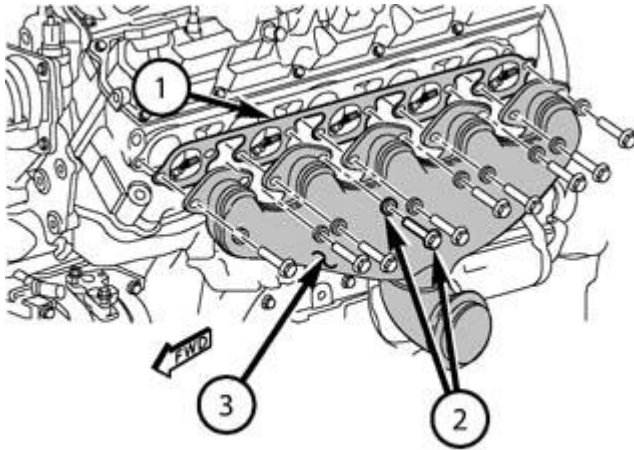
6. Install push rods (2).



81b5f15d

Fig. 83: Rocker Arm ID
Courtesy of CHRYSLER GROUP, LLC

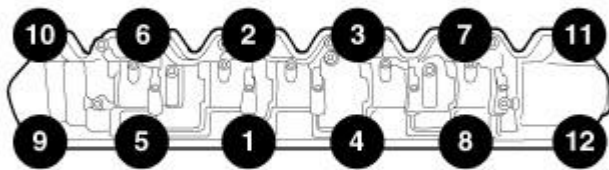
7. Install rocker arms (1, 2) and pedestal assemblies into their original positions. Refer to **ROCKER ARM, VALVE, INSTALLATION**. Ensure push rods are seated properly under each rocker arm. Tighten rocker arm bolts to 32 N.m (24 ft. lbs.).



091174549

Fig. 84: Removing & Installing Exhaust Manifolds & Gaskets
Courtesy of CHRYSLER GROUP, LLC

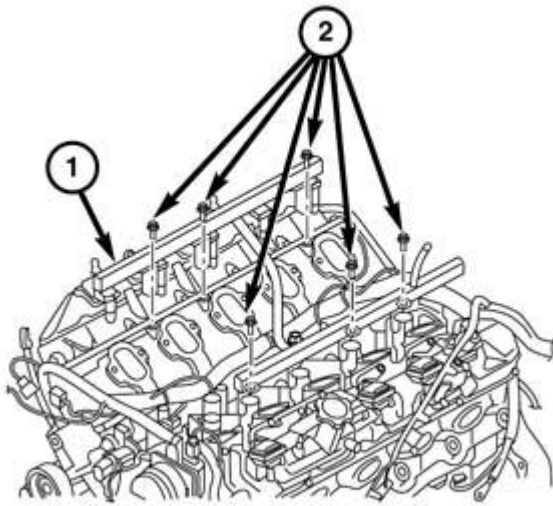
8. Install exhaust manifold(s) (3) and gasket(s) (1). Tighten bolts (2) to 29 N.m (21 ft. lbs.). Refer to **MANIFOLD, EXHAUST, INSTALLATION**.



81dd9954

Fig. 85: Head Cover Torque Sequence
Courtesy of CHRYSLER GROUP, LLC

9. Install cylinder head covers. Tighten bolts to 11 N.m (97 in. lbs.). . Refer to **COVER(S), CYLINDER HEAD, INSTALLATION**.

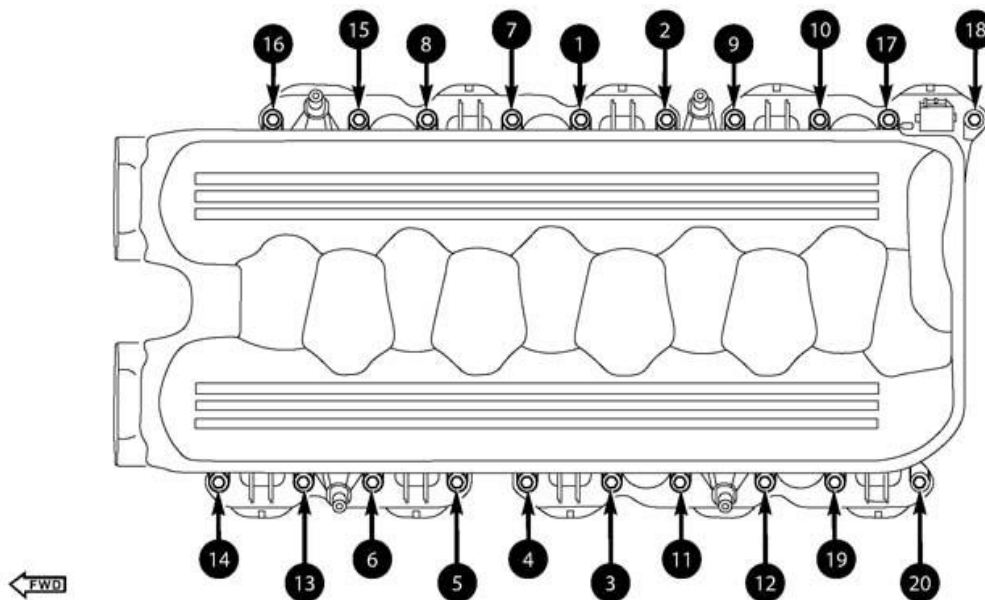


0708001923

Fig. 86: Fuel Rail

Courtesy of CHRYSLER GROUP, LLC

10. Install fuel rail (1). Tighten the bolts (2) to 10 N.m (90 in. lbs.).

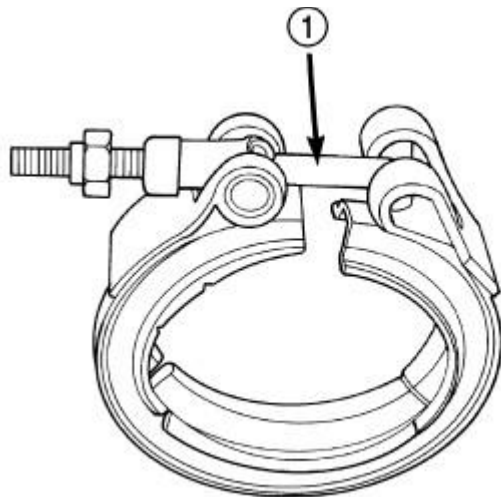


091174555

Fig. 87: Intake Manifold Bolt Tightening Sequence

Courtesy of CHRYSLER GROUP, LLC

11. Install intake manifold. Tighten the bolts in sequence to 12 N.m (106 in. lbs.). Refer to **MANIFOLD, INTAKE, INSTALLATION**.
12. Raise and support the vehicle.

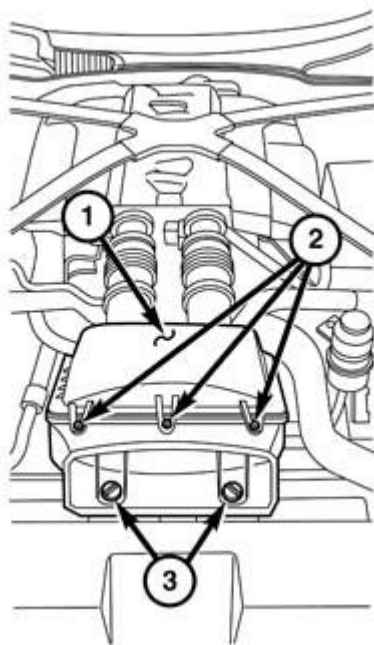


80ab8850

Fig. 88: V-Band Clamp

Courtesy of CHRYSLER GROUP, LLC

13. Connect the exhaust system to the exhaust manifold using new V-Band clamps (1).
14. Drain the engine oil.
15. Lower the vehicle.
16. Fill engine oil to the proper level. Refer to **CAPACITIES AND RECOMMENDED FLUIDS, DESCRIPTION** and **CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS**.



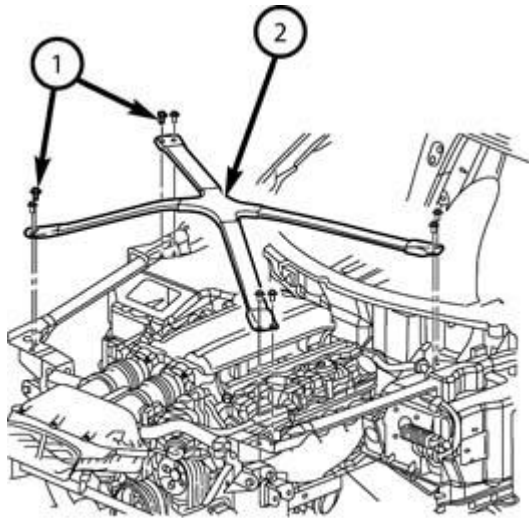
0909001912

Fig. 89: Air Cleaner Housing, Cover Screws & Housing Retainers

Courtesy of CHRYSLER GROUP, LLC

17. Fill the cooling system. Refer to **STANDARD PROCEDURE**.

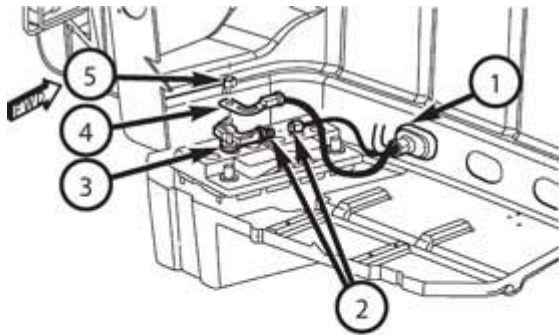
18. Install the air cleaner assembly (1). Refer to **BODY, AIR CLEANER, INSTALLATION**.



091174557

Fig. 90: Cross Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

19. Install the cross brace (2). Tighten bolts to 20 N.m (15 ft. lbs.).



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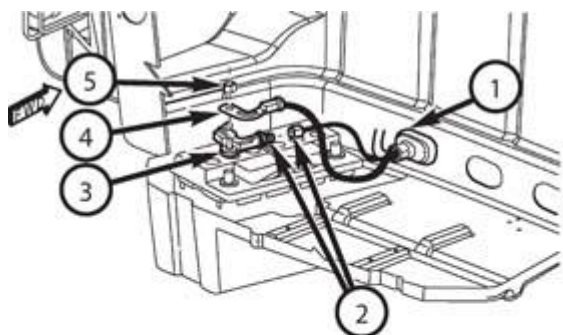
Fig. 91: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable
Courtesy of CHRYSLER GROUP, LLC

20. Connect battery negative cable (4). Install cover. Close trunk lid.
21. Start engine and inspect for leaks.

COVER(S), CYLINDER HEAD

REMOVAL

REMOVAL

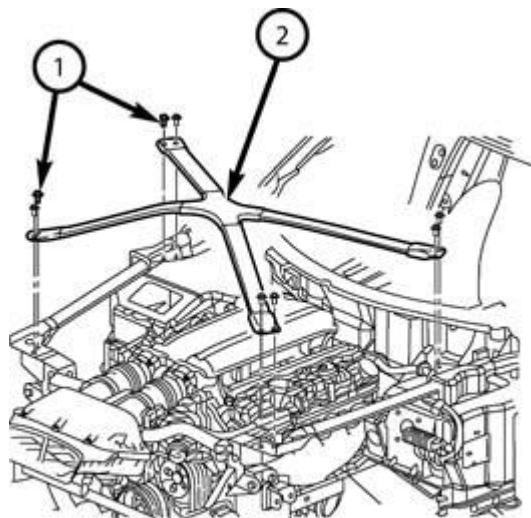


080874297

Fig. 92: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable
Courtesy of CHRYSLER GROUP, LLC

NOTE: Care must be taken to protect the cylinder head cover powder coating from scrapes and abrasions.

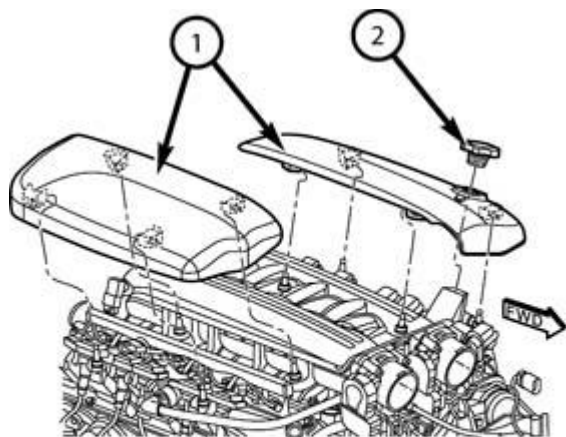
1. Disconnect the battery negative cable (4).



091174557

Fig. 93: Cross Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

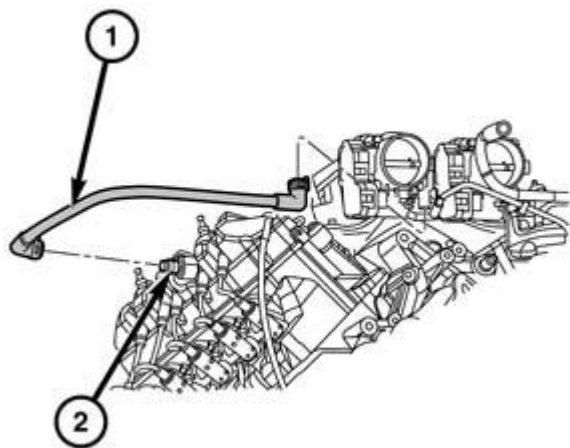
2. Remove the cross brace (2).



091174561

Fig. 94: Engine Covers
Courtesy of CHRYSLER GROUP, LLC

3. Remove the engine covers.



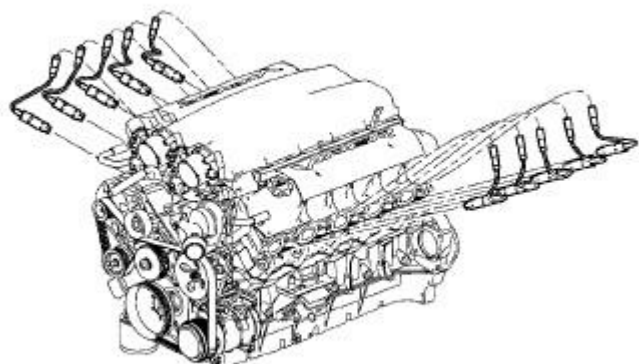
250675124

Fig. 95: PCV Valve & Hose
Courtesy of CHRYSLER GROUP, LLC

4. If removing the right cylinder head cover, disconnect PCV hose (1) and reposition oil level indicator tube.
5. When removing the left cylinder head cover, disconnect brake booster hose and make-up air hose.
6. Disconnect the coil electrical connectors.

NOTE: Do not remove the spark wires while hot.

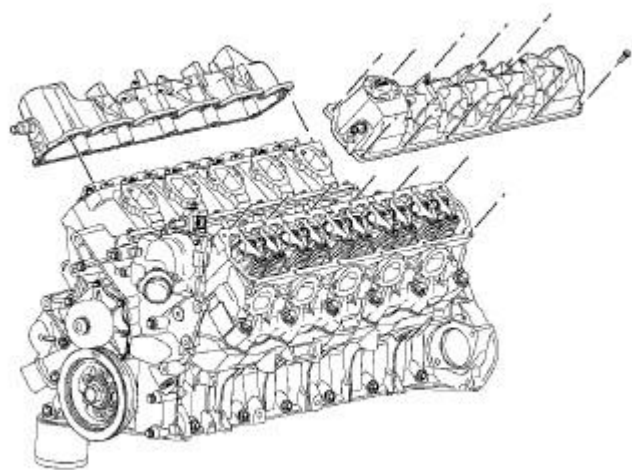
NOTE: Remove the spark plug wires and heat shields with spark plug wire pliers.



81b312dc

Fig. 96: View Of Spark Plug Wires
Courtesy of CHRYSLER GROUP, LLC

7. Remove the spark plug wires from spark plugs.



81cf2877

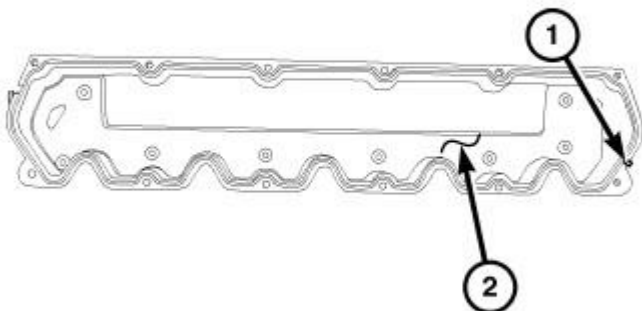
Fig. 97: Valve Cover Removal
Courtesy of CHRYSLER GROUP, LLC

8. Remove the cylinder head cover(s).

INSTALLATION

INSTALLATION

NOTE: Care must be taken to protect the cylinder head covers powder coating from scrapes and abrasions.

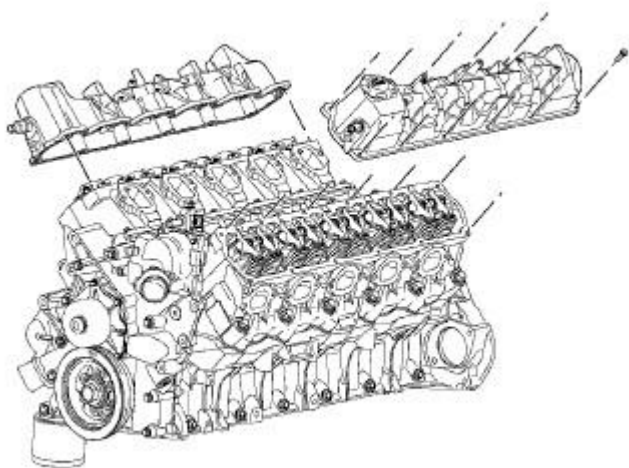


81b8200d

Fig. 98: Valve Cover Seal

Courtesy of CHRYSLER GROUP, LLC

1. Inspect the cylinder head cover gasket (1) for damage. Replace as necessary.



81cf2877

Fig. 99: Valve Cover Removal

Courtesy of CHRYSLER GROUP, LLC

2. Place cylinder head cover(s) onto cylinder head.

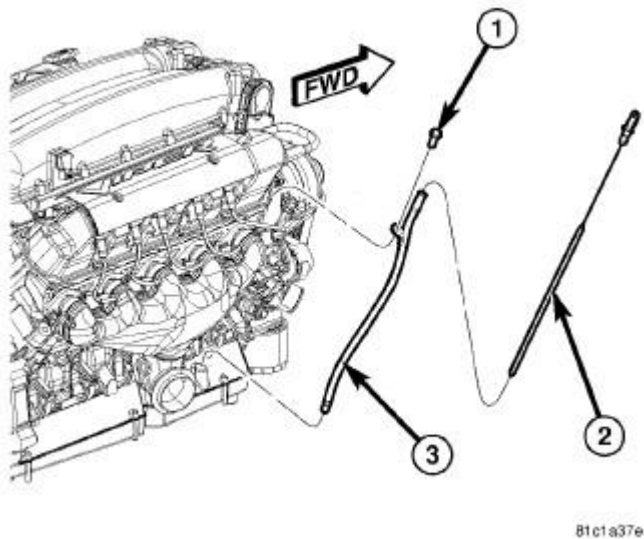


Fig. 100: Oil Level Indicator

Courtesy of CHRYSLER GROUP, LLC

3. When installing the right cover, be sure to secure the oil level indicator tube (3) with the cylinder head cover retaining bolt (1).

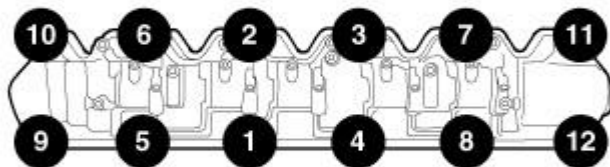
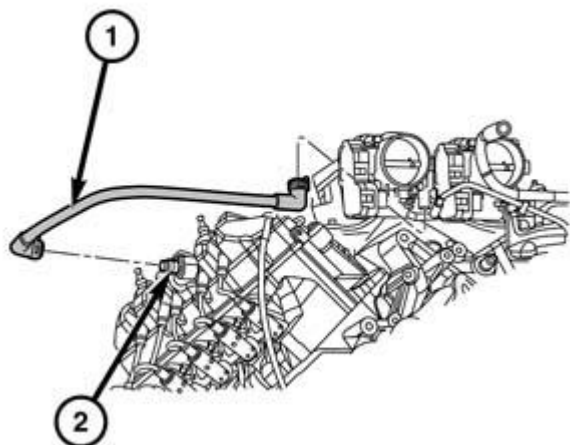


Fig. 101: Head Cover Torque Sequence

Courtesy of CHRYSLER GROUP, LLC

4. Install and tighten the cylinder head cover bolts to 9 N.m (80 in. lbs.) in the sequence shown in illustration.
5. Connect the spark plug wires.
6. Reposition the harness and connect the coil electrical connectors.

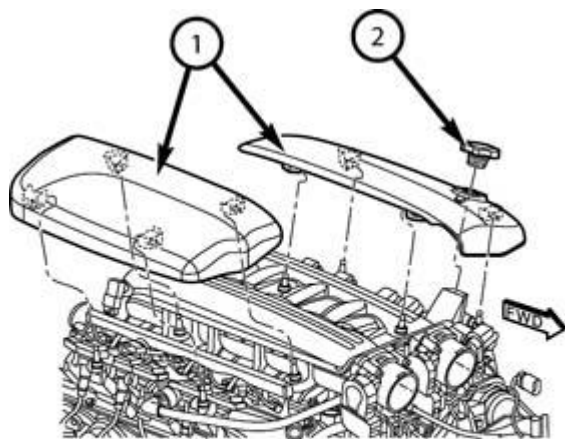


250675124

Fig. 102: PCV Valve & Hose

Courtesy of CHRYSLER GROUP, LLC

7. When installing the right cover, connect the PCV hose (1).
8. When installing the left cover, install the brake booster hose and make-up air hose.



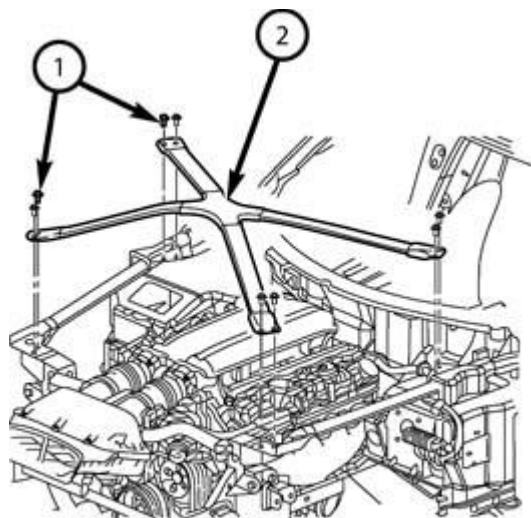
091174561

Fig. 103: Engine Covers

Courtesy of CHRYSLER GROUP, LLC

NOTE: Make sure the rubber coil cover isolators are in place prior to installing the engine covers.

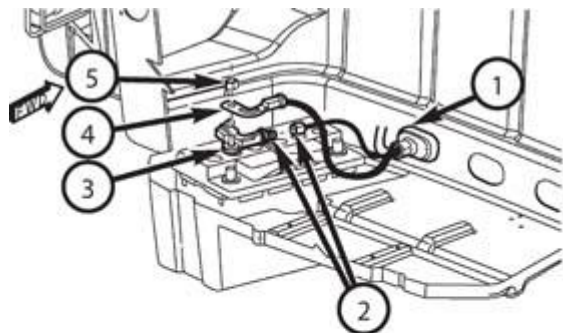
9. Position the engine covers (1).



091174557

Fig. 104: Cross Support Brace & Bolts
 Courtesy of CHRYSLER GROUP, LLC

10. Install the cross strut (2). Tighten the bolts (1) to 20 N.m (15 ft. lbs.).



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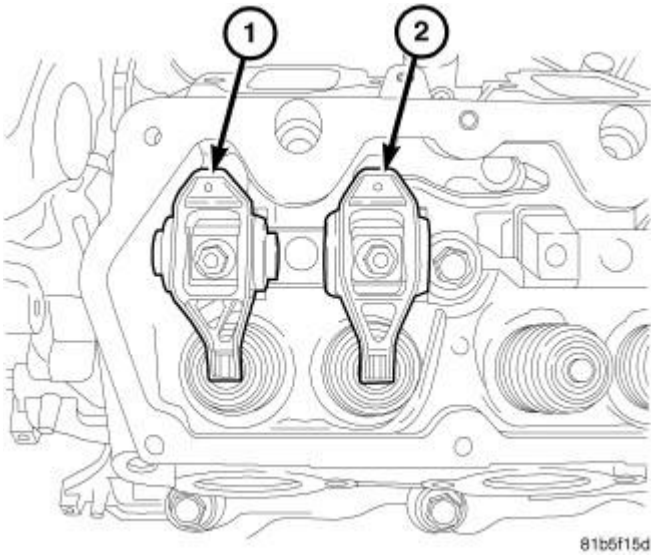
Fig. 105: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable
 Courtesy of CHRYSLER GROUP, LLC

11. Connect the negative battery cable (4).

ROCKER ARM, VALVE

REMOVAL

REMOVAL

**Fig. 106: Rocker Arm ID**

Courtesy of CHRYSLER GROUP, LLC

NOTE: Before replacing parts, inspect all related valvetrain components for damage to prevent engine misfire.

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

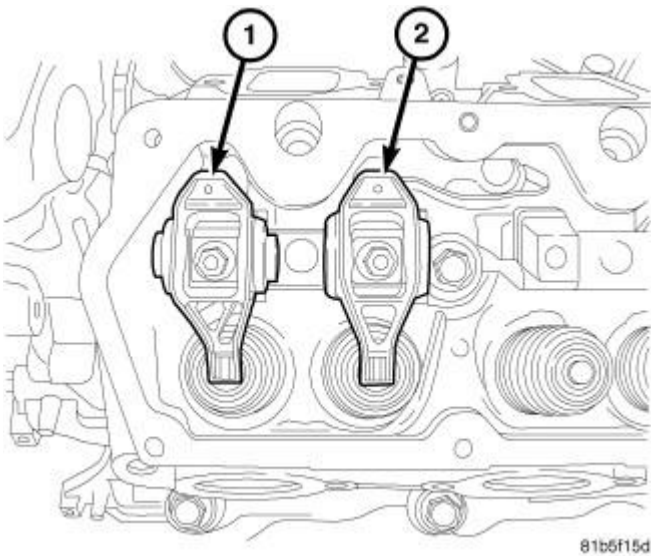
NOTE: The rocker arms are intake (2) and exhaust (1) specific.

NOTE: When removing rocker arms, do not remove the bolt from the rocker arm.

2. Loosen rocker bolt.
3. Remove rocker arm assemblies noting their location for reassembly.
4. Repeat steps 2 and 3 for remaining rocker arms.

INSTALLATION

INSTALLATION

**Fig. 107: Rocker Arm ID**

Courtesy of CHRYSLER GROUP, LLC

NOTE: Before replacing parts, inspect all related valvetrain components for damage to prevent engine misfire.

NOTE: Care should be taken not to drop push rods into engine.

NOTE: Rocker arms are intake (2) and exhaust (1) specific.

1. Install rocker arms into position. Ensure push rods are seated properly under each rocker arm and seated in lifter. Tighten rocker arm bolts to 32 N.m (24 ft. lbs.).

CAUTION: The rocker shaft assemblies are not interchangeable between the intake and the exhaust, failure to install them in the correct location could result in engine damage. The intake rocker arms (1) are marked with the letter "I" (2).

2. Install cylinder head cover(s). Refer to COVER(S), CYLINDER HEAD, INSTALLATION.

SPRING(S), VALVE

DESCRIPTION

DESCRIPTION

The valve spring is a conical design made out of ovate wire. The valve spring is serviced as an assembly along with a new seat and retainer.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - VALVE SPRING TESTING

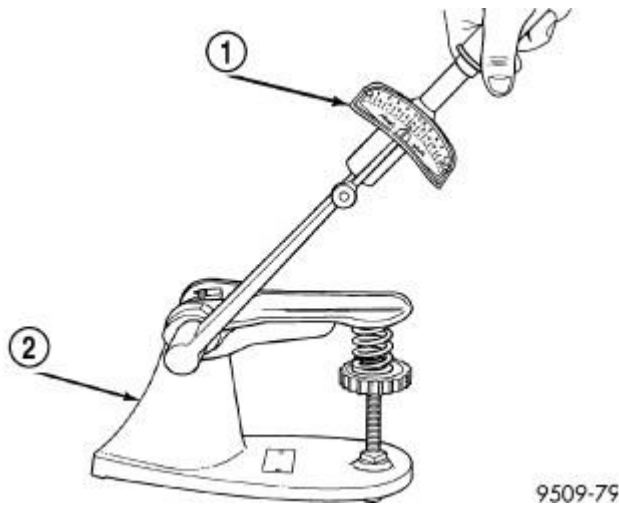


Fig. 108: Valve Spring Testing With Special Tool C-647
Courtesy of CHRYSLER GROUP, LLC

- | |
|--|
| <p>1 - TORQUE WRENCH
2 - VALVE SPRING TESTER</p> |
|--|

The valve springs should be tested whenever removed for inspection, reconditioning, or replacement.

1. Obtain specifications for spring tension at specified spring length. Refer to **SPECIFICATIONS**.
2. Turn table of Special Tool (special tool #C-647, Spring Tester) (2) until the surface is in line with the spring length specification mark on the threaded stud and the zero mark is on the front.
3. Place spring over stud on the table and lift compressing lever to set tone device.
4. Pull on torque wrench (beam or dial type) 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.
5. Compare reading to the specification. Discard the springs that do not meet specifications.

STANDARD PROCEDURE

STANDARD PROCEDURE - VALVE SPRING/SEAL SERVICE IN-CAR

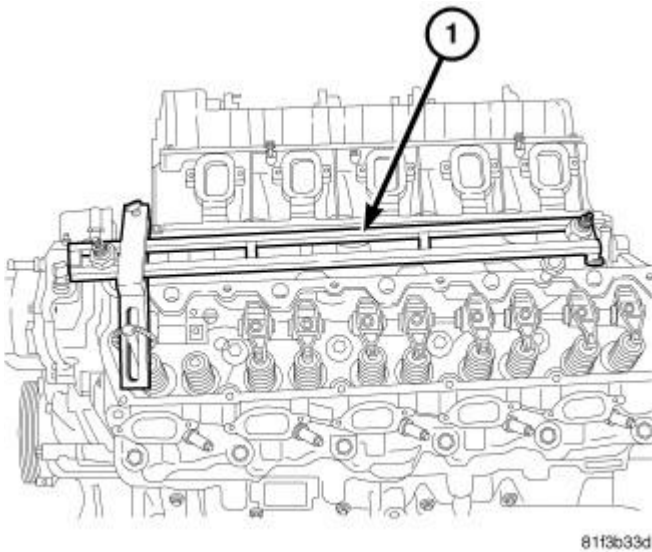


Fig. 109: In Car Valve Spring Service
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect negative battery cable.
2. Using compressed air, blow out spark plug recessed area and remove spark plugs.
3. Remove cylinder head cover(s). Refer to **COVER(S), CYLINDER HEAD, REMOVAL**.
4. Rotate crankshaft until No. 1 piston is at TDC on compression stroke.
5. Remove rocker arms with pivots. Refer to **ROCKER ARM, VALVE, REMOVAL**. The rocker arm bolts should not be removed and remain in the trunnion.
6. With air hose attached to spark plug adapter installed in No. 1 spark plug hole, apply 620.5 - 689 kPa (90 - 100 psi) air pressure. This is to hold valves into place while servicing components.
7. Install valve spring compressor (special tool #MD998772A, Compressor, Valve Spring) (1).

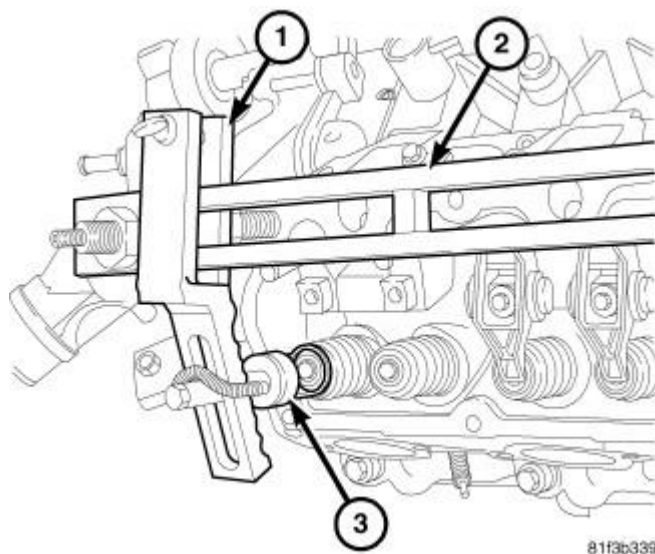


Fig. 110: Valve Tools
Courtesy of CHRYSLER GROUP, LLC

8. Using a (special tool #MD998772A, Compressor, Valve Spring) (1, 2) and valve spring adapter (3), compress the valve spring and remove valve keepers.
9. Release valve spring compressor.
10. Remove valve spring and retainer.
11. Remove valve seal.
12. The intake and exhaust valve stem seals should be pushed firmly and squarely over the valve guide using the valve stem as guide. Push seal against top of guide. When installing the valve retainer locks, compress the spring **only enough** to install the locks.

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

13. Follow the same procedure on the remaining 9 cylinders. **Make sure piston is at TDC on the cylinder the valve spring is being removed.**
14. Remove spark plug adapter tool.
15. Install rocker arms. Refer to **ROCKER ARM, VALVE, REMOVAL.**
16. Install cylinder head covers. Refer to **COVER(S), CYLINDER HEAD, INSTALLATION.**
17. Connect the battery negative cable.

REMOVAL

REMOVAL

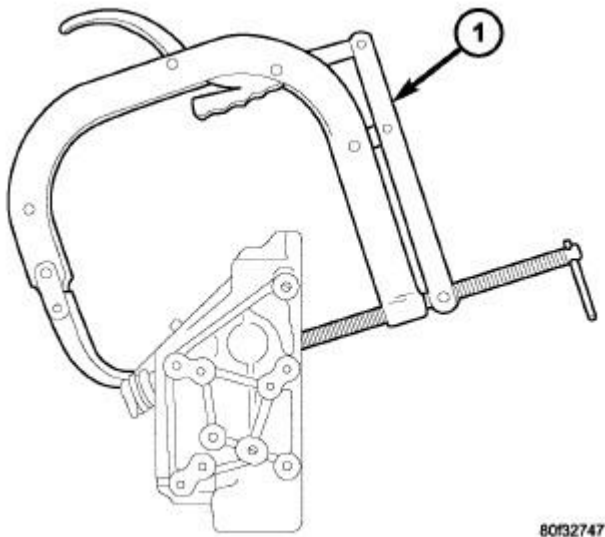


Fig. 111: Valve Spring Removal
Courtesy of CHRYSLER GROUP, LLC

NOTE: Before replacing parts, inspect all related valvetrain components for damage to prevent engine misfire.

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

1. With the cylinder head removed, compress valve springs using a valve spring compressor (1).

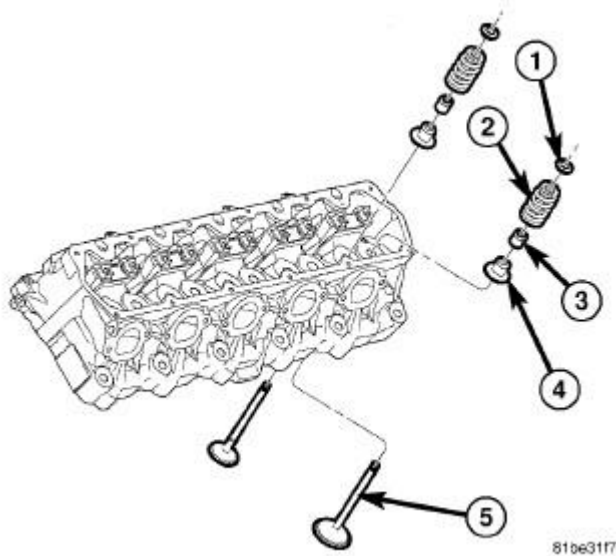


Fig. 112: Exploded View Of Valve Components
 Courtesy of CHRYSLER GROUP, LLC

2. Remove valve retaining locks.
3. Slowly release valve spring compressor.
4. Remove valve spring retainer (1) and valve spring (2).
5. Before removing the valves, **remove any burrs from valve stem lock grooves and clean the valve stem to prevent damage to the valve guides.** Identify the valves to ensure installation in original location.
6. Remove valve (5) from cylinder head.
7. Remove valve seal.
8. Repeat procedure for remaining valves.

INSTALLATION

INSTALLATION

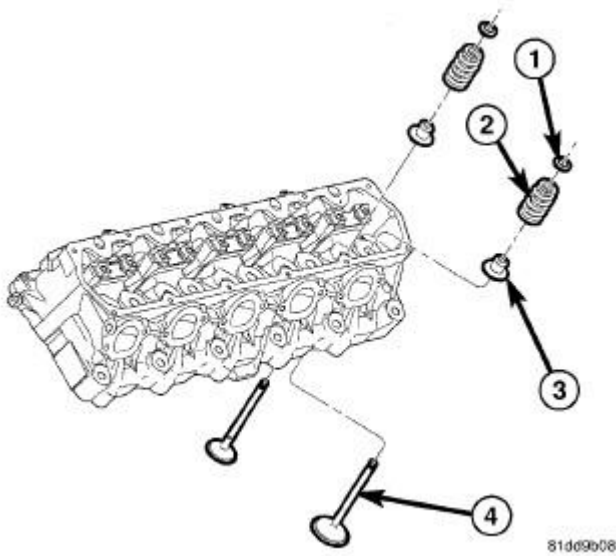


Fig. 113: Exploded View Of Valve Components
Courtesy of CHRYSLER GROUP, LLC

NOTE: Before replacing parts, inspect all related valvetrain components for damage to prevent engine misfire.

1. Install valve seat/seals (3).
2. Coat the valve stems (4) with clean engine oil and insert them in the cylinder head.
3. Install valve springs (2) and valve retainers (1).

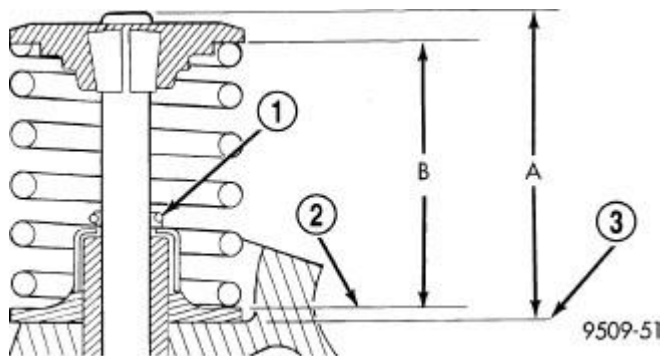


Fig. 114: Measuring Valve TIP Height And Valve Spring Installed Height
Courtesy of CHRYSLER GROUP, LLC

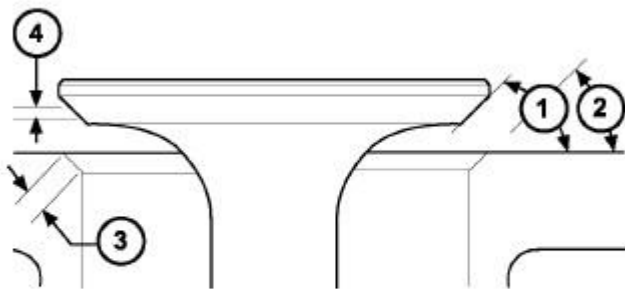
4. Compress valve springs with a valve spring compressor. Install retaining locks and release tool.
5. **If valves and/or seats have been reground, measure valve tip height (A). Make sure measurements are taken from cylinder head surface to the top of valve stem.** If valve tip height is greater than 52.96 mm (2.085 in.), grind the valve tip until within specifications.
6. **If valves and/or seats have been reground, measure installed height of springs (B). Make sure measurements are taken from top of spring seat to the bottom surface of valve spring retainer.** If

height is greater than 48.01 mm (1.8901 in.), Install a spacer in head counter-bore under the valve spring seat to bring spring height back to 48.01 mm (1.8901 in.)

VALVES/SEATS/GUIDES, INTAKE AND EXHAUST

STANDARD PROCEDURE

STANDARD PROCEDURE - VALVE AND VALVE SEAT - REFACING



809c3e98

Fig. 115: Valve Face And Seat

Courtesy of CHRYSLER GROUP, LLC

The intake and exhaust valves have a 44° - 44.5° face angle (1). The valve seats (2) have a 44.75° - 45.25° face angle.

Inspect the remaining margin after the valves are refaced. Refer to **SPECIFICATIONS**.

VALVE SEATS

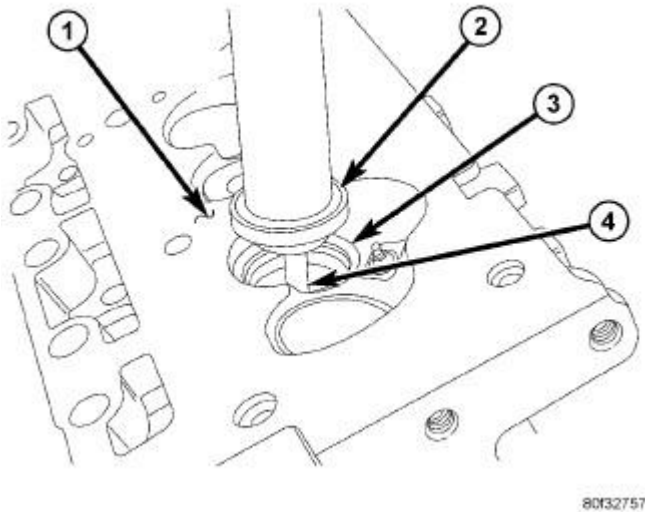


Fig. 116: Valve Seat Refacing

Courtesy of CHRYSLER GROUP, LLC

NOTE: When re-facing valve seats, it is important that the correct size valve guide pilot be used for re-seating stones. A true and complete surface must be obtained.

1. Measure the concentricity of valve seat using a dial indicator. Total runout should not exceed 0.05 mm (0.002 in.) total indicator reading.
2. 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, lower valve seat with a 30° stone. If the blue is transferred to the bottom edge of valve face raise valve seat with a 75° stone.

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

3. Measure valve seat width after refacing 1.02 - 1.52 mm (0.040 - 0.060 in.).

INSPECTION

INSPECTION

VALVE

1. Clean valves thoroughly and discard any burned, bent, warped, and cracked valves.
2. Inspect valve stems for wear and the valve tips for surface fatigue. Discard valves with scuffed stems and signs of damage at the valve tips. Refer to **SPECIFICATIONS**.

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

VALVE GUIDE

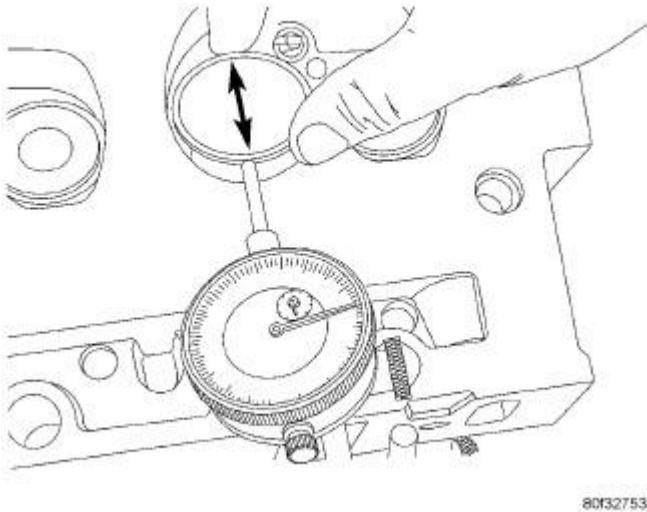


Fig. 117: Measuring Valve Guide Wear
Courtesy of CHRYSLER GROUP, LLC

1. Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.
2. Measure valve stem guide clearance using the rocking method as follows:
 1. Install valve into cylinder head so it is 14 mm (0.551 in.) off the valve seat. A small piece of hose may be used to hold valve in place.
 2. Attach dial indicator (special tool #C-3339A, Set, Dial Indicator) to cylinder head and set it at right angle of valve stem being measured.
 3. Move valve to and from the indicator. for valve guide specifications. Refer to **SPECIFICATIONS**. If guides are out of specifications, replace cylinder head.

ENGINE BLOCK

DESCRIPTION

DESCRIPTION

The cylinder block is made of a sand-cast aluminum alloy. The cylinder block has interference-fit cast iron cylinder liners. The cylinder liners are thermally installed during block manufacturing; they are not serviceable components.

Six iron main bearing caps use four bolts per cap; two vertical and two horizontal. A crankshaft oil scraper is attached to the main bearing caps via extended main bearing cap bolts and nuts.

CLEANING

CLEANING

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

1. When cleaning the cylinder block, remove the oil gallery plugs at the front and rear of the block.
2. Spray compressed air into all oil gallery passages to ensure they are clear of blockage.
3. Use a wooden or plastic scraper and MOPAR® Brake Parts Cleaner or the equivalent to remove the old gasket.
4. Clean the oil passages in the cylinder block with a brush.

INSPECTION

INSPECTION

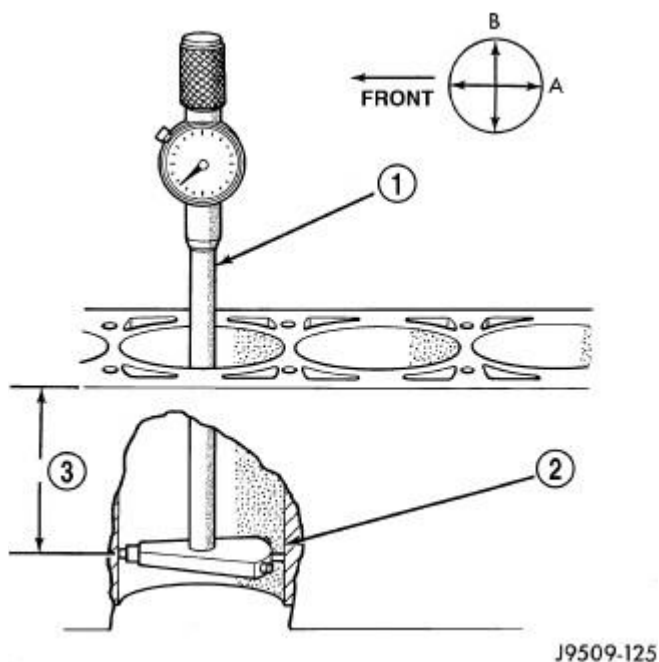


Fig. 118: Measuring Cylinder Bore Size
Courtesy of CHRYSLER GROUP, LLC

The cylinder walls should be checked for out-of-round and taper with Special Tool (special tool #C-119, Cylinder Indicator) (1).

Measure the cylinder bore at three levels in directions A and B. Top measurement should be 12 mm (0.50 in.) down and bottom measurement should be 12 mm (0.50 in.) up from bottom of bore. for cylinder bore and piston specifications. Refer to **SPECIFICATIONS**.

ASSEMBLY, VARIABLE VALVE TIMING

DESCRIPTION

DESCRIPTION

The 8.4L Viper engine is equipped with Variable Valve Timing (VVT). This system advances and/or retards exhaust camshaft timing to improve engine performance, mid-range torque, idle quality, fuel economy, and reduce emissions. The VVT assembly bolts to the camshaft assembly and is serviced as an assembly in the upper camshaft chain sprocket area. VVT assemblies are sometimes referred to as camshaft phasers.

OPERATION

OPERATION

The Variable Valve Timing (VVT) assembly is actuated with engine oil pressure. The oil flow to the VVT assemblies are controlled by an Oil Control Valve (OCV). The OCV consist of a Pulse Width Modulated (PWM) solenoid and a spool valve. The PCM actuates the OCV to control oil flow through the spool valve into the VVT assemblies. The VVT assembly consists of a rotor, stator, and sprocket. The stator is connected to the timing chain through the sprocket. The rotor is connected to the camshaft. Oil flow in to the VVT assembly rotates the rotor with respect to the stator, thus rotating the exhaust camshaft with respect to the timing chain and intake camshaft. An infinitely variable valve timing position can be achieved within the limits of the hardware. The CMP monitors the position of the camshaft with respect to the crankshaft and provides feedback to the PCM.

REMOVAL

PHASER

1. For camshaft phaser removal. Refer to **CHAIN AND SPROCKETS, TIMING, REMOVAL**.

SOLENOID

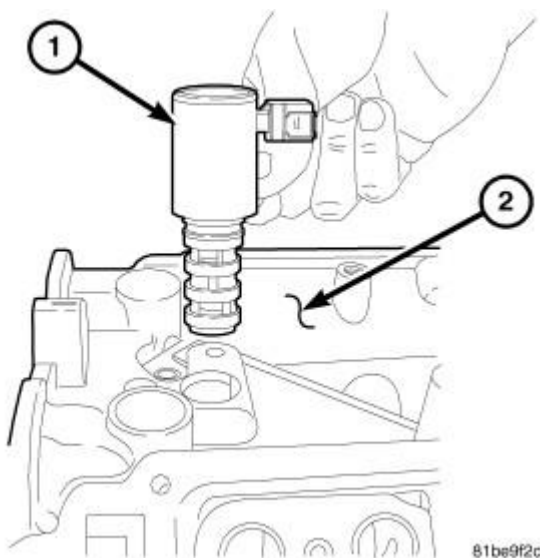


Fig. 119: VVT Solenoid

Courtesy of CHRYSLER GROUP, LLC

NOTE: The VVT solenoid can be removed without removing the intake manifold.

1. Remove air cleaner housing. Refer to **BODY, AIR CLEANER, REMOVAL**.
2. Remove the throttle bodies and reposition.
3. Disconnect solenoid electrical connector.
4. Remove retaining bolt.
5. Remove oil control valve (1) from engine block (2).

INSTALLATION

PHASER

1. For camshaft phaser installation. Refer to **CHAIN AND SPROCKETS, TIMING, INSTALLATION**.

OIL CONTROL VALVE

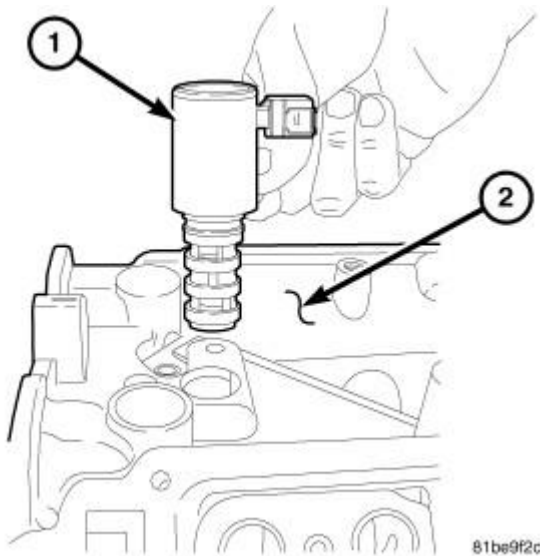


Fig. 120: VVT Solenoid

Courtesy of CHRYSLER GROUP, LLC

1. Lubricate O-ring with clean engine oil.
2. Install oil control valve (1) in engine block (2).
3. Connect oil control valve (1) electrical connector.
4. Install retaining bolt and tighten to 9 N.m (80 in. lbs.).

CAUTION: Proper torque of the throttle body is critical to normal operation. If the throttle body is over-torqued, damage to the throttle body can occur resulting in throttle plate malfunction.

5. Install throttle bodies and tighten bolts to 9 N.m (80 in. lbs.).
6. Install air cleaner housing. Refer to **BODY, AIR CLEANER, INSTALLATION**.

BEARING(S), CONNECTING ROD

DESCRIPTION

DESCRIPTION

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

The bearing shells must be installed so that the tangs are in the machined grooves in the rods and caps.

STANDARD PROCEDURE

CONNECTING ROD BEARING - FITTING

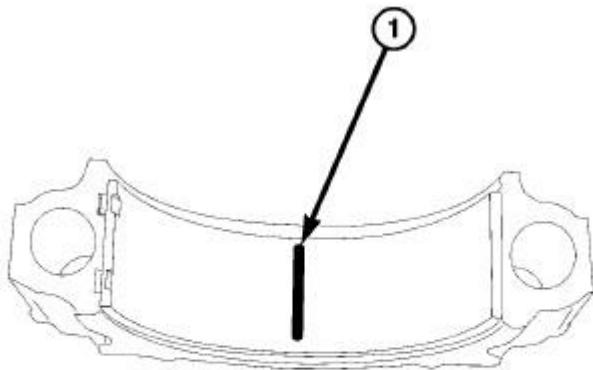
Fit all rods on one bank until complete. Do not alternate from one bank to another, because when the rods are assembled to pistons correctly, they are not interchangeable from one bank to another.

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

The bearing shells must be installed so that the tangs are in the machined grooves in the rods and caps.

1. Refer to **BEARING(S), CONNECTING ROD, STANDARD PROCEDURE** - Measuring Connecting Rod Bearing Clearance to determine bearing clearance.
2. Install piston and rod assembly with bearings in place. Refer to **ROD, PISTON AND CONNECTING, INSTALLATION**.

MEASURING CONNECTING ROD BEARING CLEARANCE



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Fig. 121: Plastigauge In Bearing

Courtesy of CHRYSLER GROUP, LLC

Engine crankshaft bearing clearances can be determined by use of Plastigage (1) or equivalent. The following is the recommended procedure for the use of Plastigage:

1. Rotate the crankshaft until the connecting rod to be checked is at the bottom of its stroke.
2. Remove oil film from surface to be checked. Plastigage is soluble in oil.
3. Place a piece of Plastigage (1) across the entire width of the bearing shell in the bearing cap approximately 6.35 mm (1/4 inch.) off center and away from the oil hole. In addition, suspect areas can be checked by placing plastigage in the suspect area.
4. Before assembling the rod cap with Plastigage in place, the crankshaft must be rotated until the connecting rod being checked starts moving toward the top of the engine. Only then should the cap be assembled and torqued to specifications. **Do not rotate the crankshaft while assembling the cap or the Plastigage may be smeared, giving inaccurate results.**

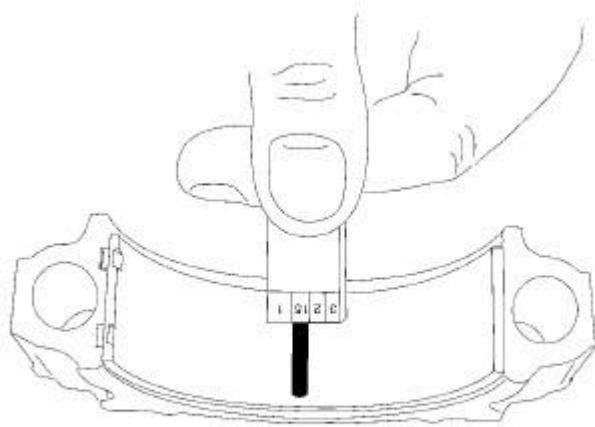


Fig. 122: Clearance Measurement
Courtesy of CHRYSLER GROUP, LLC

5. Remove the bearing cap and compare the width of the flattened Plastigage with the metric scale provided on the package. Locate the band closest to the same width. This band shows the amount of clearance in thousandths of a millimeter. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Refer to **SPECIFICATIONS**. **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.**
6. Plastigage is available in a variety of clearance ranges. The 0.025-0.076 mm (.001-.003 inch) is usually the most appropriate for checking engine bearing proper specifications.

BEARING(S), CRANKSHAFT, MAIN

DESCRIPTION

DESCRIPTION

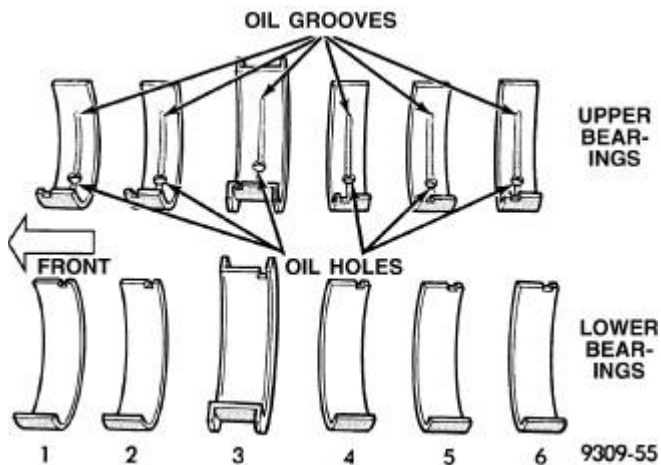


Fig. 123: Main Bearing Identification

Courtesy of CHRYSLER GROUP, LLC

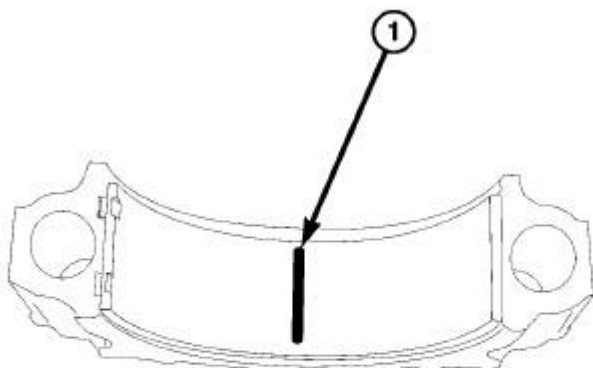
The main bearing caps are not interchangeable and should be marked at removal to insure correct assembly. Upper and lower main bearing halves are NOT interchangeable. Lower main bearing halves of No. 1, No. 2, No. 4, No. 5 and No. 6 are interchangeable. Upper main bearing halves of No. 1, No. 2, No. 4, No. 5 and No. 6 are interchangeable.

Upper and lower No. 3 bearing halves are flanged to carry the crankshaft thrust loads and are NOT interchangeable with any other bearing halves in the engine. All bearing cap bolts removed during service procedures are to be cleaned and dry before installation.

STANDARD PROCEDURE

STANDARD PROCEDURE - MEASURING CRANKSHAFT MAIN BEARING CLEARANCE IN-CAR

PLASTIGAGE METHOD



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Fig. 124: Plastigauge In Bearing

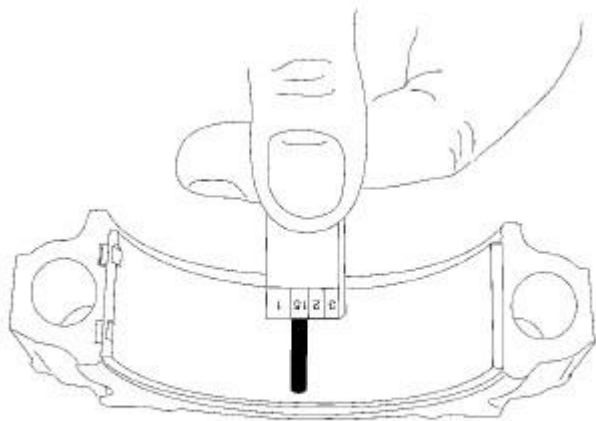
Courtesy of CHRYSLER GROUP, LLC

Engine crankshaft bearing clearances can be determined by use of Plastigage (1) or equivalent. The following is the recommended procedure for the use of Plastigage:

1. Remove oil film from surface to be checked. Plastigage is soluble in oil.
2. The total clearance of the **main bearings** can only be determined by removing the weight of the crankshaft. This can be accomplished by either of two methods:

PREFERRED METHOD

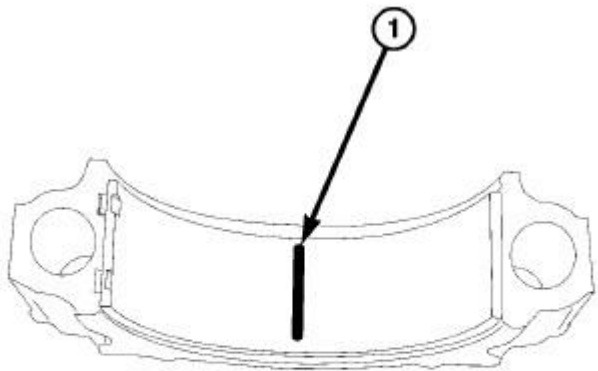
1. Support the bearings adjacent to the bearing to be checked in order to remove the clearance between upper bearing shell and the crankshaft. This can be accomplished by placing a minimum of 0.254 mm (.010 inch) shim (e. g. cardboard, matchbook cover, etc.) between the bearing shell and the bearing cap on the adjacent bearings and tighten bolts to 14-20 N.m (10-15 ft.lb.)
 - When checking No. 1 main bearing. Support No. 2 main bearing.
 - When checking No. 2 main bearing. Support No. 1 and No. 3 main bearing.
 - When checking No. 3 main bearing. Support No. 2 and No. 4 main bearing.
 - When checking No. 4 main bearing. Support No. 3 and No. 5 main bearing.
 - When checking No. 5 main bearing. Support No. 4 and No. 6 main bearing.
 - When checking No. 6 main bearing. Support No. 5 main bearing.



present. Record all readings taken. Refer to Engine Specifications. Refer to **SPECIFICATIONS**.
Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.

NOTE: Remove all support before reassembling engine.

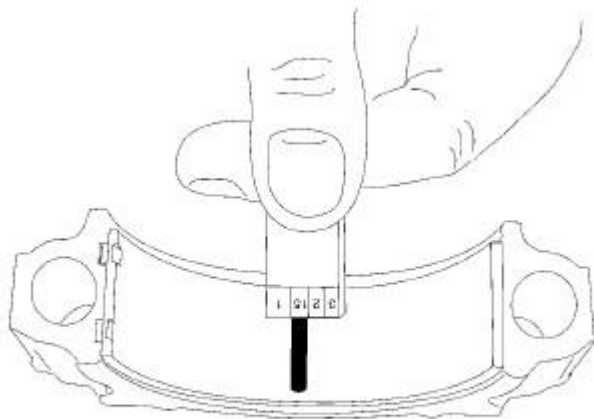
ALTERNATIVE METHOD



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Fig. 126: Plastigauge In Bearing
Courtesy of CHRYSLER GROUP, LLC

1. With the weight of the crankshaft being supported by a jack under the counterweight adjacent to the bearing being checked.
2. Place a piece of Plastigage (1) across the entire width of the bearing shell in the cap approximately 6.35 mm (1/4 inch) off center and away from the oil holes. (In addition, suspect areas can be checked by placing the Plastigage in the suspect area). Torque the bearing cap bolts of the bearing being checked to the proper specifications.



61023069

Fig. 127: Clearance Measurement
Courtesy of CHRYSLER GROUP, LLC

3. Remove the bearing cap and compare the width of the flattened Plastigage with the metric scale provided on the package. Locate the band closest to the same width. This band shows the amount of clearance in thousandths of a millimeter. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Refer to Engine Specifications. Refer to **SPECIFICATIONS**. Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.
4. Plastigage is available in a variety of clearance ranges. The 0.025-0.076 mm (.001-.003 inch) is usually the most appropriate for checking engine bearing proper specifications.

BUSHING, TRANSMISSION PILOT

REMOVAL

REMOVAL

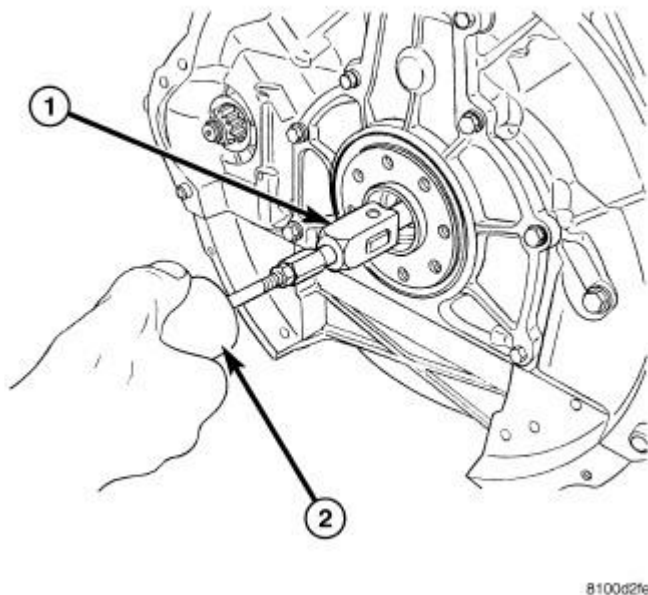


Fig. 128: Removing Crankshaft Pilot Bearing
Courtesy of CHRYSLER GROUP, LLC

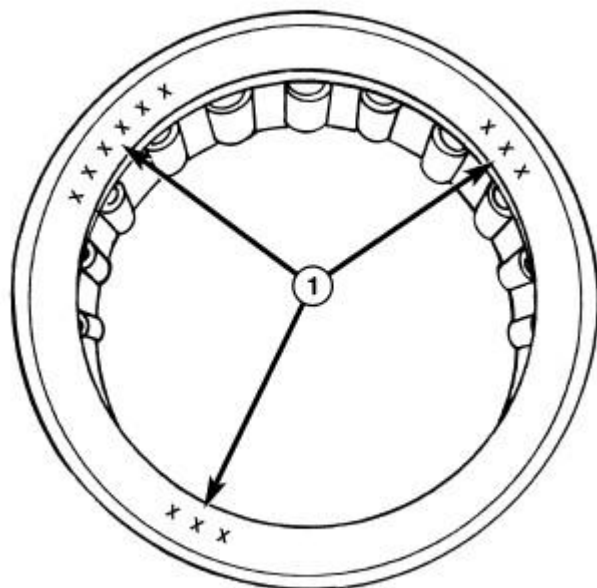
1. Remove transmission. Refer to **REMOVAL** .
2. Remove clutch and flywheel. Refer to **DISC, CLUTCH, REMOVAL** .

NOTE: Clean fly wheel flange of any thread locker debris.

3. Using seal remover (special tool #8990, Remover, Seal) (1) and slide hammer (special tool #C-3752, Slide Hammers) (2) remove pilot bearing from crankshaft.

INSTALLATION

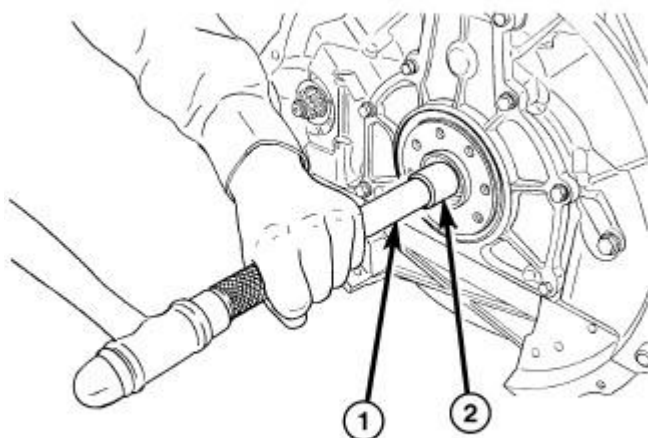
INSTALLATION



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Fig. 129: Identifying Crankshaft Pilot Bearing
 Courtesy of CHRYSLER GROUP, LLC

NOTE: New pilot bearing has special grease packed into bearing. Do not wash grease from bearing. Install bearing with part number markings (1) facing out.



8100d1f8

Fig. 130: Installing Crankshaft Pilot Bearing
 Courtesy of CHRYSLER GROUP, LLC

1. Clean pilot bearing bore and apply a light film of grease to pilot bearing bore.
2. Install pilot bearing with pilot bearing installer (special tool #9058, Installer, Pilot Bearing) (1) and driver handle (special tool #C-4171, Driver Handle, Universal) (2).

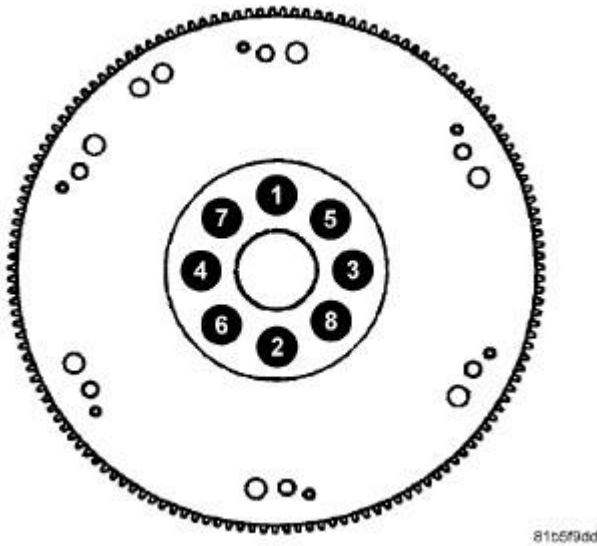


Fig. 131: Flywheel Bolt Torque Sequence
Courtesy of CHRYSLER GROUP, LLC

NOTE: Make sure there is no thread locker debris on fly wheel flange.

3. Install flywheel
4. Apply Mopar® lock AND seal adhesive to the flywheel bolts and tighten to 75 N.m (55 ft. lbs.) in the sequence shown in illustration.
5. Install clutch and pressure plate assembly. Refer to **DISC, CLUTCH, INSTALLATION** .
6. Install transmission. Refer to **INSTALLATION** .

CAMSHAFT, ENGINE

DESCRIPTION

DESCRIPTION

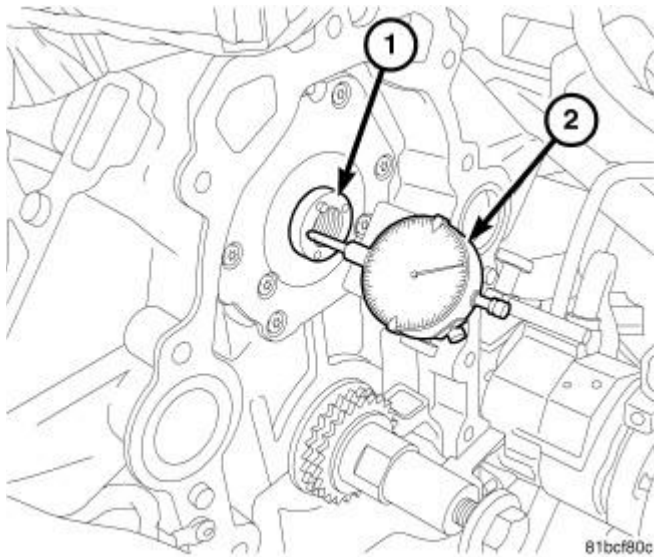


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Fig. 132: Camshaft

Courtesy of CHRYSLER GROUP, LLC

The camshaft is designed for variable valve timing. The exhaust lobes can be rotated independently from the intake lobes. The camshaft consists of an inner shaft and an outer shaft along with journals and lobes. The intake lobes are pinned to the inner shaft and the exhaust lobes are a press fit to the outer shaft.

STANDARD PROCEDURE**STANDARD PROCEDURE - CAMSHAFT END-PLAY**

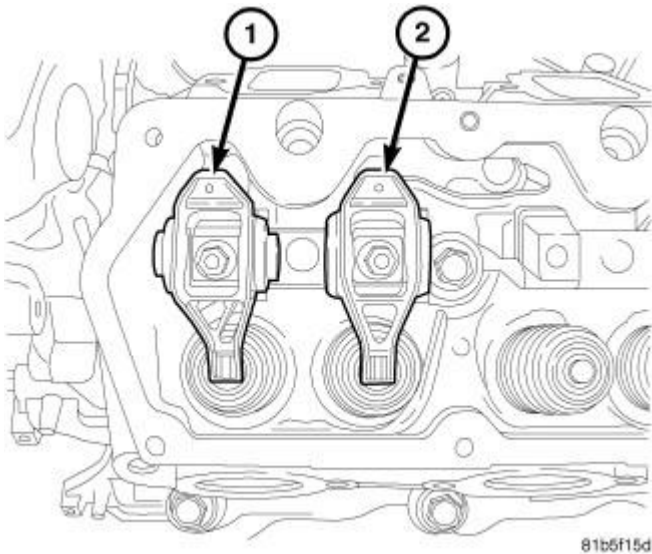
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Fig. 133: Camshaft End-Play

Courtesy of CHRYSLER GROUP, LLC

1. Install dial indicator (2) on the camshaft (1).

2. Push the camshaft towards the rear of the engine and zero the dial indicator.
3. Push the camshaft towards the front of the engine block and record the reading.
4. Measure camshaft end-play 0.101 - 0.228 mm (0.0040 - 0.0090 in.). Refer to **SPECIFICATIONS**.
5. If the reading is out of specification, replace camshaft thrust plate.

REMOVAL**REMOVAL****Fig. 134: Rocker Arm Id**

Courtesy of CHRYSLER GROUP, LLC

NOTE: Rocker arms are intake (2) and exhaust (1) specific. Rocker arms, push rods, and hydraulic tappets locations should be identified to be replaced in their original location.

NOTE: When removing rocker arms, do not remove the bolt from rocker arm.

1. Remove cylinder heads. Refer to **CYLINDER HEAD, REMOVAL**.
2. Remove hydraulic tappets.
3. Remove timing chain case. Refer to **COVER(S), ENGINE TIMING, REMOVAL**.

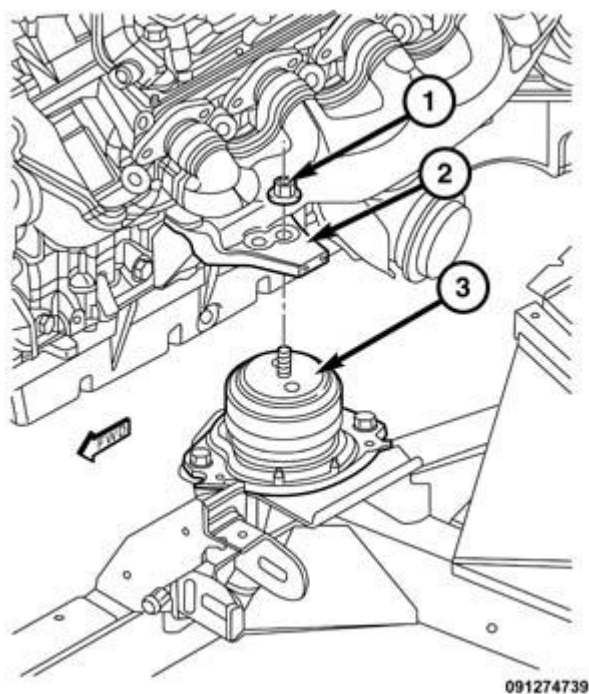


Fig. 135: Engine Mount, Bracket & Nut
Courtesy of CHRYSLER GROUP, LLC

4. Remove left and right engine mount nuts (2).
5. Install oil pan with two bolts.
6. Lower vehicle.

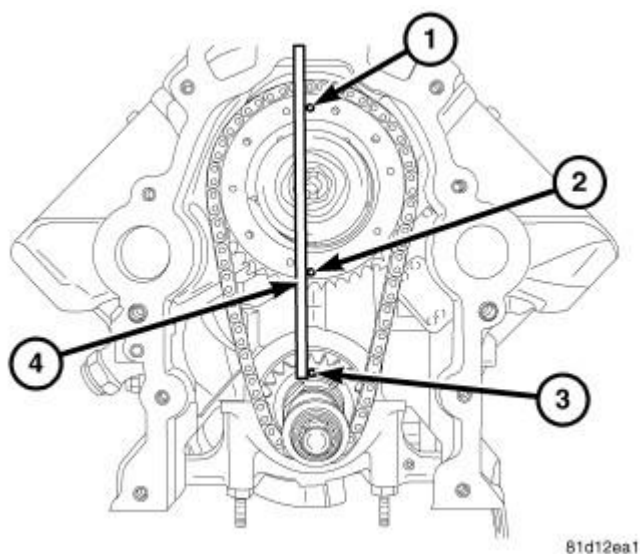


Fig. 136: Timing Marks
Courtesy of CHRYSLER GROUP, LLC

7. Align timing marks (2, 3) using a straight edge (4).

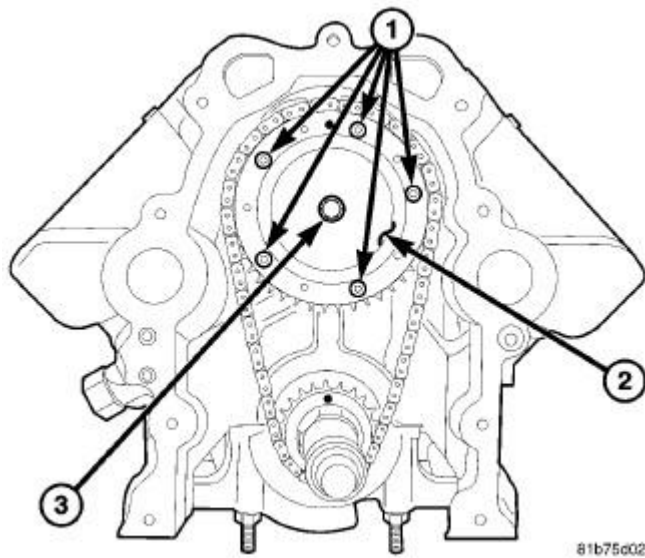


Fig. 137: Cam Drive Plate
 Courtesy of CHRYSLER GROUP, LLC

8. Remove cam phaser drive plate inner bolt (3) and outer bolts (1).
9. Remove cam phaser drive plate (2).

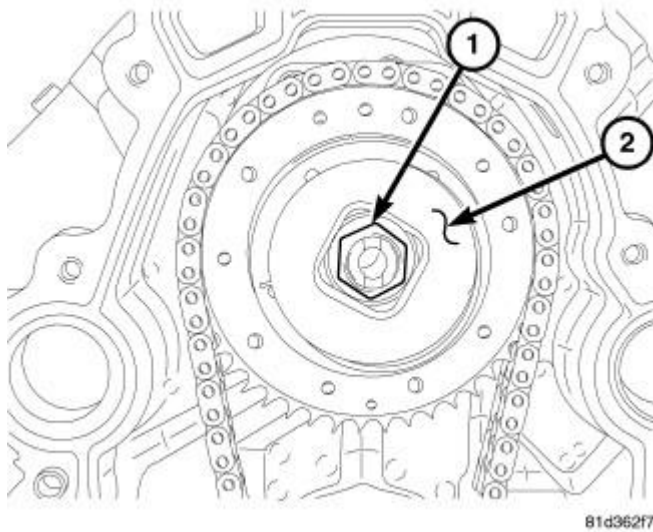


Fig. 138: Phaser Bolt
 Courtesy of CHRYSLER GROUP, LLC

10. Remove phaser/sprocket retaining bolt (1).
11. Remove camshaft phaser/sprocket (2) and timing chain.

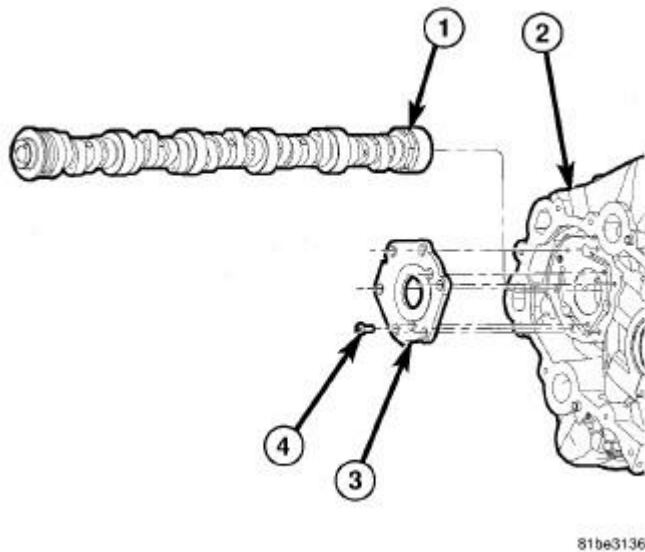


Fig. 139: Camshaft Installation

Courtesy of CHRYSLER GROUP, LLC

12. Remove camshaft thrust plate bolts (4) and thrust plate (3).

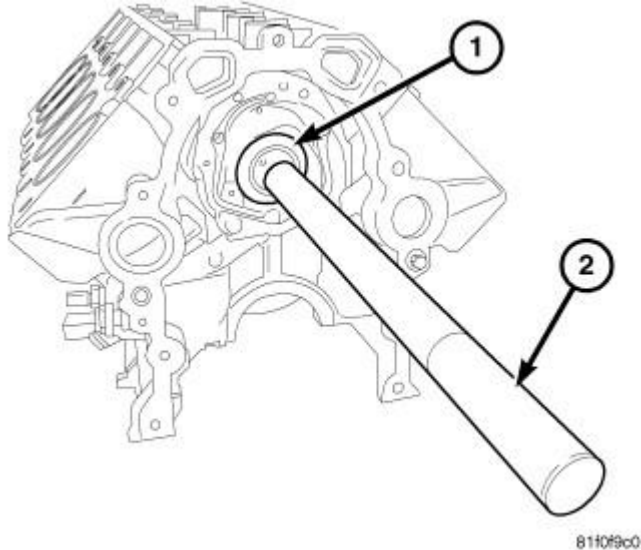
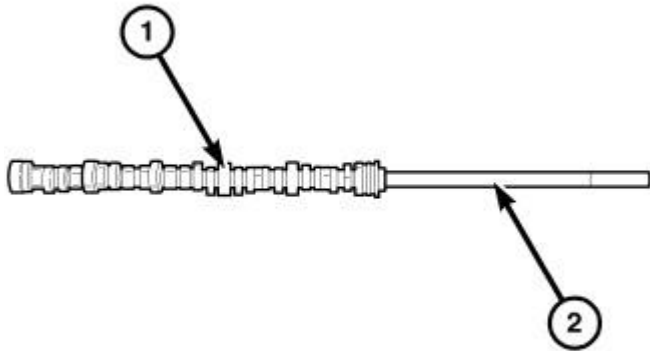


Fig. 140: Removing/Installing Camshaft

Courtesy of CHRYSLER GROUP, LLC

13. Place an appropriate jack and a block of wood under the oil pan. Raise engine enough to install (special tool #10132, Handle, Camshaft) (2).
14. Install camshaft handle (2) into camshaft (1).
15. Remove camshaft (1) from engine block using camshaft handle (2) being careful not to damage camshaft bearing surfaces with the cam lobes.

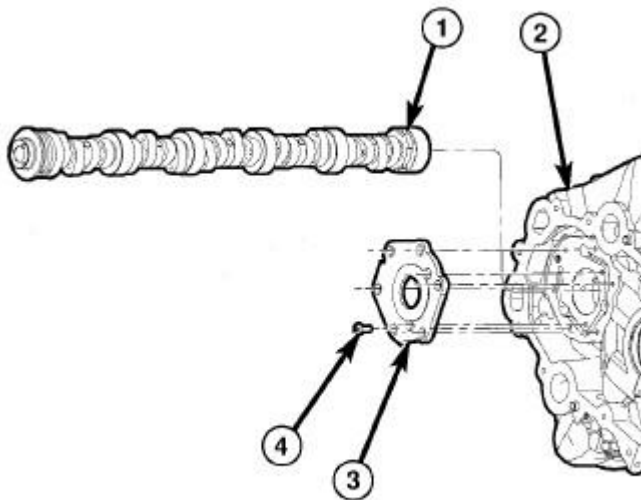
INSTALLATION

INSTALLATION

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Fig. 141: Camshaft Installation Tool 10132
Courtesy of CHRYSLER GROUP, LLC

1. Install (special tool #10132, Handle, Camshaft) (2) into camshaft (1).



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Fig. 142: Camshaft Installation
Courtesy of CHRYSLER GROUP, LLC

2. Lubricate camshaft lobes and camshaft bearing journals with clean engine oil.
3. Install camshaft (1) into engine block (2) with camshaft handle being careful not to damage camshaft bearing surfaces with the cam lobes.

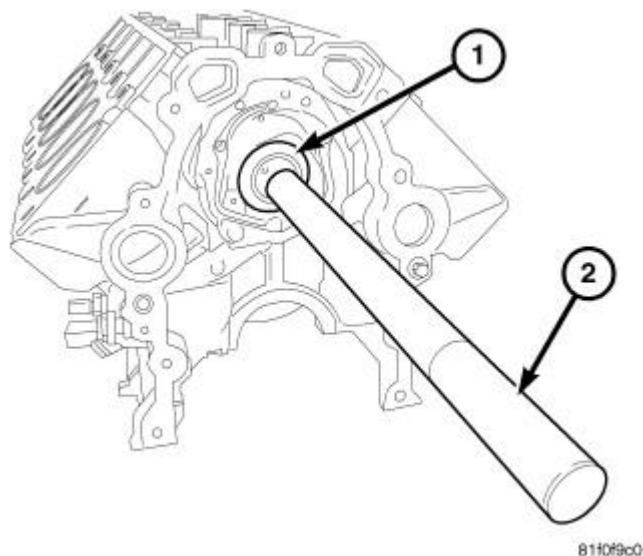


Fig. 143: Removing/Installing Camshaft
Courtesy of CHRYSLER GROUP, LLC

4. Remove camshaft handle (2) from camshaft (1).

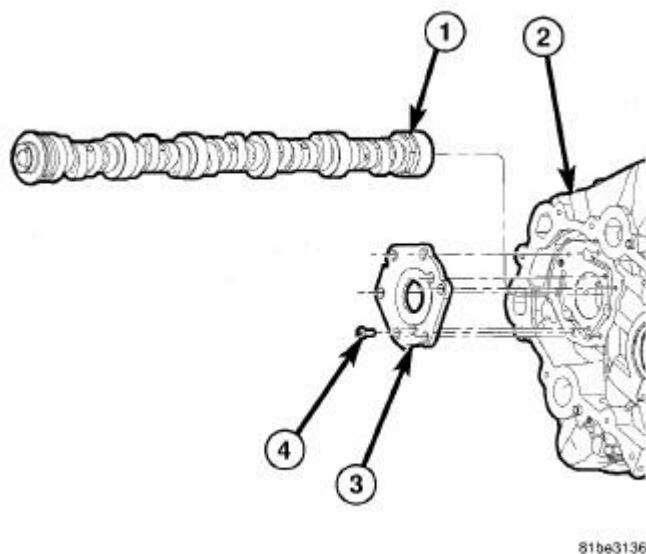


Fig. 144: Camshaft Installation
Courtesy of CHRYSLER GROUP, LLC

5. Position camshaft thrust plate (3) and apply Mopar® lock AND seal adhesive and install retaining screws (4).

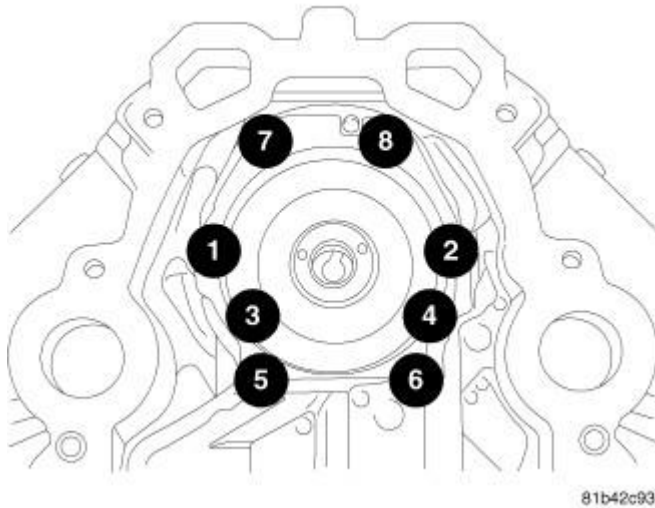


Fig. 145: Cam Thrust Plate Torque Sequence
Courtesy of CHRYSLER GROUP, LLC

6. Tighten screws to 13 N.m (115 in. lbs.) in the sequence shown in illustration.

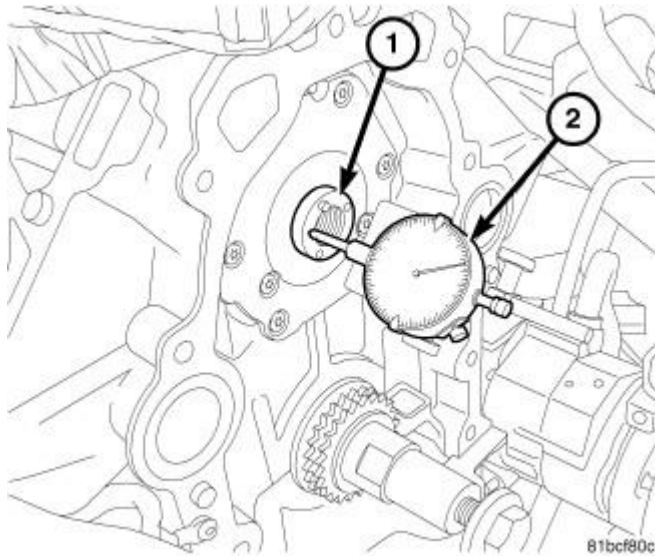


Fig. 146: Camshaft End-Play
Courtesy of CHRYSLER GROUP, LLC

7. Measure camshaft end play with a dial indicator (2). Refer to **CAMSHAFT, ENGINE, STANDARD PROCEDURE**. End Play should measure 0.0127 - 0.381 mm (0.005 - 0.015 in.) and 0.381 mm (0.015 in. Max.). If not within limits, install a new thrust plate.

NOTE: If camshaft will not rotate freely, remove thrust plate and check camshaft rotation. If camshaft does not rotate freely with thrust plate removed, check camshaft for straightness and camshaft to block clearance.

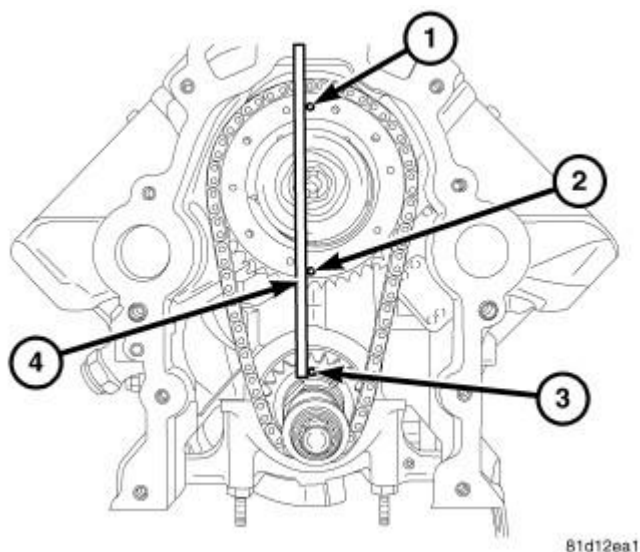


Fig. 147: Timing Marks

Courtesy of CHRYSLER GROUP, LLC

8. Align timing marks (2, 3) and dowel pin (1) with a straight edge (4).
9. Install timing chain and camshaft sprocket.

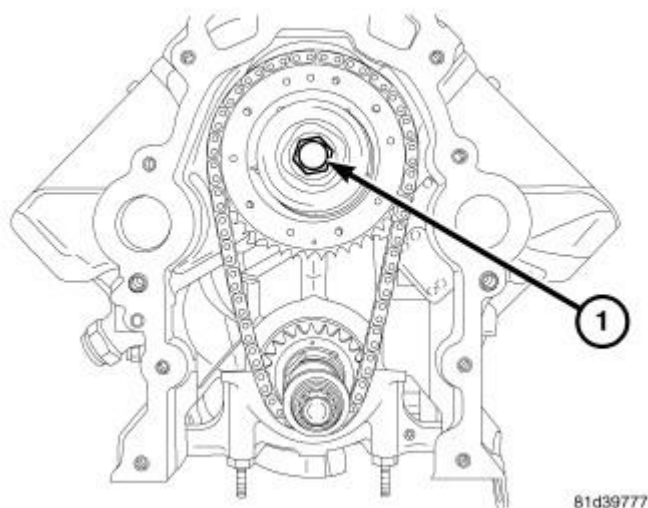
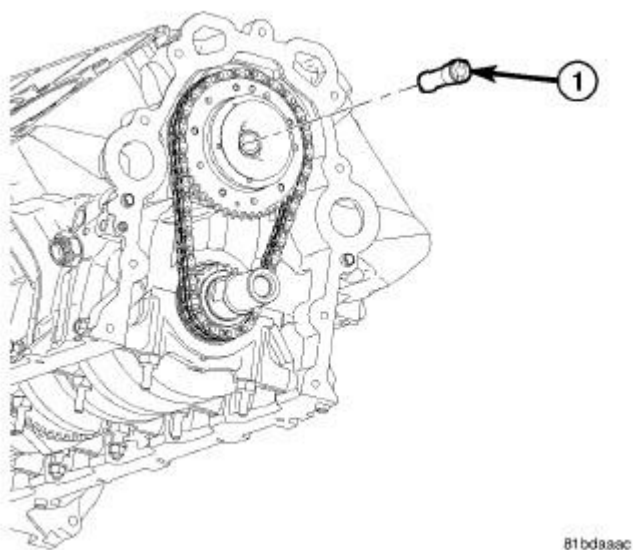


Fig. 148: Phaser Bolt

Courtesy of CHRYSLER GROUP, LLC

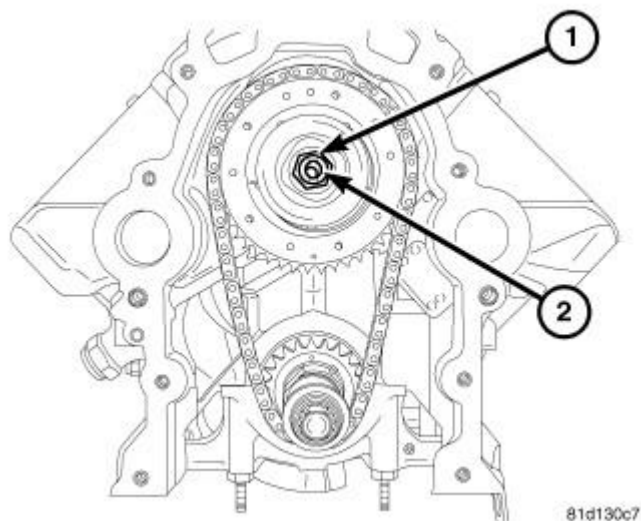
NOTE: Place a block of wood between the crankshaft counter weight and engine block to stop engine from rotating while tighten bolt.

10. Install camshaft phaser/sprocket assembly M-22 retaining bolt (1) and tighten to N.m 165 (121 ft. lbs.).

**Fig. 149: Phaser Drive Shaft**

Courtesy of CHRYSLER GROUP, LLC

11. Install camshaft phaser driveshaft (1) and rotate counter clockwise so the slot is in the 12 O'clock position.

**Fig. 150: Locating Slot & 12 O'clock Position**

Courtesy of CHRYSLER GROUP, LLC

12. Verify that the slot is in the 12 O'clock position (1).

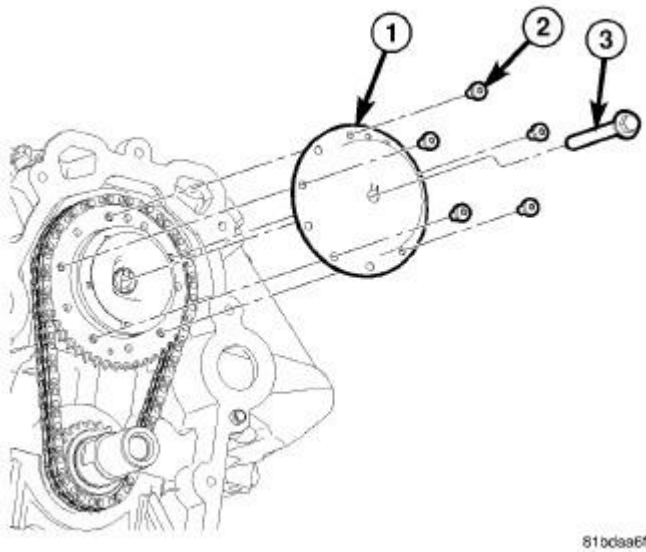


Fig. 151: Phaser Drive Plate

Courtesy of CHRYSLER GROUP, LLC

13. Position camshaft drive plate/cover (1) in place and install cover bolts (2).

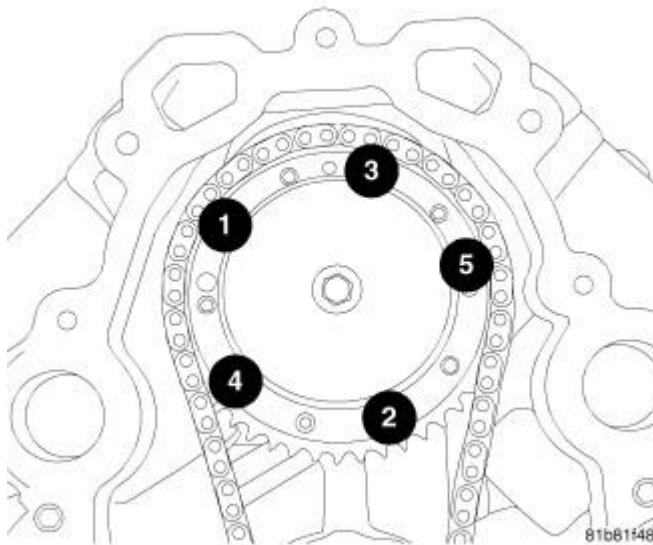


Fig. 152: Drive Plate Outer Bolt Torque Sequence

Courtesy of CHRYSLER GROUP, LLC

14. Tighten bolts to 12 N.m (106 in. lbs.) in the sequence shown in illustration.

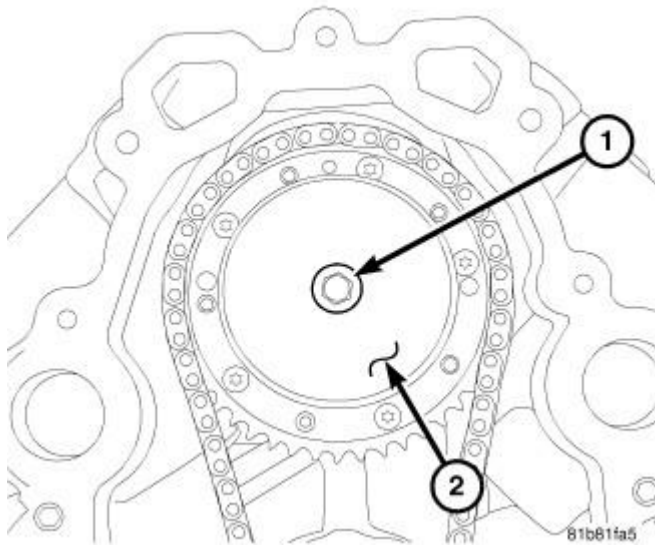


Fig. 153: Drive Plate Bolt

Courtesy of CHRYSLER GROUP, LLC

NOTE: Place a block of wood between the crankshaft counter weight and engine block to stop engine from rotating while tighten bolt.

15. Install camshaft drive plate/cover center retaining bolt (1) and tighten to 80 N.m (59 ft. lbs.).

CAUTION: If Camshaft lobes are worn, requiring camshaft replacement, it is necessary to replace the tappets also.

16. Install hydraulic tappets. Refer to **LIFTER(S), HYDRAULIC, INSTALLATION.**
17. Install timing chain case cover. Refer to **COVER(S), ENGINE TIMING, INSTALLATION.**

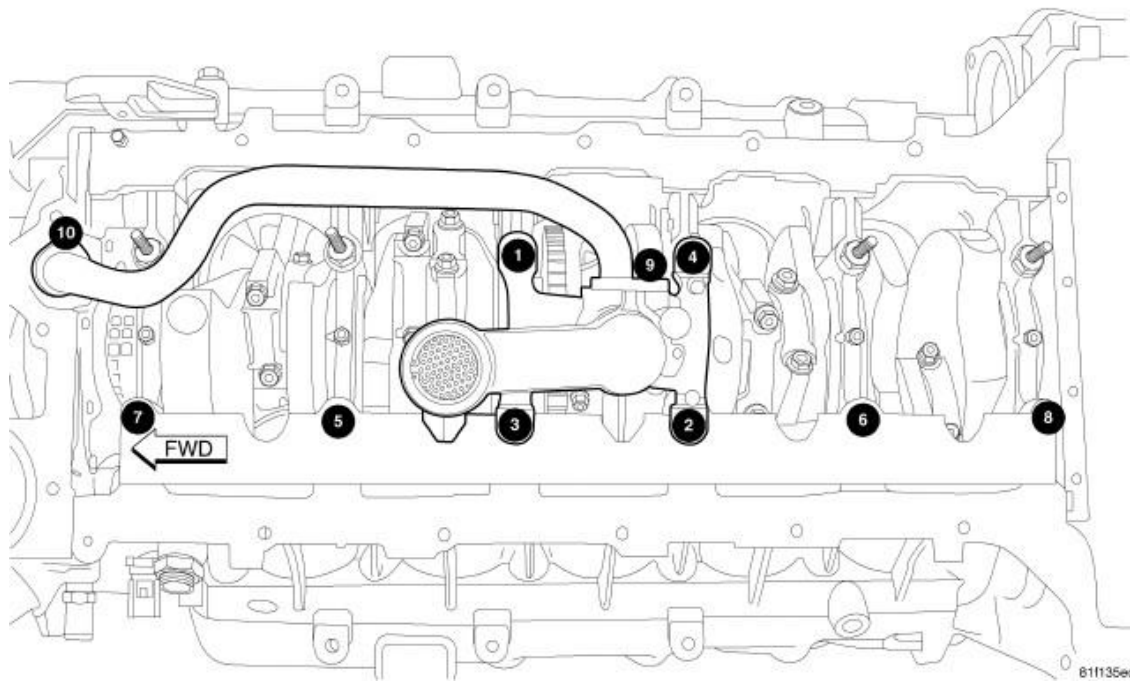


Fig. 154: Oil Pump Pick-Up Tube Torque Sequence
Courtesy of CHRYSLER GROUP, LLC

18. Inspect oil pump pick-up tube O-rings, replace as necessary. Install oil pump pick-up tube. Tighten bolts to 28 N.m (21 ft. lbs.). Refer to **PUMP, ENGINE OIL, INSTALLATION**.
19. Install oil pan gasket and oil pan. Refer to **PAN, OIL, INSTALLATION**.

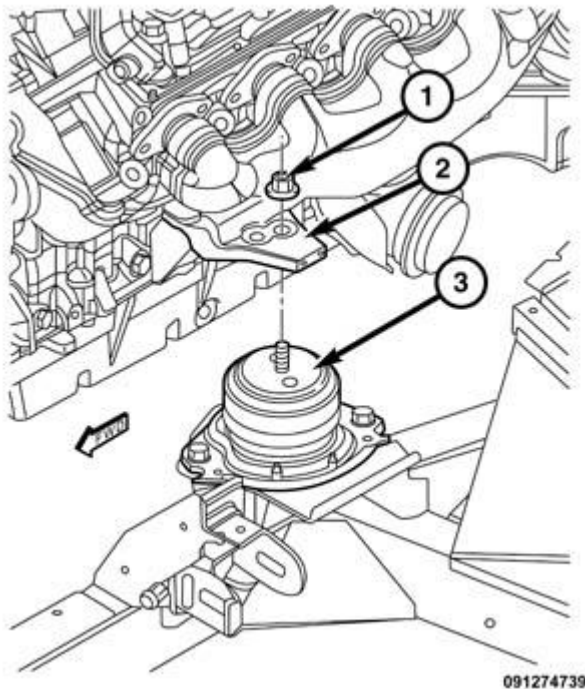


Fig. 155: Engine Mount, Bracket & Nut

Courtesy of CHRYSLER GROUP, LLC

20. Lower engine.
21. Install engine mount nut (2) and tighten to 102 N.m (75 ft. lbs.).
22. Install cylinder heads. Refer to **CYLINDER HEAD, INSTALLATION**.

CRANKSHAFT

STANDARD PROCEDURE

MEASURING CRANKSHAFT END PLAY

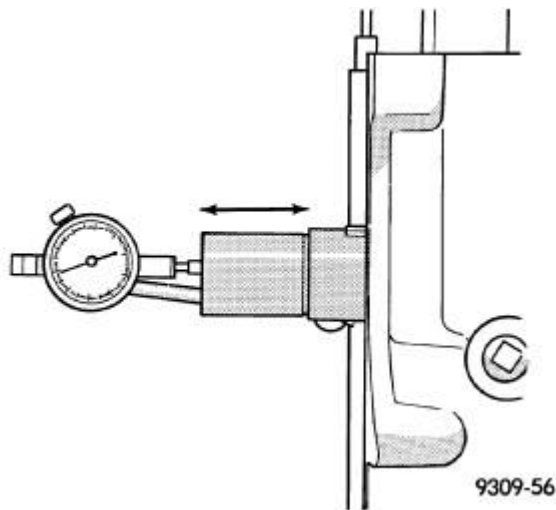


Fig. 156: Measuring Crankshaft End Play
Courtesy of CHRYSLER GROUP, LLC

1. Mount a dial indicator to front of engine, locating probe on nose of crankshaft.
2. Move crankshaft all the way to the rear of its travel.
3. Zero the dial indicator.
4. Move crankshaft all the way to the front and read the dial indicator for crankshaft end-play specifications. Refer to **SPECIFICATIONS**.

CRANKSHAFT JOURNAL MEASUREMENT

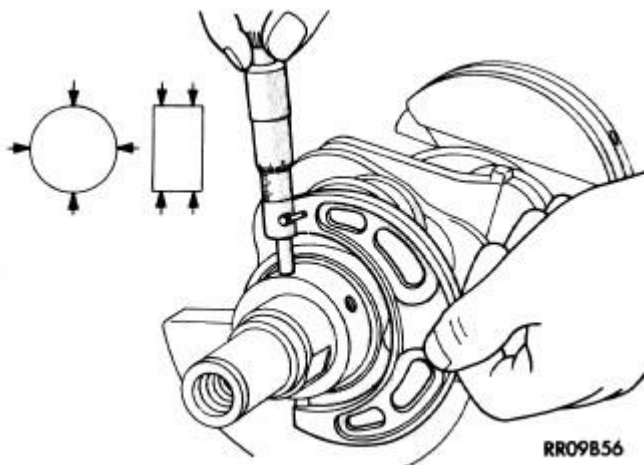


Fig. 157: Crankshaft Journal Measurements
Courtesy of CHRYSLER GROUP, LLC

The crankshaft journals should be checked for excessive wear, taper and scoring. Limits of taper or out-of-round on any crankshaft journals should be held to 0.005 mm (0.0002 in.). If the journals do not meet specifications, replace the crankshaft. DO NOT grind thrust faces of No. 3 main bearing. DO NOT nick crank pin or bearing fillets.

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.

1. Measure the journal outside diameter in a minimum of two locations and directions as illustrated for crankshaft specifications. Refer to **SPECIFICATIONS**.

REMOVAL

REMOVAL

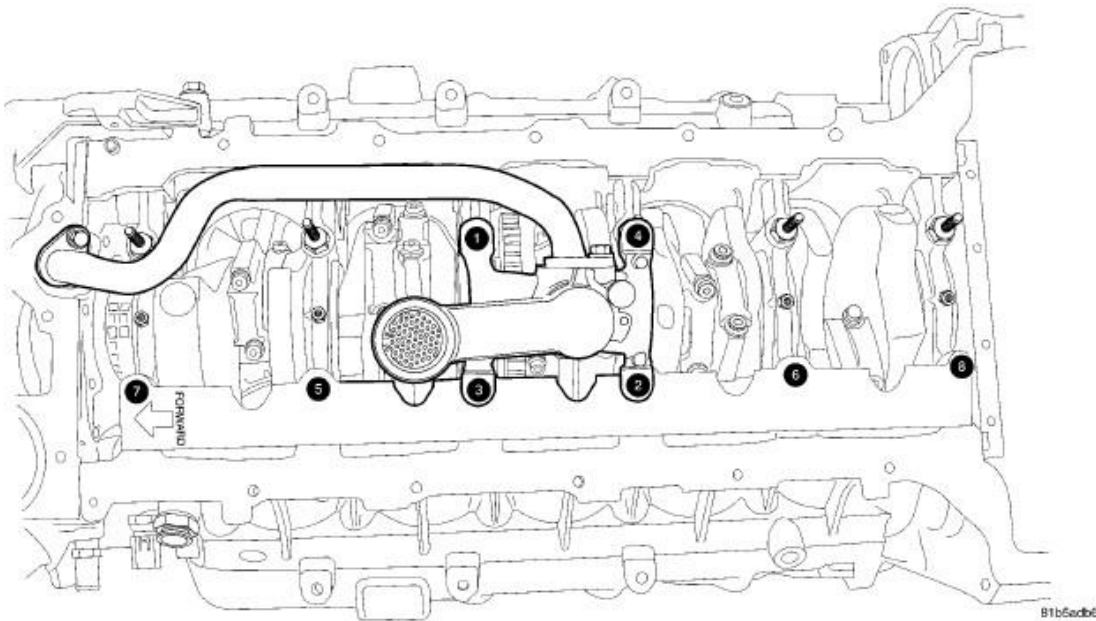


Fig. 158: Oil Pick Up Assembly

Courtesy of CHRYSLER GROUP, LLC

1. Remove engine assembly from vehicle. Refer to **REMOVAL**.
2. Remove clutch assembly. Refer to **DISC, CLUTCH, REMOVAL**.
3. Remove flywheel. Refer to **FLYWHEEL, REMOVAL**.
4. Mount engine on a suitable repair stand.
5. Remove oil pan. Refer to **PAN, OIL, REMOVAL**.
6. Remove crankshaft rear oil seal retainer. Refer to **RETAINER, CRANKSHAFT REAR OIL SEAL, REMOVAL**.
7. Remove crankshaft pulley and damper. Refer to **DAMPER, VIBRATION, REMOVAL**.
8. Remove timing chain cover. Refer to **COVER(S), ENGINE TIMING, REMOVAL**.
9. Remove timing chain. Refer to **CHAIN AND SPROCKETS, TIMING, REMOVAL**.
10. Remove oil pump pick up tube.
11. Remove swinging oil pump pick up assembly.
12. Remove crankshaft oil scraper.

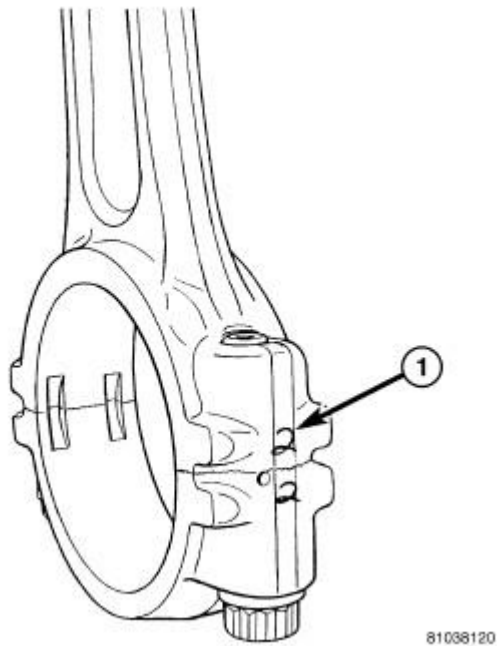


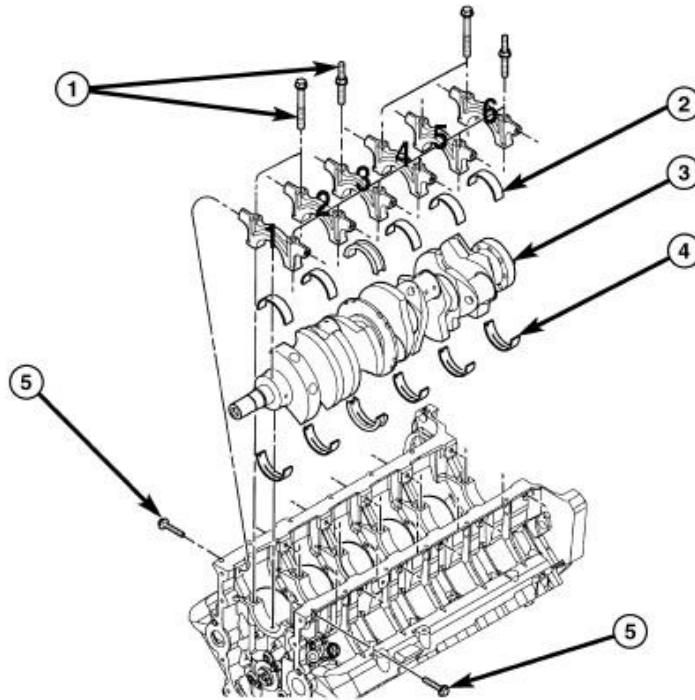
Fig. 159: Connecting Rod To Cylinder Identification
Courtesy of CHRYSLER GROUP, LLC

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods. Damage to connecting rod could occur.

13. Inspect connecting rods and connecting rod caps for cylinder identification. Identify them if necessary using a permanent ink, paint marker or engraver.

CAUTION: Care must be taken not to damage the fractured rod and cap joint face surfaces, as engine damage may occur.

14. Remove connecting rod bolts and caps.



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Fig. 160: Identifying Engine Block & Crankshaft
Courtesy of CHRYSLER GROUP, LLC

15. Main bearing caps are not interchangeable and should be marked before removal to ensure correct reassembly.
16. Remove the side main bearing cap bolts and main bearing cap bolts.
17. Remove the main bearing caps.
18. When removing the crankshaft, it should be lifted straight out of the engine block. This will prevent any damage to the engine and crankshaft and bearings.

INSPECTION

INSPECTION

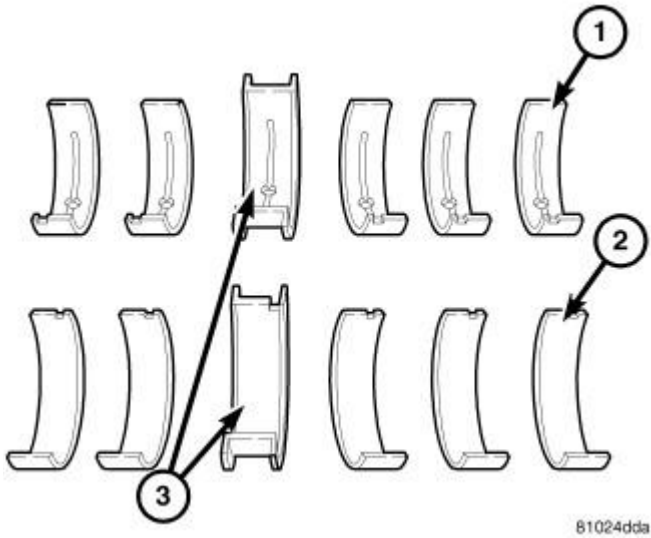
1. The crankshaft journals should be checked for excessive wear, taper and scoring or discoloration. Limits of taper or out-of-round on any crankshaft journals should be held to 0.005 mm (0.0002 in.). DO NOT nick crank pin or bearing fillets.

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.

2. Check and clean all oil holes for blockage and debris. After polishing, remove rough edges from crankshaft oil holes and clean out all passages with a brush.

INSTALLATION

INSTALLATION

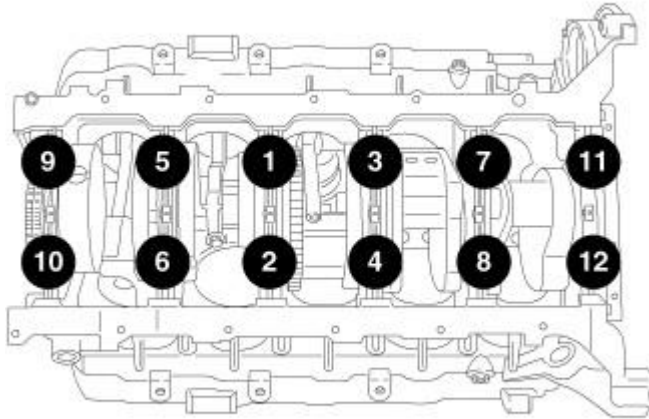
**Fig. 161: Main Bearing Identification**

Courtesy of CHRYSLER GROUP, LLC

1. Install clean upper main bearing shells into clean engine block (1).

NOTE: Make sure that the bearing tangs are seated in the machined groove in the caps and block.

2. Lubricate upper main bearing shells with clean engine oil.
3. Install the clean crankshaft.
4. Install clean lower main bearing shells (2) into clean main bearing caps.
5. Lubricate lower main bearing shells with clean engine oil.

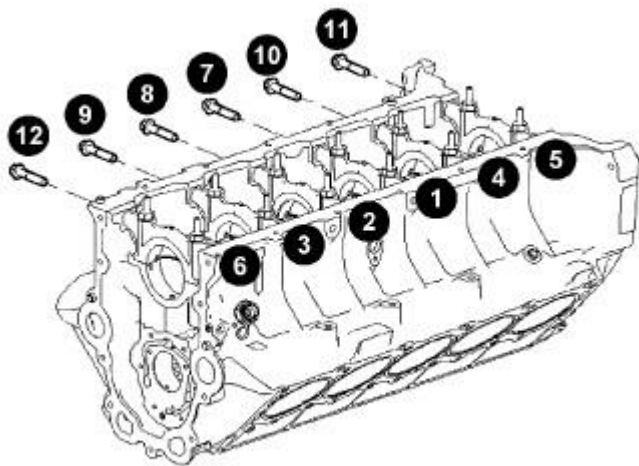


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Fig. 162: Main Bearing Cap Torque Sequence

Courtesy of CHRYSLER GROUP, LLC

6. Install each main bearing cap in proper sequence and direction. Tighten all bolts finger tight.
7. Tighten main bearing cap bolts 1-12 in the sequence shown in illustration to 20 N.m (15 ft. lbs.).
8. To ensure correct thrust bearing alignment move crankshaft all the way to the rear of its travel.
9. Then, move crankshaft all the way to the front of its travel. Wedge an appropriate tool between the rear of the cylinder block and rear crankshaft counterweight to hold the crankshaft in its forward position.
10. Tighten main bearing cap bolts 1-12 to 27 N.m (20 ft. lbs.) in the sequence shown in illustration.
11. Tighten main bearing cap bolts 1-12 to 54 N.m (40 ft. lbs.) in the sequence shown in illustration.
12. Rotate main bearing cap bolts an additional 50°.



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Fig. 163: Main Bearing Cap Side Bolt Torque Sequence

Courtesy of CHRYSLER GROUP, LLC

13. Tighten main bearing cap side bolts 1-12 to 13 N.m (115 in. lbs.) in the sequence shown in illustration.
14. Tighten main bearing cap side bolts 1-12 to 27 N.m (20 ft. lbs.) in the sequence shown in illustration.
15. Rotate main bearing cap side bolts 1-12 an additional 45°.
16. Remove the crankshaft holding tool.
17. Install new connecting rod bearings in to clean connecting rods.
18. Install rod caps. Refer to **ROD, PISTON AND CONNECTING, INSTALLATION**.

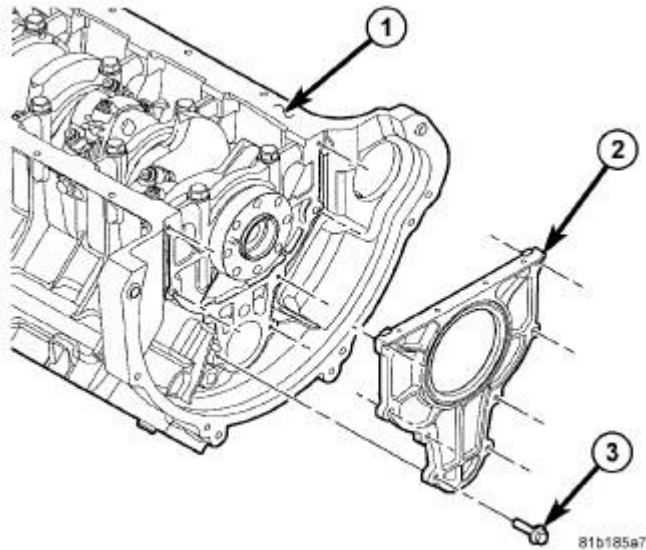
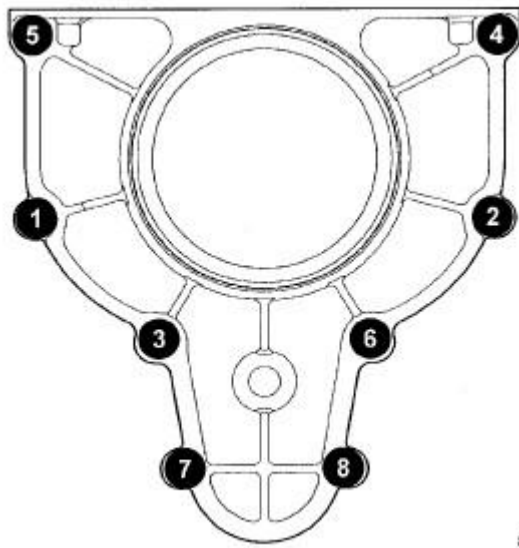


Fig. 164: Rear Main Adapter
Courtesy of CHRYSLER GROUP, LLC

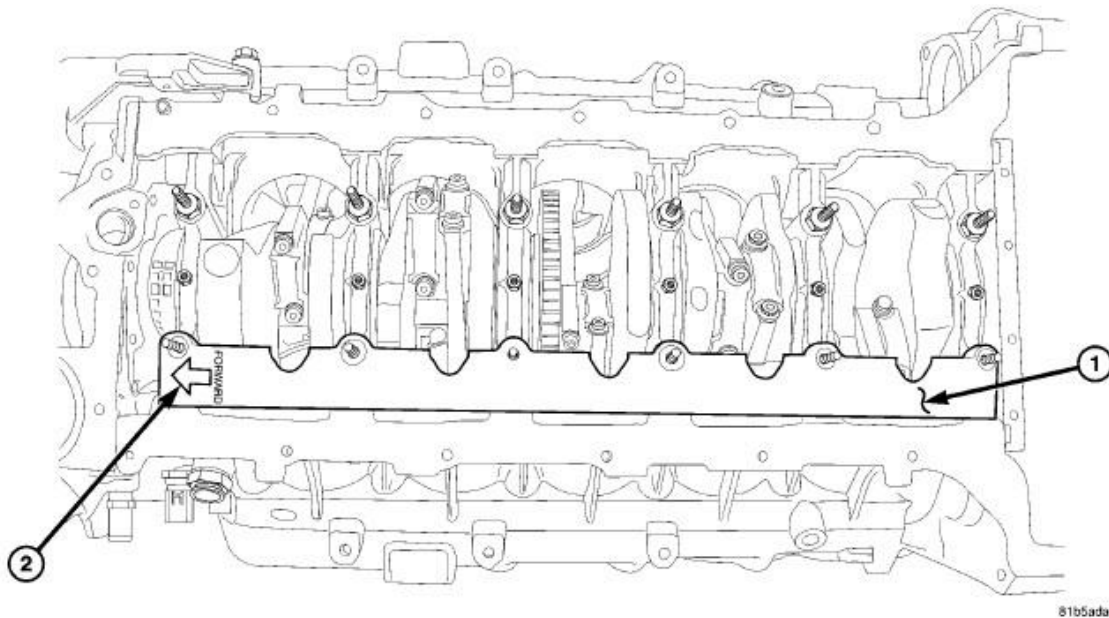
19. Install the crankshaft rear oil seal retainer (2). Refer to **RETAINER, CRANKSHAFT REAR OIL SEAL, INSTALLATION**.



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Fig. 165: Rear Main Torque Sequence
Courtesy of CHRYSLER GROUP, LLC

20. Tighten rear seal adapter retaining bolts to 11 N.m (97 in. lbs.) in the sequence shown in illustration.
21. Install timing chain. Refer to **CHAIN AND SPROCKETS, TIMING, INSTALLATION**.
22. Install timing chain cover . Refer to **COVER(S), ENGINE TIMING, INSTALLATION**.



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Fig. 166: Crankshaft Oil Scraper
Courtesy of CHRYSLER GROUP, LLC

23. Install the crankshaft oil scraper (1) with the arrow (2) pointing towards the front of the engine. Tighten nuts to 28 N.m (21 ft. lbs.).

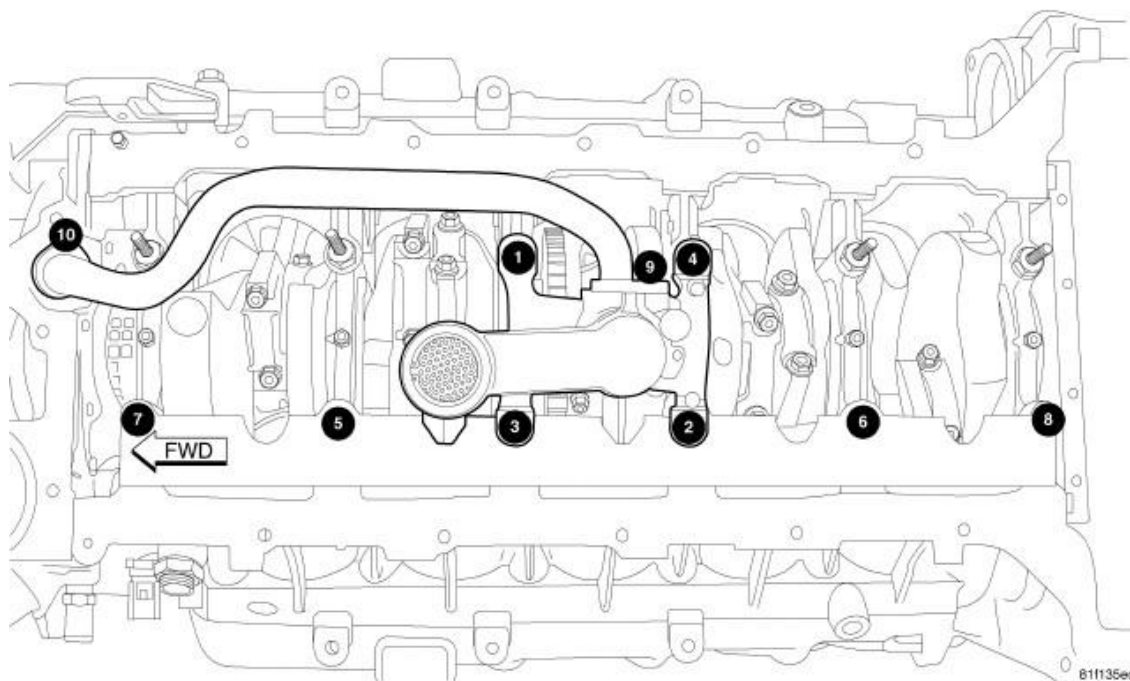


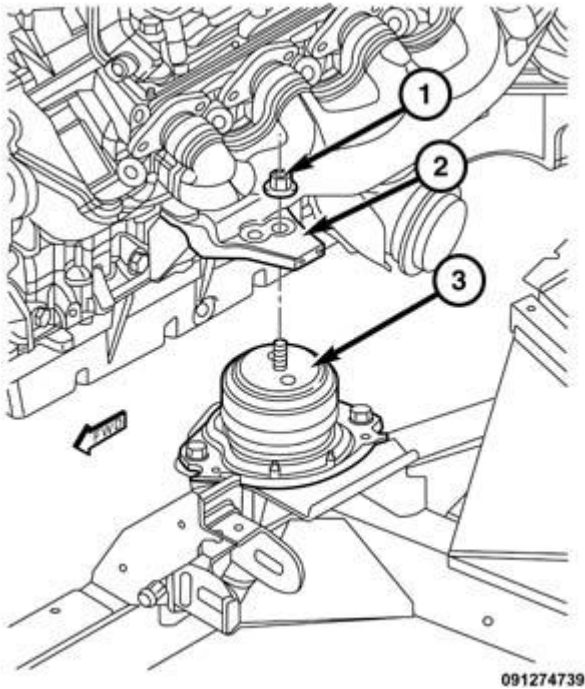
Fig. 167: Oil Pump Pick-Up Tube Torque Sequence
Courtesy of CHRYSLER GROUP, LLC

24. Install swinging oil pick-up. Refer to **PUMP, ENGINE OIL, INSTALLATION**.
25. Install oil pan and gasket. Refer to **PAN, OIL, INSTALLATION**.
26. Install crankshaft damper and pulley. Refer to **DAMPER, VIBRATION, INSTALLATION**.
27. Install engine assembly. Refer to **INSTALLATION**.

DAMPER, VIBRATION

REMOVAL

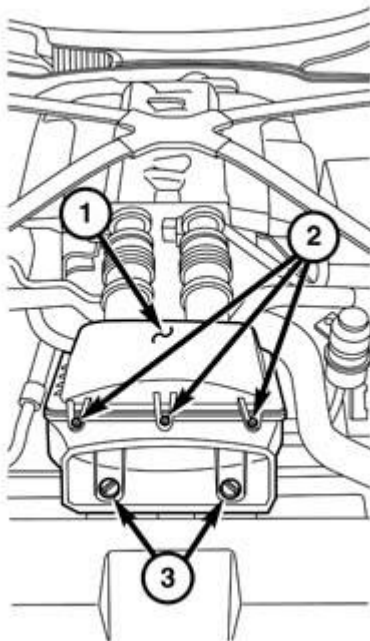
REMOVAL



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Fig. 168: Engine Mount, Bracket & Nut
Courtesy of CHRYSLER GROUP, LLC

1. Raise vehicle on hoist.
2. Remove left and right engine mount isolator to engine bracket (2) nuts (1).
3. Lower vehicle.

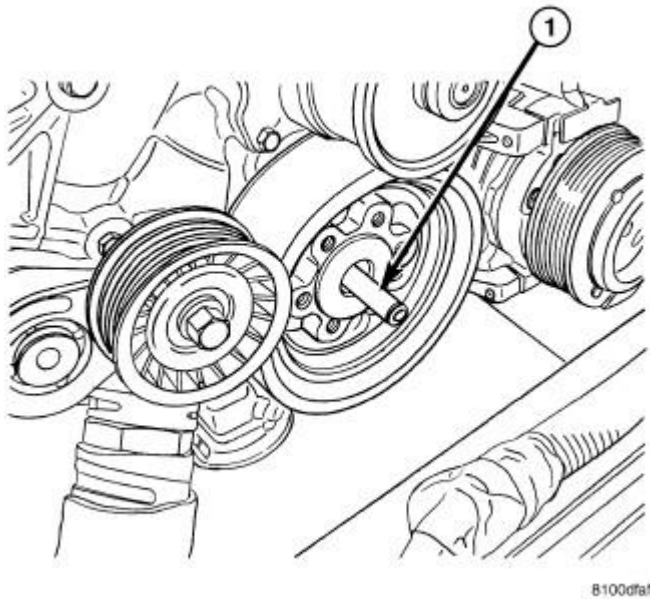


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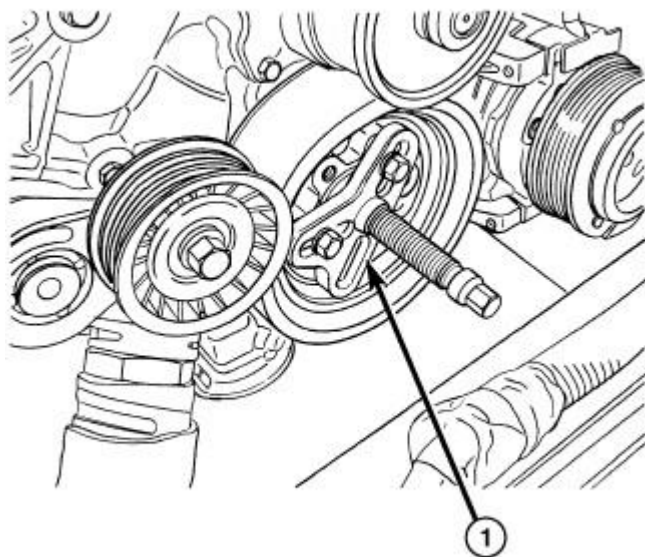
Fig. 169: Air Cleaner Housing, Cover Screws & Housing Retainers

Courtesy of CHRYSLER GROUP, LLC

4. Remove air cleaner housing (1). Refer to **BODY, AIR CLEANER, REMOVAL**.
5. Remove accessory drive belt. Refer to **BELT, SERPENTINE, REMOVAL**.

**Fig. 170: Crankshaft Insert 8194****Courtesy of CHRYSLER GROUP, LLC**

6. Remove crankshaft pulley.
7. Support engine with floor jack and wooden block on oil pan. Raise engine with floor jack enough to allow removal of crankshaft damper.
8. Remove crankshaft damper bolt.
9. Install (special tool #8194, Insert, Crankshaft) (1). Lubricate the end of crankshaft insert with wheel bearing grease or equivalent.



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Fig. 171: Removing Crankshaft Damper
Courtesy of CHRYSLER GROUP, LLC

NOTE: Lubricate the threads of the puller using Mopar® Nickel Anti-seize Compound or equivalent, before beginning crankshaft damper removal.

NOTE: Make sure puller bolts fully engage threads on damper.

10. Using a bolt-grip type universal puller (1), remove the crankshaft damper.

INSTALLATION

INSTALLATION

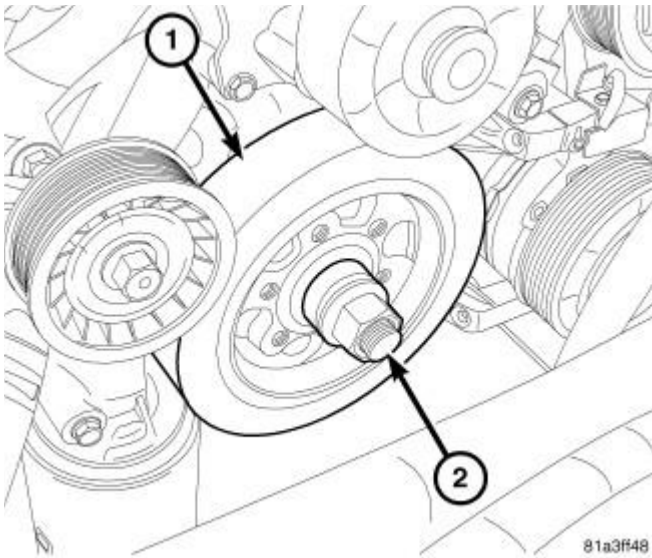


Fig. 172: Damper Installer

Courtesy of CHRYSLER GROUP, LLC

NOTE: **Inspect the crankshaft nose for high spots and remove as necessary.**

NOTE: **Lubricate the threads of Crankshaft Damper Installer (special tool #9943, Installer, Crankshaft Damper) (2) using Mopar® Nickel Anti-seize Compound or equivalent, before beginning crankshaft damper installation.**

1. Install crankshaft damper (1) using Crankshaft Damper Installer (2).
2. Place transmission in fourth gear, apply parking brake and block wheels.
3. Install and tighten damper bolt to 339 N.m (250 ft. lbs.).
4. Install the crankshaft pulley. Tighten crankshaft pulley bolts to 20 N.m (15 ft. lbs.).

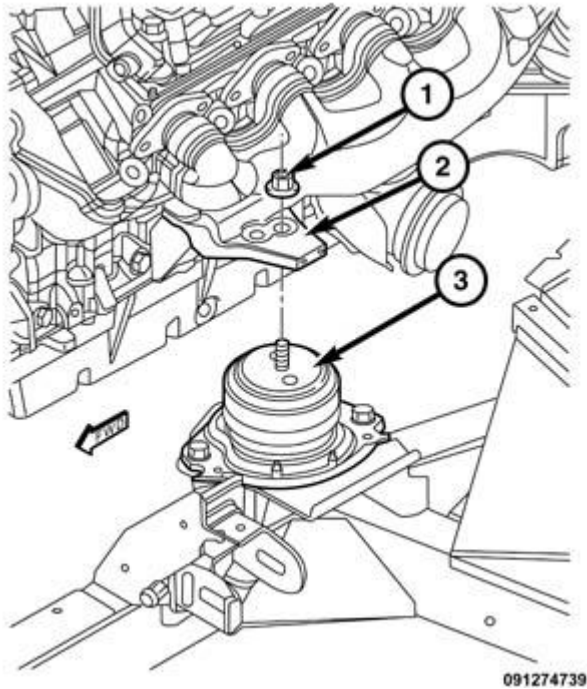
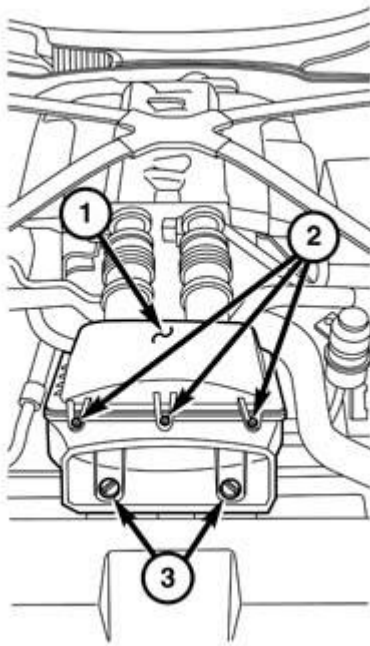


Fig. 173: Engine Mount, Bracket & Nut
Courtesy of CHRYSLER GROUP, LLC

5. Lower engine with floor jack while guiding the engine mount studs into frame bracket (2) slots.
6. Install accessory drive belt. Refer to **BELT, SERPENTINE, INSTALLATION**.

NOTE: Verify that the damper is fully seated against the crankshaft. The accessory drive belt should align with all other pulleys.

7. Raise vehicle on hoist.
8. Install engine mount isolator nut (2). Tighten nut to 102 N.m (75 ft. lbs.).
9. Lower vehicle.



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Fig. 174: Air Cleaner Housing, Cover Screws & Housing Retainers
Courtesy of CHRYSLER GROUP, LLC

10. Install air cleaner housing. Refer to **BODY, AIR CLEANER, INSTALLATION**.

LIFTER(S), HYDRAULIC

DESCRIPTION

DESCRIPTION

The roller type design hydraulic tappets are positioned in the cylinder block. Roller tappet alignment is maintained by machined flats on tappet body being fitted in pairs into ten aligning yokes.

REMOVAL

REMOVAL

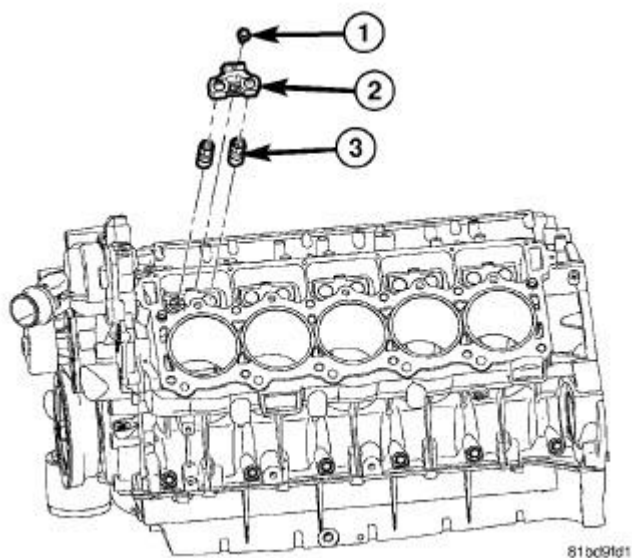


Fig. 175: Tappets

Courtesy of CHRYSLER GROUP, LLC

1. Remove cylinder head(s). Refer to CYLINDER HEAD, REMOVAL.

NOTE: If tappets (3) are to be reused, identify tappet location to ensure installation in original location.

2. Remove tappet aligning yoke bolt (1).
3. Remove tappet aligning yoke (2) and tappets (3).

INSTALLATION

INSTALLATION

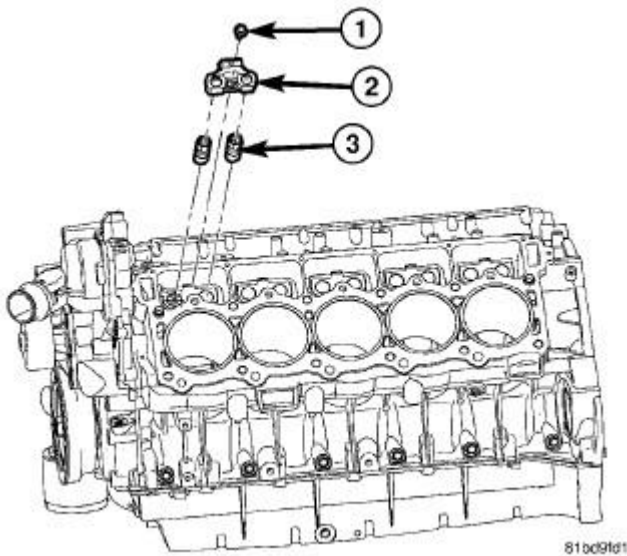


Fig. 176: Tappets

Courtesy of CHRYSLER GROUP, LLC

1. Lubricate tappets.
2. Install tappets in their original positions.

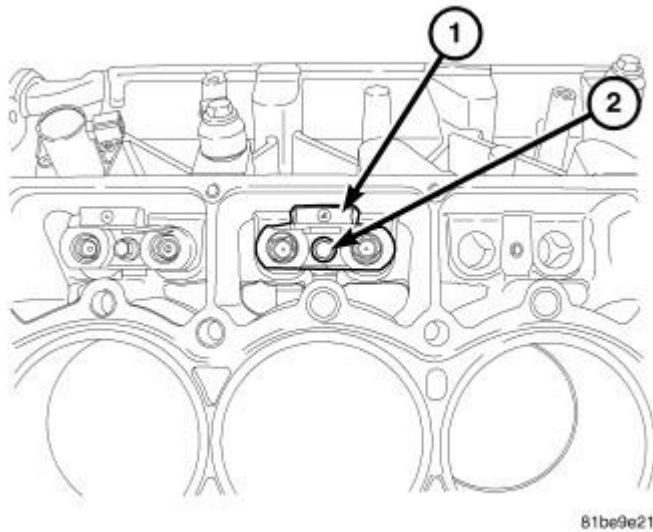


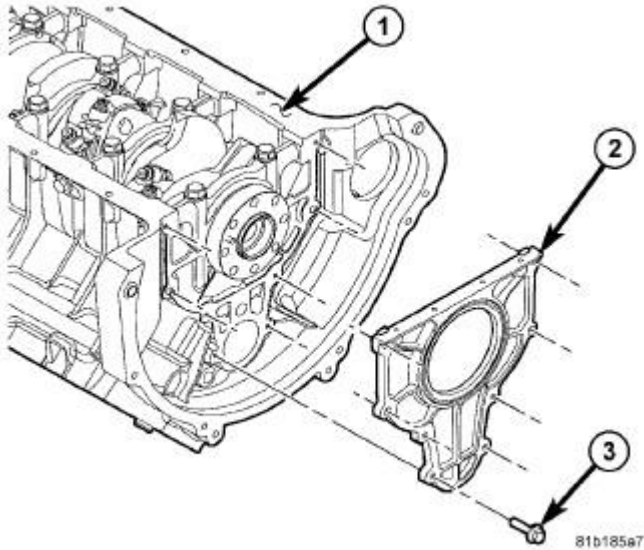
Fig. 177: Lifter Installation

Courtesy of CHRYSLER GROUP, LLC

3. Install aligning yoke assemblies (1). Apply Mopar® Lock AND Seal Adhesive (or equivalent) to the screws (2) and tighten to 11 N.m (97 in. lbs.).

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

4. Install cylinder heads. Refer to **CYLINDER HEAD, INSTALLATION**.

RETAINER, CRANKSHAFT REAR OIL SEAL**REMOVAL****REMOVAL****Fig. 178: Rear Main Adapter**

Courtesy of CHRYSLER GROUP, LLC

1. Remove the transmission. Refer to **REMOVAL**.
2. Remove the pressure plate and clutch. Refer to **FLYWHEEL, REMOVAL**.
3. Clean off any dirt or debris from crankshaft prior to removing the seal retainer (2).
4. Remove oil pan. Refer to **PAN, OIL, REMOVAL**.
5. Remove the seal retainer bolts (3) and the seal retainer (2).

INSTALLATION**INSTALLATION**

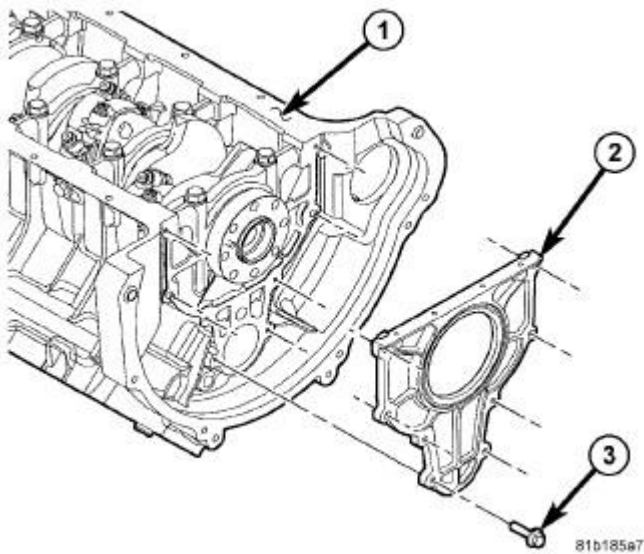


Fig. 179: Rear Main Adapter

Courtesy of CHRYSLER GROUP, LLC

1. Inspect rear crankshaft seal retainer gasket for damage. Replace as needed.
2. Verify that the seal retainer gasket is in place in the retainer.
3. Install seal retainer (2).

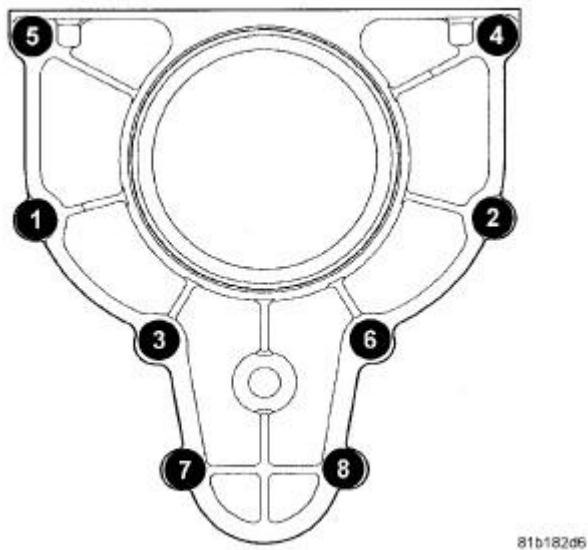


Fig. 180: Rear Main Torque Sequence

Courtesy of CHRYSLER GROUP, LLC

4. Tighten bolts to 11 N.m (97 in. lbs.) as shown in illustration.
5. Install rear crankshaft seal. Refer to **SEAL, CRANKSHAFT OIL, FRONT, INSTALLATION**.
6. Install flywheel. Refer to **FLYWHEEL, INSTALLATION**.

7. Install clutch. Refer to **DISC, CLUTCH, INSTALLATION** .
8. Install transmission. Refer to **INSTALLATION** .

RING(S), PISTON

STANDARD PROCEDURE

STANDARD PROCEDURE - MEASURING PISTON RING CLEARANCES

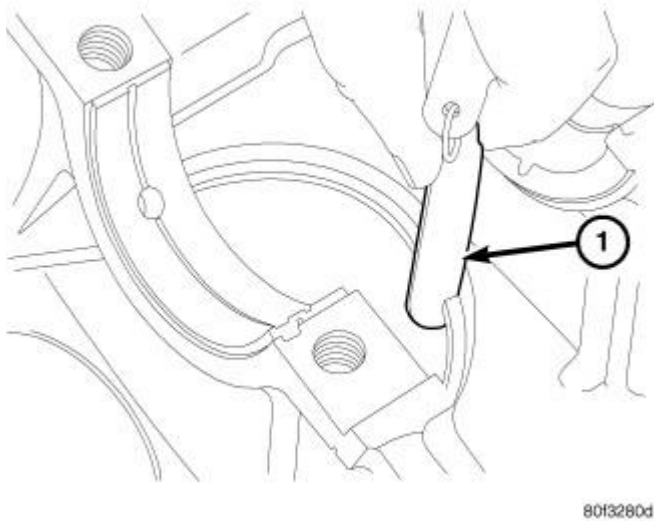


Fig. 181: Measuring Piston Ring End Gap
Courtesy of CHRYSLER GROUP, LLC

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. Measure gap with brass feeler gauge (1). for piston ring specifications. Refer to **SPECIFICATIONS**.

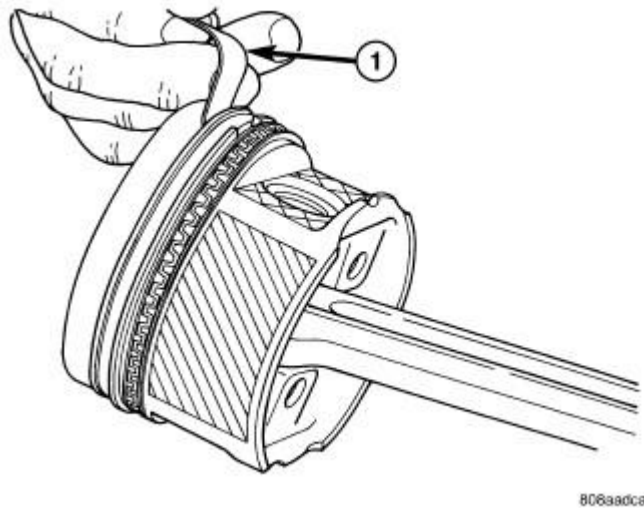


Fig. 182: Measuring Piston Ring Side Clearance
Courtesy of CHRYSLER GROUP, LLC

NOTE: Do not force feeler gauge into groove or engine damage may occur.

2. Measure piston ring side clearance with brass feeler gauge (1) for piston ring specifications. Refer to **SPECIFICATIONS**.

REMOVAL

REMOVAL

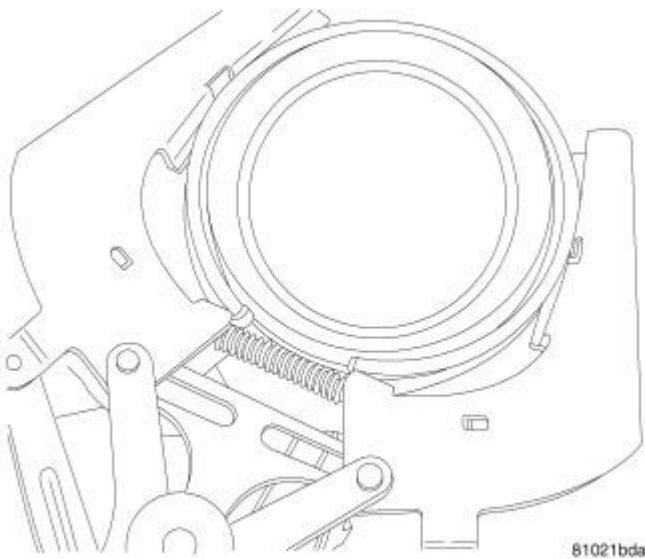


Fig. 183: Removing/Installing Piston Rings
Courtesy of CHRYSLER GROUP, LLC

1. Using a suitable ring expander, remove upper and intermediate piston rings.

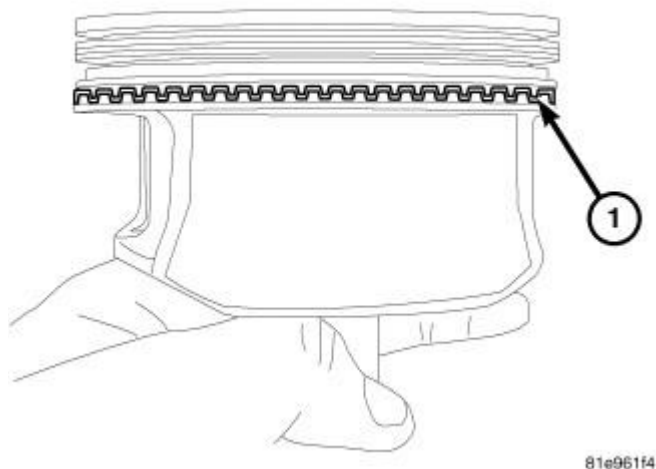
2. Remove the upper oil ring side rail, lower oil ring side rail and then oil ring expander from piston.

NOTE: Care must be taken not to remove aluminum from the piston while cleaning.

3. Clean ring grooves of any carbon deposits.

INSTALLATION

INSTALLATION

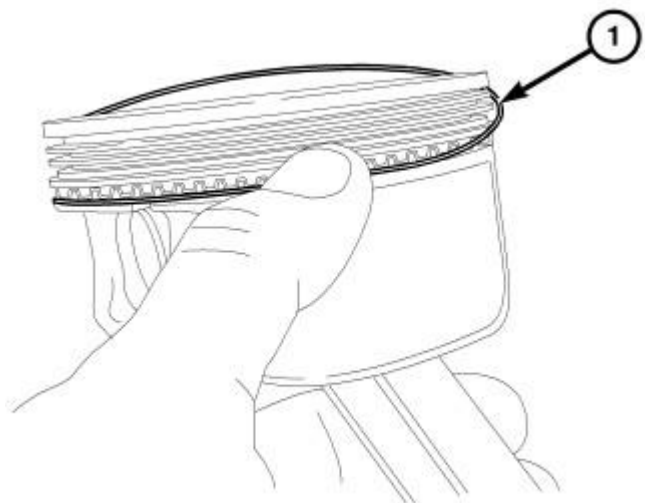


81e961f4

Fig. 184: Oil Expander

Courtesy of CHRYSLER GROUP, LLC

1. Install oil expander ring (1).

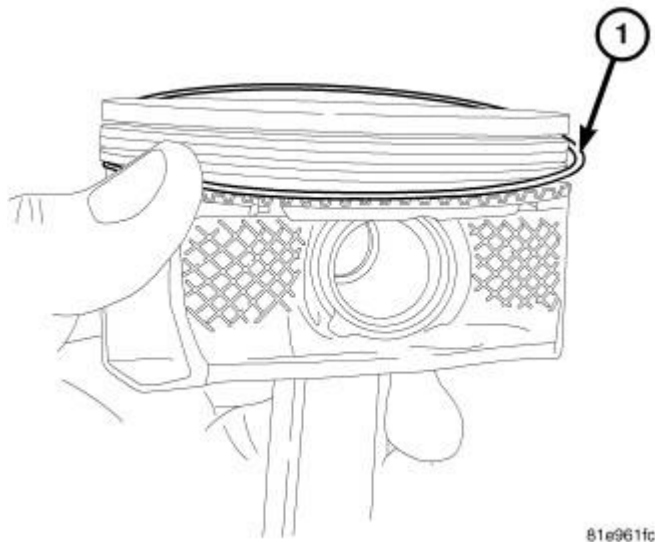


81e96222

Fig. 185: Lower Oil Rail

Courtesy of CHRYSLER GROUP, LLC

2. Install lower oil 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 (1) is in position. **Do not use a piston ring expander.**

**Fig. 186: Upper Oil Rail**

Courtesy of CHRYSLER GROUP, LLC

3. Install upper oil 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 (1) is in position. **Do not use a piston ring expander.**

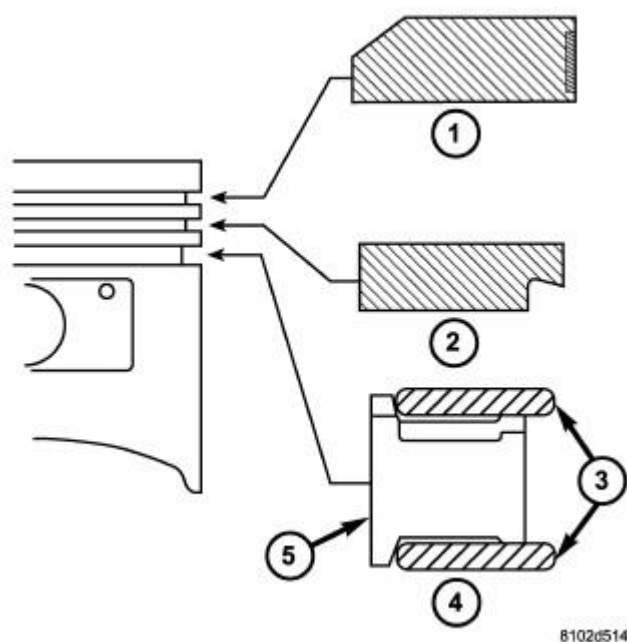


Fig. 187: Installing Piston Ring
Courtesy of CHRYSLER GROUP, LLC

CAUTION: The top compression (1) and second compression ring (2) piston rings have a different cross section. Install rings with dots facing up, to the top of the piston.

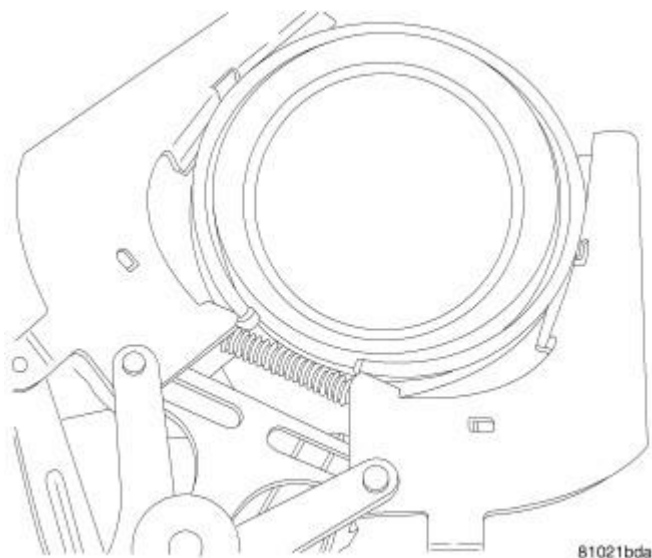
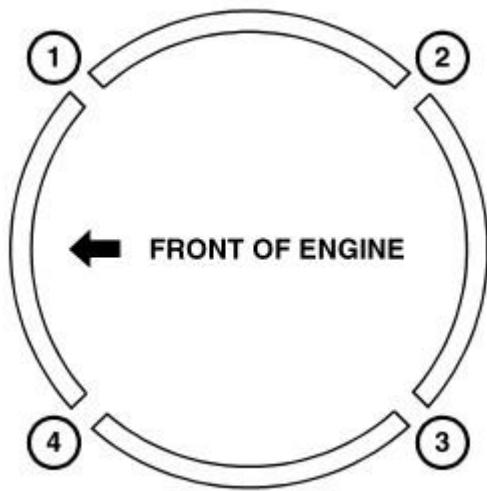


Fig. 188: Removing/Installing Piston Rings
Courtesy of CHRYSLER GROUP, LLC

4. Install No. 2 piston ring and then No. 1 piston ring using a piston ring expander.



80Baaffd

Fig. 189: Identifying Piston Ring End Gap Positions

Courtesy of CHRYSLER GROUP, LLC

NOTE: Install the piston rings so the gaps positioned as indicated with the piston viewed from the top.

NOTE: Staggering ring gap is important for oil control.

5. Install the oil expander so the ring gap is located in the (1) position.
6. Install the oil ring rails so the ring gap is located in the (2, 4) position.
7. Install the second compression ring so the ring gap is located in the (3) position.
8. Install the top compression so the ring gap is located in the (1) position.

ROD, PISTON AND CONNECTING

DESCRIPTION

DESCRIPTION

The pistons are made of cast aluminum. Three piston rings are used; two compression and one three-piece oil control ring. The piston has a floating wrist pin. The connecting rods fractured cap design connecting rod that cannot be repaired. The connecting rod also contains a wrist pin bushing. The piston and connecting rod are serviced as an assembly.

STANDARD PROCEDURE

MEASURING CONNECTING ROD SIDE CLEARANCE

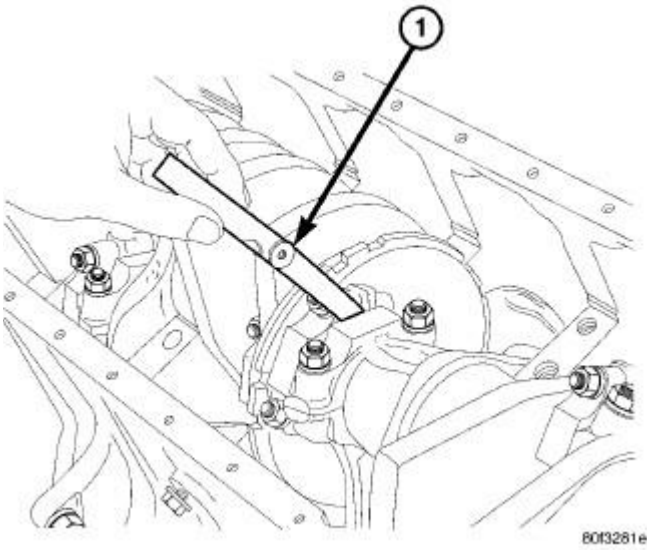


Fig. 190: Measuring Connecting Rod Side Clearance
Courtesy of CHRYSLER GROUP, LLC

1. Using a feeler gauge, measure connecting rod side clearance. For connecting rod side clearance specifications. Refer to **SPECIFICATIONS**.

PISTON FITTING

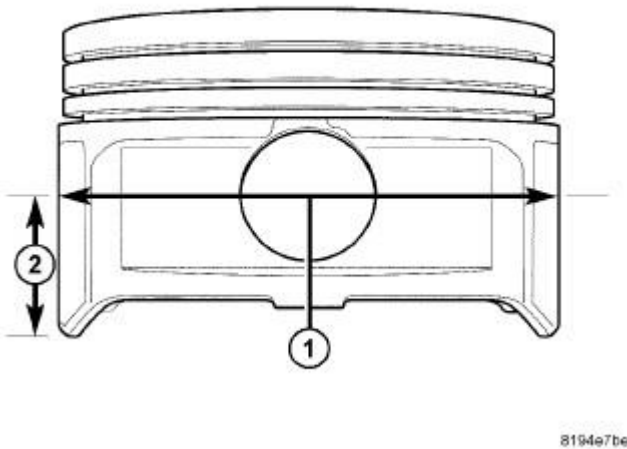


Fig. 191: Piston Measurement
Courtesy of CHRYSLER GROUP, LLC

All pistons are machined to the same weight in grams, to maintain piston balance.

Piston and cylinder wall must be clean and dry. Piston diameter (1) should be measured 90 degrees to piston pin

axis, 10 mm (0.393 in.) above bottom of the piston skirt (2) as shown in illustration.

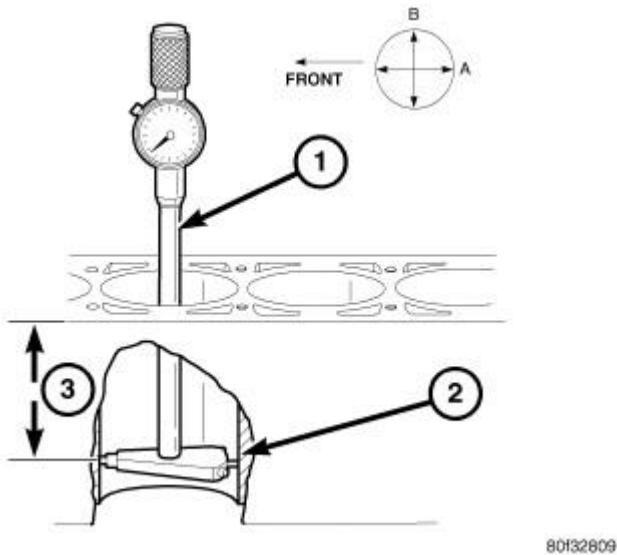


Fig. 192: Measuring Cylinder Bore Size
Courtesy of CHRYSLER GROUP, LLC

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

Cylinder bores should be measured halfway down or below the deck surface (3) with a dial bore gauge (1). The cylinder bore (2) should be measured and perpendicular (B) to the engine crankshaft center line (A) as shown in illustration. Refer to the specification table for cylinder bore and piston specifications. Refer to

SPECIFICATIONS.

REMOVAL

REMOVAL

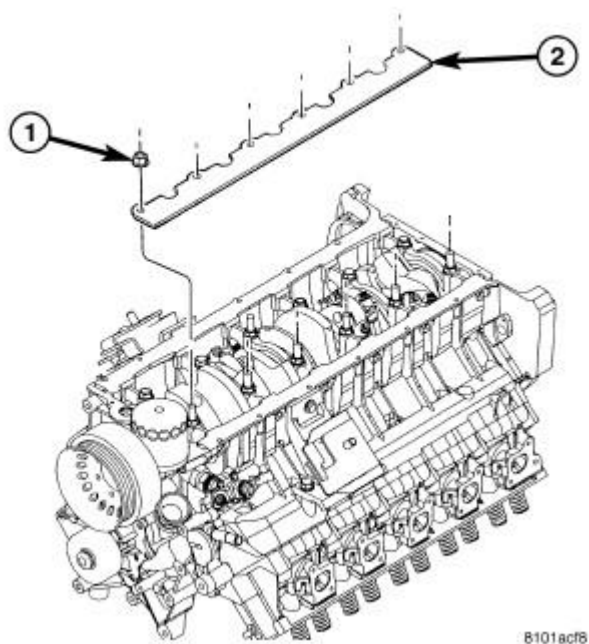


Fig. 193: Crankshaft Oil Scraper

Courtesy of CHRYSLER GROUP, LLC

1. Remove engine. Refer to **REMOVAL**.
2. Remove cylinder heads. Refer to **CYLINDER HEAD, REMOVAL**.
3. Remove oil pan. Refer to **PAN, OIL, REMOVAL**.
4. Remove the swinging oil pump pick up tube assembly. Refer to **PUMP, ENGINE OIL, REMOVAL**.
5. Remove the crankshaft oil scraper (2).

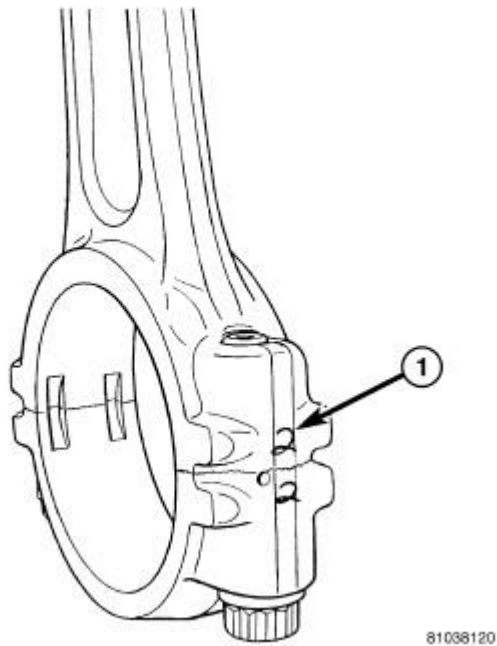


Fig. 194: Connecting Rod To Cylinder Identification
Courtesy of CHRYSLER GROUP, LLC

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods. Damage to connecting rod could occur.

6. Inspect connecting rods and connecting rod caps for cylinder identification. Identify them if necessary using an engraver, permanent ink or paint marker.

CAUTION: Care must be taken not to damage the fractured rod and cap joint surfaces, as engine damage may occur.

7. Remove connecting rod bolts and cap. Push each piston and rod assembly out the block.

NOTE: Be careful not to nick crankshaft journals or cylinder walls.

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

INSPECTION

INSPECTION

CONNECTING ROD

1. Visually inspect the connecting rods for twist or bend. Replace as necessary.
2. Check the condition of the large end. Use an oil stone to remove any nicks and burrs.

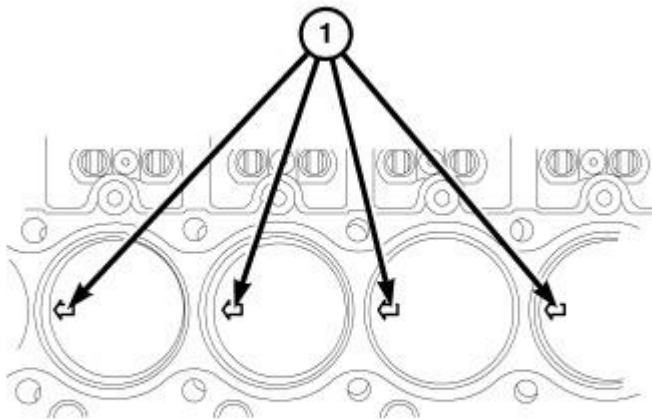
3. Check the condition of the pin bore and piston pin in the small end of the connecting rod. Use an oil stone to remove all nicks and burrs.

PISTON PIN

1. Inspect for free rotation of the piston pin in the piston and the rod.
2. If there is free play or slop in the assembly, check the piston pin bores and the connecting rod bores, and piston pin diameter to specifications replace piston and rod assembly as necessary.

PISTON

1. Inspect all piston surfaces for nicks and scuffs.
2. Inspect piston and ring grooves for wear.

INSTALLATION**INSTALLATION**

80132804

Fig. 195: Positioning Piston ID Arrows
Courtesy of CHRYSLER GROUP, LLC

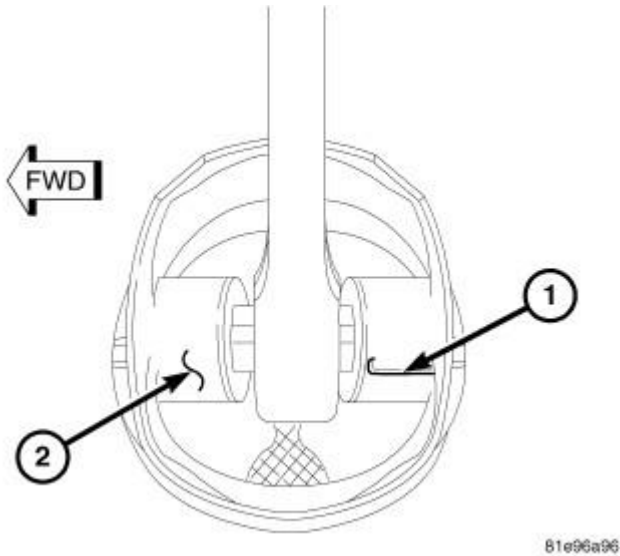


Fig. 196: Piston Location

Courtesy of CHRYSLER GROUP, LLC

NOTE: Pistons and connecting rods are serviced as an assembly. There is a right bank assembly and a left bank assembly.

NOTE: Inspect piston surfaces for nicks, scuffs or hot spots (polished raised material). Debur or replace as necessary.

CAUTION: When the piston (2) is installed in the engine, the flat spot (1) must be towards the rear of the engine.

1. Install piston rings. Refer to **RING(S), PISTON, INSTALLATION.**

NOTE: Make sure piston rings rotate freely in grooves before piston installation.

2. Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston. **Be sure position of rings does not change during this operation.**

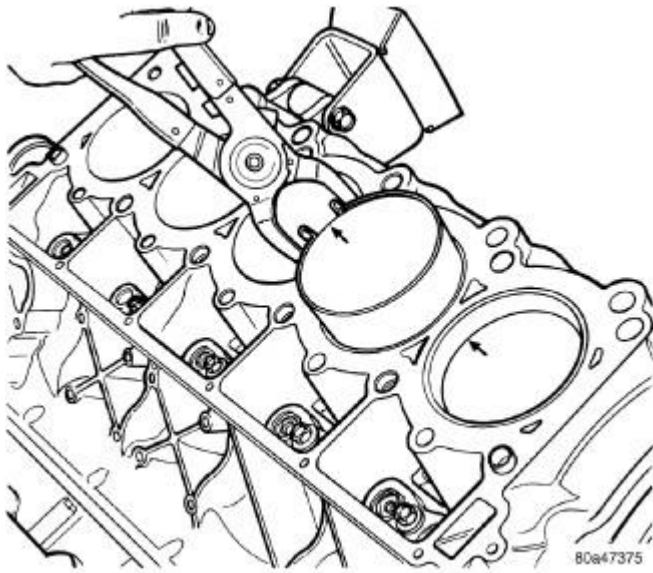


Fig. 197: Piston And Connecting Rod-Installation
 Courtesy of CHRYSLER GROUP, LLC

3. Rotate crankshaft so that the connecting rod journal is at the bottom of it's stroke and in the center of the cylinder bore.
4. The arrow on top of piston (1) must be pointing toward front of engine.

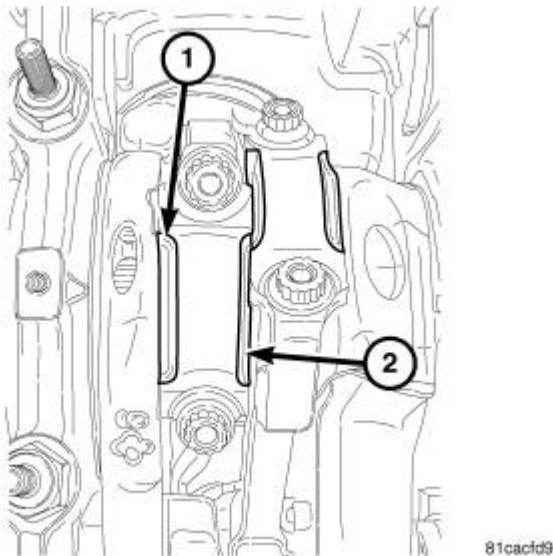


Fig. 198: Rod Installation
 Courtesy of CHRYSLER GROUP, LLC

NOTE: When installing piston and rod assembly, be sure the large flange (1) faces the crankshaft.

5. Install new connecting rod bearing in connecting rod and rod cap and apply engine assembly lube to bearing surfaces.

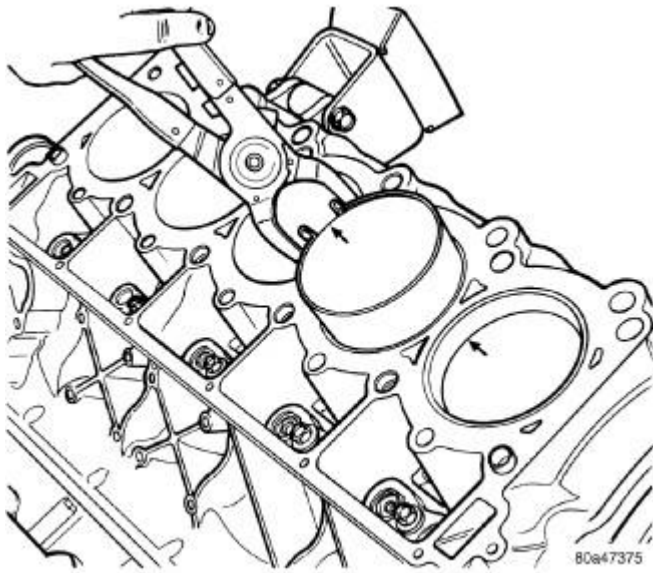


Fig. 199: Piston And Connecting Rod-Installation
 Courtesy of CHRYSLER GROUP, LLC

6. Install piston assembly from the top of the block. Tap the piston down in cylinder bore, using a hammer handle. Guide the rod over the crankshaft journal.

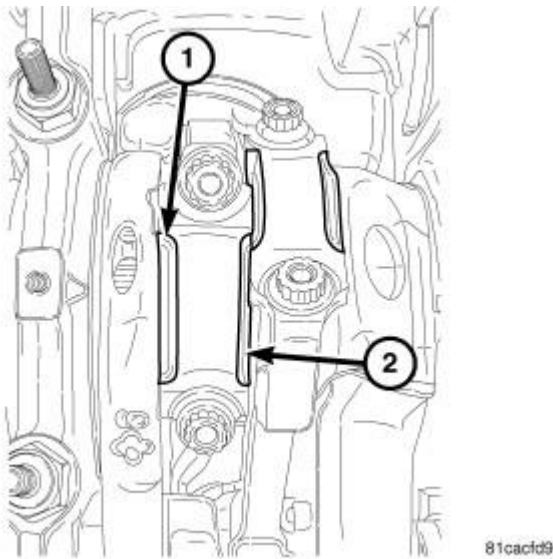


Fig. 200: Rod Installation
 Courtesy of CHRYSLER GROUP, LLC

CAUTION: Verify correct rod installation or engine damage could result. The large cut out (1) in the rod must face the crankshaft. The small cut out (2) must face the other rod. The odd bank pistons are marked "odd", while the even bank pistons have no markings.

7. Position rod cap in place and ensure that the connecting rod cap is properly seated on the connecting rod.

Install connecting rod bolts by hand. Bolt threads should be clean and free of engine oil.

8. Tighten connecting rod bolts to 45 N.m (33 ft. lbs.). Rotate an additional 45°.

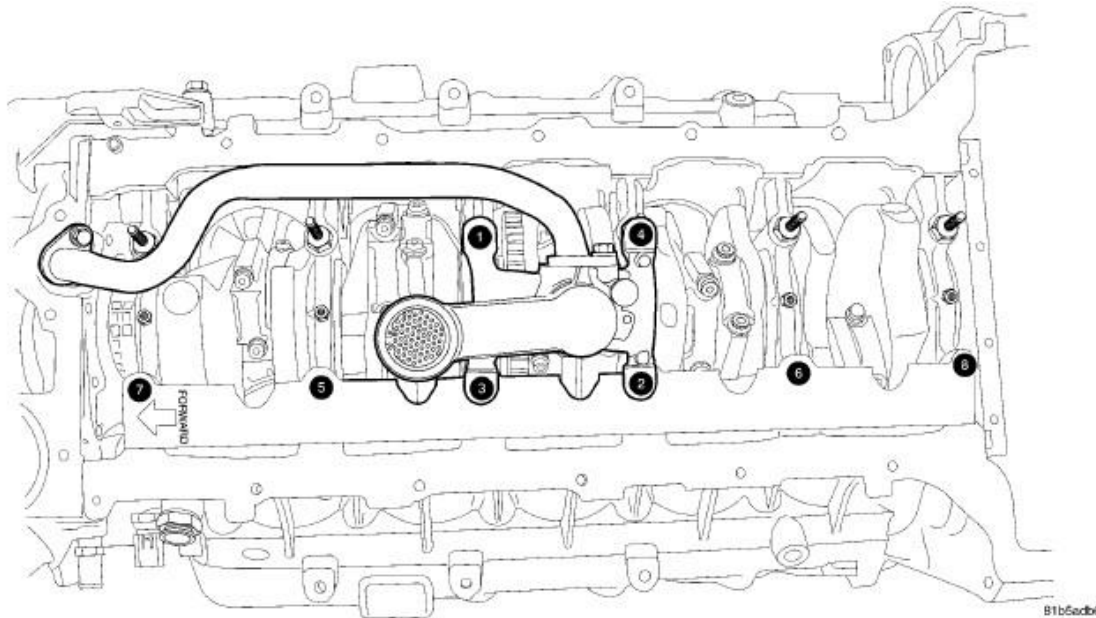


Fig. 201: Oil Pick Up Assembly
Courtesy of CHRYSLER GROUP, LLC

9. Install the crankshaft oil scraper.
10. Install swing oil pump pick-up tube assembly. Refer to **PUMP, ENGINE OIL, INSTALLATION**.
11. Install oil pan. Refer to **PAN, OIL, INSTALLATION**.
12. Install cylinder heads. Refer to **CYLINDER HEAD, INSTALLATION**.

SEAL, CRANKSHAFT OIL, REAR

REMOVAL

REMOVAL

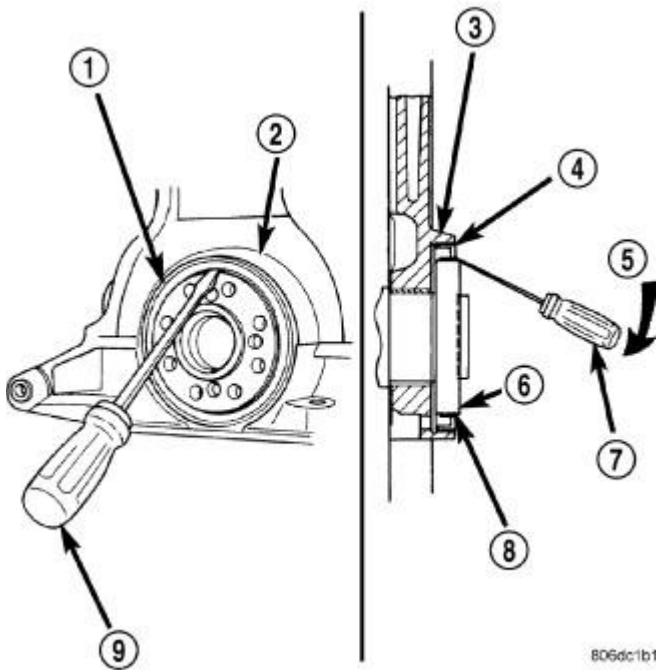


Fig. 202: Rear Crankshaft Oil Seal - Removal
Courtesy of CHRYSLER GROUP, LLC

1. Remove transmission. Refer to **REMOVAL** .
2. Remove clutch and flywheel. Refer to **DISC, CLUTCH, REMOVAL** .

CAUTION: Do not permit the screwdriver blade to contact crankshaft seal surface. Contact of the screwdriver blade against crankshaft edge (chamfer) is permitted.

3. Remove the oil seal (1) with a screw driver (9).

INSTALLATION

INSTALLATION

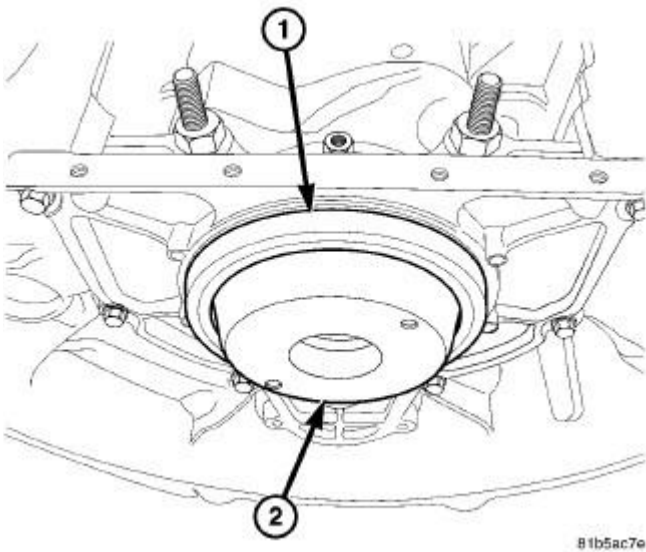


Fig. 203: Rear Crankshaft Seal And Seal Guide
 Courtesy of CHRYSLER GROUP, LLC

1. Clean the seal retainer. Make sure surfaces are clean and free of oil.
2. Install (special tool #9060A, Installer/Guide, Seal) (2) onto end of crankshaft.
3. Position rear crankshaft seal (1) over the seal guide (2).

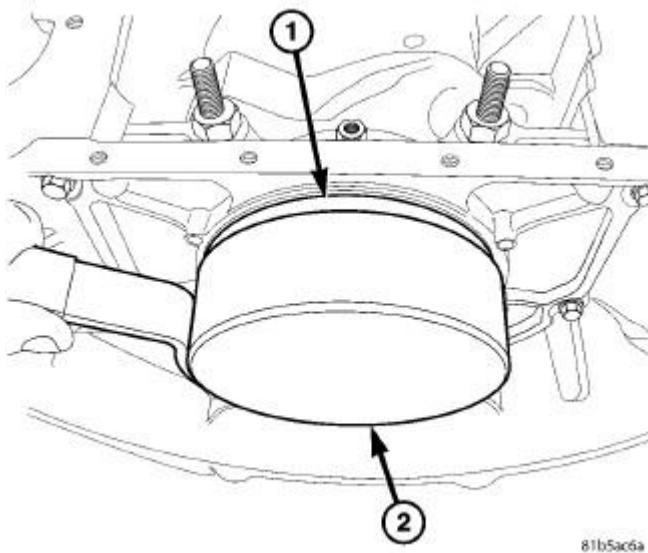
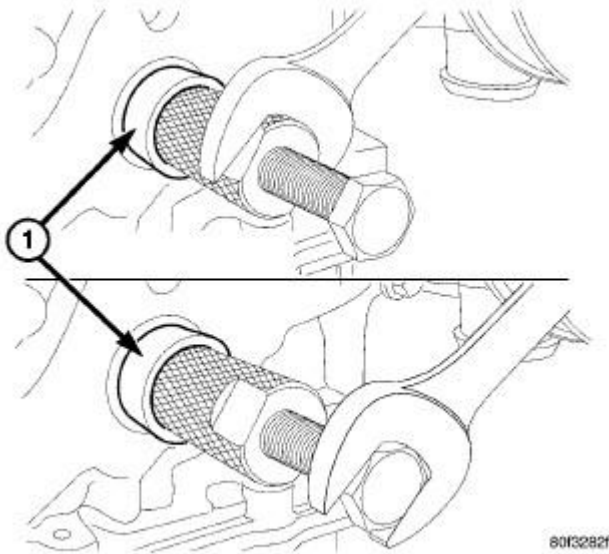


Fig. 204: Rear Main Installer
 Courtesy of CHRYSLER GROUP, LLC

4. Drive rear crankshaft seal in place using (special tool #9781, Installer, Crankshaft Rear Oil Seal) (2).
5. Install flywheel and clutch. Refer to **DISC, CLUTCH, INSTALLATION** .
6. Install transmission. Refer to **INSTALLATION** .

SEAL, CRANKSHAFT OIL, FRONT**REMOVAL****REMOVAL****Fig. 205: Removing Crankshaft Oil Seal****Courtesy of CHRYSLER GROUP, LLC**

1. Remove air cleaner housing. Refer to **BODY, AIR CLEANER, REMOVAL**.
2. Remove accessory drive belt. Refer to **BELT, SERPENTINE, REMOVAL**.
3. Remove crankshaft damper. Refer to **DAMPER, VIBRATION, REMOVAL**.
4. Use oil seal remover C-4679A to remove crankshaft front oil seal. Be careful not to damage the crankshaft seal surface of front cover or crankshaft.

INSTALLATION**INSTALLATION**

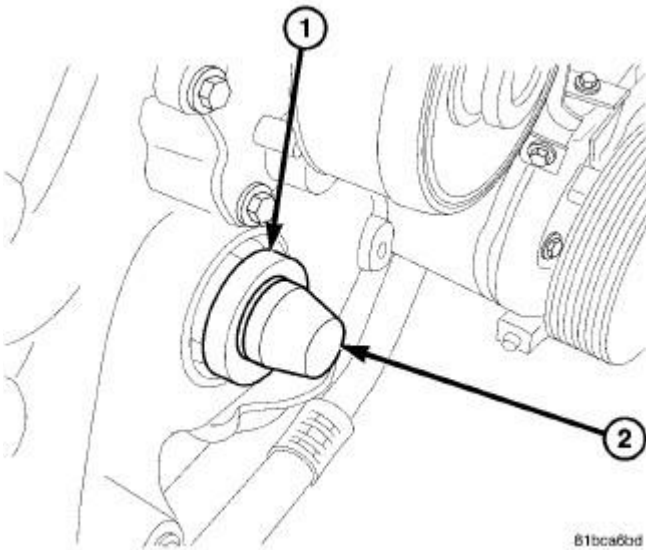


Fig. 206: Front Crankshaft Seal Installation
 Courtesy of CHRYSLER GROUP, LLC

1. Using the (special tool #10030, Installer, Seal). Install seal guide (2) into the end of the crankshaft.
2. Slide new seal (1) over guide (2) with seal spring towards the inside of engine onto crankshaft.

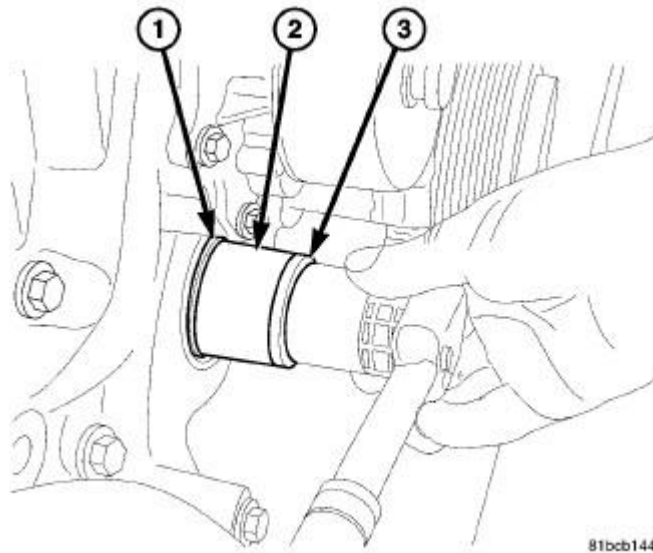


Fig. 207: Front Seal Installer
 Courtesy of CHRYSLER GROUP, LLC

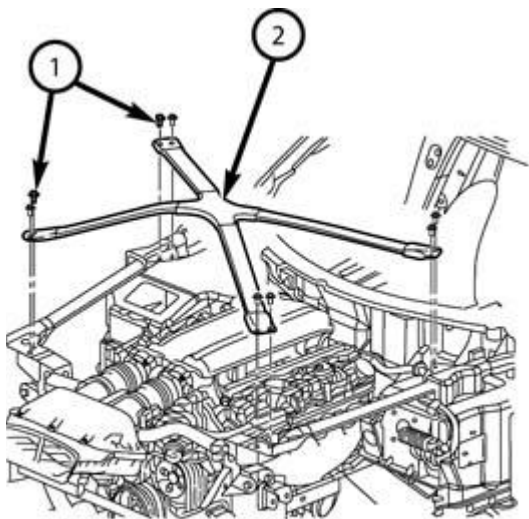
3. Install seal (1) with seal installer (2) and crankshaft damper bolt and washer (3) until tool bottoms out.
4. Install crankshaft damper. Refer to **DAMPER, VIBRATION, INSTALLATION**.
5. Install accessory drive belt. Refer to **BELT, SERPENTINE, INSTALLATION**.
6. Install air cleaner housing. Refer to **BODY, AIR CLEANER, INSTALLATION**.

ENGINE MOUNTING

INSULATOR, ENGINE MOUNT, FRONT

REMOVAL

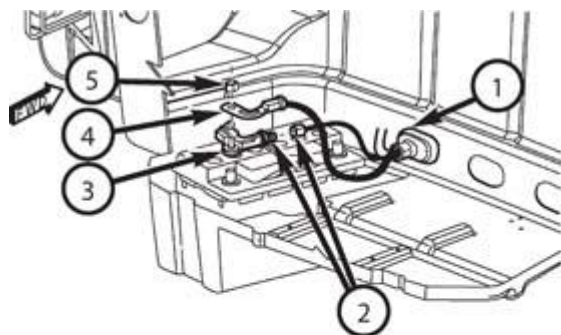
LEFT SIDE



091174557

Fig. 208: Cross Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Remove the cross support brace (2).

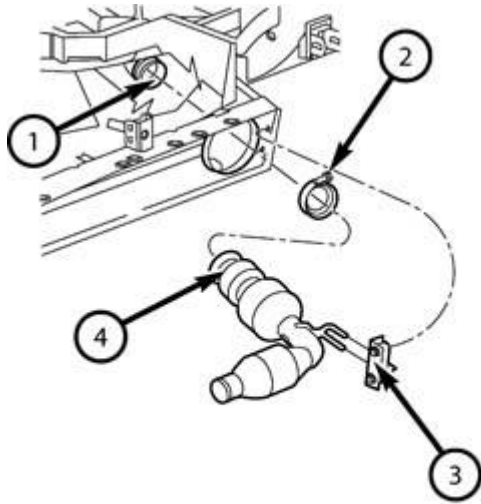


080874297

Fig. 209: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable
Courtesy of CHRYSLER GROUP, LLC

2. Disconnect the battery negative cable (4).
3. Raise vehicle on hoist.
4. Support oil pan with suitable jack.

NOTE: Right side shown in illustration. Left side mount similar.



091174564

Fig. 210: Catalytic Converter, Exhaust Manifold, Hanger & Exhaust Clamp
Courtesy of CHRYSLER GROUP, LLC

5. Remove the engine mount heat shield.
6. Remove the left side exhaust clamp (2) at the exhaust manifold (1).
7. Using care, position the catalytic converter (4) aside.
8. Raise engine with a suitable jack.
9. Remove engine mount to engine mount bracket nut.

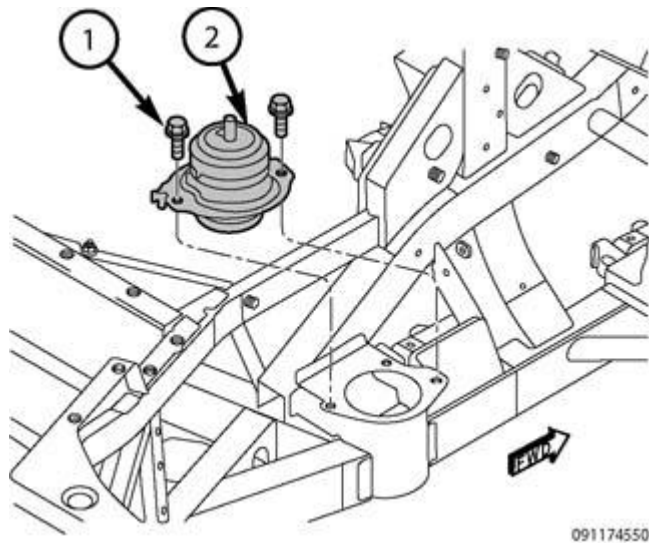


Fig. 211: Engine Mount & Bolts
 Courtesy of CHRYSLER GROUP, LLC

10. Remove engine mount (2) to frame bolts (1).
11. Remove engine mount (1).

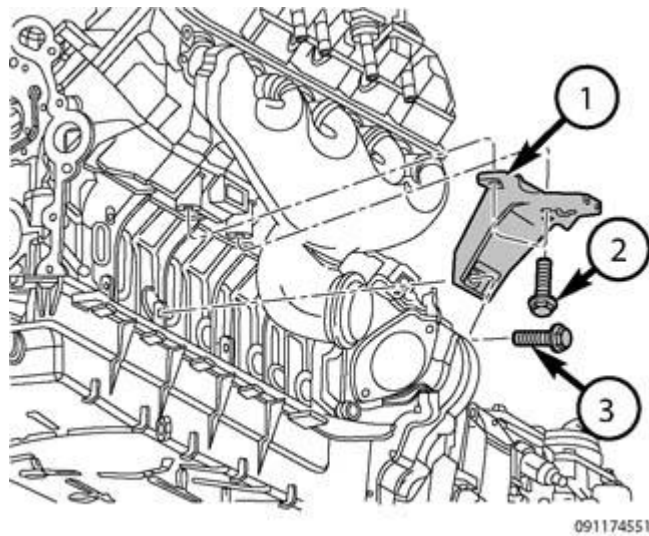
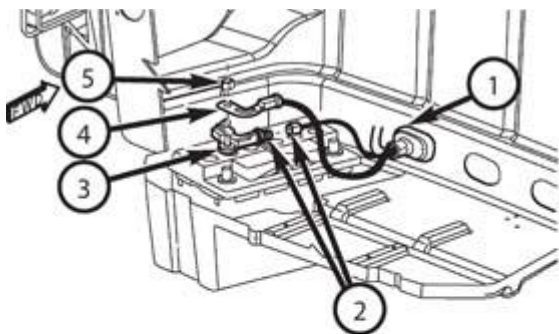


Fig. 212: Engine Mount Bracket & Bolts
 Courtesy of CHRYSLER GROUP, LLC

12. If required, Remove the engine mount bracket (1).

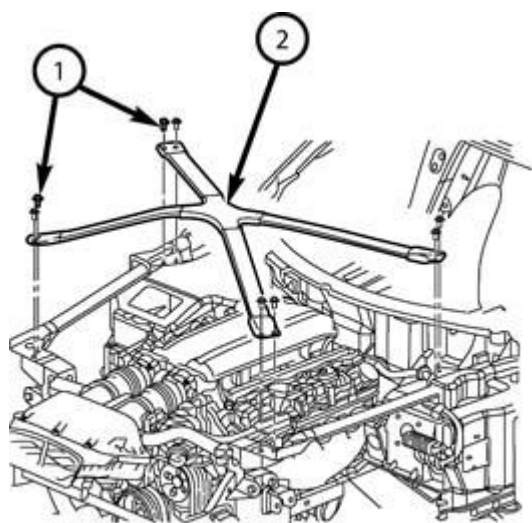
RIGHT SIDE



080874297

Fig. 213: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect the battery negative cable (4).



091174557

Fig. 214: Cross Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

2. Remove the cross brace (1).

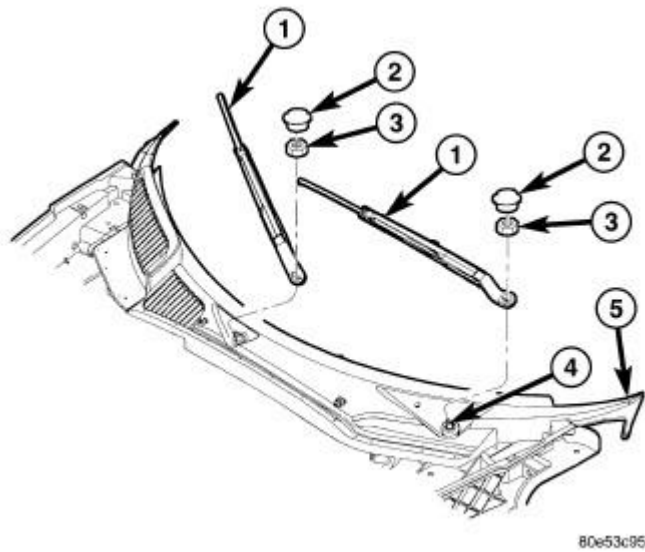


Fig. 215: Windshield Wiper Arms, Nut Cap & Nut
Courtesy of CHRYSLER GROUP, LLC

3. Remove the wiper arms (1).

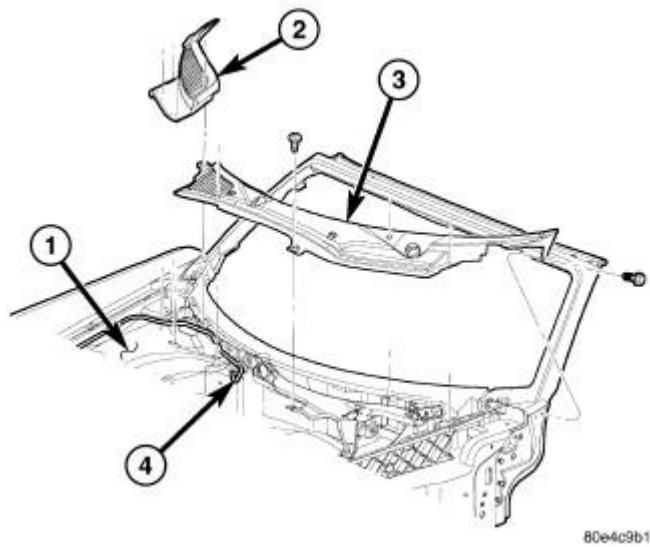
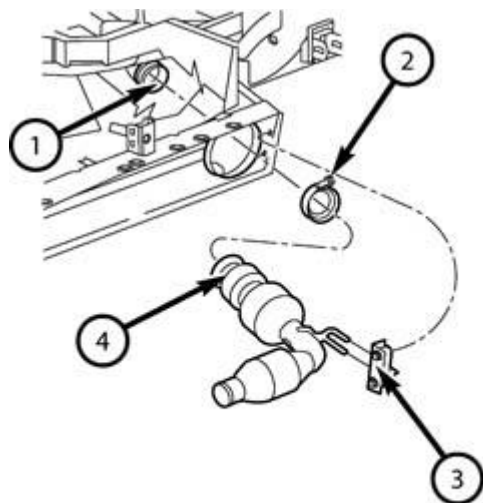


Fig. 216: Cowl Screen Panel
Courtesy of CHRYSLER GROUP, LLC

4. Remove the cowl assembly (3).
5. Raise vehicle on hoist.

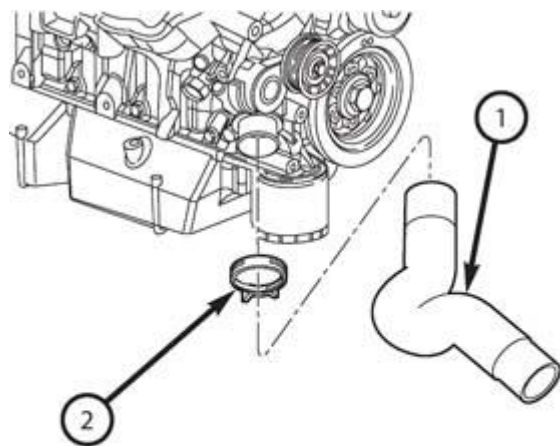
5. Raise vehicle on hoist.



091174564

Fig. 217: Catalytic Converter, Exhaust Manifold, Hanger & Exhaust Clamp
Courtesy of CHRYSLER GROUP, LLC

6. Drain the cooling system.
7. Loosen the right side exhaust clamp (2) at the exhaust manifold (1)
8. Using care, position the catalytic converter (4) aside.



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Fig. 218: Lower Radiator Hose & Clamp
Courtesy of CHRYSLER GROUP, LLC

9. Remove the oil filter.
10. Remove the lower radiator hose (1).

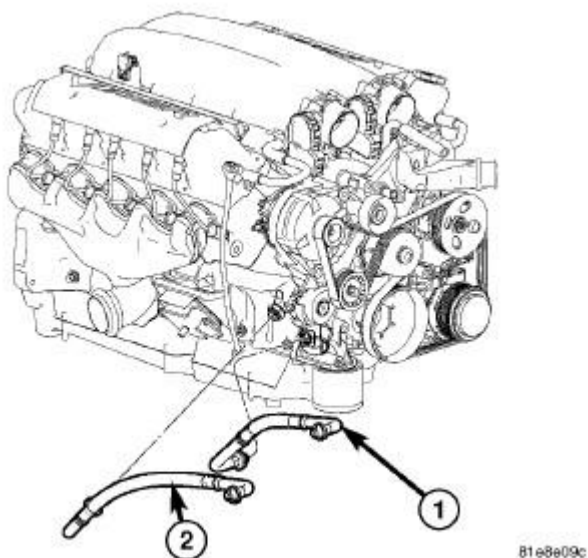


Fig. 219: Oil Cooler Lines

Courtesy of CHRYSLER GROUP, LLC

11. Disconnect the oil cooler lines at the engine.
12. Support oil pan with suitable jack.
13. Remove the engine mount heat shields.

NOTE: Left side shown in illustration. Right side similar.

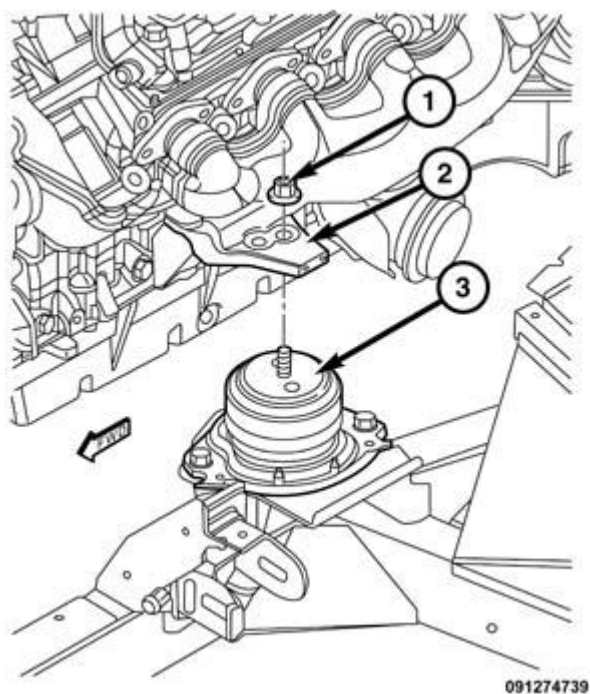


Fig. 220: Engine Mount, Bracket & Nut

Courtesy of CHRYSLER GROUP, LLC

14. Remove engine mount to engine mount bracket nut (1).

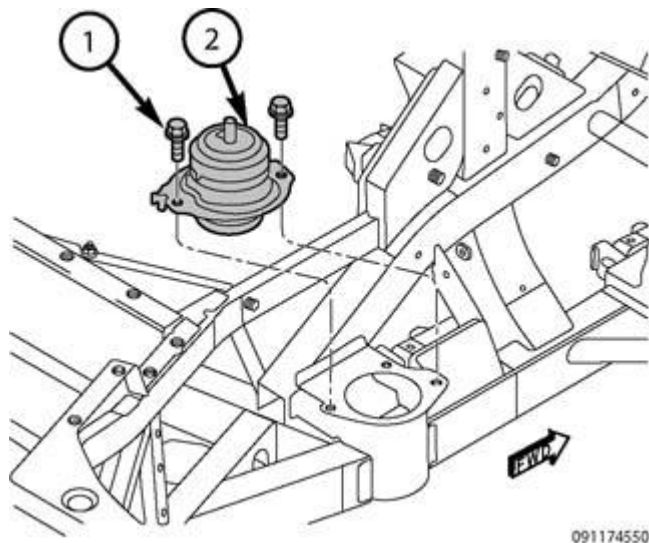


Fig. 221: Engine Mount & Bolts

Courtesy of CHRYSLER GROUP, LLC

15. Raise engine with jack.
16. Remove engine mount (2) to frame bolts (1).

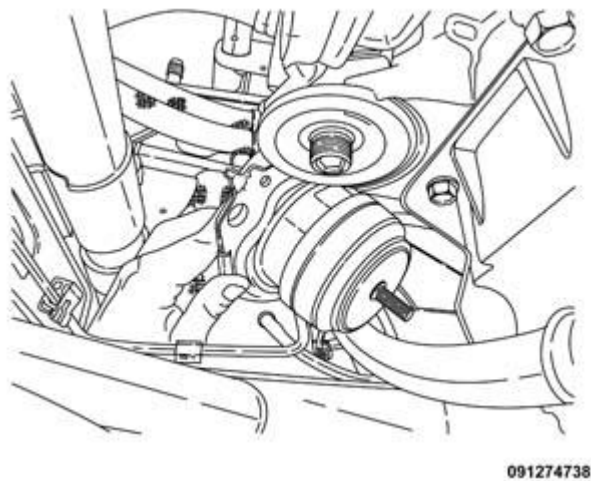


Fig. 222: Removing & Installing Engine Mount Through Front Side Of Engine

Courtesy of CHRYSLER GROUP, LLC

17. Remove engine mount through the front side of the engine.

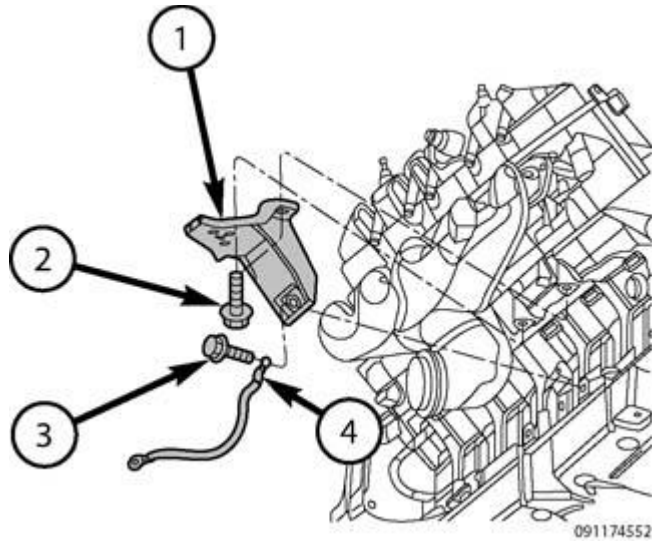


Fig. 223: Ground Strap, Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

18. If required, disconnect the engine ground strap (4) by removing the lower bolt (3) at the bracket.
19. If required, Remove the engine mount bracket (1).

INSTALLATION

LEFT SIDE

NOTE: Make sure the engine mount heat shield is located between the engine mount and the exhaust manifold.

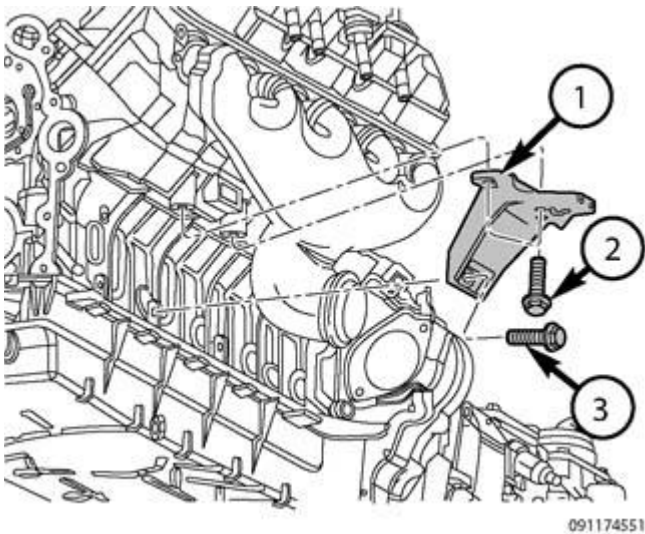


Fig. 224: Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

1. If removed, install the engine mount bracket (1). Tighten the bolts (2 and 3) to 61 N.m (45 ft. lbs.).

NOTE: Right side shown in illustration. Left side similar.

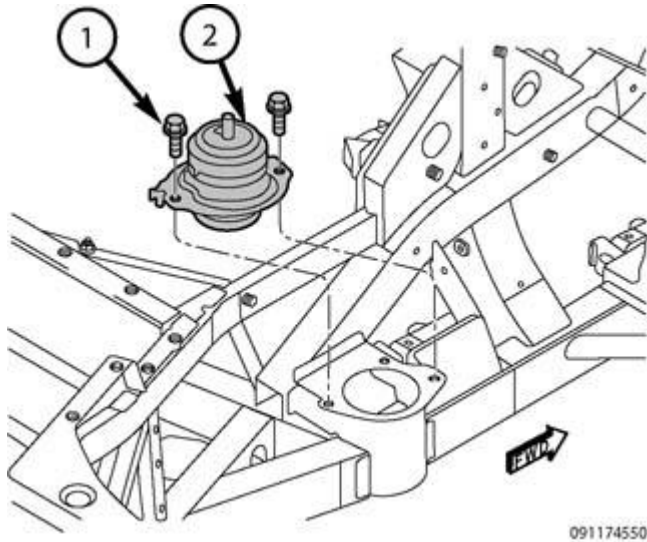


Fig. 225: Engine Mount & Bolts
Courtesy of CHRYSLER GROUP, LLC

2. Install engine mount to frame (2). Tighten bolts (1) to 61 N.m (45 ft. lbs.).
3. Lower engine with jack while guiding engine mount stud(s) (1) into frame slots.

NOTE: Verify that the engine is correctly centered in the frame and there is clearance between the frame and exhaust manifolds. If necessary, reposition engine.

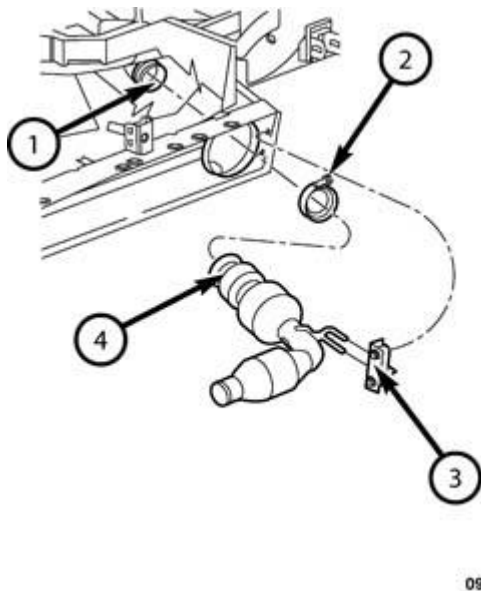
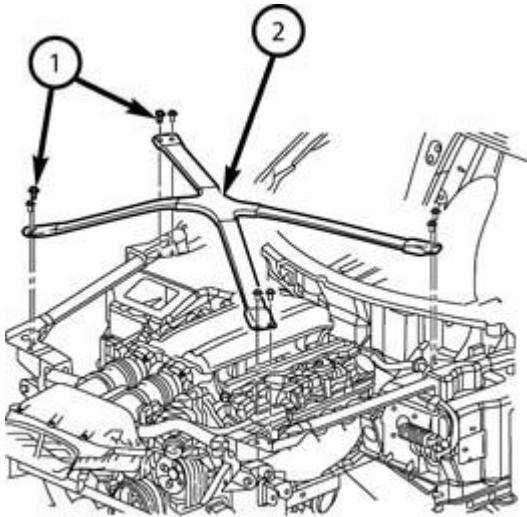


Fig. 226: Catalytic Converter, Exhaust Manifold, Hanger & Exhaust Clamp
Courtesy of CHRYSLER GROUP, LLC

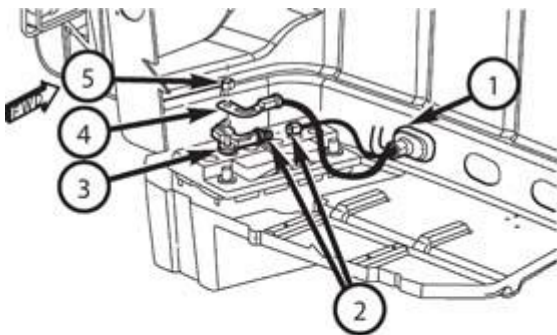
- 4.
5. Loosely install a **NEW** V-Band clamp (2) at exhaust manifold (1) to converter pipe connection (4).
6. Align the catalytic converter to the exhaust manifold.
7. Tighten catalytic converter V-Band clamp to 11 N.m (100 in. lbs.).
8. Lower vehicle.



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Fig. 227: Cross Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

9. Install the cross brace strut (2). Tighten bolts (1) to 20 N.m (15 ft. lbs.).



080874297

Fig. 228: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable
Courtesy of CHRYSLER GROUP, LLC

10. Connect the battery negative cable (4).

RIGHT SIDE

NOTE: Make sure the engine mount heat shield is located between the engine mount and the exhaust manifold.

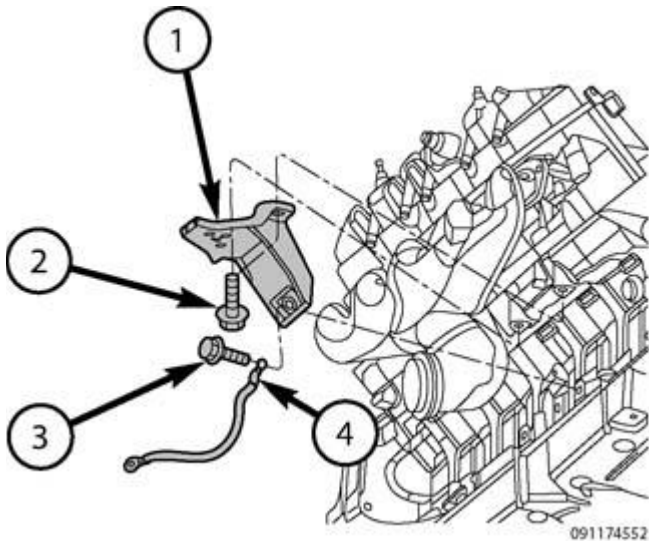


Fig. 229: Ground Strap, Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

1. If removed, install the engine mount engine bracket (1). Loosely install the bolts (2).
2. If removed, Install the ground strap (4) to the bracket.
3. Tighten bolts (2 and 3) to 61 N.m (45 ft. lbs.).

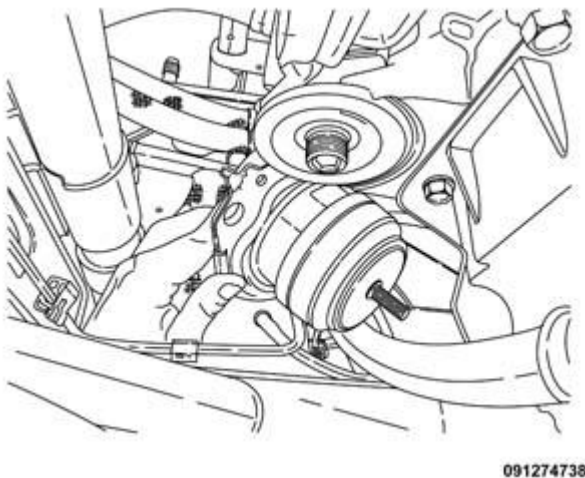


Fig. 230: Removing & Installing Engine Mount Through Front Side Of Engine
Courtesy of CHRYSLER GROUP, LLC

4. Route the engine mount through the front side of the engine.

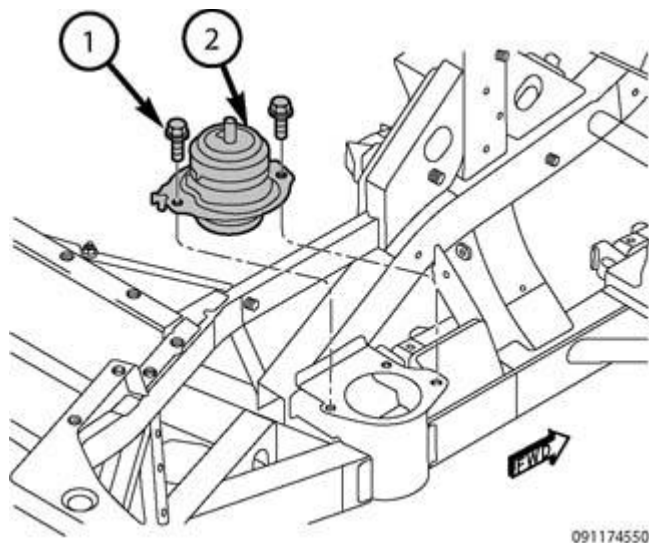


Fig. 231: Engine Mount & Bolts
Courtesy of CHRYSLER GROUP, LLC

5. Position the engine mount (2) onto the frame. Tighten bolts (1) to 61 N.m (45 ft. lbs.).

NOTE: Left side mount shown in illustration. Right side similar.

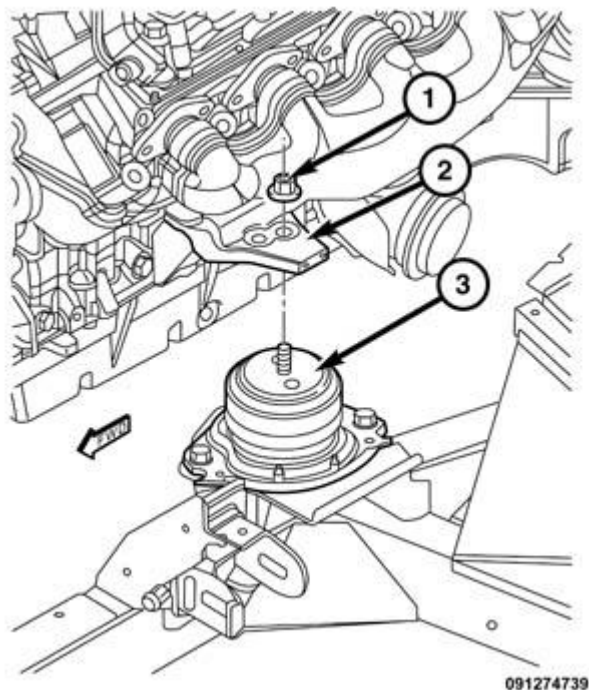


Fig. 232: Engine Mount, Bracket & Nut
Courtesy of CHRYSLER GROUP, LLC

6. Lower engine onto the engine mount stud. Tighten nut (1) to 61 N.m (45 ft. lbs.).

NOTE: Verify that the engine is correctly centered in the frame and there is clearance between the frame and exhaust manifolds. If necessary, reposition engine.

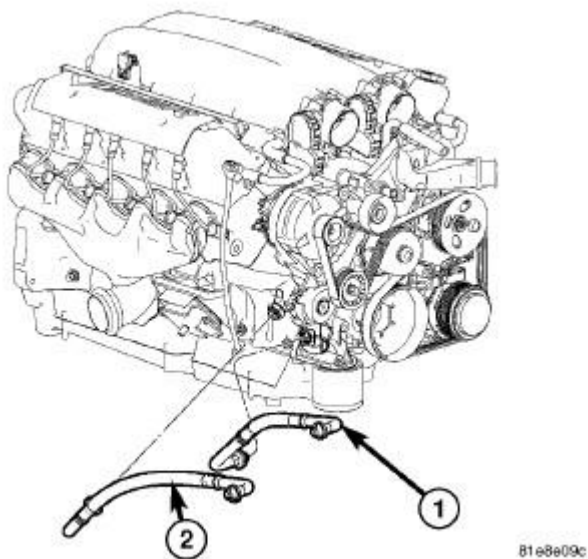


Fig. 233: Oil Cooler Lines

Courtesy of CHRYSLER GROUP, LLC

7. Install the oil cooler lines.

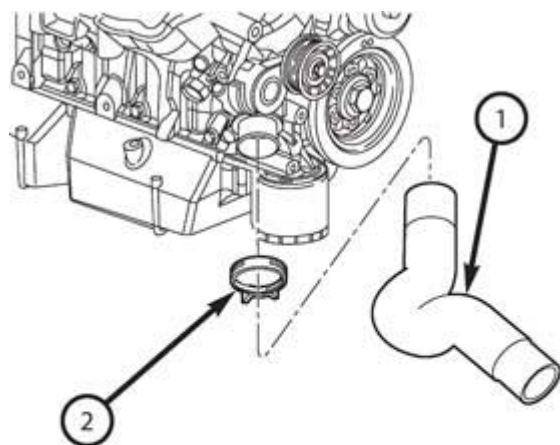
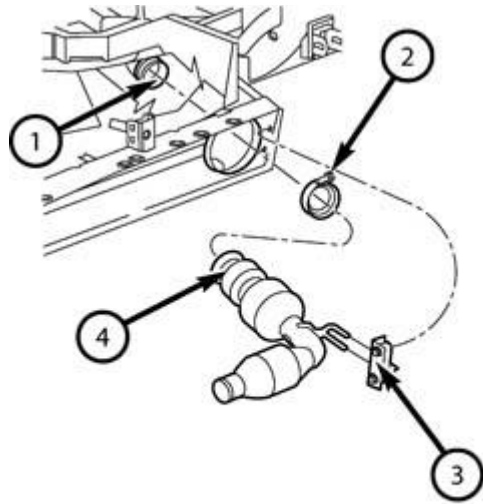


Fig. 234: Lower Radiator Hose & Clamp

Courtesy of CHRYSLER GROUP, LLC

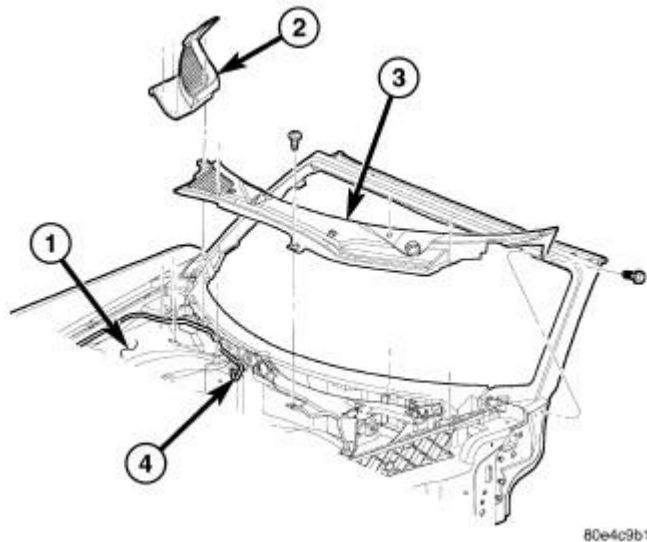
8. Install the lower radiator hose (1).
9. Install the oil filter.



091174564

Fig. 235: Catalytic Converter, Exhaust Manifold, Hanger & Exhaust Clamp
Courtesy of CHRYSLER GROUP, LLC

10. Loosely install a **NEW** V-Band clamp (2) at exhaust manifold (1) to converter pipe connection.
11. Align the catalytic convertor (4) to the exhaust manifold.
12. Tighten catalytic converter V-Band clamp to 11 N.m (100 in. lbs.).
13. Lower the vehicle.



80e4c9b1

Fig. 236: Cowl Screen Panel
Courtesy of CHRYSLER GROUP, LLC

14. Install the cowl assembly (3).

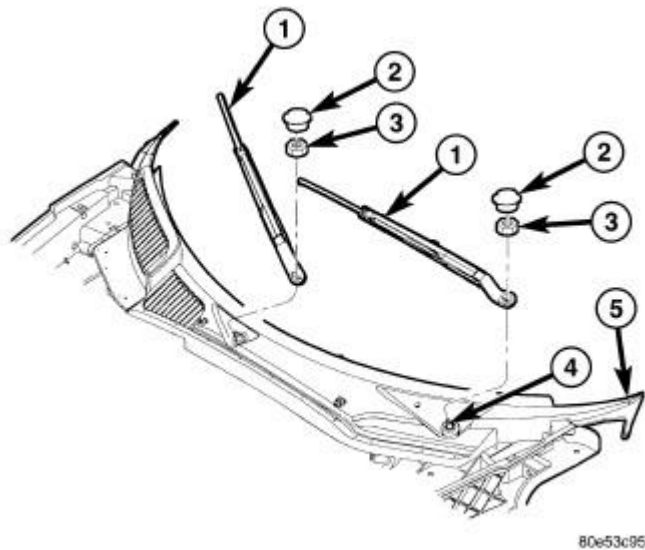


Fig. 237: Windshield Wiper Arms, Nut Cap & Nut
 Courtesy of CHRYSLER GROUP, LLC

15. Install the wiper arms (1).

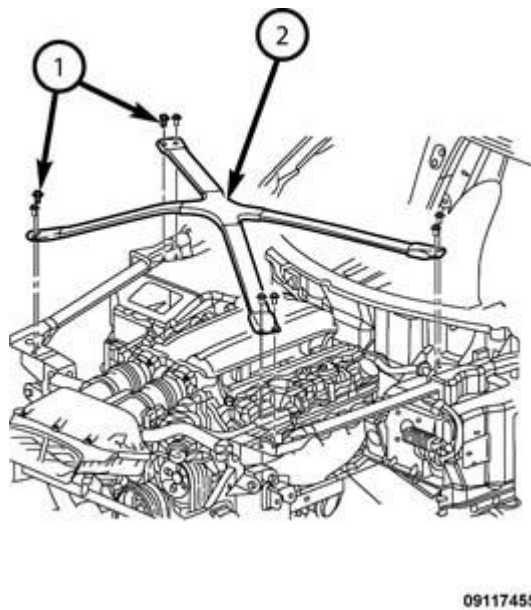


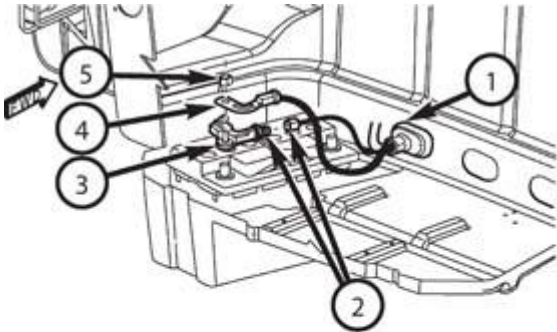
Fig. 238: Cross Support Brace & Bolts
 Courtesy of CHRYSLER GROUP, LLC

16. Install the cross brace (2). Tighten bolts (1) to 20 N.m (15 ft. lbs.).
17. Connect the battery negative cable.

INSULATOR, ENGINE MOUNT, REAR

REMOVAL

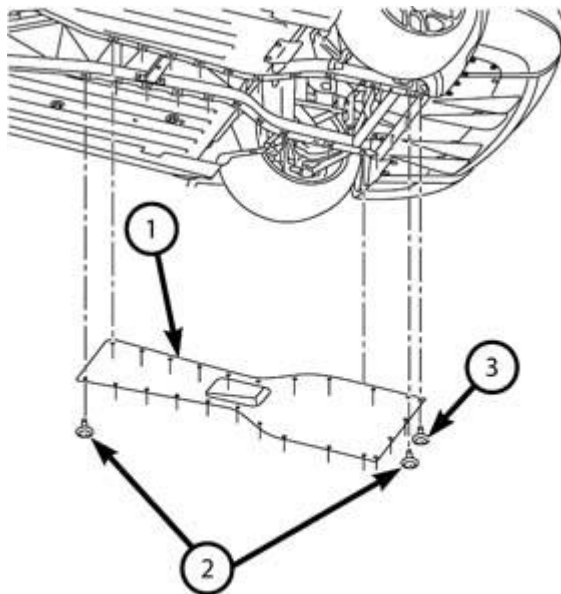
REMOVAL



080874297

Fig. 239: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable
Courtesy of CHRYSLER GROUP, LLC

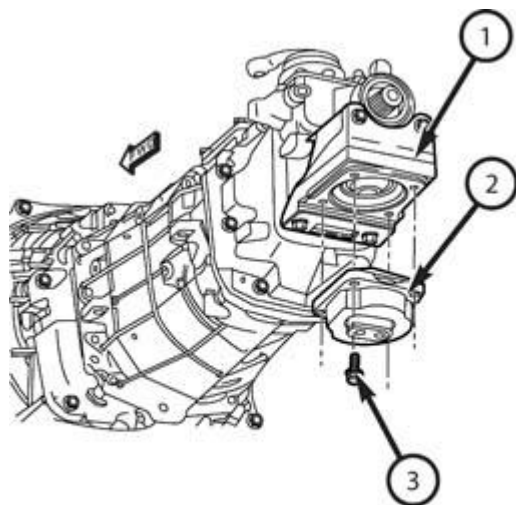
1. Disconnect negative battery cable.
2. Raise vehicle.



130574591

Fig. 240: Center Belly Pan And Fasteners
Courtesy of CHRYSLER GROUP, LLC

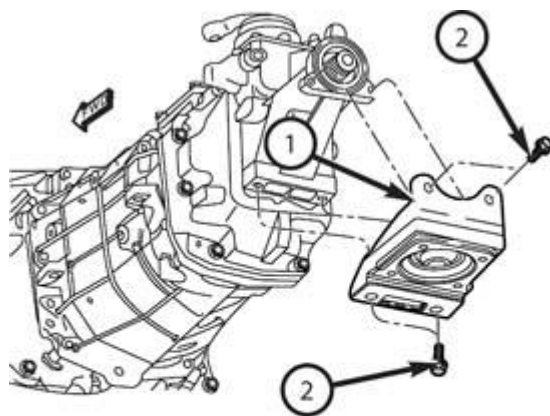
3. Remove belly pan (1).



091274748

Fig. 241: Rear Mount & Lower Transmission Crossmember Bolt
Courtesy of CHRYSLER GROUP, LLC

4. Support transmission with a suitable jack.
5. Remove the lower transmission to cross-member bolts (3).
6. Remove crossmember.
7. Remove rear mount (2).



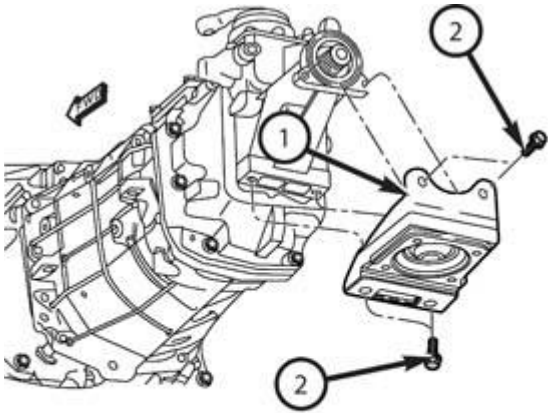
091274747

Fig. 242: Transmission Mount Bracket
Courtesy of CHRYSLER GROUP, LLC

8. If required, remove the transmission mount bracket.

INSTALLATION

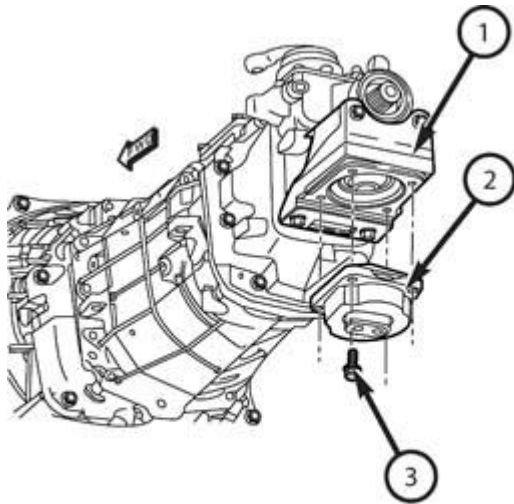
INSTALLATION



091274747

Fig. 243: Transmission Mount Bracket
Courtesy of CHRYSLER GROUP, LLC

1. If removed, install the transmission mount bracket (1). Tighten bolts (2) to 33 N.m (24 ft. lbs.).

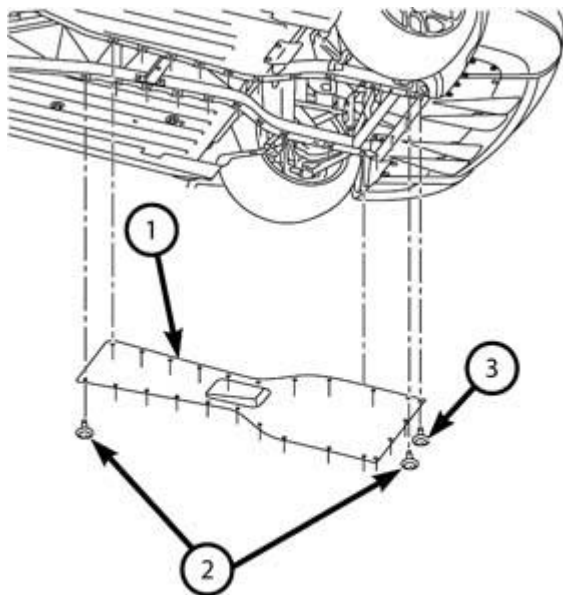


091274748

Fig. 244: Rear Mount & Lower Transmission Crossmember Bolt
Courtesy of CHRYSLER GROUP, LLC

2. Position the transmission mount (2) to the upper bracket (1). Tighten bolts to 33 N.m (24 ft. lbs.).
3. Position crossmember in place.
4. Install the lower transmission to cross-member bolts (3). Tighten the bolts to 54 N.m (40 ft. lbs.).

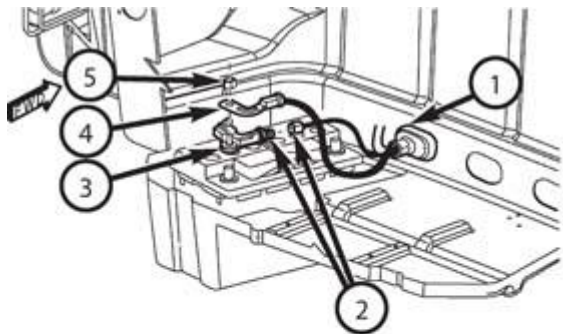
5. Install bolt crossmember retaining bolts and tighten to 52 N.m (38 ft. lbs.).
6. Remove jack.



130574591

Fig. 245: Center Belly Pan And Fasteners
 Courtesy of CHRYSLER GROUP, LLC

7. Install belly pan (1). Tighten the retainers to 25 N.m (18 ft. lbs.).
8. Lower vehicle.



080874297

Fig. 246: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable
 Courtesy of CHRYSLER GROUP, LLC

9. Connect negative battery cable.

LUBRICATION

DESCRIPTION

DESCRIPTION

The engine lubrication system is a full-flow filtration pressure feed type.

OPERATION

OPERATION

Engine oil stored in the oil pan is taken in and discharged by an internal gerotor type oil pump, which is driven by the crankshaft. A cartridge type pressure relief valve is located in the timing chain case cover; it regulates oil pressure. The oil is pumped through an oil filter and an external oil cooler that feeds a main oil gallery. The main oil gallery feeds oil under pressure to the main bearings, connecting rod bearings, and camshaft bearings. Passages in the cylinder block feed oil to the hydraulic lifters. The oil then flows through hollow pushrods, which feed the rocker arm pivots.

DIAGNOSIS AND TESTING

CHECKING ENGINE OIL PRESSURE

1. Remove oil pressure sensor. Refer to **SENSOR, OIL PRESSURE, REMOVAL**.
2. Install oil pressure gauge.
3. Warm engine at high idle until thermostat opens.

CAUTION: If engine oil pressure is zero at idle, DO NOT RUN THE ENGINE.

4. Oil pressure should be 68.9 kPa (10 psi) at idle or 310 - 517 kPa (45 - 75 psi) at 3000 RPM.
5. If oil pressure is 0 at idle, shut off engine. Check oil level, for a clogged swinging oil pick-up screen or a stuck open pressure relief valve, loose or plugged oil filter, or blown, blocked or leaking oil cooler circuits. Disassemble engine and inspect.

ENGINE OIL LEAK

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 per Service Information instructions.
4. If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.

If the oil leak source is not positively identified at this time , proceed with the AIR LEAK DETECTION TEST METHOD.

AIR LEAK DETECTION TEST METHOD

- 1.
2. Plug the PCV valve and PCV hose. Remove make up air hose and plug fitting at head cover.
3. 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.

4. Gradually apply air pressure from 6.89 - 17.23 kPa (1 - 2.5 psi) maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per Service Information procedures.
5. If the leakage occurs at the rear oil seal area, refer to **INSPECTION FOR REAR SEAL AREA LEAKS**.
6. If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve.
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.

INSPECTION FOR REAR SEAL AREA LEAKS

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

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

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
 - a. Circular spray pattern generally indicates seal leakage, leaking fly wheel bolts, or crankshaft damage.
 - b. Where leakage tends to run straight down, possible causes are a porous block, rear seal retainer, tappet galley pipe plugs, oil pan gasket at rear rail or T - joint areas.

4. If no leaks are detected, pressurize the crankcase as outlined in the **AIR LEAK DETECTION TEST METHOD**

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.

NOTE: It is normal for small bubbles to be present around the rear crankshaft seal after a new seal has been installed. This will disappear after seal is broken in.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

COOLER AND LINES, OIL

DESCRIPTION

DESCRIPTION

An engine oil cooler is used on all models. The cooler is a coolant-to-oil type and mounted on the right front inner fender.

OPERATION

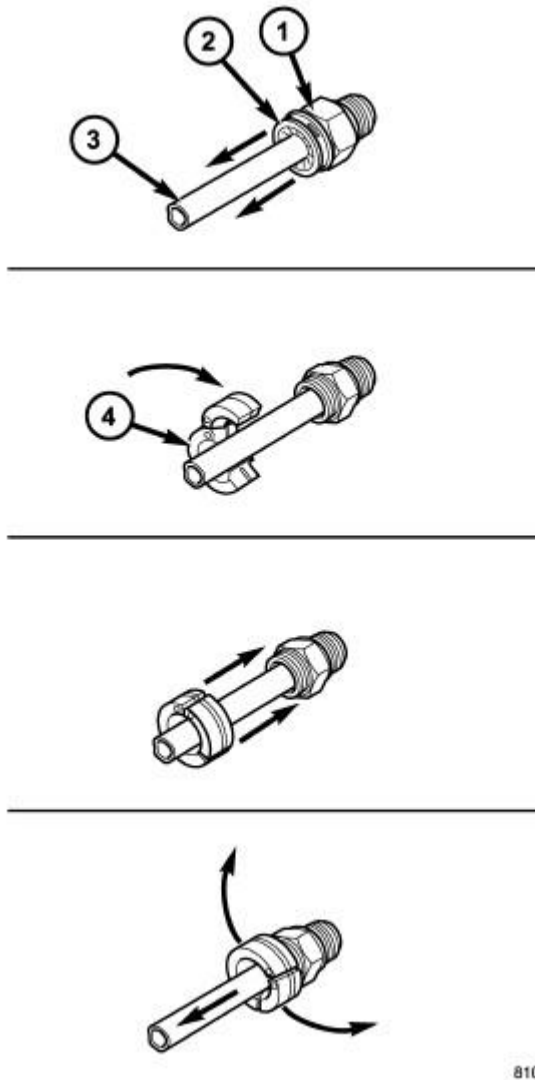
OPERATION

Engine oil travels from the oil pump and filter to the oil cooler via an oil supply line from the chain case cover. The oil is cooled and returned to the engine via an oil return line in the engine block. Engine oil is then pumped into the main oil gallery. Engine coolant flows into the cooler from the heater return hose and exits into the water pump inlet nipple.

STANDARD PROCEDURES

STANDARD PROCEDURE - OIL COOLER LINE QUICK CONNECT FITTING DISASSEMBLY/ASSEMBLY

DISASSEMBLY



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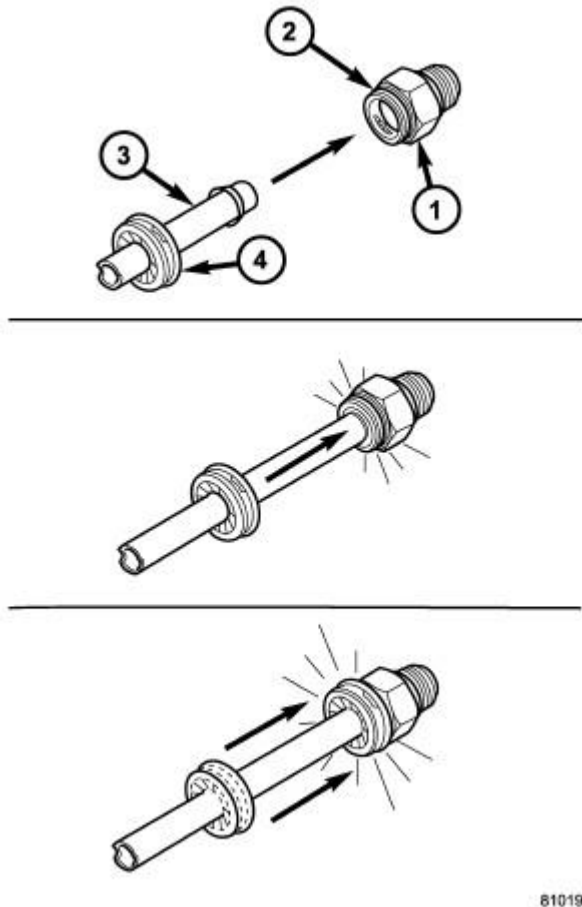
Fig. 247: Disconnecting Transmission Cooler Line Quick Connect Fitting
 Courtesy of CHRYSLER GROUP, LLC

- 1 - QUICK CONNECT FITTING
- 2 - DUST CAP
- 3 - OIL COOLER LINE
- 4 - SPECIAL TOOL 9005

1. Remove dust cap by pulling it straight back off of quick connect fitting (1).
2. Place disconnect tool (4) onto oil cooler line with the fingers of the tool facing the quick connect fitting (1).
3. Slide disconnect tool down the line and engage the fingers of the tool into the retaining clip. When properly engaged in the clip, the tool will fit flush against the quick connect fitting.

4. Rotate the disconnect tool 60° to expand the retaining clip.
5. While holding the disconnect tool against the quick connect fitting, pull back on the oil cooler line to remove.

ASSEMBLY



8101913a

Fig. 248: Connecting Transmission Cooler Line Quick Connect Fitting
 Courtesy of CHRYSLER GROUP, LLC

- 1 - QUICK CONNECT FITTING
- 2 - CLIP
- 3 - OIL COOLER LINE
- 4 - DUST CAP

1. Align oil cooler line (3) with quick connect fitting (1) while pushing straight into the fitting.
2. Push in on oil cooler line (3) until a "click" is heard or felt.
3. Slide dust cap (4) down the oil cooler line (3) and snap it over the quick connect fitting (1) until it is fully seated and rotates freely. Dust cap (4) will only snap over quick connect fitting (1) when the cooler line

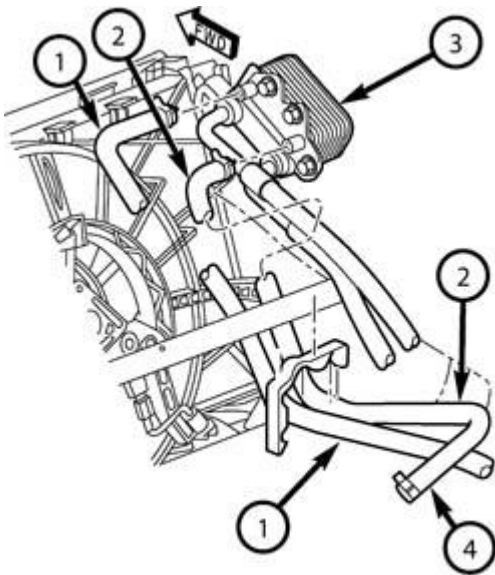
(3) is properly installed.

NOTE: If dust cap will not snap into place, repeat assembly step #2.

REMOVAL

OIL COOLER

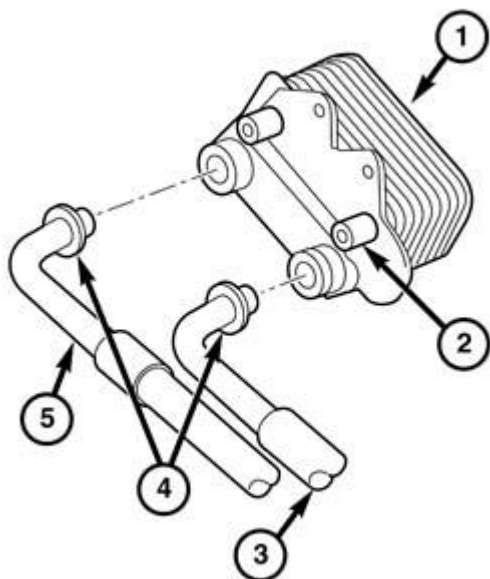
CAUTION: If the engine encounters a catastrophic failure, the engine oil cooler must be replaced or damage to the new engine and/or components could result.



0913002428

Fig. 249: Coolant Hoses & Oil Cooler
Courtesy of CHRYSLER GROUP, LLC

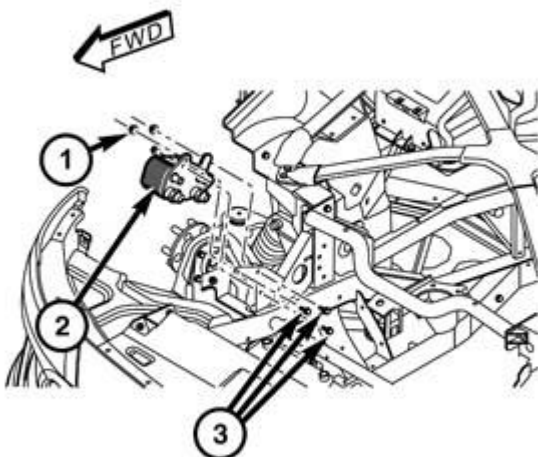
1. Remove air cleaner housing assembly. Refer to **BODY, AIR CLEANER, REMOVAL**.
2. Drain cooling system. Refer to **STANDARD PROCEDURE**.
3. Disconnect coolant hoses (1, 2) from oil cooler (3).



0913002427

Fig. 250: Oil Cooler, Oil Supply Line & Oil Return Line
 Courtesy of CHRYSLER GROUP, LLC

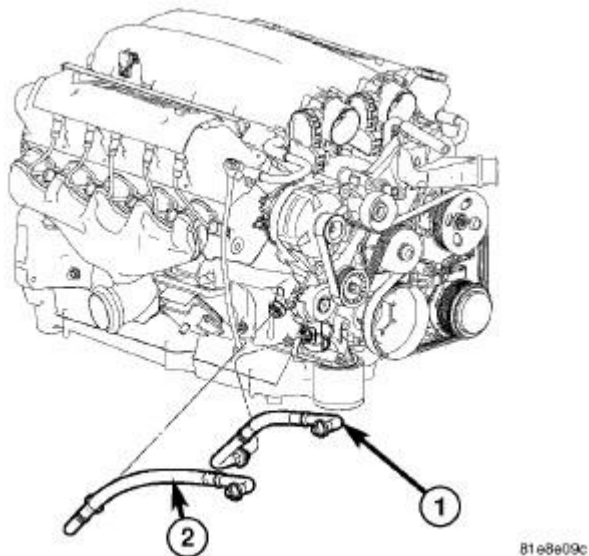
4. Using Special Tool (special tool #9005, Disconnect Tool), disconnect oil supply (3) and return (5) lines at oil cooler. Refer to **COOLER AND LINES, OIL, STANDARD PROCEDURES**.



0913002052

Fig. 251: Oil Cooler & Fasteners
 Courtesy of CHRYSLER GROUP, LLC

5. Remove fasteners (3) securing oil cooler to the bracket. Remove oil cooler (2).

OIL COOLER LINES**Fig. 252: Oil Cooler Lines**

Courtesy of CHRYSLER GROUP, LLC

NOTE: Use an oil drain pan to catch oil when removing lines.

1. Using disconnect tool (special tool #9005, Disconnect Tool), disconnect oil lines (1, 2) from engine. Refer to **COOLER AND LINES, OIL, STANDARD PROCEDURES**.

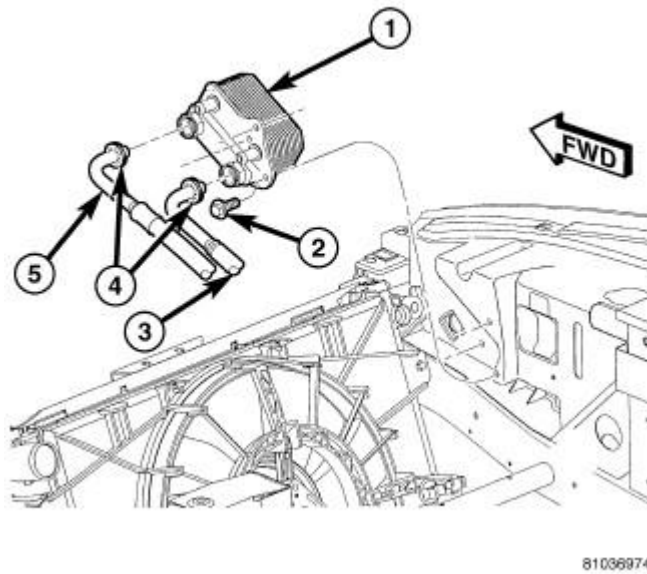


Fig. 253: Identifying Oil Cooler
Courtesy of CHRYSLER GROUP, LLC

- Using disconnect tool (special tool #9005, Disconnect Tool), disconnect oil lines (3, 5) from the oil cooler (1). Refer to **COOLER AND LINES, OIL, STANDARD PROCEDURES**.

QUICK CONNECT FITTINGS

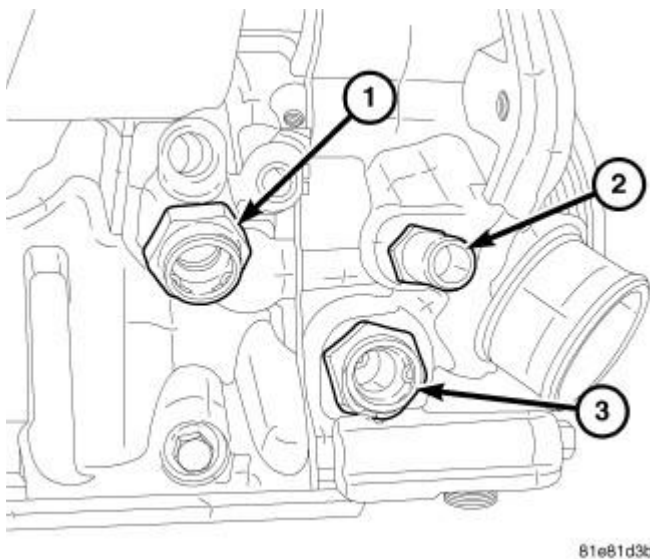
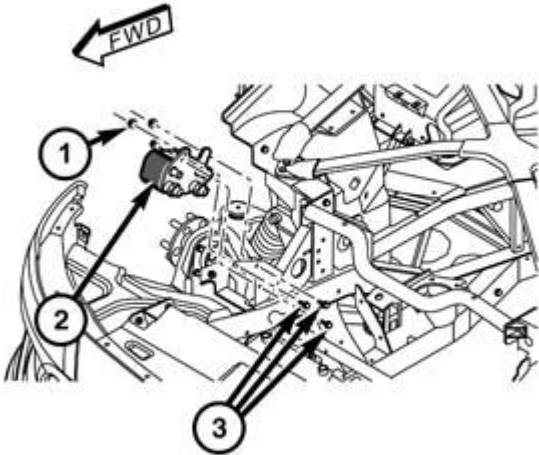


Fig. 254: Quick Connect Fittings
Courtesy of CHRYSLER GROUP, LLC

- Remove oil cooler lines.

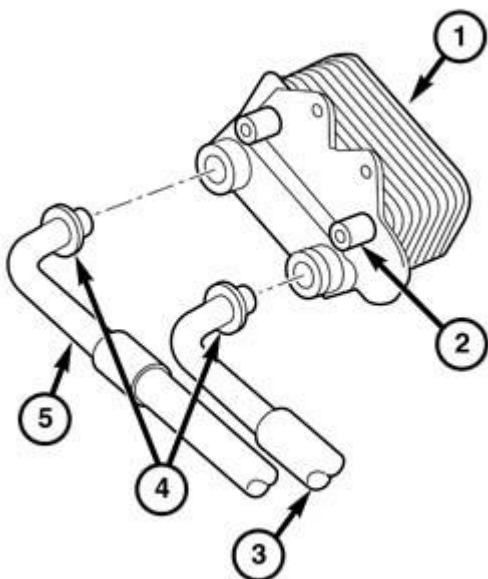
2. Remove quick connect fitting(s) (1, 3) from engine block or oil cooler.

INSTALLATION**OIL COOLER**

0913002052

Fig. 255: Oil Cooler & Fasteners**Courtesy of CHRYSLER GROUP, LLC**

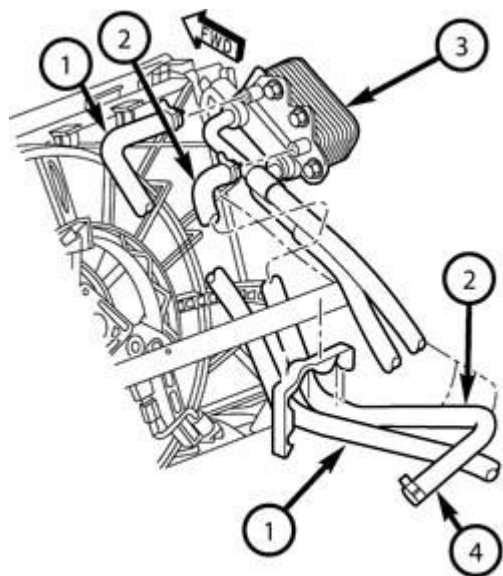
1. Position oil cooler (1) in place.
2. Install oil cooler fasteners (1 and 3). Tighten to 5 N.m (44 in. lbs.).



0913002427

Fig. 256: Oil Cooler, Oil Supply Line & Oil Return Line
Courtesy of CHRYSLER GROUP, LLC

3. Connect oil supply (3) and return lines (5) to oil cooler. Refer to **COOLER AND LINES, OIL, STANDARD PROCEDURES**.

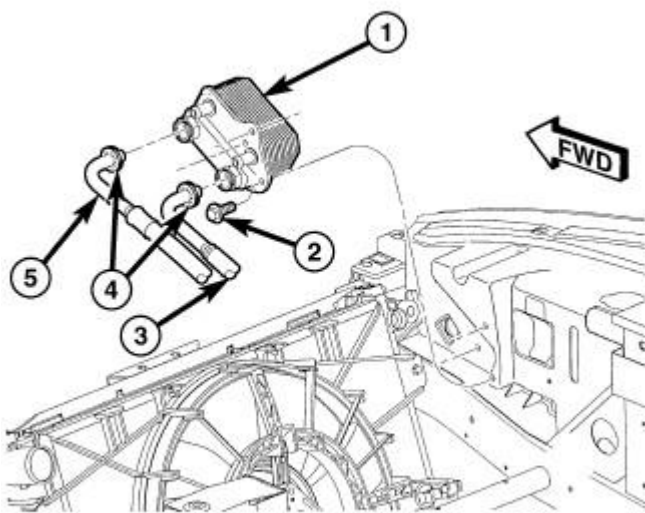


0913002428

Fig. 257: Coolant Hoses & Oil Cooler
Courtesy of CHRYSLER GROUP, LLC

4. Connect oil cooler coolant hoses (1, 2).

5. Install air cleaner housing assembly, connect throttle body air inlet hose. Refer to **BODY, AIR CLEANER, INSTALLATION**.
6. Fill cooling system. Refer to **STANDARD PROCEDURE**.
7. Start the engine to circulate and fill the oil cooler. Shut off the engine and check the oil level. Add oil as needed.
8. Inspect the oil cooler connections for leaks and correct as needed.

OIL COOLER LINES

81036974

Fig. 258: Identifying Oil Cooler

Courtesy of CHRYSLER GROUP, LLC

1. Connect oil cooler lines (3, 5) to oil cooler (1).
2. Slide retainer clips (4) in place.

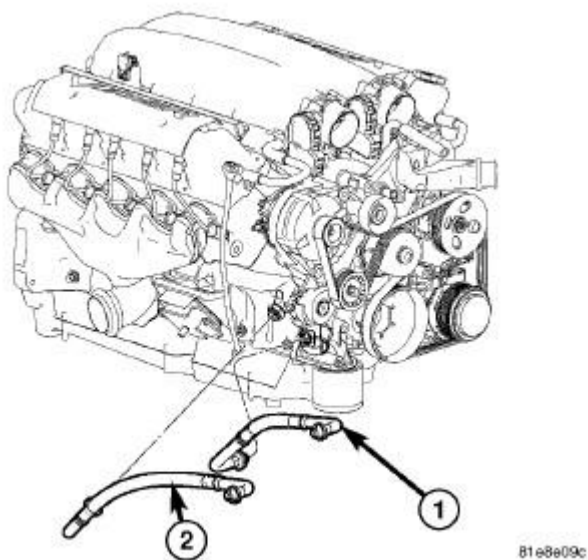


Fig. 259: Oil Cooler Lines

Courtesy of CHRYSLER GROUP, LLC

3. Connect oil lines (1, 2) to engine.
4. Slide retainer clips in place.

QUICK CONNECT FITTINGS

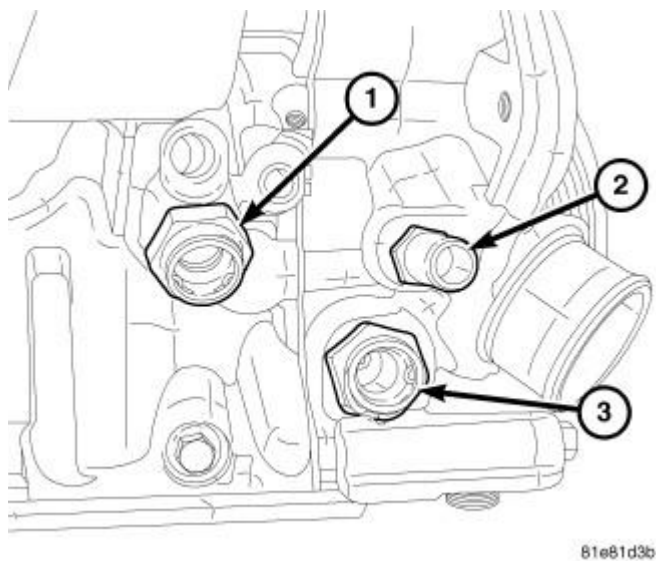


Fig. 260: Quick Connect Fittings

Courtesy of CHRYSLER GROUP, LLC

1. Install quick connect fittings (1, 3) in engine block or oil cooler. Tighten to 25 N.m (18 ft. lbs.).
2. Install oil cooler lines.

OIL

STANDARD PROCEDURE

CHECKING ENGINE OIL LEVEL

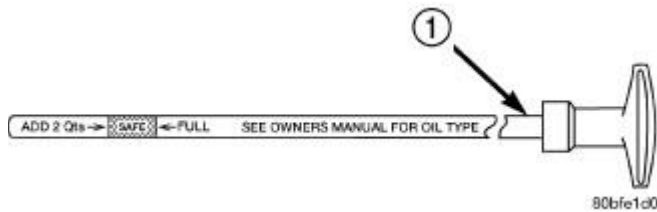


Fig. 261: Engine Oil Level

Courtesy of CHRYSLER GROUP, LLC

1 - ENGINE OIL DIPSTICK

The best time to check the engine oil level is after the vehicle has sat overnight. 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. Remove the engine oil dipstick. The dipstick is calibrated for 2 quarts within the SAFE zone.

ENGINE OIL AND FILTER CHANGE

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.

Change engine oil and filter at mileage and time intervals described in LUBRICATION AND MAINTENANCE. Refer to **MAINTENANCE SCHEDULES, DESCRIPTION** .

ENGINE OIL AND FILTER CHANGE

1. Run engine until achieving normal operating temperature.
2. Position the vehicle on a level surface and turn engine off.
3. Open hood, remove oil fill cap.
4. Raise vehicle on hoist.
5. Place a suitable drain pan under oil pan drain plug.
6. Remove drain plug from oil pan and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug and gasket if damaged.
7. Install drain plug in oil pan and tighten to 34 N.m (25 ft. lbs.).
8. Remove oil filter and replace with new tighten to 18 N.m (13 ft. lbs.).

9. Lower vehicle and fill crankcase with specified type. Refer to **CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS** and **CAPACITIES AND RECOMMENDED FLUIDS, DESCRIPTION**.
10. Install oil fill cap.
11. Start engine and inspect for leaks.
12. Stop engine and inspect oil level. Adjust oil level as necessary.

OIL FILTER SPECIFICATION

All Chrysler Corporation engines are equipped with a high quality full-flow, disposable type oil filter. Chrysler Corporation recommends a Mopar® or equivalent oil filter be used.

USED ENGINE OIL DISPOSAL

Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine.

PAN, OIL

REMOVAL

REMOVAL

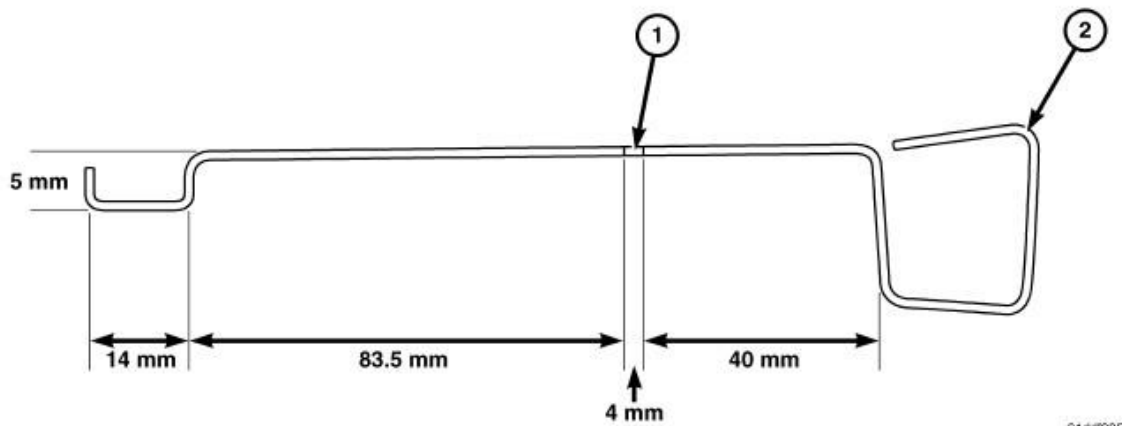


Fig. 262: Pick-Up Alignment Tool
Courtesy of CHRYSLER GROUP, LLC

NOTE: To aid in oil pan removal, fabricate a pick up alignment tool from a coat hanger.

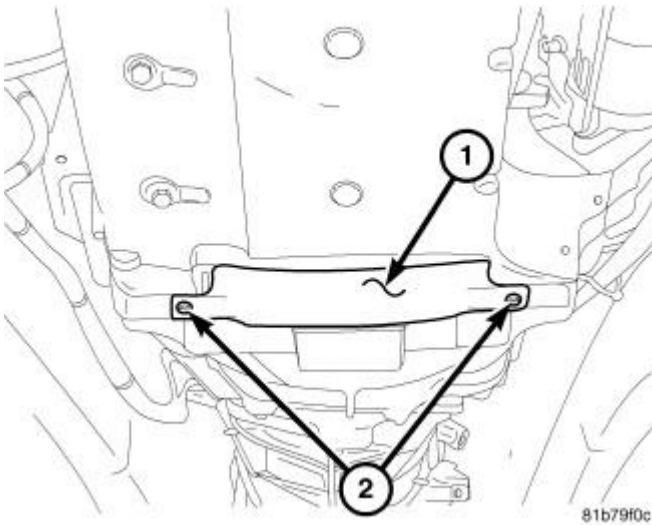


Fig. 263: Inspection Cover

Courtesy of CHRYSLER GROUP, LLC

1. Raise vehicle on hoist.
2. Drain engine oil.
3. Remove flywheel inspection cover (1).

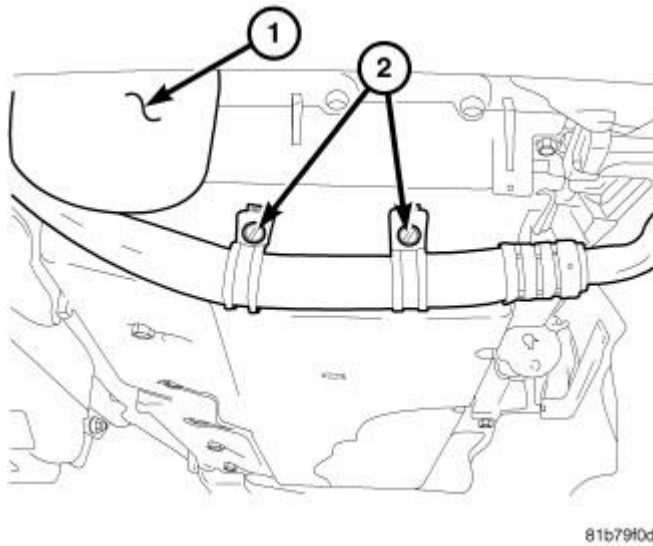


Fig. 264: A/C Line

Courtesy of CHRYSLER GROUP, LLC

4. Remove oil filter (1).
5. Remove fasteners (2) securing A/C line to oil pan.

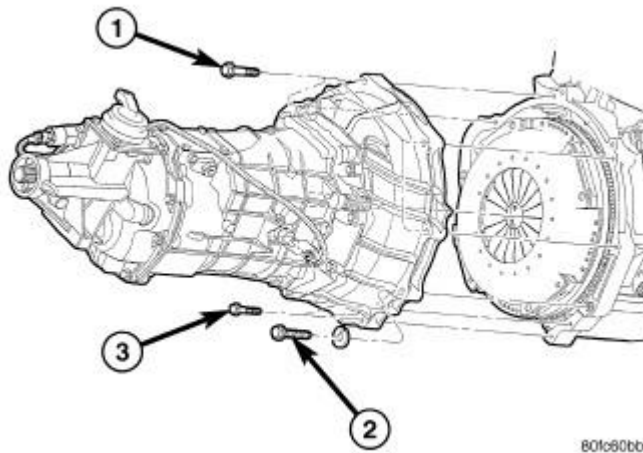


Fig. 265: Transmission To Engine Bolts
Courtesy of CHRYSLER GROUP, LLC

6. Remove transmission to oil pan fasteners (1, 2).

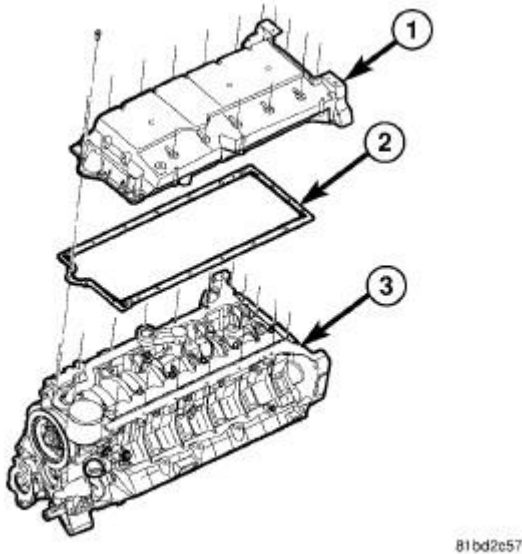
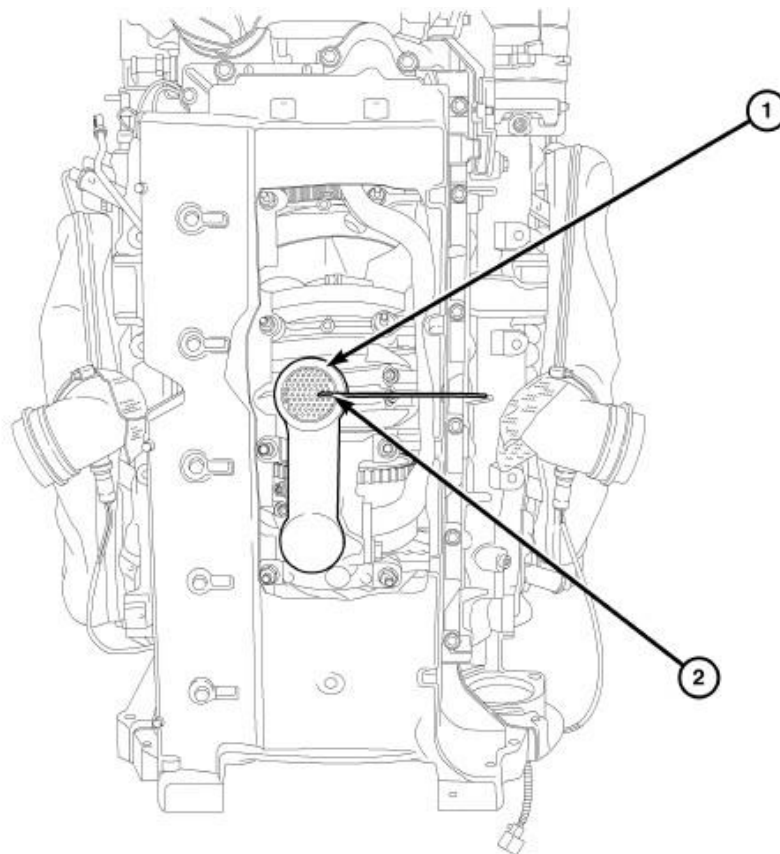


Fig. 266: Oil Pan Installation
Courtesy of CHRYSLER GROUP, LLC

7. Remove oil pan bolts and break RTV loose.

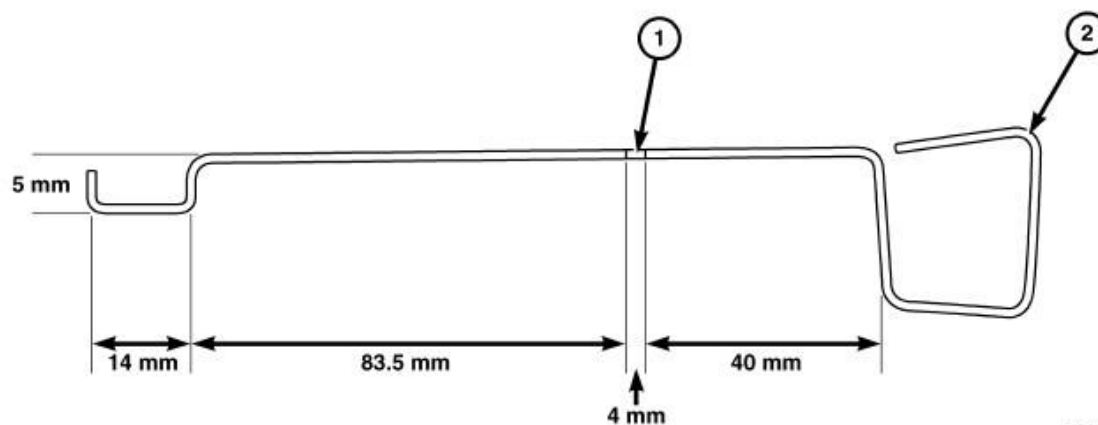
NOTE: Oil pick-up tube must be aligned properly to remove pan.



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Fig. 267: Using Alignment Tool To Hook Oil Pump Pick-Up
 Courtesy of CHRYSLER GROUP, LLC

8. Insert alignment tool (2) in through the oil drain hole and slightly angle it towards the front of the engine.
9. Try to hook oil pump pick-up (1) with alignment tool (2).



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Fig. 268: Pick-Up Alignment Tool
 Courtesy of CHRYSLER GROUP, LLC

10. After hooking the oil pump pick up, move alignment tool (2) so the mark (1) is by the edge of the oil drain hole.

11. Lift oil pan from engine block.

NOTE: Clean and inspect oil pan gasket. The pan gasket can be used again if in good condition. Replace oil pan gasket if the waffle pad area is damaged, or if the inner rubber bead is damaged.

INSTALLATION

INSTALLATION

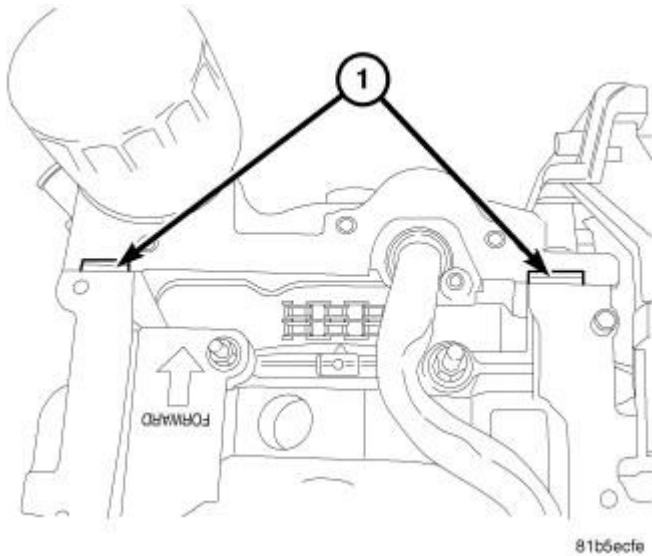
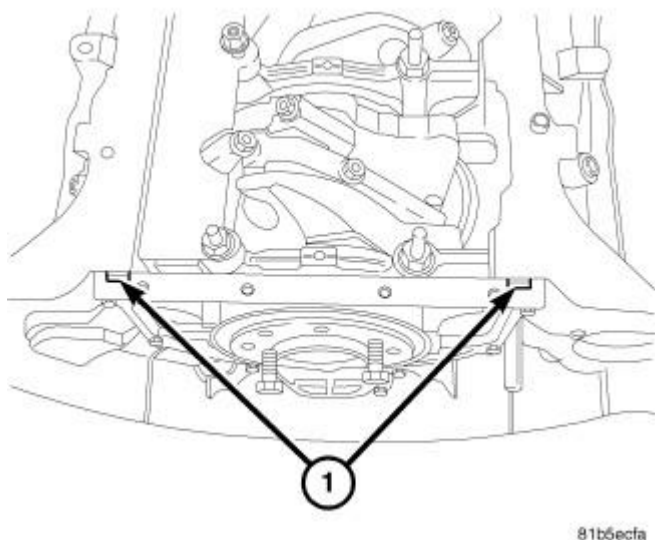


Fig. 269: Front T-Joint

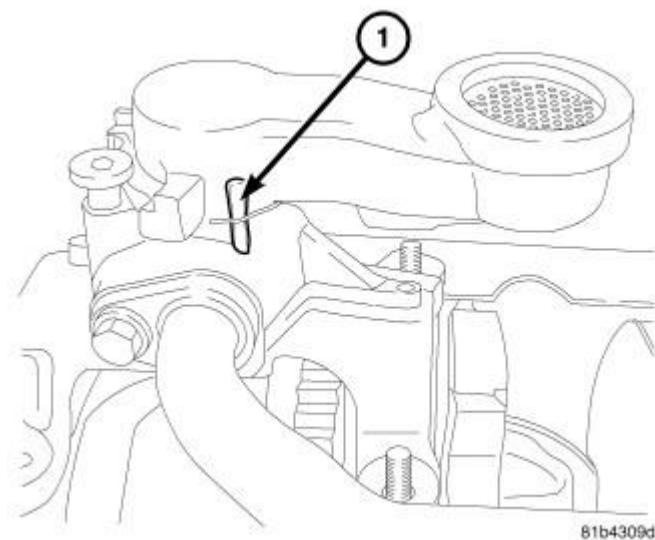
Courtesy of CHRYSLER GROUP, LLC

1. Clean gasket surfaces. Inspect oil pan gasket. Replace as necessary.
2. Apply an 1/8 in. bead of Mopar® Engine RTV at the front T-joints (1) between the cylinder block to timing chain case cover.

**Fig. 270: Rear T-Joint**

Courtesy of CHRYSLER GROUP, LLC

3. Apply an 1/8 in. bead of Mopar® Engine RTV at the rear T-joints (1) between the rear main seal retainer and engine block.

**Fig. 271: Oil Pick-Up Alignment**

Courtesy of CHRYSLER GROUP, LLC

4. Align swing oil pump pick (1).

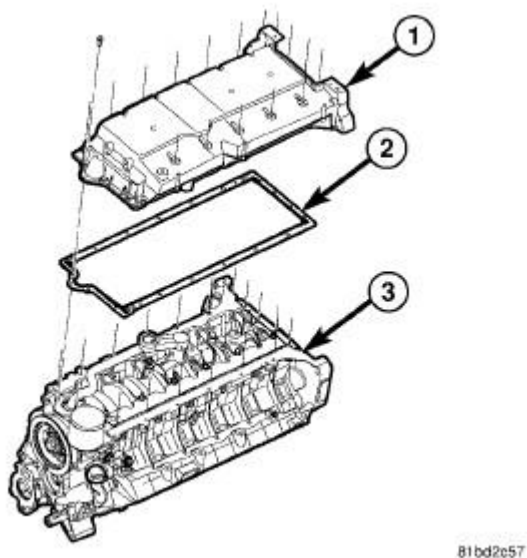


Fig. 272: Oil Pan Installation

Courtesy of CHRYSLER GROUP, LLC

5. Position oil pan (1) and gasket (2) to engine block. Hand start all fasteners.

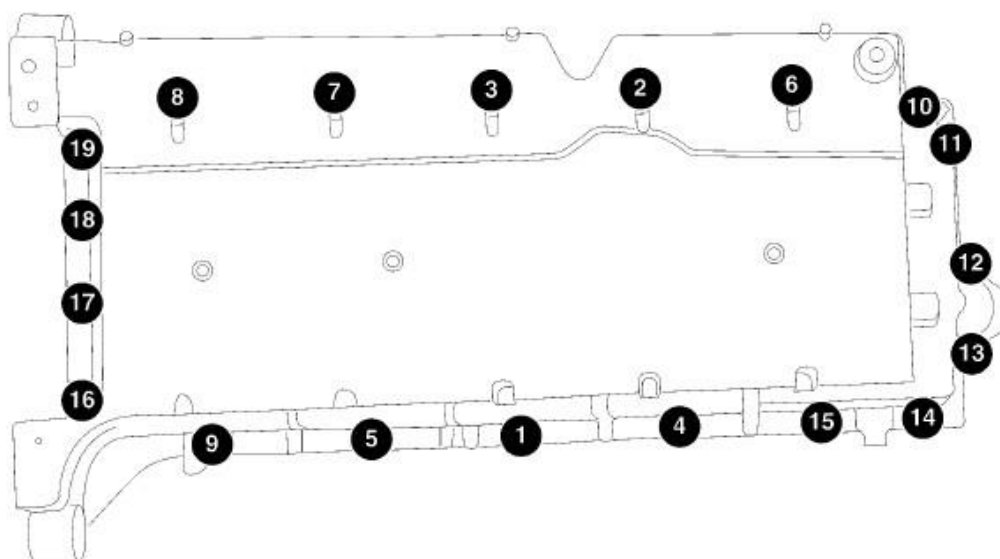


Fig. 273: Oil Pan Bolt Torque Sequence

Courtesy of CHRYSLER GROUP, LLC

6. Tighten oil pan bolts 1 - 15 to 28 N.m (21 ft. lbs.).
7. Tighten oil pan bolts 16 - 19 to 12 N.m (106 in lbs.).

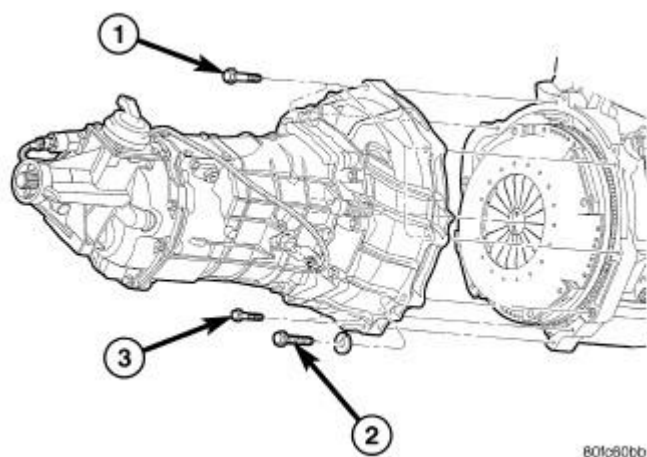


Fig. 274: Transmission To Engine Bolts
Courtesy of CHRYSLER GROUP, LLC

8. Run the transmission to oil pan bolts in finger tight.
9. Tighten transmission to oil pan bolts (3) to 28 N.m (21 ft. lbs.).

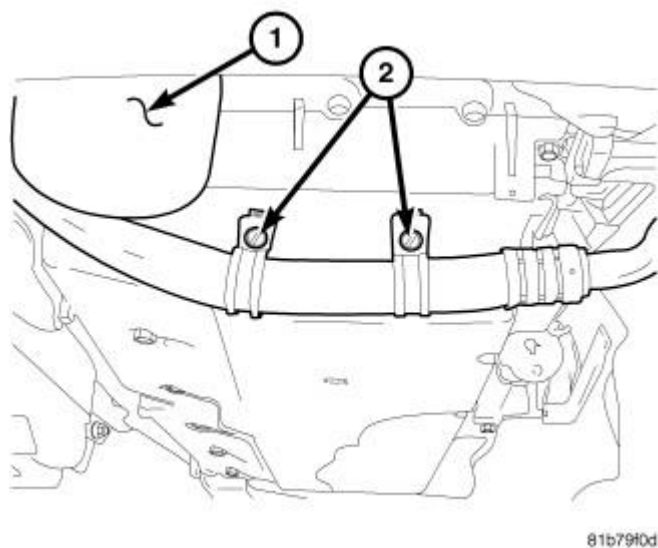


Fig. 275: A/C Line
Courtesy of CHRYSLER GROUP, LLC

10. Install fasteners securing A/C line to oil pan.

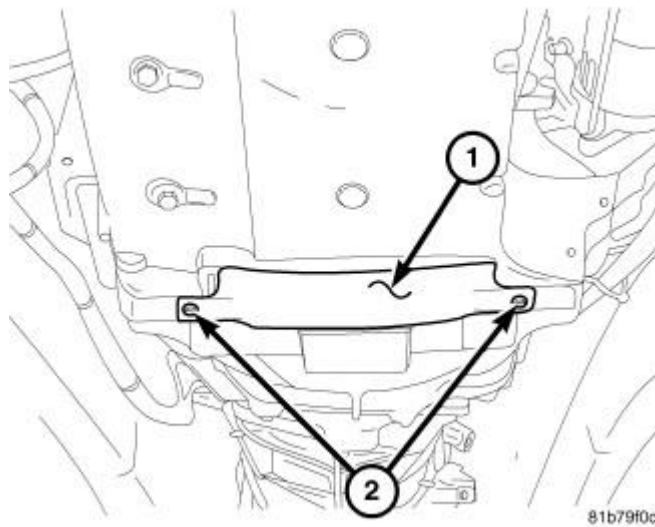


Fig. 276: Inspection Cover
Courtesy of CHRYSLER GROUP, LLC

11. Install flywheel inspection cover.
12. Lower vehicle.
13. Fill the crankcase with oil to proper level.
14. Start engine and check for leaks.

PUMP, ENGINE OIL

REMOVAL

OIL PUMP

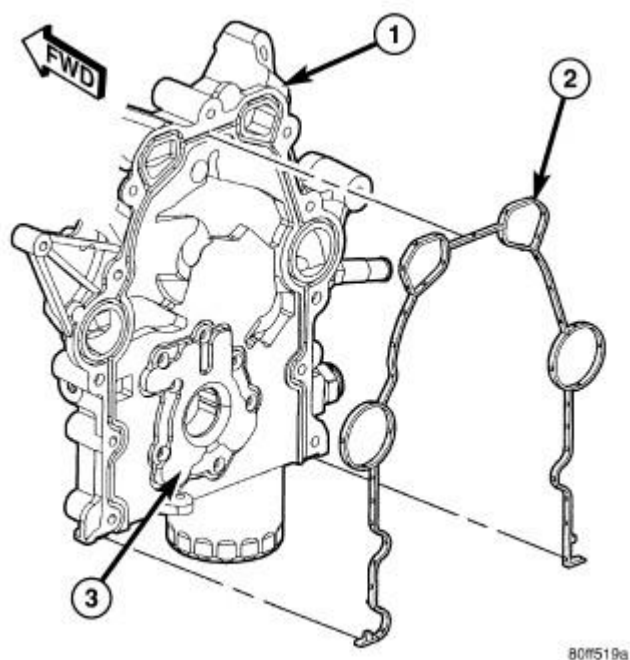


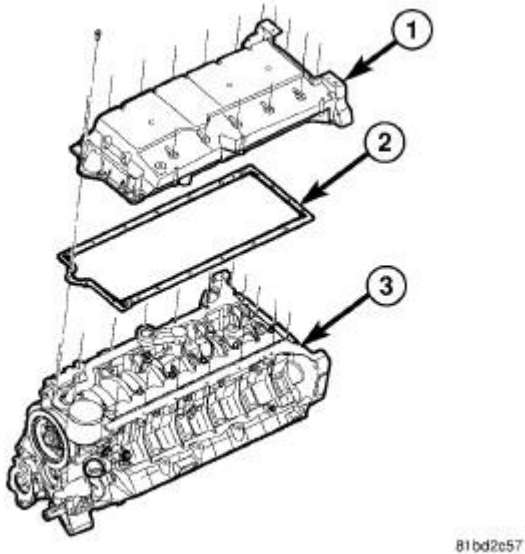
Fig. 277: Timing Chain Cover Gasket

Courtesy of CHRYSLER GROUP, LLC

NOTE: The oil pump is serviced with the timing chain cover.

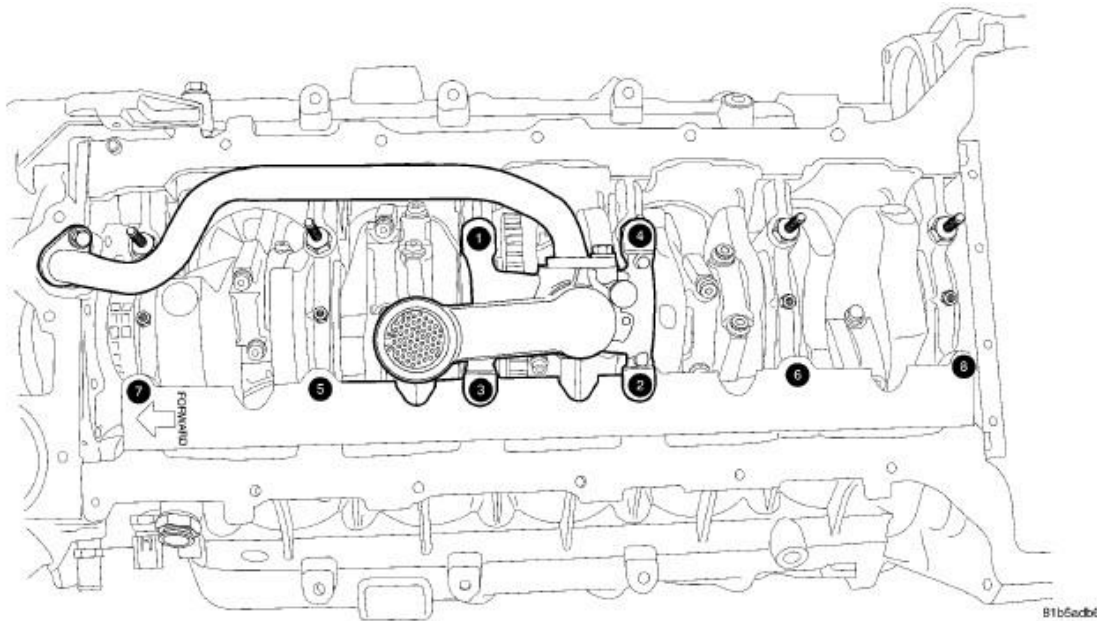
1. Remove timing chain cover (1). Refer to **COVER(S), ENGINE TIMING, REMOVAL.**
2. Disassemble oil pump (3). Refer to **PUMP, ENGINE OIL, DISASSEMBLY.**
3. Inspect oil pump parts. Refer to **PUMP, ENGINE OIL, INSPECTION.**

SWINGING OIL PICK - UP

**Fig. 278: Oil Pan Installation**

Courtesy of CHRYSLER GROUP, LLC

1. Remove oil pan (1).

**Fig. 279: Oil Pick Up Assembly**

Courtesy of CHRYSLER GROUP, LLC

2. Remove oil pump pick up tube.

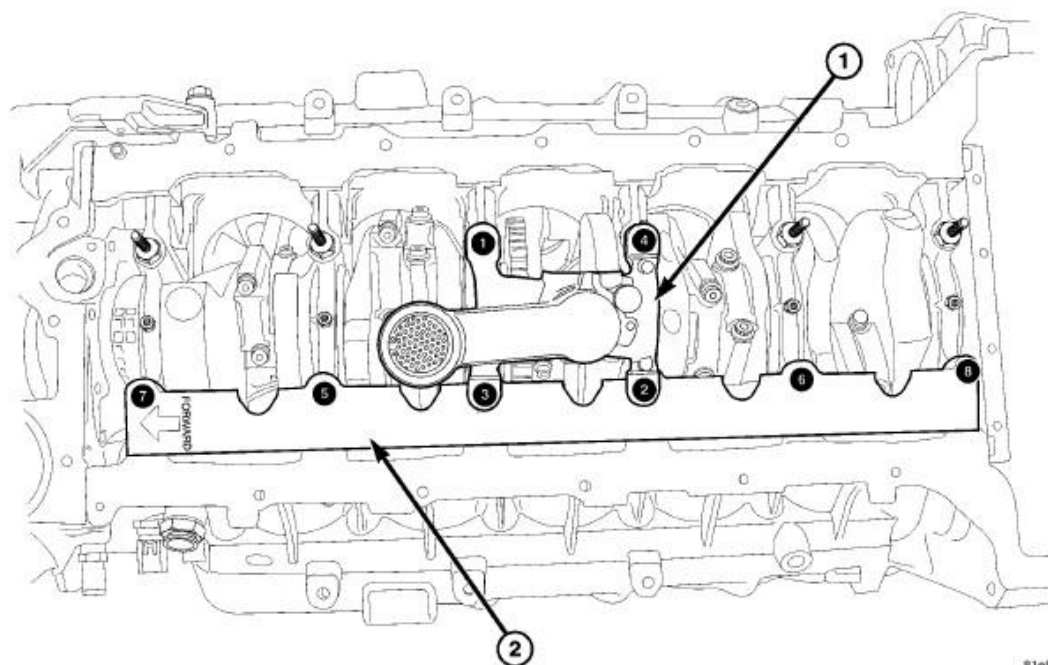


Fig. 280: Swinging Oil Pick Up
Courtesy of CHRYSLER GROUP, LLC

3. Remove swinging oil pick assembly (1).

DISASSEMBLY

DISASSEMBLY

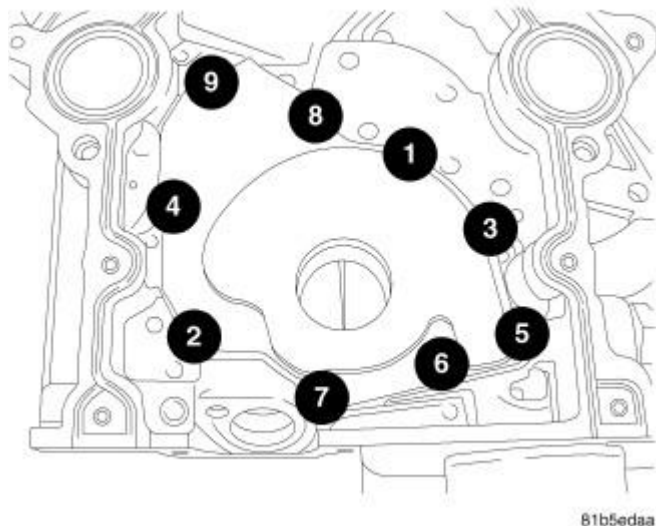


Fig. 281: Oil Pump Cover Torque Sequence
Courtesy of CHRYSLER GROUP, LLC

1. Remove oil pump cover screws (1 - 9) and lift off cover.

2. Remove pump rotors.

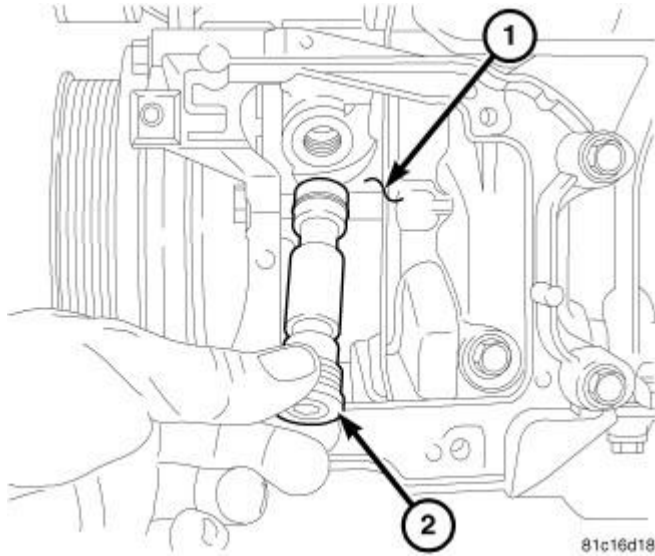


Fig. 282: Oil Pressure Relief Valve Removal/Installation
 Courtesy of CHRYSLER GROUP, LLC

3. Remove oil pressure relief valve (2).
4. Wash all parts in a suitable solvent and inspect carefully for damage or wear. Refer to **PUMP, ENGINE OIL, INSPECTION**.

CLEANING

CLEANING

Clean all parts thoroughly. Mating surface of the chain case cover should be smooth. Replace pump cover if scratched or grooved. Clean swinging pick-up assembly. Make sure the pick-up pivots freely.

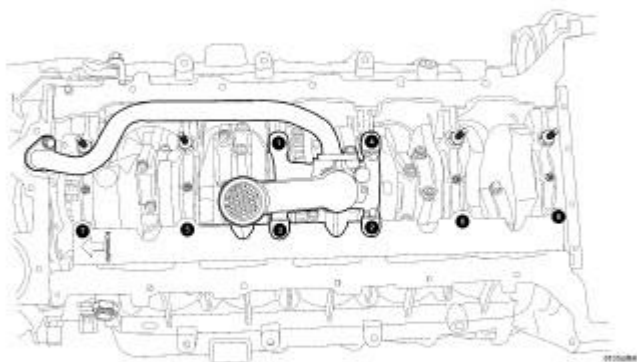
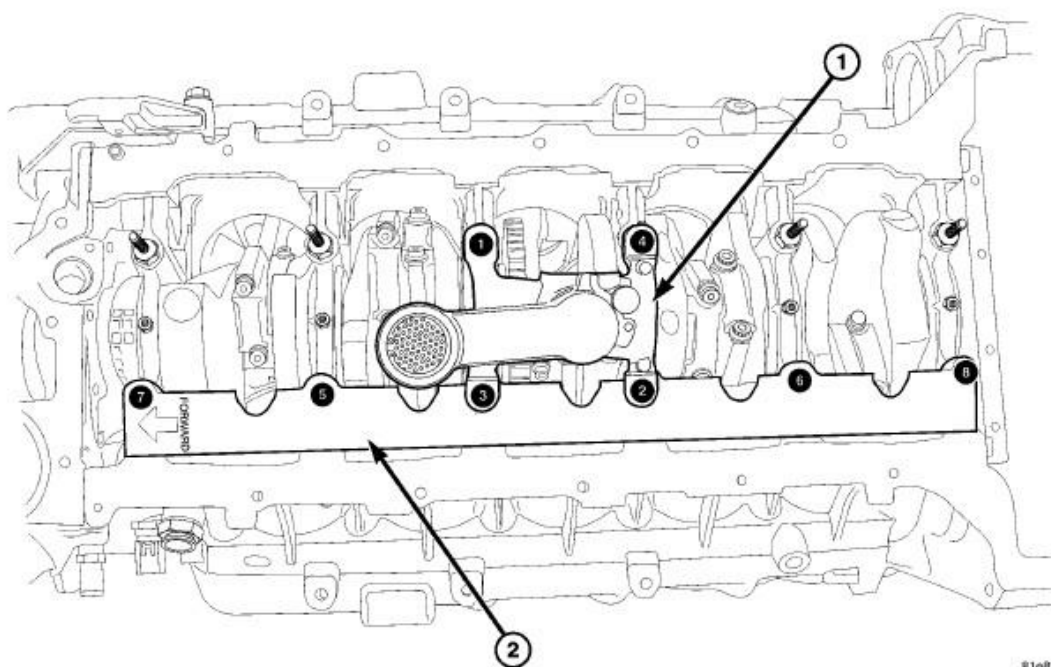


Fig. 283: Oil Pick Up Assembly

Courtesy of CHRYSLER GROUP, LLC

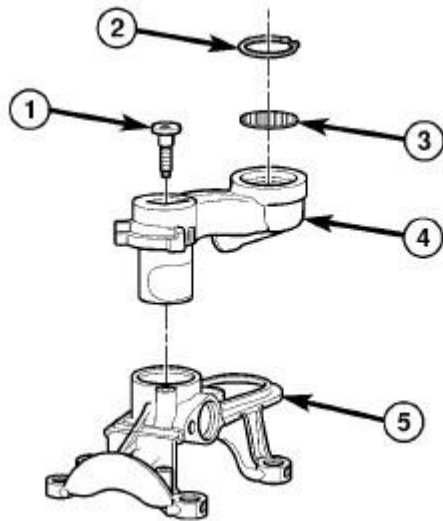
1. Remove oil pick - up tube.



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Fig. 284: Swinging Oil Pick Up
Courtesy of CHRYSLER GROUP, LLC

2. Remove pick-up assembly (1).



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Fig. 285: Pick-Up Disassembly
Courtesy of CHRYSLER GROUP, LLC

3. Remove pivot bolt (1).
4. Remove snap ring (2) and pick-up screen (3).
5. Remove swinging pick-up (4) from body (5).
6. Clean all parts in a suitable solvent.
7. Install screen (3) and snap ring (2).
8. Apply Mopar® lock AND seal adhesive to pivot bolt.
9. Install pivot bolt and tighten to 14 N.m (124 in. lbs.).
10. Verify that pivot swings freely. If pivot does not swing freely, disassemble and reassemble.

INSPECTION

INSPECTION

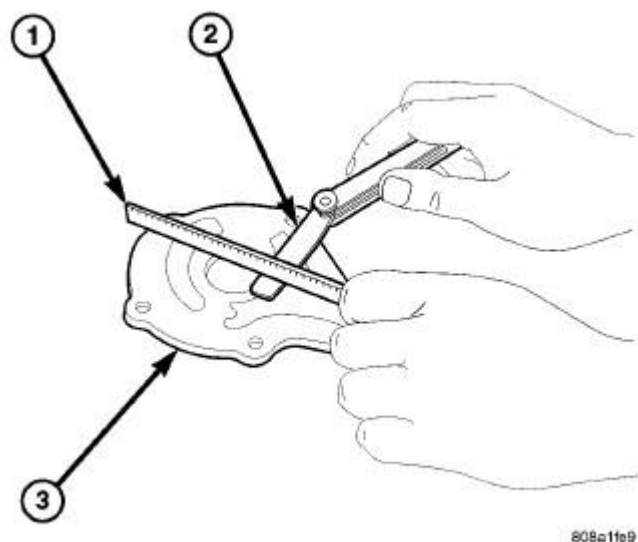


Fig. 286: Checking Oil Pump Cover Flatness

Courtesy of CHRYSLER GROUP, LLC

1. Lay a straightedge (1) across the pump cover (3) surface. If a 0.076 mm (0.003 in.) feeler gauge (2) can be inserted between cover and straight edge, cover should be replaced.

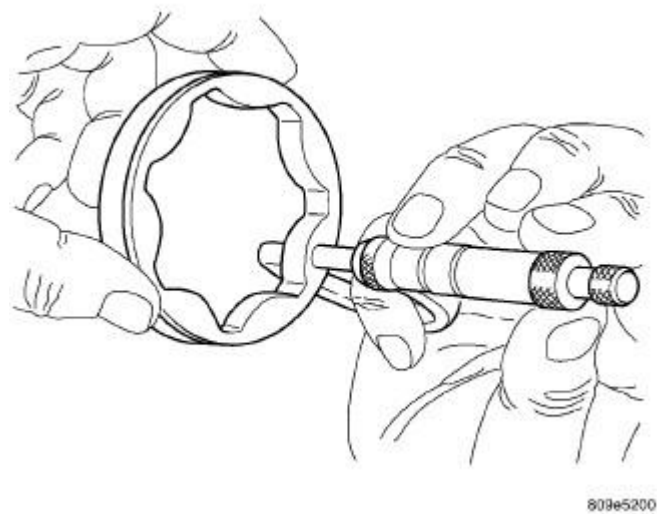


Fig. 287: Measuring Outer Rotor Thickness

Courtesy of CHRYSLER GROUP, LLC

2. Measure the outer rotor thickness.



Fig. 288: Measuring Inner Rotor Thickness
Courtesy of CHRYSLER GROUP, LLC

3. Measure the inner rotor thickness.
4. If either rotor thickness measures 18.92 mm (0.744 in.) or less, replace rotor set.
5. Measure outer rotor diameter. If the outer rotor diameter is 82.45 mm (3.246 in.) or less, replace rotor set.

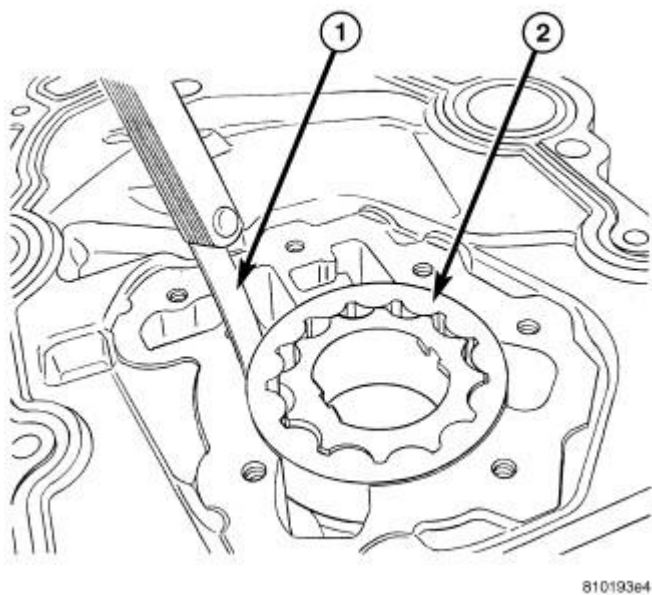


Fig. 289: Measuring Outer Rotor Clearance In Case
Courtesy of CHRYSLER GROUP, LLC

6. Measure clearance between outer rotor (2) and case. If measurement is 0.19 mm (0.007 in.) or more, and outer rotor (2) is within specification, replace chain case cover.

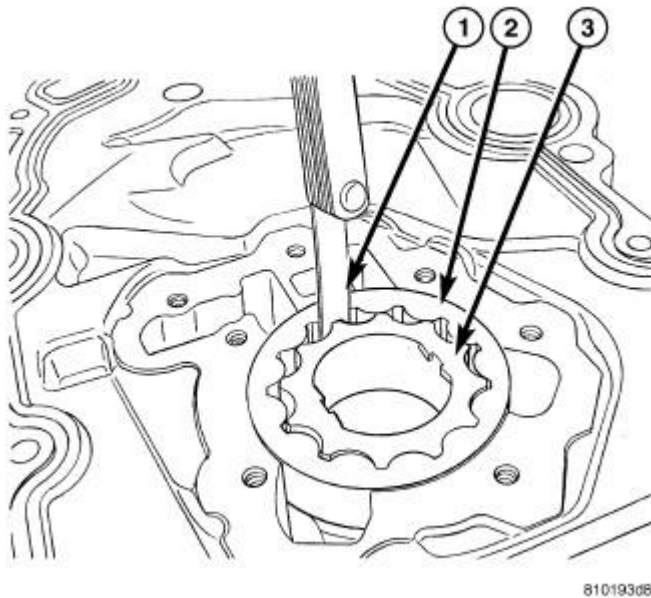


Fig. 290: Measuring Clearance Between Rotors
 Courtesy of CHRYSLER GROUP, LLC

7. Measure tip clearance between the outer rotor (2) and inner rotor (3). If clearance between inner (3) and outer rotors (2) is 0.150 mm (0.006 in.) or more, replace rotor set.
8. Place a straightedge across the face of the chain case cover, in between the bolt holes. If a feeler gauge of 0.077 mm (0.003 in.) or more can be inserted between rotors and the straightedge, and the rotors are within specification, replace the case cover.
9. Inspect oil pressure relief valve operation. Refer to **VALVE, OIL PRESSURE RELIEF, INSPECTION**.
10. If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other reasons for oil pressure loss.

ASSEMBLY

ASSEMBLY

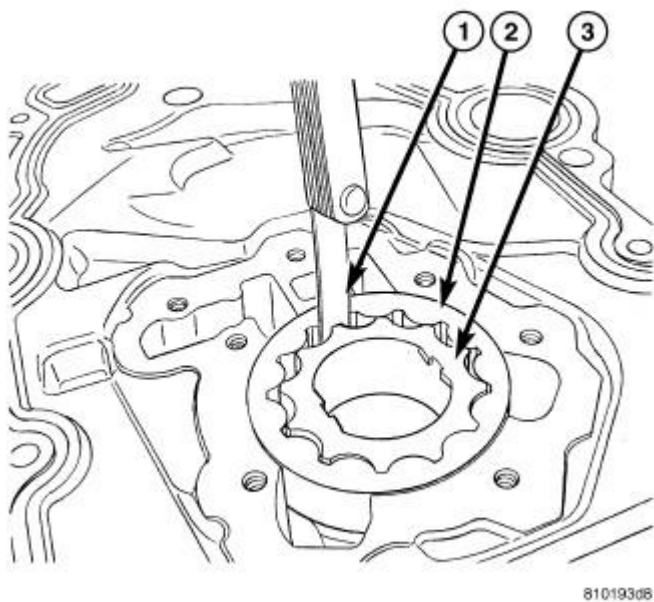


Fig. 291: Measuring Clearance Between Rotors
Courtesy of CHRYSLER GROUP, LLC

1. Apply clean engine oil to the outer rotor (2) and install with the chamfer toward the front cover.
2. Apply clean engine oil to the inner rotor (3) and install with the chamfer toward the crankshaft.
3. Assemble the pump using new parts as required.

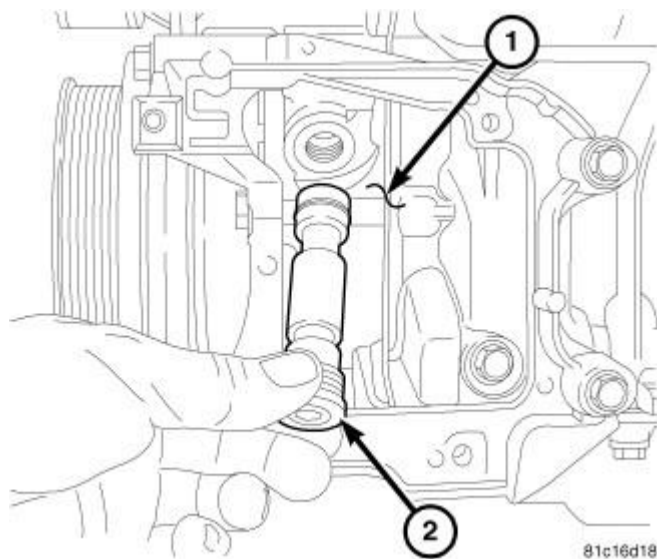


Fig. 292: Oil Pressure Relief Valve Removal/Installation
Courtesy of CHRYSLER GROUP, LLC

4. Lubricate the oil pressure relief valve with clean engine oil.

5. Install the oil pressure relief valve (2).
6. Inspect the relief valve plug O-ring (3) and replace if necessary.
7. Tighten the relief valve cartridge to 25 N.m (18 ft. lbs.).

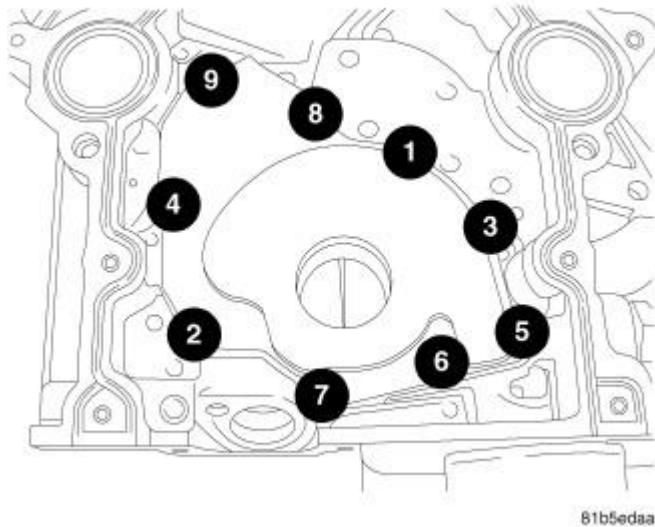


Fig. 293: Oil Pump Cover Torque Sequence
Courtesy of CHRYSLER GROUP, LLC

8. Install the pump rotors with the chamfer side to the inside of chain case cover.
9. Position the oil pump cover and install the retainers hand tight.
10. Using the sequence shown in illustration, tighten the oil pump cover retainers to 12 N.m (105 in. lbs.).

INSTALLATION

OIL PUMP

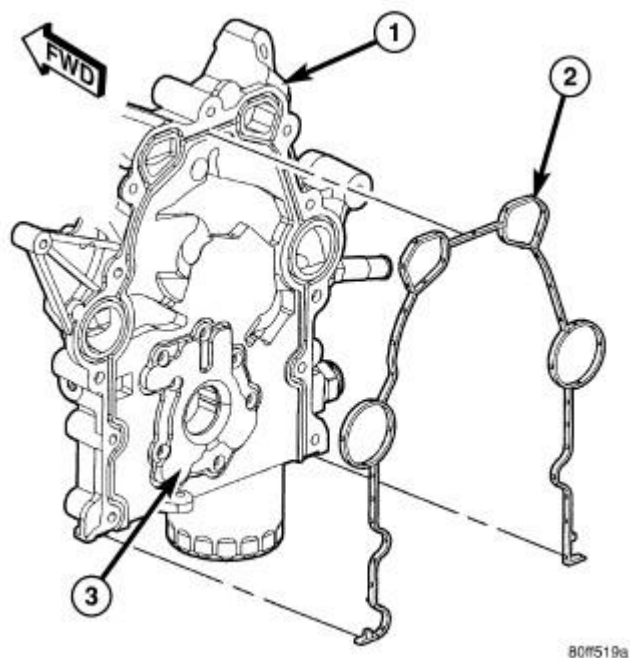
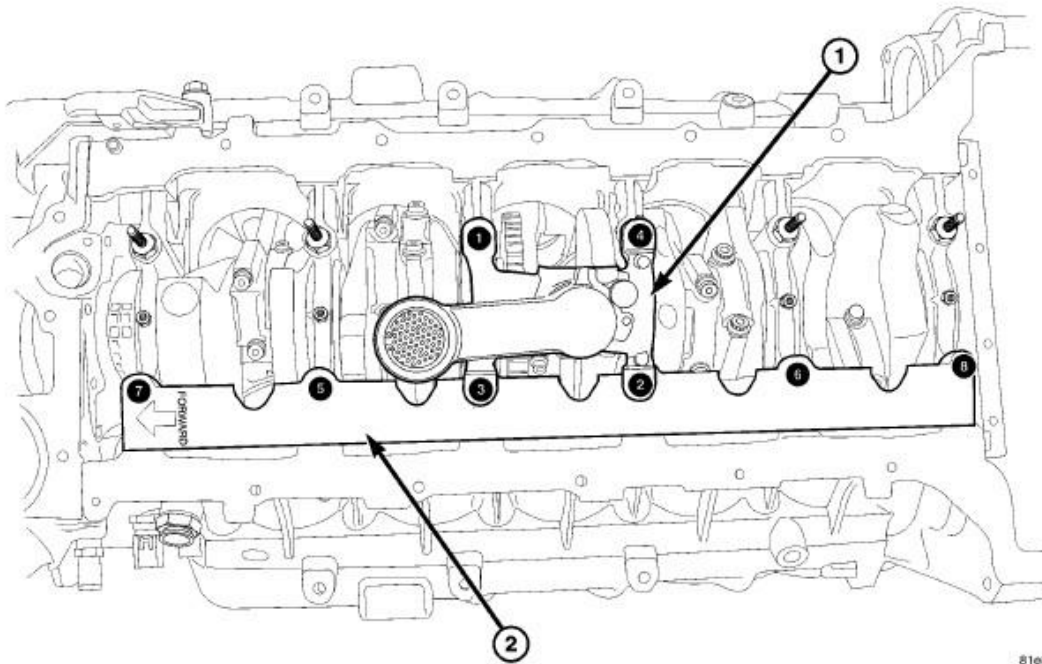


Fig. 294: Timing Chain Cover Gasket

Courtesy of CHRYSLER GROUP, LLC

1. Assemble oil pump. Refer to **PUMP, ENGINE OIL, ASSEMBLY**.
2. Prime oil pump before installation by filling rotor cavity with engine oil.
3. Install timing chain cover (1). Refer to **COVER(S), ENGINE TIMING, INSTALLATION**.
4. Install **NEW** oil filter.
5. Fill the crankcase with oil to proper level.

SWINGING OIL PICK-UP

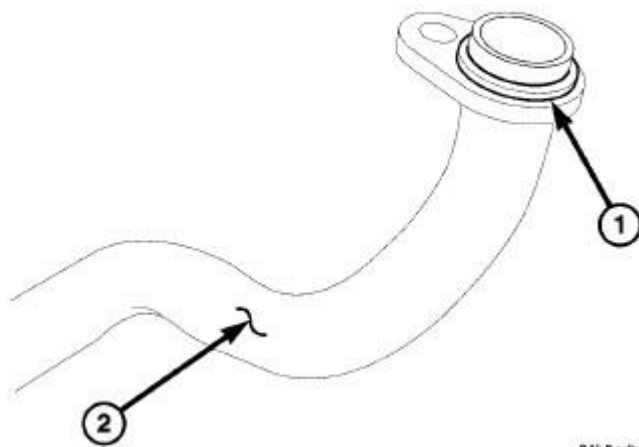


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Fig. 295: Swinging Oil Pick Up

Courtesy of CHRYSLER GROUP, LLC

1. Position swinging oil pick up in place.
2. Hand tighten bolts 1 through 4.



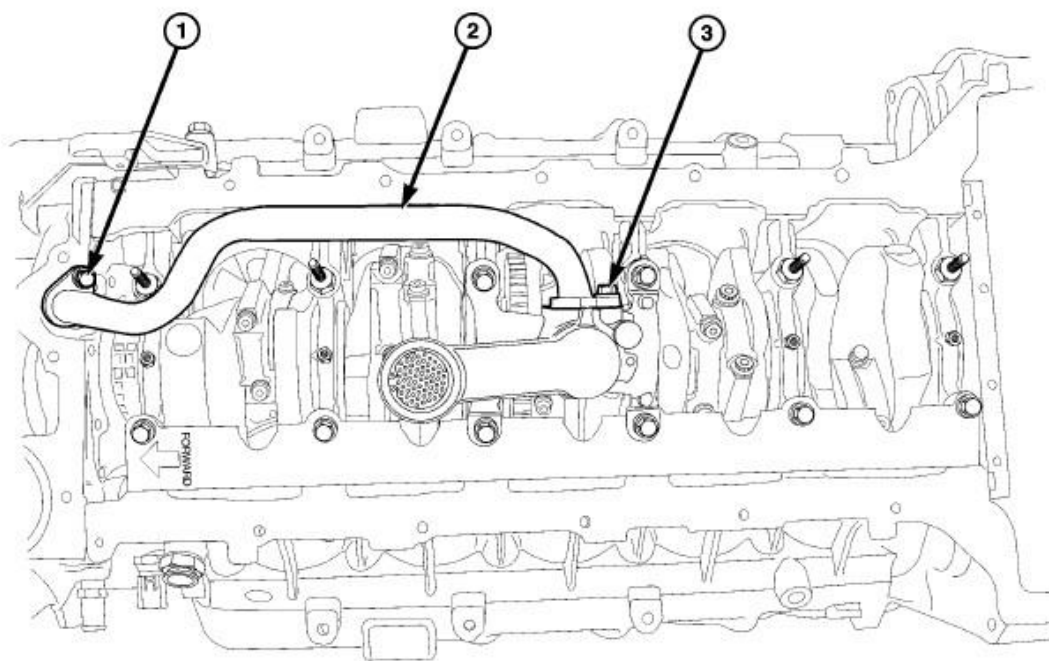
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Fig. 296: Oil Pick-Up O-Ring

Courtesy of CHRYSLER GROUP, LLC

3. Install new O-rings (1) on both ends of the flanged oil pick up tube (2).

4. Lubricate O-rings with clean engine oil.

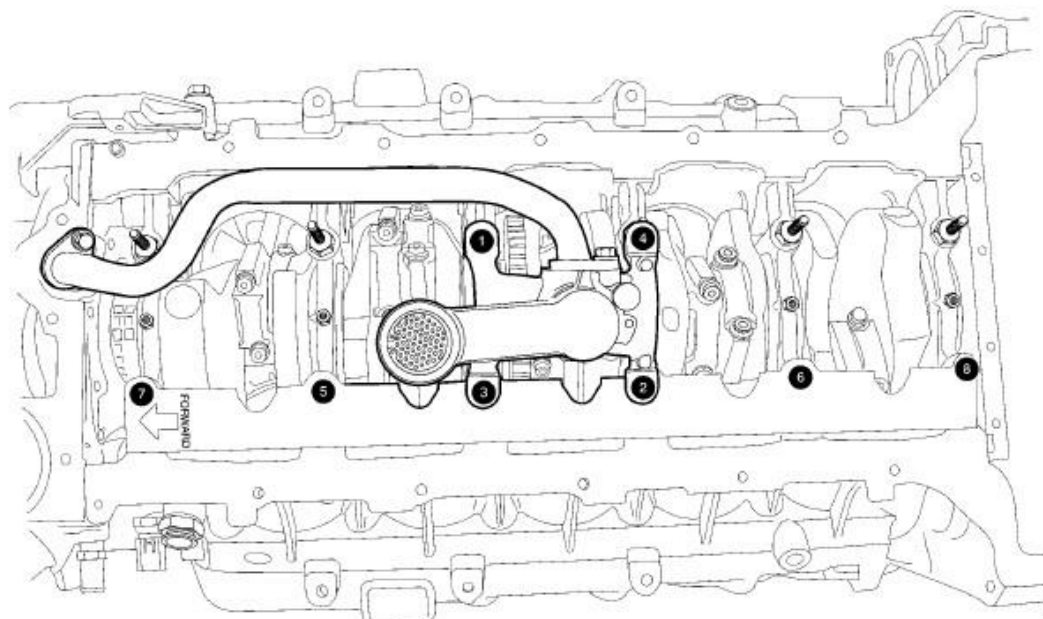


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Fig. 297: Oil Pick Up Tube

Courtesy of CHRYSLER GROUP, LLC

5. Position flanged oil pick up tube (2) into front cover and swinging pick up assembly.
6. Make sure that the O-rings are seated into place. Install fasteners (1, 3) and hand tighten.



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Fig. 298: Oil Pick Up Assembly

Courtesy of CHRYSLER GROUP, LLC

7. Tighten fasteners 1 - 4 to 28 N.m (21 ft. lbs.).

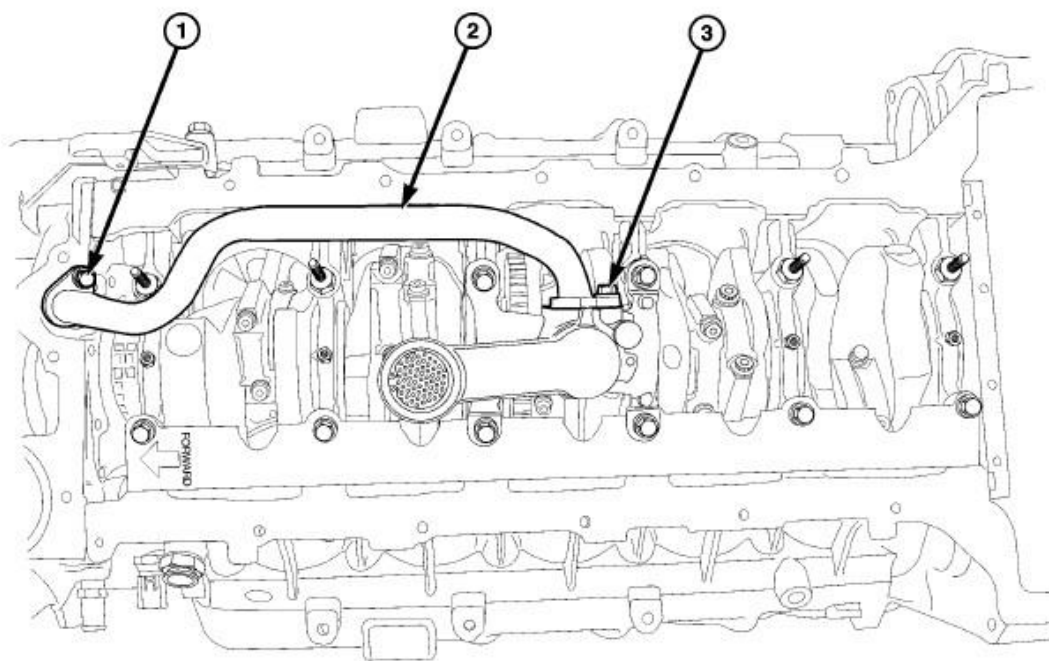


Fig. 299: Oil Pick Up Tube

Courtesy of CHRYSLER GROUP, LLC

8. Tighten flanged oil pick up tube fasteners (1, 3) to 28 N.m (21 ft. lbs.).

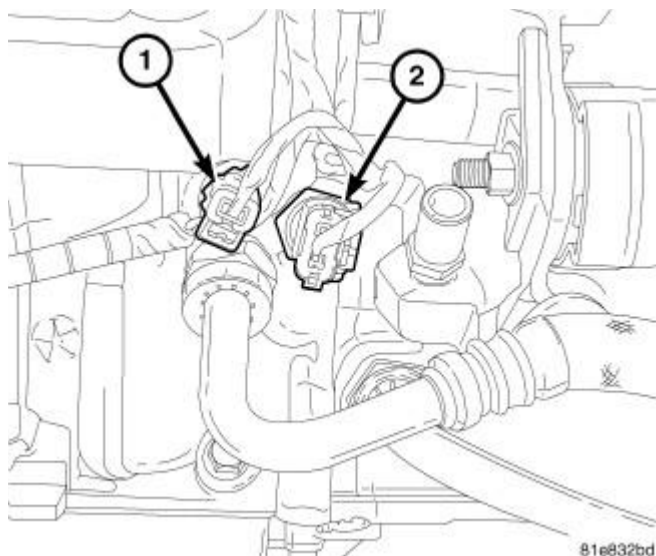
NOTE: Make sure the swinging pick up pivots freely, loosen all the bolts and re-torque them.

9. Install oil pan. Refer to **PAN, OIL, INSTALLATION.**

SENSOR, OIL PRESSURE

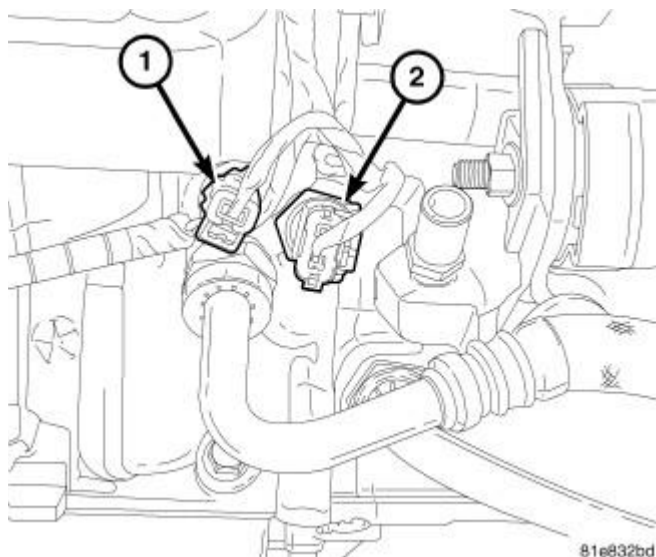
REMOVAL

REMOVAL

**Fig. 300: Oil Pressure Sensor**

Courtesy of CHRYSLER GROUP, LLC

1. Disconnect oil pressure sensor (2) electrical connector.
2. Remove oil pressure sensor (2).

INSTALLATION**INSTALLATION****Fig. 301: Oil Pressure Sensor**

Courtesy of CHRYSLER GROUP, LLC

NOTE: If reinstalling oil pressure sensor apply thread sealant.

NOTE: Sensor must be rotated to orient electrical connector clearance within 10

minutes of installation.

1. Install oil pressure sensor (2) and tighten to 9 N.m. (80 in.lbs.) and rotate to orient electrical connector.
2. Connect electrical connector.

SENSOR, OIL TEMPERATURE

REMOVAL

REMOVAL

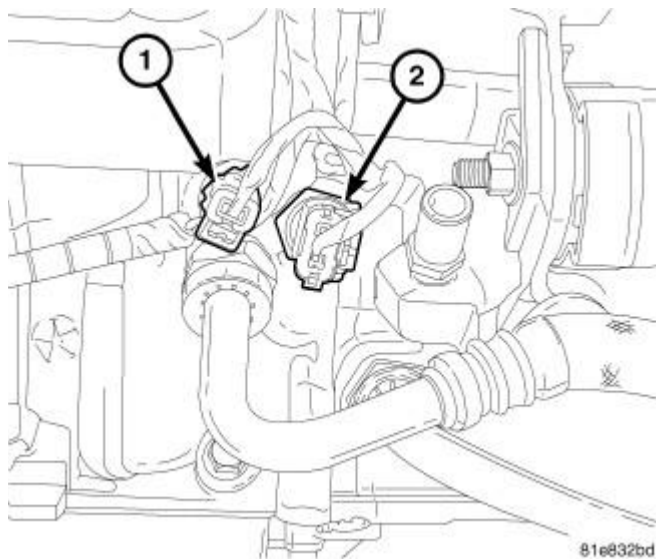


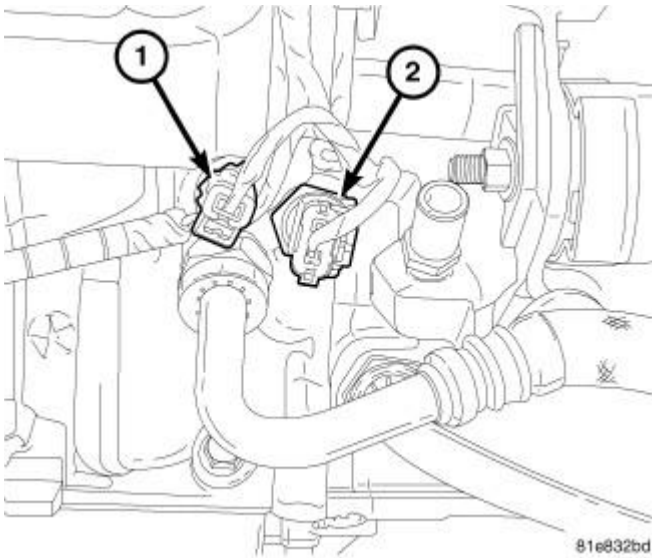
Fig. 302: Oil Pressure Sensor

Courtesy of CHRYSLER GROUP, LLC

1. Disconnect oil temperature sensor electrical connector (1).
2. Remove oil temperature sensor (1).

INSTALLATION

INSTALLATION

**Fig. 303: Oil Pressure Sensor**

Courtesy of CHRYSLER GROUP, LLC

NOTE: If reinstalling oil pressure sensor apply Mopar® thread sealant.

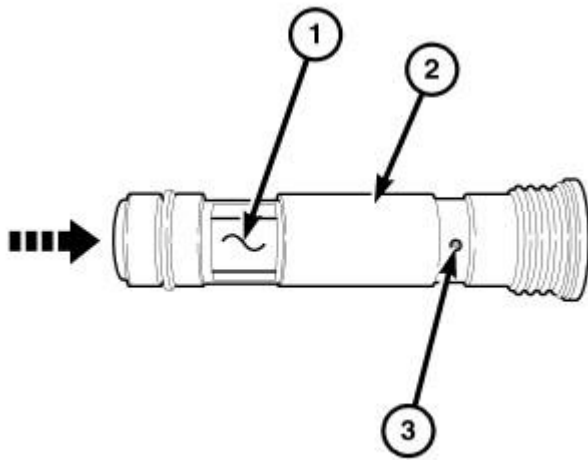
NOTE: Sensor must be rotated to orient electrical connector clearance within 10 minutes of installation.

1. Apply Mopar® thread sealant to oil temperature sensor threads.
2. Install oil temperature sensor (1) and tighten to 20 N.m (15 ft. lbs.).
3. Connect electrical connector.

VALVE, OIL PRESSURE RELIEF

DESCRIPTION

DESCRIPTION



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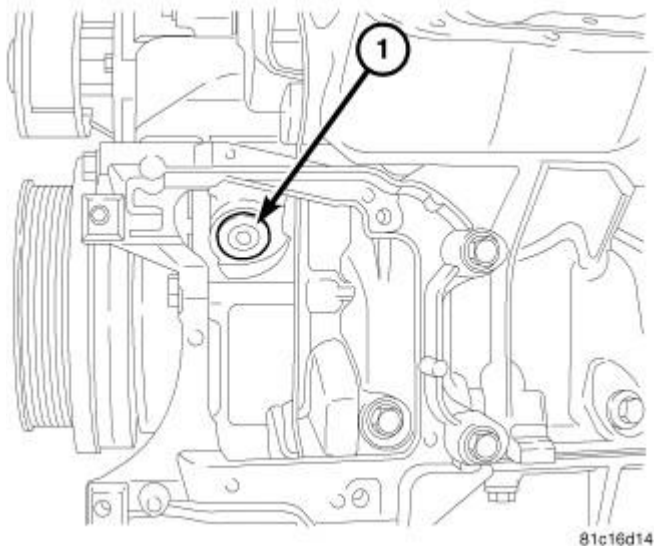
Fig. 304: Oil Pressure Relief Valve Inspection

Courtesy of CHRYSLER GROUP, LLC

The oil pressure relief valve is a cartridge design. The oil pressure relief valve (1) and spring are contained inside a cartridge (2). This prevents damage to the timing chain case cover should foreign material pass through oil pressure relief valve.

REMOVAL

REMOVAL



81c16d14

Fig. 305: Oil Pressure Relief Valve Removal

Courtesy of CHRYSLER GROUP, LLC

1. Remove A/C compressor. Refer to **COMPRESSOR, A/C, REMOVAL** .
2. Loosen oil pressure regulating valve (1).

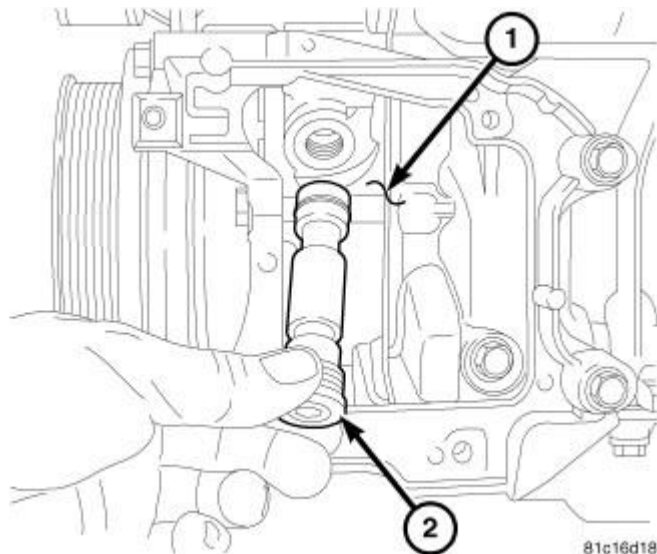


Fig. 306: Oil Pressure Relief Valve Removal/Installation
Courtesy of CHRYSLER GROUP, LLC

3. Pull oil pressure regulating valve cartridge (2) out of the timing chain cover (1).

INSPECTION

INSPECTION

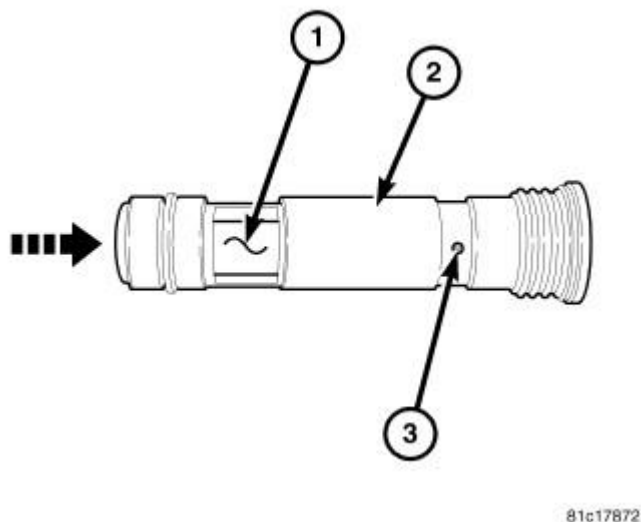
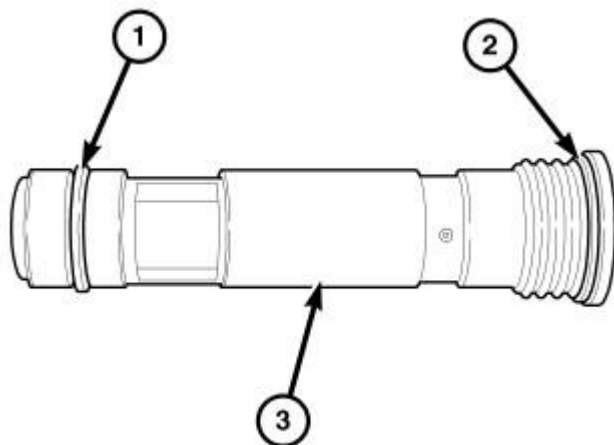


Fig. 307: Oil Pressure Relief Valve Inspection
Courtesy of CHRYSLER GROUP, LLC

Inspect the oil pressure relief valve piston (1) for deep scratches, debris, or removal of black coating on piston.



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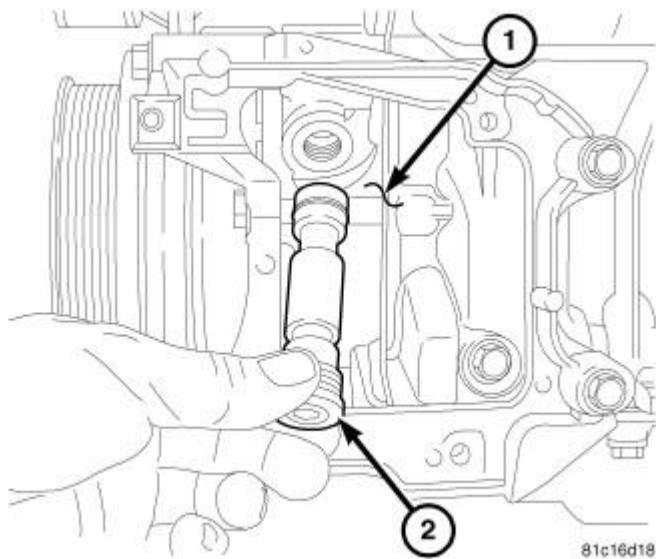
Fig. 308: Oil Pressure Relief Valve Inspection

Courtesy of CHRYSLER GROUP, LLC

Inspect oil pressure relief valve (3) O-rings (1, 2) for damage. Replace as needed.

INSTALLATION

INSTALLATION



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Fig. 309: Oil Pressure Relief Valve Removal/Installation

Courtesy of CHRYSLER GROUP, LLC

1. Install oil pressure relief valve (2) into timing chain cover (1).

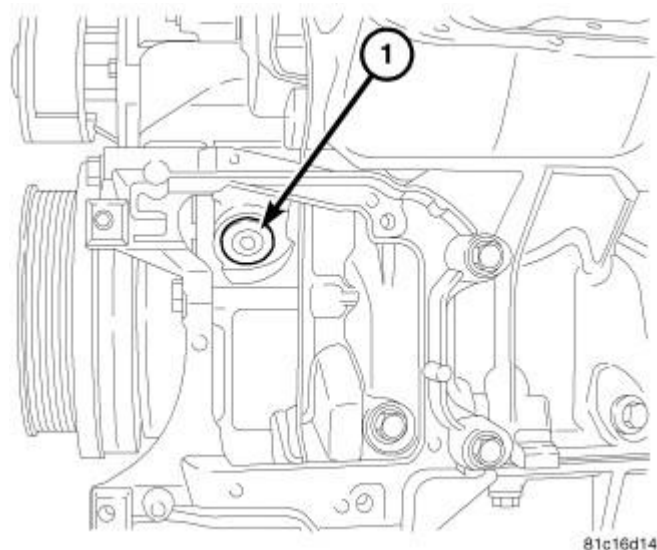


Fig. 310: Oil Pressure Relief Valve Removal

Courtesy of CHRYSLER GROUP, LLC

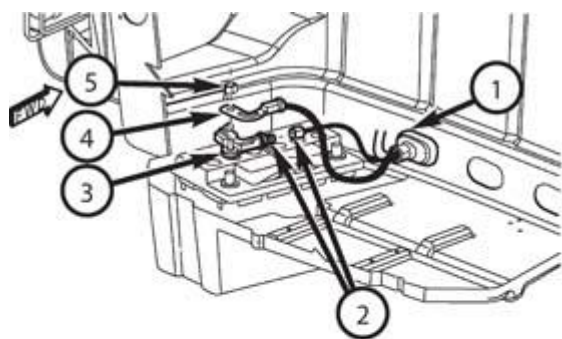
2. Tighten oil pressure relief valve to 25 N.m (18 ft. lbs.).
3. Install A/C compressor.

MANIFOLDS

MANIFOLD, EXHAUST

REMOVAL

LEFT EXHAUST MANIFOLD



080874297

Fig. 311: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable

Courtesy of CHRYSLER GROUP, LLC

NOTE: Care must be taken to protect the cylinder head covers and the intake manifolds powder coating from scrapes and abrasions.

1. Open trunk lid. Disconnect the battery negative cable (4).

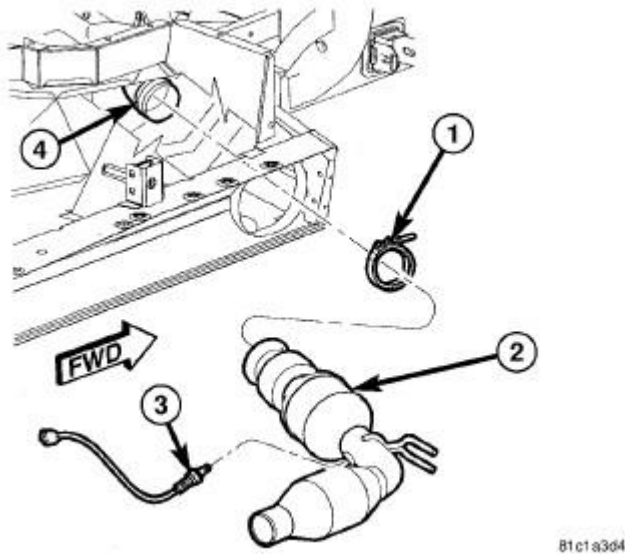


Fig. 312: Exhaust V-Band Clamp
Courtesy of CHRYSLER GROUP, LLC

2. Raise vehicle on hoist.
3. Disconnect oxygen sensor electrical.
4. Loosen and remove V-Band clamp (1) from exhaust pipe to exhaust manifold connection and discard.

NOTE: Do not reuse V-Band clamp.

5. Slide exhaust pipe off of the exhaust manifold.
6. Remove left and right engine mount retaining nuts (2).
7. Lower vehicle.

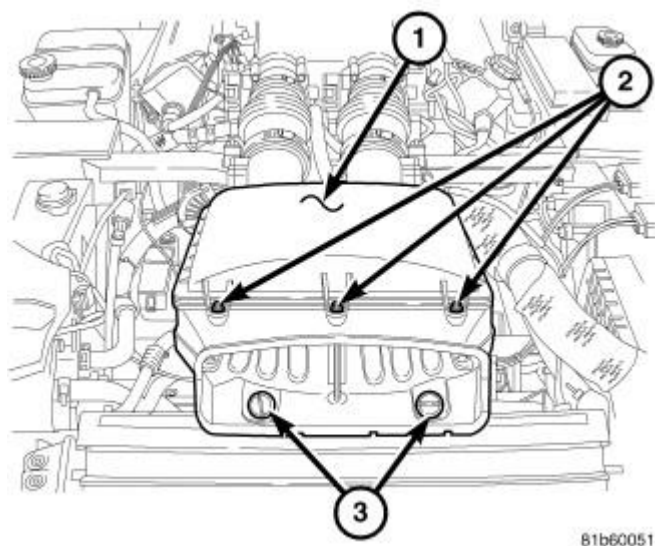


Fig. 313: Air Cleaner Housing

Courtesy of CHRYSLER GROUP, LLC

8. Remove air cleaner housing (1). Refer to **BODY, AIR CLEANER, REMOVAL**.
9. Remove power steering reservoir and mounting bracket.

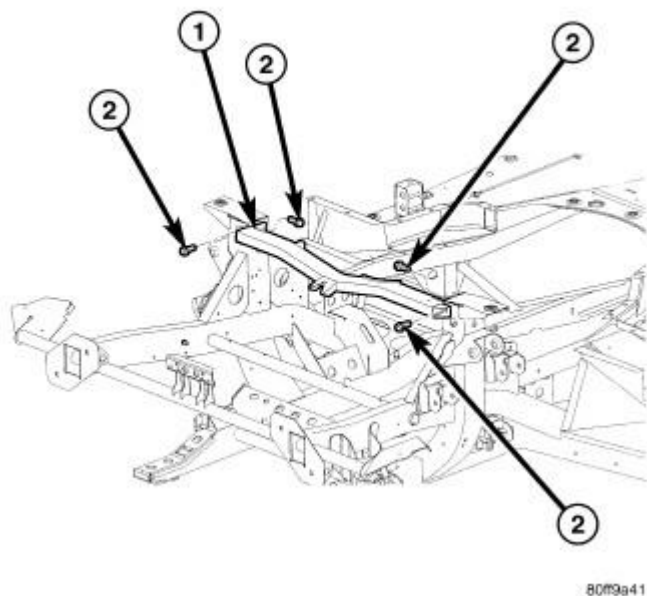


Fig. 314: Front Strut Tower To Tower Brace

Courtesy of CHRYSLER GROUP, LLC

10. Remove front suspension cross tie (1).

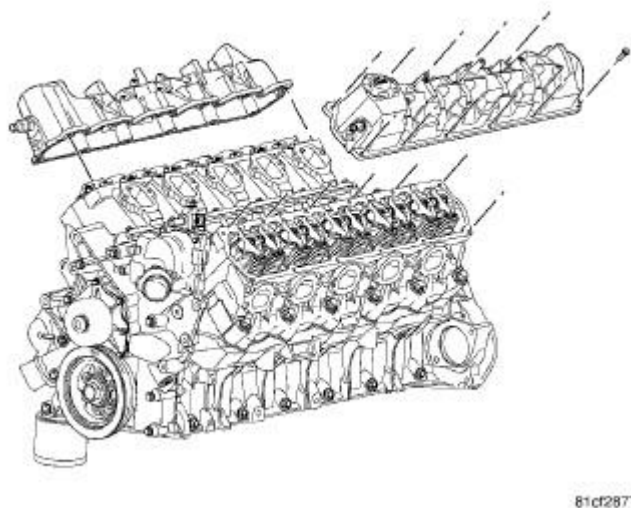
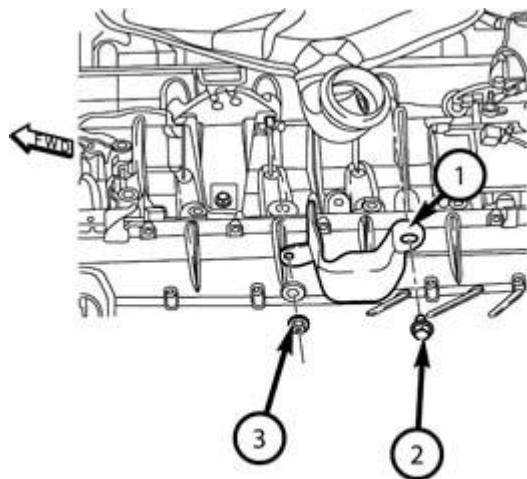


Fig. 315: Valve Cover Removal
Courtesy of CHRYSLER GROUP, LLC

11. Remove cylinder head cover. Refer to **COVER(S), CYLINDER HEAD, REMOVAL.**



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Fig. 316: Exhaust Manifold Heat Shield, Bolt & Nut
Courtesy of CHRYSLER GROUP, LLC

12. Remove the exhaust manifold heat shield (1).

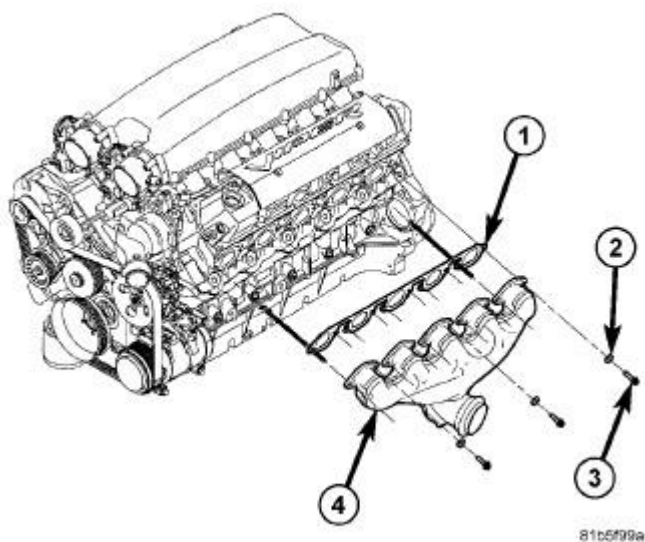


Fig. 317: Exhaust Manifold

Courtesy of CHRYSLER GROUP, LLC

13. Using a block of wood and a suitable jack under the oil pan, raise engine enough to remove exhaust manifold.
14. Remove exhaust manifold (4) and gasket (1).

RIGHT EXHAUST MANIFOLD

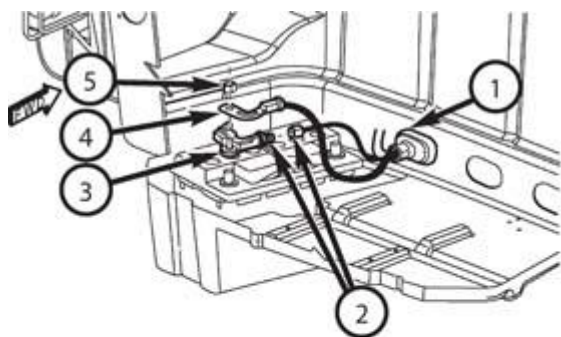
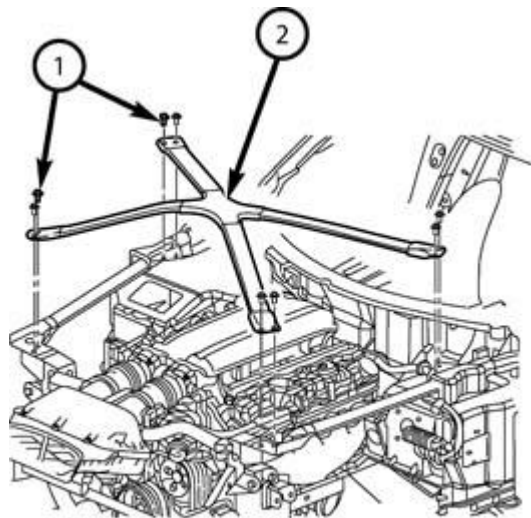


Fig. 318: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable

Courtesy of CHRYSLER GROUP, LLC

NOTE: Care must be taken to protect the cylinder head covers and the intake manifolds powder coating from scrapes and abrasions.

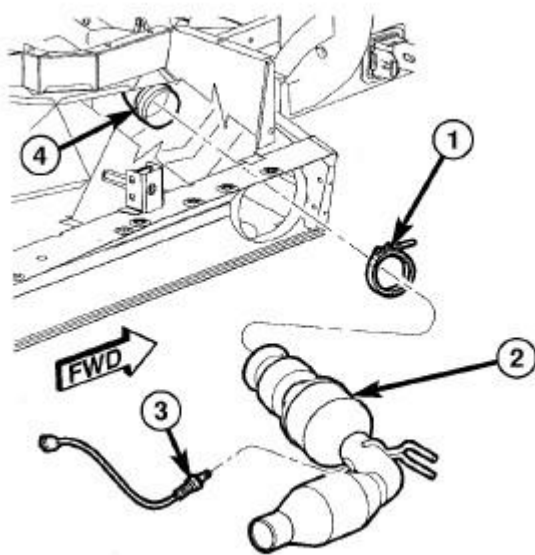
1. Open trunk lid. Disconnect the battery negative cable (4).



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Fig. 319: Cross Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

2. Remove the cross brace.
3. Raise vehicle on hoist.



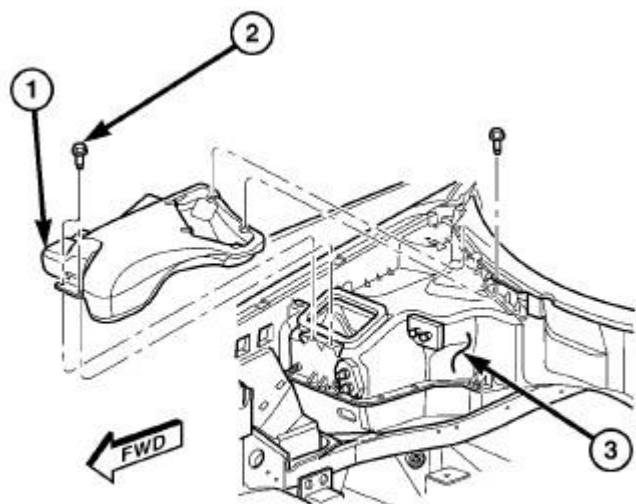
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Fig. 320: Exhaust V-Band Clamp
Courtesy of CHRYSLER GROUP, LLC

4. Disconnect oxygen sensor (3) electrical.
5. Loosen and remove V-Band clamp (1) from exhaust pipe to exhaust manifold connection and discard.

NOTE: Do not reuse V-Band clamp.

6. Slide exhaust pipe off of the exhaust manifold.
7. Lower vehicle.



812038e2

Fig. 321: HVAC Vent

Courtesy of CHRYSLER GROUP, LLC

8. Remove right windshield wiper arm.
9. Remove coolant reservoir retaining bolts and reposition reservoir.
10. Remove HVAC air inlet duct (1).

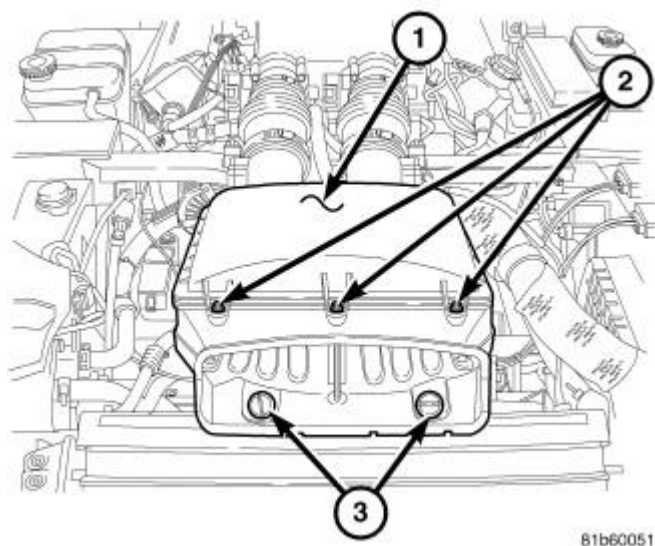


Fig. 322: Air Cleaner Housing
Courtesy of CHRYSLER GROUP, LLC

11. Remove air cleaner housing (1). Refer to **BODY, AIR CLEANER, REMOVAL.**

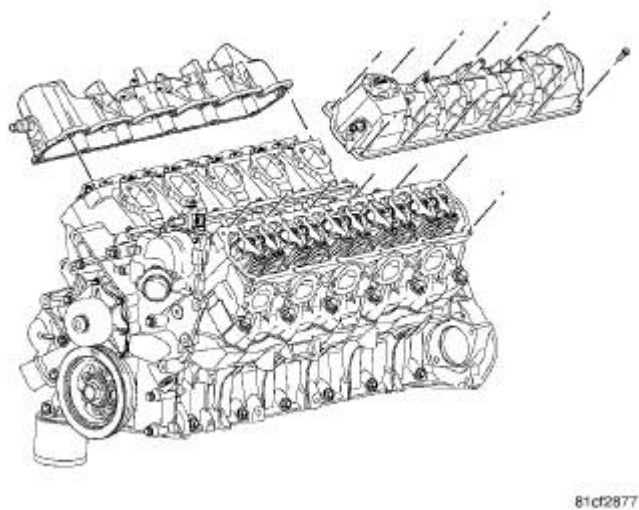


Fig. 323: Valve Cover Removal
Courtesy of CHRYSLER GROUP, LLC

12. Remove cylinder head cover to prevent paint damage. Refer to **COVER(S), CYLINDER HEAD, REMOVAL.**

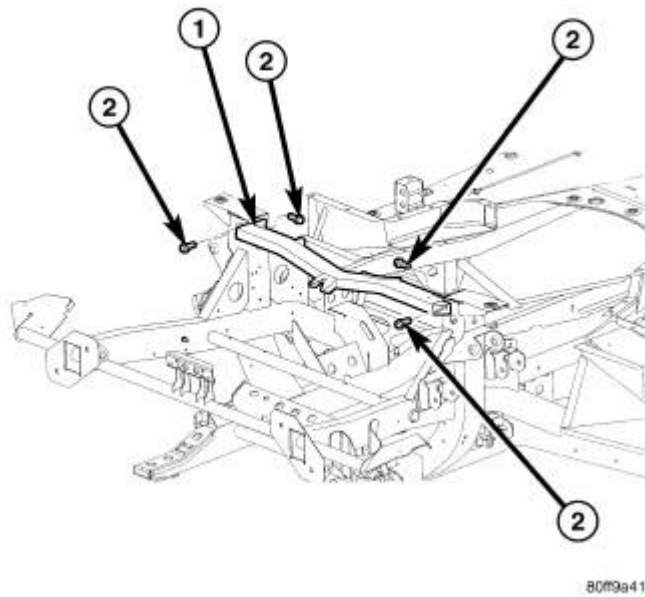


Fig. 324: Front Strut Tower To Tower Brace
Courtesy of CHRYSLER GROUP, LLC

13. Remove front suspension cross tie (1).

NOTE: Left side shown in illustration. Right side similar.

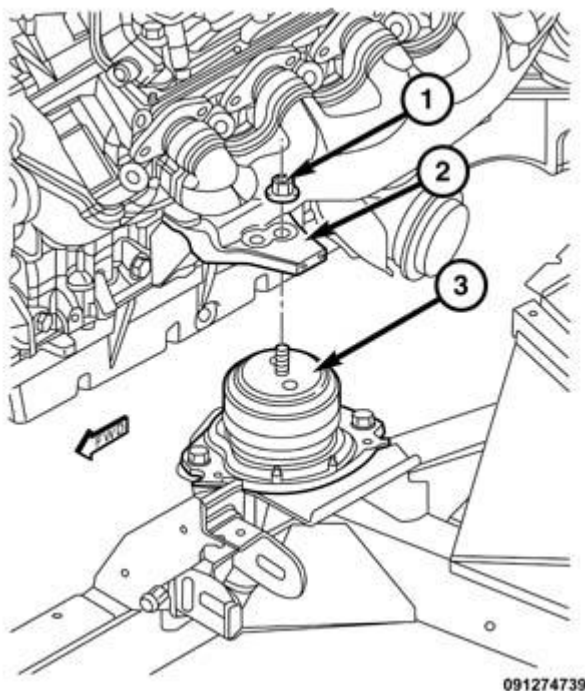
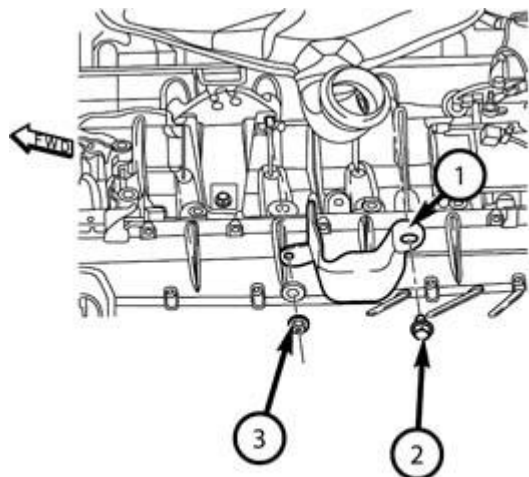


Fig. 325: Engine Mount, Bracket & Nut

Courtesy of CHRYSLER GROUP, LLC

14. Remove the engine mount to engine mount bracket nut (1).



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Fig. 326: Exhaust Manifold Heat Shield, Bolt & Nut
Courtesy of CHRYSLER GROUP, LLC

15. Remove the exhaust manifold heat shield.

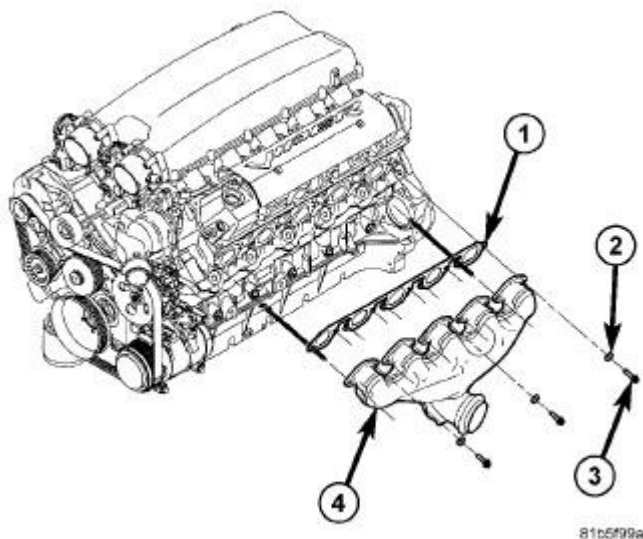


Fig. 327: Exhaust Manifold
Courtesy of CHRYSLER GROUP, LLC

16. Using an appropriate jack, raise engine and support engine.
17. Remove exhaust manifold (4) and gasket (1).

INSPECTION

INSPECTION

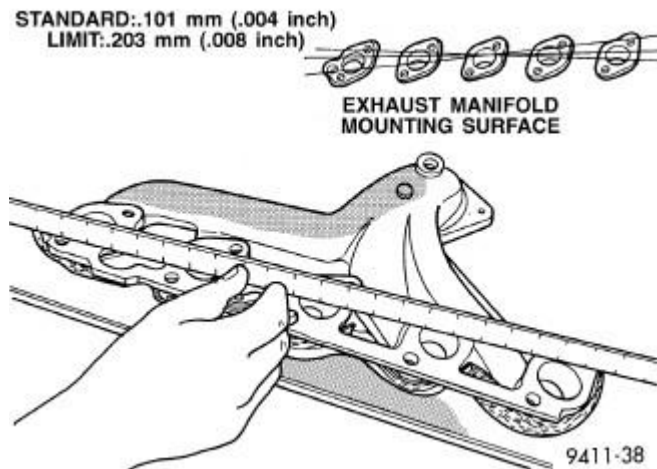


Fig. 328: Exhaust Manifold Mounting Surface Checking-Typical
Courtesy of CHRYSLER GROUP, LLC

Inspect exhaust manifolds for damage or cracks. Check for distortion of the cylinder head mounting surfaces with a straightedge and feeler gauge.

INSTALLATION

LEFT EXHAUST MANIFOLD

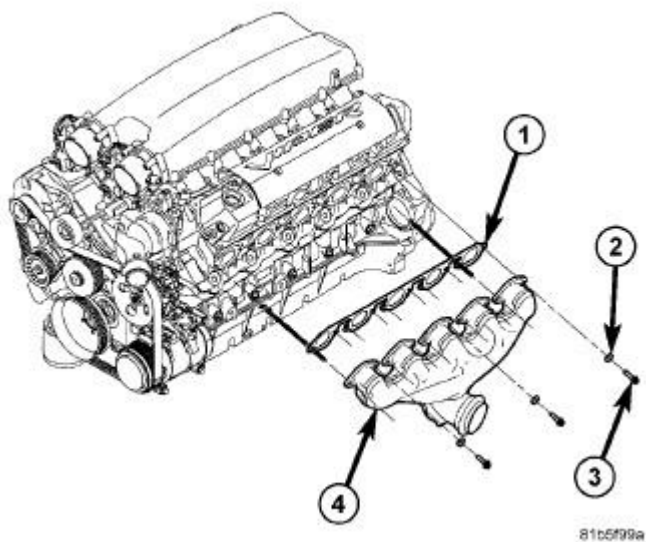
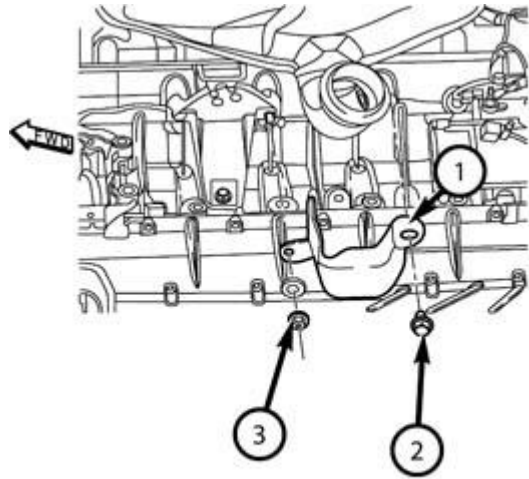


Fig. 329: Exhaust Manifold
Courtesy of CHRYSLER GROUP, LLC

NOTE: Care must be taken to protect the cylinder head covers powder coating from scrapes and abrasions.

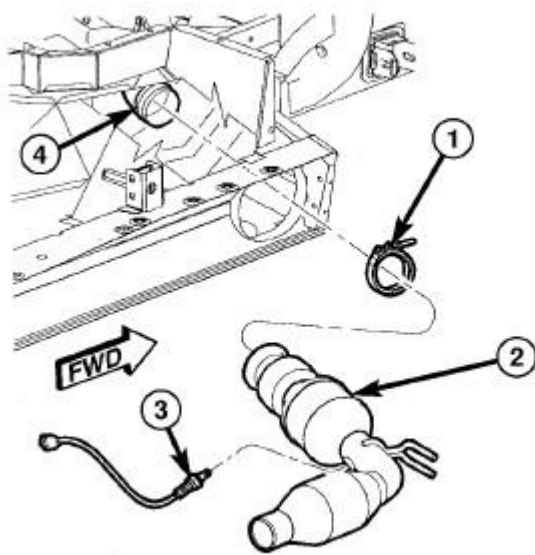
1. Install new gasket (1) and install exhaust manifold (4). Tighten attaching fasteners to 29 N.m (21 ft. lbs.).



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Fig. 330: Exhaust Manifold Heat Shield, Bolt & Nut
Courtesy of CHRYSLER GROUP, LLC

2. Install the exhaust manifold heat shield (1). Tighten the nut (3) and bolt (2) to 25 N.m (18 ft. lbs.).
3. Lower engine and remove jack.
4. Raise vehicle on hoist.



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Fig. 331: Exhaust V-Band Clamp
Courtesy of CHRYSLER GROUP, LLC

5. Connect exhaust pipe to manifold and install **NEW** V-Band clamp (1). Tighten clamp to 11 N.m (17 in. lbs.).

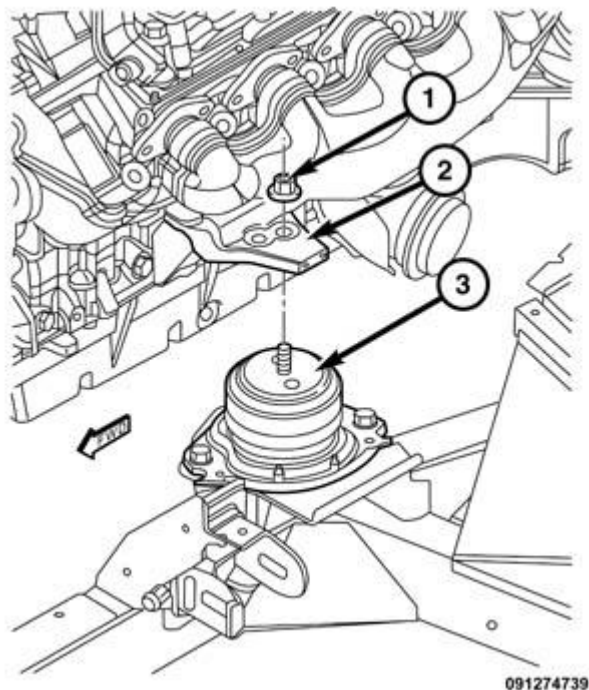


Fig. 332: Engine Mount, Bracket & Nut
 Courtesy of CHRYSLER GROUP, LLC

6. Install engine bracket to mount nut (1). Tighten nut to 102 N.m (75 ft. lbs.).
7. Connect upstream oxygen sensor electrical connector.
8. Lower vehicle.

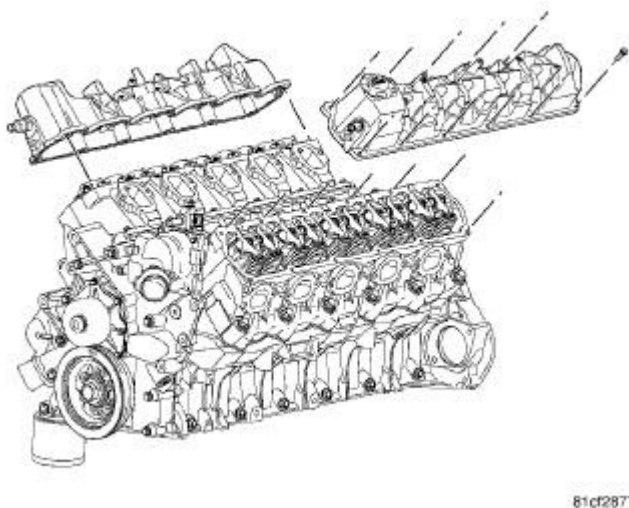
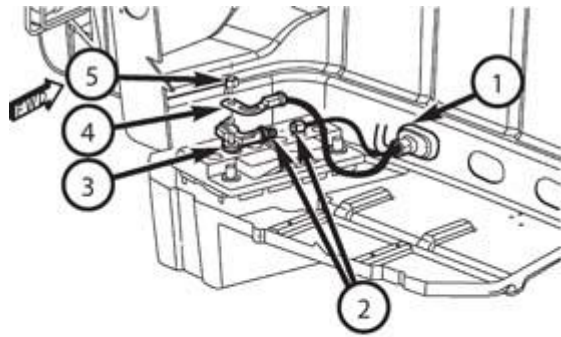


Fig. 333: Valve Cover Removal

Courtesy of CHRYSLER GROUP, LLC

9. Install cylinder head cover . Refer to **COVER(S), CYLINDER HEAD, INSTALLATION**.
10. Install front strut tower to tower brace.
11. Install air cleaner housing. Refer to **BODY, AIR CLEANER, INSTALLATION**.



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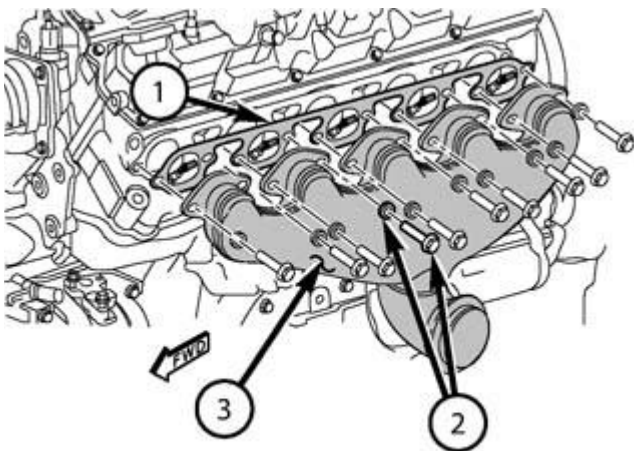
Fig. 334: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable

Courtesy of CHRYSLER GROUP, LLC

12. Connect the battery negative cable (4).

RIGHT EXHAUST MANIFOLD

NOTE: Left side shown in illustration. Right side similar.



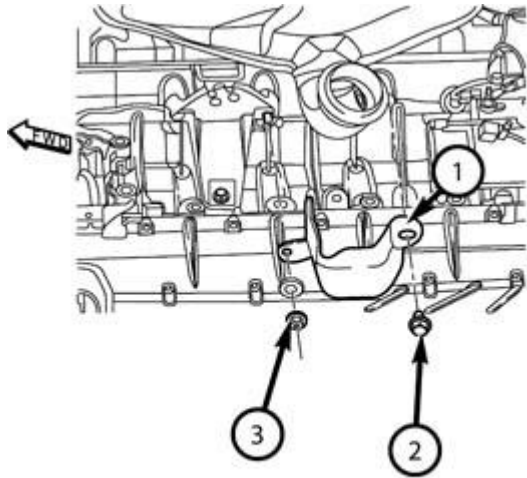
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Fig. 335: Removing & Installing Exhaust Manifolds & Gaskets

Courtesy of CHRYSLER GROUP, LLC

NOTE: Care must be taken to protect the cylinder head covers powder coating from scrapes and abrasions. This procedure covers either the left or right exhaust manifold.

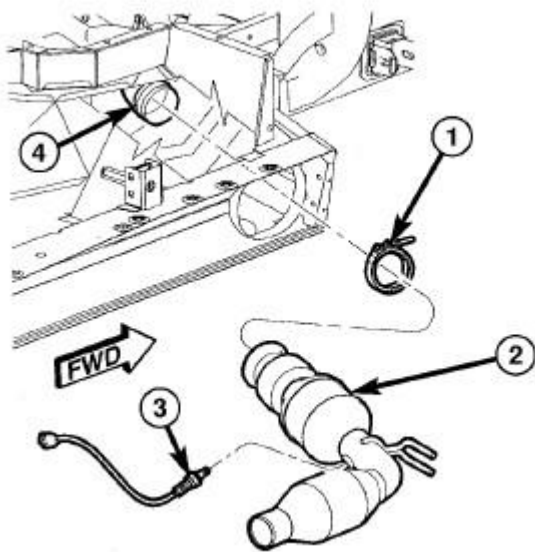
1. Install new gasket (1) and install exhaust manifold (3). Tighten bolts (2) to 29 N.m (21 ft. lbs.).



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Fig. 336: Exhaust Manifold Heat Shield, Bolt & Nut
Courtesy of CHRYSLER GROUP, LLC

2. Install the exhaust manifold heat shield (1). Tighten the nut (3) and bolt (2) to 25 N.m (18 ft. lbs.).
3. Raise vehicle on hoist.



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Fig. 337: Exhaust V-Band Clamp
Courtesy of CHRYSLER GROUP, LLC

4. Connect exhaust pipe to manifold and install **NEW** V-Band clamp. Tighten clamp to 11 N.m (100 in. lbs.).

NOTE: Left side shown in illustration. Right side similar.

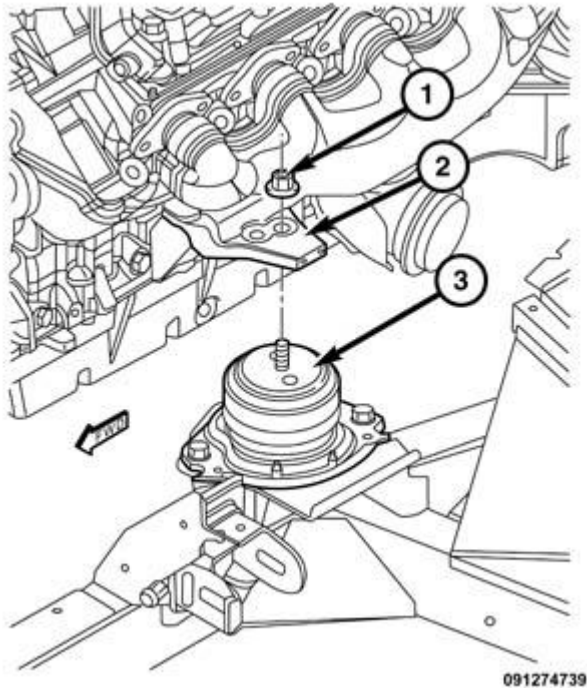


Fig. 338: Engine Mount, Bracket & Nut
Courtesy of CHRYSLER GROUP, LLC

5. Install engine bracket to mount nut (2). Tighten nut to 102 N.m (75 ft. lbs.).
6. Connect upstream oxygen sensor electrical connector.
7. Lower vehicle.
8. Install cylinder head cover . Refer to **COVER(S), CYLINDER HEAD, INSTALLATION.**

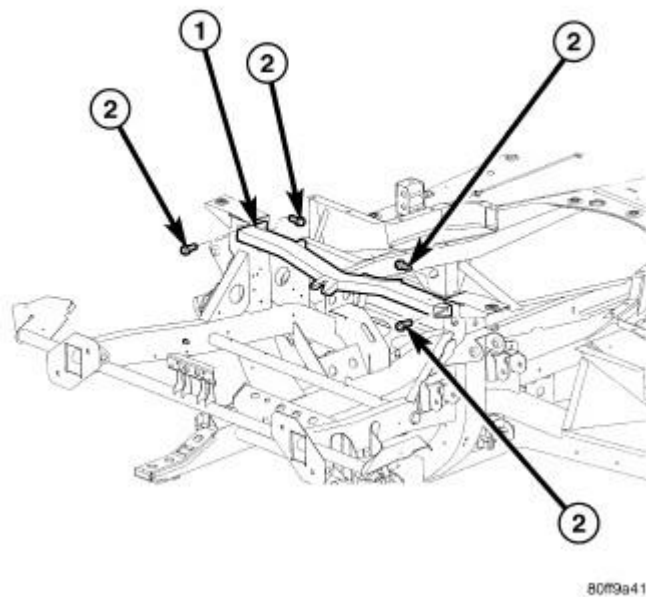


Fig. 339: Front Strut Tower To Tower Brace
Courtesy of CHRYSLER GROUP, LLC

9. Install strut tower to tower brace (1).
10. Install air cleaner housing. Refer to **BODY, AIR CLEANER, INSTALLATION**.

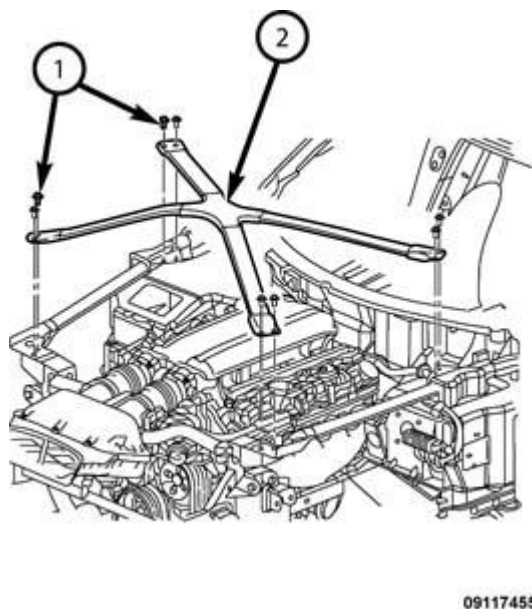


Fig. 340: Cross Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

11. Install the cross brace. tighten the bolts (1) to 20 N.m (15 ft. lbs.).

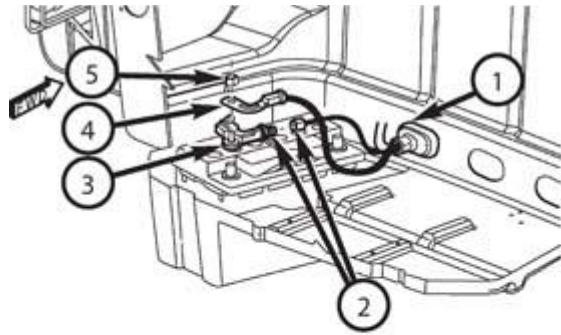


Fig. 341: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable
Courtesy of CHRYSLER GROUP, LLC

12. Connect the battery negative cable (4). Close trunk lid.

MANIFOLD, INTAKE

REMOVAL

INTAKE MANIFOLD

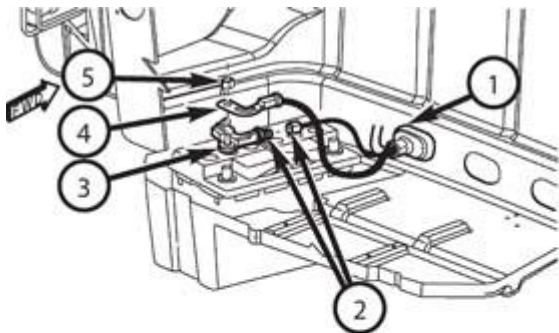


Fig. 342: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable
Courtesy of CHRYSLER GROUP, LLC

NOTE: Care must be taken to protect the intake manifold powder coating from scrapes and abrasions.

1. Perform the fuel system pressure release procedure, **before attempting any repairs.** . Refer to **FUEL**

DELIVERY, STANDARD PROCEDURE .

2. Disconnect the battery negative cable (4).

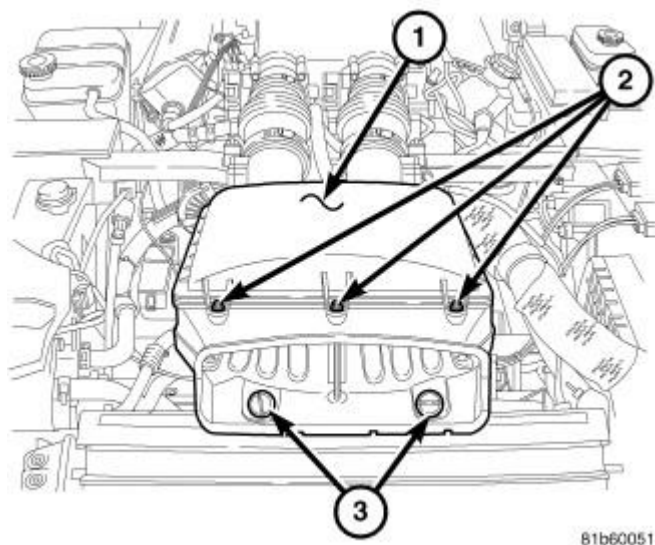


Fig. 343: Air Cleaner Housing
Courtesy of CHRYSLER GROUP, LLC

3. Remove the air cleaner housing (1). Refer to **BODY, AIR CLEANER, REMOVAL.**

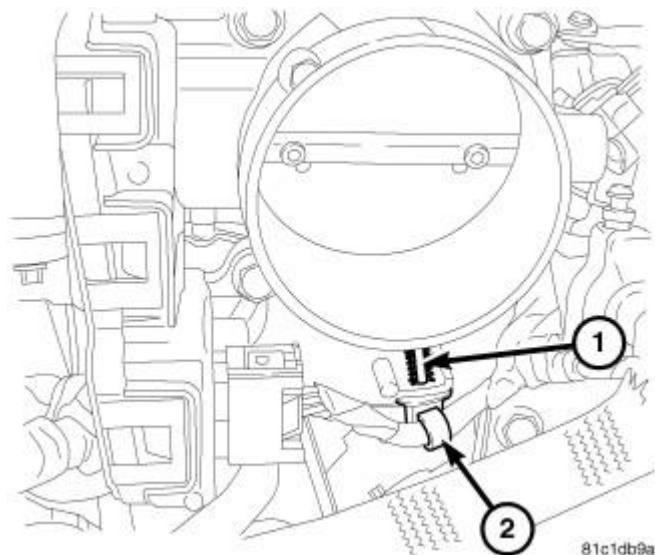


Fig. 344: Throttle Body Harness Retainer
Courtesy of CHRYSLER GROUP, LLC

4. Disconnect the electronic throttle body electrical connectors.

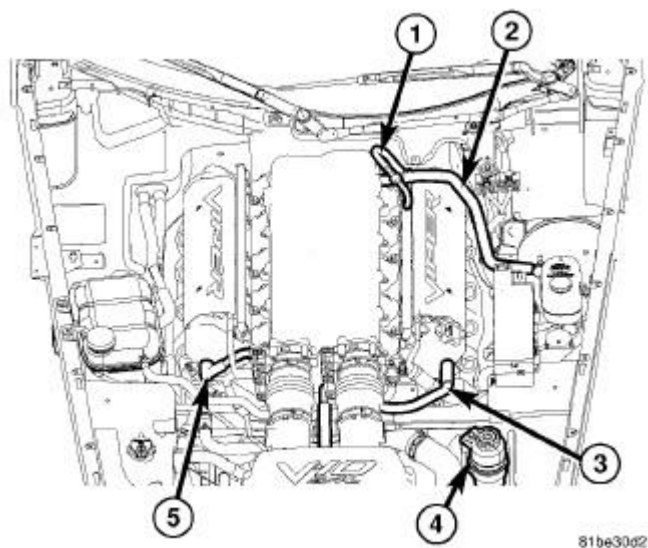


Fig. 345: PCV Hose

Courtesy of CHRYSLER GROUP, LLC

5. Disconnect the PCV hose (5) from intake.
6. Remove the brake booster hose (2).
7. Disconnect the fuel line (1).
8. Disconnect the purge solenoid vacuum line.
9. Disconnect the MAP sensor electrical connector.

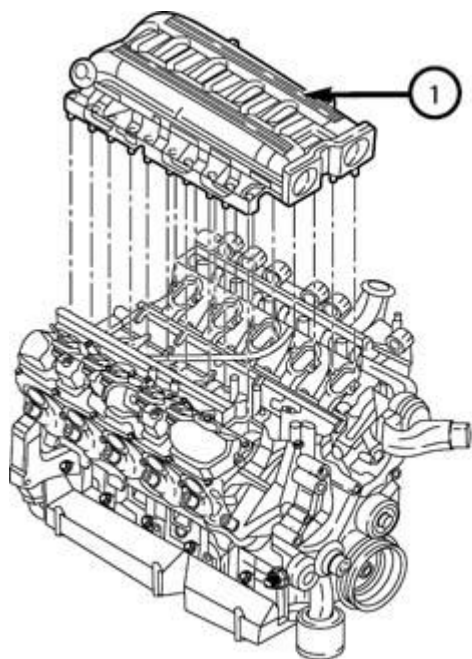


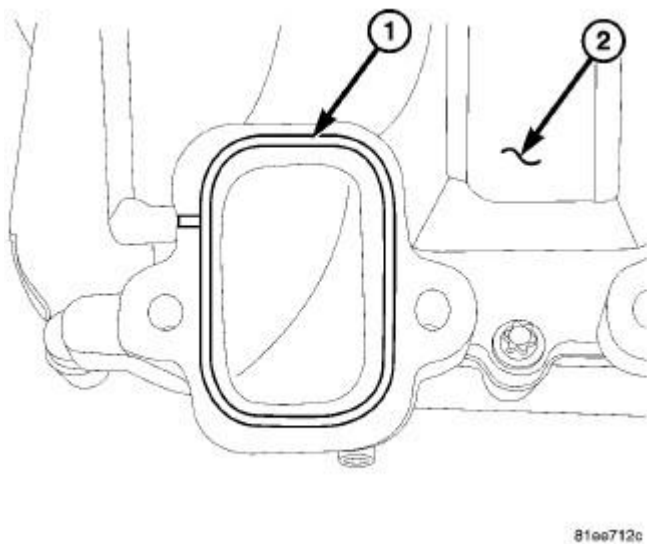
Fig. 346: Intake Manifold

Courtesy of CHRYSLER GROUP, LLC

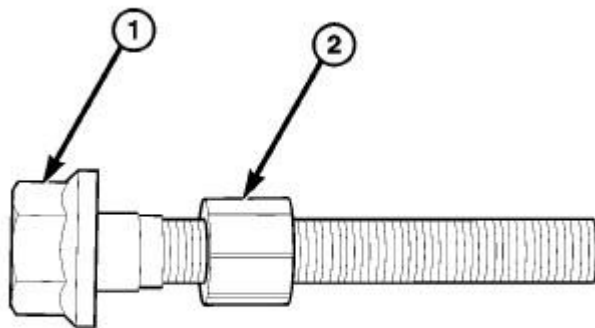
10. Remove the intake manifold bolts and intake manifold (1).
11. Cover the intake manifold openings with a suitable cover when servicing to prevent any debris from entering cylinder heads.

INSPECTION**INSPECTION**

1. Inspect manifold for cracks or other damage.
2. Inspect manifold sealing surfaces for damage.
3. Inspect manifold seals for damage.

INSTALLATION**INTAKE MANIFOLD****Fig. 347: Intake Seal****Courtesy of CHRYSLER GROUP, LLC**

1. Remove the covering from cylinder head ports.
2. Inspect the intake manifold seals (2), if damaged replace as necessary.
3. Clean the sealing surfaces with Mopar® brakes parts cleaner
4. Position the intake manifold in place and install bolts.

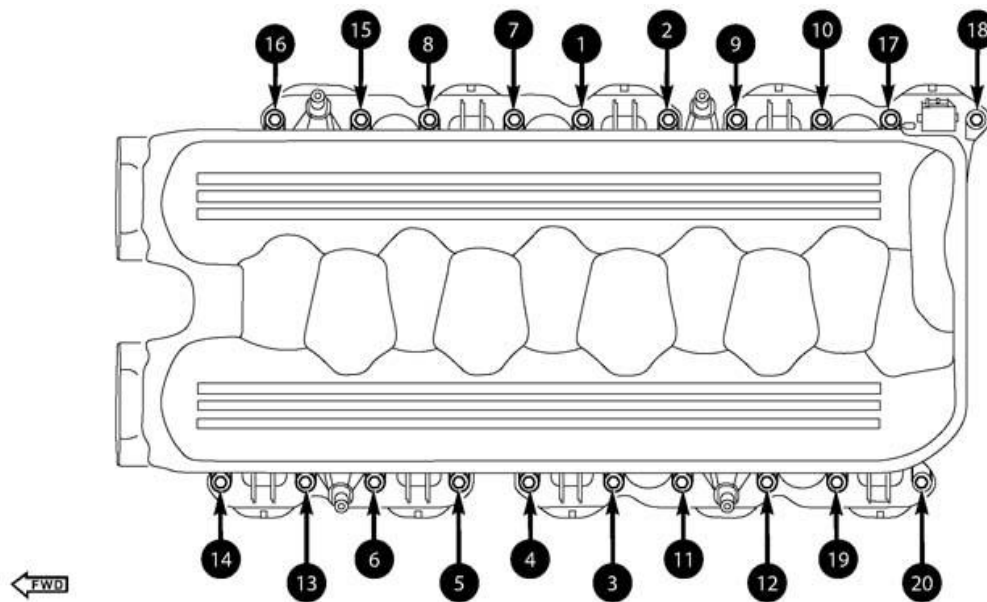


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Fig. 348: Intake Bolt Seal

Courtesy of CHRYSLER GROUP, LLC

5. The rubber collar (2) is used for production only. It is not necessary to reinstall them.



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Fig. 349: Intake Manifold Bolt Tightening Sequence

Courtesy of CHRYSLER GROUP, LLC

6. Tighten the bolts to 8 N.m (71 in. lbs.) as shown in illustration.
7. Re-tighten the bolts to 12 N.m (106 in. lbs.) as shown in illustration.

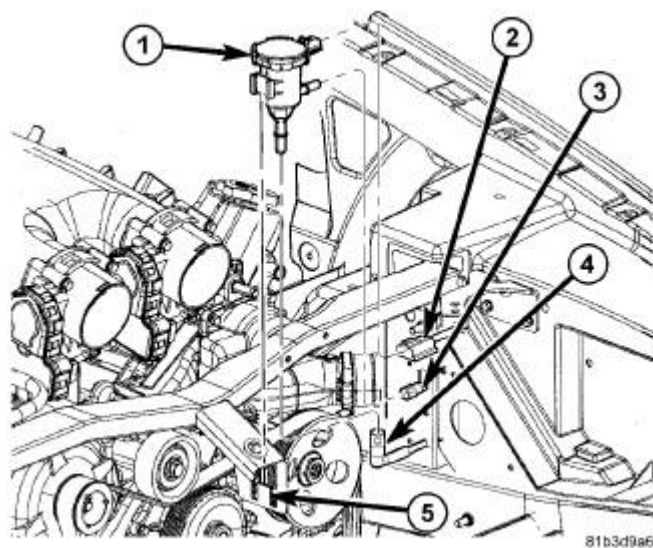


Fig. 350: EVAP Purge Solenoid

Courtesy of CHRYSLER GROUP, LLC

8. Connect the lower purge solenoid vapor tube (4).

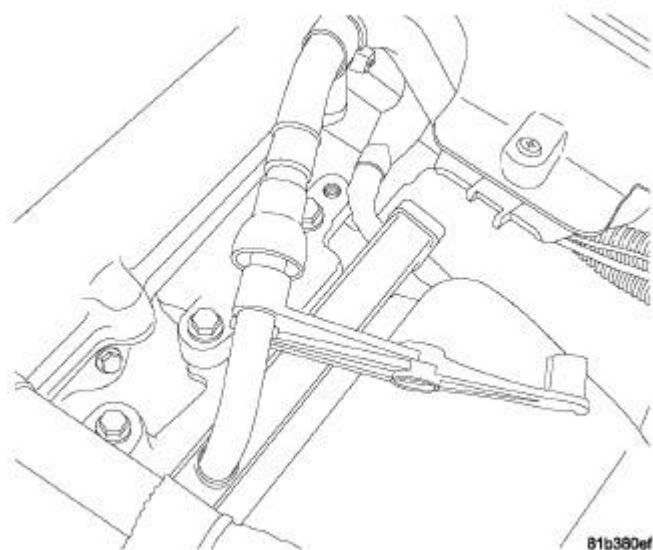


Fig. 351: Fuel Line Disconnect Tool

Courtesy of CHRYSLER GROUP, LLC

9. Connect the fuel line (1).
10. Connect the brake booster hose (2).

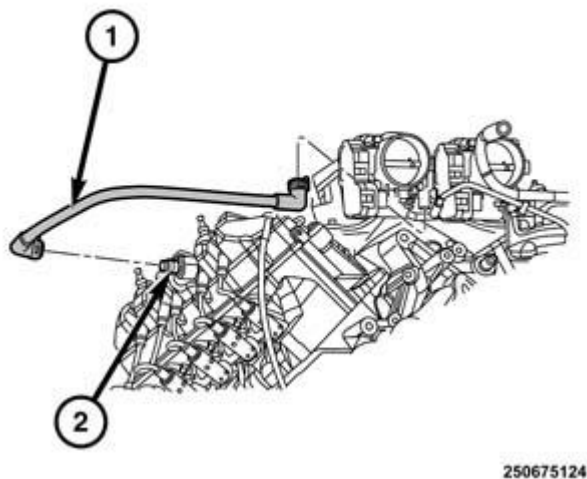


Fig. 352: PCV Valve & Hose
Courtesy of CHRYSLER GROUP, LLC

11. Connect the PCV hose (5).
12. Connect the MAP sensor electrical sensor.

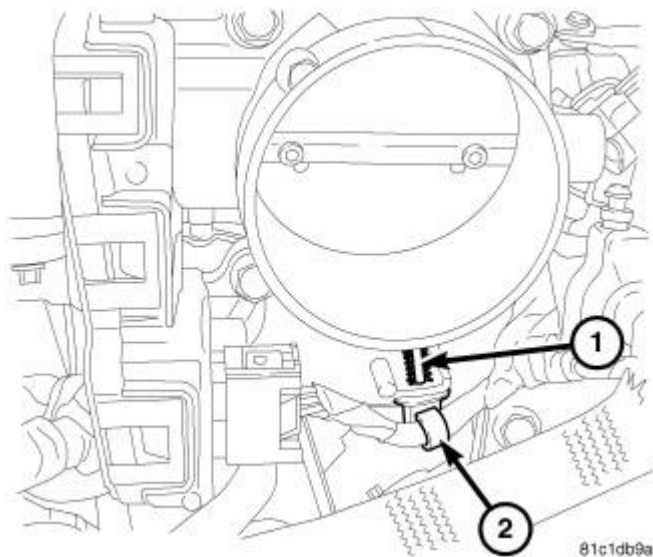
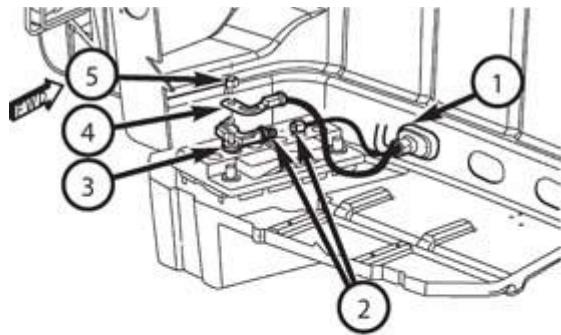


Fig. 353: Throttle Body Harness Retainer
Courtesy of CHRYSLER GROUP, LLC

13. Connect the throttle body electrical connectors.
14. Install a new harness retainer (2).
15. Install the air cleaner housing (1). Refer to **BODY, AIR CLEANER, INSTALLATION.**



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Fig. 354: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable
Courtesy of CHRYSLER GROUP, LLC

16. Connect the battery negative cable (4).

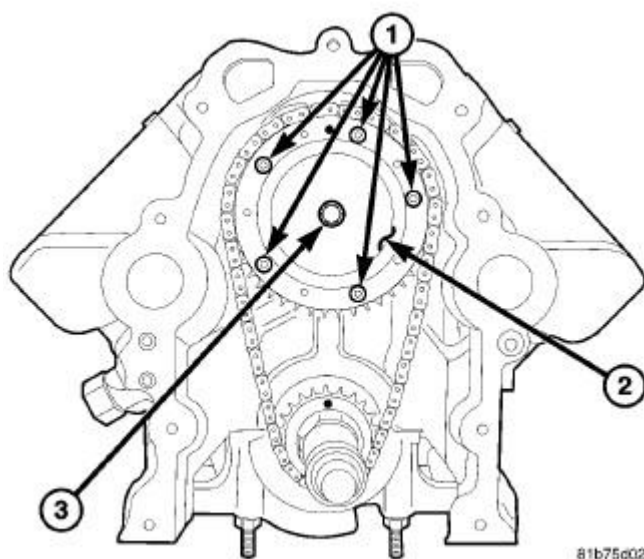
VALVE TIMING

CHAIN AND SPROCKETS, TIMING

REMOVAL

REMOVAL

CAMSHAFT SPROCKET/PHASER REMOVAL

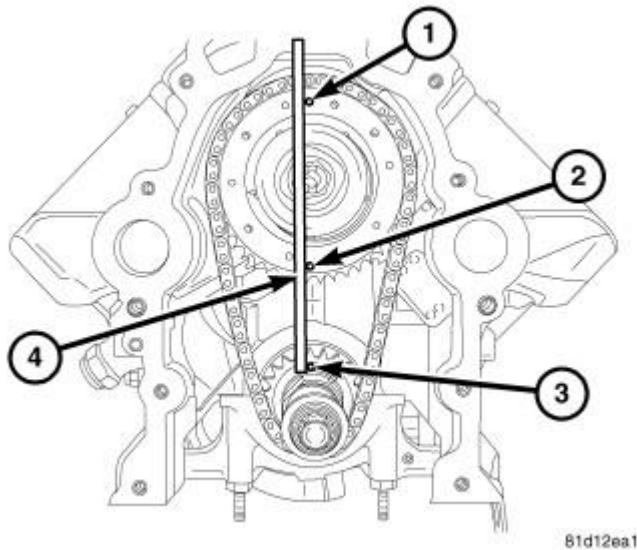


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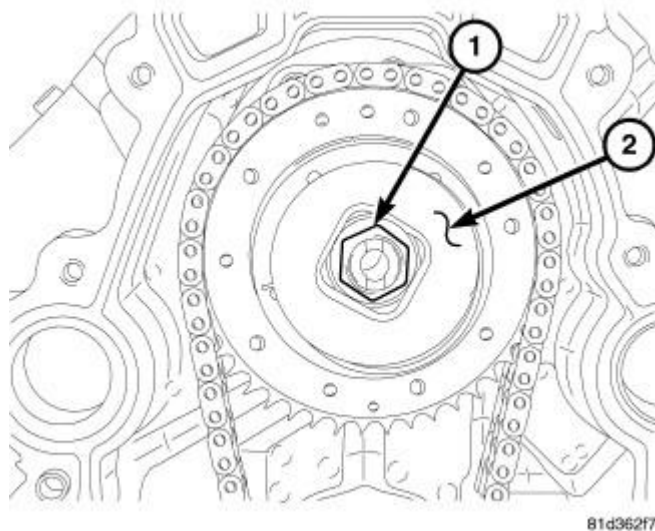
Fig. 355: Cam Drive Plate

Courtesy of CHRYSLER GROUP, LLC

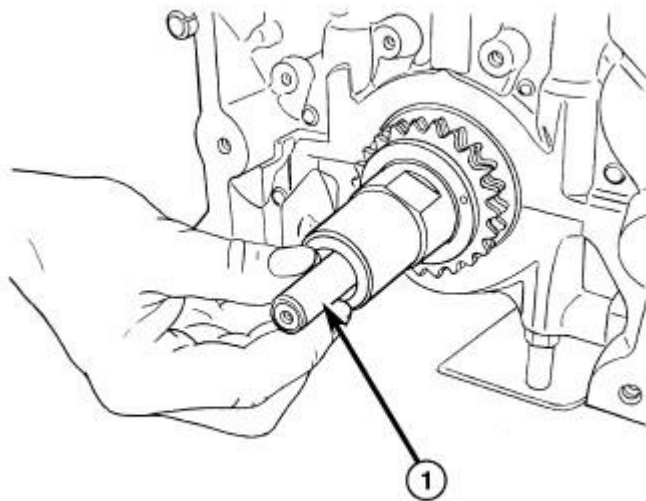
1. Remove timing chain cover. Refer to **COVER(S), ENGINE TIMING, REMOVAL**.
2. Remove camshaft drive plate bolts (1, 3).
3. Remove camshaft drive plate (2).

**Fig. 356: Timing Marks****Courtesy of CHRYSLER GROUP, LLC**

4. Rotate crankshaft until timing marks (1, 2, 3) are aligned.

**Fig. 357: Phaser Bolt****Courtesy of CHRYSLER GROUP, LLC**

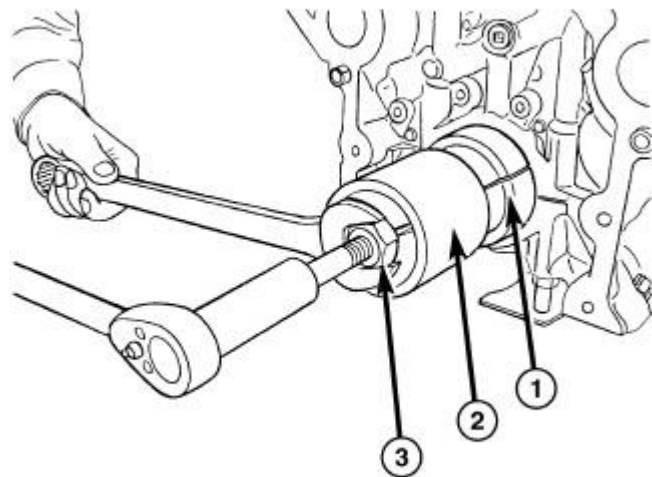
5. Remove the camshaft sprocket/phaser attaching bolt (1).
6. Remove the timing chain with the sprocket/phaser assembly (2).

CRANKSHAFT SPROCKET REMOVAL

8100d02d

Fig. 358: Crankshaft Insert - Special Tool 8194
Courtesy of CHRYSLER GROUP, LLC

1. Install (special tool #8194, Insert, Crankshaft) (1) into end of crankshaft. Lubricate the end of crankshaft insert (1) with wheel bearing grease or equivalent.



8100d01e

Fig. 359: Removing Crankshaft Sprocket
Courtesy of CHRYSLER GROUP, LLC

NOTE: Lubricate the threads of bearing puller (special tool #5048, Puller, Bearing) (3) using Mopar® Nickel Anti-seize Compound or equivalent, before beginning crankshaft sprocket removal.

2. Using (special tool #9056A, Remover, Crankshaft Sprocket) (1) and (special tool #5048, Puller, Bearing) (2), remove crankshaft sprocket.

INSTALLATION

INSTALLATION

CRANKSHAFT SPROCKET INSTALLATION

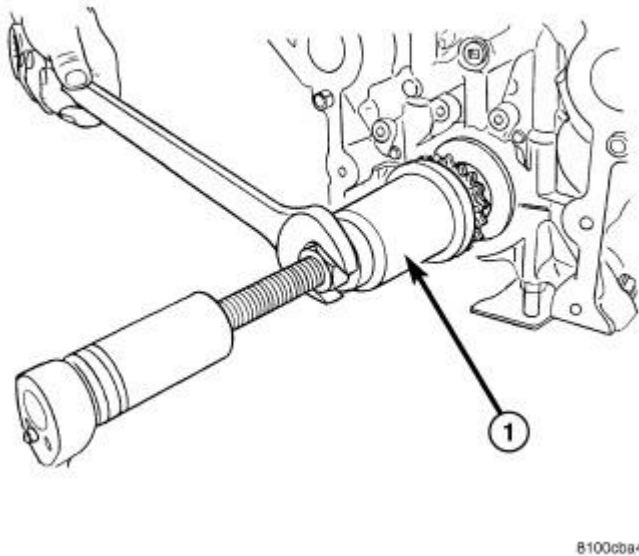


Fig. 360: Installing Crankshaft Sprocket
Courtesy of CHRYSLER GROUP, LLC

1. Position a new crankshaft sprocket on the crankshaft with timing mark facing out. Align crankshaft keyway with slot in crankshaft sprocket.

NOTE: Lubricate the threads of the (special tool #9055B, Installer, Crankshaft Sprocket/Gear) (1) using Mopar® Nickel Anti-seize Compound or equivalent, before beginning crankshaft sprocket installation.

2. Install the crankshaft sprocket with (special tool #9055B, Installer, Crankshaft Sprocket/Gear) (1). Seat

the sprocket against the crankshaft flange.

TIMING CHAIN AND CAMSHAFT SPROCKET/PHASER INSTALLATION

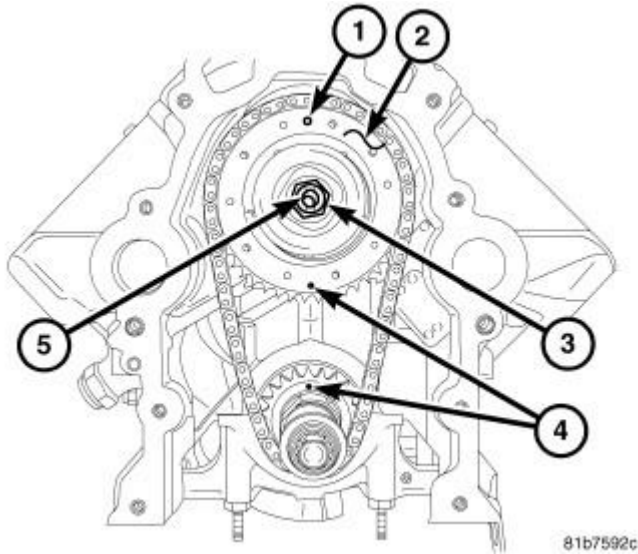


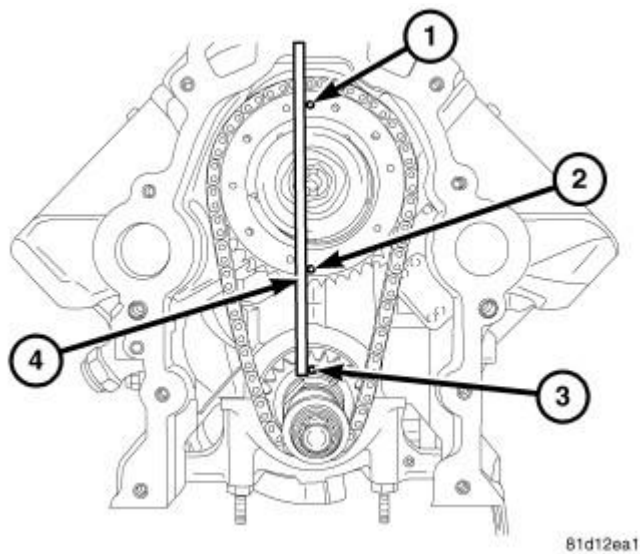
Fig. 361: Timing Drive

Courtesy of CHRYSLER GROUP, LLC

1. Rotate the crankshaft sprocket so the timing mark (4) is at the 12 O'clock position.
2. Place the timing chain around the camshaft sprocket/ Phaser and place the timing mark (4) to the 6 O'clock position.

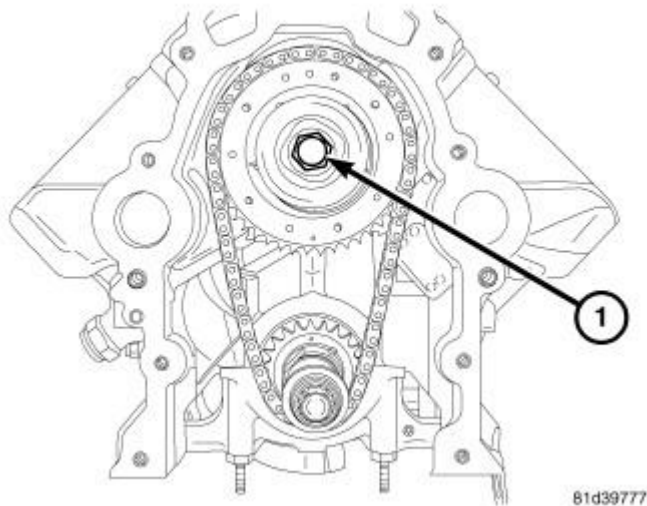
NOTE: When installing the camshaft sprocket/ Phaser onto the camshaft, make sure the camshaft alignment dowel is correctly inserted in the sprocket/ Phaser assembly.

3. Place the timing chain around crankshaft sprocket and install the camshaft sprocket/ Phaser into position.

**Fig. 362: Timing Marks**

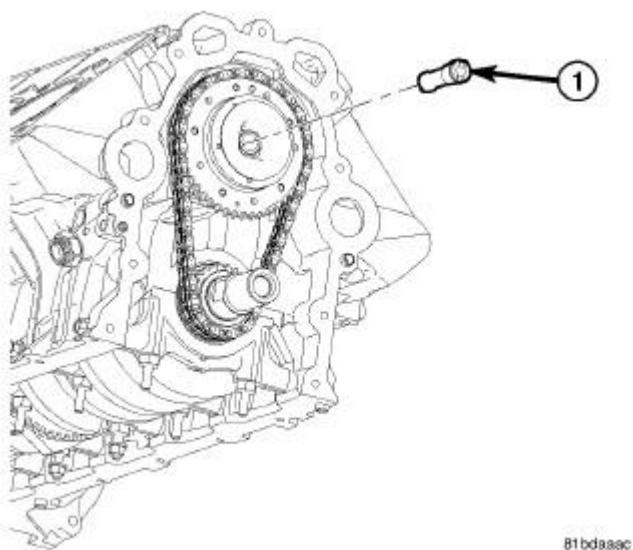
Courtesy of CHRYSLER GROUP, LLC

4. Using straight edge (4), check alignment of timing marks (2, 3).

**Fig. 363: Phaser Bolt**

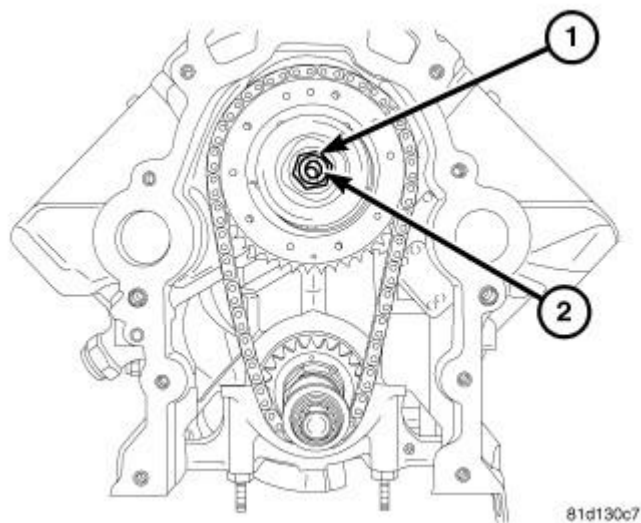
Courtesy of CHRYSLER GROUP, LLC

5. Install camshaft sprocket/phaser retaining bolt (1) and tighten to 165 N.m (122 ft. lbs.).

**Fig. 364: Phaser Drive Shaft**

Courtesy of CHRYSLER GROUP, LLC

6. Install camshaft phaser drive adapter (1) and rotate counter clockwise so the slot is in the 12 O'clock position.

**Fig. 365: Locating Slot & 12 O'clock Position**

Courtesy of CHRYSLER GROUP, LLC

7. Verify that the slot is in the 12 O'clock position (1).

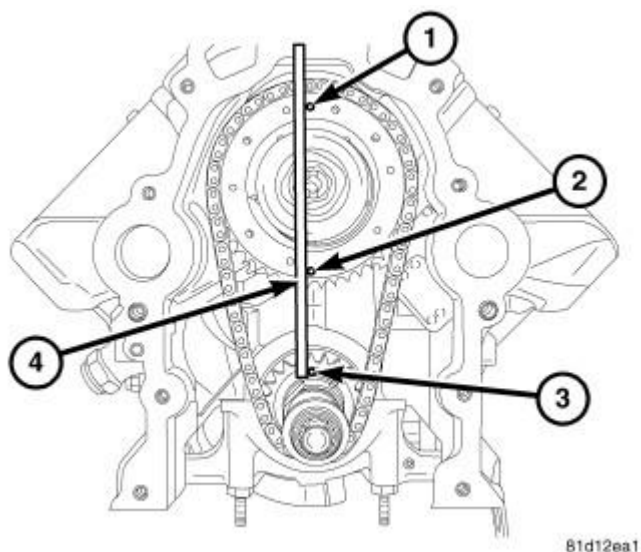


Fig. 366: Timing Marks

Courtesy of CHRYSLER GROUP, LLC

8. Rotate crankshaft 2 revolutions. Timing marks (2, 3) should line up. If timing marks do not line up, remove camshaft sprocket/phaser and realign.

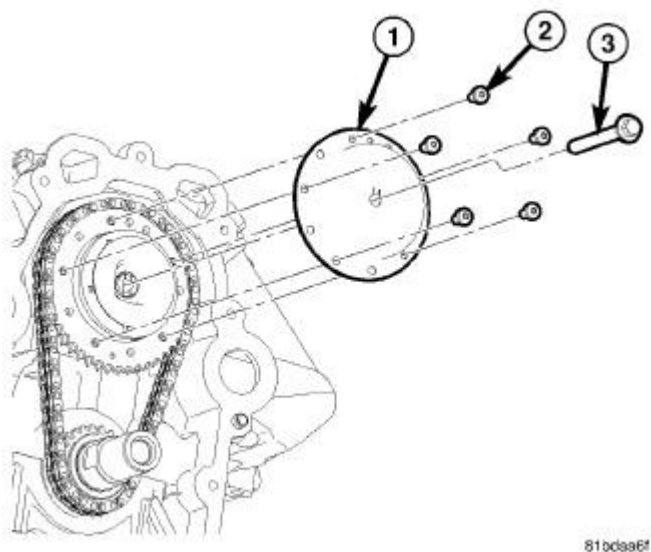


Fig. 367: Phaser Drive Plate

Courtesy of CHRYSLER GROUP, LLC

NOTE: Install camshaft drive plate outer bolts (2) prior to installing camshaft drive plate center bolt (3).

9. Install camshaft drive plate (1) in position.
10. Install camshaft drive plate retaining bolts (2).

11. Install camshaft drive plate center bolt (3).

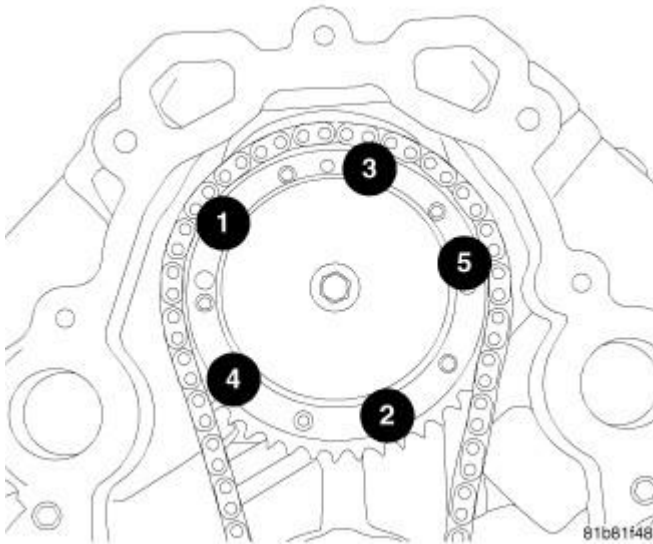


Fig. 368: Drive Plate Outer Bolt Torque Sequence
Courtesy of CHRYSLER GROUP, LLC

12. Tighten camshaft drive plate outer bolts to 12 N.m (106 in. lbs.) as shown in illustration.

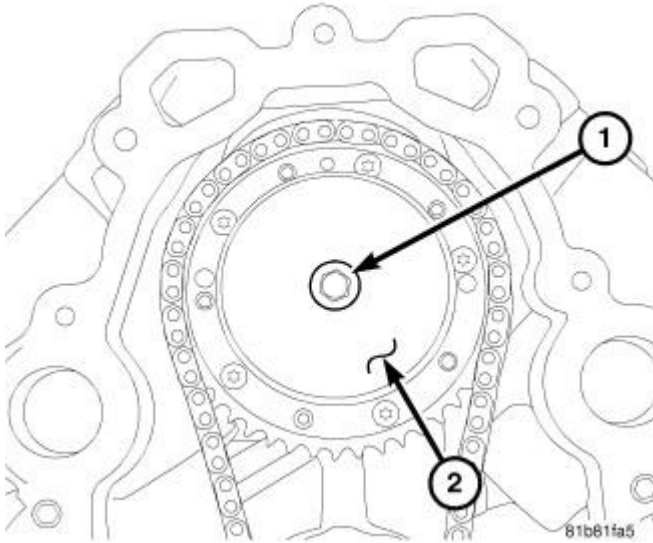


Fig. 369: Drive Plate Bolt
Courtesy of CHRYSLER GROUP, LLC

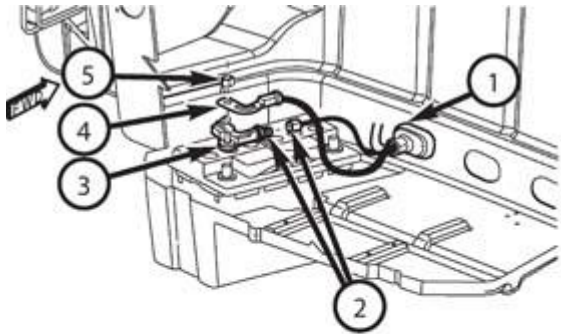
NOTE: It may be necessary to place a block of wood between the crankshaft counter weight and the block when tighten drive plate bolt.

13. Tighten camshaft drive plate center bolt (1) to 80 N.m (59 ft. lbs.).
14. Install timing chain cover. Refer to **COVER(S), ENGINE TIMING, INSTALLATION**.

COVER(S), ENGINE TIMING

REMOVAL

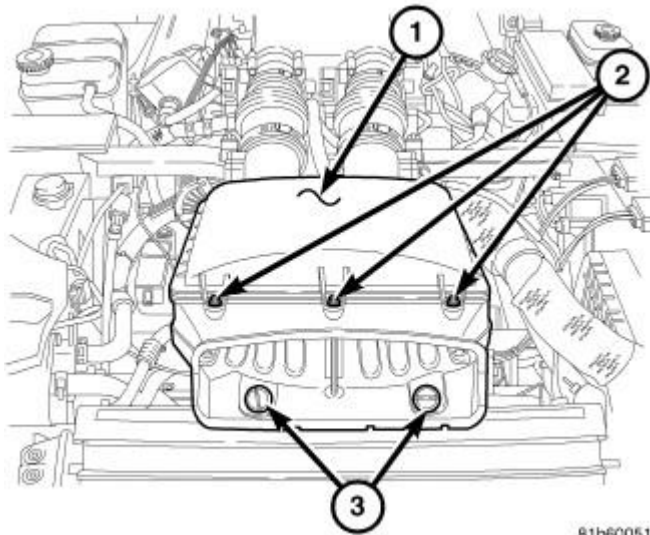
REMOVAL



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Fig. 370: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable
Courtesy of CHRYSLER GROUP, LLC

1. Open trunk lid. Remove battery cover. Disconnect negative battery cable (4).



81b60051

Fig. 371: Air Cleaner Housing
Courtesy of CHRYSLER GROUP, LLC

2. Remove air cleaner housing (1) assembly. Refer to **BODY, AIR CLEANER, REMOVAL**.
3. Drain cooling system. Refer to **STANDARD PROCEDURE**.
4. Remove upper and lower radiator hoses.

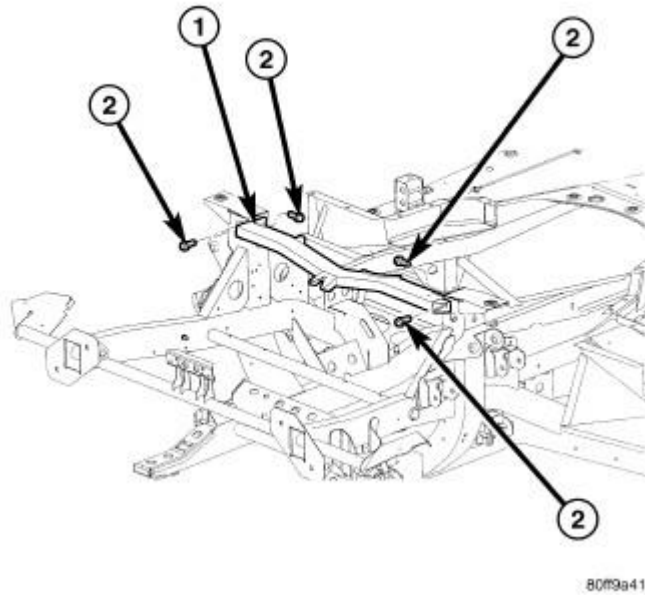


Fig. 372: Front Strut Tower To Tower Brace
 Courtesy of CHRYSLER GROUP, LLC

5. Remove front strut tower to tower brace (1). Refer to **BRACE, WHEELHOUSE, REMOVAL** .
6. Remove accessory drive belt. Refer to **BELT, SERPENTINE, REMOVAL** .
7. Remove power steering pump mounting bolts. Reposition power steering pump. **Do not** disconnect power steering lines.
8. Disconnect coolant bottle inlet hose at thermostat housing.
9. Disconnect engine coolant temperature (ECT) sensor connector.
10. Disconnect generator wiring. Remove generator.
11. Remove crankshaft pulley and damper. Refer to **DAMPER, VIBRATION, REMOVAL**.

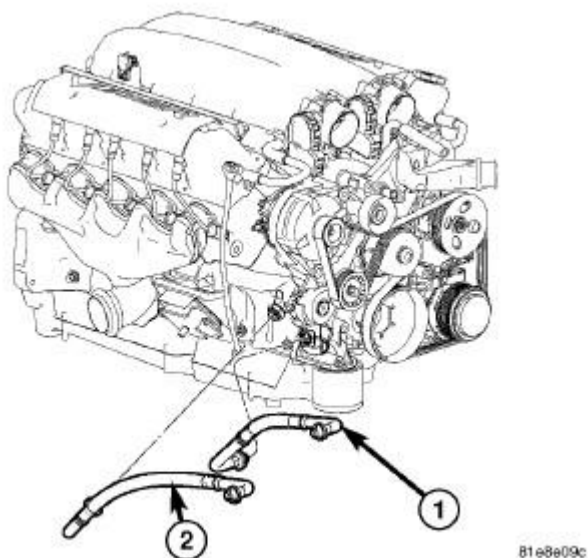


Fig. 373: Oil Cooler Lines

Courtesy of CHRYSLER GROUP, LLC

12. Disconnect heater hose.
13. Disconnect oil cooler lines (1, 2) using Special Tool (special tool #9005, Disconnect Tool). Refer to **COOLER AND LINES, OIL, STANDARD PROCEDURES**.
14. Remove A/C compressor mounting bolts. Reposition A/C compressor. **Do not** disconnect A/C lines.
15. Raise vehicle on hoist.

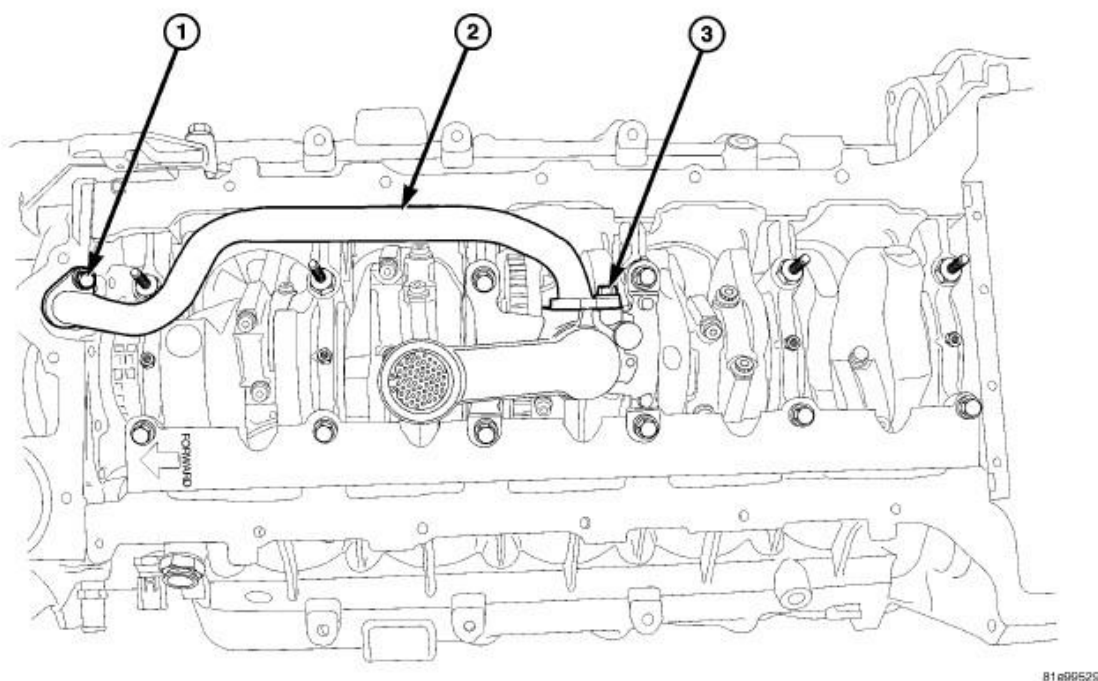


Fig. 374: Oil Pick Up Tube

Courtesy of CHRYSLER GROUP, LLC

16. Drain engine oil.
17. Remove oil pan. Refer to **PAN, OIL, REMOVAL**.
18. Remove oil pump pick up tube (2).
19. Lower vehicle.

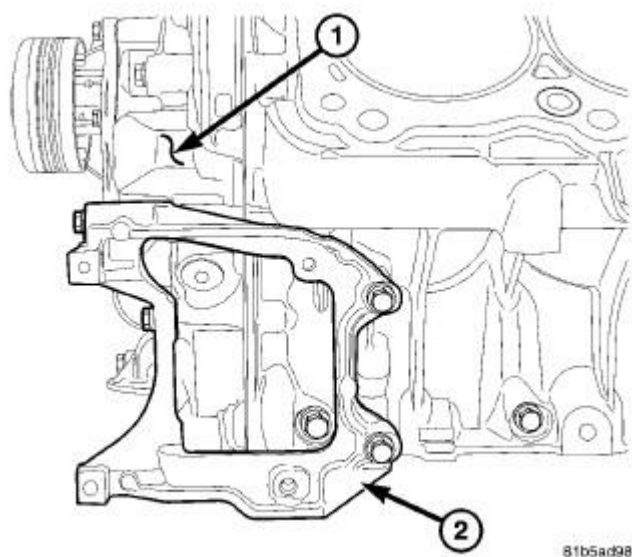


Fig. 375: A/C Bracket

Courtesy of CHRYSLER GROUP, LLC

20. Remove A/C compressor mounting bracket (2).

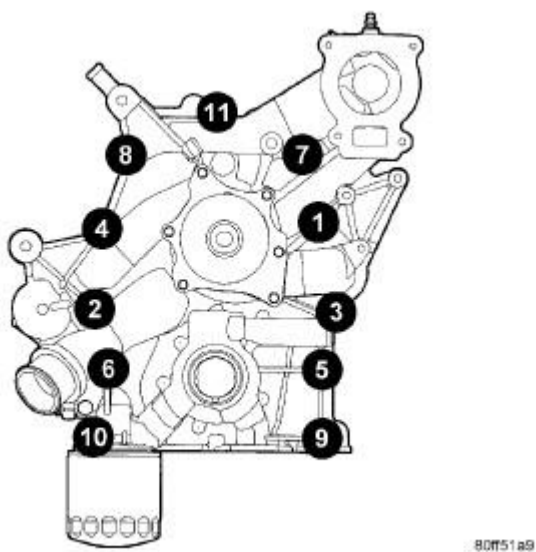


Fig. 376: Timing Chain Cover Tightening Sequence

Courtesy of CHRYSLER GROUP, LLC

21. Remove timing chain cover bolts.
22. Remove timing chain cover.

INSTALLATION

INSTALLATION

CAUTION: Do not use oil based liquids to clean timing cover or block surfaces. Use only rubbing alcohol, along with plastic or wooden scrapers. Use no wire brushes or abrasive wheels or metal scrapers, or damage to surfaces could result.

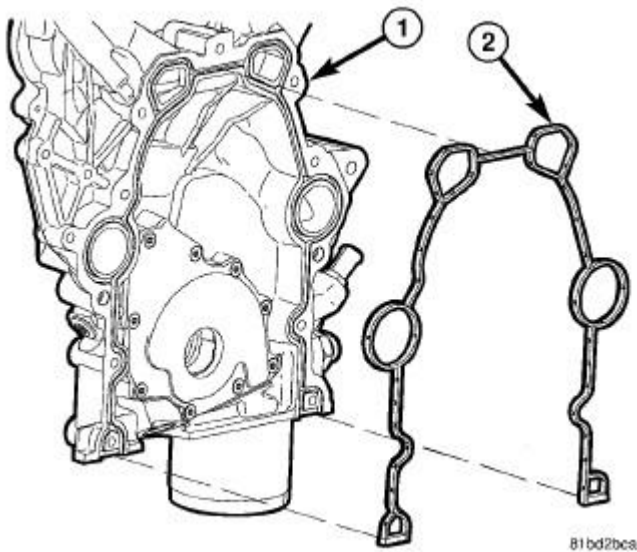


Fig. 377: Timing Chain Cover Gasket

Courtesy of CHRYSLER GROUP, LLC

1. Be sure mating surfaces of the chain case cover and the cylinder block are clean and free from burrs.
2. Remove the crankshaft oil seal to insure the correct oil pump engagement.
3. Inspect the timing chain cover gasket (2), replace as necessary.
4. Insert a gasket (2) into groove in timing chain cover (1).
5. Pour oil into the oil pump to prime the oil pump prior to installing timing chain cover.
6. Position the oil pump inner rotor mating flats in the same position as the crankshaft drive flats.

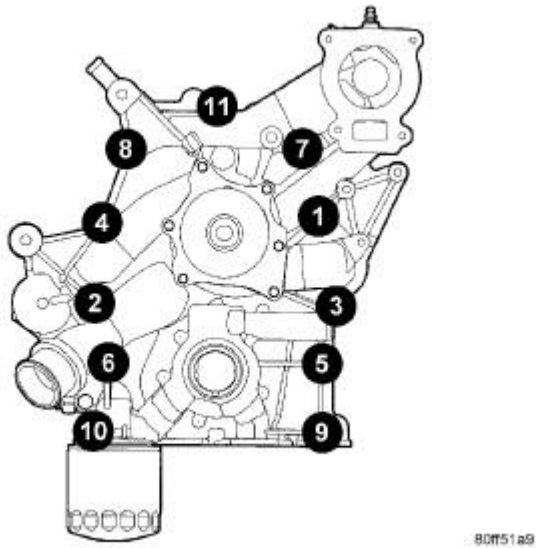


Fig. 378: Timing Chain Cover Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

7. Install the timing chain cover onto crankshaft. Ensure the oil pump is engaged on the crankshaft correctly or severe damage may result.
8. Hand start bolts #1 and #2.

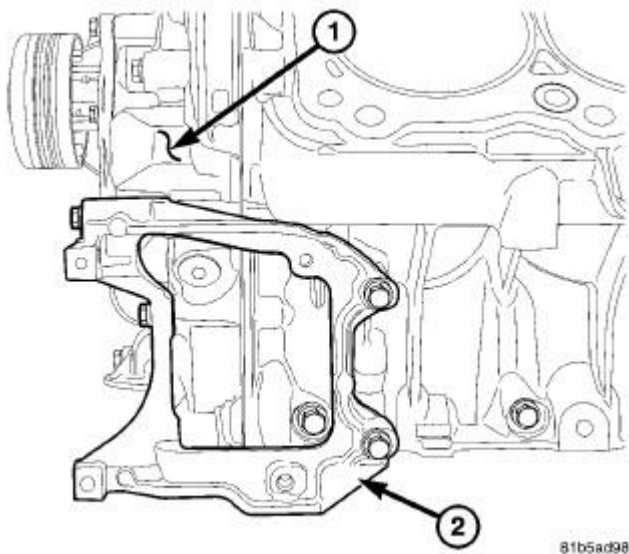


Fig. 379: A/C Bracket
Courtesy of CHRYSLER GROUP, LLC

9. Install the A/C compressor mounting bracket (2) and hand tighten the bolts.
10. Hand start the remaining timing chain cover bolts.

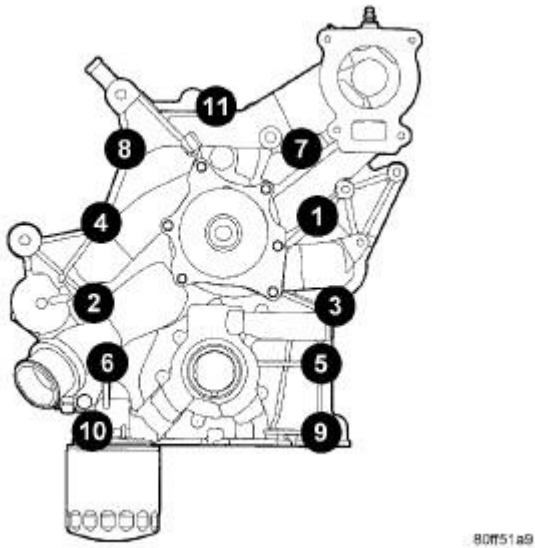


Fig. 380: Timing Chain Cover Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

11. Tighten the timing chain cover bolts in the sequence shown in illustration in to 28 N.m (21 ft. lbs.).
12. Tighten the A/C compressor mounting bracket bolts to 29 N.m (21 ft. lbs.).
13. Install the front crankshaft oil seal. Refer to **SEAL, CRANKSHAFT OIL, FRONT, INSTALLATION**.
14. Raise the vehicle on hoist.

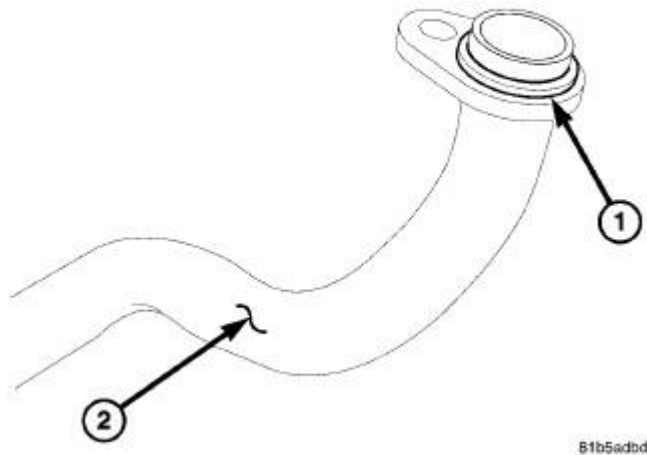


Fig. 381: Oil Pick-Up O-Ring
Courtesy of CHRYSLER GROUP, LLC

15. Inspect the oil tube O-rings (1), replace as necessary.

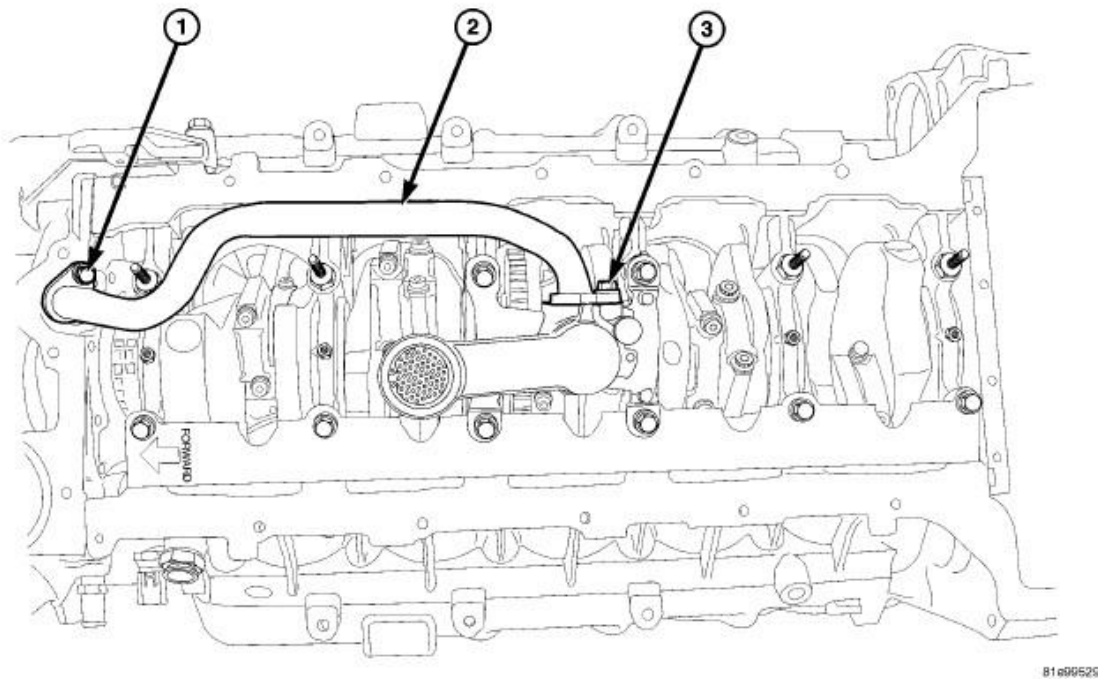


Fig. 382: Oil Pick Up Tube

Courtesy of CHRYSLER GROUP, LLC

16. Install the oil pick up tube oil tube (2) and tighten bolts (1, 3) to 28 N.m (21 ft. lbs.).
17. Verify that the singing oil pick - up swings freely. If pick up does not swing freely, loosen mounting bolts and re-tighten bolts. Refer to **PUMP, ENGINE OIL, INSTALLATION**.
18. Install the oil pan and drain plug. Refer to **PAN, OIL, INSTALLATION**.
19. Lower the vehicle.
20. Install the A/C compressor mounting bolts. Tighten bolts to 24 N.m (17 ft. lbs.).
21. Connect the oil cooler line. Refer to **COOLER AND LINES, OIL, STANDARD PROCEDURES**.
22. Connect the heater hose.

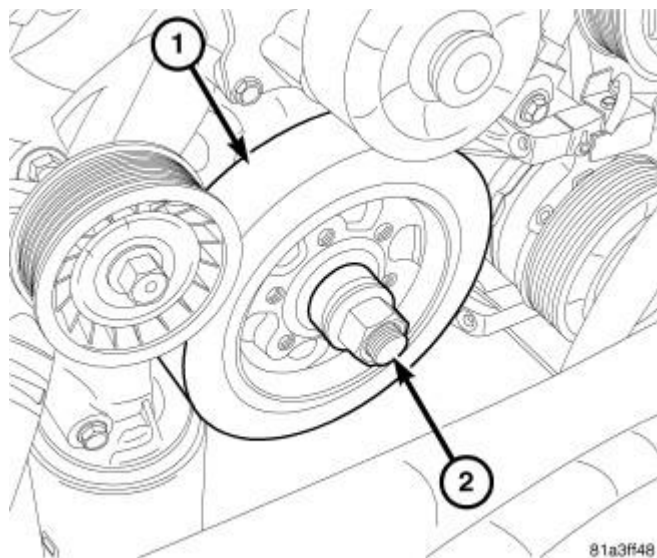


Fig. 383: Damper Installer

Courtesy of CHRYSLER GROUP, LLC

23. Install the crankshaft damper (2) and pulley. Refer to **DAMPER, VIBRATION, INSTALLATION**.
24. Connect the coolant bottle inlet hose at thermostat housing.
25. Install the generator. Connect the electrical connectors.
26. Connect the engine coolant temperature (ECT) sensor wiring harness connector.
27. Install the power steering pump mounting bolts.

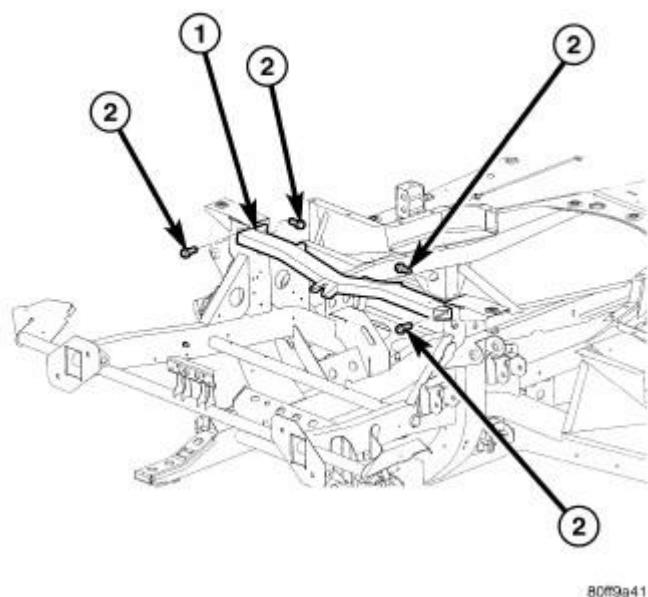


Fig. 384: Front Strut Tower To Tower Brace

Courtesy of CHRYSLER GROUP, LLC

28. Install the accessory drive belt. Refer to **BELT, SERPENTINE, INSTALLATION** .
29. Install the upper and lower radiator hoses.
30. Install the front strut tower to tower brace (1). Refer to **BRACE, WHEELHOUSE, INSTALLATION** .

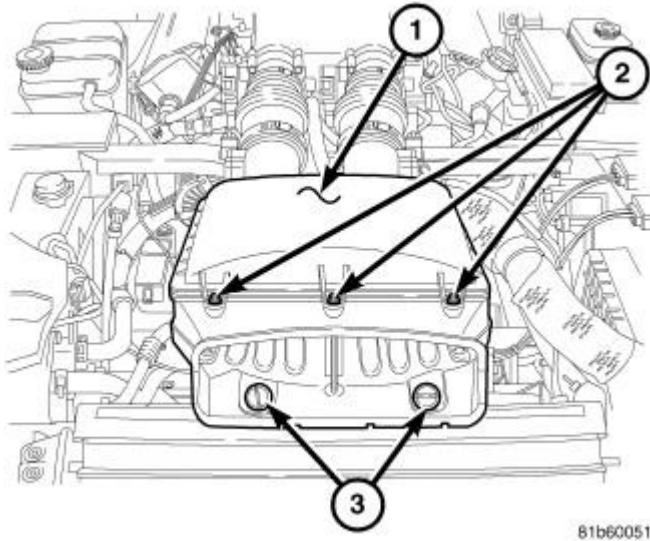


Fig. 385: Air Cleaner Housing
Courtesy of CHRYSLER GROUP, LLC

31. Install the air cleaner housing (1) assembly. Refer to **BODY, AIR CLEANER, INSTALLATION**.
32. Install a **NEW** oil filter.
33. Fill the engine crankcase with proper oil to correct level.
34. Fill the cooling system. Refer to **STANDARD PROCEDURE** .

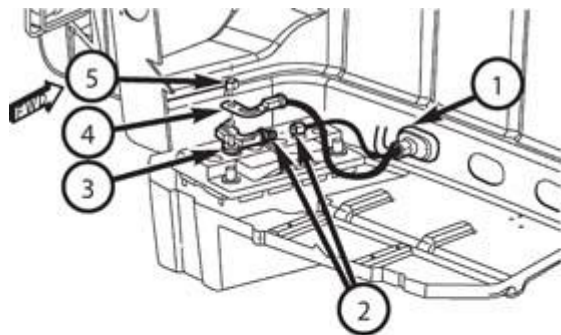


Fig. 386: Identifying IBS, Electrical Connector, (-) Battery Post, Cable Nut & Cable
Courtesy of CHRYSLER GROUP, LLC

35. Connect the battery negative cable (4).