2013 ENGINE

1.4L - Service Information - Dart

DESCRIPTION

DESCRIPTION

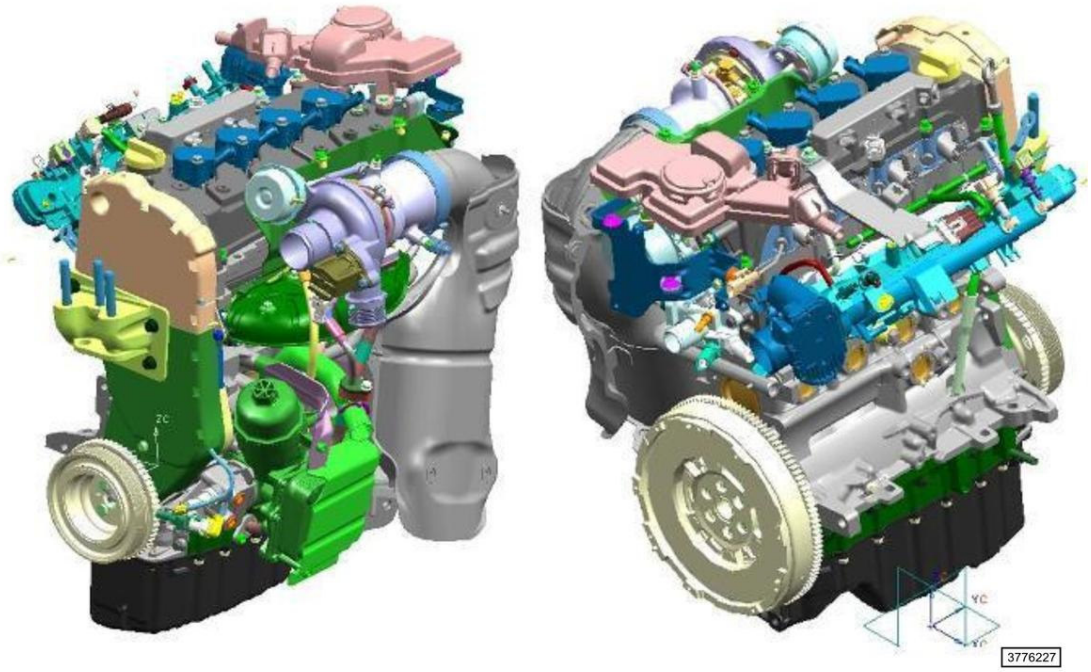


Fig. 1: 1.4L Turbo Engine (Code EAF)
Courtesy of CHRYSLER GROUP, LLC

MultiAir technology manages the torque and power delivered by the engine by varying the lift profile of the intake valves without direct use of the throttle body. The main features of the MultiAir engine are:

- Single camshaft
- Standard and hydraulic exhaust tappets
- Intake tappets integrated in the MultiAir actuator
- Brake servo vacuum pump

Compared to a traditional engine, the special characteristics of the MultiAir system offer better combustion control and a faster response to torque requests, both of which are available and exploitable at each top dead center (TDC). This means:

- Reduced fuel consumption
- Reduced CO2 emissions
- Increased power and torque

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- Increased driver responsiveness
- Less pollution
- Easier start-up

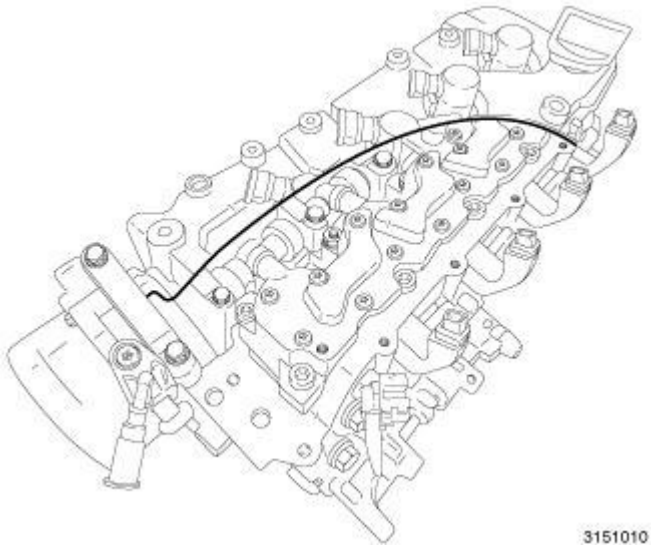


Fig. 2: Cutaway View Of MultiAir System
Courtesy of CHRYSLER GROUP, LLC

The MultiAir system consists of a hydraulic-mechanical actuator fitted inside the MultiAir engine. MultiAir also includes hardware and software electronic components, built into the powertrain control module (PCM) to manage the engine intake valve motion. At each engine cycle, the MultiAir system controls the quantity of fresh air entering each cylinder by managing intake valve motion.

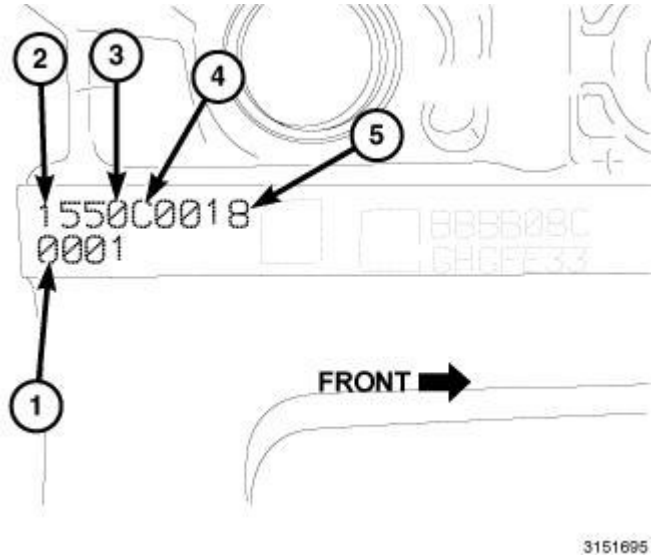


Fig. 3: Engine Identification Information
Courtesy of CHRYSLER GROUP, LLC

The readable engine identification is located near the flywheel end of the engine on a machined surface along

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with a QR Code scannable code symbol. The engine identification is structured as follows:

(1) Block Type (four digits):

- 0001 = Naturally Aspirated
- 0002 = Turbocharged
- 0003 = Naturally Aspirated with Cold Weather Package
- 0004 = Turbocharged with Cold Weather Package

(2) Julian Date (three digits).

(3) Calendar Year (one digit).

(4) Line Designation (one digit). C = Block Line 1.4L FIRE.

(5) Part Sequence for the day (four digits).

DIAGNOSIS AND TESTING

ENGINE DIAGNOSIS - 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 performance (e.g., engine idles rough and stalls) or mechanical (e.g., a strange noise).

Refer to **ENGINE PERFORMANCE DIAGNOSTIC TABLE** and **ENGINE MECHANICAL DIAGNOSTIC TABLE** for possible causes and corrections of malfunctions. Refer to the **FUEL SYSTEM** article for the fuel system diagnosis.

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

- Cylinder Compression Pressure Test: Refer to **CYLINDER COMPRESSION PRESSURE LEAKAGE** .
- Cylinder Combustion Pressure Leakage Test: Refer to **CYLINDER COMBUSTION PRESSURE LEAKAGE** .
- Engine Cylinder Head Gasket Failure Diagnosis: Refer to **DIAGNOSIS AND TESTING** .
- Intake Manifold Leakage Diagnosis. Refer to **MANIFOLD, INTAKE, DIAGNOSIS AND TESTING**.

ENGINE PERFORMANCE DIAGNOSTIC TABLE

CONDITION	POSSIBLE CAUSE	CORRECTION

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ENGINE WILL NOT START	1. Weak battery	1. Charge or replace as necessary. Refer to **BATTERY, DIAGNOSIS AND TESTING** .
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Refer to **CLEANING** .
	3. Faulty engine starting system.	3. Diagnose engine starting system. Refer to **DIAGNOSIS AND TESTING** .
	4. Faulty coil or control unit.	4. Replace ignition coil. Refer to **COIL, IGNITION, REMOVAL** .
	5. Incorrect spark plug gap.	5. Correct as necessary.
	6. Incorrect cam timing.	6. Verify cam timing. Refer to **STANDARD PROCEDURE** .
	7. Dirt or water in fuel system.	7. Clean fuel system.
	8. Faulty fuel pump or wiring.	8. Repair or replace as necessary.
	9. Faulty Camshaft Position (CMP) sensor. 10. Faulty Crankshaft Position (CKP) sensor. 11. Insufficient quantity of engine oil in the Variable Valve Actuation Assembly due to: • Long term storage • Engine not started within the last 30 days • Replaced Variable Valve Actuation Assembly (MultiAir module)	9. Replace sensor. Refer to **SENSOR, CAMSHAFT POSITION, REMOVAL** . 10. Replace sensor. Refer to **SENSOR, CRANKSHAFT POSITION, REMOVAL** . 11. Operate the starter to fill the Variable Valve Actuation Assembly with oil and enable its operation. **CAUTION: Do not exceed 20 seconds of starter operation and allow 60 seconds cool-down between cycles.**
ENGINE STALLS OR ROUGH IDLE	1. Vacuum leak.	1. Inspect intake manifold and vacuum hoses, repair or replace as necessary.
	2. Faulty Crankshaft Position (CKP) sensor.	2. Replace sensor. Refer to **SENSOR, CRANKSHAFT POSITION, REMOVAL** .
	3. Faulty ignition coil.	3. Replace ignition coil. Refer to **COIL, IGNITION, REMOVAL** .
	4. Incorrect cam timing.	4. Verify cam timing. Refer to **STANDARD PROCEDURE** .
ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped spark plugs.	1. Correct as necessary. Refer to **SPARK PLUG, REMOVAL** .

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	2. Dirt or water in fuel system.	2. Clean fuel system.
	3. Faulty fuel pump.	3. Replace fuel pump. Refer to **MODULE, FUEL PUMP, REMOVAL** .
	4. Leaking cylinder head gasket.	4. Replace cylinder head gasket. Refer to **CYLINDER HEAD, REMOVAL**.
	5. Low compression.	5. Determine the cause and repair as necessary. Refer to **CYLINDER COMPRESSION PRESSURE LEAKAGE** .
	6. Burned, warped or pitted valves.	6. Replace as necessary. Refer to **VALVES, INTAKE AND EXHAUST, REMOVAL**.
	7. Plugged or restricted exhaust system.	7. Inspect and replace as necessary.
	8. Faulty ignition coil.	8. Replace ignition coil. Refer to **COIL, IGNITION, REMOVAL** .
	9. Incorrect cam timing.	9. Verify cam timing. Refer to **STANDARD PROCEDURE** .
ENGINE MISSES ON ACCELERATION	1. Dirty or incorrectly gapped spark plugs.	1. Correct as necessary. Refer to **SPARK PLUG, REMOVAL** .
	2. Dirt in fuel system.	2. Clean fuel system.
	3. Burned, warped or pitted valves.	3. Replace as necessary. Refer to **VALVES, INTAKE AND EXHAUST, REMOVAL**.
	4. Faulty ignition coil.	4. Replace ignition coil. Refer to **COIL, IGNITION, REMOVAL** .
ENGINE MISSES AT HIGH SPEED	1. Dirty or incorrectly gapped spark plugs.	1. Correct as necessary. Refer to **SPARK PLUG, REMOVAL** .
	4. Faulty ignition coil.	2. Replace ignition coil. Refer to **COIL, IGNITION, REMOVAL** .
	3. Dirt or water in fuel system.	3. Clean fuel system.

ENGINE MECHANICAL DIAGNOSTIC TABLE

CONDITION	POSSIBLE CAUSES	CORRECTIONS
NOISY VALVES	1. High or low oil level in crankcase.	1. Refer to **STANDARD PROCEDURE** .
	2. Thin or diluted oil.	2. Change oil and filter.
	3. Low oil pressure.	3. Check oil pump, if OK, check rod and main bearings for excessive wear.
	4. Dirt in lash adjusters.	4. Replace as necessary.
	5. Worn rocker arms.	5. Replace as necessary.

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	6. Worn lash adjusters	6. Replace as necessary.
	7. Worn valve guides.	7. Inspect the valve guides for wear, cracks or looseness. If either condition exists, replace the cylinder head. Refer to **CYLINDER HEAD, REMOVAL**.
	8. Excessive runout of valve seats on valve faces.	8. Refer to **STANDARD PROCEDURE** .
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. Refer to **STANDARD PROCEDURE** .
	2. Low oil pressure.	2. Check oil pump, if OK, check rod and main bearings for excessive wear.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Connecting rod journal out-of-round.	5. Service or replace crankshaft.
	6. Misaligned connecting rods.	6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply.	1. Refer to **STANDARD PROCEDURE** .
	2. Low oil pressure.	2. Check oil pump, if OK, check rod and main bearings for excessive wear.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Excessive end play.	5. Check thrust washers for wear.
	6. Crankshaft journal out-of round.	6. Service or replace crankshaft.
	7. Loose flywheel or torque converter.	7. Tighten to correct torque

CYLINDER COMPRESSION PRESSURE LEAKAGE

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

NOTE: 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. Clean the spark plug recesses with compressed air.
2. Remove the spark plugs and record the cylinder number of each spark plug for future reference.
3. Inspect the spark plug electrodes for abnormal firing indicators such as fouled, hot, oily, etc.
4. Disable the fuel system and perform the fuel system pressure release procedure. Refer to **FUEL DELIVERY, GAS, STANDARD PROCEDURE** .

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5. Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.
6. Record the compression pressure on the 3rd revolution. Continue the test for the remaining cylinders.

NOTE: 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.

7. Compression should not be less than 689 kPa (100 psi) and not vary more than 25 percent from cylinder to cylinder.
8. If one or more cylinders have abnormally low compression pressures, repeat the compression test.

NOTE: 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.

9. If one or more cylinders continue to have abnormally low compression pressures, perform the cylinder combustion pressure leakage test. Refer to **CYLINDER COMBUSTION PRESSURE LEAKAGE** .

CYLINDER COMBUSTION PRESSURE LEAKAGE

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

Combustion pressure leakage testing will detect:

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

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, then turn the engine OFF.
3. Remove the spark plugs.
4. Remove the oil filler cap.
5. Remove the air cleaner hose.
6. Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1, 379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.
7. Perform the test procedures on each cylinder according to the tester manufacturer's instructions. Set piston of cylinder to be tested at TDC compression. While 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: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in

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the cylinder.

CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
AIR ESCAPES THROUGH THROTTLE BODY	Intake valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH TAILPIPE	Exhaust valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH RADIATOR	Head gasket leaking or cracked cylinder head or block	Remove cylinder head and inspect. Replace defective part
MORE THAN 50% LEAKAGE FROM ADJACENT CYLINDERS	Head gasket leaking or crack in cylinder head or block between adjacent cylinders	Remove cylinder head and inspect. Replace gasket, head, or block as necessary
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	Stuck or broken piston rings; cracked piston; worn rings and/or cylinder wall	Inspect for broken rings or piston. Measure ring gap and cylinder diameter, taper and out-of-round. Replace defective part as necessary

OIL CONSUMPTION TEST AND DIAGNOSIS

The following diagnostic procedures are used to determine the source of excessive internal oil Consumption, these procedures and tests apply to vehicles with 50,000 miles or less.

NOTE: Engine oil consumption may be greater than normal during engine break-in. Repairs should be delayed until vehicle has been driven at least 7,500 miles.

Severe service (high ambient temperature, short trips, heavy loading, trailer towing, taxi, off-road, or law enforcement use) may result in greater oil consumption than normal.

Sustained high speed driving and high engine RPM operation may result in increased oil consumption.

Failure to comply with the recommended oil type and viscosity rating, as outlined in the owner's manual, may impact oil economy as well as fuel economy.

Oil consumption may increase with vehicle age and mileage due to normal engine wear.

NOTE: Because a few drops of external oil leakage per mile can quickly account for the loss of one quart of oil in a few hundred miles, ensure no external engine oil leaks are present.

- **Oil leakage is not the same as oil consumption and all external leakage must be eliminated before any action can be taken to verify and/or correct oil consumption complaints.**
- **Verify that the engine has the correct oil level dipstick and dipstick tube installed.**

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- **Verify that the engine is not being run in an overfilled condition. Check the oil level 15 minutes after a hot shutdown with the vehicle parked on a level surface. In no case should the level be above MAX or the FULL mark on the dipstick.**

OIL CONSUMPTION TEST

1. Check the oil level at least 15 minutes after a hot shutdown.
2. If the oil level is low, top off with the proper viscosity and API service level engine oil. Add one bottle of MOPAR® 4-In-1 Leak Detection Dye into the engine oil.
3. Tamper proof the oil pan drain plug, oil filter, dipstick and oil fill cap.
4. Record the vehicle mileage.
5. Instruct the customer to drive the vehicle as usual.
6. Ask the customer to return to the servicing dealer after accumulating 500 miles, Check the oil level at least 15 minutes after a hot shutdown. If the oil level is half way between the "FULL" and "ADD" mark continue with the next step.
7. Using a black light, recheck for any external engine oil leaks, repair as necessary, if no external engine oil leaks are present, continue with oil consumption diagnosis.

OIL CONSUMPTION DIAGNOSIS

1. Check the positive crankcase ventilation (PCV) system. Make sure the system is not restricted and the PCV valve has the correct part number and correct vacuum source (18-20 in. Hg at idle below 3000 ft. above sea level is considered normal).
2. Perform a cylinder compression test and cylinder leak down test using the standard leak down gauge following manufacturers suggested best practices.

   NOTE: Verify the spark plugs are not oil saturated. If the spark plugs are oil saturated and compression is good it can be assumed the valve seals or valve guides are at fault.

3. If one or more cylinders have more than 15% leak down further engine tear down and inspection will be required.

TOP 19 REASONS THAT MAY LEAD TO ENGINE OIL CONSUMPTION

1. **Tapered and Out-of-Round Cylinders**

   The increased piston clearances permit the pistons to rock in the worn cylinders. While tilted momentarily, an abnormally large volume of oil is permitted to enter on one side of the piston. The rings, also tilted in the cylinder, permit oil to enter on one side. Upon reversal of the piston on each stroke, some of this oil is passed into the combustion chamber.

2. **Distorted Cylinders**

   This may be caused by unequal heat distribution or unequal tightening of cylinder head bolts. This

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condition presents a surface which the rings may not be able to follow completely. In this case, there may be areas where the rings will not remove all of the excess oil. When combustion takes place, this oil will be burned and cause high oil consumption.

3. **Improper operation of "PCV" system**

   The main purpose of the Positive Crankcase Ventilation (PCV) valve is to recirculate blow-by gases back from the crankcase area through the engine to consume unburned hydrocarbons. The PCV system usually has a one way check valve and a make up air source. The system uses rubber hoses that route crankcase blow by gases to the intake manifold. Vacuum within the engine intake manifold pulls the blow by gases out of the crankcase into the combustion chamber along with the regular intake air and fuel mixture.

   The PCV system can become clogged with sludge and varnish deposits and trap blow by gases in the crankcase. This degrades the oil, promoting additional formation of deposit material. If left uncorrected, the result is plugged oil rings, oil consumption, rapid ring wear due to sludge buildup, ruptured gaskets and seals due to crankcase pressurization.

   If equipped with an engine driven vacuum pump, high oil consumption can be caused by unchecked airflow into the pump. This can be caused by anything that opens the vacuum pump intake port up to the atmosphere such as a faulty vacuum pump, hose fitting, hose and brake booster. If there is not a restriction (normally caused by the pump pulling vacuum on the brake booster), then the vacuum pump will pump a high volume of air. This high volume of air will pressurize the crankcase and cause excessive oil burning and oil flow through the PCV system.

4. **Worn Piston Ring Grooves**

   For piston rings to form a good seal, the sides of the ring grooves must be true and flat - not flared or shouldered. Piston rings in tapered or irregular grooves will not seal properly and, consequently, oil will pass around behind the rings into the combustion chamber.

5. **Worn, Broken or Stuck Piston Rings**

   When piston rings are broken, worn or stuck to such an extent that the correct tension and clearances are not maintained, this will allow oil to be drawn into the combustion chamber on the intake stroke and hot gases of combustion to be blown down the cylinder past the piston on the power stroke. All of these conditions will result in burning and carbon build up of the oil on the cylinders, pistons and rings.

6. **Cracked or Broken Ring Lands**

   Cracked or broken ring lands prevent the rings from seating completely on their sides and cause oil pumping. This condition will lead to serious damage to the cylinders as well as complete destruction of the pistons and rings. Cracked or broken ring lands cannot be corrected by any means other than piston replacement.

7. **Worn Valve Stems and Guides**

   When wear has taken place on valve stems and valve guides, the vacuum in the intake manifold will draw oil and oil vapor between the intake valve stems and guides into the intake manifold and then into the

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cylinder where it will be burned.

8. **Bent or Misaligned Connecting Rods**

   Bent or misaligned connecting rods will not allow the pistons to ride straight in the cylinders. This will prevent the pistons and rings from forming a proper seal with the cylinder walls and promote oil consumption. In addition, it is possible that a bearing in a bent connect rod will not have uniform clearance on the connecting rod wrist pin. Under these conditions, the bearing will wear rapidly and throw off an excessive amount of oil into the cylinder.

9. **Fuel Dilution**

   If raw fuel is allowed to enter the lubrication system, the oil will become thinner and more volatile and will result in higher oil consumption. The following conditions will lead to higher oil consumption;

   - Excess fuel can enter and mix with the oil via a leaking fuel injector
   - Gasoline contaminated with diesel fuel
   - Restricted air intake
   - Excessive idling

10. **Contaminated Cooling Systems**

    Corrosion, rust, scale, sediment or other formations in the water jacket and radiator will prevent a cooling system from extracting heat efficiently. This is likely to cause cylinder distortion thus leading to higher oil consumption.

11. **Oil Viscosity**

    The use of oil with a viscosity that is too light may result in high oil consumption. Refer to the vehicle owner's manual for the proper oil viscosity to be used under specific driving conditions and/or ambient temperatures.

12. **Dirty Engine Oil**

    Failure to change the oil and filter at proper intervals may cause the oil to be so dirty that it will promote accumulation of sludge and varnish and restrict oil passages in the piston rings and pistons. This will increase oil consumption; dirty oil by nature is also consumed at a higher rate than clean oil.

13. **Crankcase Overfull**

    Due to an error in inserting the oil dip stick so that it does not come to a seat on its shoulder, a low reading may be obtained. Additional oil may be added to make the reading appear normal with the stick in this incorrect position which will actually make the oil level too high. If the oil level is so high that the lower ends of the connecting rods touch the oil in the oil pan excessive quantities of oil will be thrown on the cylinder walls and some of it will work its way up into the combustion chamber.

14. **Excessively High Oil Pressure**

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A faulty oil pressure relief valve may cause the oil pressure to be too high. The result will be that the engine will be flooded with an abnormally large amount of oil in a manner similar to that which occurs with worn bearings. This condition may also cause the oil filter to burst.

15. **Aftermarket Performance Chips and Modification**

Increasing performance through the use of performance/power enhancement products to a stock or factory engine will increase the chance of excessive oil consumption.

16. **Lugging Engine**

Lugging is running the engine at a lower RPM in a condition where a higher RPM (more power/torque) should be implemented. Especially susceptible on vehicles equipped with a manual transmission. This driving habit causes more stress loading on the piston and can lead to increases in engine oil consumption.

17. **Turbocharged Engines**

There is a possibility for PCV "push-over" due to higher crankcase pressure (as compared to naturally aspirated engines) which is normal for turbocharged engines. This condition causes varying amounts of engine oil to enter the intake manifold, charge air cooler and associated plumbing to and from the charge air cooler, also a leaking turbocharger seal will draw oil into the combustion chamber where it will burn (blue smoke from tail pipe may be present) and form carbon deposits which contribute to further oil consumption as they interfere with proper engine function.

18. **Restricted Air Intake**

Excessive restriction in the air intake system will increase engine vacuum and can increase oil consumption, an extremely dirty air filter would be one example of this situation.

19. **Intake Manifold port seals**

Engines that have a "V" configuration and a "wet valley" (3.3/3.8L) could draw oil into the intake ports due to improper sealing between the intake manifold ports and cylinder head. Causes may include improper torque of intake manifold bolts, corrosion (aluminum intake manifold) and or warped sealing surface.

ENGINE LUBRICATION DIAGNOSTIC TABLE

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL LEAKS	1. Gaskets and O-rings. Misaligned or damaged.	1. Replace as necessary.
	(a) Loose fasteners, broken or porous metal parts.	(a) Tighten fasteners, Repair or replace metal parts.
	2. Crankshaft rear oil seal.	2. Replace rear crankshaft oil seal. Refer to **SEAL, CRANKSHAFT OIL, REAR, REMOVAL**.

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	3. Crankshaft rear oil seal surface. Scratched, nicked or grooved.	3. Polish or replace crankshaft.
	4. Oil pan flange cracked.	4. Replace oil pan. Refer to **PAN, OIL, REMOVAL**.
	5. Crankshaft front oil seal.	5. Replace front crankshaft oil seal. Refer to **SEAL, CRANKSHAFT OIL, FRONT, REMOVAL**.
	6. Crankshaft front oil seal surface. Scratched, nicked or grooved.	6. Polish or replace crankshaft.
OIL PRESSURE DROP	1. Low oil level.	1. Check and correct oil level.
	2. Faulty oil pressure switch.	2. Replace switch. Refer to **SWITCH, OIL PRESSURE, REMOVAL**.
	3. Low oil pressure.	3. Check main bearing clearance. Refer to**STANDARD PROCEDURE** . 3. Check rod bearing clearance. Refer to **STANDARD PROCEDURE** .
	4. Clogged oil filter.	4. Replace oil filter. Refer to **FILTER, ENGINE OIL, REMOVAL**.
	5. Worn oil pump.	5. Replace oil pump. Refer to **PUMP, ENGINE OIL, REMOVAL**.
	6. Thin or diluted oil.	6. Change oil and filter. Refer to **STANDARD PROCEDURE** .
	7. Excessive bearing clearance.	7. Replace crankshaft bearings. Refer to **STANDARD PROCEDURE** . 7. Replace rod bearings. Refer to **STANDARD PROCEDURE** .
	8. Oil pump relief valve stuck.	8. Replace oil pump. Refer to **PUMP, ENGINE OIL, REMOVAL**.
	9. Oil pump pick-up tube loose, damaged or clogged.	9. Replace oil pump pick-up. Refer to **PICK-UP, OIL PUMP, REMOVAL**.
OIL PUMPING AT RINGS; SPARK PLUGS FOULING	1. Worn or damaged rings.	1. Hone cylinder bores and replace rings. Refer to **STANDARD PROCEDURE** .
	2. Carbon in oil ring slots.	2. Replace rings. Refer to **ROD, PISTON AND CONNECTING, REMOVAL**.
	3. Worn valve guides.	3. Replace cylinder heads. Refer to **CYLINDER HEAD, REMOVAL**.
	4. Leaking valve guide seals.	4. Replace valve guide seals. Refer to

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		SEAL(S), VALVE GUIDE, REMOVAL.

STANDARD PROCEDURE

DUST COVERS AND CAPS

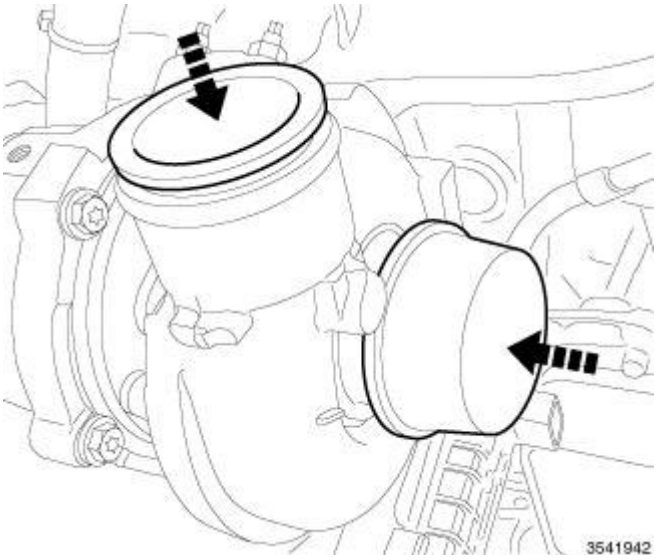


Fig. 4: Identifying Covers/Caps Applications
Courtesy of CHRYSLER GROUP, LLC

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.

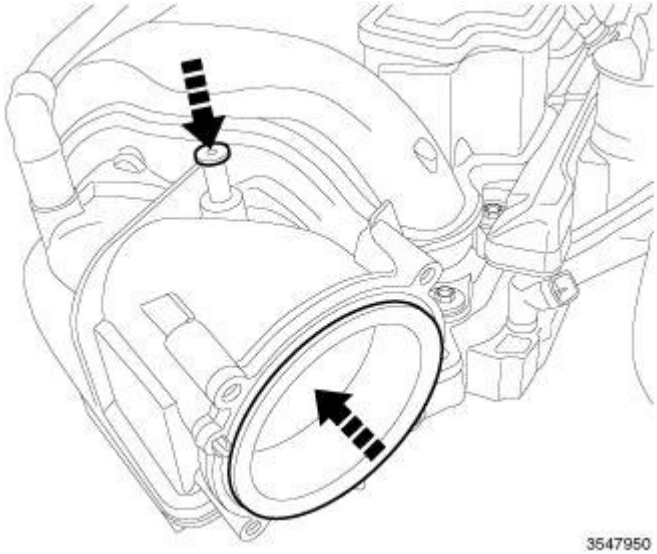


Fig. 5: Opening Cover
Courtesy of CHRYSLER GROUP, LLC

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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.

REPAIR DAMAGED OR WORN THREADS

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

Damaged or worn threads can be repaired. Essentially, this repair consists of:

- Drilling out worn or damaged threads.
- Tapping the hole with a special Heli-Coil Tap, or equivalent.
- Installing an insert into the tapped hole to bring the hole back to its original thread size.

FORM-IN-PLACE GASKETS AND SEALERS

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

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

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

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

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

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

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material is for use between two machined surfaces. Do not use on flexible metal flanges.

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

MOPAR® THREEBOND ENGINE RTV SEALANT is a unique gasket material that is specially made to retain adhesion and sealing properties when used to seal components exposed to engine oil.

SEALER APPLICATION

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

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

Mopar® Threebond Engine RTV Sealant gasket material should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. The gasket surfaces should be cleaned with isopropyl alcohol wipes in preparation for sealant application. All mounting holes must be circled. For corner sealing and "T" joint locations, a 3.17 or 6.35 mm (1/8 or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be assembled within 20 minutes and torqued in place within 45 minutes. The usage of a locating dowel is recommended during assembly to prevent smearing material off the location.

ENGINE GASKET SURFACE PREPARATION

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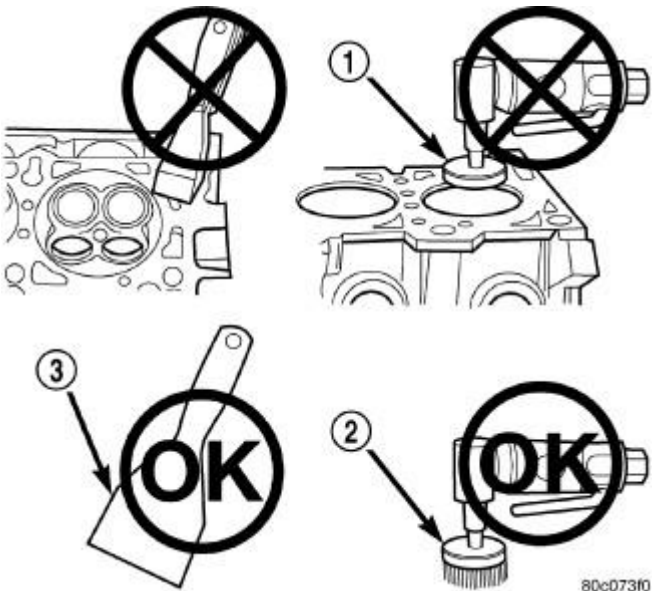


Fig. 6: Proper Tool Usage For Surface Preparation
Courtesy of CHRYSLER GROUP, LLC

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

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

Only use the following for cleaning gasket surfaces:

- Solvent or a commercially available gasket remover
- Plastic or wood scraper (3).
- Drill motor with 3M Roloc™ Bristle Disc (white or yellow) (2).

CAUTION: Excessive pressure or high RPM (beyond the recommended speed), can damage the sealing surfaces. The mild (white, 120 grit) bristle disc is recommended. If necessary, the medium (yellow, 80 grit) bristle disc may be used on cast iron surfaces with care.

SPECIFICATIONS

SPECIFICATIONS

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GENERAL SPECIFICATIONS

DESCRIPTION	SPECIFICATION	
Type	SOHC I-4 16-Valve MultiAir Turbocharged	
Compression Ratio	9.8:1	
Lead Cylinder	#1 Timing Drive End	
Firing Order	1 - 3 - 4 - 2	
	Metric	**Standard**
Displacement	1.368 Liters	83.5 Cubic Inches
Bore and Stroke	72 mm x 84 mm	2.83 in. x 3.31 in.
Maximum Power (EEC)	100 kW @ 5000 RPM	135 HP @ 5000 RPM
Maximum Torque (EEC)	180 N.m @ 1750 RPM	133 ft. lbs. @ 1750 RPM

CYLINDER BLOCK

Description	Specification	
	Metric	**Standard**
Cylinder Bore Diameter - Class A	72.000 - 72.010 mm	2.8346 - 2.8350 in.
Cylinder Bore Diameter - Class B	72.010 - 72.020 mm	2.8350 - 2.8354 in.
Cylinder Bore Diameter - Class C	72.020 - 72.030 mm	2.8354 - 2.8358 in.
Cylinder Bore Roundness (Ovality)	± 0.05 mm	± 0.002 in.
Flatness - Cylinder Head Gasket Surface	< 0.1 mm	< 0.004 in.
Cylinder Bore Taper	± 0.005 mm	± 0.0002 in.

PISTONS

Description	Specification	
	Metric	**Standard**
Material	Cast Aluminum Alloy	
Piston Diameter - Class A*	71.960 - 71.970 mm	2.8331 - 2.8835 in.
Piston Diameter - Class B*	71.970 - 71.980 mm	2.8835 - 2.8339 in.
Piston Diameter - Class C*	71.980 - 71.990 mm	2.8339 - 2.8342 in.
Clearance at Size Location	0.030 - 0.050 mm	0.0012 - 0.0020 in.
Piston Weight Variation	± 5.0 grams	± 0.18 oz.
Piston Pin Bore	17.982 - 17.986 mm	0.7080 - 0.7081 in.
Piston Ring Groove Width - No. 1	1.020 - 1.040 mm	0.0402 - 0.0409 in.
Piston Ring Groove Width - No. 2	1.210 - 1.230 mm	0.0486 - 0.0484 in.
Piston Ring Groove Width - No. 3	2.010 - 2.030 mm	0.0791 - 0.0799 in.
*Measured perpendicular to piston pin bore, 0.9 mm (0.35 in.) from base of piston skirt		

PISTON PINS

Description	Specification	
	Metric	**Standard**

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Type	Floating	
Pin Diameter	17.970 - 17.974 mm	0.7075 - 0.7076 in.
Clearance in Piston	0.008 - 0.016 mm	0.0003 - 0.0006 in.
Clearance in Rod	x.xxx - x.xxx mm	x.xxxx - x.xxxx in.

PISTON RING END GAP

Description	Specification	
	Metric	Standard
Number 1 Ring (Top)	0.20 - 0.35 mm	0.008 - 0.014 in.
Number 2 Ring (Center)	0.40 - 0.60 mm	0.016 - 0.024 in.
Oil Control Ring (Bottom)	0.20 - 0.40 mm	0.008 - 0.016 in.

PISTON RING SIDE CLEARANCE

Description	Specification	
	Metric	Standard
Number 1 Ring (Top)	0.030 - 0.070 mm	0.0012 - 0.0028 in.
Number 2 Ring (Center)	0.020 - 0.060 mm	0.0008 - 0.0024 in.
Oil Control Ring (Bottom)	0.020 - 0.055 mm	0.0008 - 0.0022 in.

PISTON RING WIDTH

Description	Specification	
	Metric	Standard
Number 1 Ring (Top)	0.970 - 0.990 mm	0.0382 - 0.0390 in.
Number 2 Ring (Center)	1.170 - 1.190 mm	0.0461 - 0.0469 in.
Oil Control Ring (Bottom)	1.975 - 1.990 mm	0.0778 - 0.0783 in.

CONNECTING RODS

Description	Specification	
	Metric	Standard
Bearing Clearance	0.024 - 0.060 mm	0.0009 - 0.0024 in.
Piston Pin Bore Diameter	xx.xxx - xx.xxx mm	x.xxxx - x.xxxx in.
Crank Journal Bore Diameter	45.128 - 45.138 mm	1.7767 - 1.7771 in.

CRANKSHAFT MAIN BEARING JOURNALS

Description	Specification	
	Metric	Standard
Diameter - Class A	47.994 - 48.000 mm	1.8895 - 1.8898 in.
Diameter - Class B	47.988 - 47.994 mm	1.8893 - 1.8895 in.
Diameter - Class C	47.982 - 47.988 mm	1.8890 - 1.8893 in.
Bearing Clearance	0.025 - 0.040 mm	0.0010 - 0.0016 in.
End Play	0.155 - 0.355 mm	0.0061 - 0.0140 in.

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CRANKSHAFT CONNECTING ROD JOURNALS

Description	Specification	
	Metric	Standard
Diameter	41.990 - 42.008 mm	1.6531 - 1.6539 in.
Bearing Clearance	0.024 - 0.060 mm	0.0009 - 0.0024 in.

CAMSHAFT

Description	Specification	
	Metric	Standard
Bearing Journal Diameter	26.000 - 26.015 mm	1.0236 - 1.0242 in.
Lobe Lift - Exhaust	7.5 mm	0.295 in.

VALVE TIMING - MULTIAIR PUMPING ELEMENTS

Description	Specification
Opens	11° (BTDC)
Closes	58° (ABDC)
Duration	249°
Centerline	125°
Note: Units are in crank degrees.	

VALVE TIMING - EXHAUST VALVES

Description	Specification
Opens	34° (BBDC)
Closes	2° (ATDC)
Duration	216°
Note: Units are in crank degrees.	

CYLINDER HEAD

Description	Specification	
	Metric	Standard
Cylinder Head Height	77 mm	3.03 in.
Flatness - Cylinder Block Gasket Surface	< 0.1 mm	< 0.004 in.
Combustion Chamber Volume	14.30 ml	0.484 oz.
Valve Guide Bore Diameter	6.022 - 6.040 mm	0.2371 - 0.2378 in.

VALVES

Description	Specification	
	Metric	Standard
Head Diameter - Intake	26.75 - 27.05 mm	1.053 - 1.065 in.
Head Diameter - Exhaust	22.25 - 22.55 mm	0.876 - 0.888 in.
Stem Diameter - Intake	5.982 - 6.000 mm	0.2355 - 0.2362 in.

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Stem Diameter - Exhaust	5.974 - 5.992 mm	0.2352 - 0.2359 in.
Stem-to-Guide Clearance - Intake	0.022 - 0.058 mm	0.0009 - 0.0023 in.
Stem-to-Guide Clearance - Exhaust	0.030 - 0.066 mm	0.0012 - 0.0026 in.

VALVE SPRING

Description	Specification	
	Metric	Standard
Free Length - Intake and Exhaust	47.6 mm	1.87 in.
Length @ Spring Force - Intake and Exhaust	35.2 mm @ 197 - 211 N	1.39 in. @ 44 - 47 lbs.
Length @ Spring Force - Intake and Exhaust	27.2 mm @ 380 - 416 N	1.07 in. @ 85 - 94 lbs.

OIL PUMP

Description	Specification	
	Metric	Standard
Pressure @ Curb Idle Speed*	> 0.7 bar	> 10 psi
Pressure @ 4000 RPM*	> 4.0 bar	> 58 psi
*At Normal Operating Temperatures		

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Accessory Belt Tensioner - M8 Bolt	26	19	-
Accessory Mounting Bracket - M8 Nuts	25	18	-
Accessory Mounting Bracket - M10 Bolts	50	37	-
Accessory Mounting Bracket - M10 Nuts	50	37	-
Air inlet hose - M6 Bolt	4	-	35
Air Cleaner Cover to Housing	4	-	35
Battery Cable to Battery Terminal - M6 Nut	5	-	45
Block Heater to Engine Block	2.37	-	21
Camshaft Cap - M7 Bolts	10*	-	89*
Camshaft Housing Pipe Plug - M16	22	16	-
Camshaft Housing to Cylinder Head - M8 Bolts	25*	18*	-
Camshaft Position (CMP) Sensor - M6 Bolt	9	-	80
Camshaft Sprocket - M12 Bolt	120	89	-
Catalytic Converter to Turbocharger Clamp	8	-	71
Catalytic Converter to Lower Support Bracket - M8 Bolts	56	41	-
Charge Air Cooler Bracket - Bolt	18	13	-

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Clutch to Flywheel - M6 Bolts	14	-	124
Connecting Rod Cap - M8 Bolts	20 + 40° Turn*	15 + 40° Turn*	-
Coolant Supply Tube to Thermostat Housing - M6 Bolt	9	-	80
Coolant Supply Tube to Oil Filter Housing - M6 Bolt	9	-	80
Coolant Pump Inlet Tube to Engine Block - M6 Bolt	9	-	80
Coolant Pump to Engine Block - M6 Stud	4	-	35
Coolant Pump to Engine Block - M6 Bolts	10	-	89
Coolant Pump to Engine Block - M6 Nuts	10	-	89
Coolant Pump Inlet Pipe Support Bracket to Engine Block - M6 Bolt	10	-	89
Coolant Return Tube to Oil Filter Housing - M16	40	30	-
Coolant Return Tube to Turbocharger Housing	38	28	-
Coolant Return Tube to Coolant Pump Inlet Pipe - M16	45	33	-
Crankshaft Rear Oil Seal Retainer - M6 Bolts	10*	-	89*
Crankshaft Sprocket - M12 Bolt	20 + 110° Turn	15 + 110° Turn	-
Crankshaft Vibration Damper - M8 Bolts	25	19	-
Crankshaft Position (CKP) Sensor to Oil Pump Housing - M6 Bolt	9	-	80
Cylinder Head Cover - M6 Bolts	9*	-	80*
Cylinder Head to Engine Block - M9 Bolts	30 + 180° Turn*	22 + 180° Turn*	-
Engine Coolant Temperature (ECT) Sensor - M12	20	15	-
Front Exhaust Pipe to Rear Exhaust Flange - Nuts	69	51	-
Flywheel Dust Shield to Bell Housing - M6 Bolts	9	-	80
Flywheel Dust Shield to Oil Pan - M6 Bolt	9	-	80
Ground Strap to Transmission - M8 Bolt	24	18	-
Heatshield to Oil Filter Housing - M6 Bolts	3	-	26
Ignition Coil to Cylinder Head Cover - M6 Bolts	9	-	80
Intake Manifold to Cylinder Head - M7 Bolts	15*	11*	-
Knock Sensor to Engine Block - M8 Bolt	25	18	-
Left Engine Mount Bracket to Manual Transmission - M8 Bolts	50	37	-
Left Engine Mount Isolator to Body - M12 Bolts	50	37	-
Left Engine Mount Isolator to Engine Mount Bracket - M12 Bolt	110	81	-
Lower Crankcase to Engine Block - M8 Bolts	32*	27*	-
Lower Crankcase to Engine Block - M10 Bolts	20 + 80° Turn*	15 + 80° Turn*	-
Lower Timing Cover to Oil Pump - M6 Bolt	9	-	80

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Front Exhaust Pipe Bracket to Oil Pan - M10 Bolt	56	41	-
Exhaust Manifold to Cylinder Head - M8 Nuts	15 + 30° Turn*	-	133 + 30° Turn*
Exhaust Manifold Stud to Cylinder Head - M8 Stud	11	-	97
Exhaust Manifold Heatshield - M6 Nuts & Bolts	9	-	80
Catalytic Converter Heatshield - M6 Nuts & Bolts	8	-	71
Catalytic Converter to Front Exhaust Pipe Flange - M8 Nuts	56	41	-
Manual Transmission to Engine Block - M12 Bolts	60	44	-
Manual Transmission to Engine Block - M12 Nut	60	44	-
Manual Transmission to Oil Pan - M10 Bolts	40	30	-
MultiAir Actuator Oil Supply Filter - M18	27	20	-
Negative Battery Cable to Battery - M6 Nut	5	-	45
Oil Cooler to Oil Filter Housing Bolts - M6	9	-	80
Oil Cooler Return Tube to Lower Crankcase - M6 Bolt	9	-	80
Oil Filter Housing Coolant Return Tube to Oil Cooler - M16	33	24	-
Oil Filter Housing Coolant Return Tube to Coolant Pump Inlet Tube	33	24	-
Oil Filter Cap	25	18	-
Oil Filter Housing to Engine Block - M10 Bolts	50	37	-
Oil Filter Housing to Oil Pump - M20	45	33	-
Oil Level Indicator to Cylinder Head - M6 Bolt	9	-	80
Oil Pan to Lower Crankcase - M6 Bolts	9*	-	80*
Oil Pan to Oil Pump - M6 Nuts	9	-	80
Oil Pan Drain Plug	27	20	-
Oil Pressure Switch to Oil Pump	32	24	-
Oil Pump to Lower Crankcase - M6 Bolts	10*	-	89*
Oil Pump Pick Up Tube to Oil Pump - M6 Bolt	10	-	89
Oil Separator Housing Bracket to Cylinder Head Cover - M6 Bolt	13	-	115
Oil Separator Housing Bracket to Cylinder Head Cover - M6 Nut	13	-	115
Oil Separator Housing Bracket to Camshaft Housing - M6 Bolt	13	-	115
Oil Separator Housing to Cylinder Head Cover - M6 Bolts	13	-	115
Oil Supply Tube to Turbocharger Housing	30	22	-
Oil Return Tube to Turbocharger Housing	14	-	124

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Oil Temperature Sensor to Variable Valve Actuation Assembly	18	13	-
Oxygen Sensor to Front Exhaust Pipe - M18	45	33	-
Oxygen Sensor to Catalytic Converter - M18	45	33	-
Powertrain Control Module (PCM) to Mounting Bracket - M6 Nuts	8	-	71
Positive Battery Cable to Battery - M6 Nut	5	-	45
Positive Crankcase Ventilation (PCV) Valve	2.5	-	22
Rear Engine Mount Isolator to Body - M12 Bolt	130	96	-
Rear Engine Mount Isolator to Rear Engine Mount Bracket - M8 Bolt and Nut	80	59	-
Rear Engine Mount Bracket to Manual Transmission - M8 Bolts and Nut	80	59	-
Right Engine Mount Isolator to Body - M10 Bolts	60	44	-
Right Engine Mount Isolator to Engine Mount Bracket - M10 Bolts	60*	44*	-
Right Engine Mount Bracket to Cylinder Head - M8 Bolts	25	18	-
Side Timing Cover to Cylinder Head - M8 Bolt	25	18	-
Upper/Lower Timing Covers to Side Timing Cover - M6 Bolt	9	-	80
Spark Plug to Cylinder Head - M12	19	14	-
Spark Plug Tube to Cylinder Head - M28	45	33	-
Surge Valve to Turbocharger - Bolts	9	-	80
Tensioner to Cylinder Head - M8 Nut	28	21	-
Tensioner Stud to Cylinder Head - M8 Stud	11	-	97
Thermostat Housing to Cylinder Head - M6 Bolts	10	-	89
Tunnel Support Brace to Front Crossmember - M10 Bolts	80	59	-
Turbocharger to Exhaust Manifold - M8 Nuts	35	26	-
Turbocharger Support Bracket - M8 Bolts & Nut	25	18	-
Turbocharger Upper Heatshield - M6 Bolts & Nuts	9	-	80
Upper Timing Cover to Camshaft Housing - M6 Bolt	9	-	80
Vacuum Pump Fitting - M6 Screw	8	-	71
Vacuum Pump to Cylinder Head - M8 Bolts	20	15	-
Variable Valve Actuation Assembly - M8 Bolts	22*	16*	-
Wastegate Actuator - M6 Bolt	8	-	71
Wire Harness Ground Lug to Cylinder Head Cover - M6 Bolt	9	-	80
Wiring Duct to Cylinder Head Cover - M6 Bolt	9	-	80

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* See procedure for multiple fastener tightening sequence.

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: The oil cooler can not be cleaned out. In the event that the engine requires rebuilding or replacement, replace the oil cooler. Refer to COOLER, OIL, REMOVAL.

1. Remove the engine cover.
2. Perform the fuel pressure release procedure. Refer to **FUEL DELIVERY, GAS, STANDARD PROCEDURE** .
3. Remove the air cleaner body. Refer to **BODY, AIR CLEANER, REMOVAL**.
4. Disconnect and remove the battery. Refer to **BATTERY, REMOVAL** .
5. Remove the battery tray assembly. Refer to **TRAY, BATTERY, REMOVAL** .
6. Recover the refrigerant from the refrigerant system. Refer to **PLUMBING, STANDARD PROCEDURE** .

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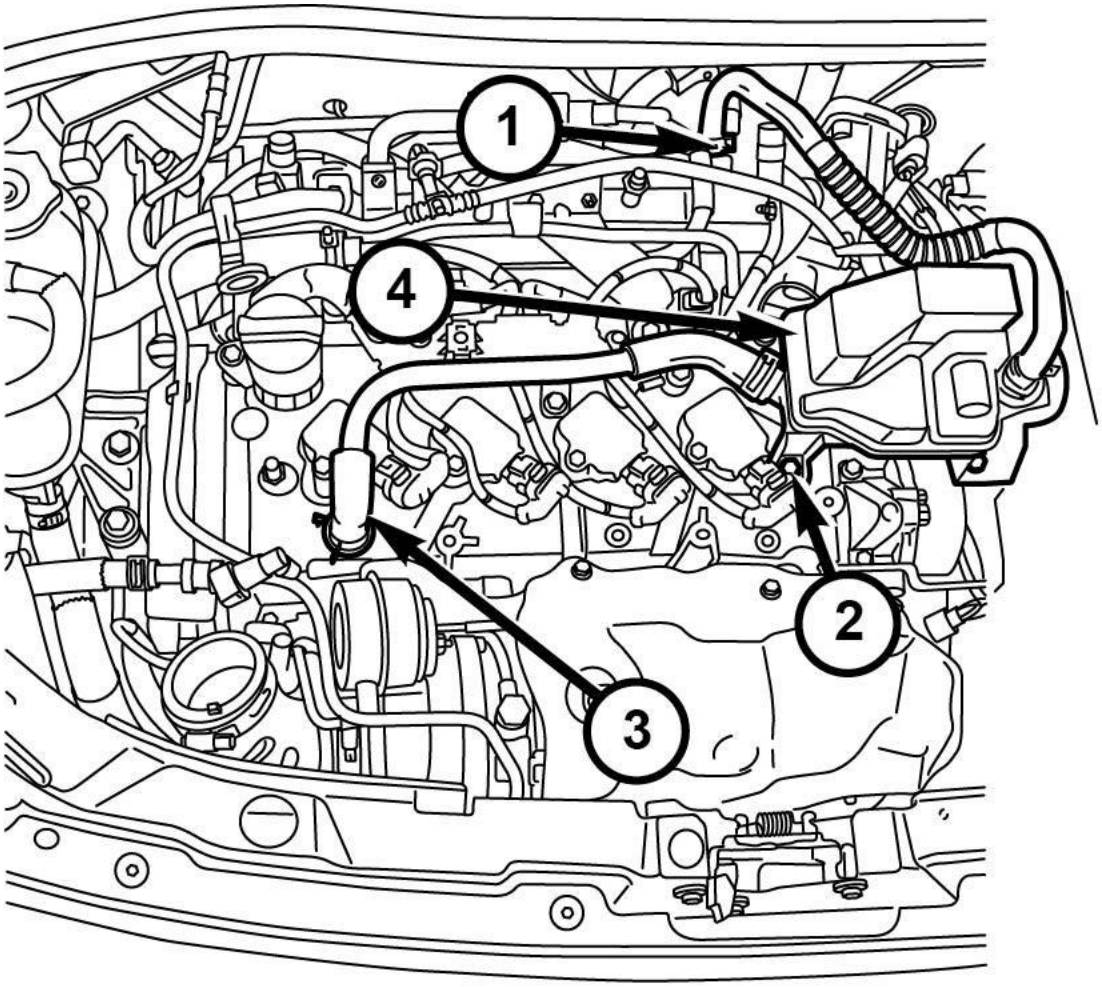


Fig. 7: PCV Hose, Vent Hose, Oil Separator Housing & Bolts
Courtesy of CHRYSLER GROUP, LLC

7. Disconnect the PCV hose (1) from the intake manifold and set aside.
8. Disconnect the vent hose (3) from the cylinder head cover.
9. Remove the three bolts (2) and remove the oil separator housing (4) from the cylinder head cover.

CAUTION: When servicing components near the vacuum pump, avoid contact with the plastic nipple that connects the vacuum pump to the brake booster hose. It is possible to crack the plastic nipple resulting in a brake booster vacuum leak.

10. Remove the cooling fan module. Refer to **FAN, COOLING, REMOVAL** .
11. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
12. Remove the belly pan. Refer to **BELLY PAN, REMOVAL** .

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13. Drain the cooling system. Refer to **STANDARD PROCEDURE** .
14. Remove both front tire and wheel assemblies. Refer to **REMOVAL** .
15. Remove both front inner wheel well splash shields. Refer to **SHIELD, SPLASH, FRONT WHEELHOUSE, REMOVAL** .
16. Remove the lower closeout panel.

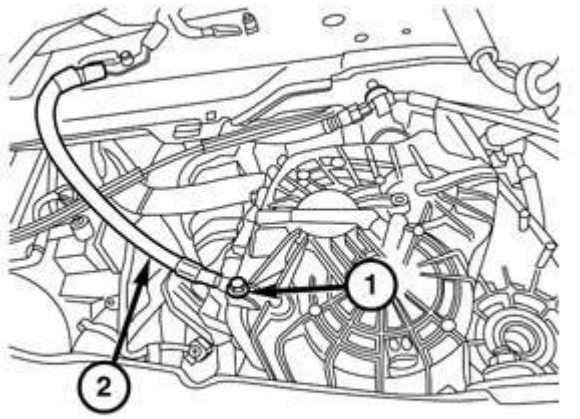


Fig. 8: Ground Cable & Bolt
Courtesy of CHRYSLER GROUP, LLC

17. Remove the ground cable bolt (1) and ground cable (2) from the transmission case.
18. Remove the four bracket retaining bolts (1) from the cross member to fascia support beams bracket, then remove the bracket.

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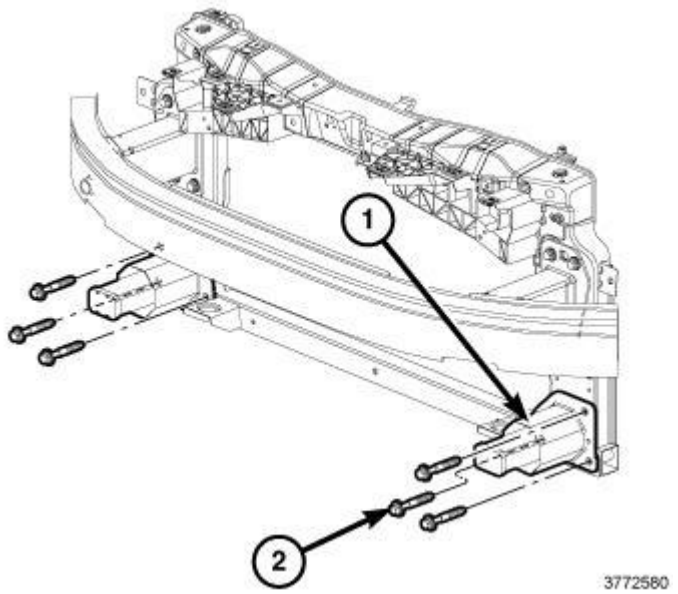


Fig. 9: Lower Bumper Reinforcements & Fasteners
Courtesy of CHRYSLER GROUP, LLC

19. Remove the fasteners (2) securing the lower bumper reinforcement (1) and front fascia support beams to the frame/front end module.

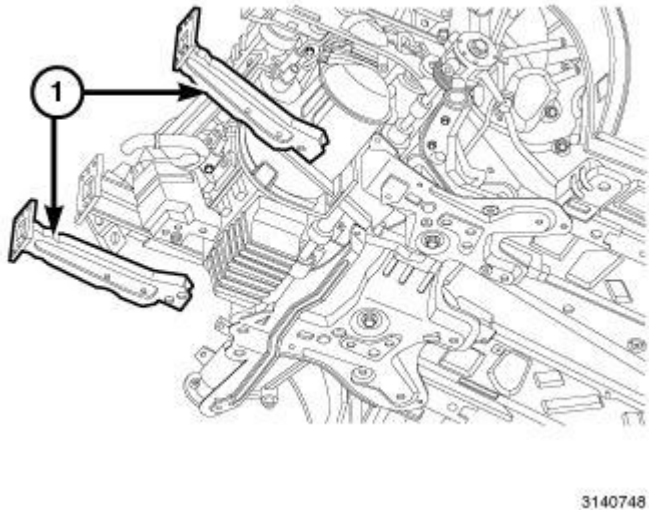


Fig. 10: Front Fascia Support Beams
Courtesy of CHRYSLER GROUP, LLC

20. Remove the front fascia support beams (1).
21. Disconnect the charge air cooler (CAC) hose connections at the cooler inlet and outlet.

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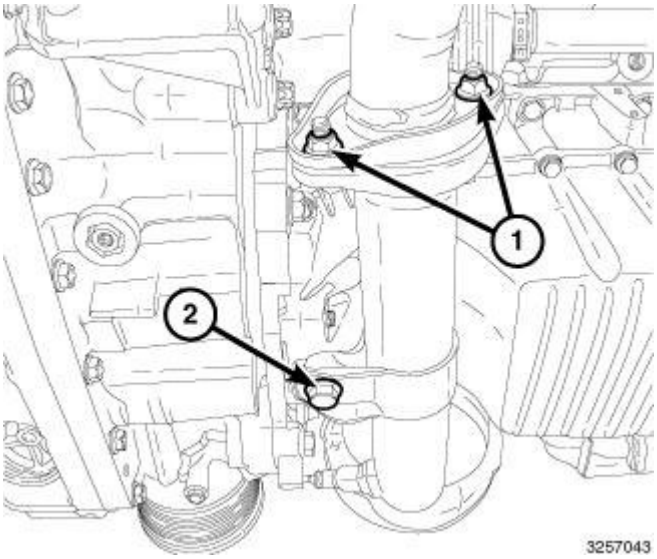
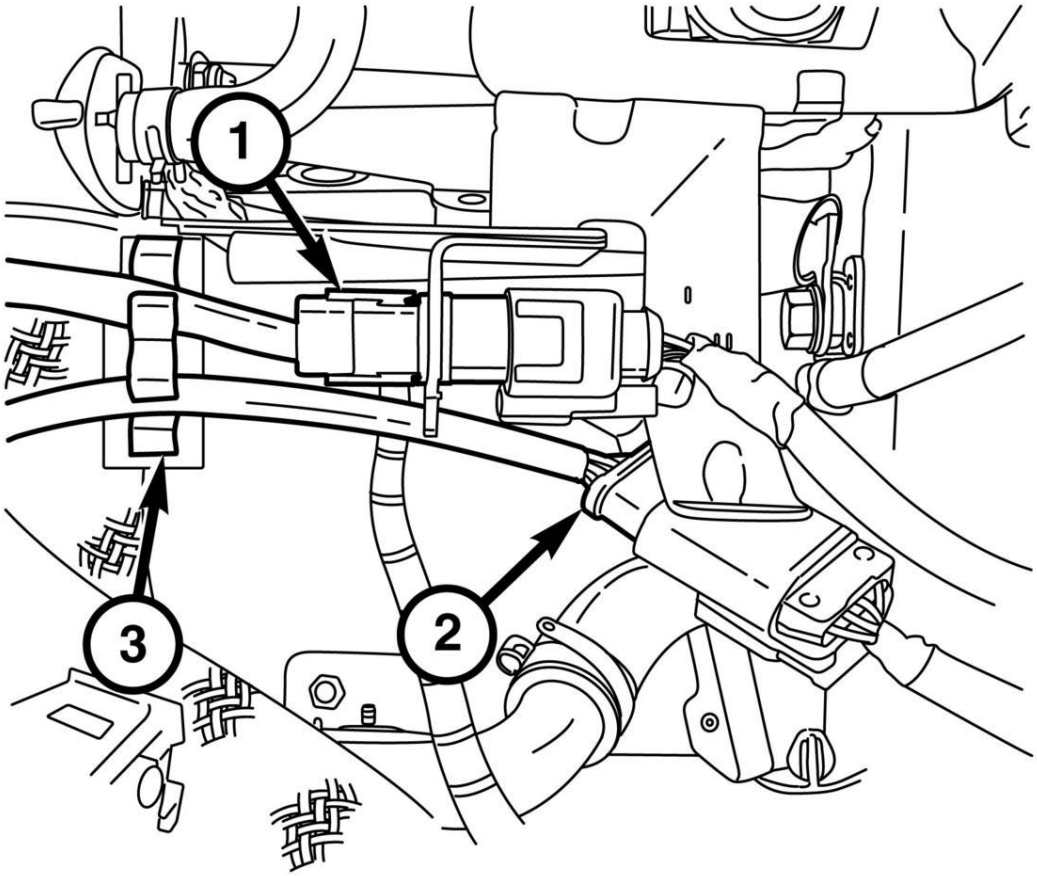


Fig. 11: Front Exhaust Pipe Support Bolt & Flange Nuts
Courtesy of CHRYSLER GROUP, LLC

22. Remove the exhaust pipe bracket bolt (2).
23. Remove the exhaust flange nuts (1) and the flange gasket.

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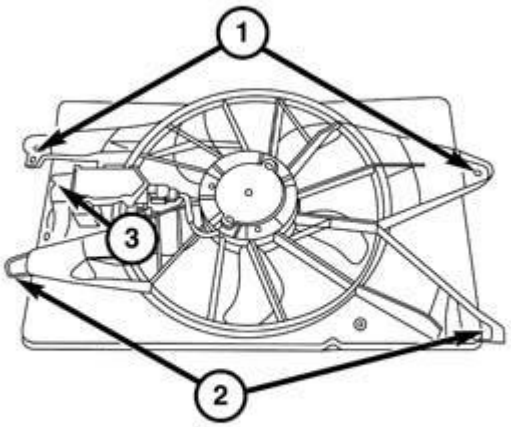


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Fig. 12: Downstream & Upstream Oxygen Sensors With Retainer
Courtesy of CHRYSLER GROUP, LLC

24. Disconnect the wire harness connectors from the upstream (1) and downstream (2) oxygen sensors.
25. Disengage the oxygen sensor wire harness from the retainer (3).
26. Remove the left and right axle shafts. Refer to **REMOVAL** .
27. Remove the intermediate shaft.
28. Disconnect the lower coolant hose from the radiator.
29. Remove the rear engine mount. Refer to **BRACKET, ENGINE MOUNT, RIGHT, REMOVAL**.
30. Lower the vehicle.
31. Remove the upper radiator hose.

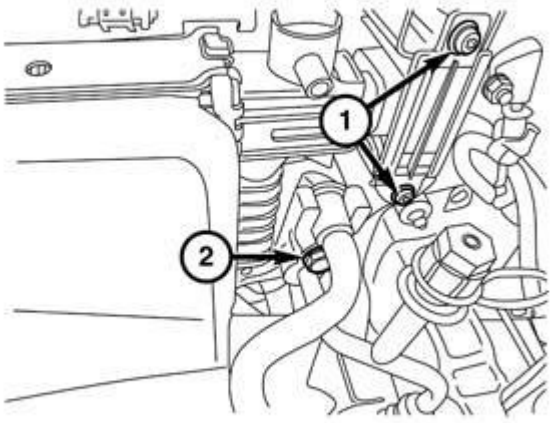
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Fig. 13: Cooling Fan Electrical Connector And Retainer
Courtesy of CHRYSLER GROUP, LLC

32. Disconnect the cooling fan electrical connector and retainer (3).

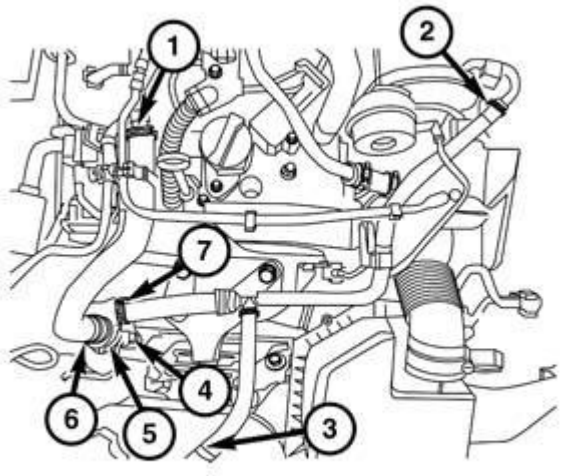


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Fig. 14: A/C Condenser Tapping Block & Bolt
Courtesy of CHRYSLER GROUP, LLC

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33. Remove the bolt (2) and disconnect the A/C liquid line and the A/C discharge line from the A/C condenser tapping block. Remove and discard the dual plain seals.
34. Install plugs in, or tape over, the opened refrigerant line fittings and condenser ports.
35. Remove the suction line from the compressor. Refer to **LINE, A/C SUCTION, REMOVAL** .
36. Remove the discharge line from the compressor. Refer to **LINE, A/C DISCHARGE, REMOVAL** .



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Fig. 15: Coolant Pump Hoses, Coolant Hose & Pressurized Coolant Bottle
Courtesy of CHRYSLER GROUP, LLC

37. Disconnect the after-run coolant pump hoses (1 and 2).
38. Remove the coolant hose (3) from the pressurized coolant bottle (1).
39. Remove the two bolts and reposition the pressurized coolant bottle.

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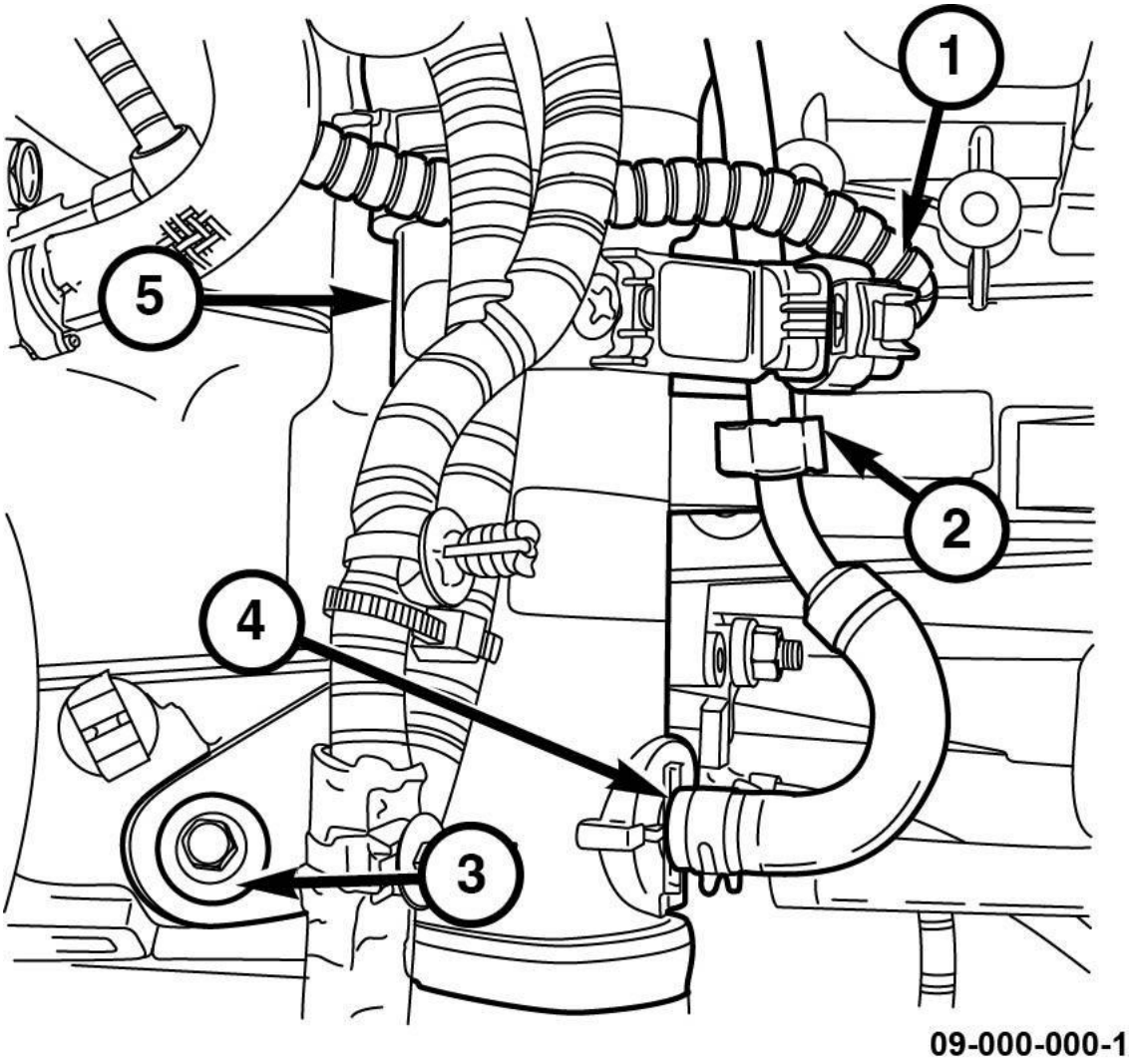


Fig. 16: EVAP Purge Hose, Charge Air Cooler Outlet Hose, Retaining Clip, Bolt & Wire Harness Connector
Courtesy of CHRYSLER GROUP, LLC

40. Disconnect the boost pressure sensor wire harness connector (1).
41. Disengage the EVAP purge hose (4) from the retaining clip (2) and remove the hose from the charge air cooler outlet hose (5).
42. Loosen the clamp securing the charge air cooler outlet hose to the throttle body.
43. Remove the bolt (3) and remove the charge air cooler outlet hose (5) from the vehicle.
44. Pull the retaining clip (1) to disengage the concentric slave cylinder hose (2). Remove and reposition the hose.
45. **For automatic transmissions** , remove the Park cable bracket.
46. **For manual transmissions** , disconnect the shift selector cables from the shift levers. Refer to **CABLE, GEARSHIFT CONTROL, REMOVAL** .
47. Disconnect the heater core outlet and inlet hoses from the heater core quick connects.
48. Disconnect the A/C lines from the A/C expansion valve. Install plugs in, or tape over all the opened

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refrigerant line fittings and expansion valve ports.

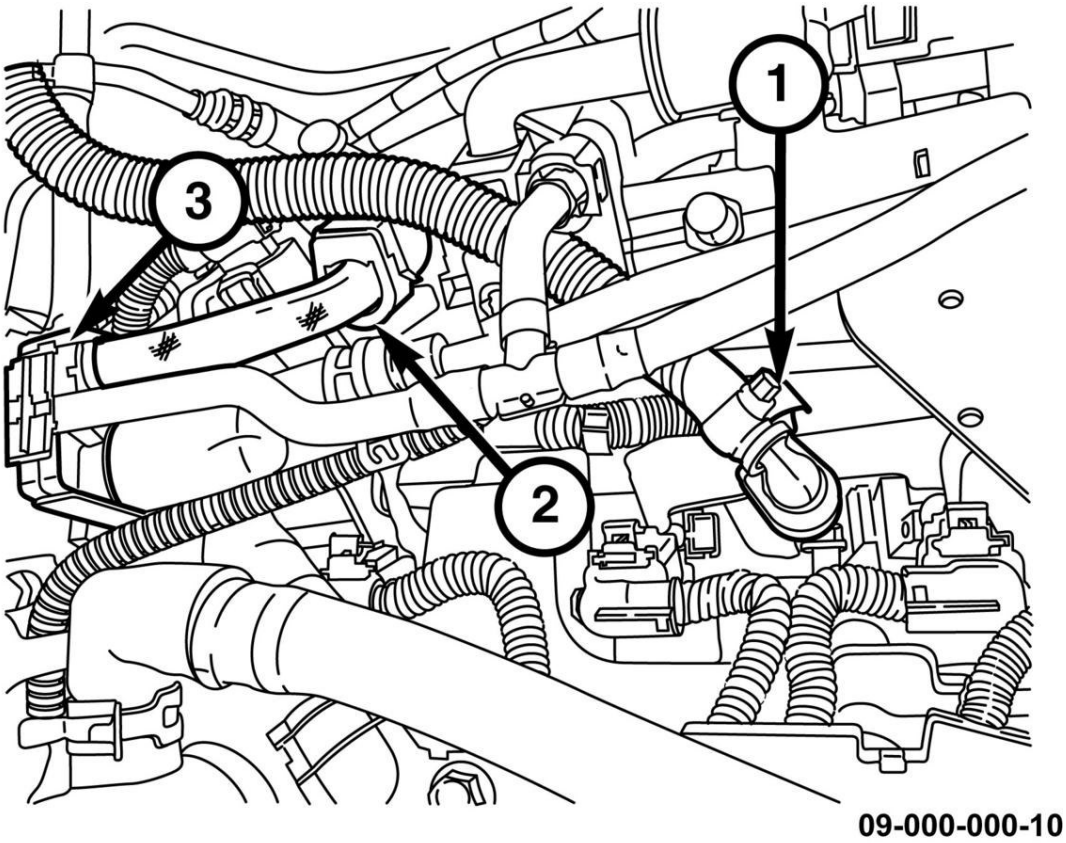


Fig. 17: Fuel Purge Hose & Hose Retainer
Courtesy of CHRYSLER GROUP, LLC

49. Open the hose retainer (3) and disconnect the fuel purge hose (2). Refer to **FITTING, QUICK CONNECT, STANDARD PROCEDURE** .
50. Disconnect the fuel line (1) from the fuel rail. Refer to **FITTING, QUICK CONNECT, STANDARD PROCEDURE** .
51. Reposition the main wire harness away from the engine.

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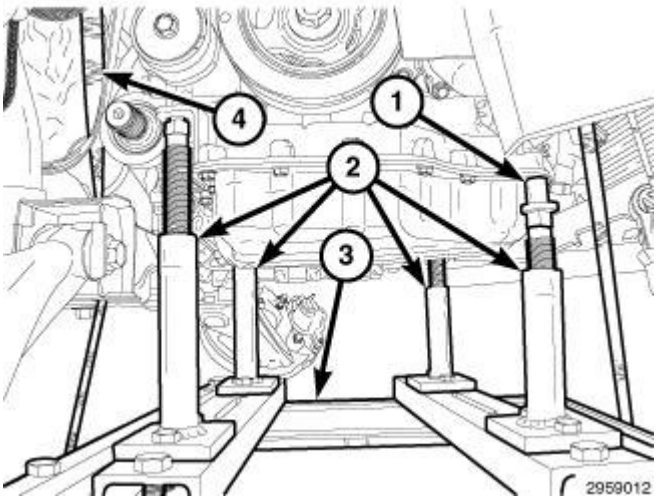


Fig. 18: Adapter, Engine Support Cradle, Power Train Dolly & Safety Straps
Courtesy of CHRYSLER GROUP, LLC

52. Raise and position vehicle height to allow Power Train Dolly (special tool #6135, Dolly, Power Train) (3) and Engine Support Cradle (special tool #6710A, Cradle, Engine Support) (2) to be installed under the engine/transaxle assembly.
53. Loosen the cradle engine mounts to allow movement for positioning onto the engine locating holes on the engine block and oil pan rail. Place Adapter (special tool #6848-3, Adapter) (1) on the front post and align to the oil pan mounting stud. Lower the vehicle and position cradle until the engine is resting on the posts. Tighten the post mounts to the cradle frame. Secure the engine/transaxle assembly to the dolly/cradle with safety straps (4).
54. Remove the left engine mount. Refer to **INSULATOR, ENGINE MOUNT, LEFT, REMOVAL**, **INSULATOR, ENGINE MOUNT, REAR, REMOVAL** or **INSULATOR, ENGINE MOUNT, RIGHT, REMOVAL**
55. Remove the right engine mount. Refer to **BRACKET, ENGINE MOUNT, RIGHT, REMOVAL**.
56. Raise the vehicle off of the engine and transmission assembly.

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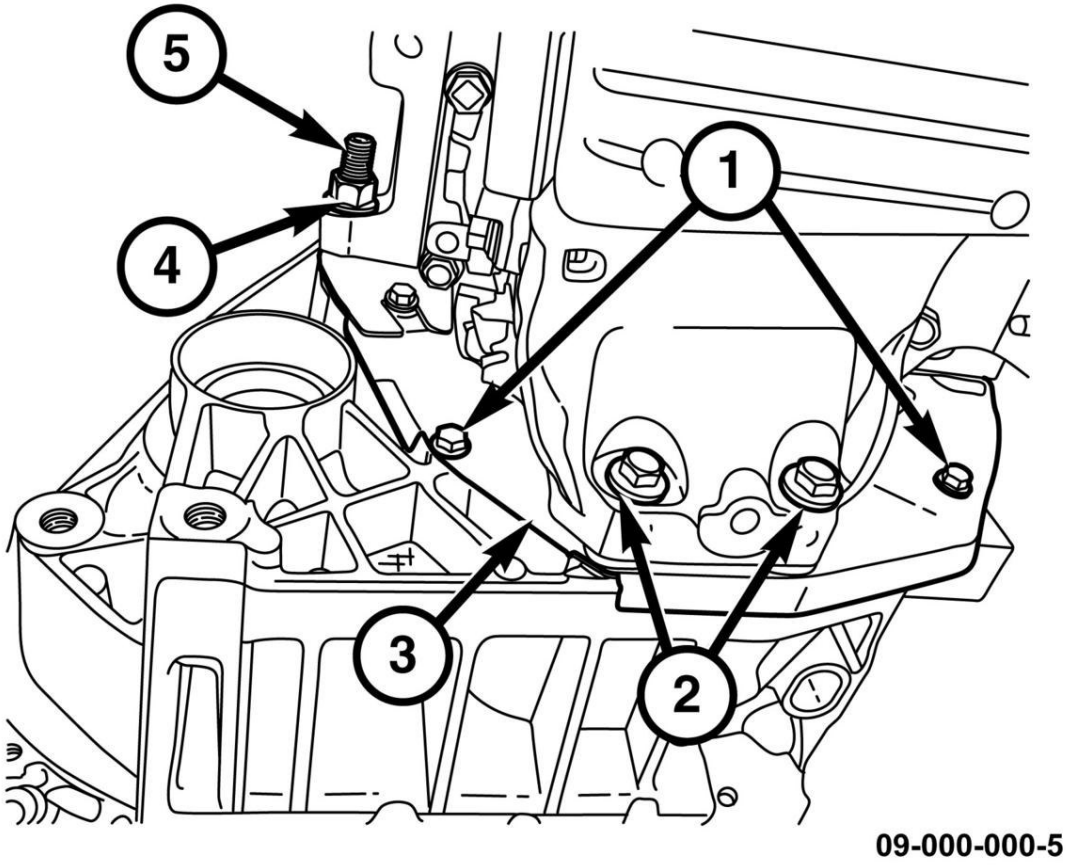


Fig. 19: Transmission Bell Housing Bolts, Transmission Stud, Flywheel Dust Cover & Nut
Courtesy of CHRYSLER GROUP, LLC

NOTE: Perform the following steps to remove the transmission from the engine if required.

NOTE: The flywheel dust cover (3) is bolted to the oil pan and cannot be removed at this time.

57. Remove the two bolts (1) from the flywheel dust cover.
58. Remove the lower transmission bell housing bolts (2).
59. Remove the nut (4) from the transmission stud (5).

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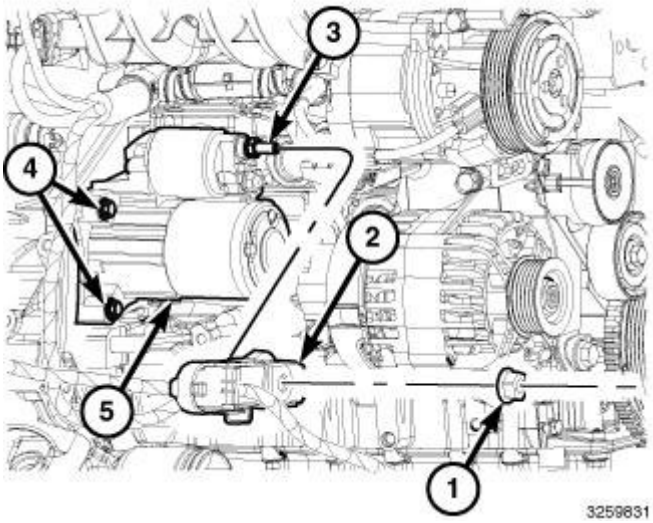


Fig. 20: Starter Assembly, Connector & Fasteners
Courtesy of CHRYSLER GROUP, LLC

60. Remove the starter assembly (5). Refer to **STARTER, REMOVAL** .

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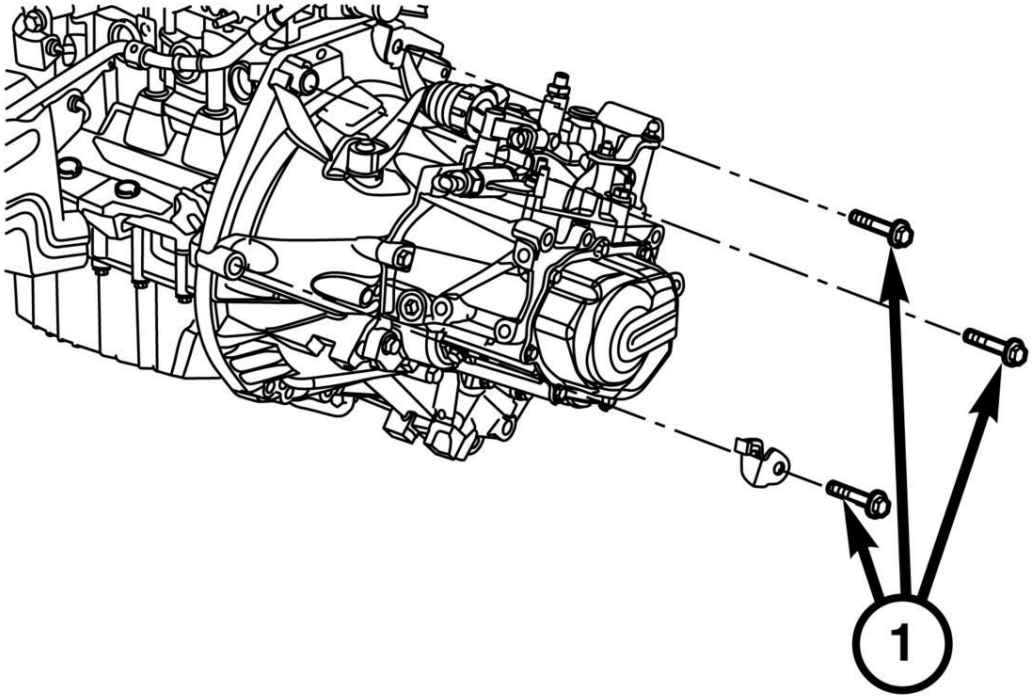


Fig. 21: Upper Bell Housing Bolts
Courtesy of CHRYSLER GROUP, LLC

61. Position a transmission jack under the transmission. Secure the transmission to the jack.
62. Remove the upper bell housing bolts (1) and separate the transmission from the engine.

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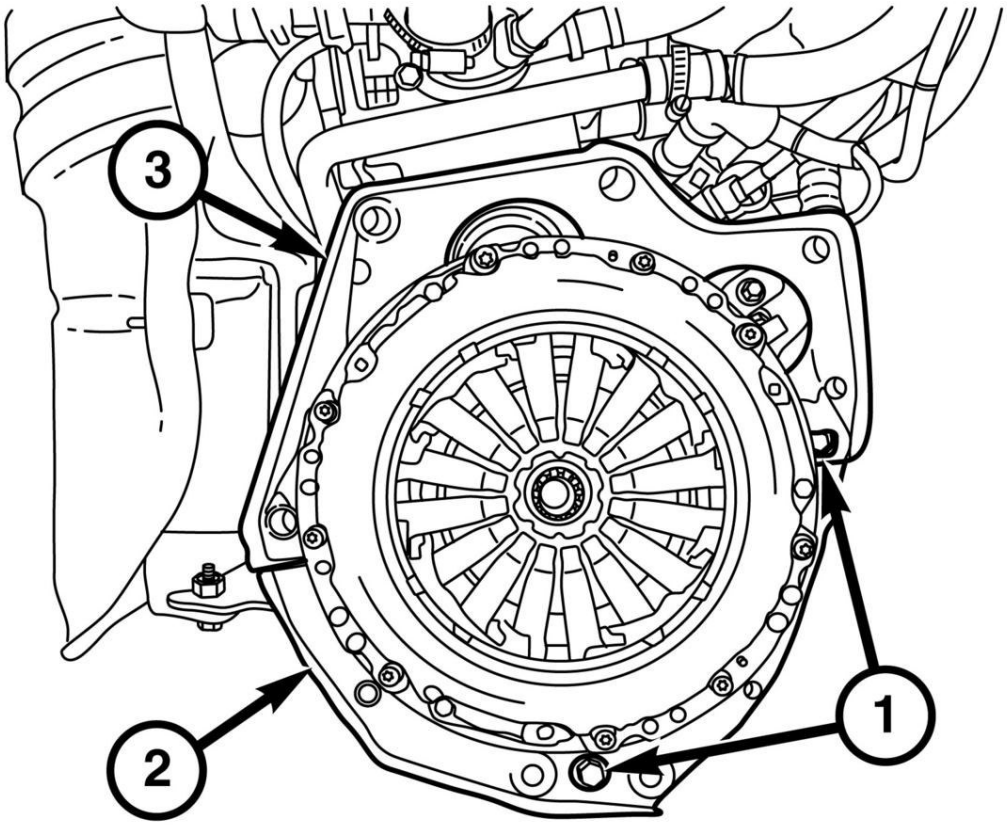


Fig. 22: Flywheel Dust Covers & Bolts
Courtesy of CHRYSLER GROUP, LLC

63. Remove the two bolts (1) and the flywheel dust covers (2 and 3).

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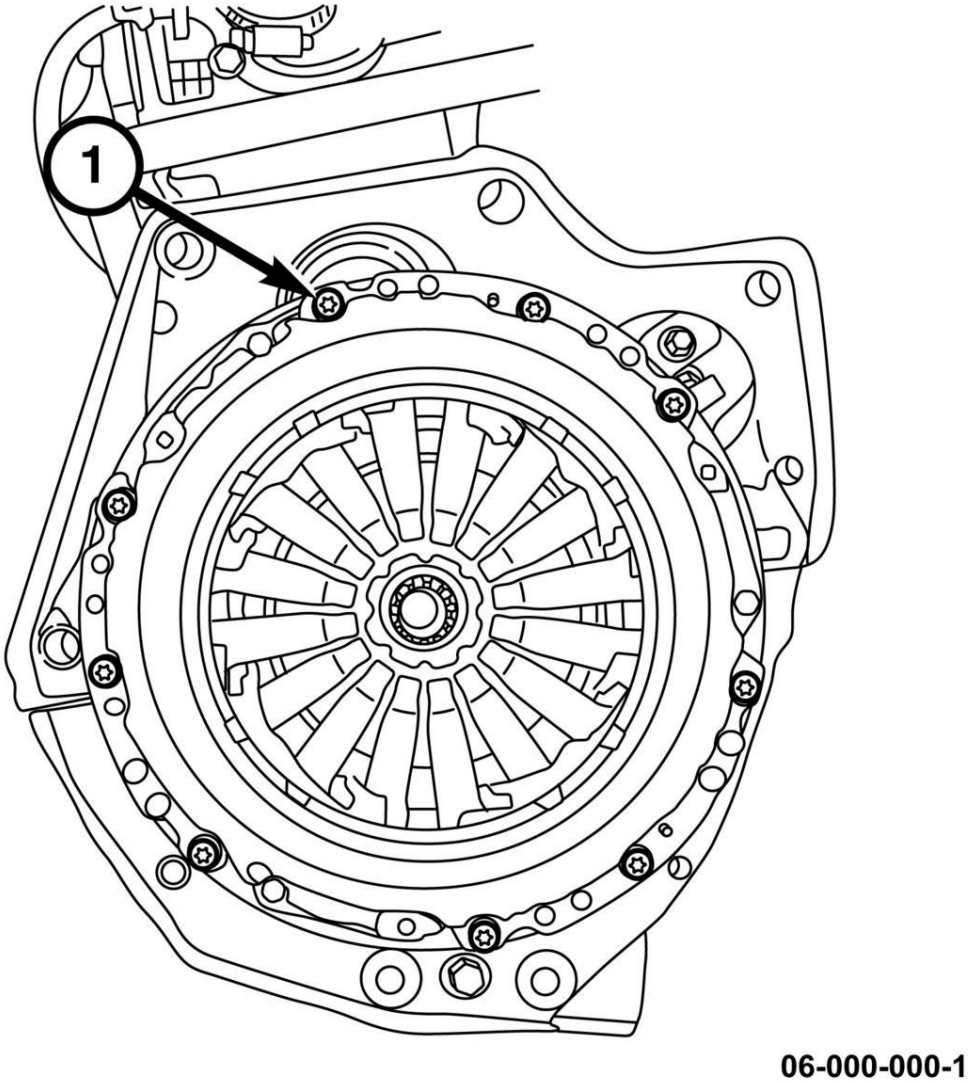


Fig. 23: Pressure Plate Bolts
Courtesy of CHRYSLER GROUP, LLC

NOTE: Perform the following steps to remove components for installation on a replacement engine if required.

64. Remove bolts (1) and the clutch and pressure plate.

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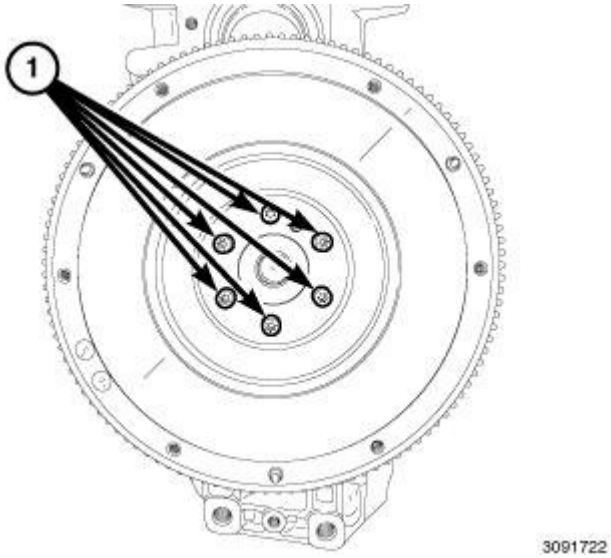


Fig. 24: Flywheel-To-Crankshaft Bolts
Courtesy of CHRYSLER GROUP, LLC

65. Remove bolts (1) and the flywheel.

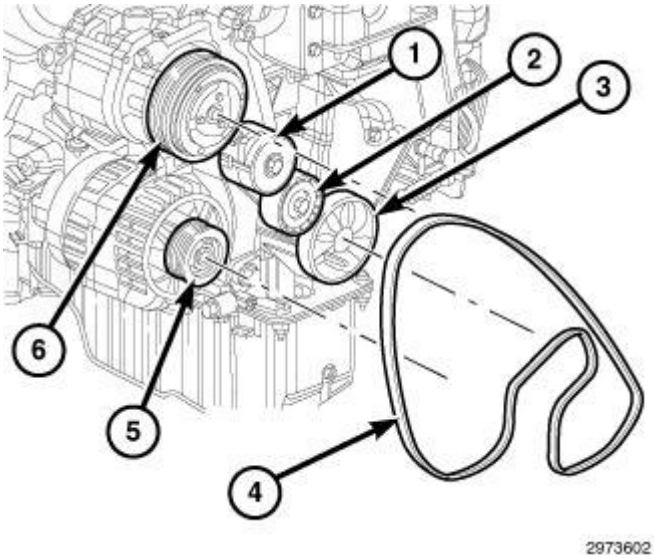


Fig. 25: Drive Belt Tensioners & Assembly With Drive Belt Routing
Courtesy of CHRYSLER GROUP, LLC

66. Remove the accessory drive belt (4). Refer to **BELT, SERPENTINE, REMOVAL** .

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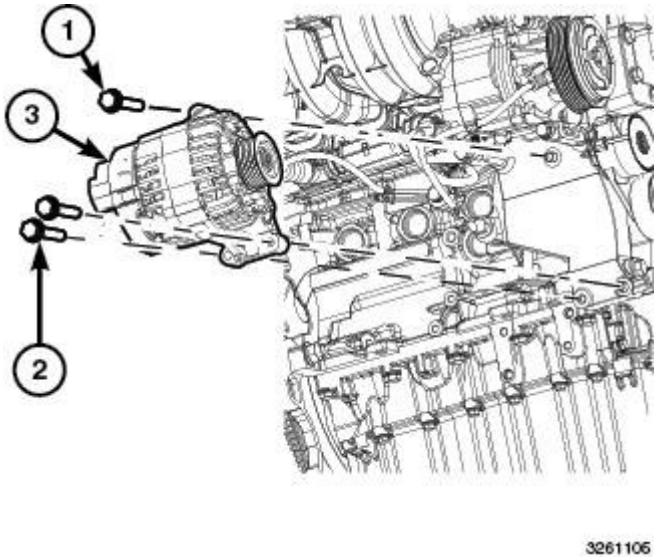


Fig. 26: Generator & Fasteners
Courtesy of CHRYSLER GROUP, LLC

67. Remove the generator (3). Refer to **GENERATOR, REMOVAL** .
68. Remove the A/C compressor. Refer to **COMPRESSOR, A/C, REMOVAL** .

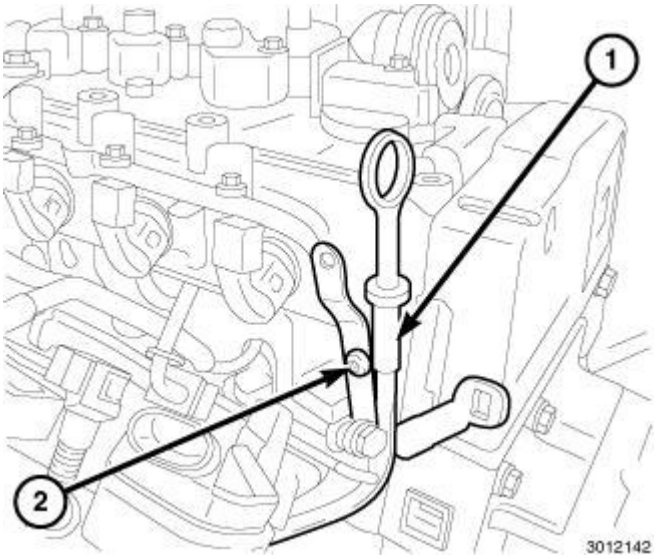


Fig. 27: Oil Level Indicator Tube & Bolt
Courtesy of CHRYSLER GROUP, LLC

69. Remove the bolt (2) and the oil level indicator tube (1).

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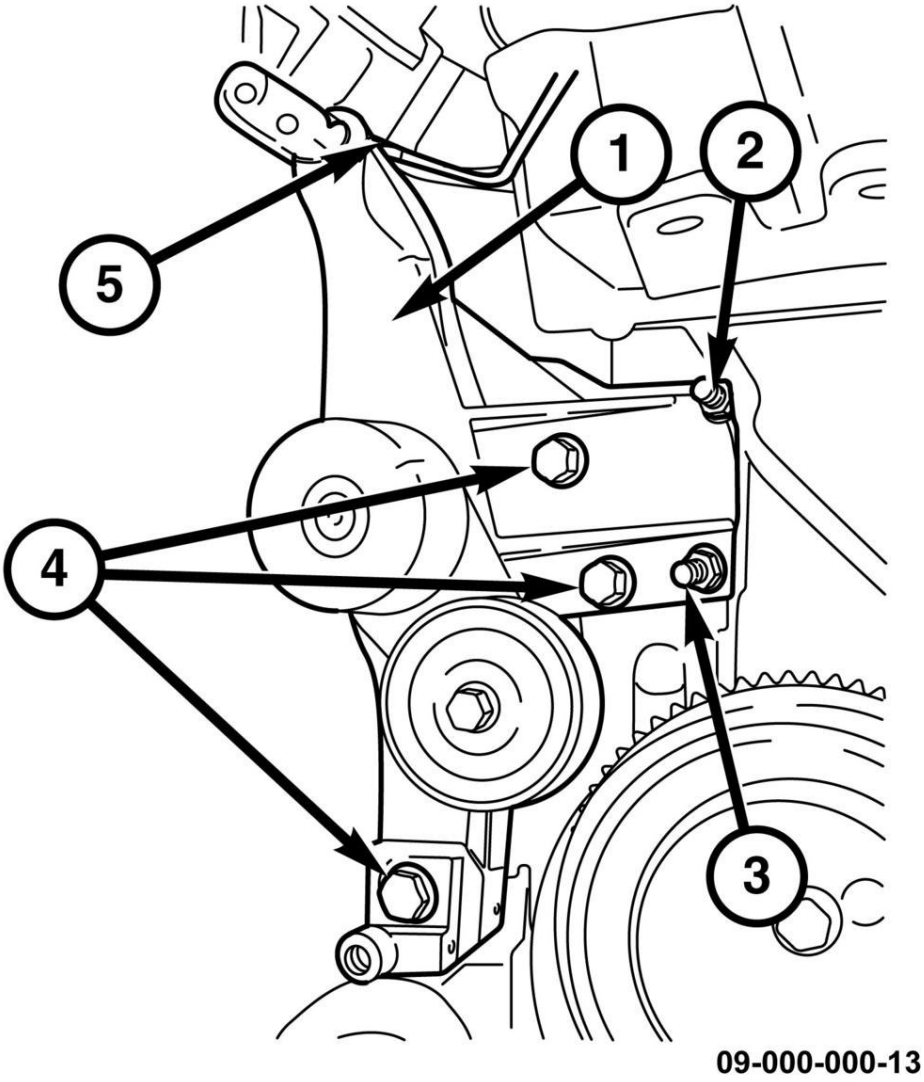


Fig. 28: Accessory Drive Mounting Bracket, Nuts & Bolts
Courtesy of CHRYSLER GROUP, LLC

70. Remove the bolt (5) and the ground wire.
71. Remove the three bolts (4), two nuts (2 and 3) and the accessory drive mounting bracket (1).

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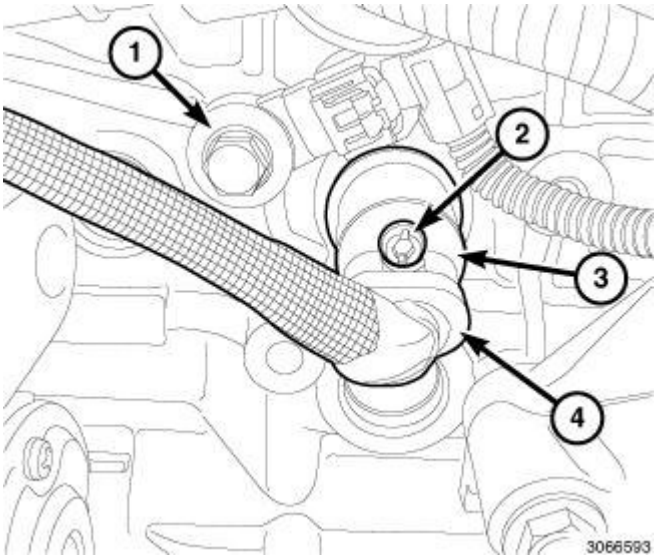


Fig. 29: Screw, Block Heater & Power Cord
Courtesy of CHRYSLER GROUP, LLC

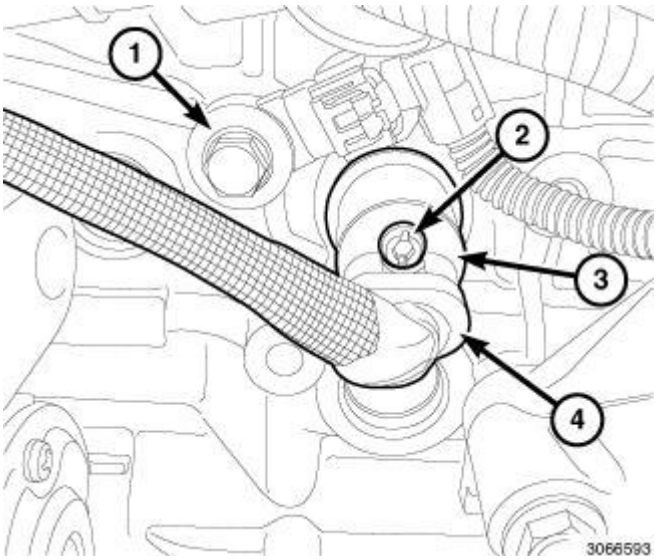
72. Remove the block heater (3) (if equipped). Refer to **HEATER, ENGINE BLOCK, REMOVAL** .

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.

NOTE: Perform the following steps to prepare a replacement engine for installation into the vehicle.



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Fig. 30: Screw, Block Heater & Power Cord
Courtesy of CHRYSLER GROUP, LLC

1. Install the block heater (3) (if equipped). Refer to **HEATER, ENGINE BLOCK, INSTALLATION** .

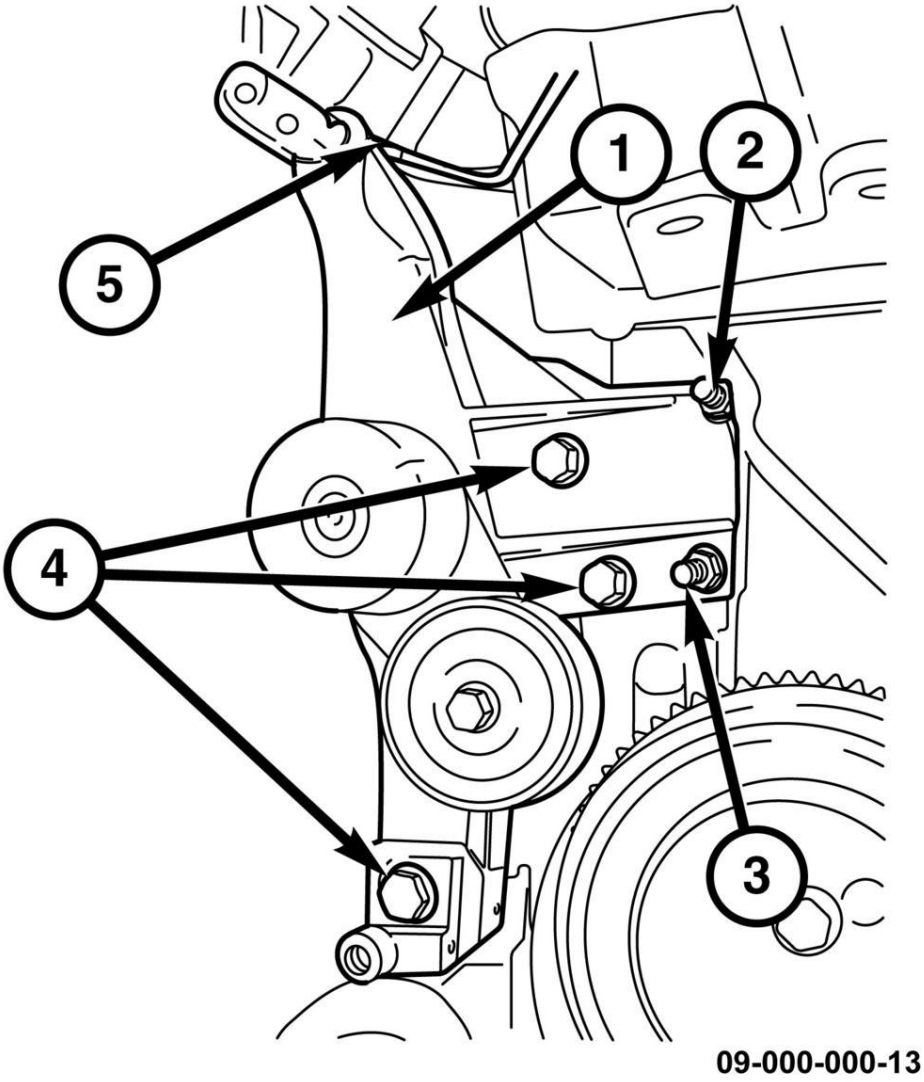


Fig. 31: Accessory Drive Mounting Bracket, Nuts & Bolts
Courtesy of CHRYSLER GROUP, LLC

2. Install the accessory drive mounting bracket (1). Tighten the to nuts (2 and 3) and the three bolts (4) as follows:
   - Three bolts (4) to 50 N.m (37 ft. lbs.).
   - One nut (3) to 50 N.m (37 ft. lbs.).
   - One nut (2) to 25 N.m (18 ft. lbs.).
3. Install the ground wire and tighten the bolt (5) to 9 N.m (80 in. lbs.).

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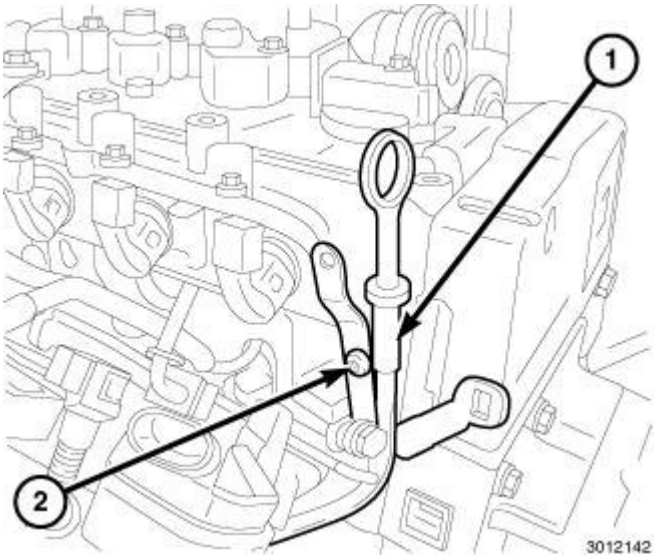


Fig. 32: Oil Level Indicator Tube & Bolt
Courtesy of CHRYSLER GROUP, LLC

4. Install the oil level indicator tube (1). Tighten bolt (2) 9 N.m (80 in. lbs.).

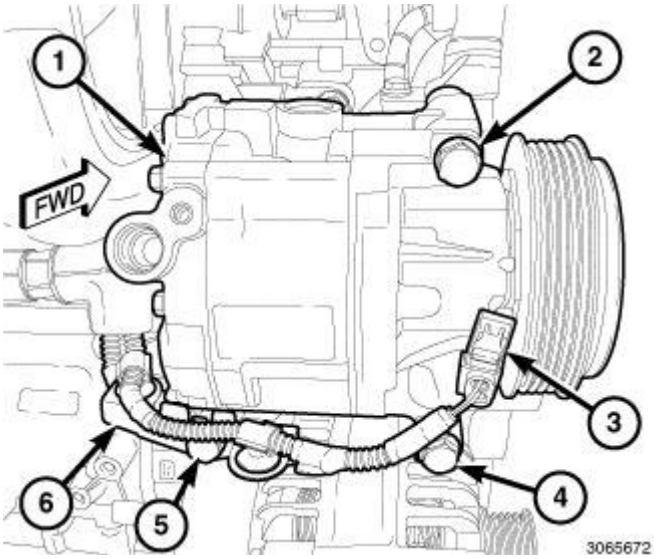


Fig. 33: A/C Compressor Assembly
Courtesy of CHRYSLER GROUP, LLC

5. Install the A/C compressor (1). Refer to **COMPRESSOR, A/C, INSTALLATION** .

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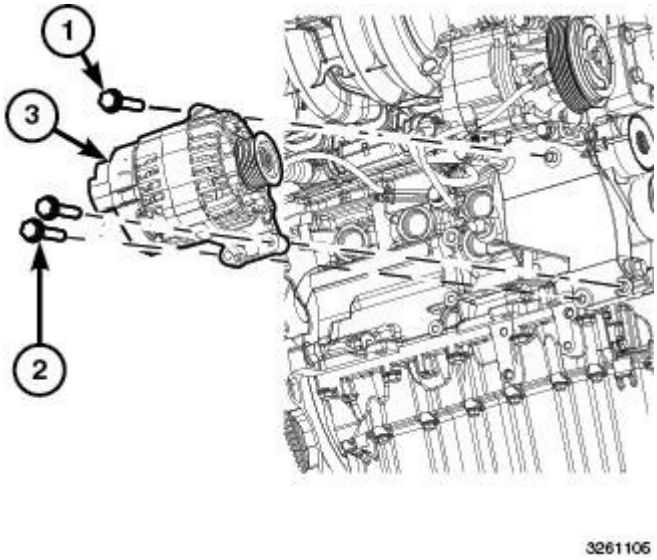


Fig. 34: Generator & Fasteners
Courtesy of CHRYSLER GROUP, LLC

6. Install the generator (3). Refer to **GENERATOR, INSTALLATION** .

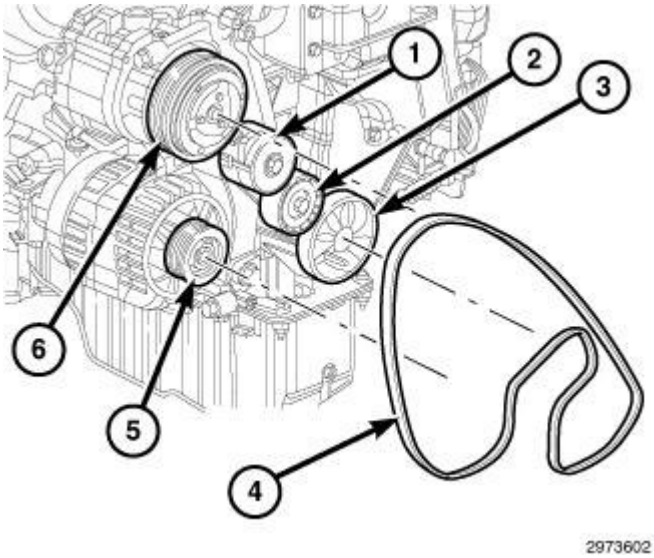


Fig. 35: Drive Belt Tensioners & Assembly With Drive Belt Routing
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7. Install the accessory drive belt (4). Refer to **BELT, SERPENTINE, INSTALLATION** .

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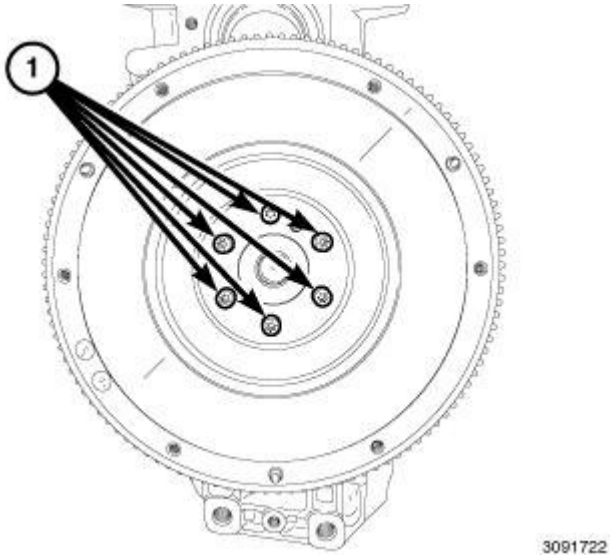


Fig. 36: Flywheel-To-Crankshaft Bolts
Courtesy of CHRYSLER GROUP, LLC

8. Install the flywheel. Using a star pattern, tighten the bolts (1) to 15 N.m (11 ft. lbs.). plus an additional 40 degrees.

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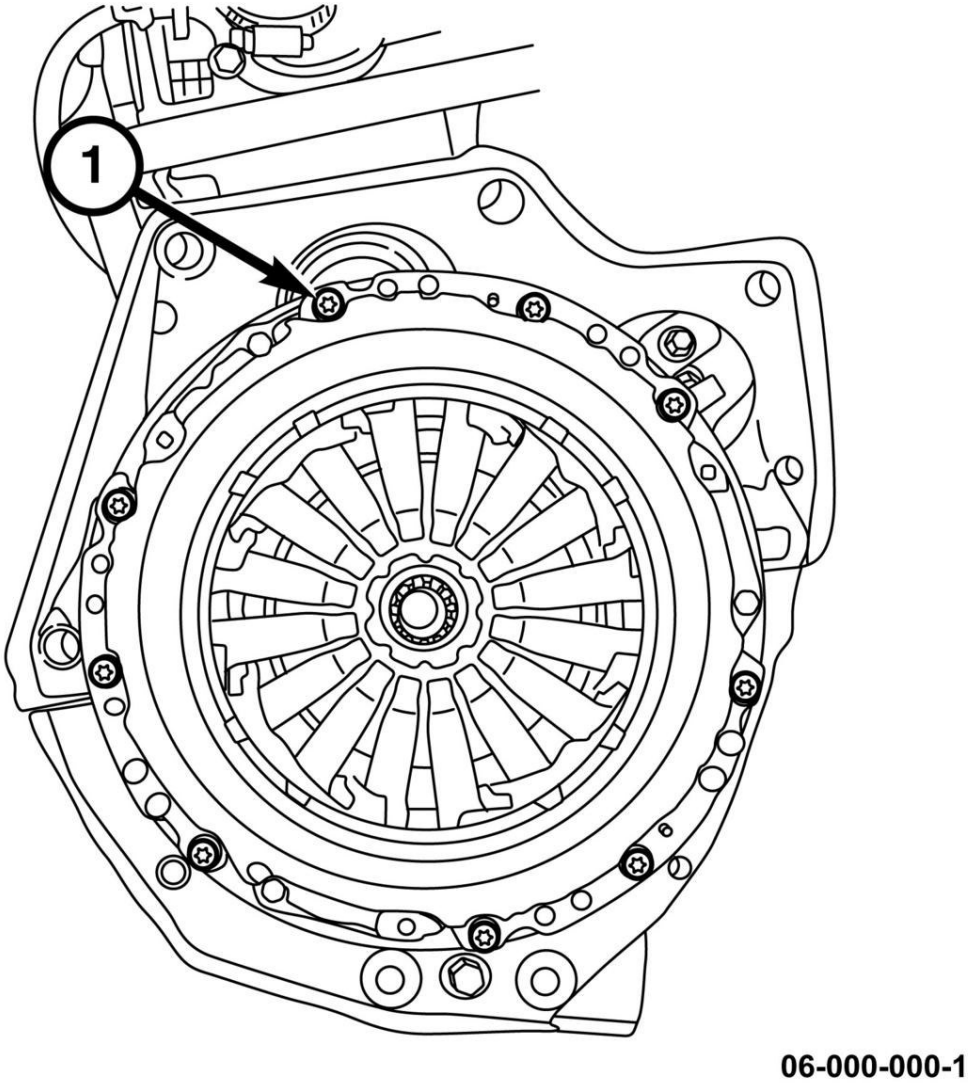


Fig. 37: Pressure Plate Bolts
Courtesy of CHRYSLER GROUP, LLC

9. Using new bolts (1), install the clutch and pressure plate. Refer to **DISC, CLUTCH, INSTALLATION** .

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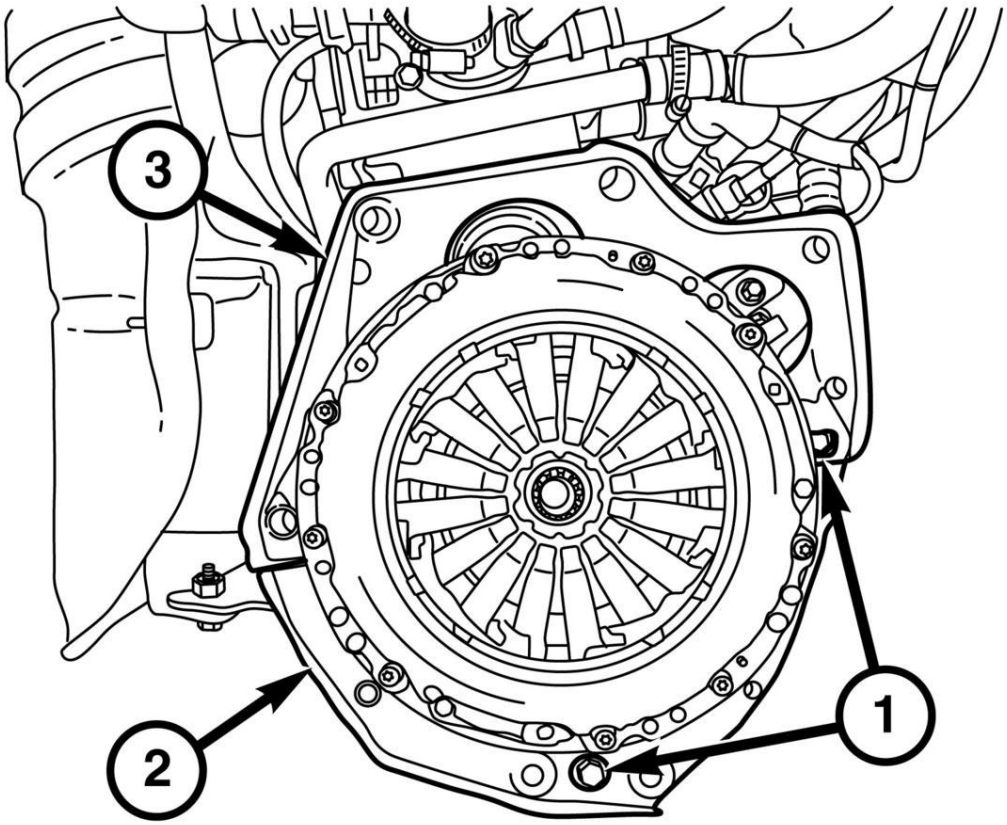


Fig. 38: Flywheel Dust Covers & Bolts
Courtesy of CHRYSLER GROUP, LLC

10. Install the flywheel dust covers (2 and 3). Tighten bolts (1) to 9 N.m (80 in. lbs.).

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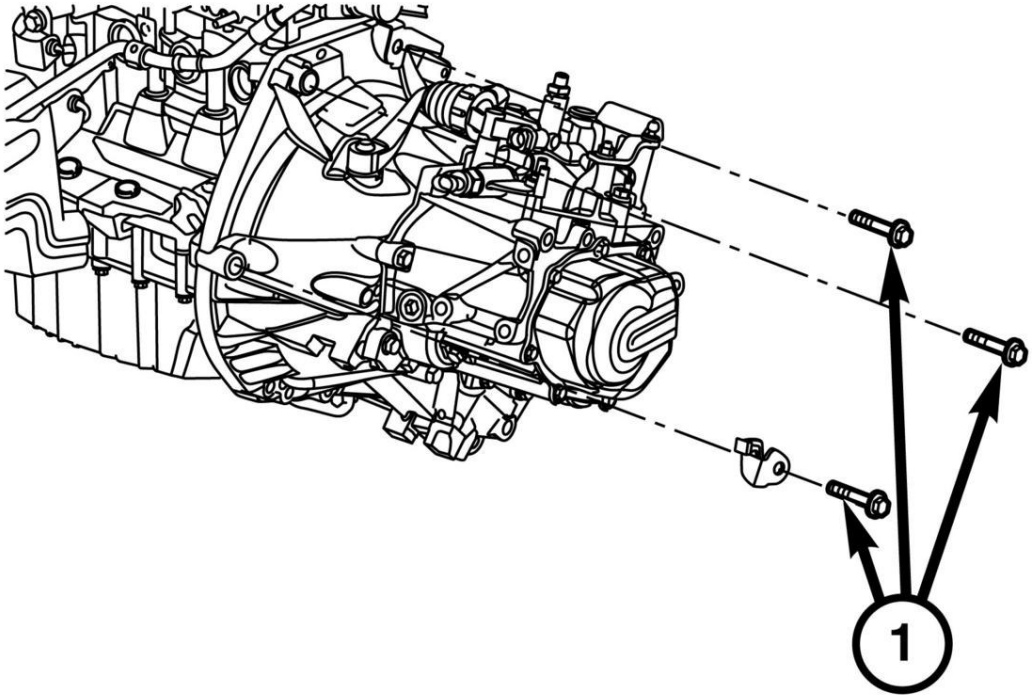


Fig. 39: Upper Bell Housing Bolts
Courtesy of CHRYSLER GROUP, LLC

NOTE: Perform the following steps to Install the transmission to the engine if required.

11. Mate the transmission to the engine. Tighten the upper bell housing bolts (1) to 60 N.m (44 ft. lbs.).

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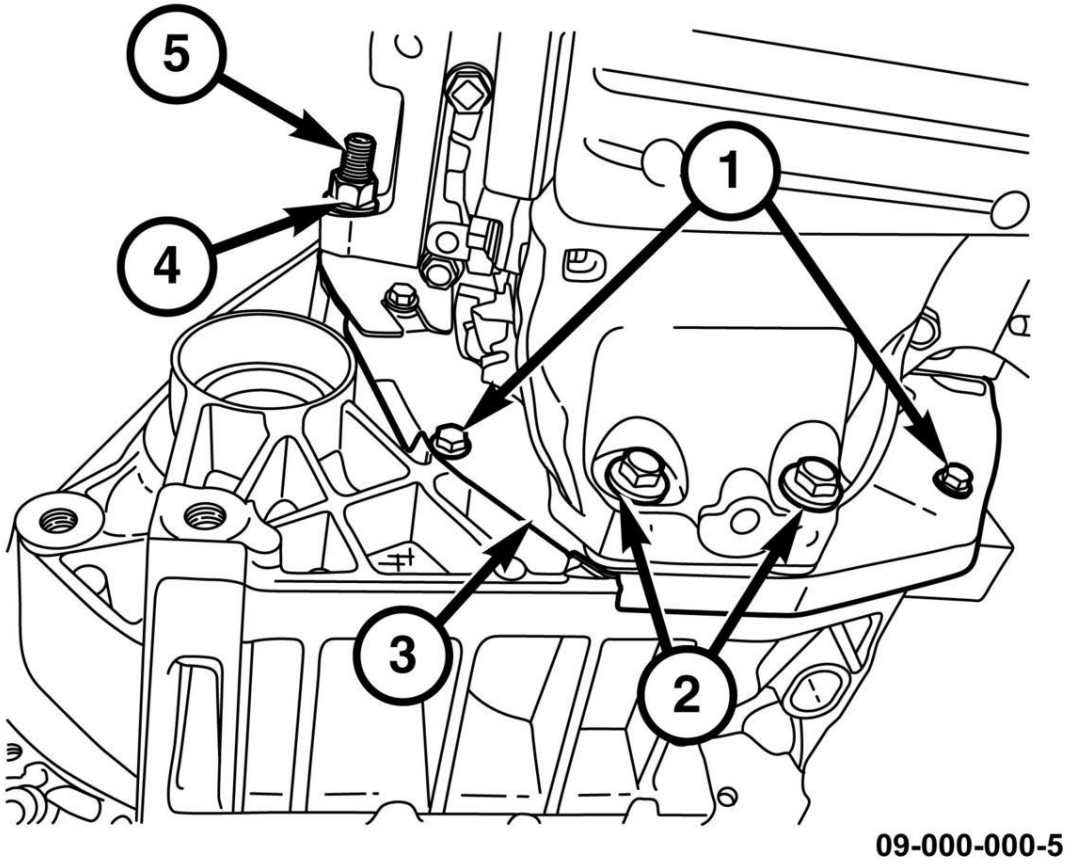


Fig. 40: Transmission Bell Housing Bolts, Transmission Stud, Flywheel Dust Cover & Nut
Courtesy of CHRYSLER GROUP, LLC

12. Install the nut (4) to the transmission stud (5). Tighten Nut (4) to 60 N.m (44 ft. lbs.).
13. Install the remaining transmission bell housing bolts (2). Tighten bolts (2) 40 N.m (30 ft. lbs.).
14. Install the two bolts (1) to the flywheel dust cover and tighten to 9 N.m (80 in. lbs.).

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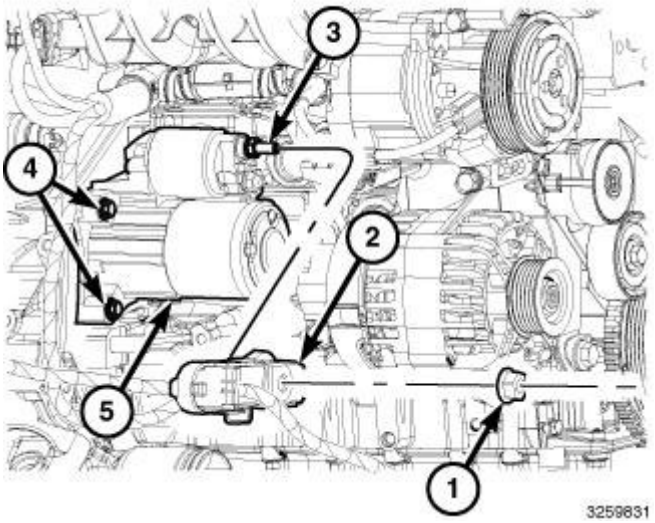


Fig. 41: Starter Assembly, Connector & Fasteners
Courtesy of CHRYSLER GROUP, LLC

15. Install the starter assembly (5) and connect the electrical wiring (2). Refer to **STARTER, INSTALLATION** .

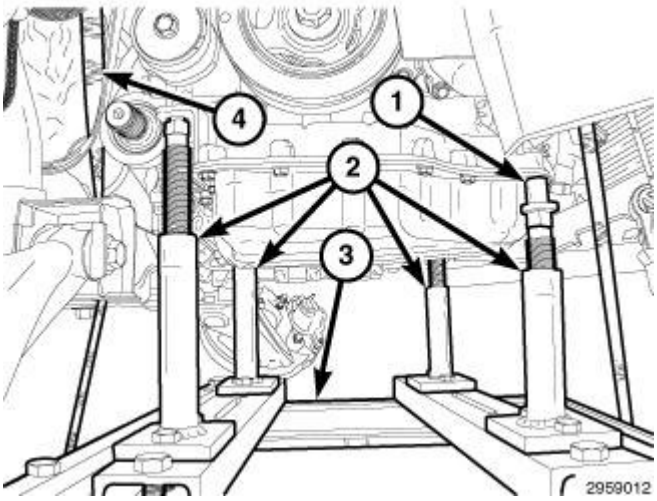


Fig. 42: Adapter, Engine Support Cradle, Power Train Dolly & Safety Straps
Courtesy of CHRYSLER GROUP, LLC

16. Position vehicle height to allow Power Train Dolly, cradle and engine to be installed into the engine compartment. (3) and Engine Support Cradle (2) to be installed under the engine/transaxle assembly.
17. Install the right engine mount assembly. Refer to **BRACKET, ENGINE MOUNT, RIGHT, INSTALLATION**.
18. Install the left engine mount assembly. Refer to **INSULATOR, ENGINE MOUNT, LEFT, INSTALLATION**, **INSULATOR, ENGINE MOUNT, REAR, INSTALLATION** and **INSULATOR, ENGINE MOUNT, RIGHT, INSTALLATION**

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CAUTION: When servicing components near the vacuum pump, avoid contact with the plastic nipple that connects the vacuum pump to the brake booster hose. It is possible to crack the plastic nipple resulting in a brake booster vacuum leak.

CAUTION: The vacuum hose and the pressurized coolant bottle return hose have the same quick-connect fitting end. Verify that the hoses are correctly installed. Failure to properly install the hoses can result in engine damage.

19. **If removed during engine removal, install the vacuum pump (1) and wiring harness bracket. Refer to PUMP, VACUUM, REMOVAL.**
20. Connect the main wire harness connector to the engine harness.

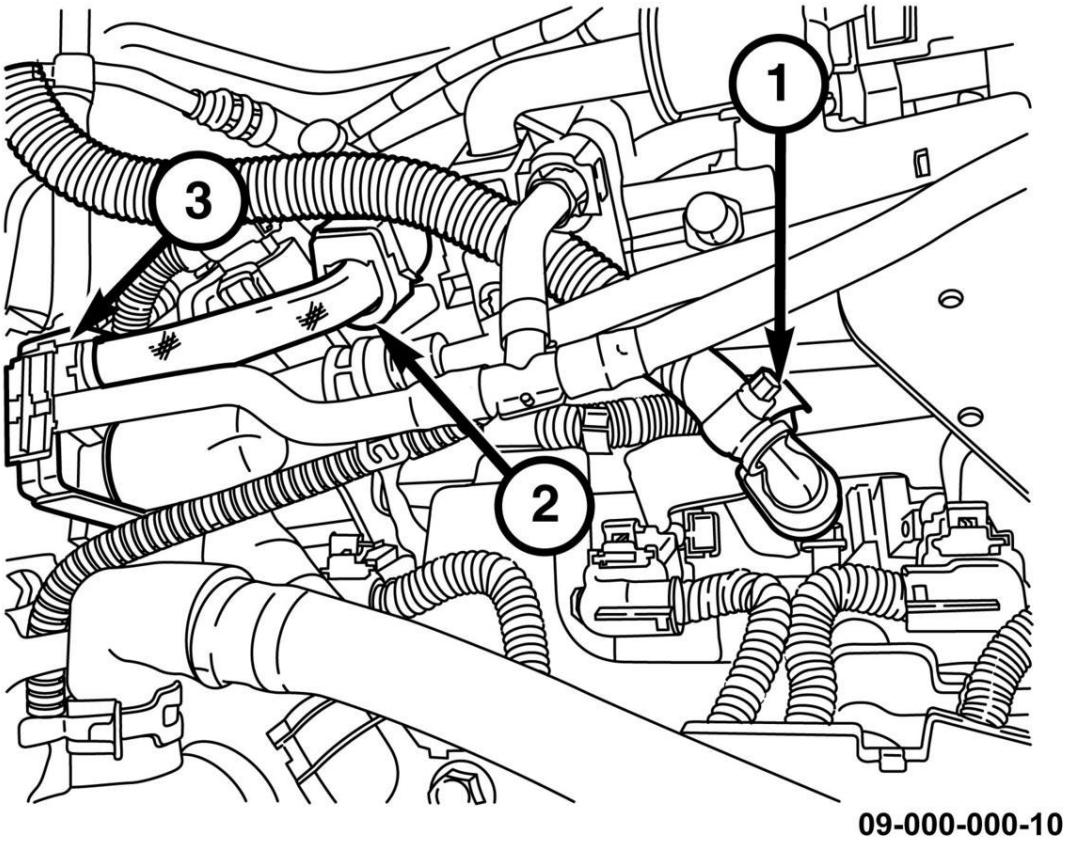


Fig. 43: Fuel Purge Hose & Hose Retainer

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Courtesy of CHRYSLER GROUP, LLC

21. Connect the fuel line (1) to the fuel rail.
22. Connect the fuel vapor purge hose (2) to the intake manifold and close the hose retainer (3).
23. Install the A/C lines with new seals to the A/C expansion valve. Install the nut and tighten to 20 N.m (15 ft. lbs.).
24. Connect the heater core inlet hose and outlet hose to the heater core fittings.
25. Connect the shift cables to the levers. Refer to **CABLE, GEARSHIFT CONTROL, INSTALLATION** .

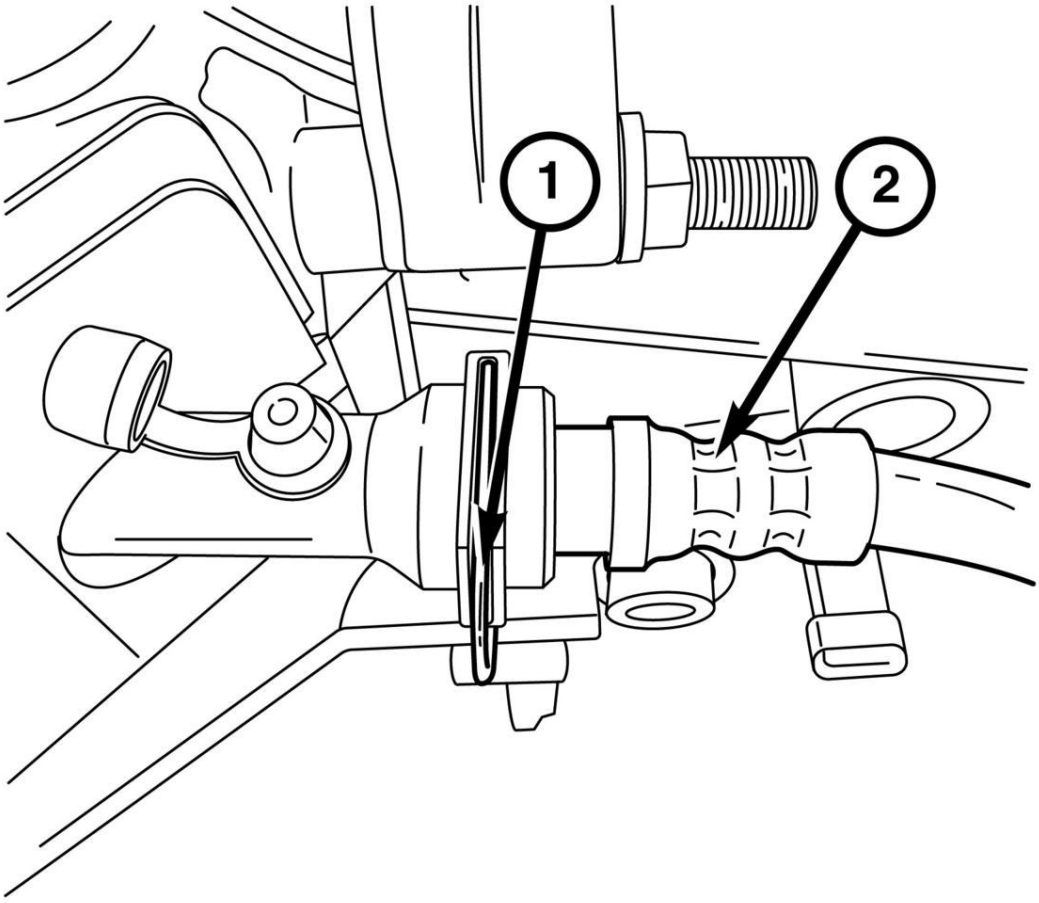


Fig. 44: Clutch Slave Cylinder Hose & Retaining Clip
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26. Install the hydraulic clutch slave cylinder hose (2) and install the retaining clip (1).

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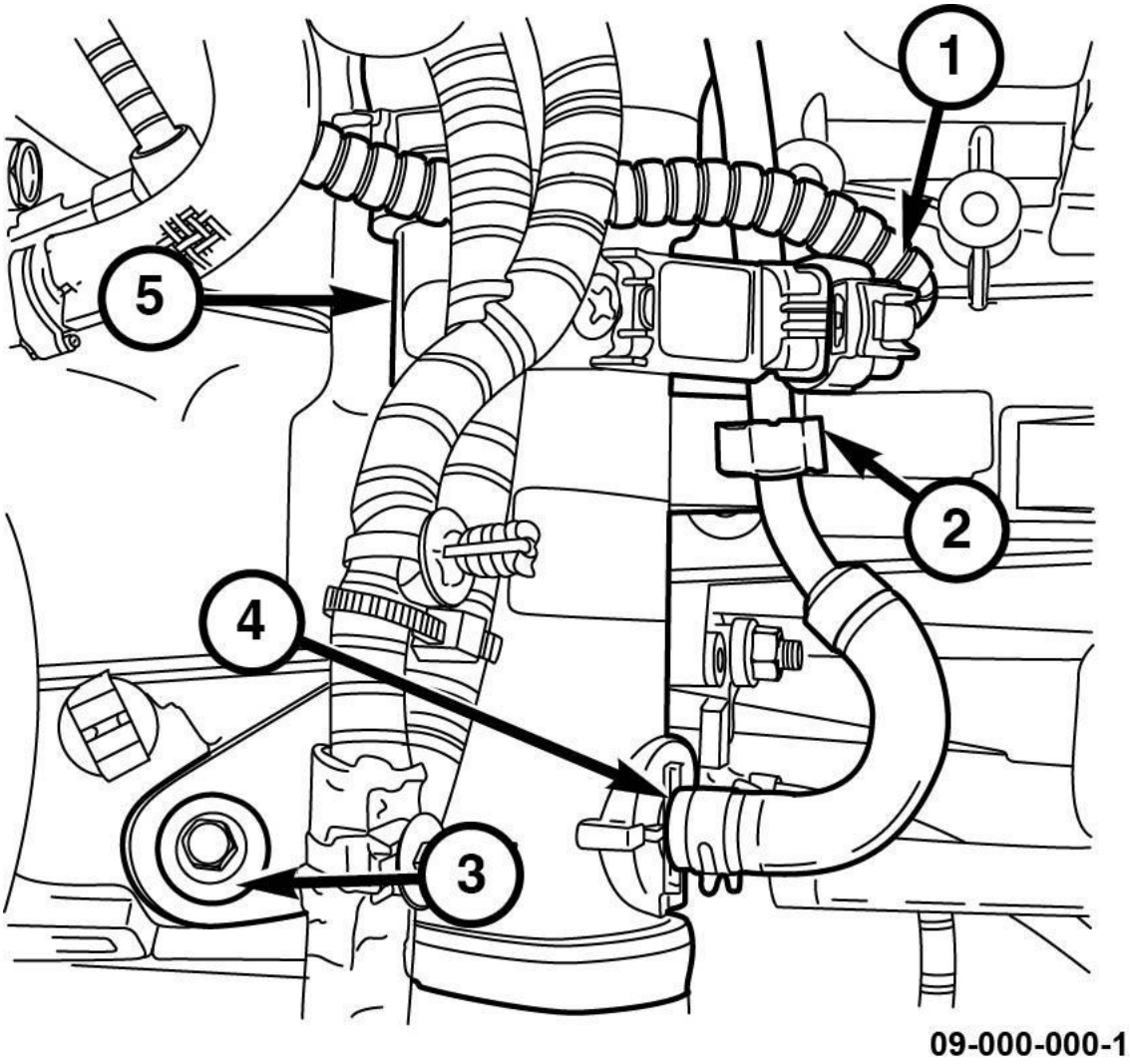
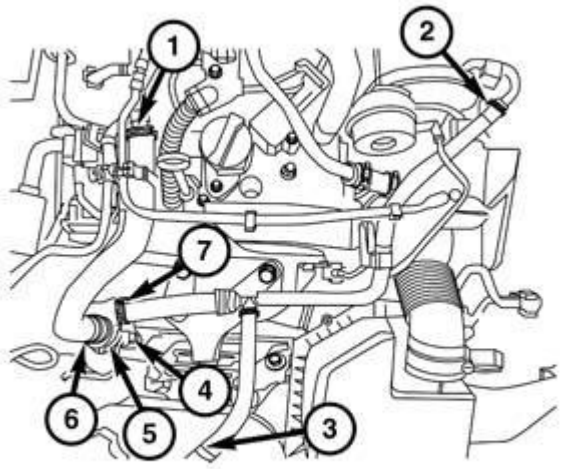


Fig. 45: EVAP Purge Hose, Charge Air Cooler Outlet Hose, Retaining Clip, Bolt & Wire Harness Connector
Courtesy of CHRYSLER GROUP, LLC

27. Install the charge air cooler outlet hose (5) to the vehicle. Tighten bolt (3) to 9 N.m (80 in. lbs.).
28. Tighten the clamp securing the charge air cooler outlet hose to the throttle body.
29. Install the EVAP purge hose (4) to the charge air cooler outlet hose (5) and engage the hose to the retaining clip (2).
30. Connect the boost pressure sensor wire harness connector (1).
31. Install the pressurized coolant bottle. Tighten the two bolts to 8 N.m (70 in. lbs.).

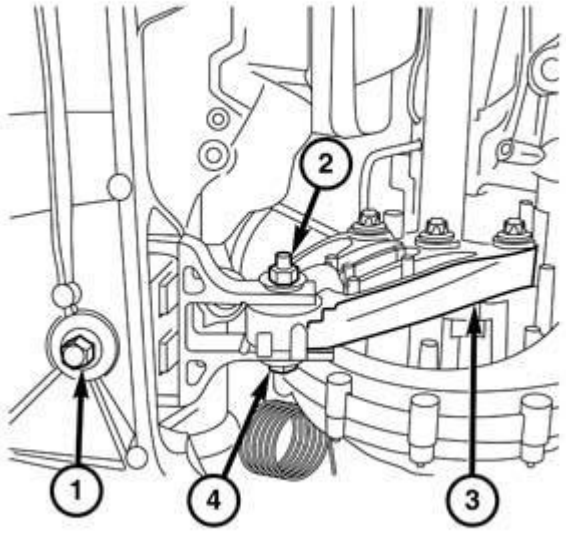
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Fig. 46: Coolant Pump Hoses, Coolant Hose & Pressurized Coolant Bottle
Courtesy of CHRYSLER GROUP, LLC

32. Install the afterrun pump hoses (1 and 2) and secure the clamps in position.
33. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .



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Fig. 47: Rear Engine Isolator To Engine Mount Bracket Bolt
Courtesy of CHRYSLER GROUP, LLC

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34. Position rear mount into the crossmember pocket.
35. Install the through bolt (1) into the crossmember portion of the mount.
36. Position the front arm of the mount around the bracket (3) and install the through bolt and nut (4 and 2)
37. Tighten both to 47 N.m (35 ft. lbs.).
38. Install the rear engine mount isolator (3) to the transmission with the rear engine mount bracket bolt (4) and tightened to 80 N.m (59 ft. lbs.).
39. Install the rear engine mount bracket (2) with two bolts (1).
40. Install the rear engine mount bracket bolt and nut (5). Tighten to 80 N.m (59 ft. lbs.).
41. Install the intermediate shaft and both axle shafts. Refer to **INSTALLATION** .

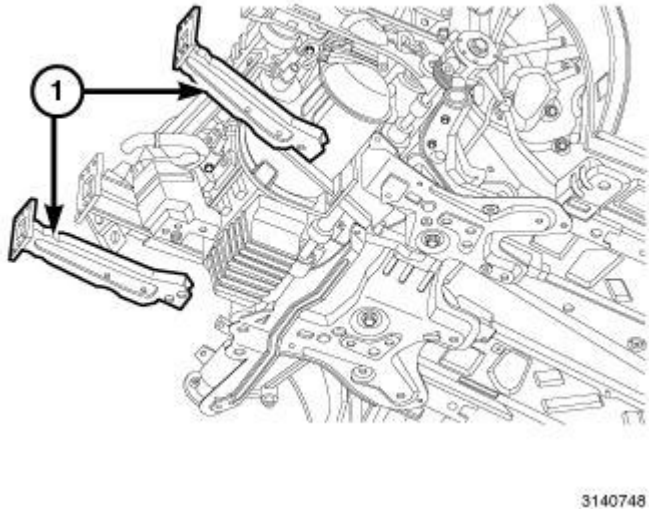


Fig. 48: Front Fascia Support Beams
Courtesy of CHRYSLER GROUP, LLC

42. Install the front fascia beams (1).

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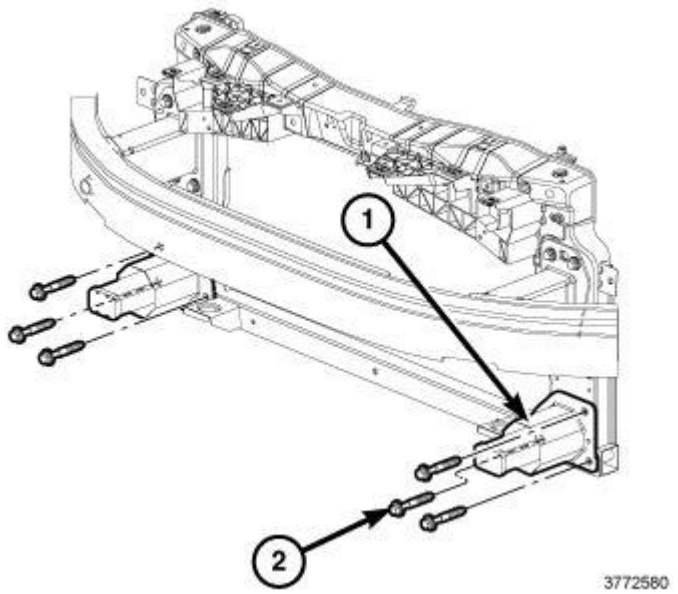


Fig. 49: Lower Bumper Reinforcements & Fasteners
Courtesy of CHRYSLER GROUP, LLC

43. Install the fasteners (2) securing the lower bumper reinforcement (1) to the frame/front end module. Tighten the fasteners to 45 N.m (33 ft. lbs.).

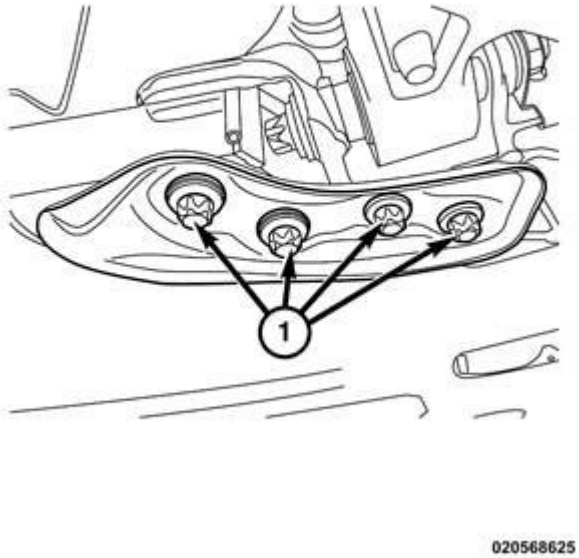


Fig. 50: Crossmember To Fascia Support Beams Bracket Retaining Bolts
Courtesy of CHRYSLER GROUP, LLC

44. Install the crossmember to fascia support beam bracket and install the four retaining bolts (1) and tighten to 95 N.m (70 ft. lbs.).

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45. Install the lower radiator hose to the engine.
46. Install the crossunder pipe. Refer to **PIPE, EXHAUST CROSSUNDER, INSTALLATION** .
47. Engage the oxygen sensor wire harness to the retainer.
48. Connect the wire harness connectors to the upstream and downstream oxygen sensors.

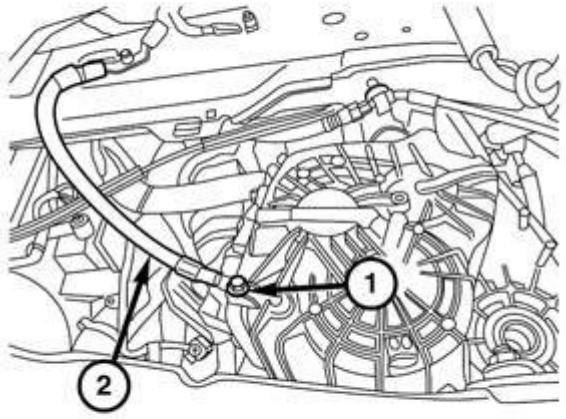


Fig. 51: Ground Cable & Bolt
Courtesy of CHRYSLER GROUP, LLC

49. Install the ground cable (2) to the transmission case. Tighten the bolt to 24 N.m (18 ft. lbs.). Install the frame splash shield with three screws.
50. Install both front inner wheel well splash shields. Refer to **SHIELD, SPLASH, FRONT WHEELHOUSE, INSTALLATION** .
51. Install both front tire and wheel assemblies. Refer to **INSTALLATION** .

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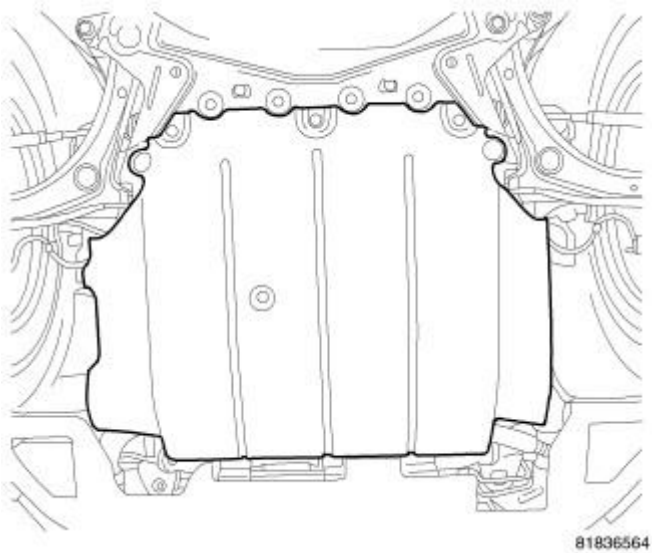


Fig. 52: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

52. Install the belly pan. Refer to **BELLY PAN, INSTALLATION** .

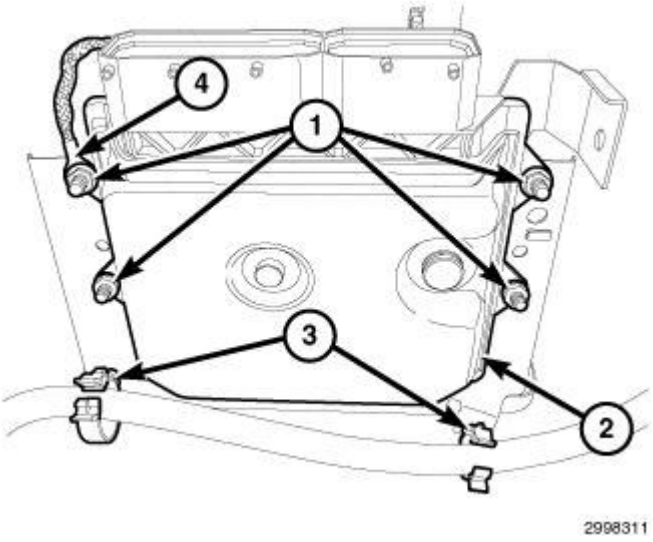
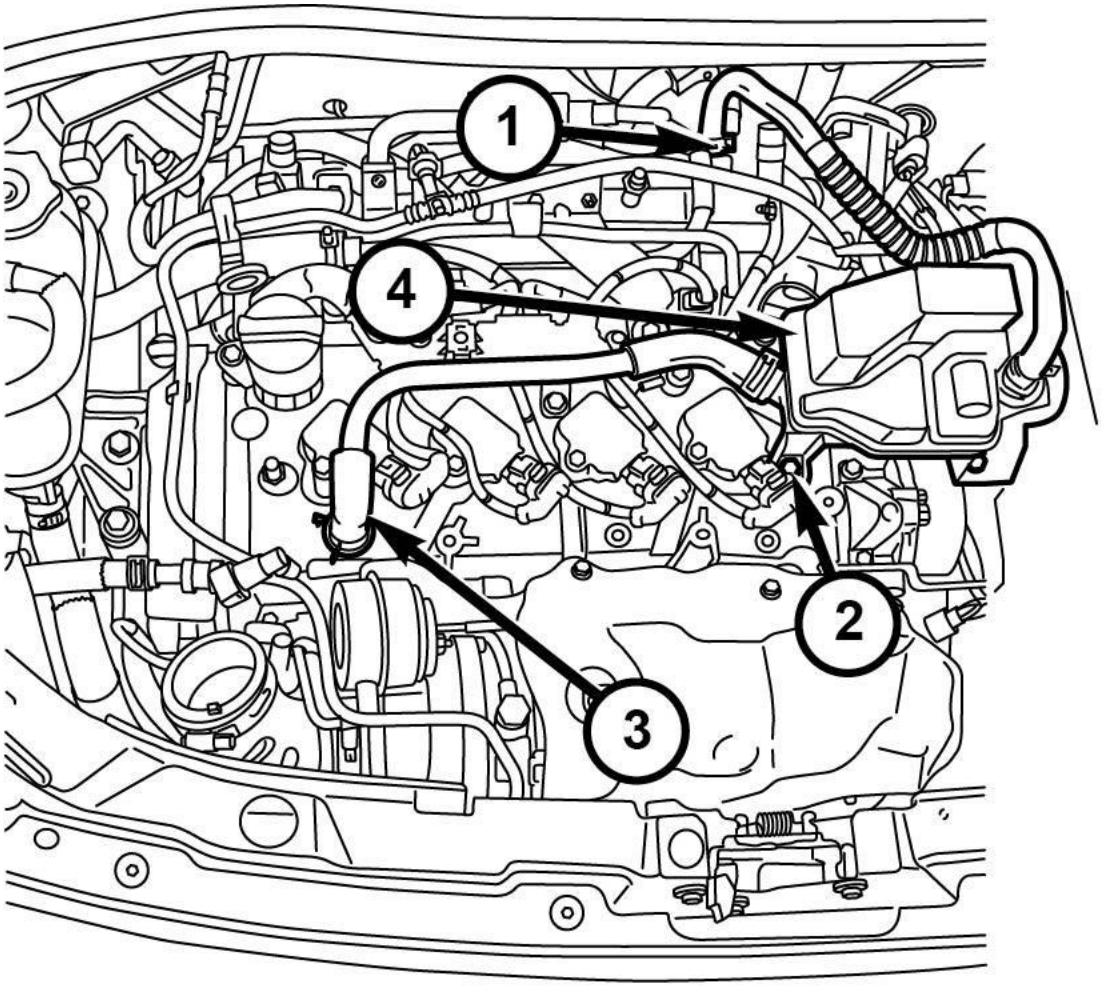


Fig. 53: PCM, Retainers, Ground Strap & Nuts
Courtesy of CHRYSLER GROUP, LLC

53. Lower the vehicle.
54. Position the battery tray and PCM in the vehicle. Route the wire harness and close the wire harness retainers (3).
55. Install the ground strap (4) with nut (1) tightened to 5 N.m (44 in. lbs.).
56. Position the wire harness into wire harness retainers (3) and close retainers.
57. Install the battery tray. Refer to **TRAY, BATTERY, INSTALLATION** .
58. Connect the Powertrain Control Module (PCM) harness connectors.

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59. Install the upper radiator hose to the engine.
60. Fill the transmission with the proper fluid to the correct level. Refer to **FLUID, STANDARD PROCEDURE** .
61. Lower the vehicle.



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Fig. 54: PCV Hose, Vent Hose, Oil Separator Housing & Bolts
Courtesy of CHRYSLER GROUP, LLC

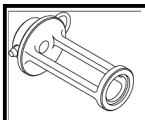
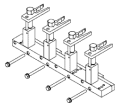
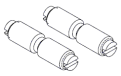
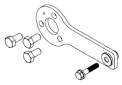
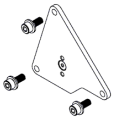
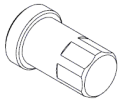
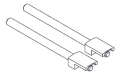
62. Install the oil separator housing (4) to the cylinder head cover with three bolts (2) tightened to 13 N.m (115 in. lbs.).
63. Connect the vent hose (3) to the cylinder head cover.
64. Connect the PCV hose (1) to the intake manifold.
65. Install the air cleaner body. Refer to **BODY, AIR CLEANER, INSTALLATION**
66. If removed, install the oil filter and fill the engine crankcase with the proper oil to the correct level. Refer to **STANDARD PROCEDURE**.

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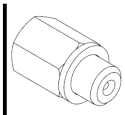
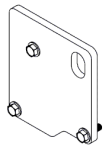
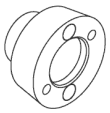
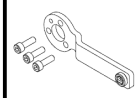
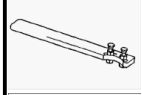
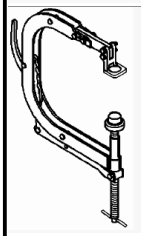
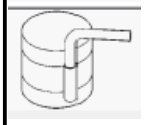
67. Fill the transmission. Refer to **FLUID, STANDARD PROCEDURE** .
68. Fill the cooling system. Refer to **STANDARD PROCEDURE** .
69. Install and connect the battery. Refer to **BATTERY, INSTALLATION** .
70. Evacuate and charge the refrigerant system. Refer to **PLUMBING, STANDARD PROCEDURE** .
71. Run the engine until it reaches normal operating temperature. Check cooling system for correct fluid level. Refer to **STANDARD PROCEDURE** .
72. The Clear Misfire TLC Miscellaneous Function must be performed using the scan tool anytime there has been a repair/replacement made to a powertrain system, for example: flywheel, valvetrain, camshaft and/or crankshaft sensors or components. Refer to the appropriate Diagnostic Information.

SPECIAL TOOLS

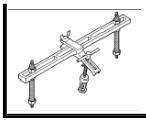
SPECIAL TOOLS

	10224 - Adapter, Valve Spring (Originally Shipped In Kit Number(s) 10223.)
	10259B - Compressor, MultiAir® Spring
	10273 - Installer, Crankshaft Front Oil Seal
	10275 - Studs, Valve Spring Compressor
	10276 - Tool, Crankshaft Timing Locking
	10277 - Tool, Camshaft Timing Locking
	10278 - Installer, Camshaft Oil Seal
	10280 - Remover/Installer, Spark Plug Tube
	10281 - Pins, Connecting Rod Guide

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	10282 - Adapter, Engine Oil Pressure
	10299 - Bracket, Engine Lifting
	10306 - Guide, Rear Crankshaft Oil Seal
	10307 - Holder, Crankshaft Sprocket
	10368 - Set, Universal Protective Cap
	6847 - Holder, Camshaft Sprocket (Originally Shipped In Kit Number(s) 6849, 6880, 6882.)
	7700-A - Tester, Cooling System
	8225 - Alignment Fixture (Originally Shipped In Kit Number(s) 8180, 8180CC, 8263, 8263CC.)
	C-119 - Cylinder Indicator
	C-3292A - Gauge, Pressure
	C-3339A - Set, Dial Indicator (Originally Shipped In Kit Number(s) 9202.)
	C-3422-D - Compressor, Valve Spring
	C-3685-A - Bloc-Chek Kit
	C-385 - Compressor, Piston
	MD998772A - Compressor, Valve Spring

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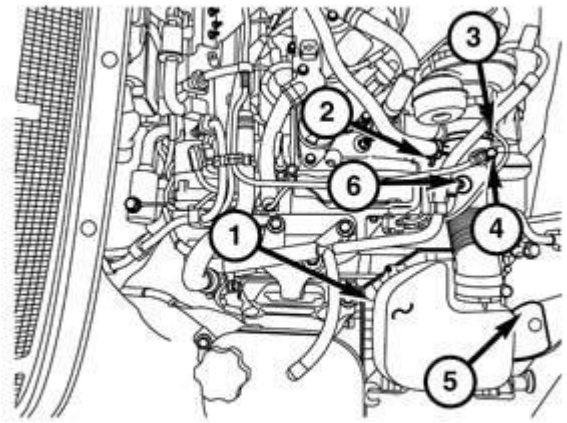
	(Originally Shipped In Kit Number(s) 8678, 8853, 8854.)

AIR INTAKE SYSTEM

BODY, AIR CLEANER

REMOVAL

REMOVAL



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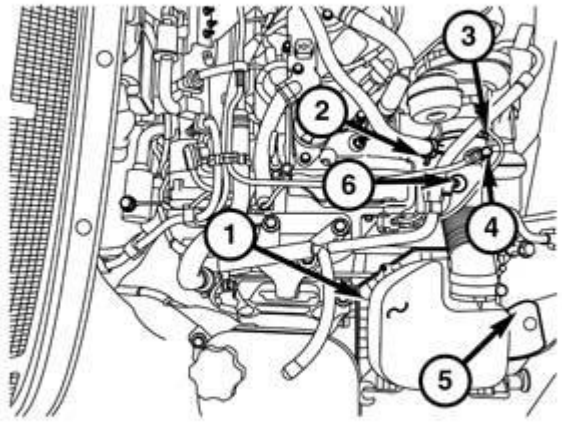
Fig. 55: EVAP Hose Quick Release Fitting, Wastegate Solenoid Vent Hose, Clamps, Screws & Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect the wastegate solenoid vent hose (6) from the turbocharger inlet duct.
2. Disconnect the EVAP hose quick release fitting (4) from the turbocharger inlet duct. Refer to **FITTING, QUICK CONNECT, STANDARD PROCEDURE** .
3. Release the hose clamp (2) at the fresh air make-up hose and remove the hose.
4. Loosen the clamp (3) at the turbocharger inlet duct and remove the duct from the turbocharger.
5. Remove the bolt (5) from the air box and remove the air cleaner housing from the vehicle.
6. If necessary to access the filter element, remove the two screws (1) that hold the upper and lower halves of the housing together.

INSTALLATION

INSTALLATION

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Fig. 56: EVAP Hose Quick Release Fitting, Wastegate Solenoid Vent Hose, Clamps, Screws & Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Install the air filter into the housing if it was removed. Tighten the two screws (1) that hold the housing halves together.
2. Install the air box retainer bolt (5). Tighten to 9 N.m (80 in. lbs.).
3. Install the turbocharger inlet duct to the turbocharger inlet and tighten the clamp (3) to 4 N.m (35 in. lbs.).
4. Install the fresh air make-up hose and hose clamp (2).
5. Connect the EVAP hose quick release fitting (4) to the turbocharger inlet duct.
6. Connect the wastegate solenoid vent hose (6) to the turbocharger inlet duct.

CYLINDER HEAD

DESCRIPTION

DESCRIPTION

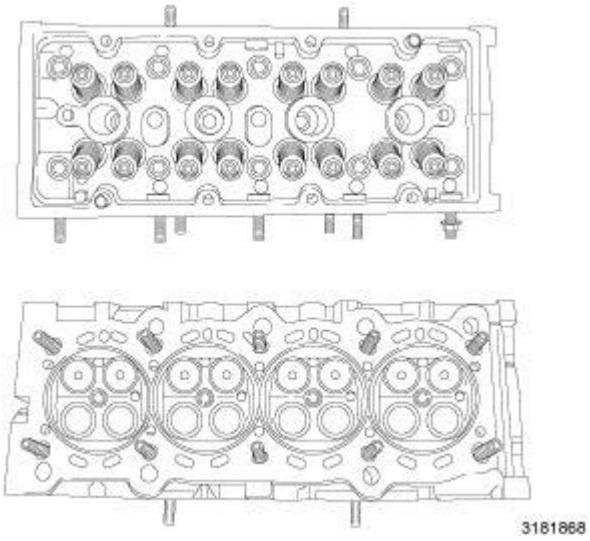


Fig. 57: Cylinder Head
Courtesy of CHRYSLER GROUP, LLC

The 1.4L aluminum cylinder head features four valves per cylinder with pressed in metal valve guides. The valve guides are not serviceable.

DIAGNOSIS AND TESTING

CYLINDER HEAD GASKET

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

Possible indications of the cylinder head gasket leaking between adjacent cylinders are:

- Loss of engine power
- Engine misfiring
- Poor fuel economy

Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:

- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test. Refer to **CYLINDER COMPRESSION PRESSURE LEAKAGE** . An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50 - 70%

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reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

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

COOLING SYSTEM TESTER METHOD

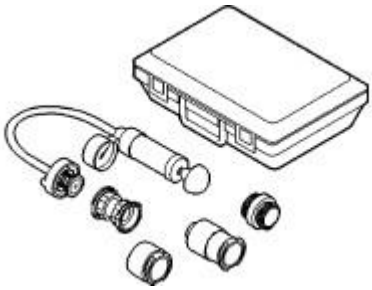


Fig. 58: Cooling System Pressure Tester - 7700a
Courtesy of CHRYSLER GROUP, LLC

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

CHEMICAL TEST METHOD



Fig. 59: Bloc-Chek-Kit - C-3685-A
Courtesy of CHRYSLER GROUP, LLC

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit (special tool #C-3685-A,

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Bloc-Chek Kit) or equivalent. Perform test following the procedures supplied with the tool kit.

HYDRAULIC LASH ADJUSTER

A tappet-like noise may be produced from several items. Check the following items.

1. Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.
2. Insufficient running time after rebuilding the cylinder head. Low speed running up to one hour may be required.
3. Turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.
4. Low oil pressure.
5. The oil screen in cylinder head or the oil passage to the cylinder head is plugged with debris.
6. Air ingested into oil due to broken or cracked oil pump pick-up.
7. Worn valve guides.
8. Rocker arm ears contacting valve spring retainer.
9. Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.
10. Oil leak or excessive cam bore wear in the cylinder head.
11. Faulty lash adjuster.

- Check lash adjusters for "sponginess" while installed in the cylinder head and cam lobe at base circle. Depress part of rocker arm over the adjuster. Normal adjusters should feel firm when pressed quickly. When pressed very slowly, lash adjusters should collapse.
- Remove suspected lash adjusters, and replace.
- Before installation, make sure adjusters are full of oil. This can be verified by little plunger travel when lash adjuster is depressed quickly.

REMOVAL

REMOVAL

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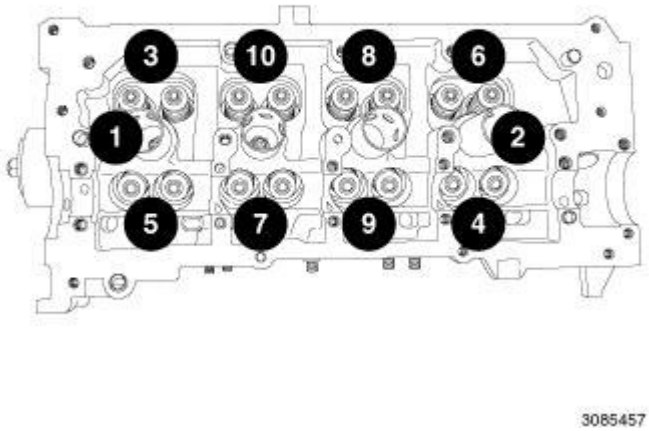


Fig. 60: Camshaft Bearing Housing Bolt Removal Sequence
Courtesy of CHRYSLER GROUP, LLC

1. Remove the camshaft bearing housing. Refer to **HOUSING, CAMSHAFT BEARING, REMOVAL**.

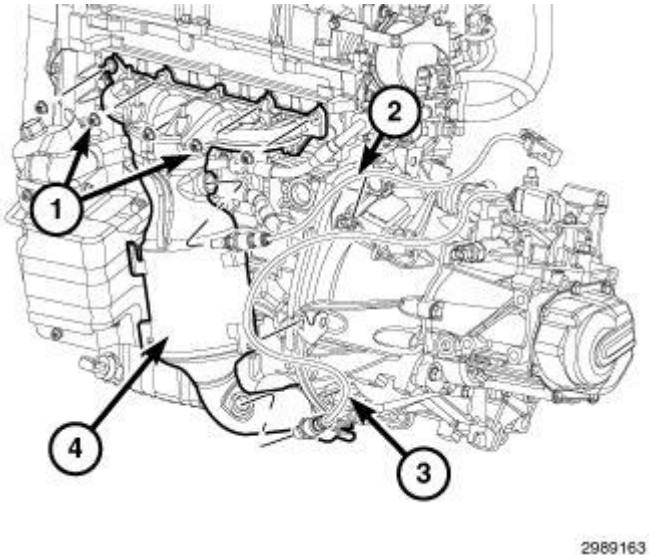


Fig. 61: Upstream And Downstream Oxygen Sensors, Maniverter & Fasteners
Courtesy of CHRYSLER GROUP, LLC

2. Remove the maniverter (4). Refer to **MANIFOLD, EXHAUST, REMOVAL**.

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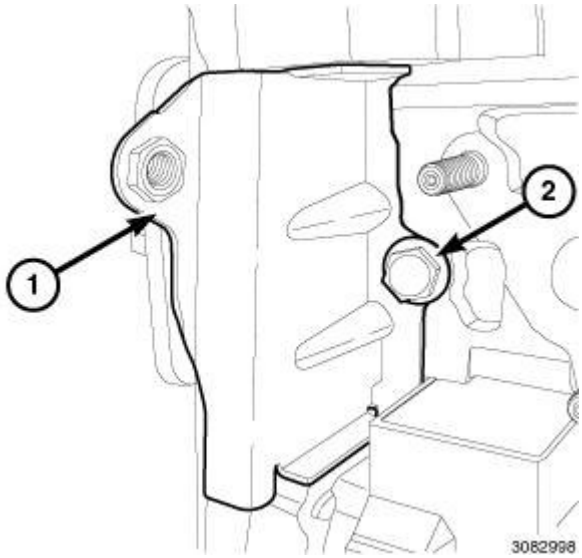


Fig. 62: Side Timing Belt Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

3. Remove the bolt (2) and the side timing belt cover (1).

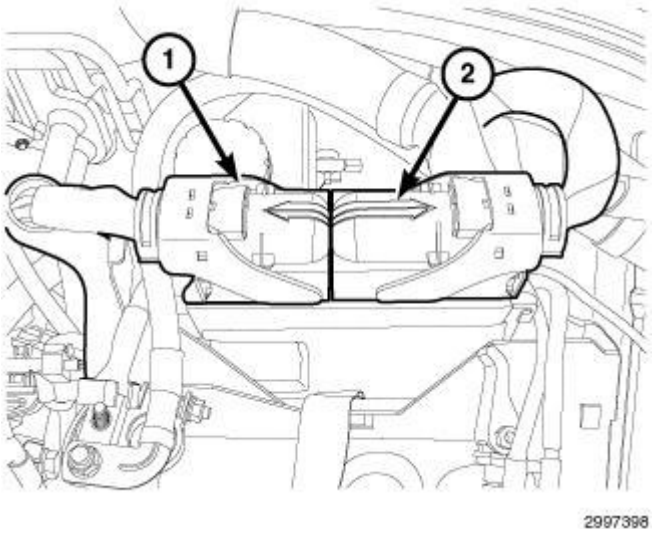


Fig. 63: PCM Electrical Connectors
Courtesy of CHRYSLER GROUP, LLC

4. Unlock and disconnect the Powertrain Control Module (PCM) harness connectors (1 and 2).

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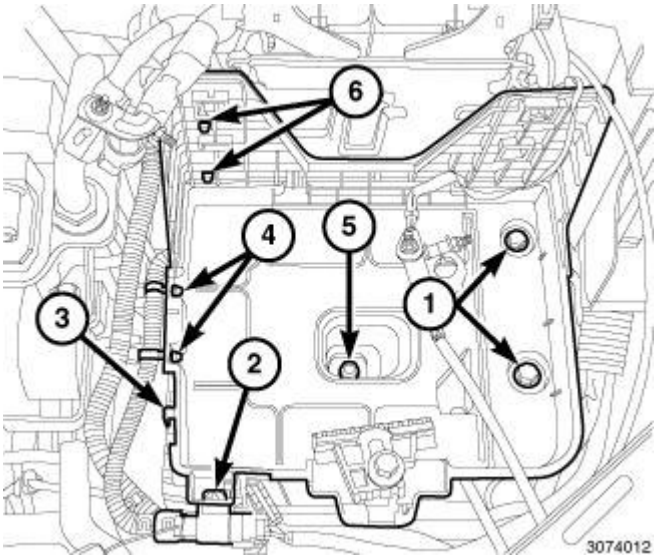


Fig. 64: Battery Tray, Connectors, Retainers, Nut & Bolts
Courtesy of CHRYSLER GROUP, LLC

5. Disengage two starter wire harness retainers (6) from the battery tray (3).
6. Disengage two engine wire harness retainers (4) from the battery tray (3).
7. Disengage the engine wire harness connector (2) from the battery tray (3) and reposition the wire harness.
8. Remove the nut (5) and two bolts (1).

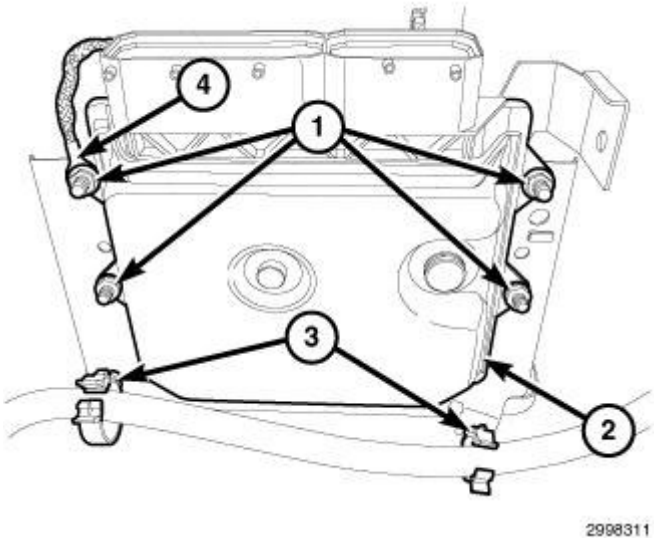


Fig. 65: PCM, Retainers, Ground Strap & Nuts
Courtesy of CHRYSLER GROUP, LLC

9. Open the two wire harness retainers (3) and reposition the wire harness.
10. Remove the nut (1) and the ground strap (4).
11. Remove the battery tray with the PCM (2) attached.

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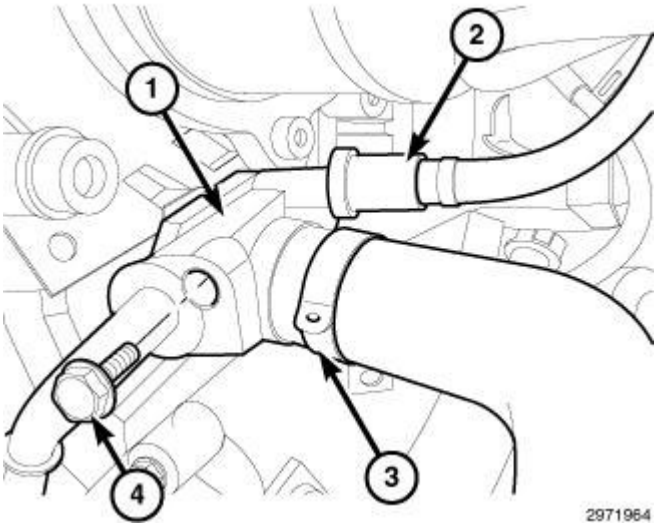


Fig. 66: Thermostat Housing, Pressurized Coolant Bottle Return Hose, Clamp & Bolt
Courtesy of CHRYSLER GROUP, LLC

CAUTION: The vacuum hose and the afterrun coolant pump hose have the same quick-connect fitting end. If removing both hoses, it is recommended that the hoses be marked at disassembly to avoid an incorrect installation. Failure to properly install the hoses can result in engine damage.

12. Disconnect the pressurized coolant bottle return hose (2).
13. Loosen the clamp (3) and disconnect the lower radiator hose.
14. Remove the bolt (4) and disconnect the oil filter housing coolant return hose.

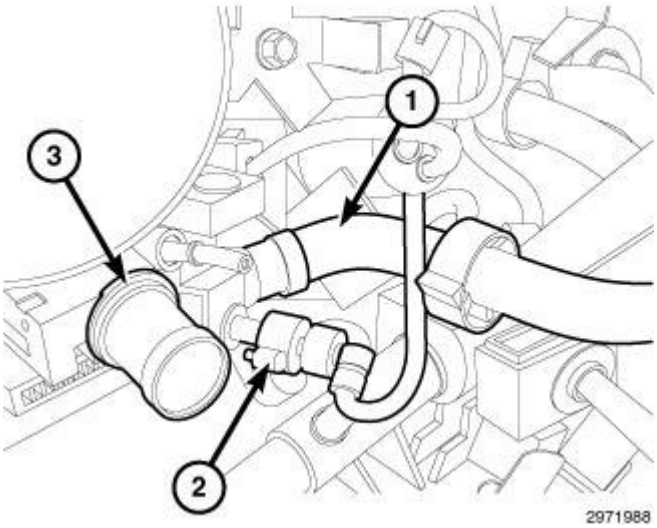


Fig. 67: Heater Core Inlet Hose, Engine Coolant Temperature (ECT) Sensor Electrical Connector & Cylinder Head Coolant Outlet Flange
Courtesy of CHRYSLER GROUP, LLC

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15. Unlock and disconnect the Engine Coolant Temperature (ECT) sensor electrical connector (2).
16. Disconnect the heater core inlet hose (1).

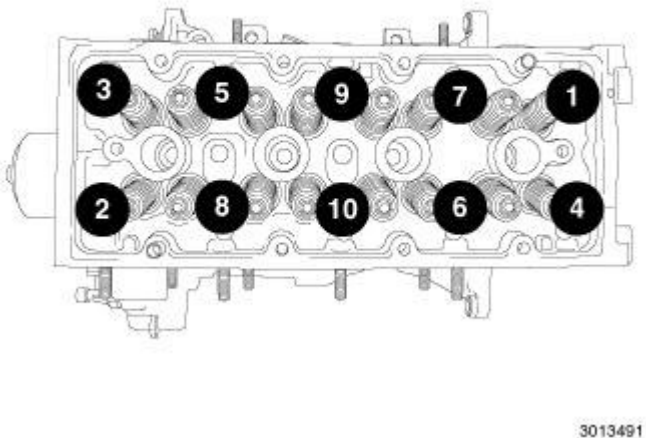


Fig. 68: Cylinder Head Bolt Removal Sequence
Courtesy of CHRYSLER GROUP, LLC

17. Using the sequence shown in illustration, remove the cylinder head retaining bolts.

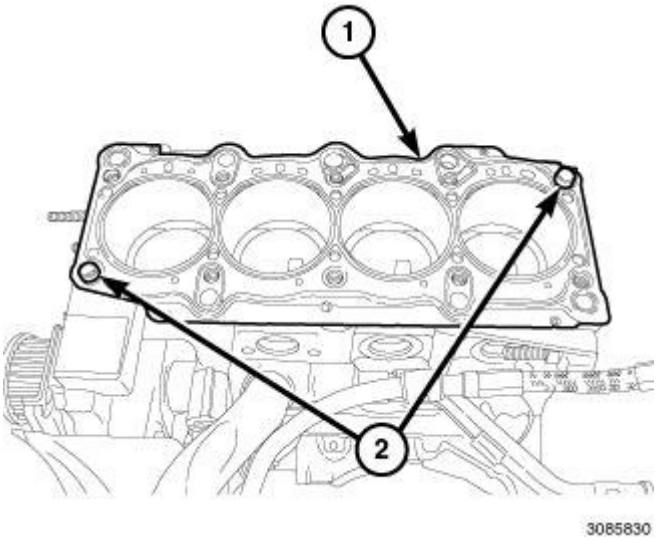


Fig. 69: Cylinder Head Gasket & Locating Dowels
Courtesy of CHRYSLER GROUP, LLC

18. Remove the cylinder head and gasket (1). Discard the gasket.

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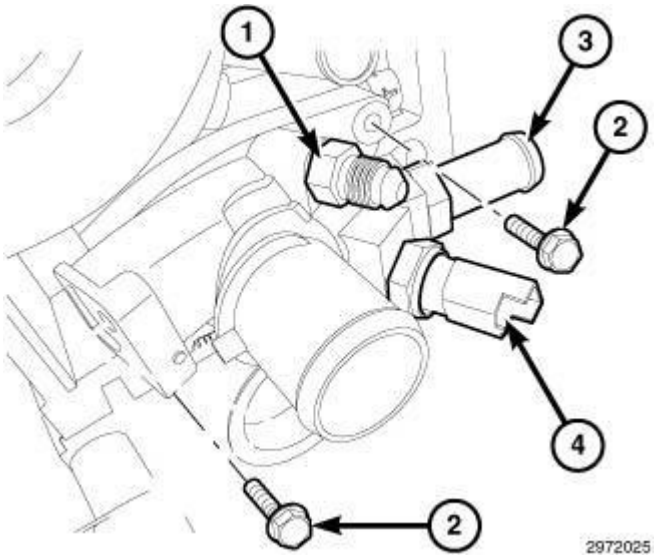


Fig. 70: Thermostat Housing Assembly, Engine Coolant Temperature Sensor & Fasteners
Courtesy of CHRYSLER GROUP, LLC

19. If required, remove the bolts (2) and the thermostat housing from the cylinder head.

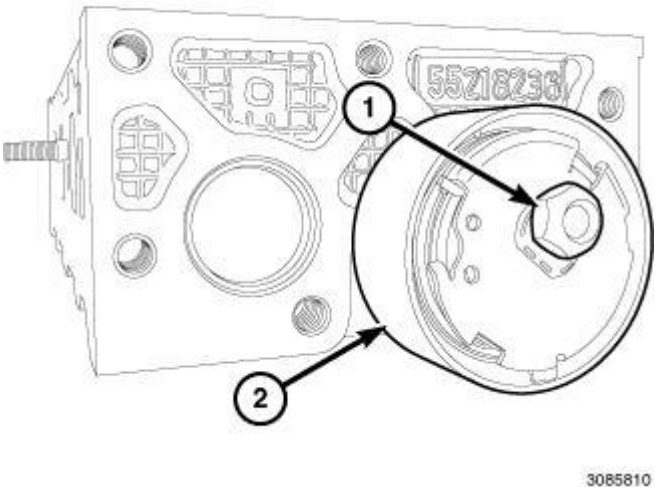


Fig. 71: Tensioner & Lock Nut
Courtesy of CHRYSLER GROUP, LLC

20. If required, remove the tensioner lock nut (1) and the tensioner (2) from the cylinder head.

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

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wooden or plastic scraper.

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

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

1. Remove all gasket material from cylinder head and block. Refer to **ENGINE GASKET SURFACE PREPARATION** . Be careful not to gouge or scratch the aluminum head sealing surface.
2. Clean all engine oil passages.
3. Clean out the cylinder head bolt holes in the engine block.

INSPECTION

INSPECTION

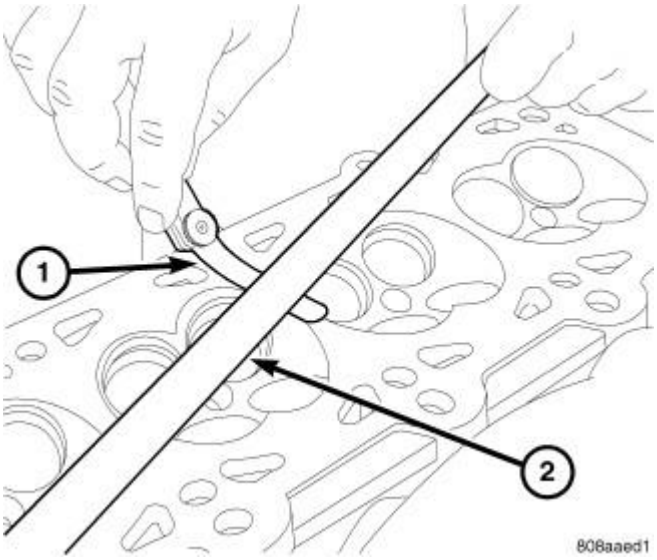


Fig. 72: Checking Cylinder Head Flatness
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical Cylinder Head shown in illustration.

1. Check for cylinder head warping with a straight edge (2) and feeler gauge (1).
2. Cylinder head must be flat within specification. Refer to **SPECIFICATIONS** .
3. Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.
4. Inspect the following components and verify that they are within specification: Refer to **SPECIFICATIONS** .
   - Springs
   - Valve Seats
   - Valve Guides

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- Valves

INSTALLATION

INSTALLATION

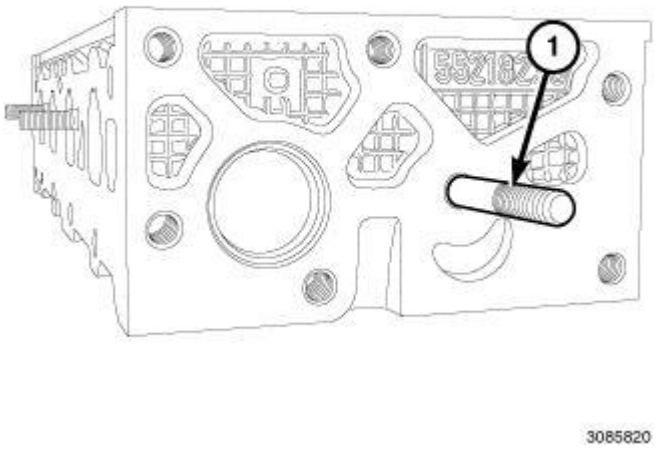


Fig. 73: Tensioner Mounting Stud
Courtesy of CHRYSLER GROUP, LLC

1. If removed, install the tensioner mounting stud to the cylinder head and tighten to 11 N.m (97 in. lbs.).
2. If removed, install new exhaust maniverter mounting studs.

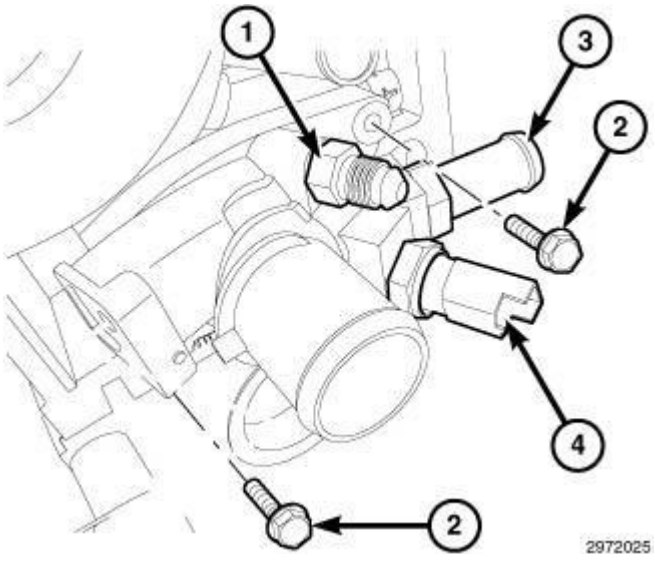


Fig. 74: Thermostat Housing Assembly, Engine Coolant Temperature Sensor & Fasteners
Courtesy of CHRYSLER GROUP, LLC

3. If removed, install the thermostat housing and gasket with bolts (2) tightened to 10 N.m (89 in. lbs.).

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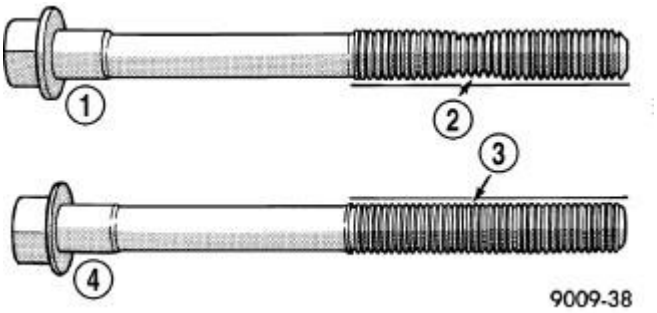


Fig. 75: Identifying Cylinder Head Bolts
Courtesy of CHRYSLER GROUP, LLC

CAUTION: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down the bolts must be replaced.

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

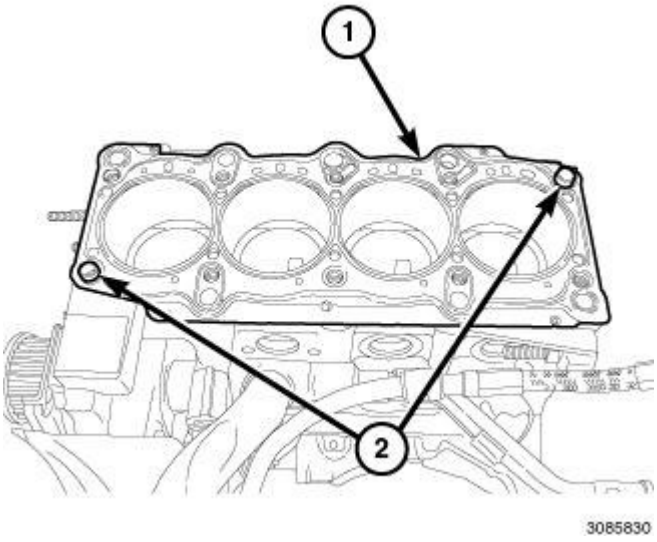


Fig. 76: Cylinder Head Gasket & Locating Dowels
Courtesy of CHRYSLER GROUP, LLC

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

5. Clean and prepare the gasket sealing surfaces of the cylinder head and block. Refer to **ENGINE GASKET SURFACE PREPARATION** .
6. Install two cylinder head locating dowels (2).
7. Position the new cylinder head gasket (1) on the locating dowels (2).

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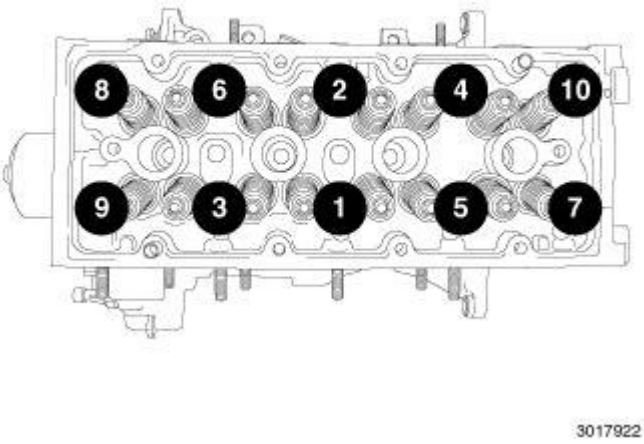


Fig. 77: Cylinder Head Bolt Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

8. Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.
9. Install the ten head bolts finger tight.
10. Tighten the cylinder head bolts in the sequence shown in illustration, following this 4 step torque plus angle method. Tighten according to the following torque values:
    - Step 1: All to 20 N.m (15 ft. lbs.).
    - Step 2: All to 30 N.m (22 ft. lbs.).
    - Step 3: All + 90° Turn **Do not use a torque wrench for this step.**
    - Step 4: All an additional + 90° Turn **Do not use a torque wrench for this step.**

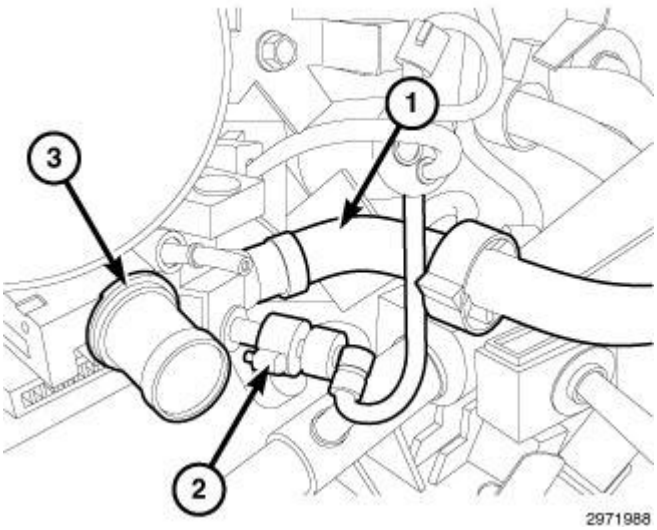


Fig. 78: Heater Core Inlet Hose, Engine Coolant Temperature (ECT) Sensor Electrical Connector & Cylinder Head Coolant Outlet Flange

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Courtesy of CHRYSLER GROUP, LLC

11. Connect the heater core inlet hose (1).
12. Connect and lock the engine coolant temperature (ECT) sensor electrical connector (2).

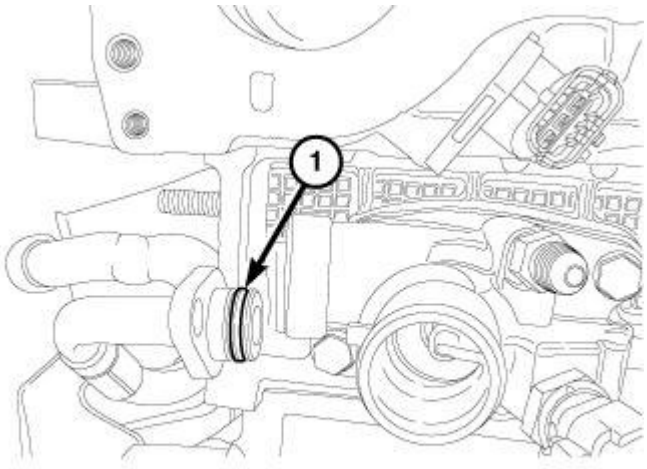


Fig. 79: Oil Filter Housing Coolant Return Hose O-Ring
Courtesy of CHRYSLER GROUP, LLC

13. Apply engine oil to the oil filter housing coolant return hose O-ring (1).

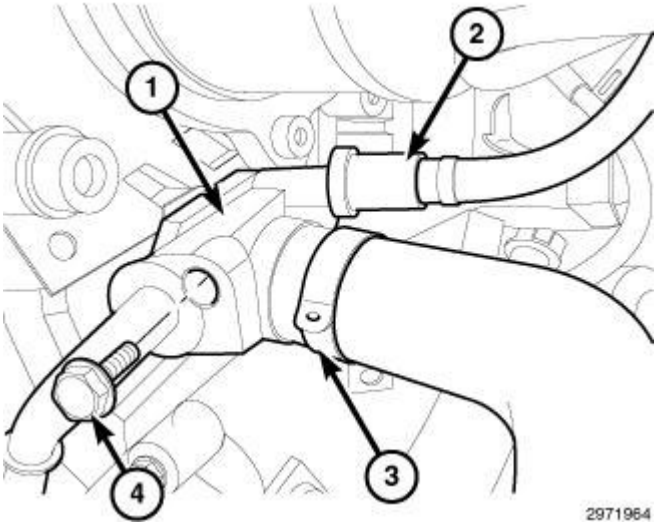


Fig. 80: Thermostat Housing, Pressurized Coolant Bottle Return Hose, Clamp & Bolt
Courtesy of CHRYSLER GROUP, LLC

14. Install the oil filter housing coolant return hose to the thermostat housing (1). Tighten the bolt (4) to 9 N.m (80 in. lbs.).

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CAUTION: The vacuum hose and the pressurized coolant bottle return hose have the same quick-connect fitting end. Verify that the hoses are correctly installed. Failure to properly install the hoses can result in engine damage.

15. Connect the pressurized coolant bottle return hose (2).
16. Connect the lower radiator hose and tighten the clamp (3).

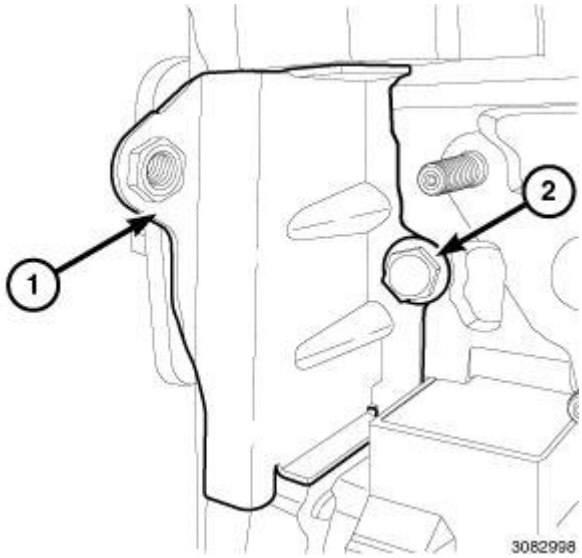


Fig. 81: Side Timing Belt Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

17. Install the side timing belt cover (1) with bolt (2) tightened to 25 N.m (18 ft. lbs.).

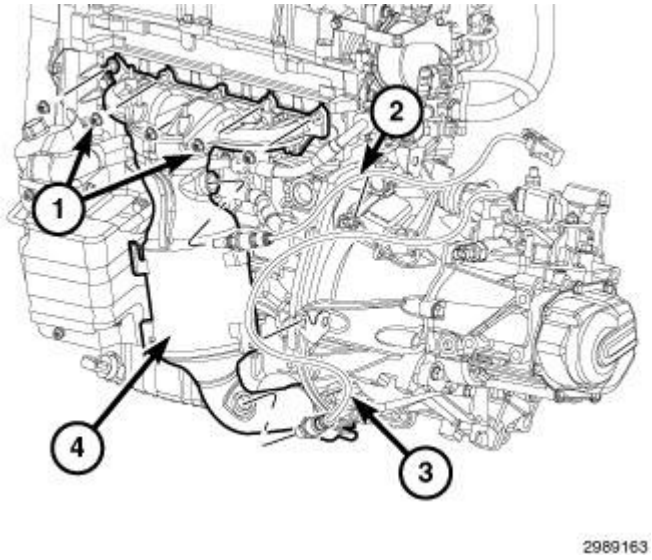


Fig. 82: Upstream And Downstream Oxygen Sensors, Maniverter & Fasteners
Courtesy of CHRYSLER GROUP, LLC

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18. Install the maniverter (4), cooling module and front fascia. Refer to **MANIFOLD, EXHAUST, INSTALLATION**.

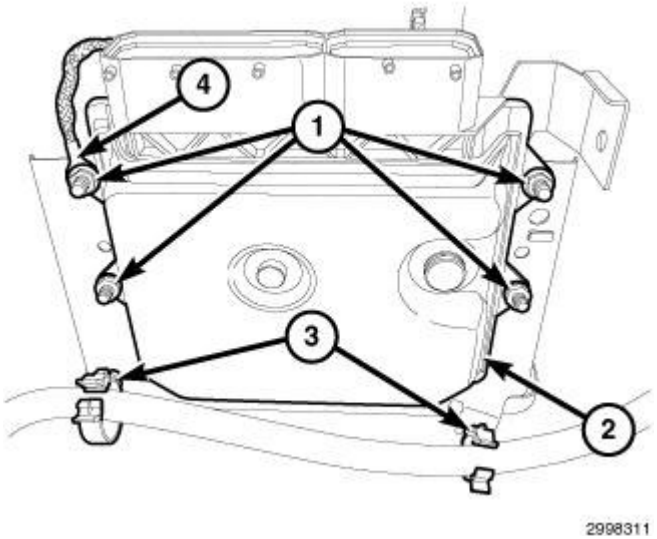


Fig. 83: PCM, Retainers, Ground Strap & Nuts
Courtesy of CHRYSLER GROUP, LLC

19. Lower the vehicle.
20. Position the battery tray and PCM in the vehicle. Route the wire harness and close the wire harness retainers (3).

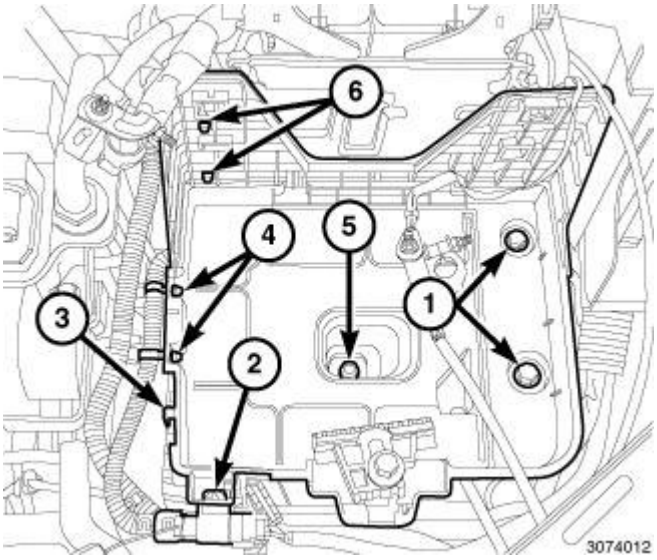


Fig. 84: Battery Tray, Connectors, Retainers, Nut & Bolts
Courtesy of CHRYSLER GROUP, LLC

21. Install the battery tray (3) with one nut (5) and two bolts (1) tightened to 25 N.m (18 ft. lbs.).
22. Engage the engine wire harness connector (2) to the battery tray (3).

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23. Engage two engine wire harness retainers (4) to the battery tray (3).
24. Engage two starter wire harness retainers (6) to the battery tray (3).

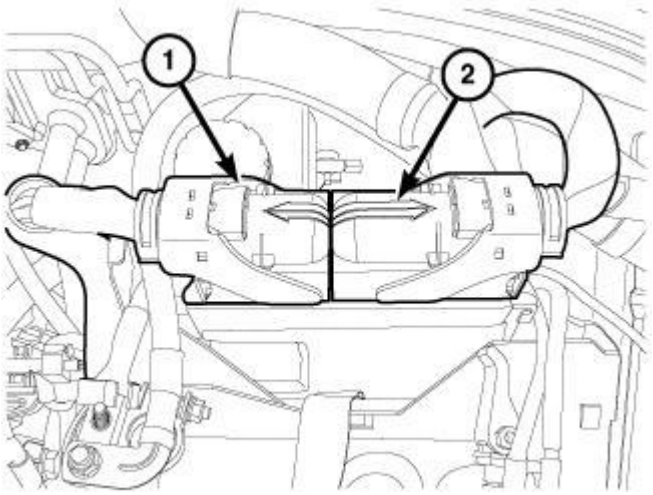


Fig. 85: PCM Electrical Connectors
Courtesy of CHRYSLER GROUP, LLC

25. Connect the powertrain control module (PCM) electrical connectors (1 and 2).

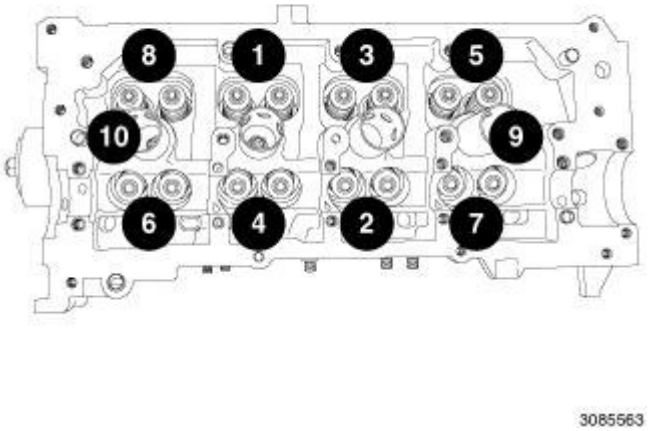


Fig. 86: Camshaft Bearing Housing Bolt Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

26. Install the camshaft bearing housing. Refer to **HOUSING, CAMSHAFT BEARING, INSTALLATION**.

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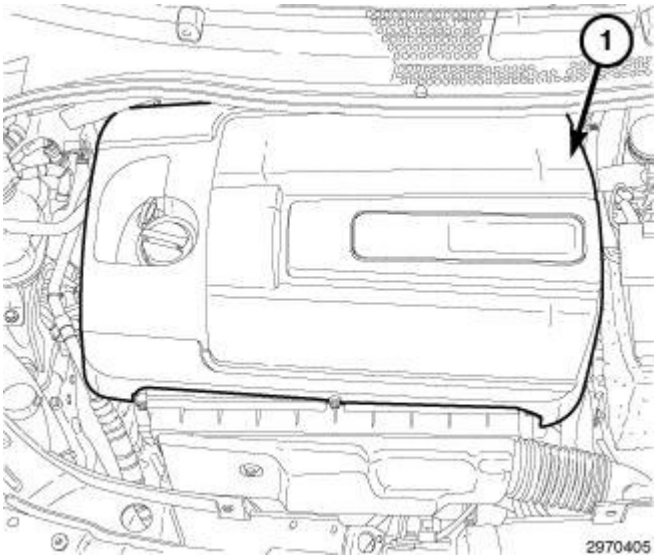


Fig. 87: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

27. If removed, install the oil filter and fill the engine crankcase with the proper oil to the correct level. Refer to **STANDARD PROCEDURE** .
28. Fill the cooling system. Refer to **STANDARD PROCEDURE** .
29. Install the engine cover (1).
30. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
31. Run the engine until it reaches normal operating temperature. Check cooling system for correct fluid level. Refer to **STANDARD PROCEDURE** .

NOTE: The Cam/Crank Variation Relearn procedure must be performed using the scan tool anytime there has been a repair/replacement made to a powertrain system, for example: flywheel, valvetrain, camshaft and/or crankshaft sensors or components. Refer to the appropriate Diagnostic Information.

ASSEMBLY, VARIABLE VALVE ACTUATION

DESCRIPTION

DESCRIPTION

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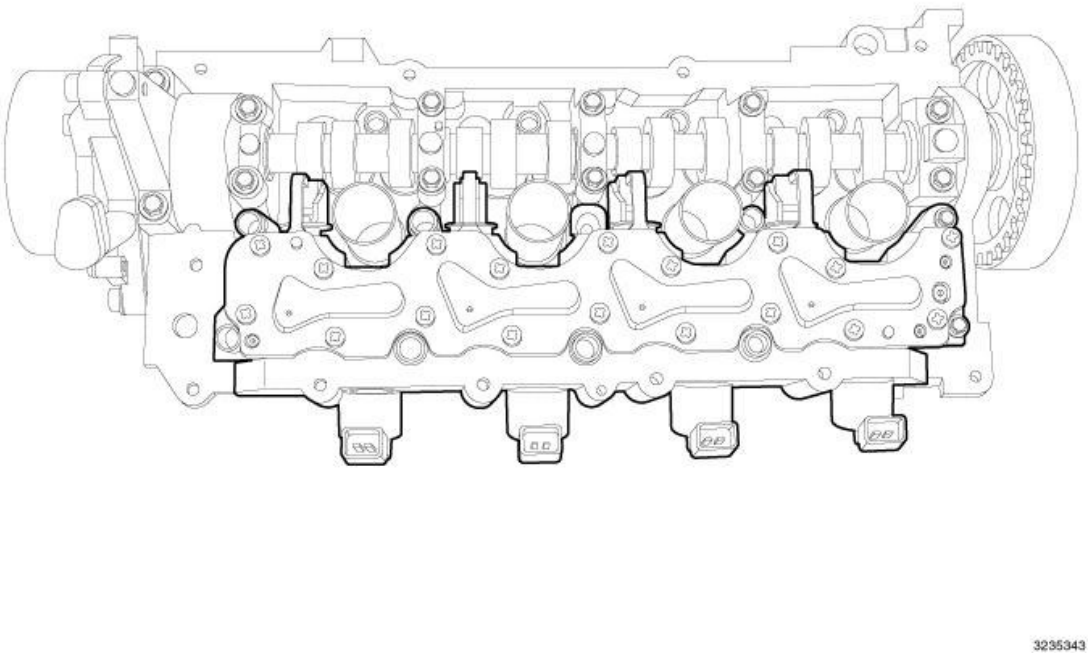


Fig. 88: Variable Valve Actuation Assembly
Courtesy of CHRYSLER GROUP, LLC

The primary component of variable valve actuation is the variable valve actuation module. The variable valve actuation module is bolted to the top of the camshaft bearing housing above the intake valves, next to the camshaft. The intake lobes on the camshaft operate hydraulic pumping elements instead of directly acting on the valves. The pumping elements provide high-pressure oil to open the intake valves. The relationship between the camshaft lobe and the intake valves is controlled by a solenoid operated hydraulic port. By varying the solenoid operation, the Powertrain Control Module (PCM) is able to control intake valve lift and duration.

OPERATION

OPERATION

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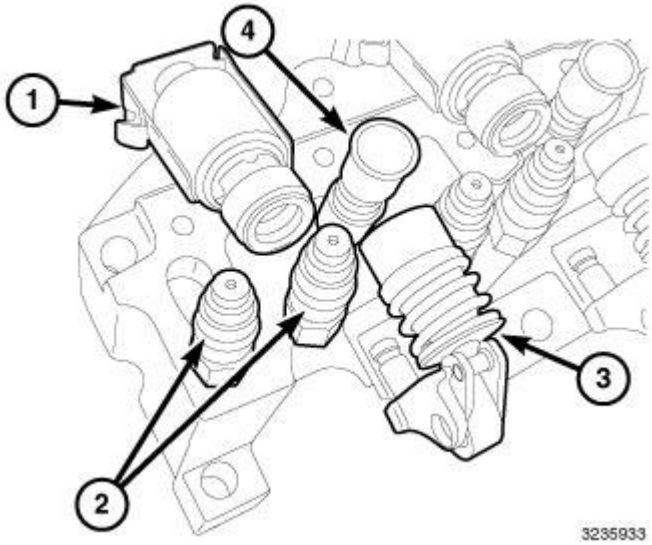


Fig. 89: Solenoid Valve, Hydraulic Brake Pumping Element/Hydraulic Lash Adjusters, Upper Pumping Element & Oil Accumulator
Courtesy of CHRYSLER GROUP, LLC

Variable valve actuation controls the operation of the intake valves. By using a hydraulic link between the camshaft and the intake valves, the valve lift and timing can be adjusted infinitely.

The main components of variable valve actuation are the Powertrain Control Module (PCM) programming and the variable valve actuation module. The variable valve actuation module contains one set of the following components for each cylinder:

- Upper Pumping Element (3)
- Solenoid Valve (1)
- Hydraulic Brake Pumping Element/Hydraulic Lash Adjusters (2)
- Oil Accumulator (4)

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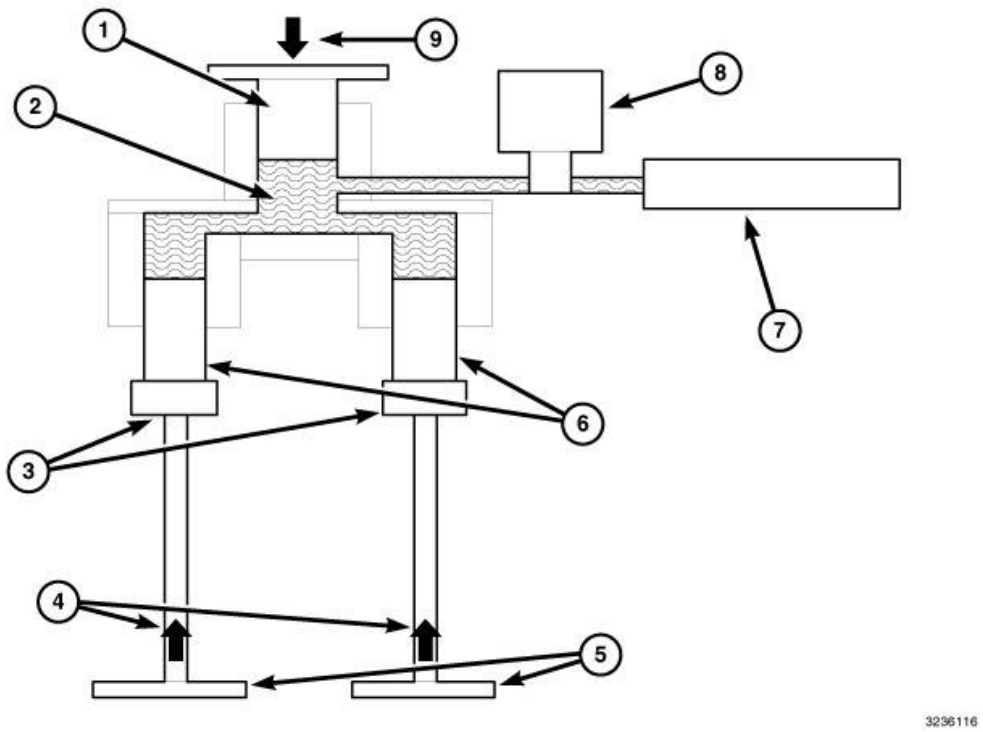


Fig. 90: Variable Valve Actuation Assembly Operating Description
Courtesy of CHRYSLER GROUP, LLC

The upper pumping elements (1) in the variable valve actuator are filled with oil from the engine lubrication system. The upper pumping elements (1) are driven by the rocker arms through camshaft motion (9) to create high-pressure oil inside the oil chamber (2). As the camshaft continues to rotate and the camshaft lobe ramps down, a spring in the upper pumping element returns the piston and the rocker arm to their home positions.

The high-pressure oil in the oil chamber passageway is delivered to the solenoid valve (8) from the upper pumping element. The solenoid valve (8) is a normally open hydraulic control valve. Therefore, the high-pressure oil is vented from the oil chamber to the accumulator (7) unless the solenoid valve is powered. When the solenoid valve is supplied 12 volts, the valve closes and high pressure oil instead acts upon the hydraulic brake pumping elements (6) to operate the intake valves (5).

The hydraulic brake pumping element (6) is essentially a piston that is operated by the high-pressure oil to open the intake valves (5). It also functions as a brake to stop the movement of the pumping element and intake valves. The braking function is the result of vent holes around the perimeter of the element's cylinder. When the piston approaches full stroke, the lower perimeter vent holes bleed off oil. This stops the piston from moving any farther. When the pressure from the solenoid is taken away, the upper supply holes in the cylinder become bleed holes that allow the piston to return to the home position. The piston is pushed back to the home position by the force of the intake valve springs. As the piston approaches the home position, some of the bleed holes are covered and the speed of the piston is regulated as it approaches the final resting position. This also controls the valve speed as it seats in the cylinder head. The hydraulic brake pumping element also functions as a hydraulic lash adjuster (3) because the valve stem clearance is hydraulically taken up by the piston. This occurs because the hydraulic brake pumping element/hydraulic lash adjuster is always under some oil pressure from the engine oil lubrication system. This creates enough pressure to take up valve clearance.

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The variable valve actuator features three areas that function together as an oil reservoir so that the actuator always has a ready supply of engine oil. The engine lubrication system provides oil to the lower reservoir area and keeps it full of oil. To flow from the lower reservoir to the upper reservoir, the oil must pass through very small holes. This helps to purge air from the lower reservoir and to maintain engine oil pressure in the lower reservoir. The third reservoir area, the oil accumulator (7), is filled by oil vented from the oil chamber by the solenoid valve (8). The oil accumulator is a spring loaded accumulator that absorbs the hydraulic shock that would otherwise be created when the solenoid valves are opened. This helps to increase the durability of the system, maintains higher pressure in the lower pressure side of the system and lowers the overall load on the engine oil pump.

Variable valve actuation provides five possible phases of operation. Each phase offers unique advantages compared to normal camshaft operation. The five phases are:

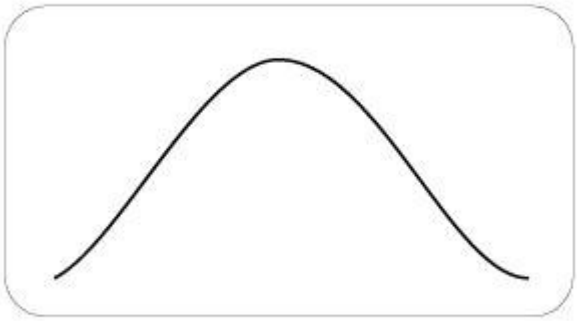


Fig. 91: Full Lift
Courtesy of CHRYSLER GROUP, LLC

- Full Lift. When variable valve actuation functions in the full lift phase, all of the camshaft lobe lift is transferred to the intake valves. The intake camshaft lobe is designed with a very aggressive lift and duration profile. This results in good power in the upper RPM ranges with high loads. This profile would rarely be used in everyday driving.

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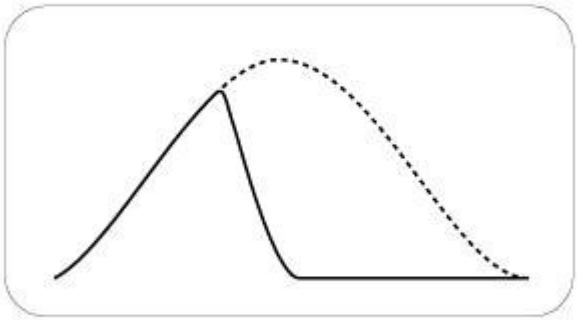


Fig. 92: Early Intake Valve Closing (EIVC)
Courtesy of CHRYSLER GROUP, LLC

- Early intake valve closing (EIVC). When variable valve actuation functions in the EIVC phase, the camshaft lobe lift is transferred to the intake valves at the beginning of the lift duration cycle. However, the hydraulic connection between the camshaft lobe and the valves is taken away before the lobe reaches full lift. The exact timing and lift can be infinitely varied to meet driver requirements. EIVC provides smooth engine performance and more torque at lower engine speeds.

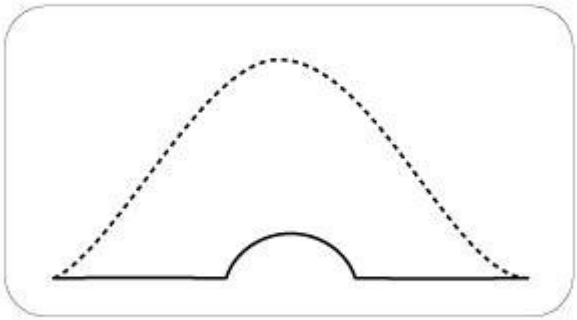
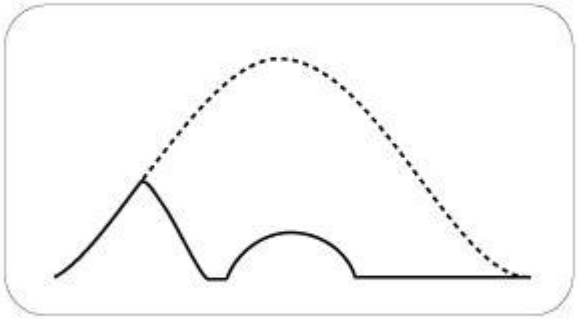


Fig. 93: Late Intake Valve Opening (LIVO)
Courtesy of CHRYSLER GROUP, LLC

- Late intake valve opening (LIVO). When variable valve actuation functions in the LIVO phase, the camshaft lobe lift is NOT transferred to the intake valves at the beginning of the lift duration cycle. The hydraulic connection between the camshaft lobe and the valves is completed after the rocker arm has already begun riding the ramp of the camshaft lobe. When the hydraulic connection is completed, the intake valves will begin to open. The valve lift timing can be varied infinitely within the full profile of the

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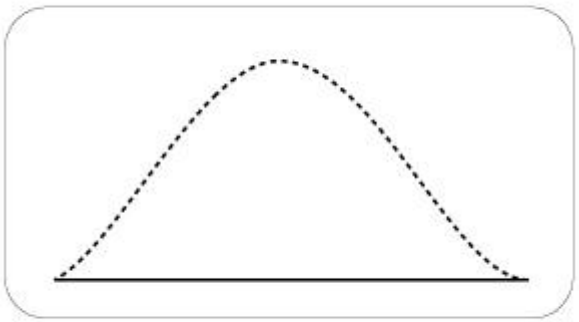
camshaft lobe. Therefore, as long as the hydraulic connection is completed before the camshaft lobe reaches its maximum lift, some valve lift will result. The lift profile will follow the camshaft lobe profile for the time that the hydraulic link is complete. Like EIVC, the exact timing and lift can be infinitely varied to meet driver requirements. LIVO provides lower emissions and a higher efficiency at lower loads or idle conditions.



3250458

Fig. 94: Multi-Lift
Courtesy of CHRYSLER GROUP, LLC

- Multi-Lift. Multi-Lift is a combination of EIVC and LIVO because the hydraulic connection between the camshaft lobe and the intake valves is closed early and then re-opened later in the cycle. This creates a longer duration valve lift with a smaller amount of lift. The result is a higher velocity of air flow into the cylinder over a longer period of time. Multi-Lift may be used in mixed driving of acceleration and deceleration with moderate engine speeds.



3250466

Fig. 95: Closed
Courtesy of CHRYSLER GROUP, LLC

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- Closed. The closed phase simply leaves the intake valves closed by not utilizing the camshaft lobe to lift the intake valves.

REMOVAL

REMOVAL

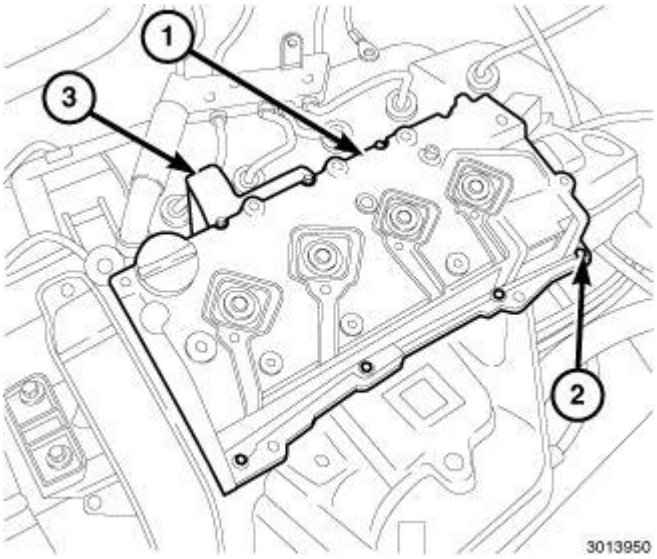


Fig. 96: Cylinder Head Cover, Fuel Rail Blocker & Bolts
Courtesy of CHRYSLER GROUP, LLC

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

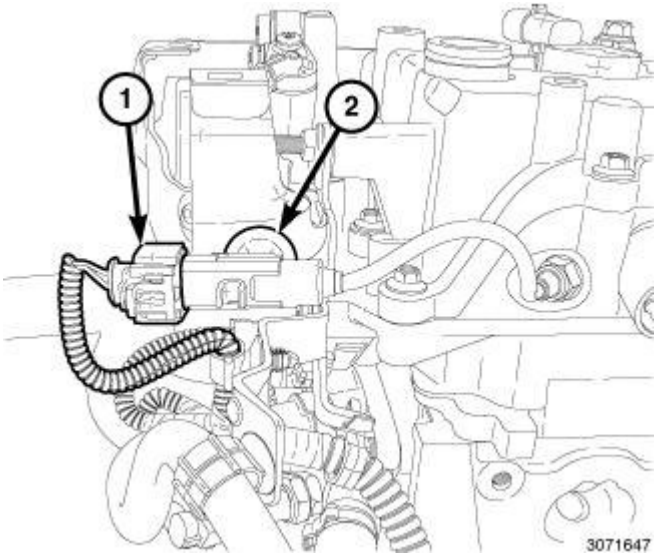
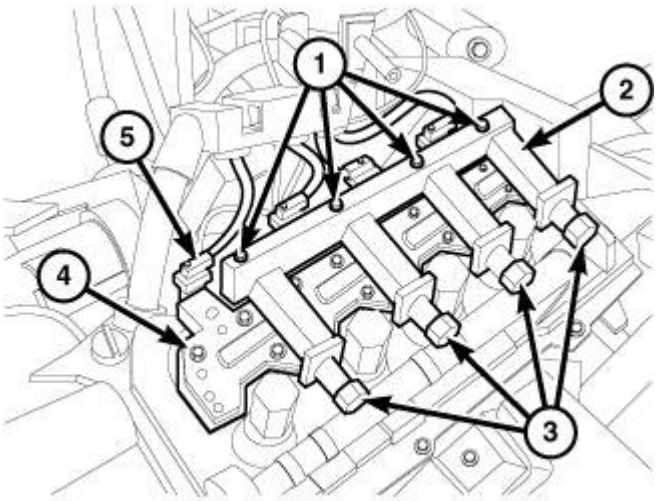


Fig. 97: Oil Temperature Sensor Electrical Connector & Bracket
Courtesy of CHRYSLER GROUP, LLC

2. Unlock and disconnect the oil temperature sensor electrical connector (1).

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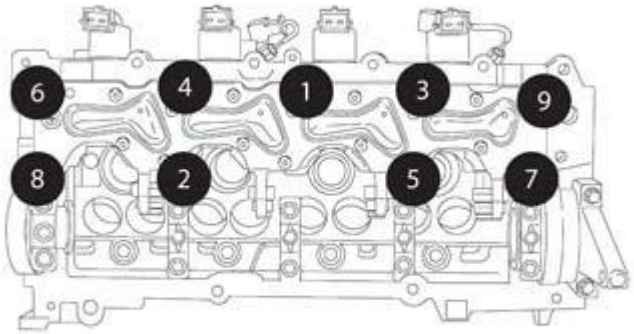
3. Disengage the oil temperature electrical connector from the bracket (2).



3061576

Fig. 98: Variable Valve Actuation Assembly Removal/Installation Tool & Variable Valve Timing Actuator Connectors
Courtesy of CHRYSLER GROUP, LLC

4. Unlock and disconnect the four variable valve timing actuator electrical connectors (5).
5. Install the (special tool #10259B, Compressor, MultiAir® Spring) (2) with four bolts (1) tightened to 9 N.m (80 in. lbs.).
6. Rotate the spring compressors (3) CCW until fully seated.



3062031

Fig. 99: Variable Valve Actuation Assembly Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not invert the variable valve actuation assembly when it is

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removed from the engine. Oil will drain from the assembly and excessive engine cranking will be required to refill the assembly and start the engine.

7. Remove the ten bolts in the sequence shown in illustration.
8. Remove the variable valve timing actuation assembly, with the spring compressor attached, from the camshaft bearing housing.

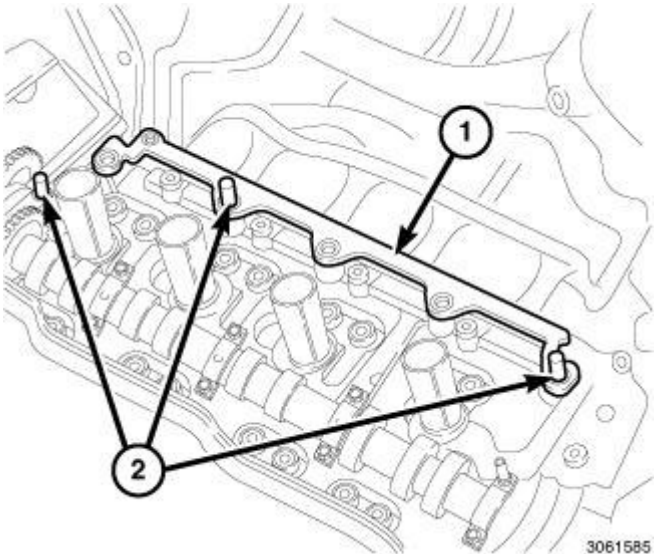


Fig. 100: Variable Valve Actuation Assembly Gasket & Locating Pins
Courtesy of CHRYSLER GROUP, LLC

9. Remove and discard the variable valve actuation assembly gasket (1).

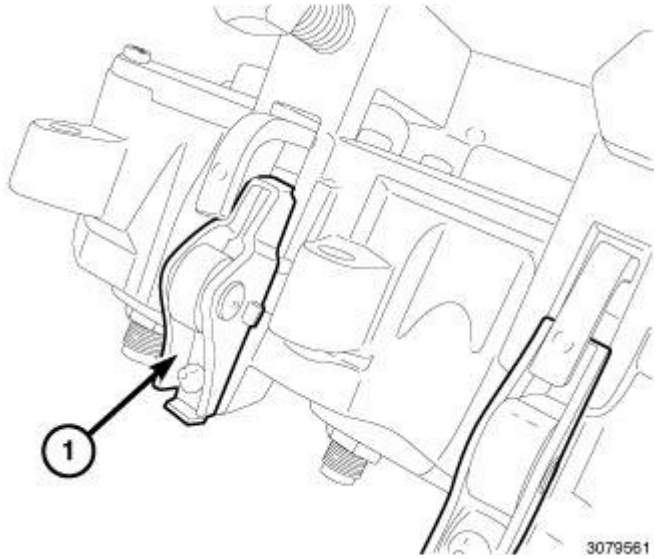


Fig. 101: Rocker Arms
Courtesy of CHRYSLER GROUP, LLC

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10. If required, remove the rocker arms. Refer to **ROCKER ARM, VALVE, REMOVAL**.

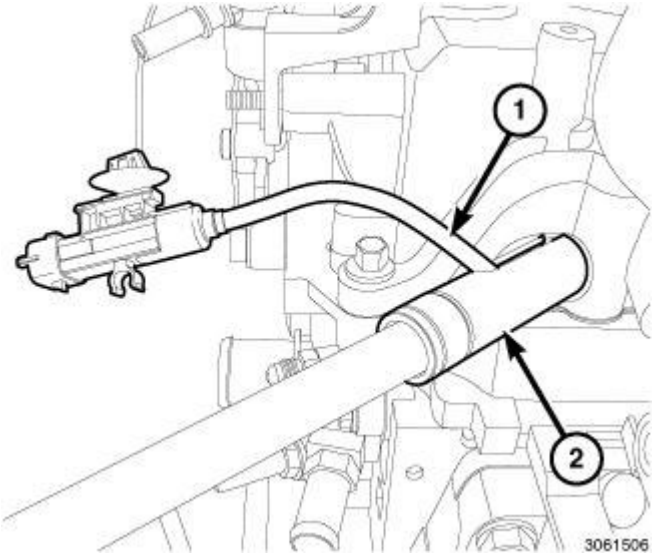


Fig. 102: Remove/Install Oil Temperature Sensor
Courtesy of CHRYSLER GROUP, LLC

11. If required, use an appropriate socket (2) and remove the oil temperature sensor (1).

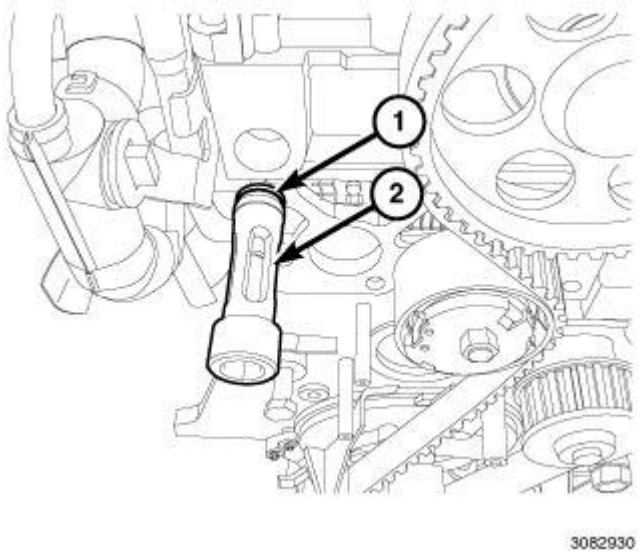


Fig. 103: MultiAir Actuator Oil Supply Filter & O-Ring
Courtesy of CHRYSLER GROUP, LLC

12. If required, remove the MultiAir actuator oil supply filter (2) from the camshaft bearing housing.

INSPECTION

INSPECTION

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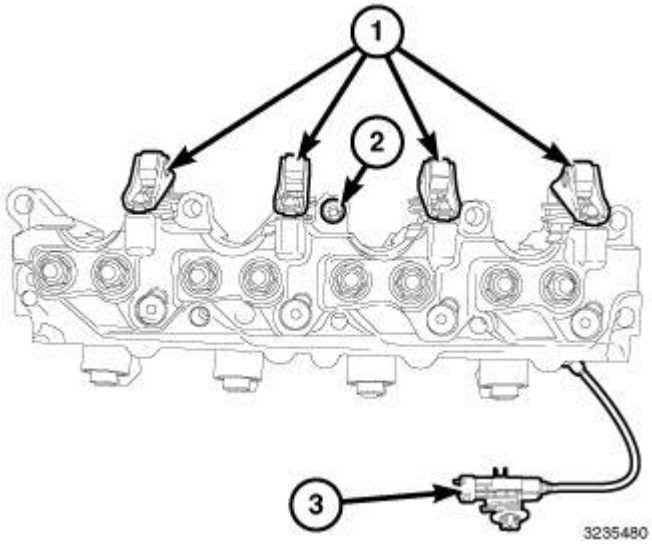


Fig. 104: Valve Rocker Arms, Oil Supply O-Ring & Oil Temperature Sensor
Courtesy of CHRYSLER GROUP, LLC

Because variable valve actuation is so closely monitored, the diagnostics of the system are strongly Diagnostic Trouble Code (DTC) driven. If the system does not perform according to design, many DTC's may be produced from a condition in the variable valve actuation system.

The variable valve actuation module includes very few serviceable components. The module has no internal components that are serviceable. The following components are serviceable:

- Valve rocker arms (1)
- Oil supply O-ring (2)
- Oil temperature sensor (3)

INSTALLATION

INSTALLATION

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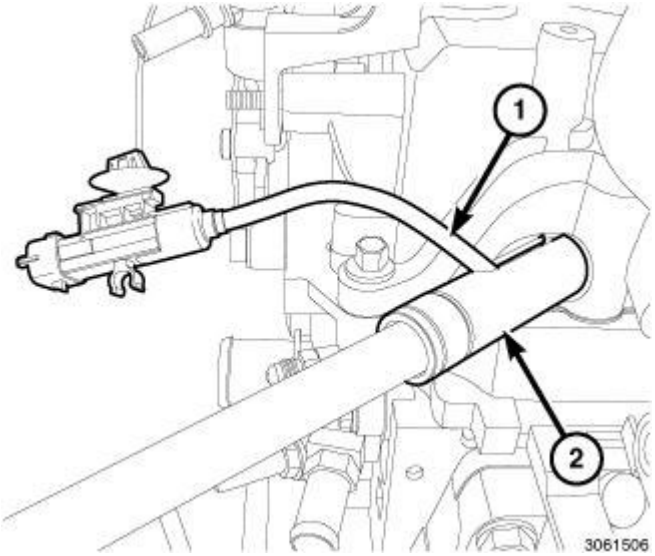


Fig. 105: Remove/Install Oil Temperature Sensor
Courtesy of CHRYSLER GROUP, LLC

1. If removed, install the oil temperature sensor (1). Refer to **SENSOR, OIL TEMPERATURE, INSTALLATION**. Tighten the oil temperature sensor to 18 N.m (13 ft. lbs.).

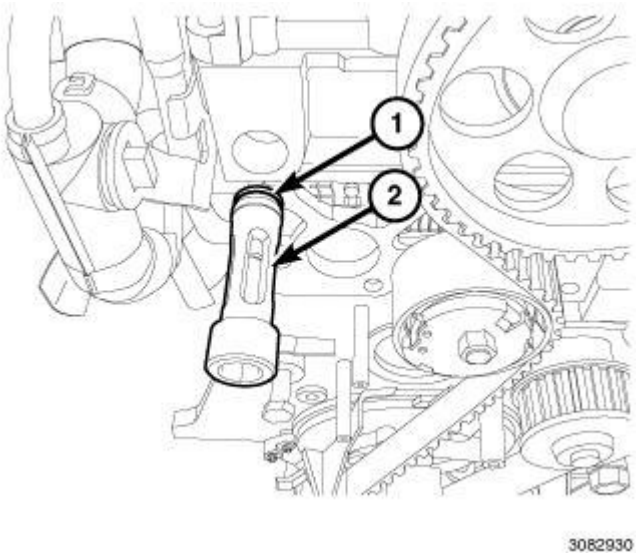


Fig. 106: MultiAir Actuator Oil Supply Filter & O-Ring
Courtesy of CHRYSLER GROUP, LLC

2. If removed, install a new O-ring (1) lubricated with engine oil on the MultiAir actuator oil supply filter (2). Install the filter into the camshaft bearing housing and tighten to 27 N.m (20 ft. lbs.).

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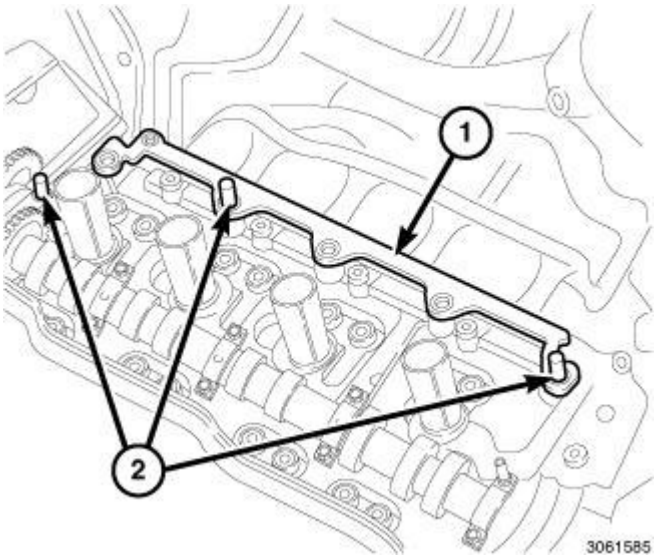


Fig. 107: Variable Valve Actuation Assembly Gasket & Locating Pins
Courtesy of CHRYSLER GROUP, LLC

3. Install three variable valve actuation assembly locating pins (2).
4. Install the variable valve actuation assembly gasket (1).

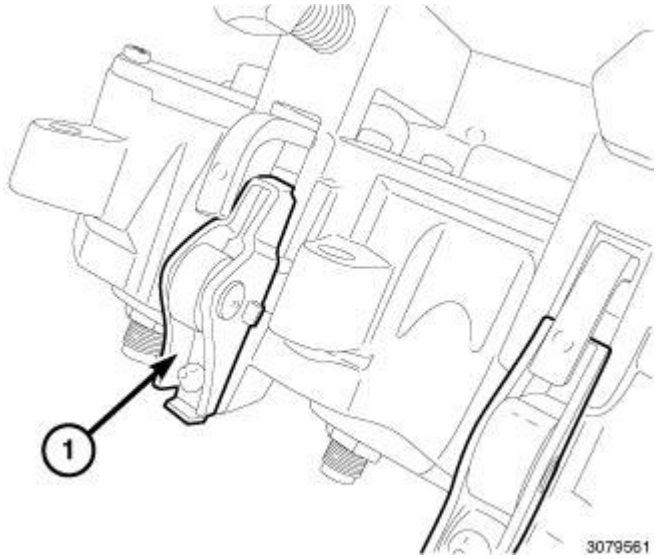


Fig. 108: Rocker Arms
Courtesy of CHRYSLER GROUP, LLC

5. If removed, install the rocker arms (1). Refer to **ROCKER ARM, VALVE, INSTALLATION**.

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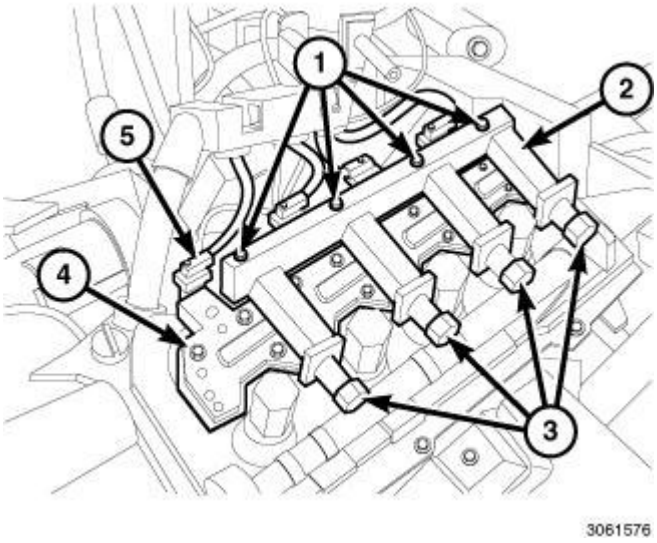


Fig. 109: Variable Valve Actuation Assembly Removal/Installation Tool & Variable Valve Timing Actuator Connectors
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not invert the variable valve actuation assembly when it is removed from the engine. Oil will drain from the assembly and excessive engine cranking will be required to refill the assembly and start the engine.

6. If removed, install the (special tool #10259B, Compressor, MultiAir® Spring) (2) with four bolts (1) tightened to 9 N.m (80 in. lbs.).
7. Rotate the spring compressors (3) CCW until fully seated.

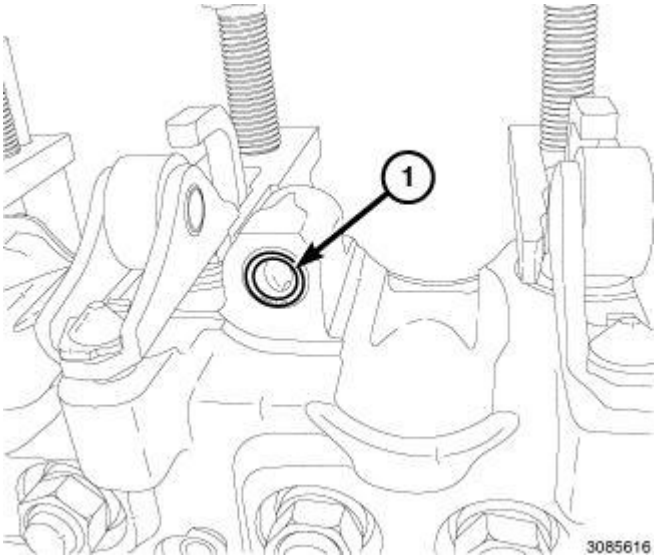


Fig. 110: Variable Valve Actuation Assembly O-Ring
Courtesy of CHRYSLER GROUP, LLC

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8. Install the variable valve actuation assembly O-ring (1).

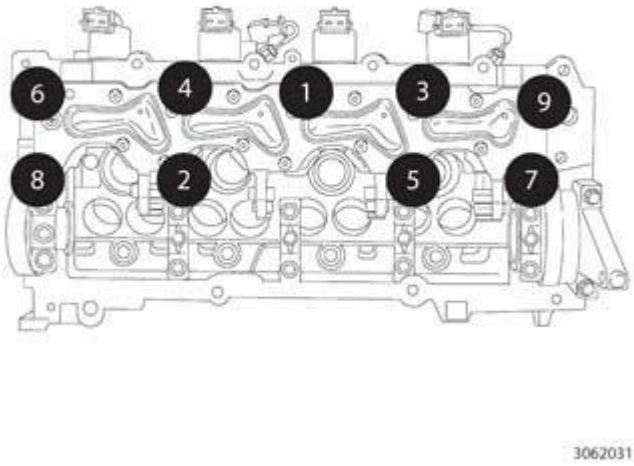


Fig. 111: Variable Valve Actuation Assembly Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

9. Install the variable valve actuation assembly with the spring compressor in place. Install and hand tighten the retaining bolts.
10. Remove the spring compressor and tighten the ten bolts in three steps following the sequence shown in illustration:
    - Step 1: All to 10 N.m (89 in. lbs.).
    - Step 2: All to 22 N.m (16 ft. lbs.).
    - Step 3: All again to 22 N.m (16 ft. lbs.).

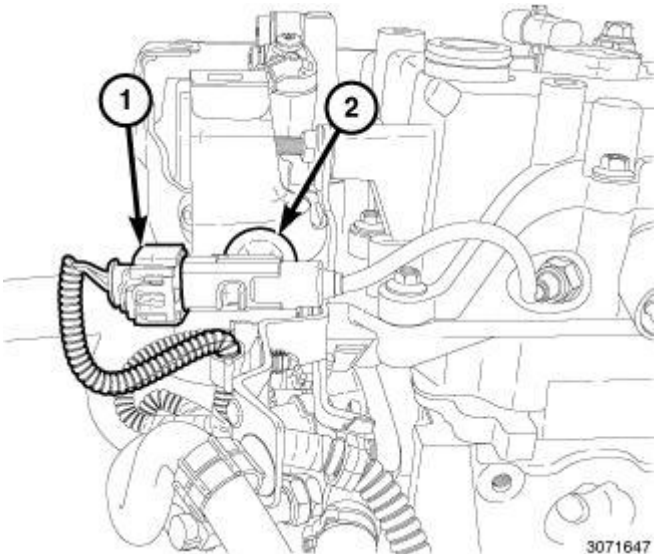


Fig. 112: Oil Temperature Sensor Electrical Connector & Bracket
Courtesy of CHRYSLER GROUP, LLC

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11. Connect and lock the four variable valve timing actuator electrical connectors.
12. Connect and lock the oil temperature sensor electrical connector (1).
13. Engage the oil temperature electrical connector to the bracket (2).

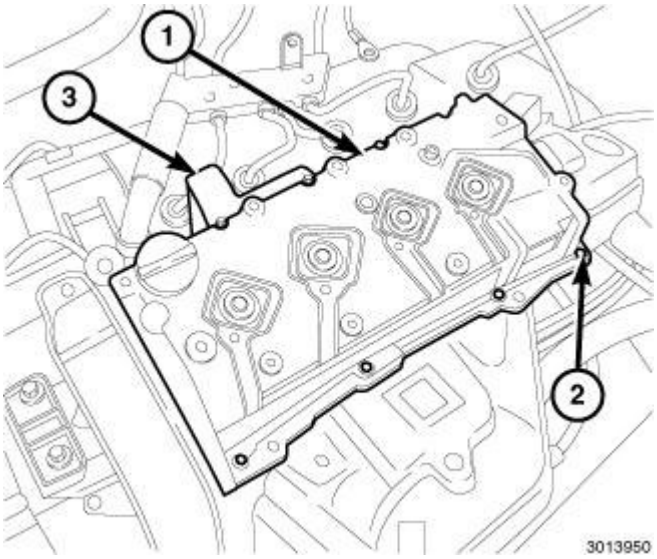


Fig. 113: Cylinder Head Cover, Fuel Rail Blocker & Bolts
Courtesy of CHRYSLER GROUP, LLC

14. Install the cylinder head cover (1). Refer to **COVER(S), CYLINDER HEAD, INSTALLATION**.

NOTE: The Cam/Crank Variation Relearn procedure must be performed using the scan tool anytime there has been a repair/replacement made to a powertrain system, for example: flywheel, valvetrain, camshaft and/or crankshaft sensors or components. Refer to the appropriate Diagnostic Information .

CAMSHAFT, ENGINE

DESCRIPTION

DESCRIPTION

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Fig. 114: Engine Camshaft
Courtesy of CHRYSLER GROUP, LLC

The 1.4L engine uses a Single Over Head Camshaft (SOHC) to provide valve actuation but the camshaft is in the standard position of an exhaust camshaft in a Double Over Head Camshaft (DOHC) engine. The camshaft has five bearing journal surfaces and three cam lobes per cylinder. The camshaft is built up on a hollow tube with cam lobes, bearing journals and end caps pressed into position. The front end cap includes the camshaft sprocket mounting and front bearing journal with end play thrust walls. The rear end cap is the camshaft position sensor pick-up wheel and also drives the vacuum pump.

OPERATION

OPERATION

The camshaft is driven by the crankshaft via drive sprockets and belt. As the crankshaft turns, the timing belt turns the camshaft. The camshaft has precisely machined lobes to provide accurate valve timing and duration.

The exhaust camshaft lobes are located directly over the exhaust valves and are actuated through bucket style hydraulic lash adjusters. The third lobe on the camshaft functions as an intake lobe. This lobe drives a roller follower rocker arm mounted to the variable valve actuator assembly. The rocker arm drives a pumping element within the variable valve actuator that creates oil pressure needed to open the intake valves.

The camshaft is supported by five bearing journals. The front and rear bearing journal caps are located to the camshaft housing with dowel pins. Camshaft end play is controlled by two thrust walls that border the nose piece journal. Camshaft bearing lubrication is provided via a oil supply passage through the camshaft bearing housing and from an orifice in the rocker arm ball socket.

STANDARD PROCEDURE

STANDARD PROCEDURE - CAMSHAFT END PLAY

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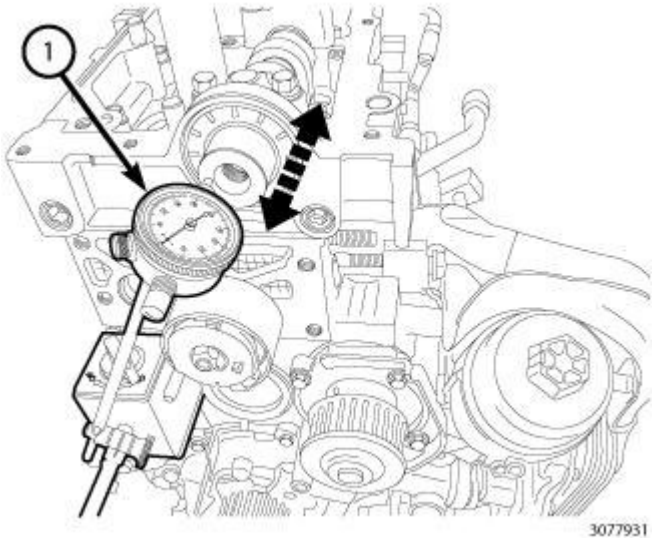


Fig. 115: Measuring Camshaft End Play
Courtesy of CHRYSLER GROUP, LLC

1. Remove the cylinder head cover. Refer to **COVER(S), CYLINDER HEAD, REMOVAL**.
2. Mount Dial Indicator Set (special tool #C-3339A, Set, Dial Indicator) (1) to a stationary point at the front of the engine. Locate the probe perpendicular against the nose of the camshaft.
3. Move the camshaft all the way to the rear of its travel.
4. Zero the dial indicator.
5. Move the camshaft forward to the limit of travel and read the dial indicator. Compare the measured end play to the specification. Refer to **SPECIFICATIONS** .

REMOVAL

REMOVAL

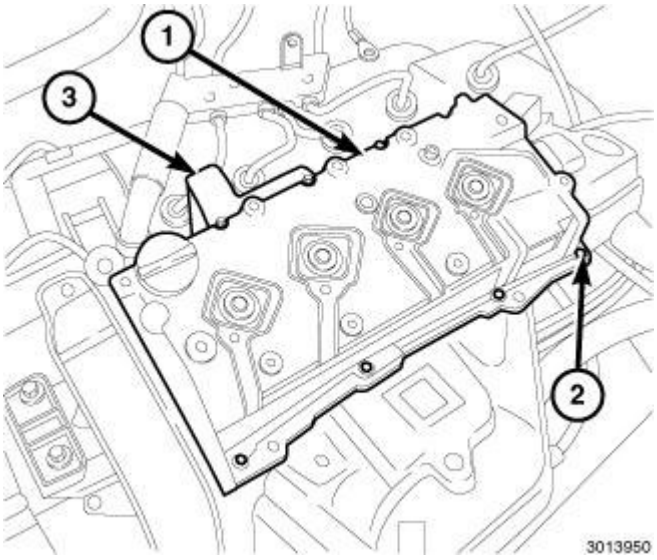


Fig. 116: Cylinder Head Cover, Fuel Rail Blocker & Bolts

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Courtesy of CHRYSLER GROUP, LLC

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

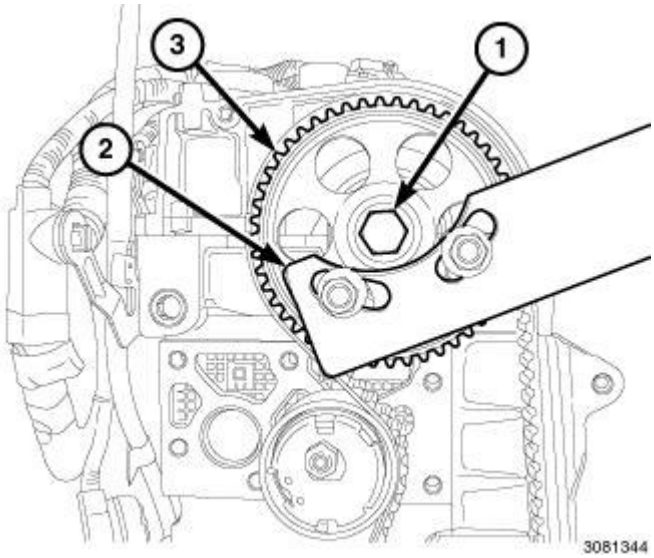


Fig. 117: Camshaft Sprocket, Holder & Bolt
Courtesy of CHRYSLER GROUP, LLC

2. Remove the timing belt. Refer to **BELT, TIMING, REMOVAL**.
3. Use the (special tool #6847, Holder, Camshaft Sprocket) (2) and remove the bolt (1) and the camshaft sprocket (3).

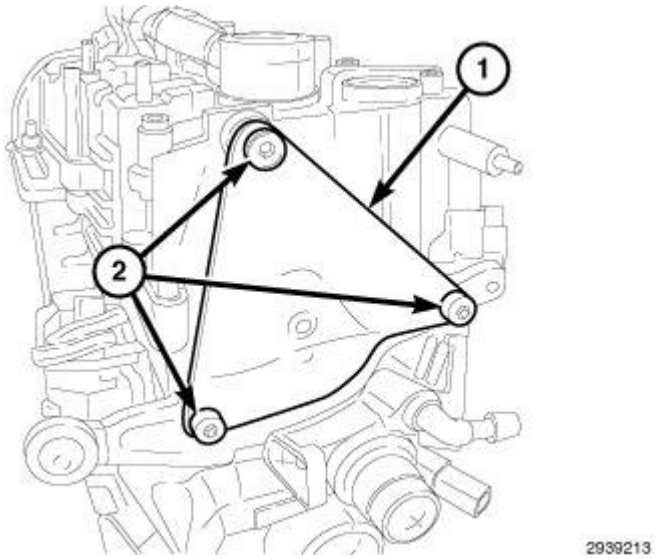


Fig. 118: Camshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

4. Remove the three bolts (2) and the (special tool #10277, Tool, Camshaft Timing Locking) (1).

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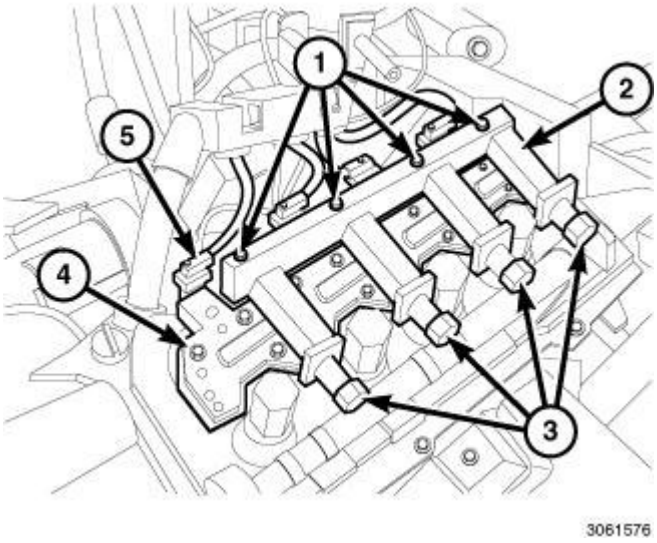


Fig. 119: Variable Valve Actuation Assembly Removal/Installation Tool & Variable Valve Timing Actuator Connectors
Courtesy of CHRYSLER GROUP, LLC

5. Install the (special tool #10259B, Compressor, MultiAir® Spring) (2) with four bolts (1) tightened to 9 N.m (80 in. lbs.).
6. Rotate the spring compressors (3) CCW until fully seated.

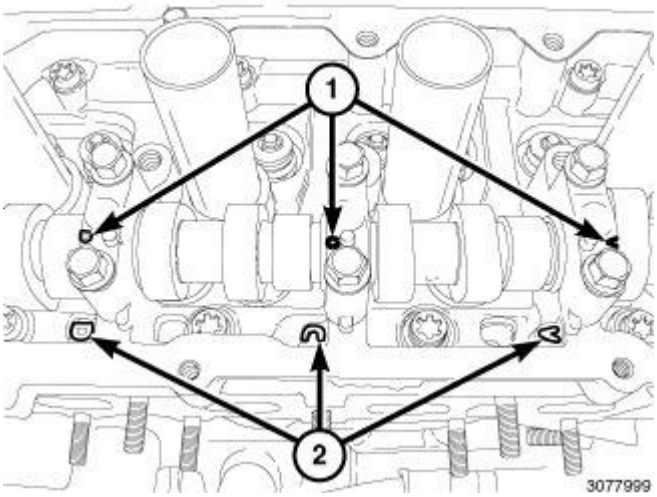


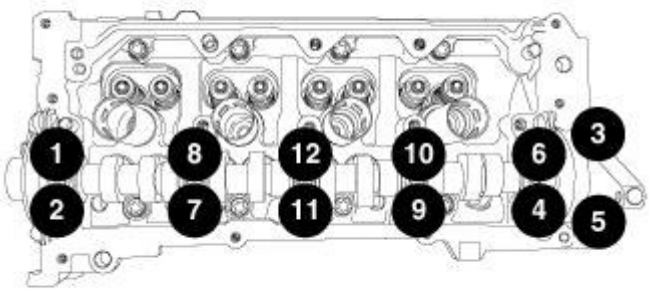
Fig. 120: Markings On Camshaft Caps & Housing
Courtesy of CHRYSLER GROUP, LLC

NOTE: Camshaft bearing caps are marked during engine manufacturing. For example, the center camshaft bearing cap is marked "C". The markings on the caps (1) should align with the markings on the camshaft housing (2).

CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS.

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SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.



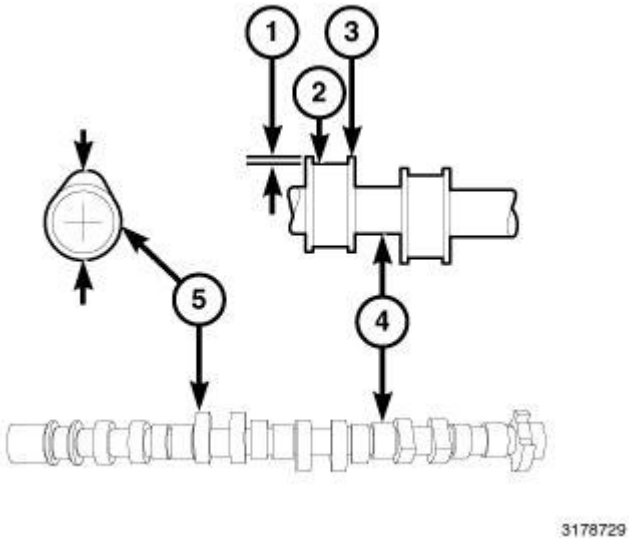
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Fig. 121: Camshaft Bearing Cap Bolt Removal Sequence
Courtesy of CHRYSLER GROUP, LLC

7. Slowly loosen the camshaft bearing cap bolts in the sequence shown in illustration.
8. Remove the camshaft bearing caps and the camshaft.

INSPECTION

INSPECTION



3178729

Fig. 122: Inspecting Camshaft Wear Areas
Courtesy of CHRYSLER GROUP, LLC

1. Inspect the camshaft bearing journals (4) for damage and binding. If the journals are binding, check the

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camshaft bearing housing for damage. Also check the oil supply holes for clogging.

2. Check the surface of the cam lobes (5) for abnormal wear (1). Measure and compare the unworn area (3) to the worn area (2). Replace the camshaft if it is not within specification. Refer to **SPECIFICATIONS** .

INSTALLATION

INSTALLATION

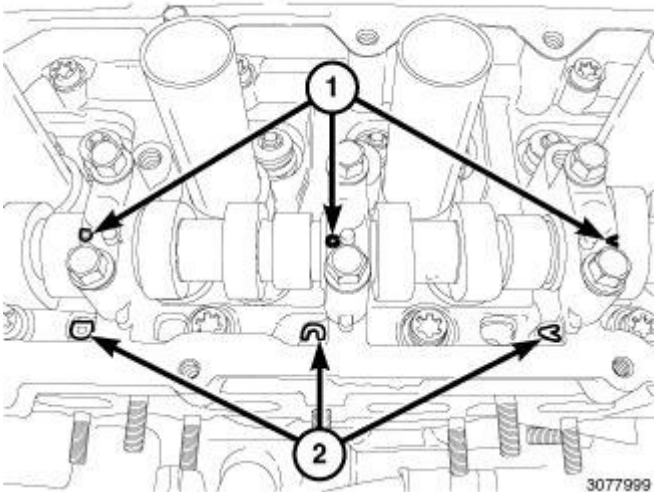


Fig. 123: Markings On Camshaft Caps & Housing
Courtesy of CHRYSLER GROUP, LLC

NOTE: Camshaft bearing caps are marked during engine manufacturing. For example, the center camshaft bearing cap is marked "C". The markings on the caps (1) should align with the markings on the camshaft housing (2).

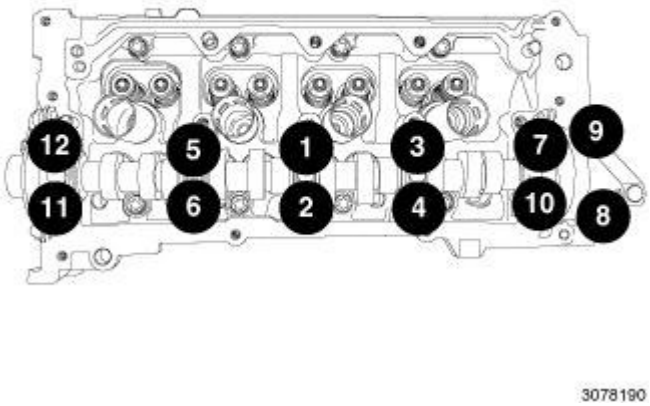


Fig. 124: Camshaft Bearing Cap Tightening Sequence

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Courtesy of CHRYSLER GROUP, LLC

NOTE: Following the installation of each camshaft bearing cap, visually verify that the camshaft has some endplay.

1. Lubricate camshaft journals with clean engine oil.
2. Apply a seam of Anaerobic Loctite® 518 Sealant on the camshaft housing in the contact area of the front and rear camshaft caps.
3. Install the camshaft and camshaft bearing caps. Tighten the twelve bolts in two steps following the sequence shown in illustration:
   - Step 1: All to 5 N.m (44 in. lbs.).
   - Step 2: All to 10 N.m (89 in. lbs.).

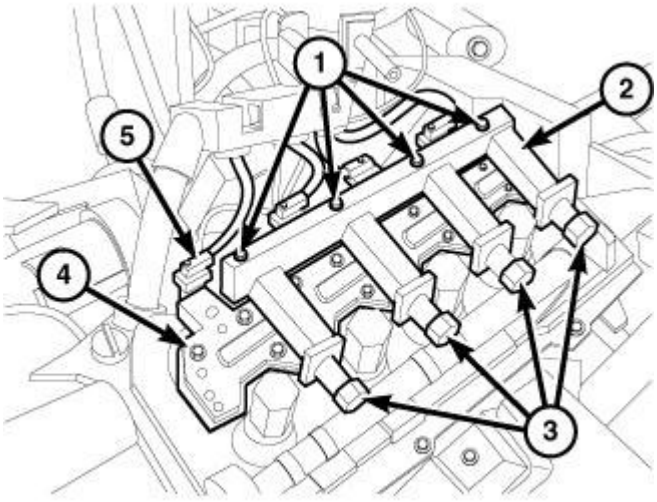


Fig. 125: Variable Valve Actuation Assembly Removal/Installation Tool & Variable Valve Timing Actuator Connectors
Courtesy of CHRYSLER GROUP, LLC

4. Loosen the spring compressors (3), remove the four bolts (1) and the (special tool #10259B, Compressor, MultiAir® Spring) (2).

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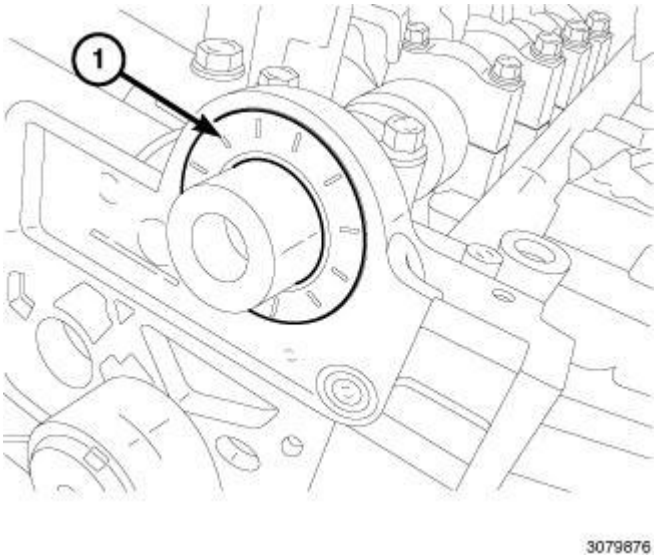


Fig. 126: Camshaft Seal
Courtesy of CHRYSLER GROUP, LLC

5. If required, install a new camshaft seal (1). Refer to **SEAL(S), CAMSHAFT, INSTALLATION**.
6. Install the camshaft sprocket and timing belt. Refer to **BELT, TIMING, INSTALLATION**.
7. Install the cylinder head cover. Refer to **COVER(S), CYLINDER HEAD, INSTALLATION**.

NOTE: The Cam/Crank Variation Relearn procedure must be performed using the scan tool anytime there has been a repair/replacement made to a powertrain system, for example: flywheel, valvetrain, camshaft and/or crankshaft sensors or components. Refer to the appropriate Diagnostic Information.

COVER(S), CYLINDER HEAD

DESCRIPTION

DESCRIPTION

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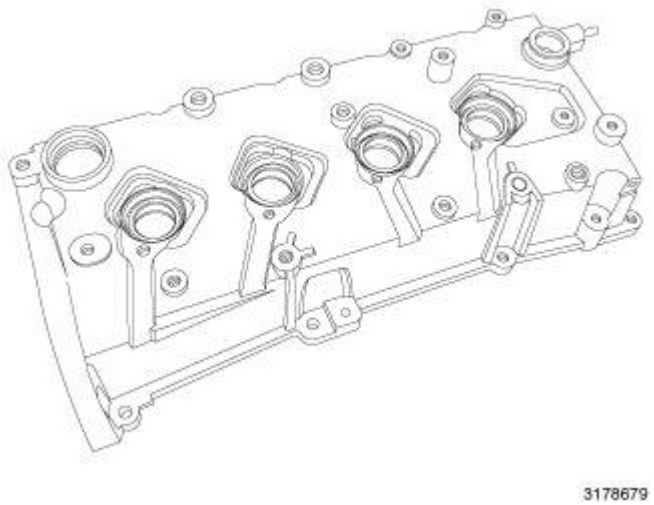


Fig. 127: Cylinder Head Cover
Courtesy of CHRYSLER GROUP, LLC

The cylinder head cover is made of die cast aluminum. The cylinder head cover is sealed with a press-in-place gasket. RTV is used to seal the T-joint at the camshaft bearing caps, variable valve actuator and cylinder head cover.

REMOVAL

REMOVAL

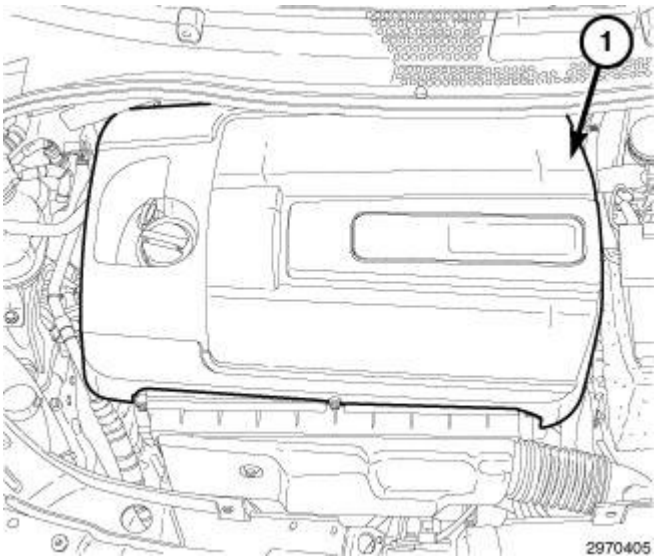


Fig. 128: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

1. Perform the fuel pressure release procedure. Refer to **FUEL DELIVERY, GAS, STANDARD PROCEDURE** .
2. Disconnect and isolate the negative battery cable.

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3. Recover the refrigerant from the refrigerant system. Refer to **PLUMBING, STANDARD PROCEDURE** .
4. Remove the engine cover (1).

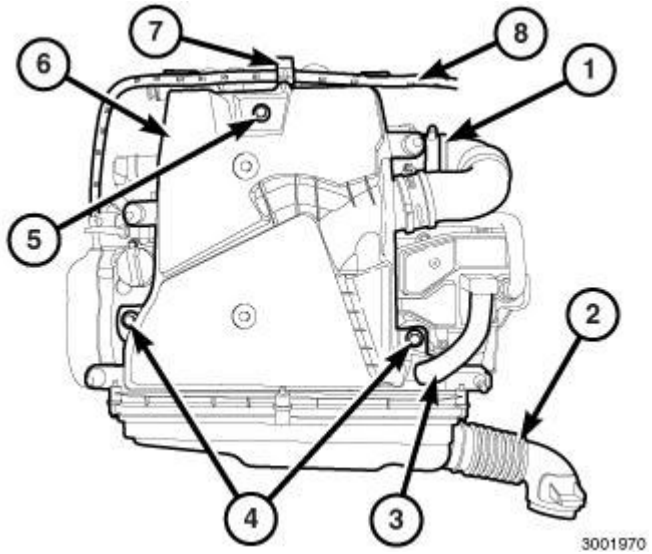


Fig. 129: Air Cleaner Body Assembly
Courtesy of CHRYSLER GROUP, LLC

5. Remove the air cleaner body (6). Refer to **BODY, AIR CLEANER, REMOVAL**.

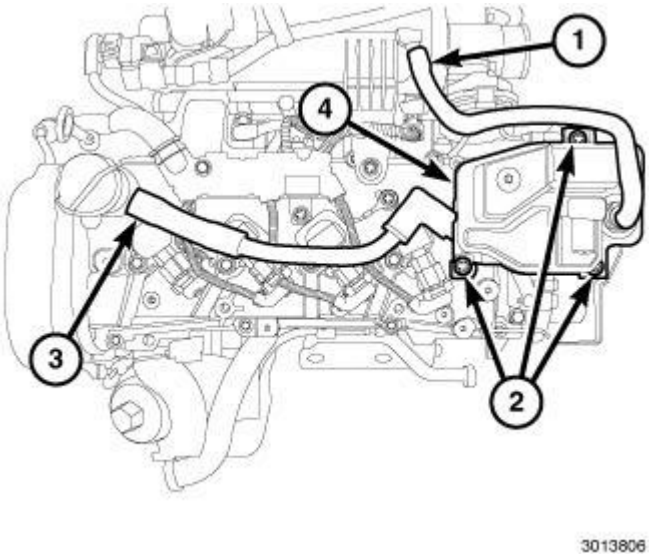


Fig. 130: PCV Hose, Bolts, Vent Hose & Oil Separator Housing
Courtesy of CHRYSLER GROUP, LLC

6. Disconnect the PCV hose (1) from the intake manifold.
7. Disconnect the vent hose (3) from the oil filler neck.
8. Remove three bolts (2) and remove the oil separator housing (4) from the cylinder head cover.

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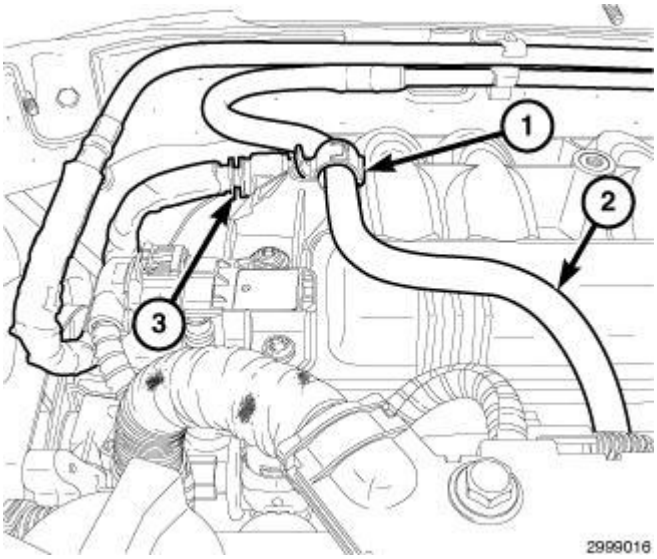


Fig. 131: Fuel Line, Hose Retainer & Fuel Vapor Purge Hose
Courtesy of CHRYSLER GROUP, LLC

9. Disconnect the fuel vapor purge hose (3) from the intake manifold.
10. Open the hose retainer (1) and disconnect the fuel line (2) from the fuel rail. Refer to **FITTING, QUICK CONNECT, STANDARD PROCEDURE** .

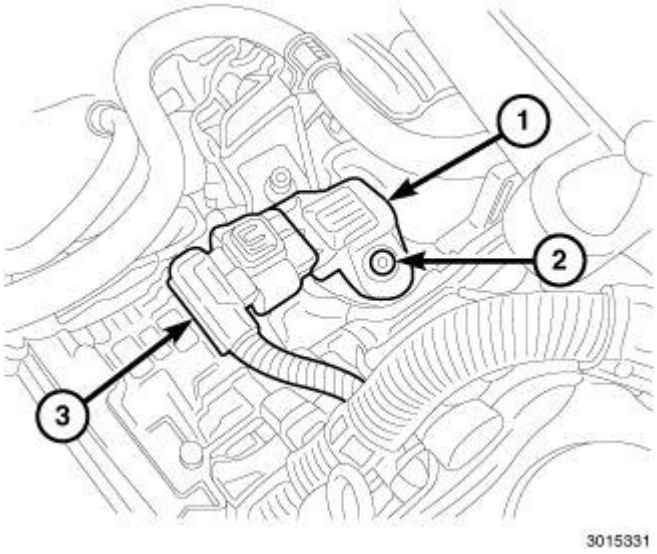


Fig. 132: IAT/MAP Sensor, Connector & Bolt
Courtesy of CHRYSLER GROUP, LLC

11. Unlock and disconnect the IAT/MAP sensor electrical connector (3).

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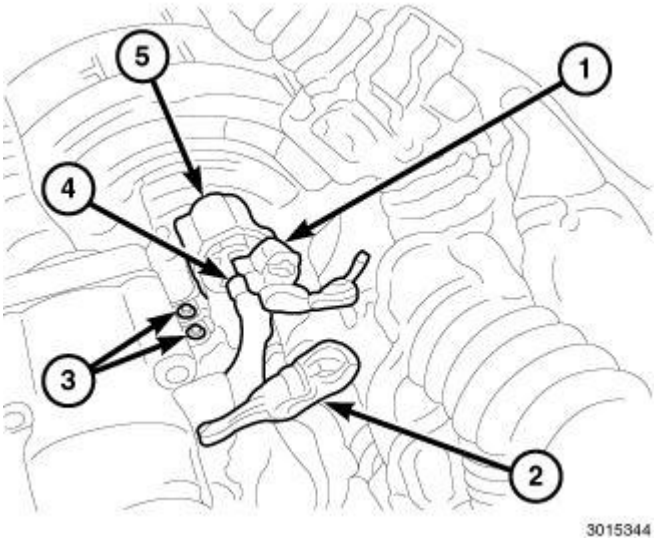


Fig. 133: Evaporative Emissions Purge Solenoid Connector, Fuel Injector Wire Harness Connector & Fasteners
Courtesy of CHRYSLER GROUP, LLC

12. Unlock and disconnect the evaporative emissions purge solenoid electrical connector (1).
13. Unlock and disconnect the fuel injector wire harness electrical connector (2).

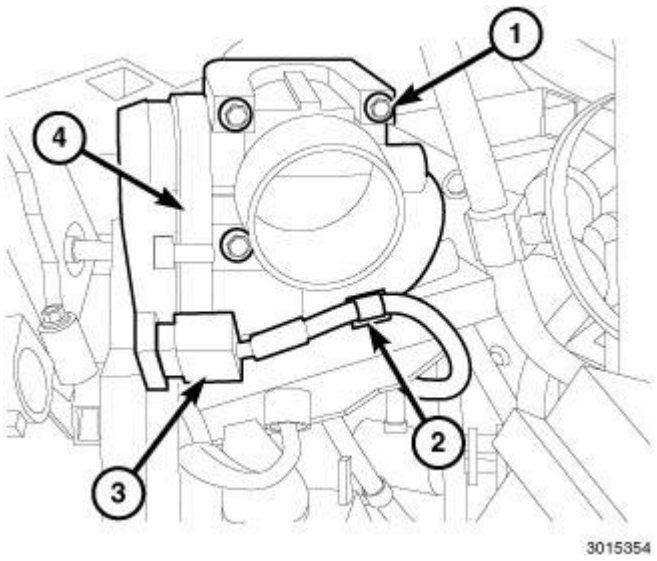


Fig. 134: Electronic Throttle Control, Connector, Clip & Bolts
Courtesy of CHRYSLER GROUP, LLC

14. Unlock and disconnect the electrical connector (3) from the Electronic Throttle Control (ETC) (4) and disengage the ETC harness from the clip (2) on the throttle body.

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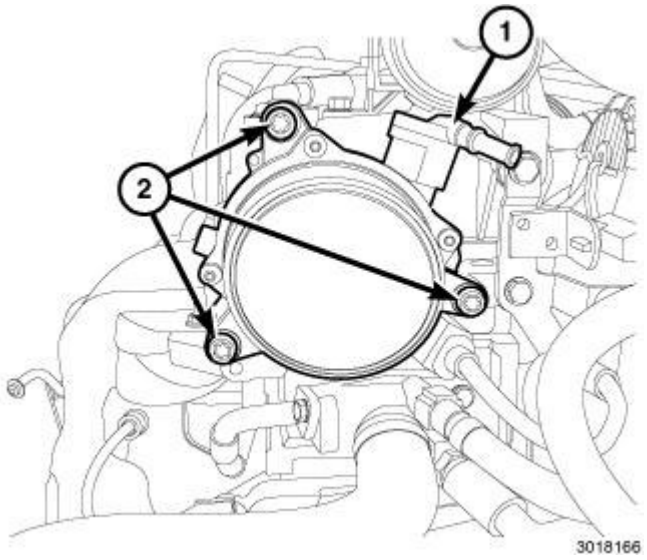


Fig. 135: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When servicing components near the vacuum pump, avoid contact with the plastic nipple that connects the vacuum pump to the brake booster hose. It is possible to crack the plastic nipple resulting in a brake booster vacuum leak.

15. Disconnect the vacuum line from the vacuum pump (1).

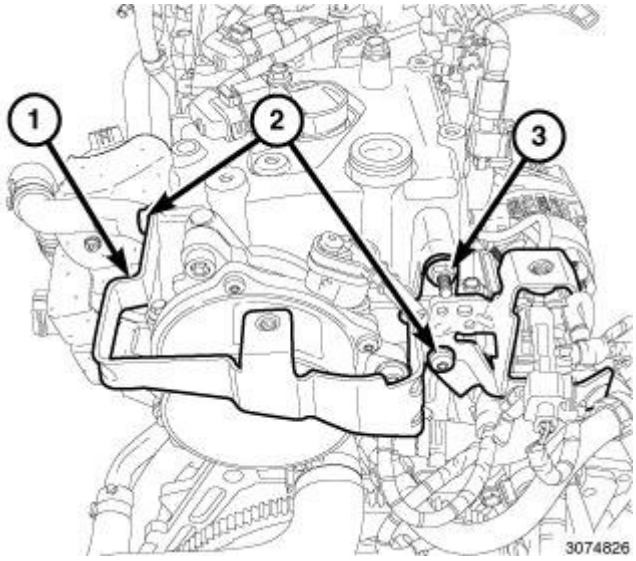


Fig. 136: Oil Separator Housing Bracket & Fasteners
Courtesy of CHRYSLER GROUP, LLC

16. Remove two bolts (2), one nut (3) and reposition the oil separator housing bracket (1).

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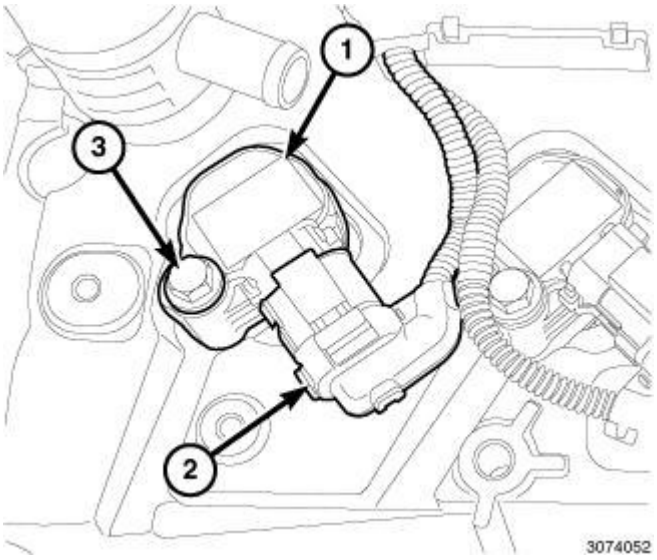


Fig. 137: Ignition Coil, Connector & Bolt
Courtesy of CHRYSLER GROUP, LLC

NOTE: Number 1 cylinder ignition coil shown in illustration, all others similar.

17. Remove the ignition coils (1). Refer to **COIL, IGNITION, REMOVAL** .

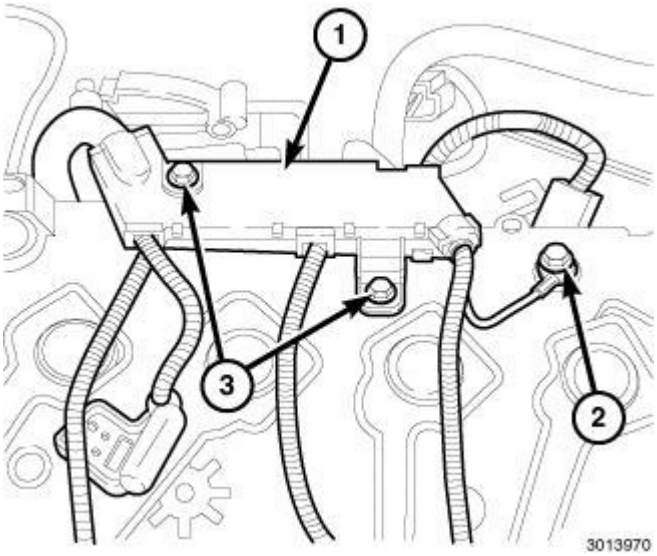


Fig. 138: Wire Harness Duct & Bolts
Courtesy of CHRYSLER GROUP, LLC

18. Remove the bolt (2) and the ground lug from the cylinder head cover.
19. Remove two bolts (3) and reposition the wire harness duct (1).

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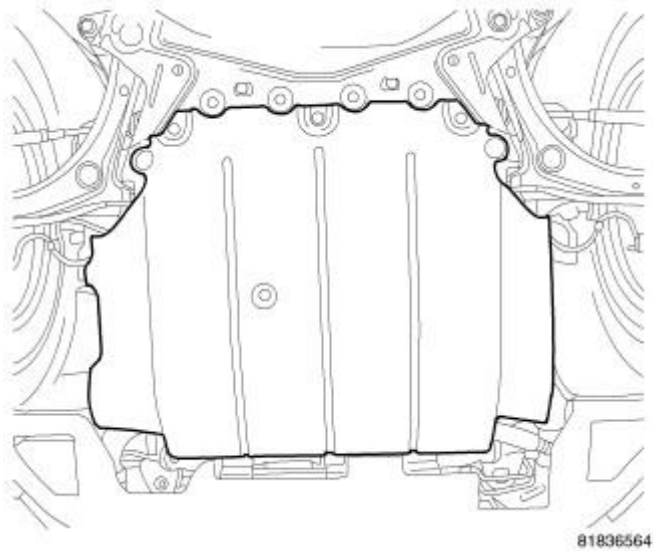


Fig. 139: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

20. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
21. Remove the belly pan. Refer to **BELLY PAN, REMOVAL** .

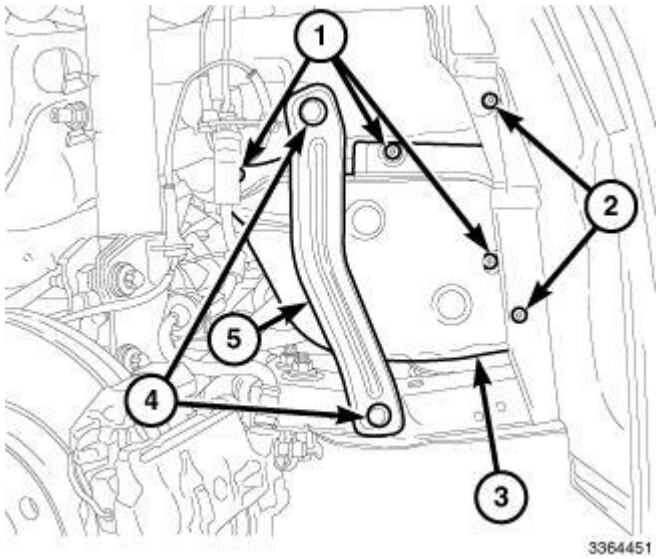


Fig. 140: Right Vertical Brace, Frame Splash Shield & Fasteners
Courtesy of CHRYSLER GROUP, LLC

22. Remove two bolts (4) and the right vertical brace (5).
23. Remove two screws (2) from the front wheelhouse splash shield.
24. Remove three screws (1) and the frame splash shield (3).

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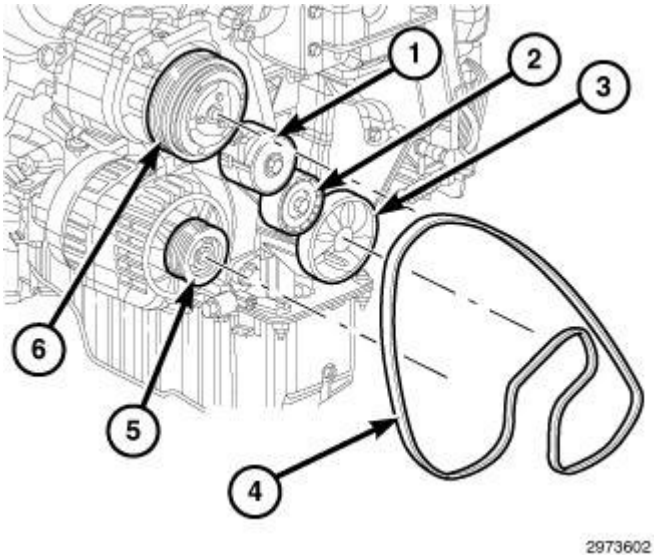


Fig. 141: Drive Belt Tensioners & Assembly With Drive Belt Routing
Courtesy of CHRYSLER GROUP, LLC

25. Remove the accessory drive belt (4). Refer to **BELT, SERPENTINE, REMOVAL** .

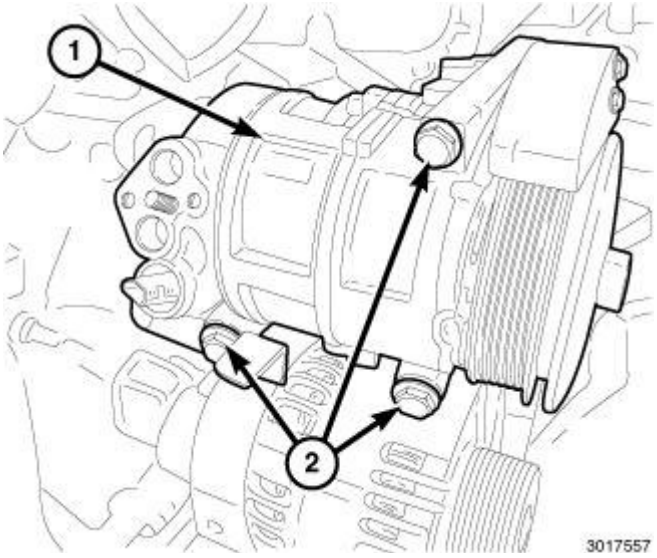


Fig. 142: A/C Compressor & Fasteners
Courtesy of CHRYSLER GROUP, LLC

26. Remove the A/C compressor (1). Refer to **COMPRESSOR, A/C, REMOVAL** .

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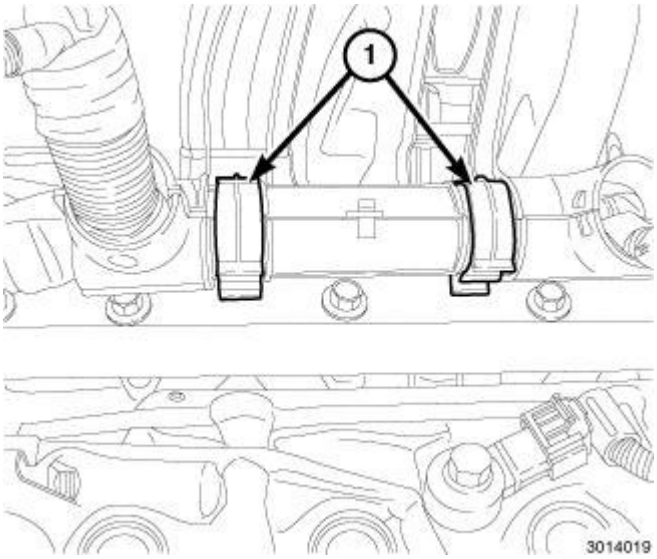


Fig. 143: Wire Harness Retainers
Courtesy of CHRYSLER GROUP, LLC

27. Open the two wire harness retainers (1) and reposition the wire harness.

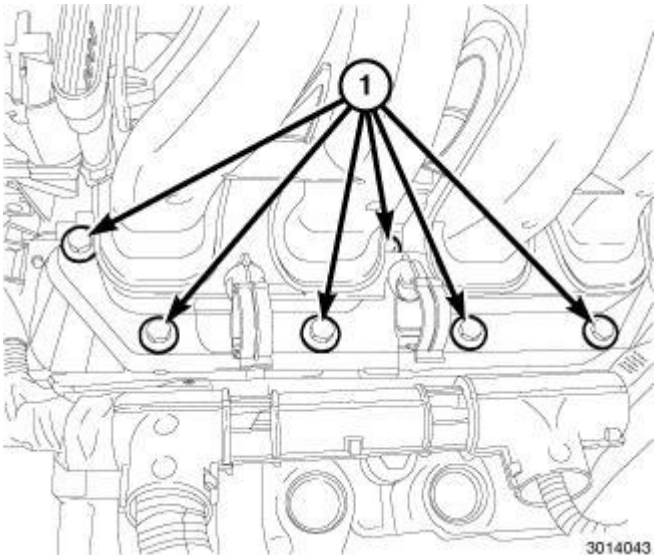


Fig. 144: Intake Manifold Flange Bolts
Courtesy of CHRYSLER GROUP, LLC

28. Remove six of the seven intake manifold flange bolts (1).

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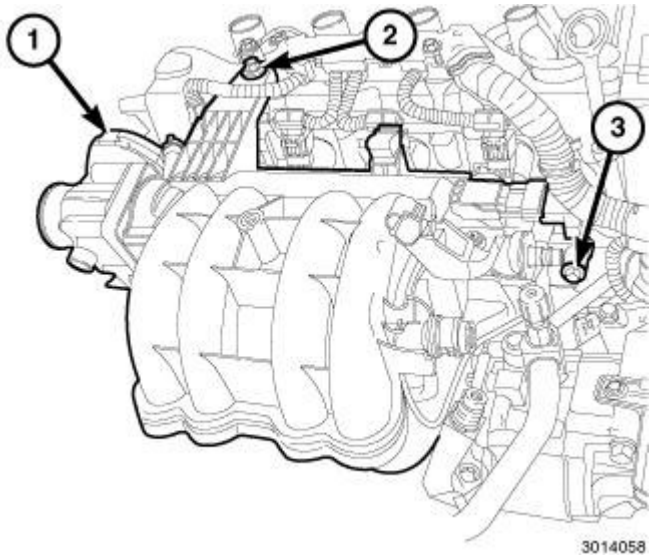


Fig. 145: Intake Manifold & Fasteners
Courtesy of CHRYSLER GROUP, LLC

29. Lower the vehicle.
30. Remove the remaining intake manifold flange bolt (3), the intake manifold support bolt (2) and reposition the intake manifold (1).

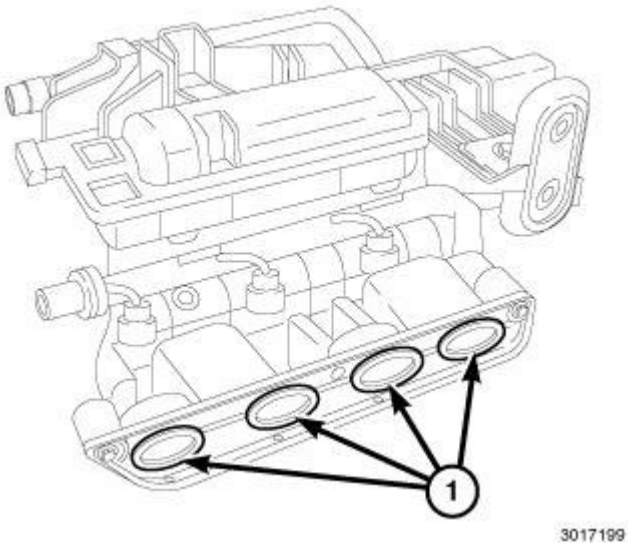


Fig. 146: Intake Manifold Seals
Courtesy of CHRYSLER GROUP, LLC

31. Remove and discard the four intake manifold seals (1).
32. Cover the open intake ports to prevent debris from entering the engine.

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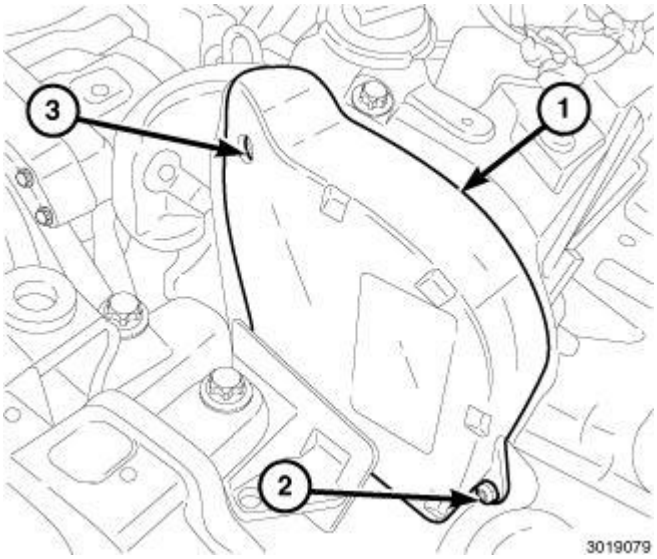


Fig. 147: Upper Timing Belt Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

33. Remove the bolt (3) from the upper timing belt cover (1).

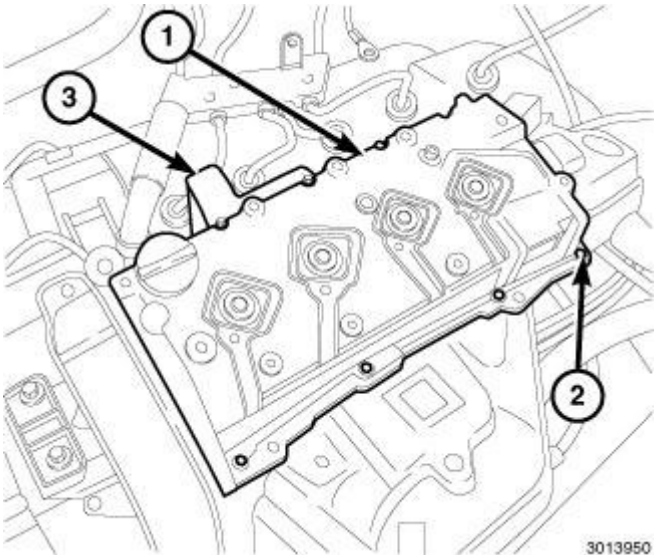


Fig. 148: Cylinder Head Cover, Fuel Rail Blocker & Bolts
Courtesy of CHRYSLER GROUP, LLC

34. Remove twelve bolts (2), the fuel rail blocker (3) and the cylinder head cover (1).

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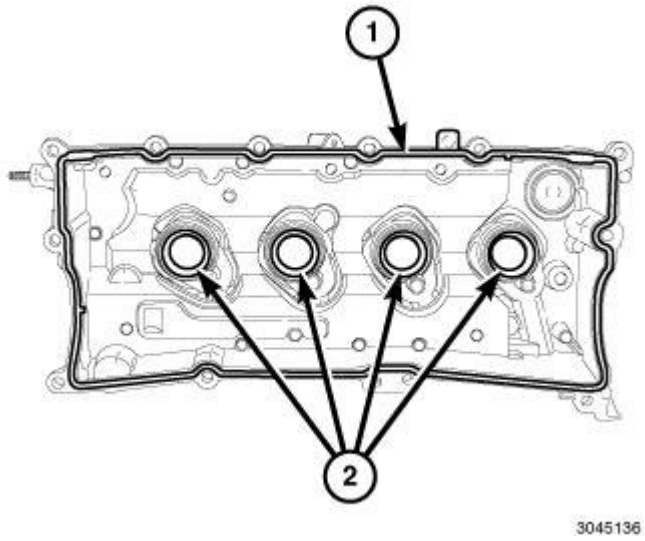


Fig. 149: Cylinder Head Cover Gasket & Spark Plug Tube Seals
Courtesy of CHRYSLER GROUP, LLC

35. Remove and discard the cylinder head cover gasket (1).
36. The spark plug tube seals (2) can be reused if not damaged.

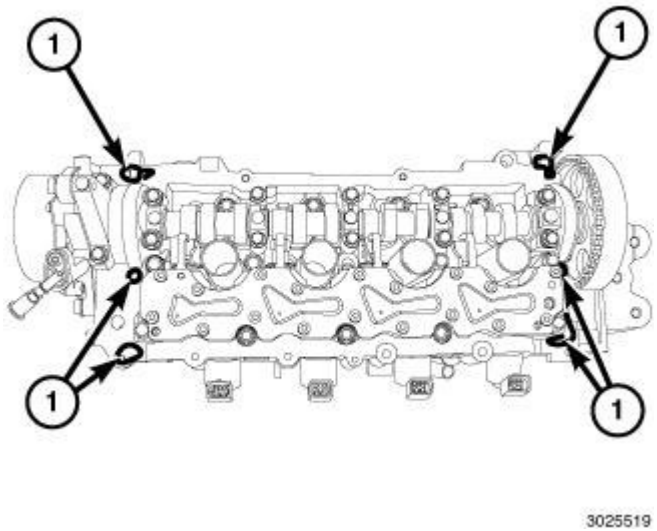


Fig. 150: Residual Sealant Locations
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not use oil based liquids, wire brushes, abrasive wheels or metal scrapers to clean the engine gasket surfaces. Use only isopropyl (rubbing) alcohol, along with plastic or wooden scrapers. Improper gasket surface preparation may result in engine fluid leakage.

37. Remove all residual sealant (1) from the variable valve actuator assembly, camshaft caps, camshaft housing and cylinder head cover mating surfaces. Refer to **ENGINE GASKET SURFACE**

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PREPARATION .

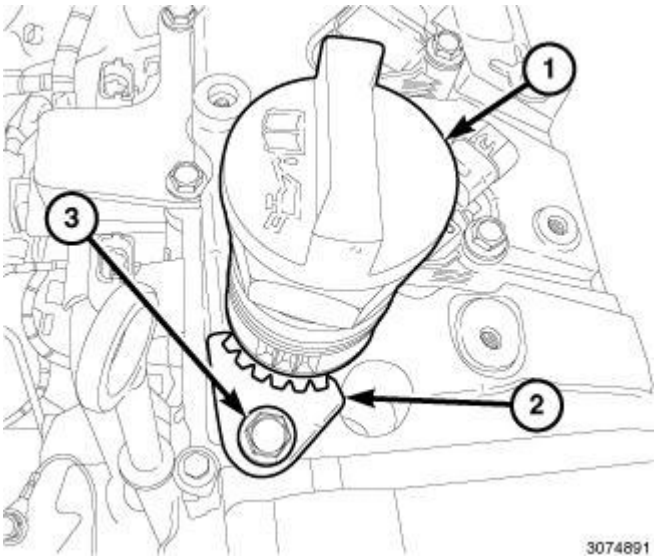


Fig. 151: Oil Filler Neck, Oil Filler Neck Lock & Bolt
Courtesy of CHRYSLER GROUP, LLC

38. If required, remove the bolt (3), oil filler neck lock (2) and the oil filler neck (1) from the cylinder head cover.

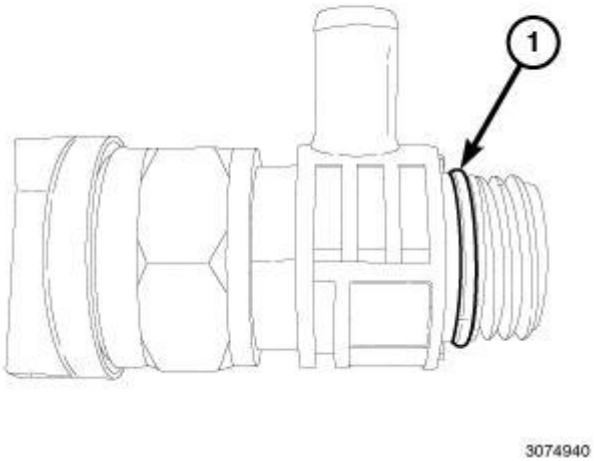


Fig. 152: Oil Filler Neck O-Ring
Courtesy of CHRYSLER GROUP, LLC

39. The oil filler neck O-ring (1) can be reused if not damaged.

INSTALLATION

INSTALLATION

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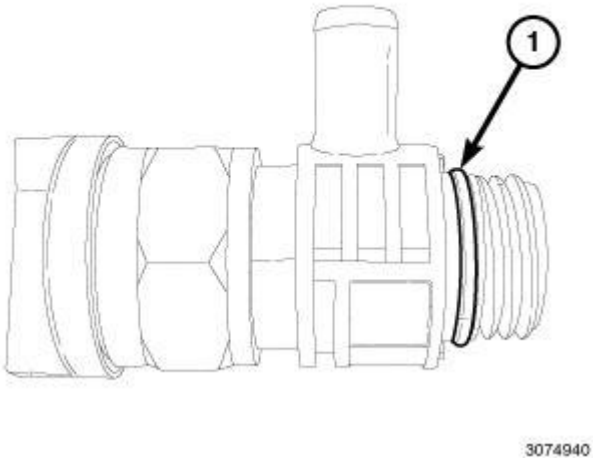


Fig. 153: Oil Filler Neck O-Ring
Courtesy of CHRYSLER GROUP, LLC

1. If required, install a new oil filler neck O-ring (1).

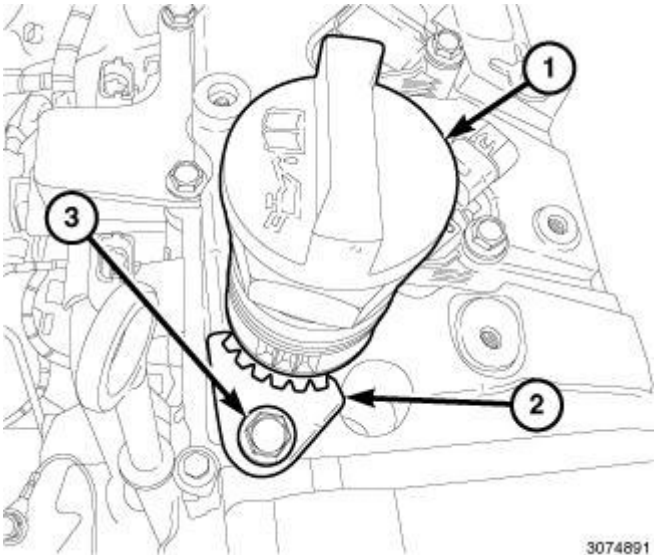


Fig. 154: Oil Filler Neck, Oil Filler Neck Lock & Bolt
Courtesy of CHRYSLER GROUP, LLC

2. If required, install the oil filler neck (1) to the cylinder head cover. Secure the oil filler neck (1) with the oil filler neck lock (2) and bolt (3) tightened to 9 N.m (80 in. lbs.).

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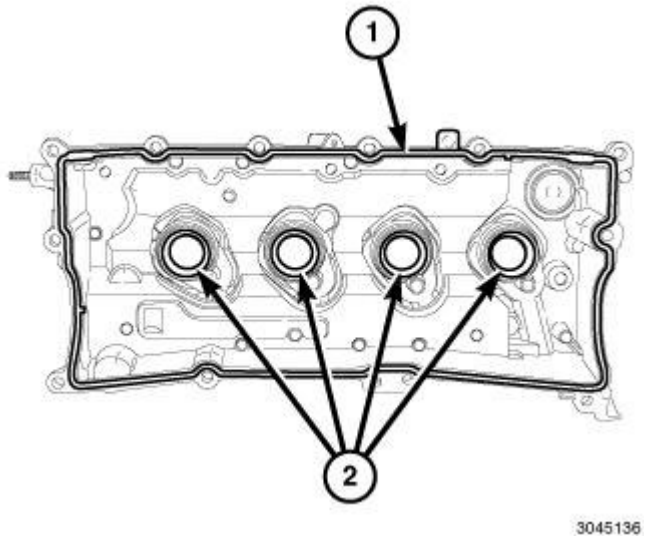


Fig. 155: Cylinder Head Cover Gasket & Spark Plug Tube Seals
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When servicing components near the vacuum pump, avoid contact with the plastic nipple that connects the vacuum pump to the brake booster hose. It is possible to crack the plastic nipple resulting in a brake booster vacuum leak.

3. Install the cylinder head cover gasket (1).
4. The spark plug tube seals (2) can be reused if not damaged.

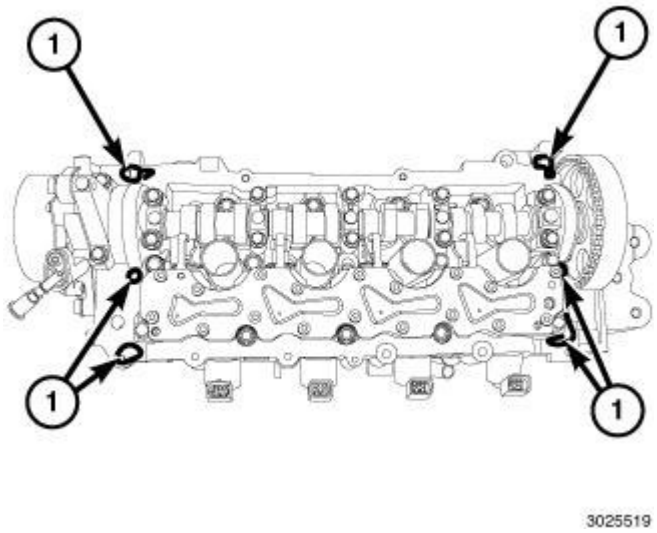


Fig. 156: Residual Sealant Locations
Courtesy of CHRYSLER GROUP, LLC

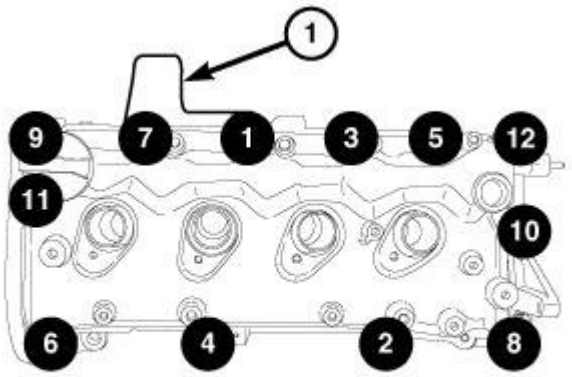
5. Clean the variable valve actuator assembly, camshaft caps, camshaft housing and cylinder head cover mating surfaces with isopropyl alcohol in preparation for sealant application.

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CAUTION: Engine assembly requires the use of a unique sealant that is compatible with engine oil. Using a sealant other than Mopar® Engine RTV GEN II may result in engine fluid leakage.

CAUTION: Following the application of Mopar® Engine RTV GEN II to the gasket surfaces, the components must be assembled within 10 minutes and the attaching fasteners must be tightened to specification within the next 10 minutes. Prolonged exposure to the air prior to assembly may result in engine fluid leakage.

6. Apply a 2 to 3 mm wide bead of Mopar® Engine RTV GEN II sealant (1) to the cylinder head cover T-joints as shown in illustration.



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Fig. 157: Cylinder Head Cover & Fuel Rail Blocker Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

7. Install the cylinder head cover and fuel rail blocker (1) with twelve bolts. Tighten the twelve bolts in two steps following the sequence shown in illustration:
   - Step 1: All to 5 N.m (44 in. lbs.).
   - Step 2: All to 9 N.m (80 in. lbs.).

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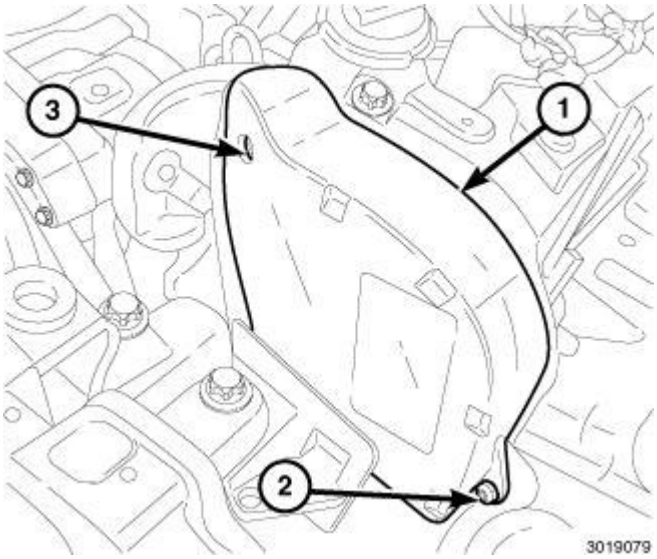


Fig. 158: Upper Timing Belt Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

8. Install the upper timing belt cover (1) with two bolts (2 and 3) tightened to 9 N.m (80 in. lbs.).

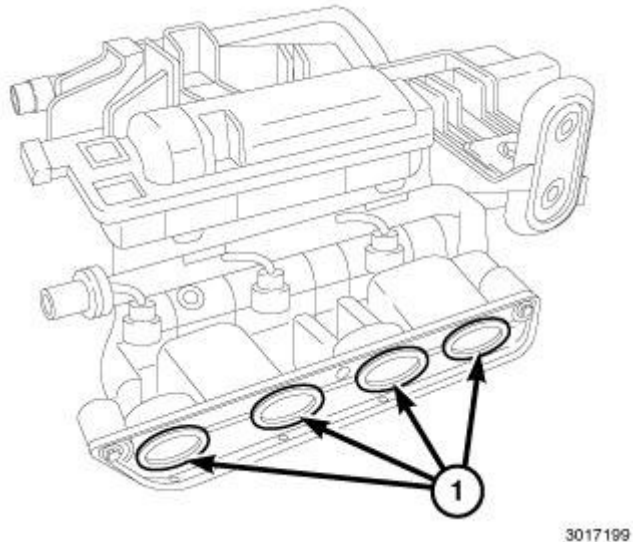


Fig. 159: Intake Manifold Seals
Courtesy of CHRYSLER GROUP, LLC

9. Install four new intake manifold seals (1).

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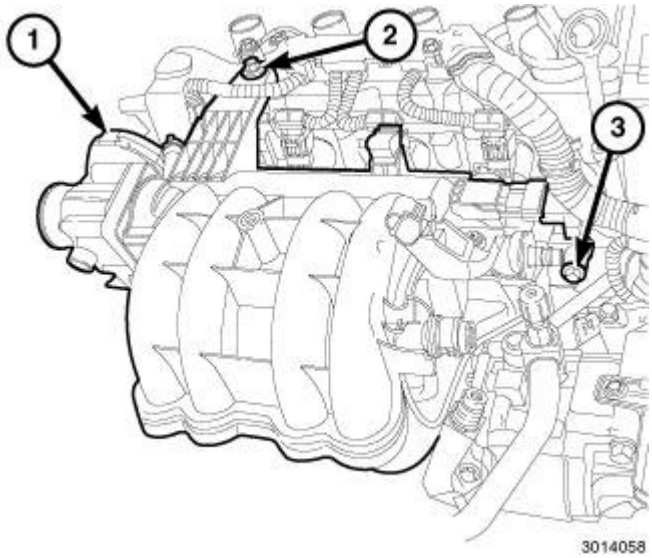


Fig. 160: Intake Manifold & Fasteners
Courtesy of CHRYSLER GROUP, LLC

10. Loosely install an intake manifold flange bolt (3) and the support bolt (2) to hold the intake manifold in position.

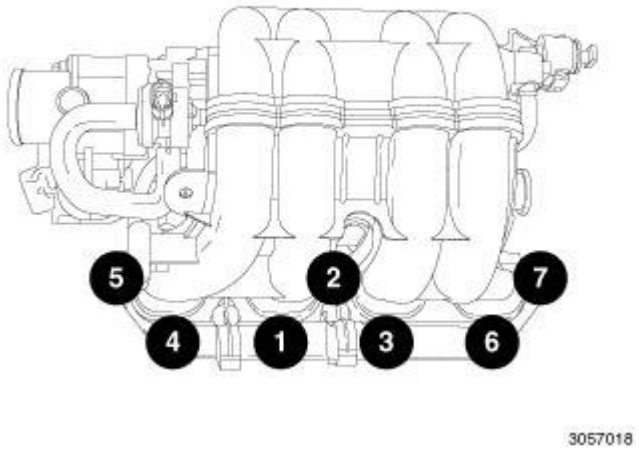


Fig. 161: Intake Manifold Flange Bolts Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

11. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
12. Install the remaining six of the seven intake manifold flange bolts (1). Tighten all seven intake manifold flange bolts in the sequence shown in illustration to 15 N.m (11 ft. lbs.).

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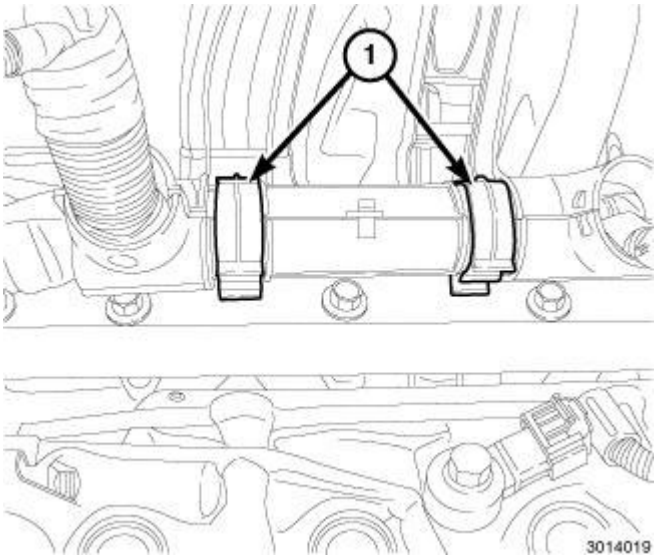


Fig. 162: Wire Harness Retainers
Courtesy of CHRYSLER GROUP, LLC

13. Position the wire harness and close the two wire harness retainers (1).

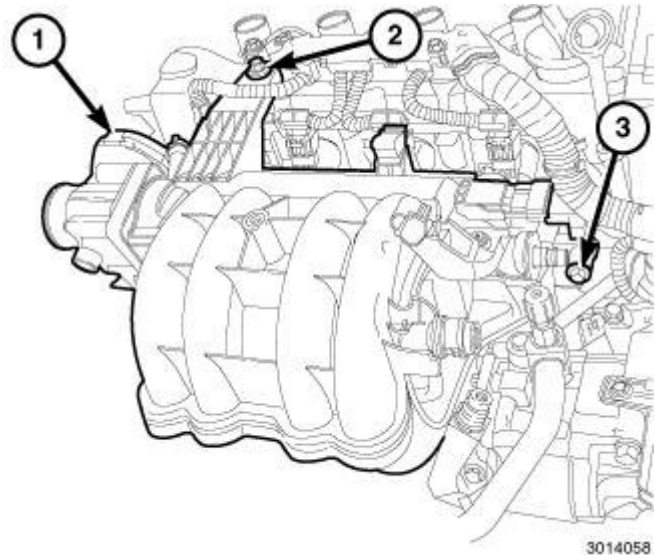


Fig. 163: Intake Manifold & Fasteners
Courtesy of CHRYSLER GROUP, LLC

14. Lower the vehicle.
15. Tighten the intake manifold support bolt (2) to 9 N.m (80 in. lbs.).

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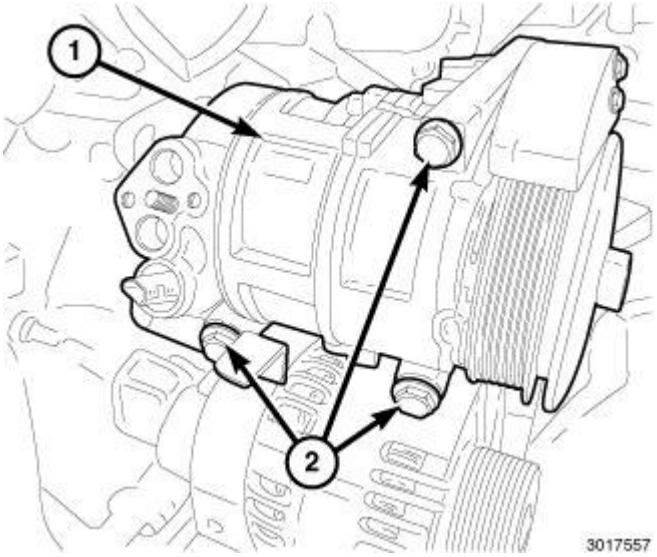


Fig. 164: A/C Compressor & Fasteners
Courtesy of CHRYSLER GROUP, LLC

16. Install the A/C compressor (1). Refer to **COMPRESSOR, A/C, INSTALLATION** .

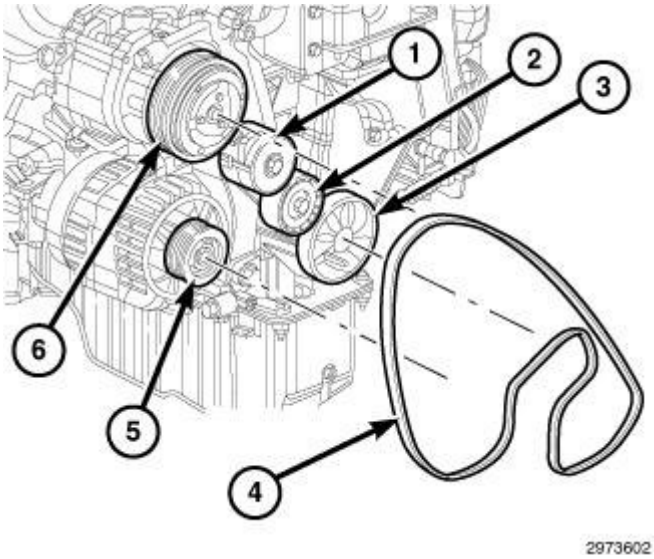


Fig. 165: Drive Belt Tensioners & Assembly With Drive Belt Routing
Courtesy of CHRYSLER GROUP, LLC

17. Install the accessory drive belt (4). Refer to **BELT, SERPENTINE, INSTALLATION** .

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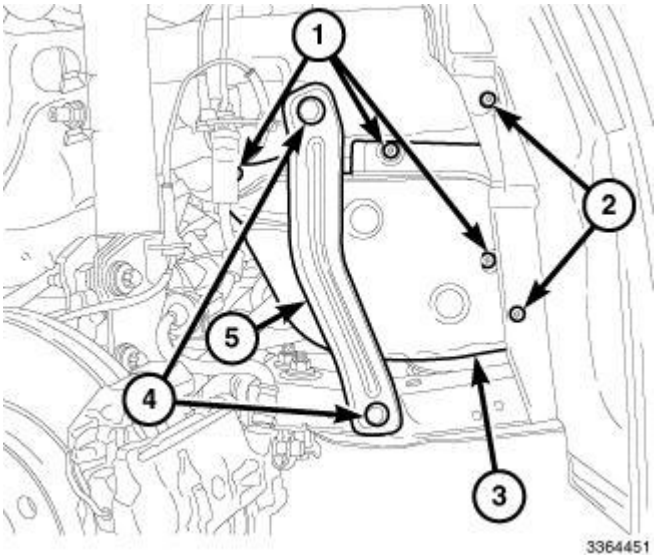


Fig. 166: Right Vertical Brace, Frame Splash Shield & Fasteners
Courtesy of CHRYSLER GROUP, LLC

18. Install the frame splash shield (3) with three screws (1).
19. Install two screws (2) to the front wheelhouse splash shield.
20. Install the right vertical brace (5) with two bolts (4) tightened to 45 N.m (33 ft. lbs.).

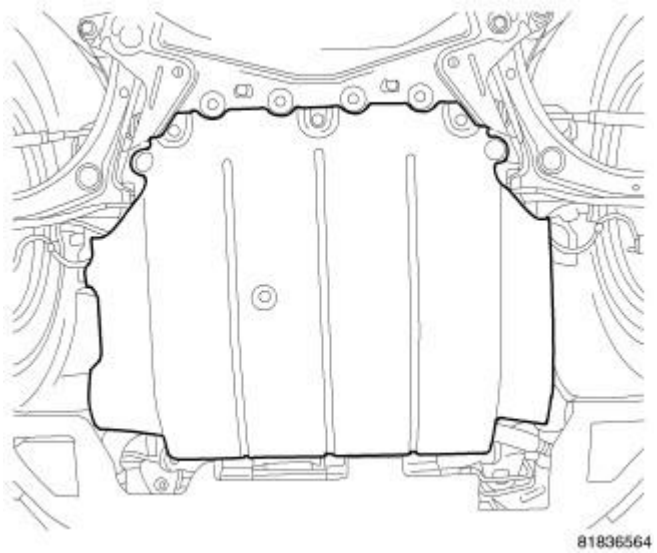


Fig. 167: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

21. Install the belly pan. Refer to **BELLY PAN, INSTALLATION** .

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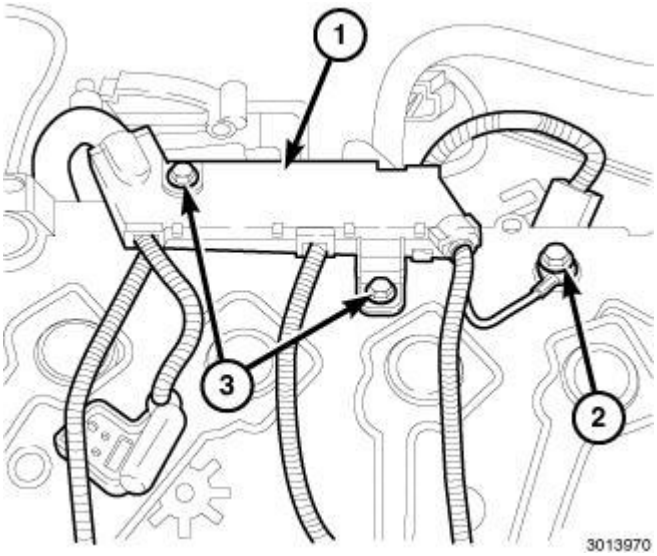


Fig. 168: Wire Harness Duct & Bolts
Courtesy of CHRYSLER GROUP, LLC

22. Install the wiring harness duct (1) to the cylinder head cover with two bolts (3) tightened to 9 N.m (80 in. lbs.).
23. Install the ground lug (2) to the cylinder head cover and tighten the bolt (2) to 9 N.m (80 in. lbs.).

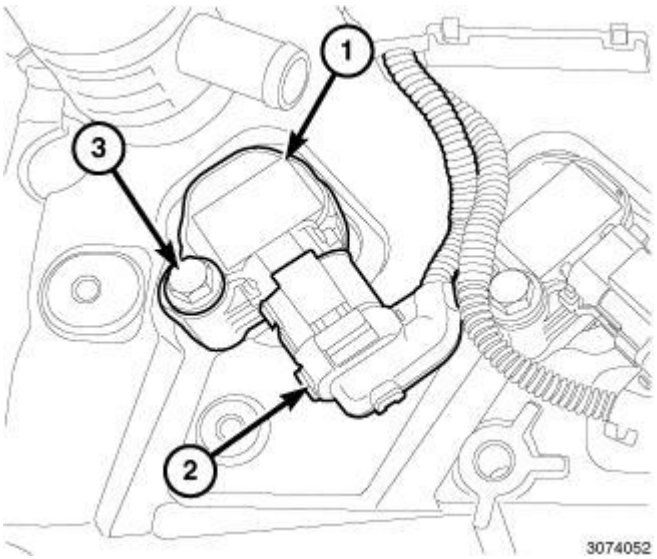


Fig. 169: Ignition Coil, Connector & Bolt
Courtesy of CHRYSLER GROUP, LLC

NOTE: Number 1 cylinder ignition coil shown in illustration, all others similar.

24. Install the ignition coils (1). Refer to **COIL, IGNITION, INSTALLATION** .

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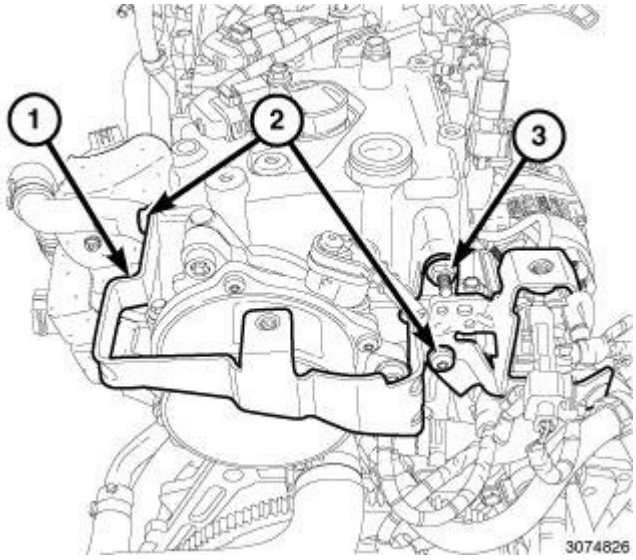


Fig. 170: Oil Separator Housing Bracket & Fasteners
Courtesy of CHRYSLER GROUP, LLC

25. Install the oil separator housing bracket (1) with two bolts (2) and one nut (3). Tighten the three fasteners to 13 N.m (115 in. lbs.).

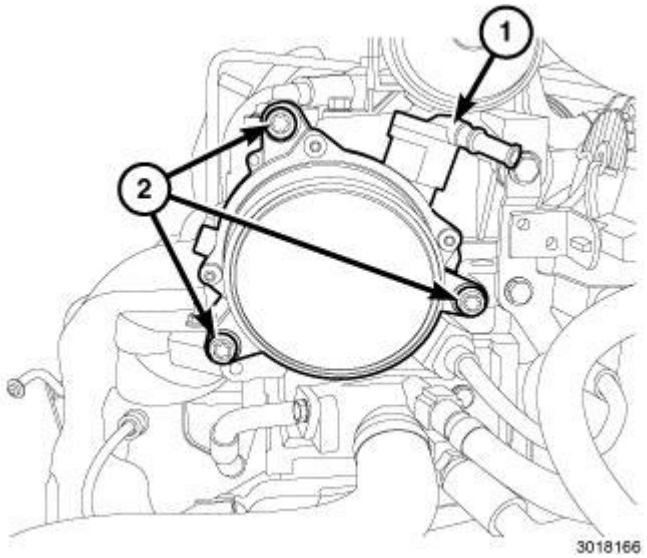


Fig. 171: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

26. Connect the vacuum line to the vacuum pump (1).

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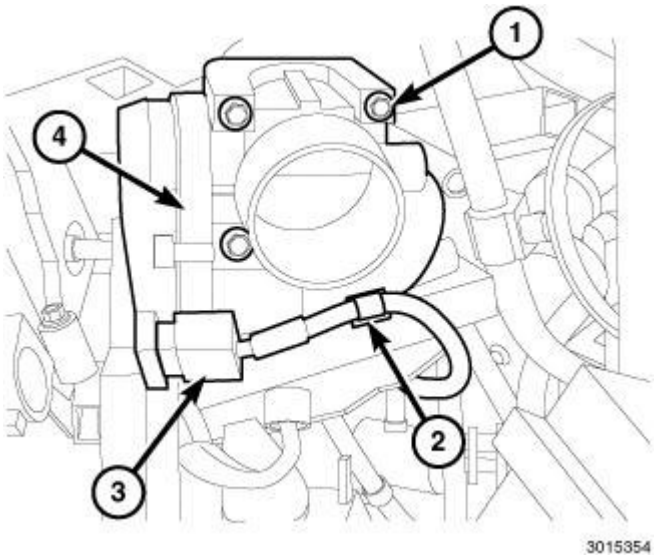


Fig. 172: Electronic Throttle Control, Connector, Clip & Bolts
Courtesy of CHRYSLER GROUP, LLC

27. Connect and lock the electrical connector (3) to the Electronic Throttle Control (ETC) (4) and engage the ETC harness to the clip (2) on the throttle body.

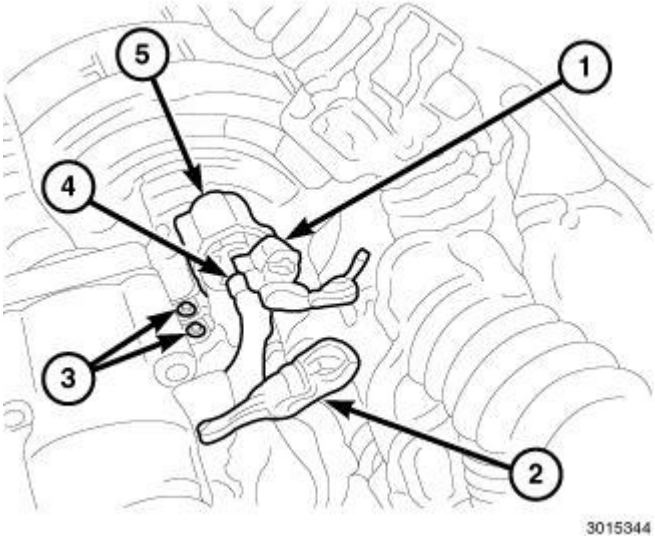


Fig. 173: Evaporative Emissions Purge Solenoid Connector, Fuel Injector Wire Harness Connector & Fasteners
Courtesy of CHRYSLER GROUP, LLC

28. Connect and lock the fuel injector wire harness electrical connector (2).
29. Connect and lock the evaporative emissions purge solenoid electrical connector (1).

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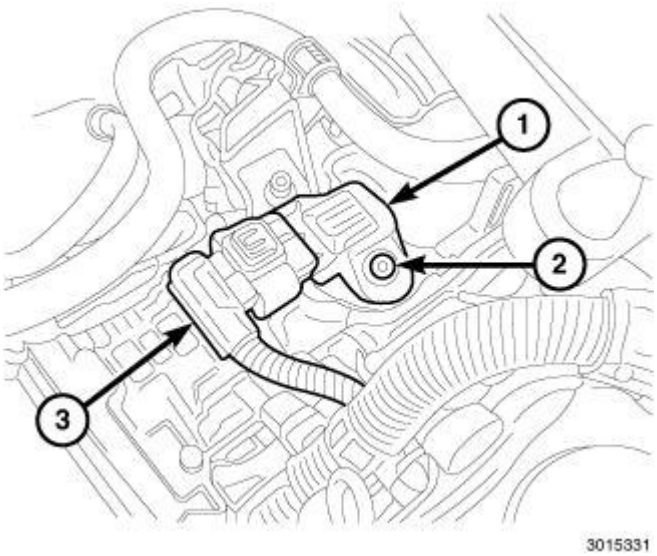


Fig. 174: IAT/MAP Sensor, Connector & Bolt
Courtesy of CHRYSLER GROUP, LLC

30. Connect and lock the IAT/MAP sensor electrical connector (3).

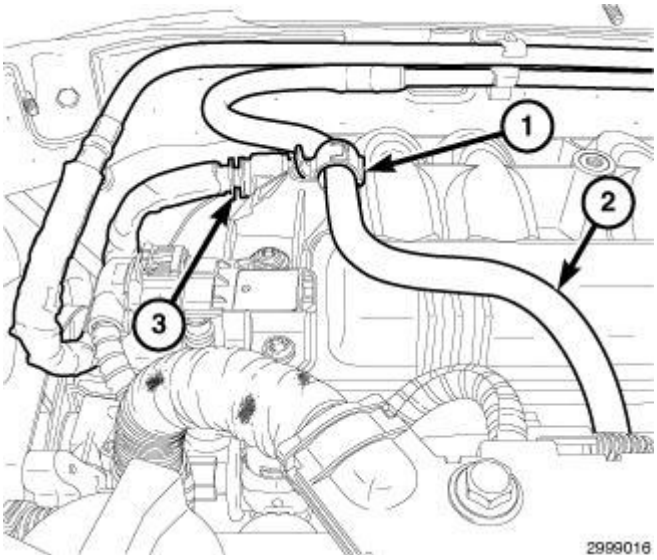


Fig. 175: Fuel Line, Hose Retainer & Fuel Vapor Purge Hose
Courtesy of CHRYSLER GROUP, LLC

31. Connect the fuel vapor purge hose (3) to the intake manifold.
32. Connect the fuel line (2) to the fuel rail and close the hose retainer (1). Refer to **FITTING, QUICK CONNECT, STANDARD PROCEDURE** .

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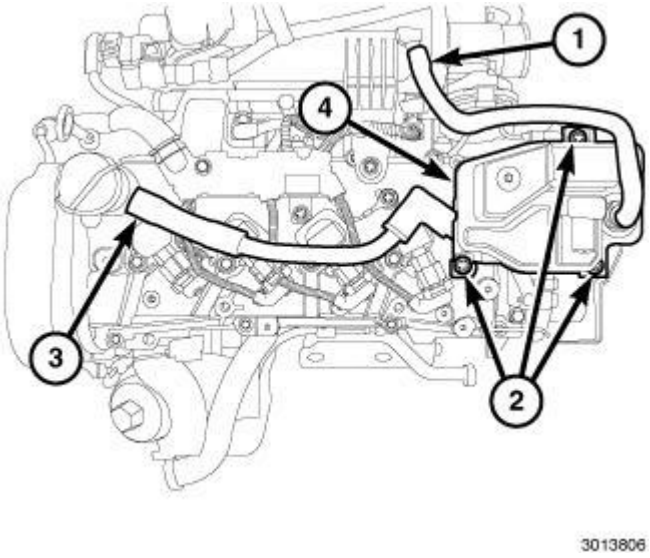


Fig. 176: PCV Hose, Bolts, Vent Hose & Oil Separator Housing
Courtesy of CHRYSLER GROUP, LLC

33. Install the oil separator housing (4) to the cylinder head cover with three bolts (2) tightened to 13 N.m (115 in. lbs.).
34. Connect the vent hose (3) to the oil filler neck.
35. Connect the PCV hose (1) to the intake manifold.

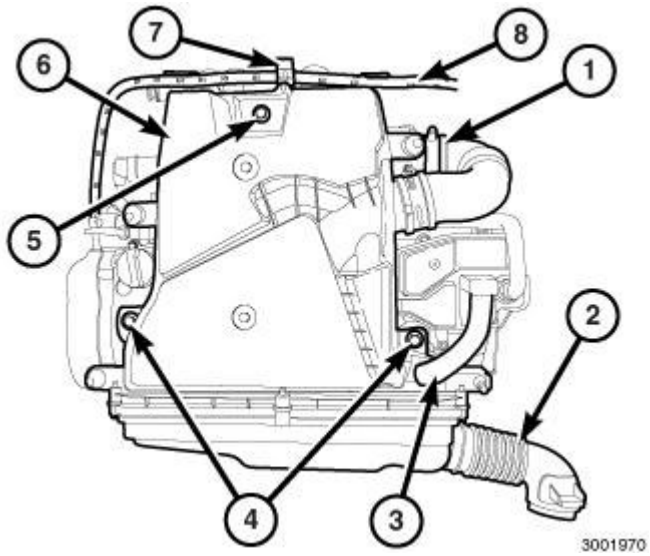


Fig. 177: Air Cleaner Body Assembly
Courtesy of CHRYSLER GROUP, LLC

36. Install the air cleaner body (6). Refer to **BODY, AIR CLEANER, INSTALLATION**.

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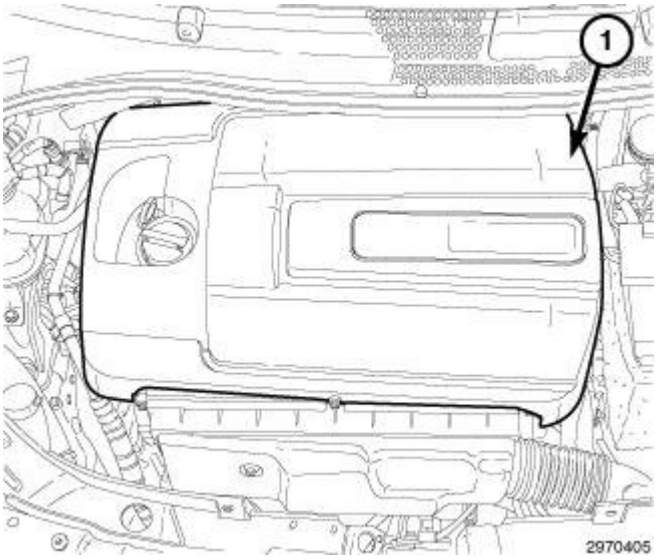


Fig. 178: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

37. Evacuate and charge the refrigerant system. Refer to **PLUMBING, STANDARD PROCEDURE** .
38. Install the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
39. Install the engine cover (1).
40. Run the engine until it reaches normal operating temperature. Check cooling system for correct fluid level. Refer to **STANDARD PROCEDURE** .

HOUSING, CAMSHAFT BEARING

DESCRIPTION

DESCRIPTION

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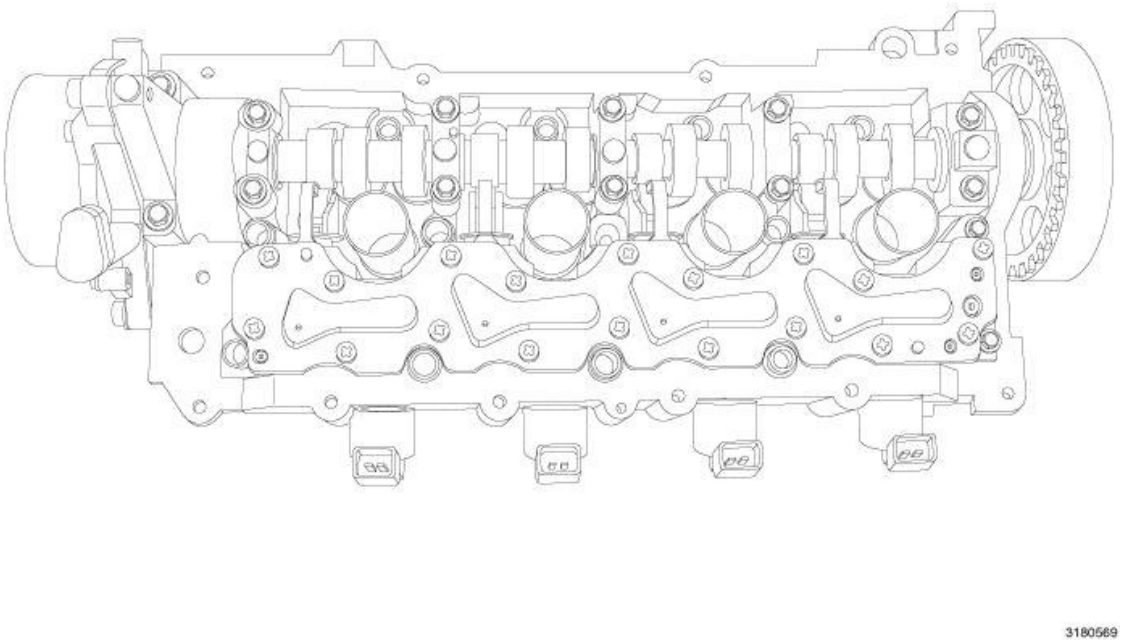


Fig. 179: Camshaft Bearing Housing
Courtesy of CHRYSLER GROUP, LLC

The camshaft bearing housing is bolted to the top of the cylinder head. The camshaft bearing housing primarily supports the camshaft, hydraulic valve lash adjusters and the variable valve actuator assembly. The spark plug tubes are threaded into the camshaft bearing housing and the vacuum pump is bolted to the rear camshaft bearing cap and the housing. The camshaft bearing housing supplies oil to the camshaft bearings, hydraulic valve lash adjusters, vacuum pump and the variable valve actuator assembly. A removable filter screen is installed in the housing for the variable valve actuation oil supply.

REMOVAL

REMOVAL

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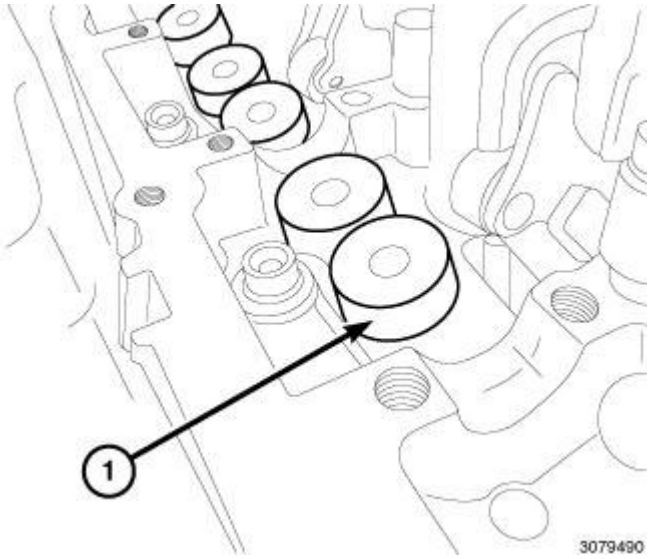


Fig. 180: Hydraulic Lifters
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect and isolate the negative battery cable.
2. Remove the camshaft. Refer to **CAMSHAFT, ENGINE, REMOVAL**.

NOTE: If the hydraulic lifters are to be reused, identify their positions so that they can be reassembled into their original locations.

3. Remove the hydraulic lifter(s) (1).

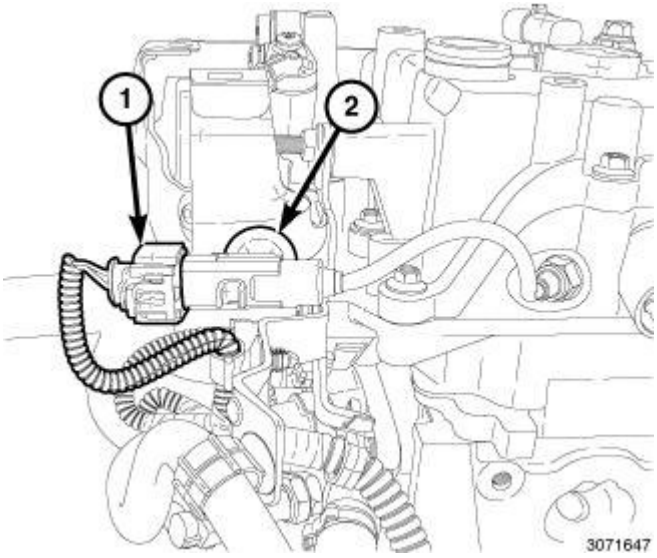


Fig. 181: Oil Temperature Sensor Electrical Connector & Bracket
Courtesy of CHRYSLER GROUP, LLC

4. Unlock and disconnect the oil temperature sensor electrical connector (1).
5. Disengage the oil temperature electrical connector from the bracket (2).

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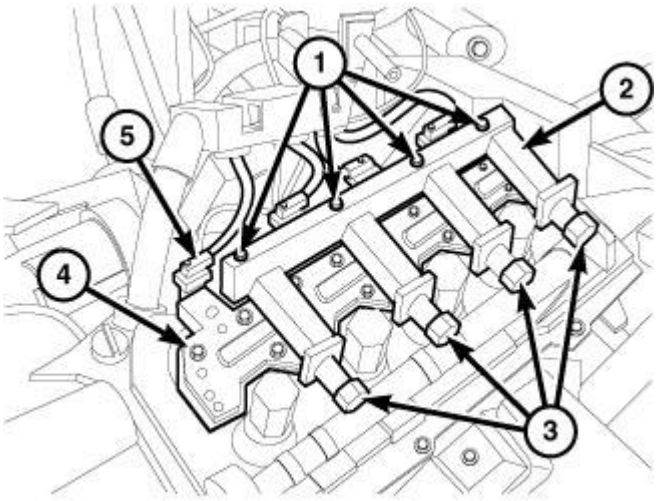


Fig. 182: Variable Valve Actuation Assembly Removal/Installation Tool & Variable Valve Timing Actuator Connectors
Courtesy of CHRYSLER GROUP, LLC

6. Unlock and disconnect the four variable valve timing actuator electrical connectors (5).
7. Install the (special tool #10259B, Compressor, MultiAir® Spring) (2) with four bolts (1) tightened to 9 N.m (80 in. lbs.).
8. Rotate the spring compressors (3) CCW until fully seated.

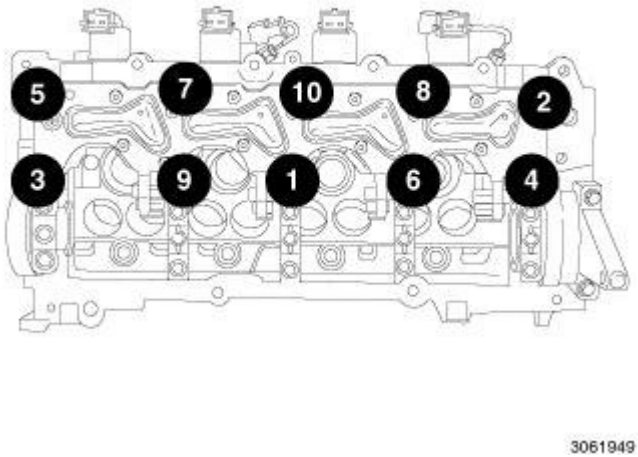


Fig. 183: Variable Valve Timing Actuation Assembly Removal Sequence
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not invert the variable valve actuation assembly when it is removed from the engine. Oil will drain from the assembly and excessive engine cranking will be required to refill the assembly and start the engine.

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9. Remove the ten bolts in the sequence shown in illustration.
10. Remove the variable valve timing actuation assembly, with the spring compressor attached, from the camshaft bearing housing.

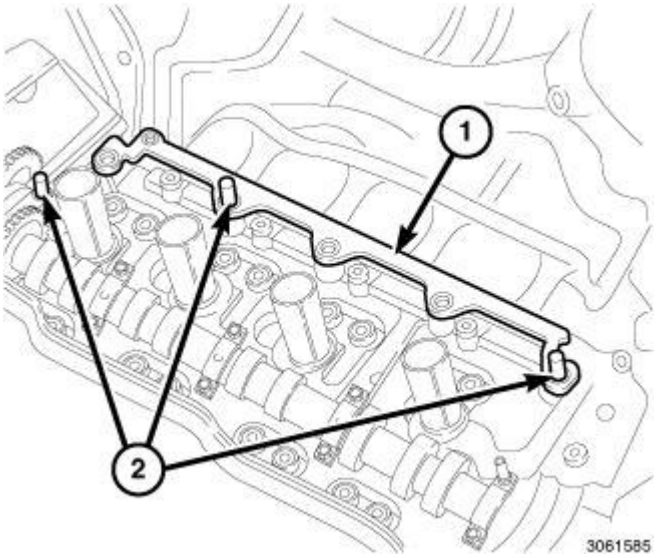


Fig. 184: Variable Valve Actuation Assembly Gasket & Locating Pins
Courtesy of CHRYSLER GROUP, LLC

11. Remove and discard the variable valve actuation assembly gasket (1).

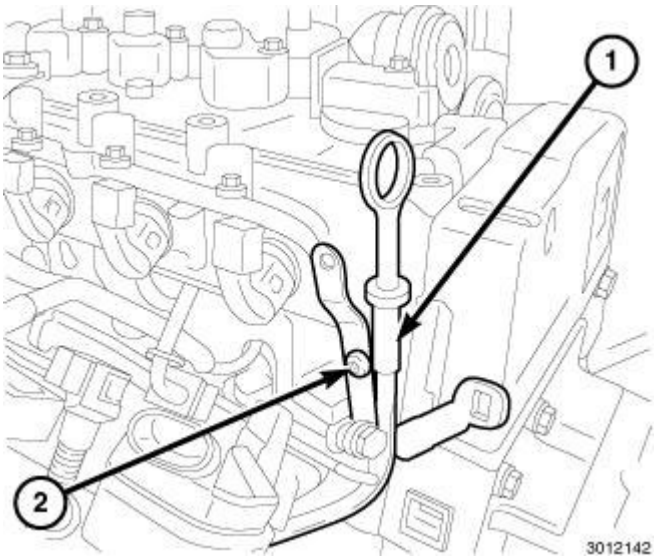


Fig. 185: Oil Level Indicator Tube & Bolt
Courtesy of CHRYSLER GROUP, LLC

12. Remove the bolt (2) and the oil level indicator tube (1).

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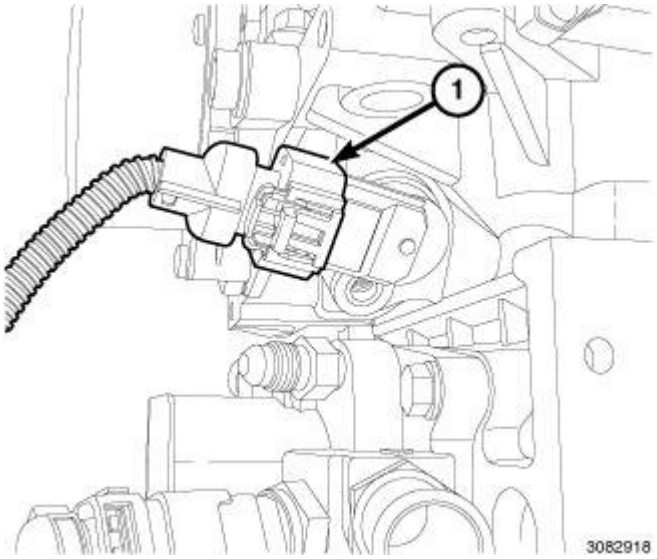


Fig. 186: Camshaft Position (CMP) Sensor Electrical Connector
Courtesy of CHRYSLER GROUP, LLC

13. Unlock and disconnect the camshaft position (CMP) sensor electrical connector (1).

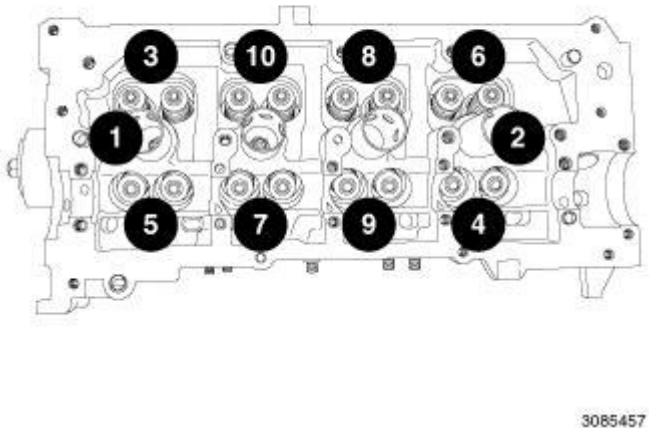


Fig. 187: Camshaft Bearing Housing Bolt Removal Sequence
Courtesy of CHRYSLER GROUP, LLC

14. Using the sequence shown in illustration, remove the ten camshaft bearing housing retaining bolts and the camshaft bearing housing.

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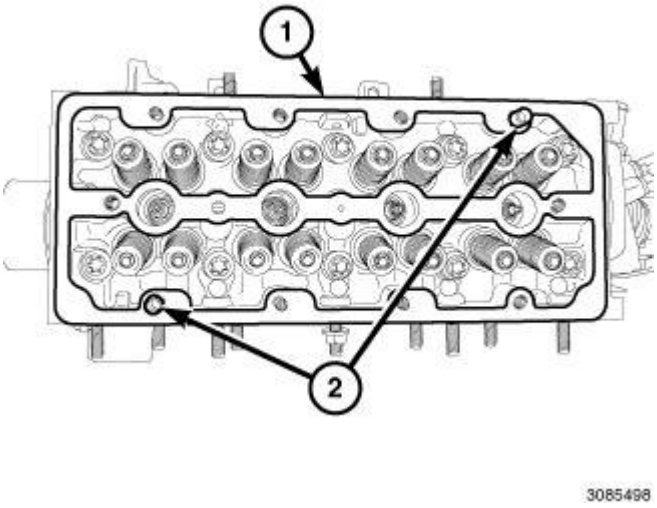


Fig. 188: Camshaft Bearing Housing Gasket & Locating Pins
Courtesy of CHRYSLER GROUP, LLC

15. Remove the camshaft bearing housing gasket (1).

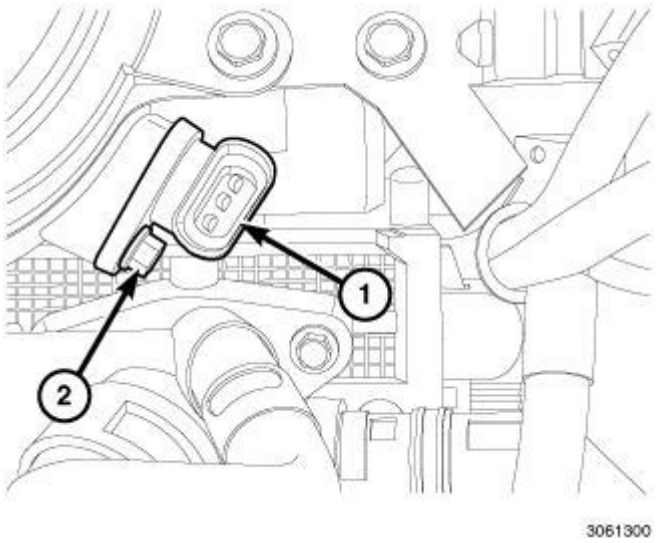


Fig. 189: Camshaft Position (CMP) Sensor & Bolt
Courtesy of CHRYSLER GROUP, LLC

16. If required, remove the mounting bolt (2) and Camshaft Position (CMP) sensor (1) from the camshaft bearing housing.

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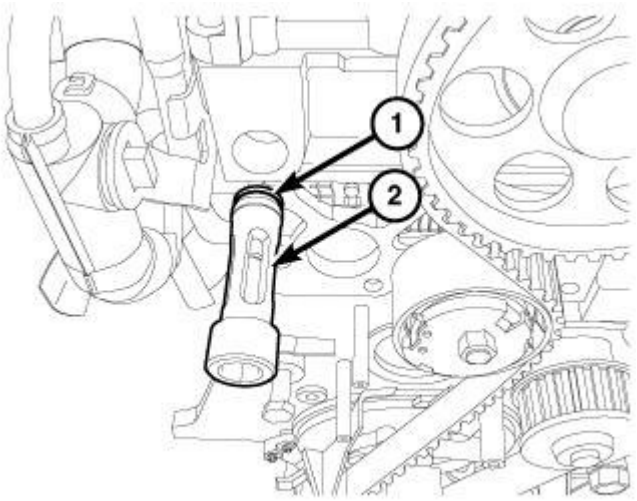


Fig. 190: MultiAir Actuator Oil Supply Filter & O-Ring
Courtesy of CHRYSLER GROUP, LLC

17. If required, remove the MultiAir actuator oil supply filter (2) from the camshaft bearing housing.

INSPECTION

INSPECTION

1. Verify that the valve tappets move freely in theirs bores and that they have been rotating.
2. Inspect camshaft bearing journals for scoring.
3. Inspect the following components and verify that they are within specification: Refer to **SPECIFICATIONS** .
    - Camshafts
    - Valve Tappets

INSTALLATION

INSTALLATION

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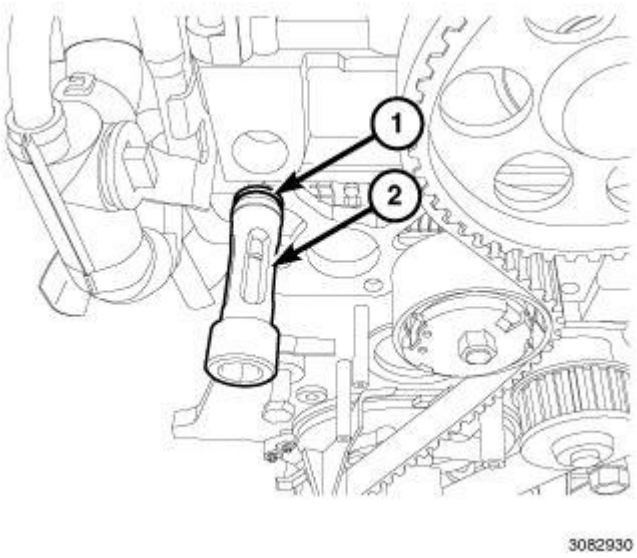


Fig. 191: MultiAir Actuator Oil Supply Filter & O-Ring
Courtesy of CHRYSLER GROUP, LLC

1. If removed, install a new O-ring (1) lubricated with engine oil on the MultiAir actuator oil supply filter (2). Install the filter into the camshaft bearing housing and tighten to 27 N.m (20 ft. lbs.).

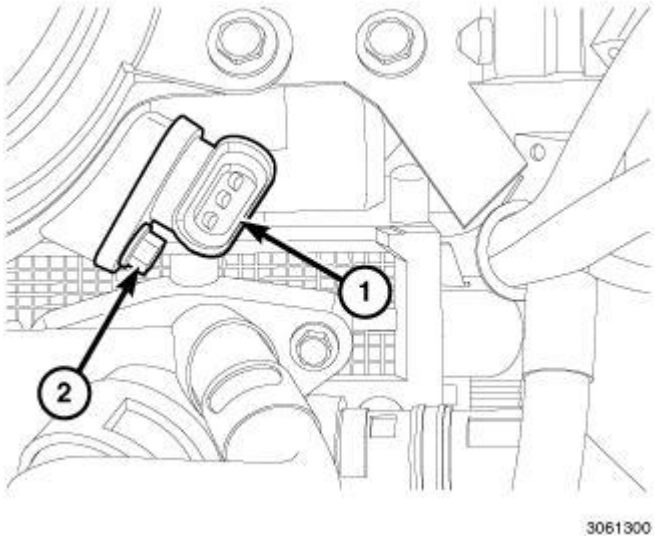
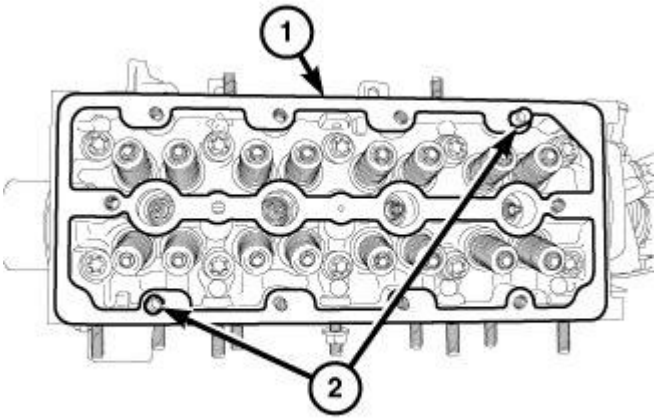


Fig. 192: Camshaft Position (CMP) Sensor & Bolt
Courtesy of CHRYSLER GROUP, LLC

2. If removed, apply engine oil to the O-ring seal and install the Camshaft Position (CMP) sensor (1) with bolt (2) tightened to 9 N.m (80 in. lbs.).

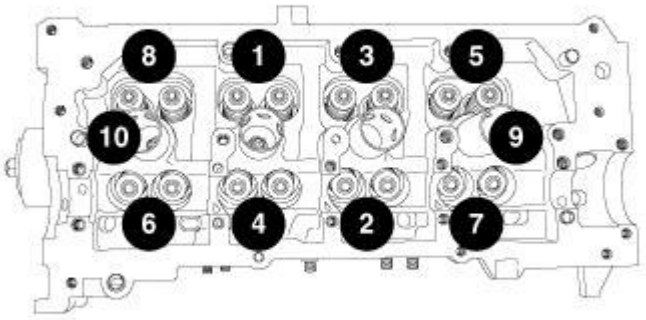
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Fig. 193: Camshaft Bearing Housing Gasket & Locating Pins
Courtesy of CHRYSLER GROUP, LLC

3. Install two camshaft bearing housing locating pins (2).
4. Install the camshaft bearing housing gasket (1).



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Fig. 194: Camshaft Bearing Housing Bolt Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

5. Install the camshaft bearing housing with ten bolts. Tighten the ten bolts in three steps following the sequence shown in illustration:
   - Step 1: All to 7 N.m (62 in. lbs.).
   - Step 2: Positions 1 through 8 to 25 N.m (18 ft. lbs.).
   - Step 3: Positions 9 and 10 to 30 N.m (22 ft. lbs.).

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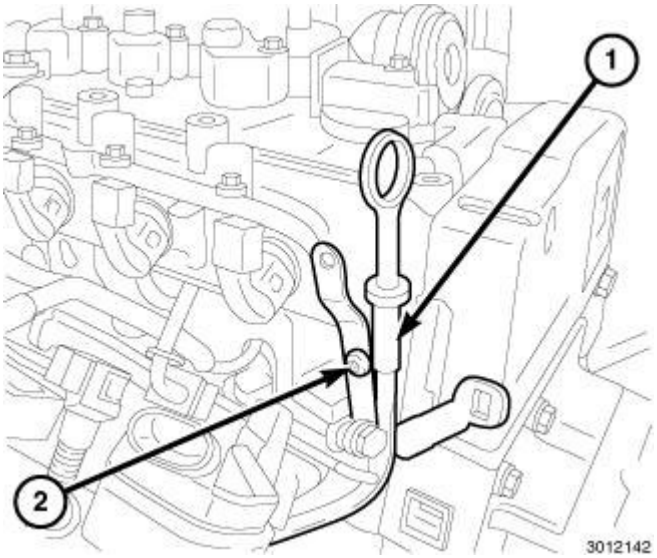


Fig. 195: Oil Level Indicator Tube & Bolt
Courtesy of CHRYSLER GROUP, LLC

6. Install the oil level indicator tube (1). Tighten the bolt (2) to 9 N.m (80 in. lbs.).

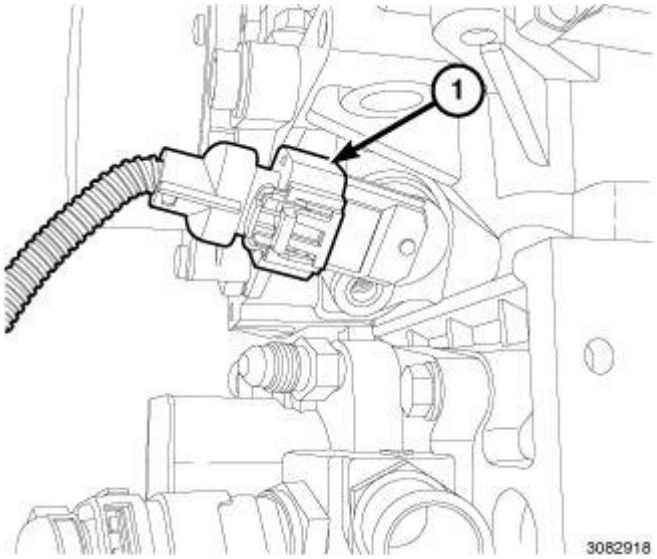


Fig. 196: Camshaft Position (CMP) Sensor Electrical Connector
Courtesy of CHRYSLER GROUP, LLC

7. Connect and lock the Camshaft Position (CMP) sensor electrical connector (1).

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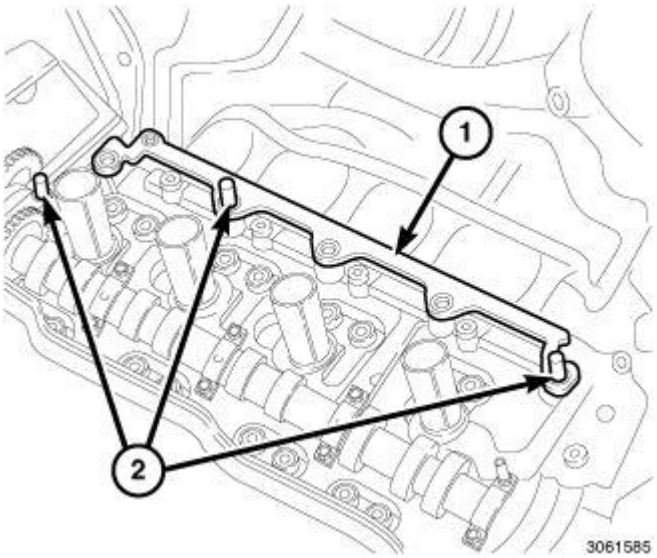


Fig. 197: Variable Valve Actuation Assembly Gasket & Locating Pins
Courtesy of CHRYSLER GROUP, LLC

8. Install the three variable valve actuation assembly locating pins (2).
9. Install the variable valve actuation assembly gasket (1).

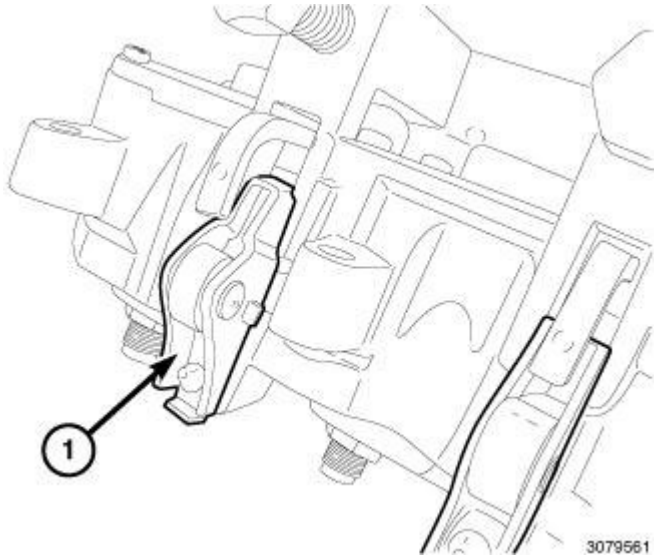


Fig. 198: Rocker Arms
Courtesy of CHRYSLER GROUP, LLC

10. If removed, install the rocker arms (1). Refer to **ROCKER ARM, VALVE, INSTALLATION**.

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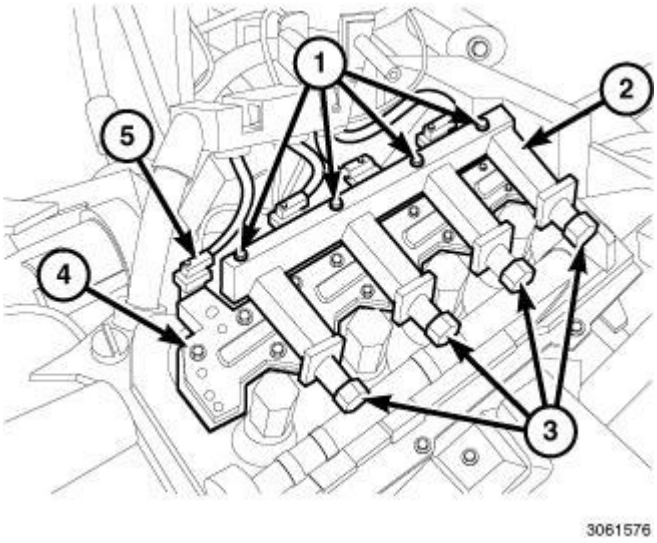


Fig. 199: Variable Valve Actuation Assembly Removal/Installation Tool & Variable Valve Timing Actuator Connectors
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not invert the variable valve actuation assembly when it is removed from the engine. Oil will drain from the assembly and excessive engine cranking will be required to refill the assembly and start the engine.

11. If removed, install the (special tool #10259B, Compressor, MultiAir® Spring) (2) with four bolts (1) tightened to 9 N.m (80 in. lbs.).
12. Rotate the spring compressors (3) CCW until fully seated.

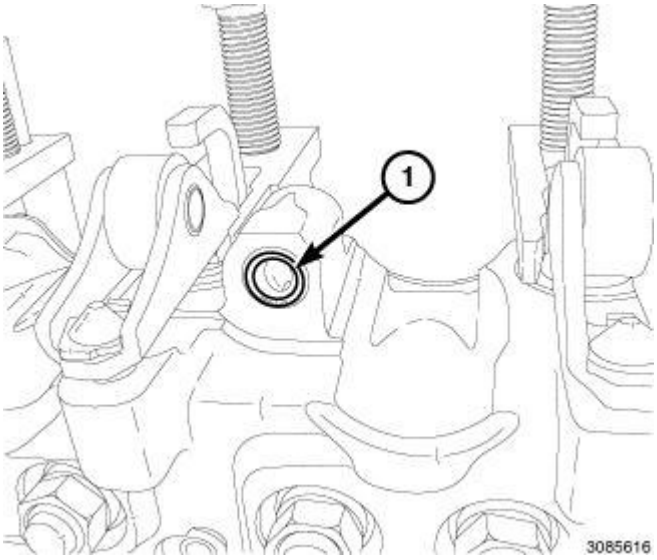


Fig. 200: Variable Valve Actuation Assembly O-Ring
Courtesy of CHRYSLER GROUP, LLC

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13. Install the variable valve actuation assembly O-ring (1).

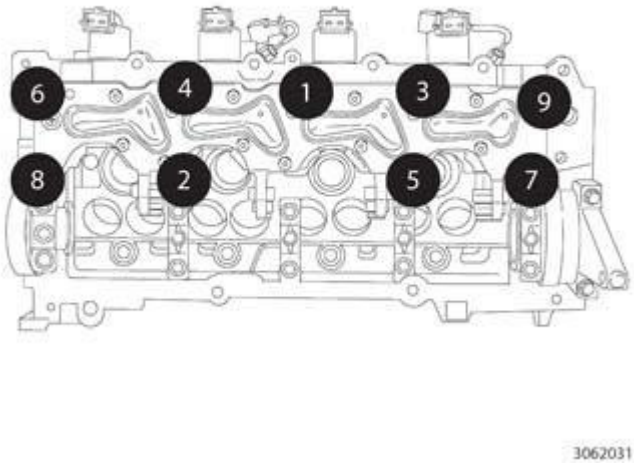


Fig. 201: Variable Valve Actuation Assembly Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

14. Install the variable valve actuation assembly with the spring compressor in place. Install and hand tighten the retaining bolts.
15. Remove the spring compressor and tighten the ten bolts in three steps following the sequence shown in illustration:
    - Step 1: All to 10 N.m (89 in. lbs.).
    - Step 2: All to 22 N.m (16 ft. lbs.).
    - Step 3: All again to 22 N.m (16 ft. lbs.).

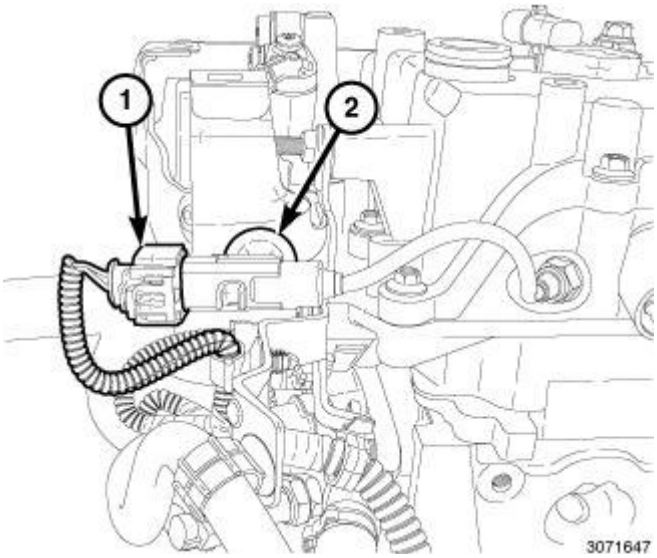


Fig. 202: Oil Temperature Sensor Electrical Connector & Bracket
Courtesy of CHRYSLER GROUP, LLC

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16. Connect and lock the four variable valve timing actuator electrical connectors.
17. Connect and lock the oil temperature sensor electrical connector (1).
18. Engage the oil temperature electrical connector to the bracket (2).

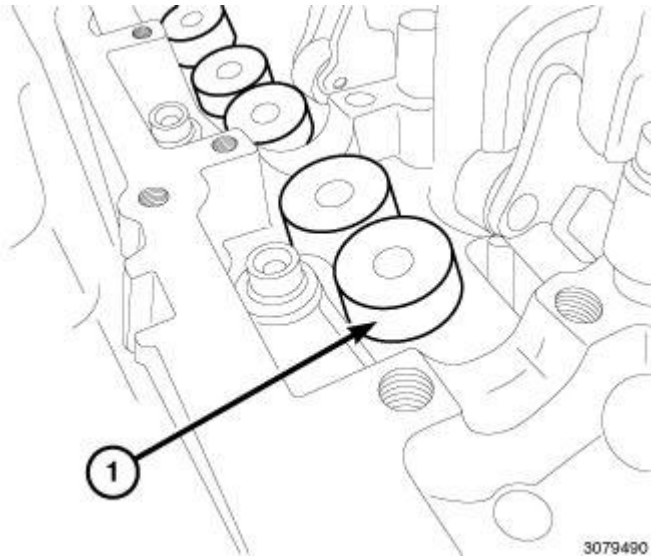


Fig. 203: Hydraulic Lifters
Courtesy of CHRYSLER GROUP, LLC

NOTE: If the hydraulic lifters are being reused, reassemble them into their original locations.

19. Verify that the hydraulic lifters are at least partially full of oil. There should be little or no plunger travel when the hydraulic lifter is depressed.
20. Install the hydraulic lifter(s) (1).
21. Install the camshaft(s). Refer to **CAMSHAFT, ENGINE, INSTALLATION**.
22. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).

NOTE: The Cam/Crank Variation Relearn procedure must be performed using the scan tool anytime there has been a repair/replacement made to a powertrain system, for example: flywheel, valvetrain, camshaft and/or crankshaft sensors or components. Refer to the appropriate Diagnostic Information .

LIFTER(S), HYDRAULIC

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - LASH ADJUSTER (TAPPET) NOISE

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

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Refer to the following chart for possible causes and correction of a lash adjuster (tappet) type noise.

LASH ADJUSTER (TAPPET) NOISE CHART

POSSIBLE CAUSES	CORRECTION
1. Engine oil level-too high or too low. This may allow aerated oil to enter the adjusters and cause them to be spongy.	1. Check and correct the engine oil level.
2. Insufficient running time after rebuilding a cylinder head.	2. Low speed running of up to 1 hour may be required to fully evacuate trapped air from the valve train system. During this time, turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.
3. Air trapped in the lash adjuster (after 1 hour of run time).	3. See below: (a) Check lash adjusters for sponginess while installed in the cylinder head. Depress the lash adjuster. Normal adjusters should feel very firm. Very spongy adjusters can be bottomed out easily. (b) If the lash adjuster(s) are still spongy, replace the lash adjuster(s). Refer to **LIFTER(S), HYDRAULIC, REMOVAL**.
4. Low oil pressure.	4. See below: (a) Check and correct the engine oil level. (b) Check the engine oil pressure. Refer to **DIAGNOSIS AND TESTING** . (c) Check for excessive main bearing clearance and correct. Refer to **STANDARD PROCEDURE** . (d) Check for a worn oil pump.
5. Oil passage to the cylinder head(s) plugged with debris.	5. Check cylinder head oil passages for blockage. Clean or replace as necessary.
6. Worn valve guide(s).	6. Measure valve stem-to-guide clearance. Refer to **STANDARD PROCEDURE** .
7. Air ingested into oil due to broken or cracked oil pump pickup tube.	7. Inspect pickup tube and replace as necessary. Refer to **PICK-UP, OIL PUMP, REMOVAL**.
8. Collapsed lash adjuster due to debris ingestion.	8. Clean debris from engine and replace lash adjuster (s). Refer to **LIFTER(S), HYDRAULIC, REMOVAL**.

REMOVAL

REMOVAL

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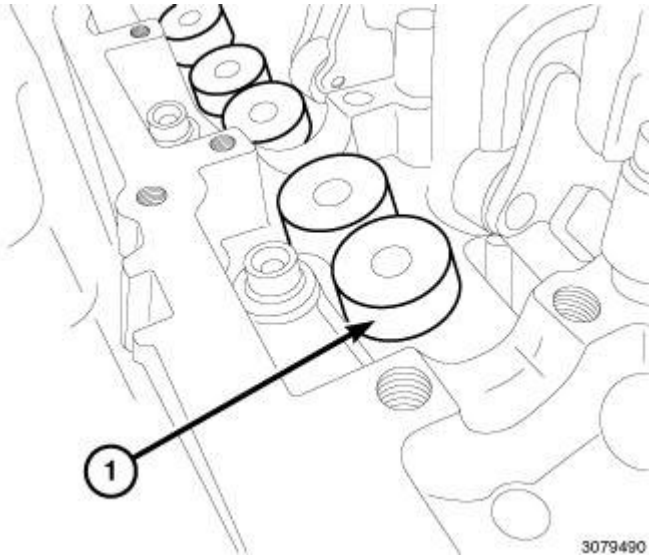


Fig. 204: Hydraulic Lifters
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect and isolate the negative battery cable.
2. Remove the camshaft. Refer to **CAMSHAFT, ENGINE, REMOVAL**.

NOTE: If the hydraulic lifters are to be reused, identify their positions so that they can be reassembled into their original locations.

3. Remove the hydraulic lifter(s) (1).

INSTALLATION

INSTALLATION

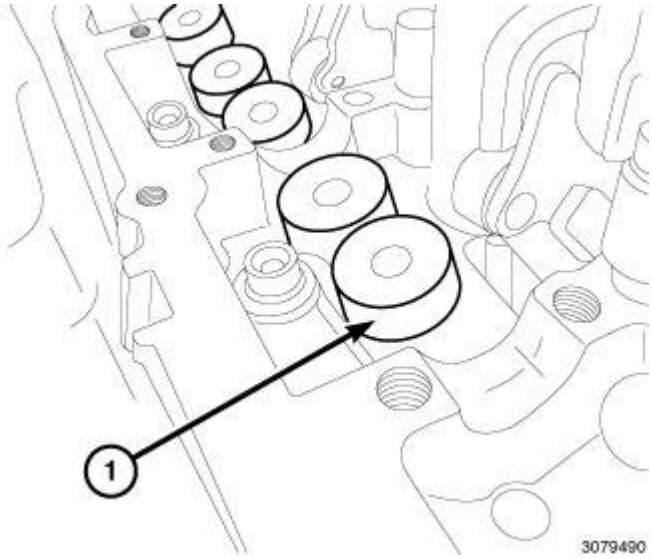


Fig. 205: Hydraulic Lifters

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Courtesy of CHRYSLER GROUP, LLC

NOTE: If the hydraulic lifters are being reused, reassemble them into their original locations.

1. Verify that the hydraulic lifters are at least partially full of oil. There should be little or no plunger travel when the hydraulic lifter is depressed.
2. Install the hydraulic lifter(s) (1).
3. Install the camshaft(s). Refer to **CAMSHAFT, ENGINE, INSTALLATION**.
4. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).

ROCKER ARM, VALVE

DESCRIPTION

DESCRIPTION

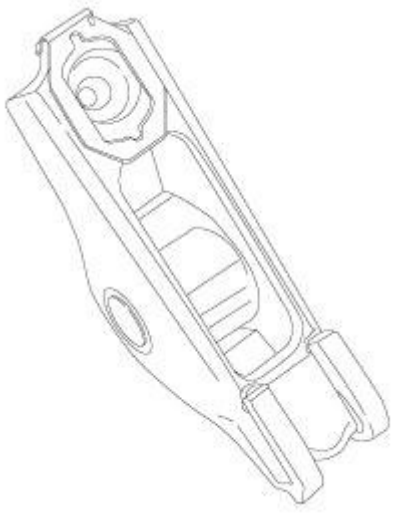


Fig. 206: Valve Rocker Arm
Courtesy of CHRYSLER GROUP, LLC

The valve rocker arms are steel stampings with an integral roller bearing. A spring clip helps to hold the rocker arm in position on the ball socket when removing or installing the variable valve actuation assembly. The rocker arm ball socket also incorporates a 0.5 mm oil hole for roller and camshaft lubrication.

REMOVAL

REMOVAL

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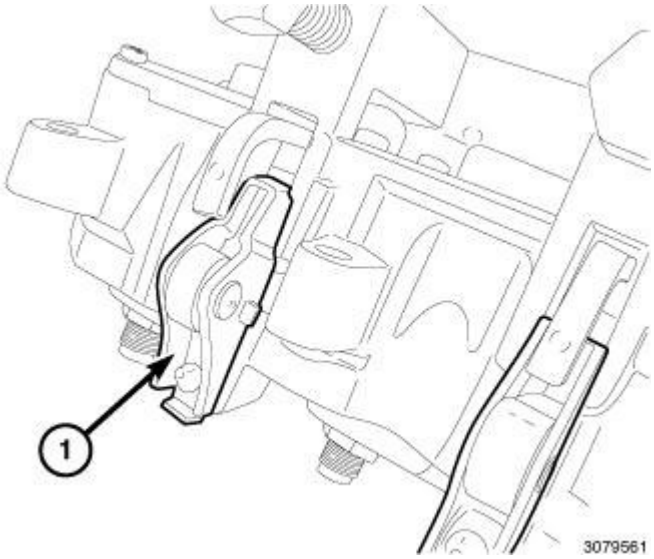


Fig. 207: Rocker Arms
Courtesy of CHRYSLER GROUP, LLC

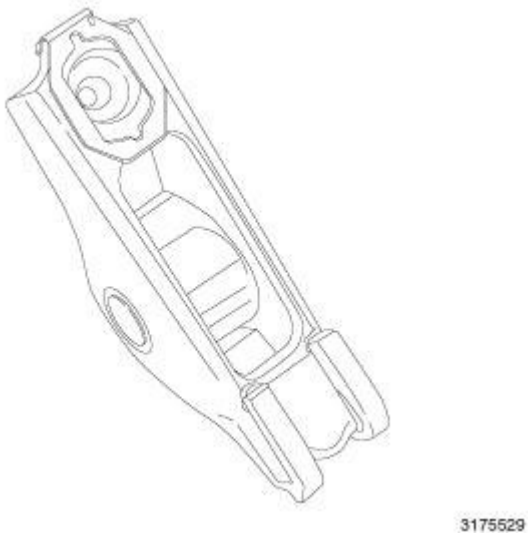
1. Disconnect and isolate the negative battery cable.
2. Remove the variable valve actuation assembly. Refer to **ASSEMBLY, VARIABLE VALVE ACTUATION, REMOVAL**.

NOTE: If the rocker arms are to be reused, identify their positions so that they can be reassembled into their original locations.

3. Disengage the retaining clip and remove the rocker arm(s) (1).

INSPECTION

INSPECTION



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Fig. 208: Valve Rocker Arm
Courtesy of CHRYSLER GROUP, LLC

Inspect the valve rocker arm for wear or damage. Replace as necessary.

INSTALLATION

INSTALLATION

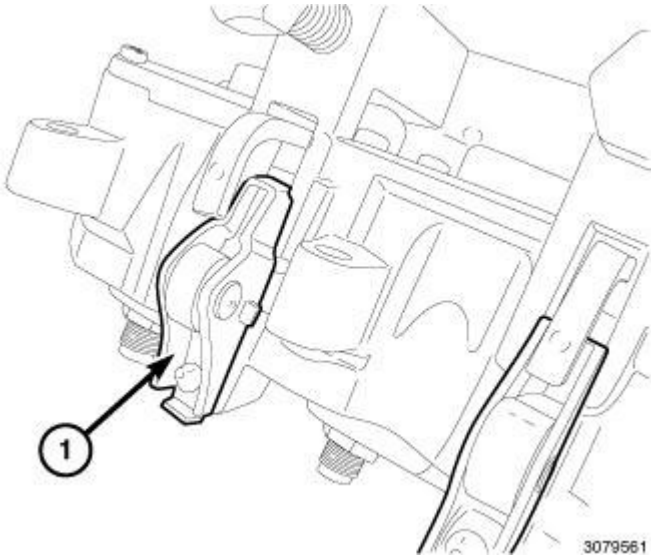


Fig. 209: Rocker Arms
Courtesy of CHRYSLER GROUP, LLC

1. Lubricate the rocker arms with clean engine oil before installation.
2. Install the rocker arm(s) (1) and engage the retaining clip.
3. Install the variable valve actuation assembly. Refer to **ASSEMBLY, VARIABLE VALVE ACTUATION, INSTALLATION**.
4. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).

PUMP, VACUUM

DESCRIPTION

DESCRIPTION

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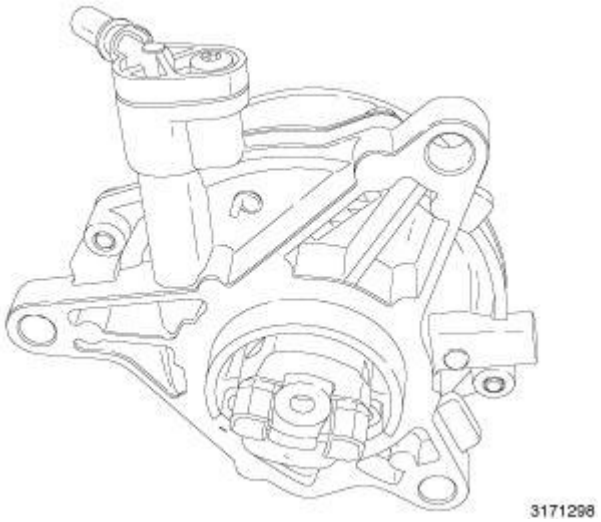


Fig. 210: Vacuum Pump
Courtesy of CHRYSLER GROUP, LLC

The vane-type vacuum pump is mounted to the rear of the cylinder head and is driven by the camshaft. The vacuum pump supplies vacuum to the brake booster.

REMOVAL

REMOVAL

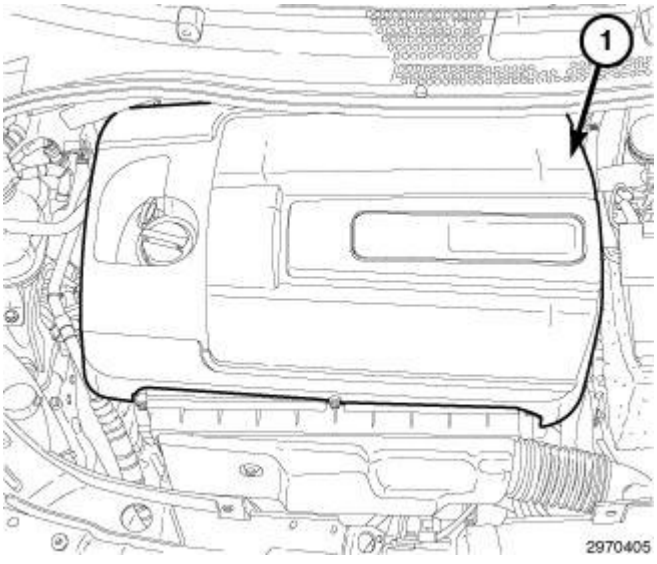


Fig. 211: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

1. Remove the engine cover (1).

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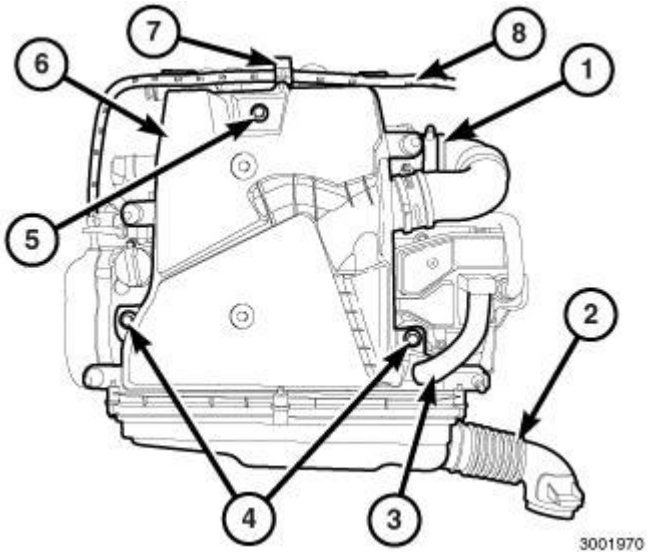


Fig. 212: Air Cleaner Body Assembly
Courtesy of CHRYSLER GROUP, LLC

2. Remove the air cleaner body (6). Refer to **BODY, AIR CLEANER, REMOVAL**.

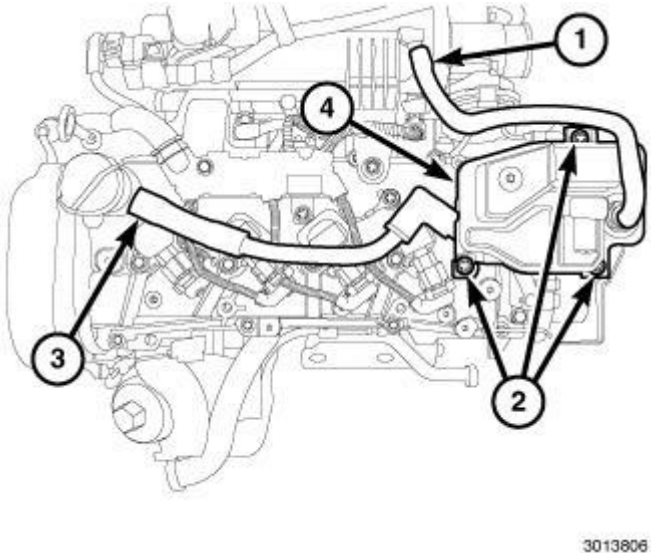


Fig. 213: PCV Hose, Bolts, Vent Hose & Oil Separator Housing
Courtesy of CHRYSLER GROUP, LLC

3. Disconnect the PCV hose (1) from the intake manifold.
4. Disconnect the vent hose (3) from the oil filler neck.
5. Remove three bolts (2) and remove the oil separator housing (4) from the cylinder head cover.

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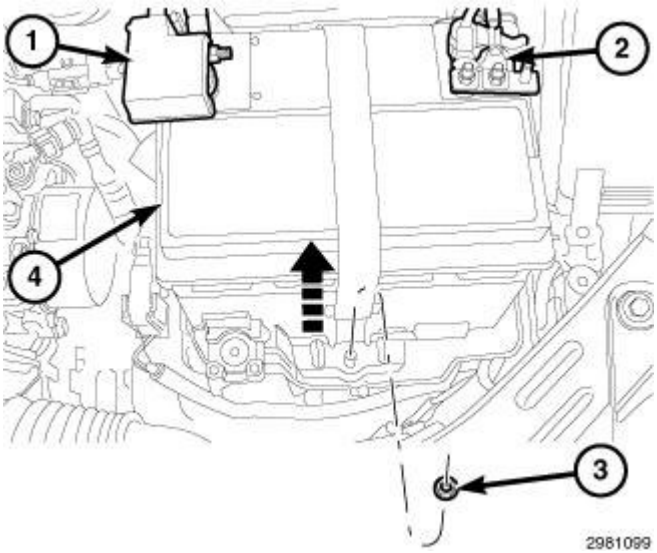


Fig. 214: Positive Cable Terminal, Negative Cable Terminal, Fastener & Battery
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When servicing components near the vacuum pump, avoid contact with the plastic nipple that connects the vacuum pump to the brake booster hose. It is possible to crack the plastic nipple resulting in a brake booster vacuum leak.

6. Remove the battery (4). Refer to **BATTERY, REMOVAL** .

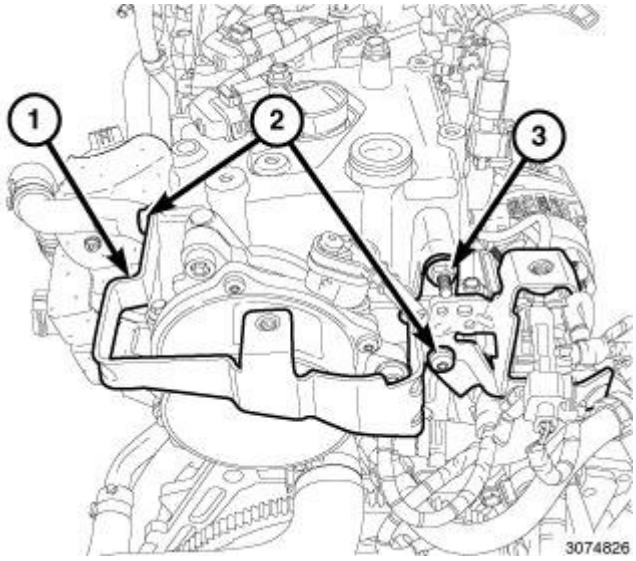


Fig. 215: Oil Separator Housing Bracket & Fasteners
Courtesy of CHRYSLER GROUP, LLC

7. Remove two bolts (2), one nut (3) and reposition the oil separator housing bracket (1).

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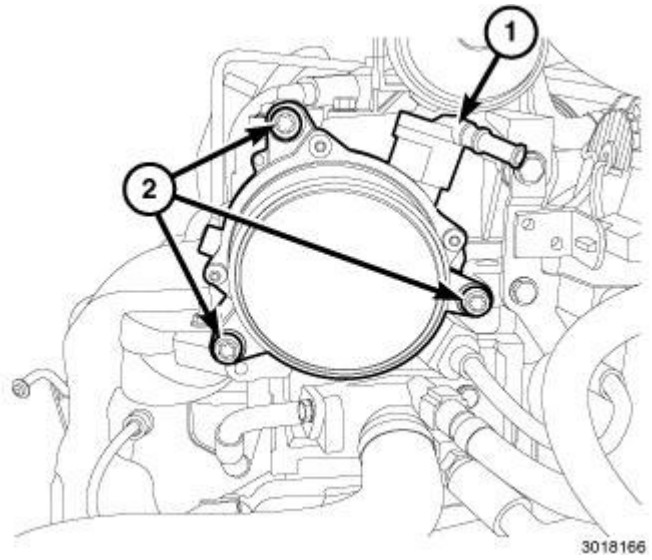


Fig. 216: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

NOTE: Oil may leak from the vacuum pump drive when the pump is removed. Place a shop towel under the pump to prevent oil leakage onto the engine or transmission assembly.

8. Disconnect the vacuum line at the pump (1).
9. Remove the vacuum pump mounting bolts (2) and the vacuum pump (1).

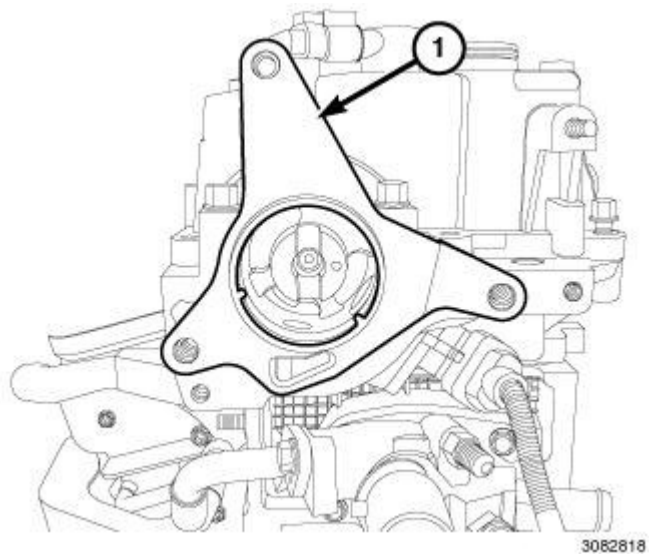


Fig. 217: Vacuum Pump Gasket
Courtesy of CHRYSLER GROUP, LLC

10. Remove and discard the vacuum pump gasket (1). Note the location of the pump drive tab.

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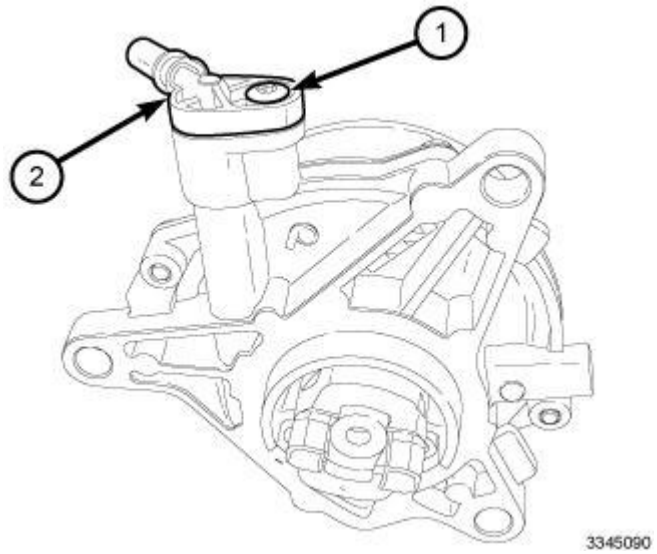


Fig. 218: Vacuum Fitting & Screw
Courtesy of CHRYSLER GROUP, LLC

11. If required, remove the screw (1) and the vacuum fitting (2).

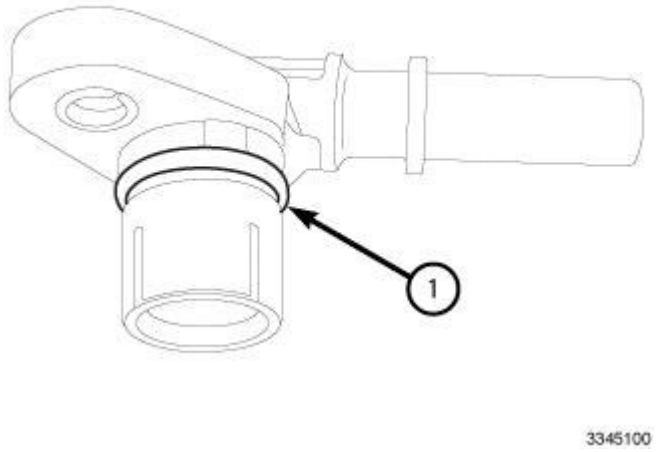


Fig. 219: Vacuum Fitting O-Ring Seal
Courtesy of CHRYSLER GROUP, LLC

12. The vacuum fitting O-ring seal (1) can be reused if not damaged.

INSTALLATION

INSTALLATION

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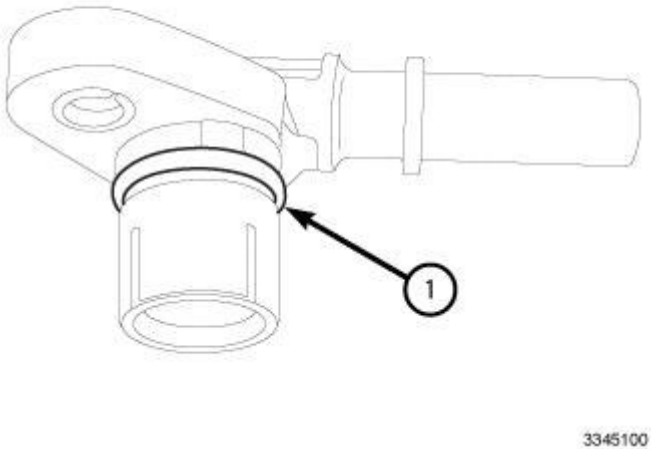


Fig. 220: Vacuum Fitting O-Ring Seal
Courtesy of CHRYSLER GROUP, LLC

1. The vacuum fitting O-ring seal (1) can be reused if not damaged. If removed, lightly lubricate the O-ring seal (1) with clean engine oil and install on the vacuum fitting.

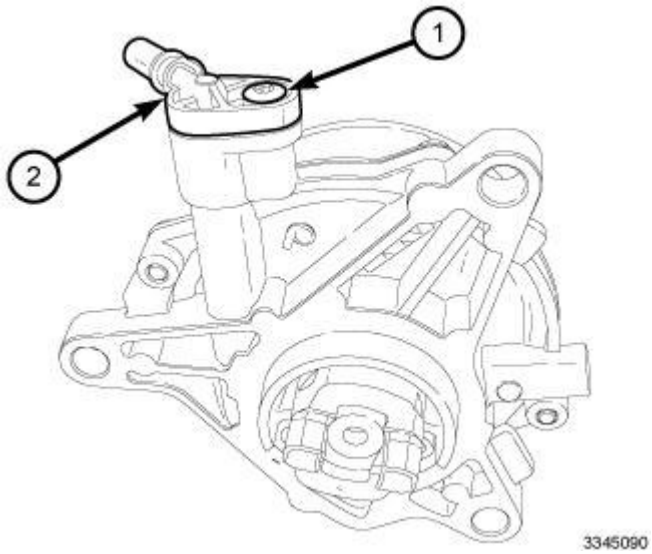


Fig. 221: Vacuum Fitting & Screw
Courtesy of CHRYSLER GROUP, LLC

2. If removed, install the vacuum fitting (2) to the vacuum pump with the screw (1) tightened to 8 N.m (71 in. lbs.).

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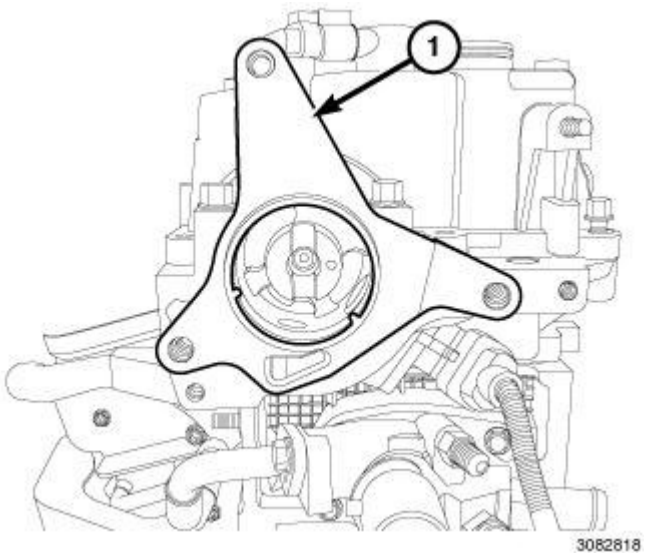


Fig. 222: Vacuum Pump Gasket
Courtesy of CHRYSLER GROUP, LLC

3. Clean the mating surfaces of the cylinder head and the vacuum pump. Install a new vacuum pump gasket (1).

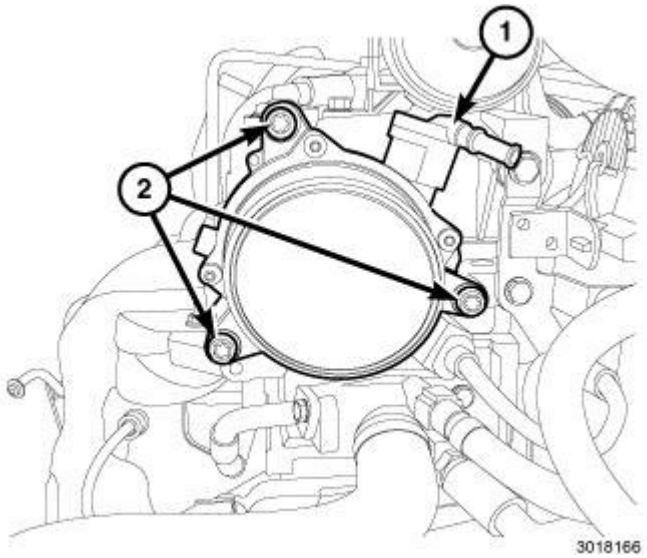


Fig. 223: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

4. Align the pump drive tab with the pump drive slot located on the cam shaft.
5. Install the vacuum pump mounting bolts (2). Tighten the bolts to 20 N.m (15 ft. lbs.).
6. Connect the vacuum supply line to the pump (1).

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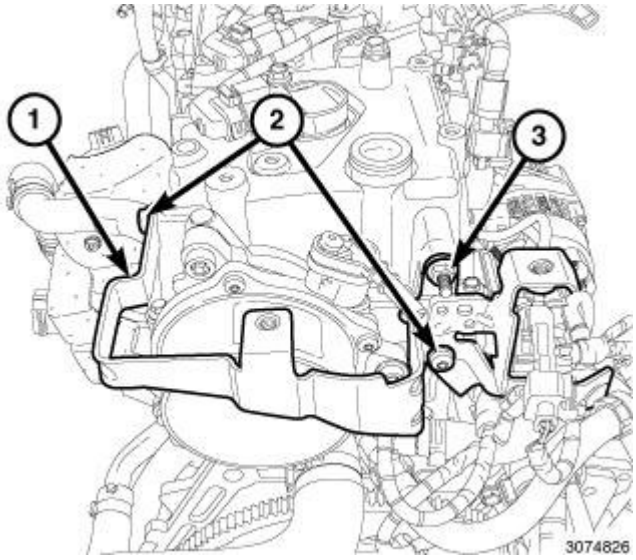


Fig. 224: Oil Separator Housing Bracket & Fasteners
Courtesy of CHRYSLER GROUP, LLC

7. Install the oil separator housing bracket (1) with two bolts (2) and one nut (3). Tighten the three fasteners to 13 N.m (115 in. lbs.).

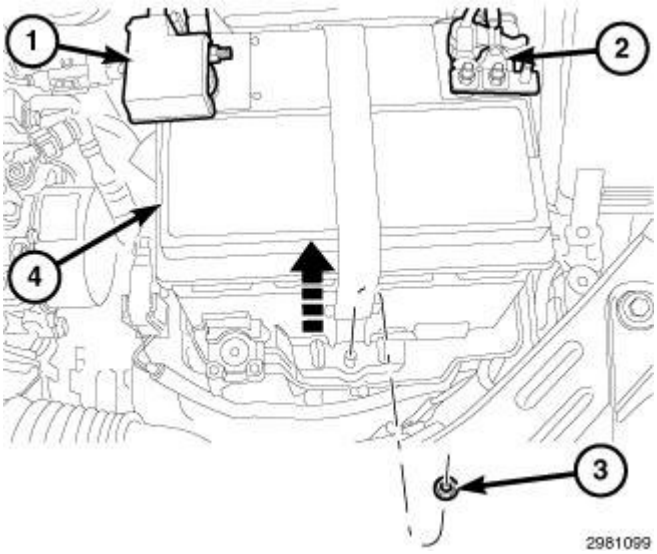


Fig. 225: Positive Cable Terminal, Negative Cable Terminal, Fastener & Battery
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When servicing components near the vacuum pump, avoid contact with the plastic nipple that connects the vacuum pump to the brake booster hose. It is possible to crack the plastic nipple resulting in a brake booster vacuum leak.

8. Install the battery (4). Refer to **BATTERY, INSTALLATION** .

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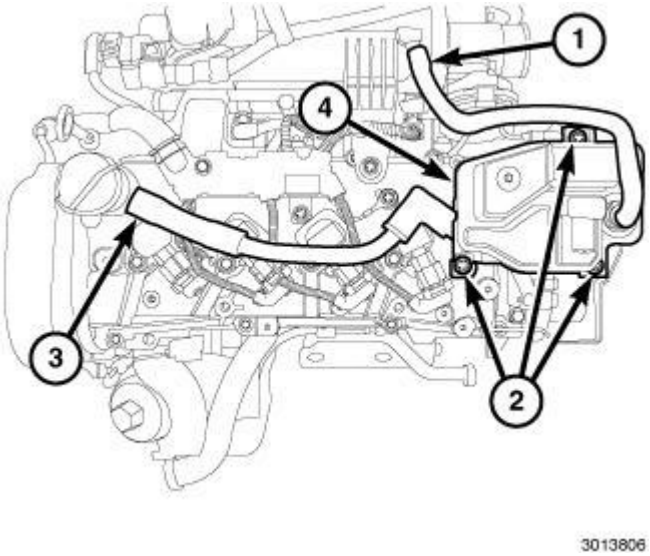


Fig. 226: PCV Hose, Bolts, Vent Hose & Oil Separator Housing
Courtesy of CHRYSLER GROUP, LLC

9. Install the oil separator housing (4) to the cylinder head cover with three bolts (2) tightened to 13 N.m (115 in. lbs.).
10. Connect the vent hose (3) to the oil filler neck.
11. Connect the PCV hose (1) to the intake manifold.

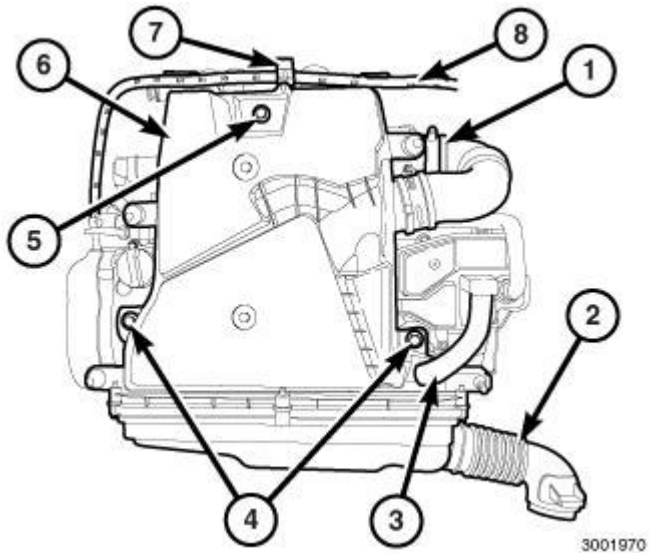


Fig. 227: Air Cleaner Body Assembly
Courtesy of CHRYSLER GROUP, LLC

12. Install the air cleaner body (6). Refer to **BODY, AIR CLEANER, INSTALLATION**.

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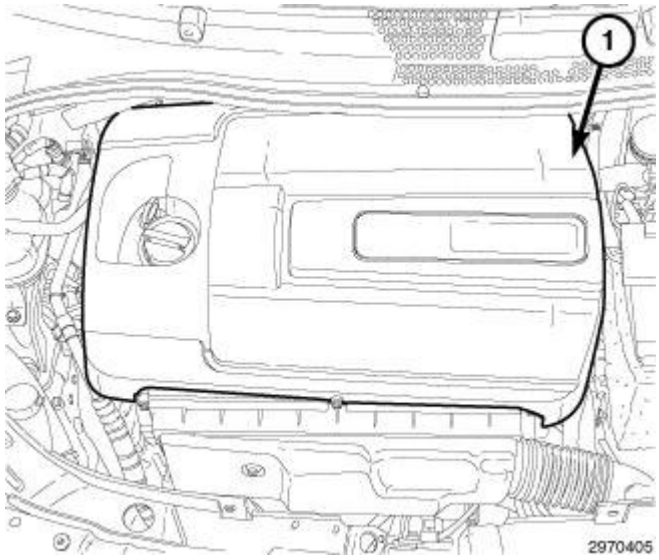


Fig. 228: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

13. Install the engine cover (1).
14. Run the engine a check the vacuum pump for proper operation.

SEAL(S), CAMSHAFT

REMOVAL

REMOVAL

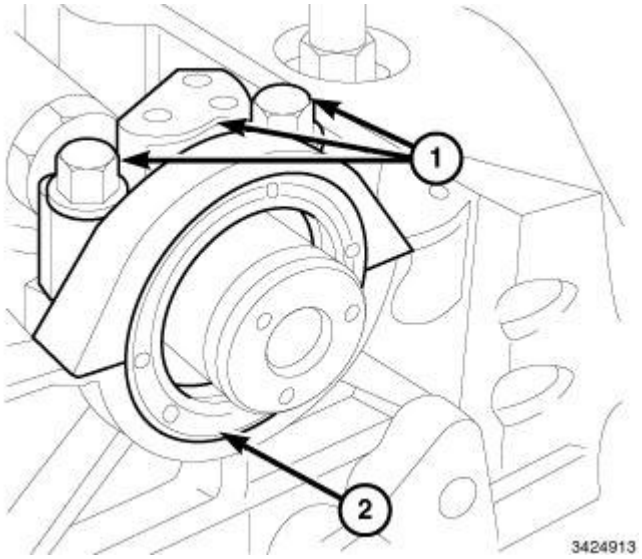


Fig. 229: Camshaft Cap, Bolts & Seal
Courtesy of CHRYSLER GROUP, LLC

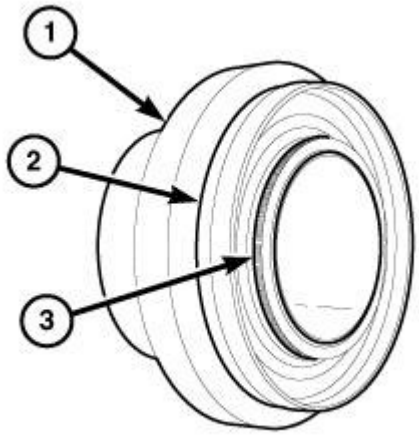
1. Remove the cylinder head cover. Refer to **COVER(S), CYLINDER HEAD, REMOVAL**.

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2. Remove the camshaft pulley. Refer to **SPROCKET(S), TIMING BELT AND CHAIN, REMOVAL**.
3. Remove the bolts and the camshaft cap (1).
4. Remove the camshaft seal (2).

INSTALLATION

INSTALLATION



3086126

Fig. 230: Camshaft Oil Seal Installer, Camshaft Oil Seal & Garter Spring
Courtesy of CHRYSLER GROUP, LLC

1. Apply engine oil to the seal pilot diameter of the (special tool #10278, Installer, Camshaft Oil Seal) (1) and to the inside diameter of the camshaft oil seal (2).
2. Carefully install the oil seal onto the seal installer.

NOTE: Make sure that the garter spring (3) is intact around the inside of the oil seal lip.

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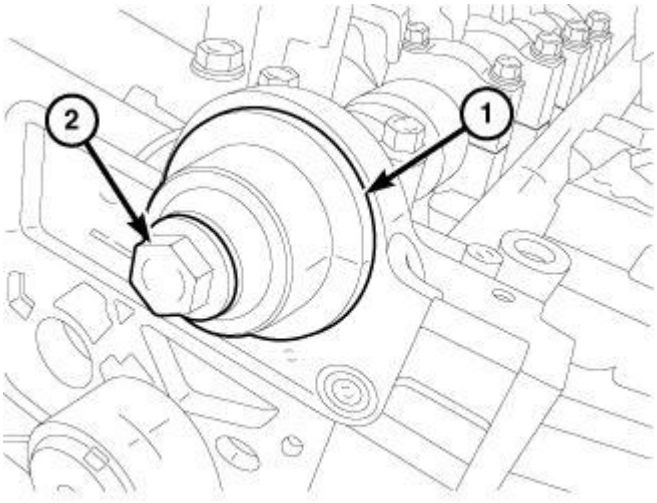


Fig. 231: Camshaft Sprocket Bolt & Seal Installer
Courtesy of CHRYSLER GROUP, LLC

3. Apply engine oil to the outside diameter of the oil seal.
4. Position the seal installer (1) on the camshaft and install the camshaft sprocket bolt (2).
5. Tighten the camshaft sprocket bolt (2) until the camshaft oil seal is seated in the camshaft bearing housing.

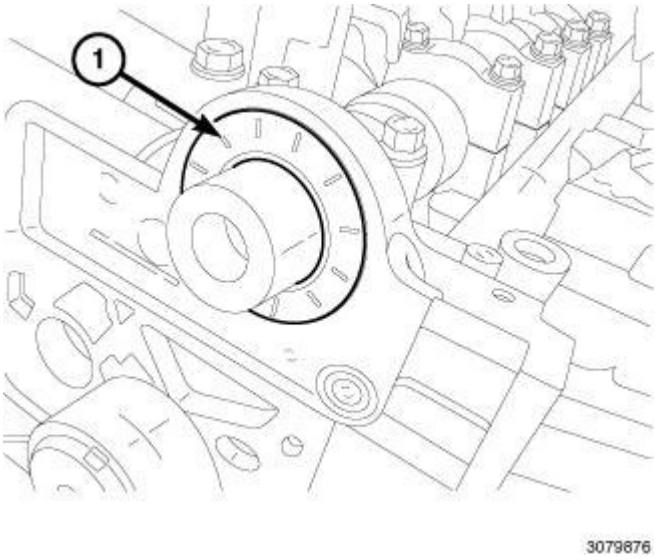


Fig. 232: Camshaft Seal
Courtesy of CHRYSLER GROUP, LLC

6. Verify that the oil seal is uniformly seated and that the seal lip (1) is not curled inward toward the engine.
7. Install the camshaft sprocket and timing belt. Refer to **BELT, TIMING, INSTALLATION**.

SEAL(S), VALVE GUIDE

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DESCRIPTION

DESCRIPTION

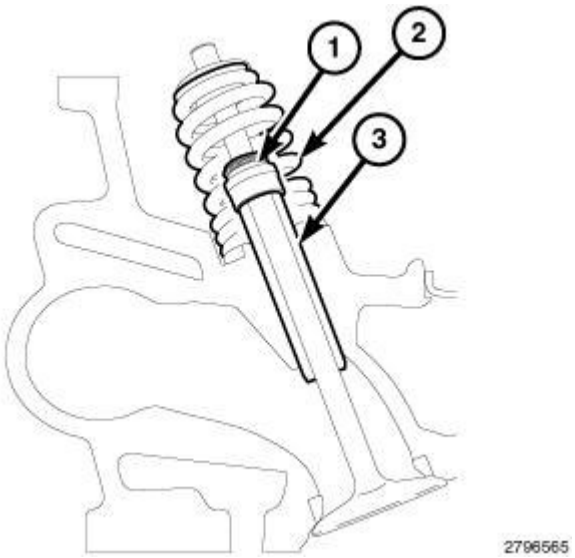


Fig. 233: Valve Stem Oil Seal, Valve Spring & Valve Guide
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical valve configuration shown in illustration.

The valve stem oil seals (1) are made of elastomer over-molded steel in a non-integrated type guide mounted configuration. The seal is not held in place by the valve spring (2). The valve stem seals are not reusable if removed from the valve guides (3), they must be replaced. Always coat the valve seals with clean engine oil before installing the valves.

REMOVAL

REMOVAL

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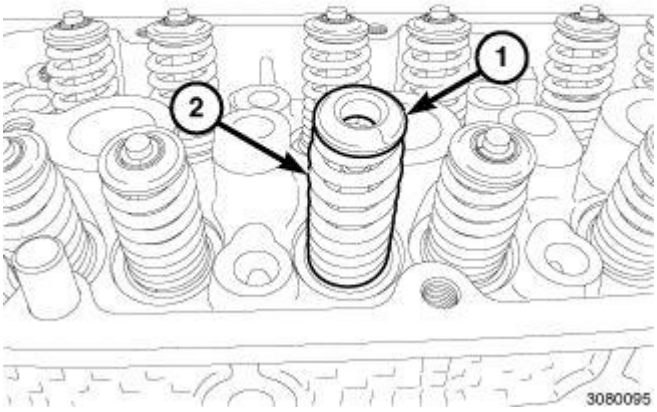


Fig. 234: Valve Spring & Retainer
Courtesy of CHRYSLER GROUP, LLC

NOTE: If the springs are to be reused, identify their positions so that they can be reassembled into their original locations. Number 2 cylinder exhaust valve spring shown in illustration, all other valve springs similar.

1. Remove the valve spring(s) (2). Refer to **SPRING(S), VALVE, REMOVAL**.

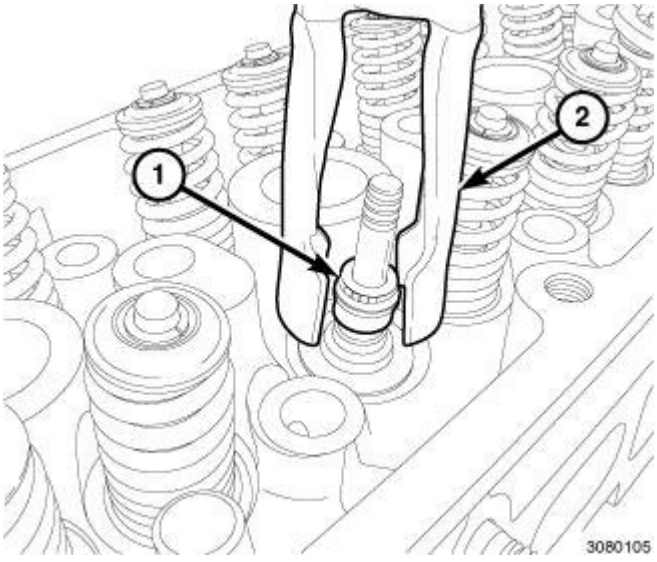


Fig. 235: Valve Guide Seal & Valve Seal Tool
Courtesy of CHRYSLER GROUP, LLC

NOTE: Number 2 cylinder exhaust valve guide seal shown in illustration, all other valve guide seals similar.

2. Remove the valve guide seal (1) using a valve seal tool (2). Discard the removed seal.

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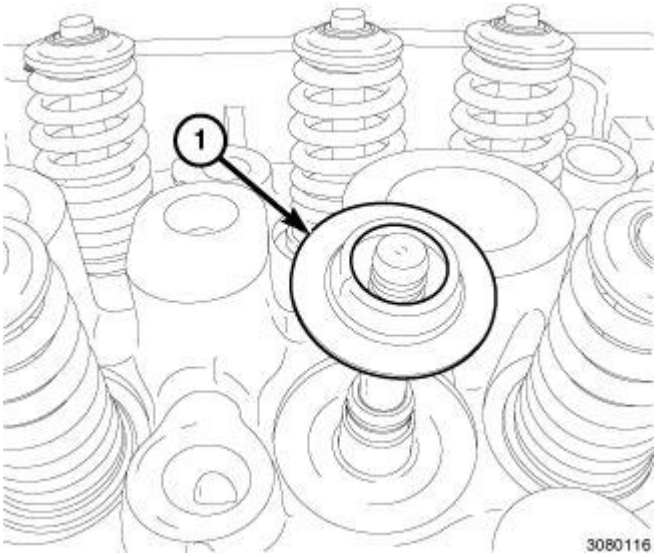


Fig. 236: Valve Spring Seat
Courtesy of CHRYSLER GROUP, LLC

NOTE: Number 2 cylinder exhaust valve spring seat shown in illustration. Exhaust valve spring seats are marked with the letter "S" and have a thickness of 0.8 mm (0.031 in.). Intake valve spring seats are marked with the letter "A" and have a thickness of 3.2 mm (0.126 in.).

3. If required, remove the valve spring seat (1).
4. If required, remove the valve(s). Refer to **VALVES, INTAKE AND EXHAUST, REMOVAL**.

INSTALLATION

INSTALLATION

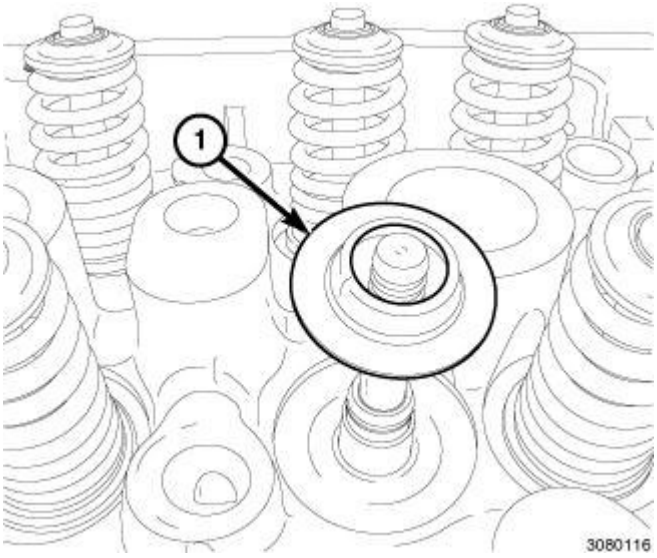


Fig. 237: Valve Spring Seat

 © 2011 Mitchell Repair Information Company, LLC.

Courtesy of CHRYSLER GROUP, LLC

NOTE: Reassemble the valves into their original locations. If the valves or valve seats have been refinished, verify that the valve stem tip height is within specification. Refer to SPECIFICATIONS .

1. If removed, install the valve(s). Refer to **VALVES, INTAKE AND EXHAUST, INSTALLATION**.

NOTE: Number 2 cylinder exhaust valve spring seat shown in illustration. Exhaust valve spring seats are marked with the letter "S" and have a thickness of 0.8 mm (0.031 in.). Intake valve spring seats are marked with the letter "A" and have a thickness of 3.2 mm (0.126 in.).

2. If removed, install the spring seat (1) over the valve guide.

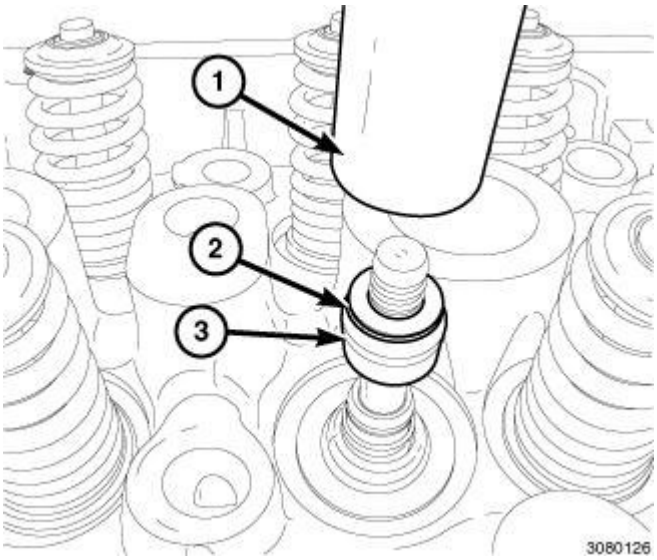


Fig. 238: Driver, Garter Spring & Valve Guide Seal
Courtesy of CHRYSLER GROUP, LLC

3. Apply engine oil to the lip of the valve guide seal (3). Install the valve guide seal (3) over the valve stem. Using an appropriate driver (1), push the seal firmly and squarely over the valve guide. **Do Not Force** the seal against the top of guide.

NOTE: Make sure that the garter spring (2) is intact around the top of the valve guide seal (3). Number 2 cylinder exhaust valve guide seal shown in illustration, all other valves similar.

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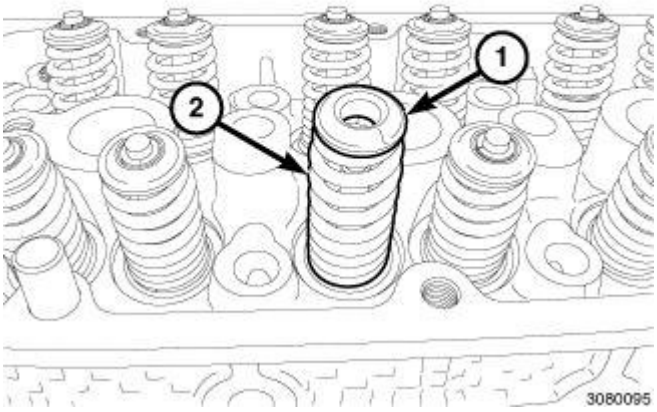


Fig. 239: Valve Spring & Retainer
Courtesy of CHRYSLER GROUP, LLC

NOTE: If the valve springs are being reused, reassemble them into their original locations. Number 2 cylinder exhaust valve spring shown in illustration, all other valves similar.

4. Install the valve spring(s) (2). Refer to **SPRING(S), VALVE, INSTALLATION**.

SPRING(S), VALVE

DESCRIPTION

DESCRIPTION

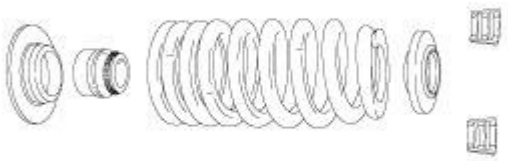


Fig. 240: Valve Springs Assembly

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Courtesy of CHRYSLER GROUP, LLC

The valve springs are a beehive design and made from high strength chrome silicon steel. The springs are common for intake and exhaust applications. Valve guide seals are rubber overmolded on a steel support cylinder with a garter spring at the seal lip. The seals are not integrated with the valve spring seat. The steel valve spring retainers are designed for use with beehive springs and the valve spring retainer locks are a three bead Butt type design to promote valve rotation.

REMOVAL

ON VEHICLE

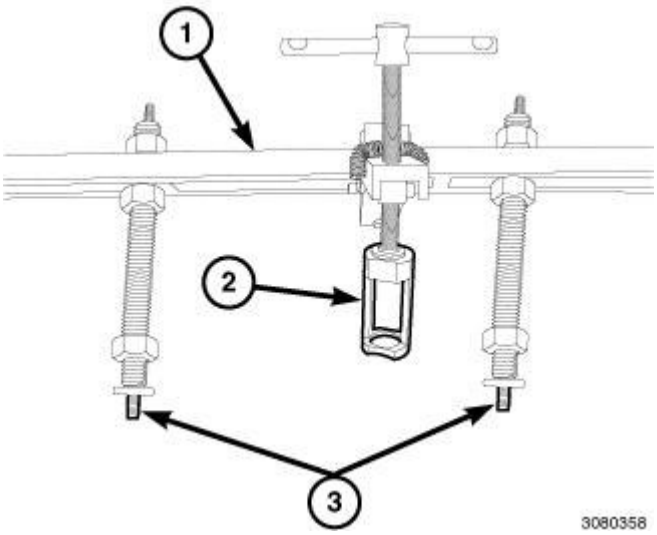


Fig. 241: Valve Spring Compressor, Valve Spring Compressor Studs & Valve Spring Adapter
Courtesy of CHRYSLER GROUP, LLC

1. Remove the camshaft bearing housing. Refer to **HOUSING, CAMSHAFT BEARING, REMOVAL**.
2. Install the (special tool #10224, Adapter, Valve Spring) (2) and the (special tool #10275, Studs, Valve Spring Compressor) (3) on the (special tool #MD998772A, Compressor, Valve Spring) (1).

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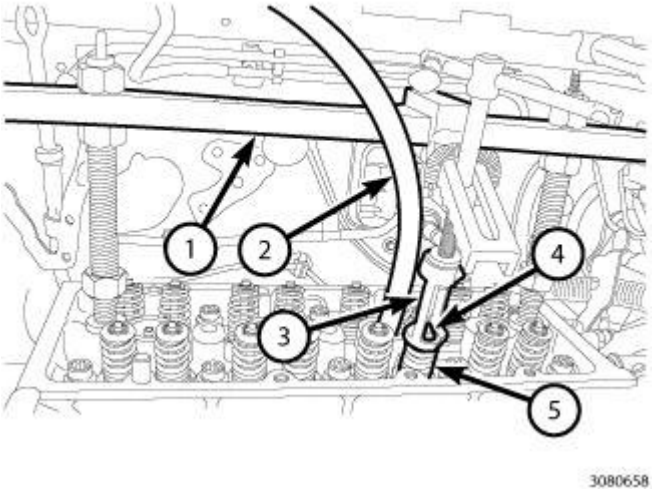


Fig. 242: Valve Spring Compressor, Air Supply, Valve Spring Adapter, Valve Retaining Locks & Compressed Valve Spring
Courtesy of CHRYSLER GROUP, LLC

NOTE: Number 3 cylinder exhaust valve spring compression shown in illustration, all other valves similar.

3. Remove the spark plug. Refer to **SPARK PLUG, REMOVAL** .
4. Install the (special tool #MD998772A, Compressor, Valve Spring) (1) onto the cylinder head.
5. Install a spark plug adapter attached to a regulated shop air supply (2). Pressurize the cylinder being serviced to 620.5 - 689 kPa (90 - 100 psi) to hold the valves in place.

CAUTION: Air pressure must be maintained as long as the valve springs are removed to prevent the valves from dropping into the cylinders.

6. Using the (special tool #10224, Adapter, Valve Spring) (3), compress valve spring (5) and remove valve retaining locks (4).

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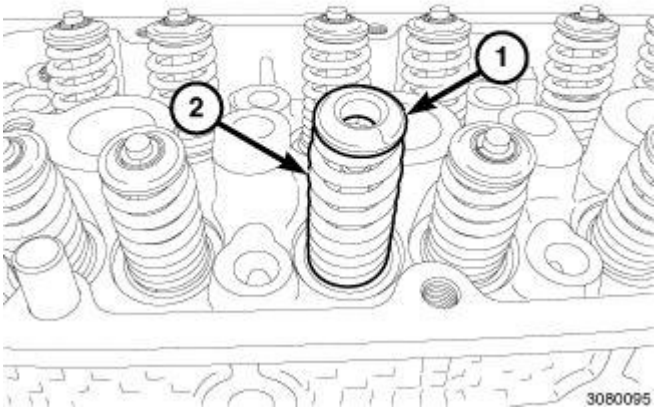


Fig. 243: Valve Spring & Retainer
Courtesy of CHRYSLER GROUP, LLC

NOTE: If the springs are to be reused, identify their positions so that they can be reassembled into their original locations. Number 2 cylinder exhaust valve spring shown in illustration, all other valve springs similar.

7. Release the valve spring compression and remove the valve spring retainer (1) and valve spring (2).
8. If required, remove the valve guide seal and spring seat. Refer to **SEAL(S), VALVE GUIDE, REMOVAL**.

OFF VEHICLE

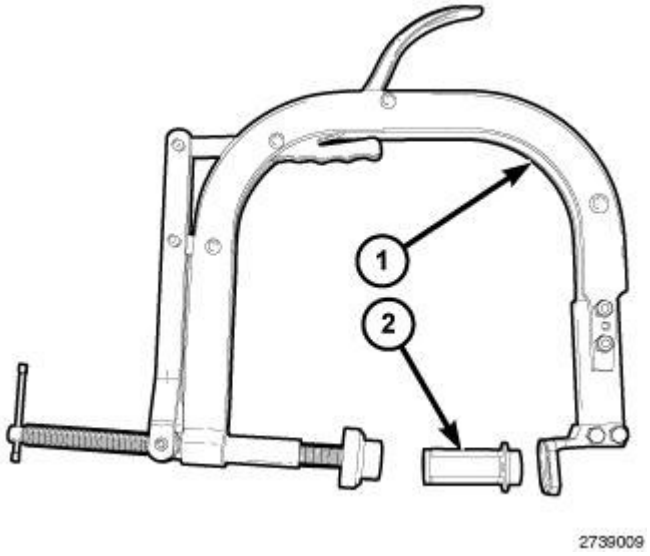


Fig. 244: Valve Spring Compressor Components
Courtesy of CHRYSLER GROUP, LLC

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1. Remove the cylinder head. Refer to **CYLINDER HEAD, REMOVAL**.
2. Position the (special tool #10224, Adapter, Valve Spring) (2) in the (special tool #C-3422-D, Compressor, Valve Spring) (1).

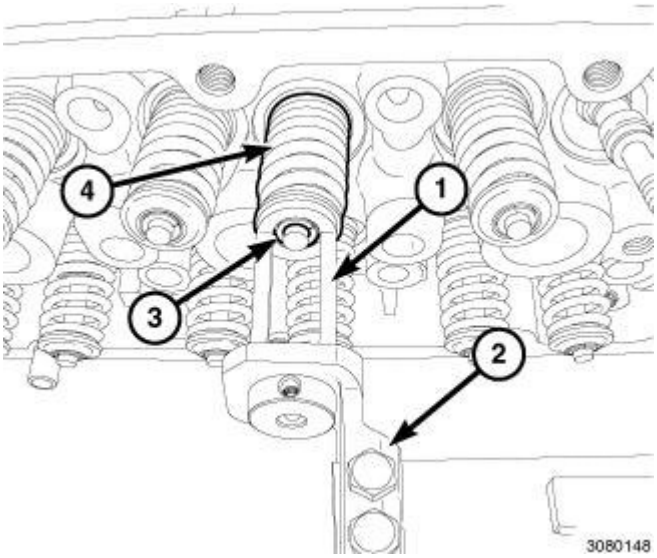


Fig. 245: Valve Spring Adapter, Valve Spring Compressor, Retaining Locks & Valve Springs
Courtesy of CHRYSLER GROUP, LLC

NOTE: Number 3 cylinder exhaust valve spring compression shown in illustration, all other valves similar.

3. Compress the valve spring (4) and remove the valve retaining locks (3).

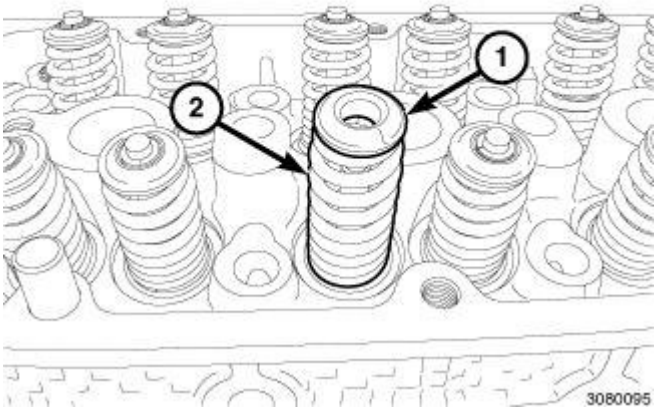


Fig. 246: Valve Spring & Retainer
Courtesy of CHRYSLER GROUP, LLC

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NOTE: If the springs are to be reused, identify their positions so that they can be reassembled into their original locations. Number 2 cylinder exhaust valve spring shown in illustration, all other valves similar.

4. Release the valve spring compression and remove the valve spring retainer (1) and valve spring (2).
5. If required, remove the valve(s). Refer to **VALVES, INTAKE AND EXHAUST, REMOVAL**.
6. If required, remove the valve guide seal and spring seat. Refer to **SEAL(S), VALVE GUIDE, REMOVAL**.

INSPECTION

INSPECTION

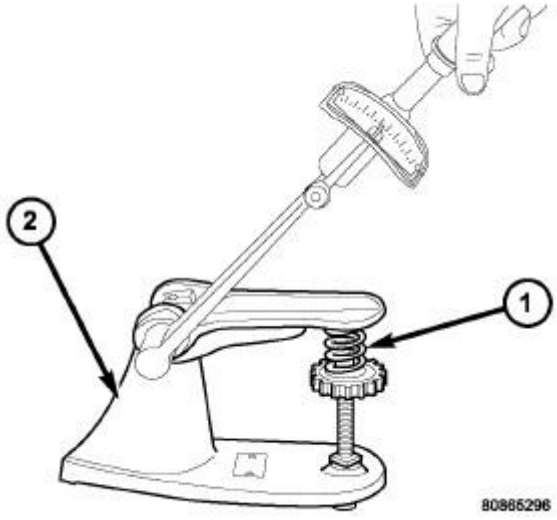


Fig. 247: Testing Valve Spring
Courtesy of CHRYSLER GROUP, LLC

When valves have been removed for inspection, reconditioning or replacement, valve springs should be checked against specifications for free-length, spring force and spring installed height. Refer to **SPECIFICATIONS** .

Spring force can be measured with a test fixture (2). Follow the tool manufactures instructions. Replace any springs that do not meet specifications.

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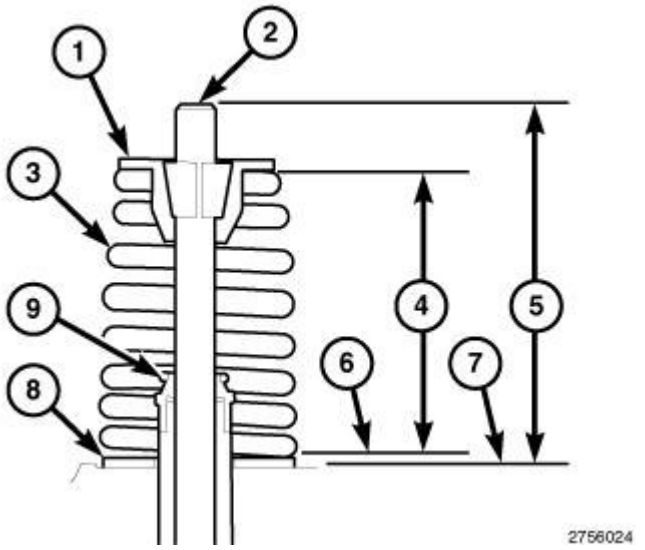


Fig. 248: Checking Valve Spring Installed Height
Courtesy of CHRYSLER GROUP, LLC

Installed height of the valve spring must be checked with the valve assembled into the cylinder head. Refer to **SPRING(S), VALVE, INSTALLATION**.

If the valves or valve seats have been refinished, check the installed height of the valve springs (4). Make sure the measurement is taken from the top of spring seat (6) to the bottom surface of spring retainer (1). Refer to **SPECIFICATIONS** .

INSTALLATION

ON VEHICLE

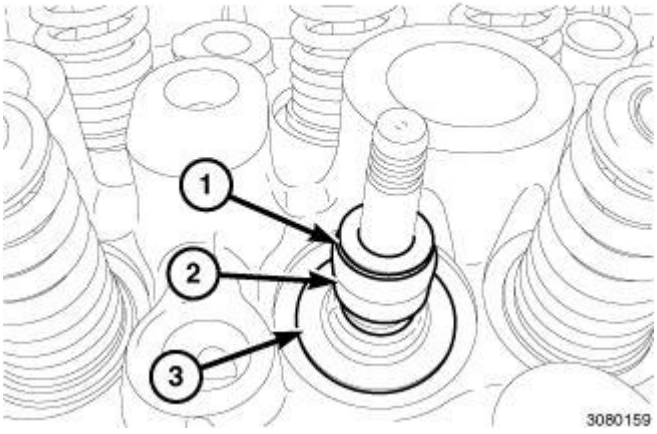


Fig. 249: Garter Spring, Valve Guide Seal & Spring Seat
Courtesy of CHRYSLER GROUP, LLC

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1. If removed, install the spring seat (3) and valve guide seal (2) over the valve guide. Refer to **SEAL(S), VALVE GUIDE, INSTALLATION**.

NOTE: Make sure that the garter spring (1) is intact around the top of the valve guide seal (2). Number 2 cylinder exhaust valve guide seal shown in illustration, all other valves similar.

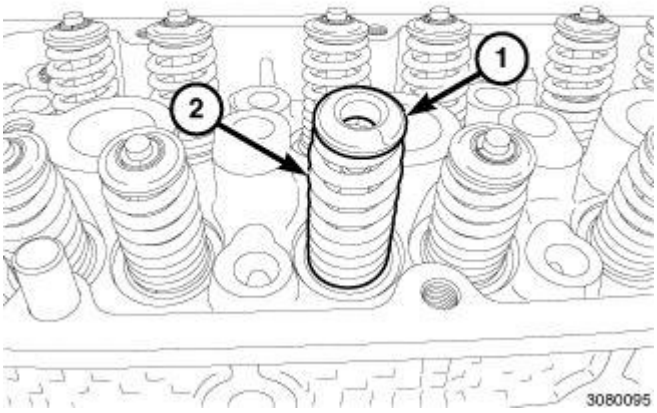
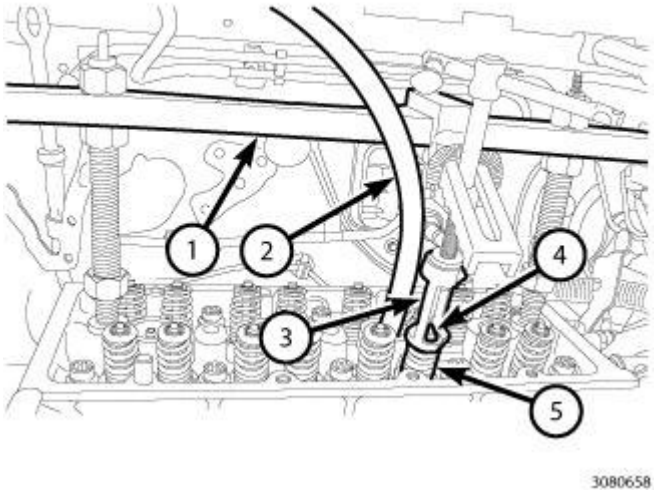


Fig. 250: Valve Spring & Retainer
Courtesy of CHRYSLER GROUP, LLC

NOTE: If the valve springs are being reused, reassemble them into their original locations. Number 2 cylinder exhaust valve spring shown in illustration, all other valves similar.

2. Install the valve spring (2) and valve spring retainer (1).



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Fig. 251: Valve Spring Compressor, Air Supply, Valve Spring Adapter, Valve Retaining Locks & Compressed Valve Spring
Courtesy of CHRYSLER GROUP, LLC

NOTE: Number 3 cylinder exhaust valve spring compression shown in illustration, all other valves similar.

3. Using the (special tool #10224, Adapter, Valve Spring) (3) with the (special tool #MD998772A, Compressor, Valve Spring) (2), compress the valve spring (5) **only enough** to install the valve retaining locks (4).
4. Relieve the air pressure and remove the spark plug adapter.
5. Install the spark plug and tighten to 19 N.m (14 ft. lbs.). Refer to **SPARK PLUG, INSTALLATION** .
6. Install the camshaft bearing housing. Refer to **HOUSING, CAMSHAFT BEARING, INSTALLATION**.
7. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).

OFF VEHICLE

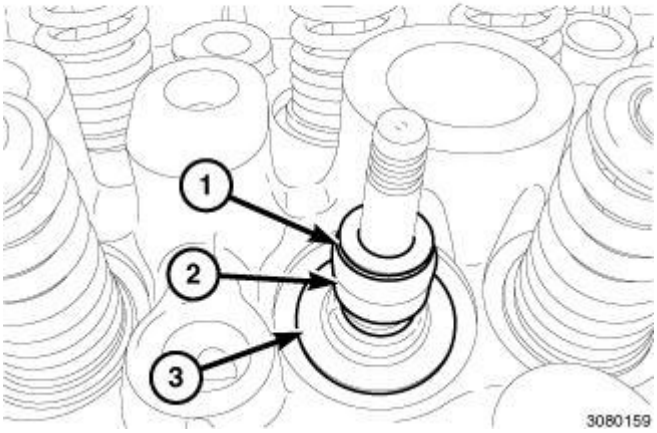


Fig. 252: Garter Spring, Valve Guide Seal & Spring Seat
Courtesy of CHRYSLER GROUP, LLC

1. If removed, install the valve(s). Refer to **VALVES, INTAKE AND EXHAUST, INSTALLATION**.

NOTE: Reassemble the valves into their original locations. If the valves or valve seats have been refinished, verify that the valve stem tip height is within specification. Refer to SPECIFICATIONS .

2. If removed, install the spring seat (3) and valve guide seal (2) over the valve guide. Refer to **SEAL(S), VALVE GUIDE, INSTALLATION**.

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NOTE: Make sure that the garter spring (1) is intact around the top of the valve guide seal (2). Number 2 cylinder exhaust valve guide seal shown in illustration, all other valves similar.

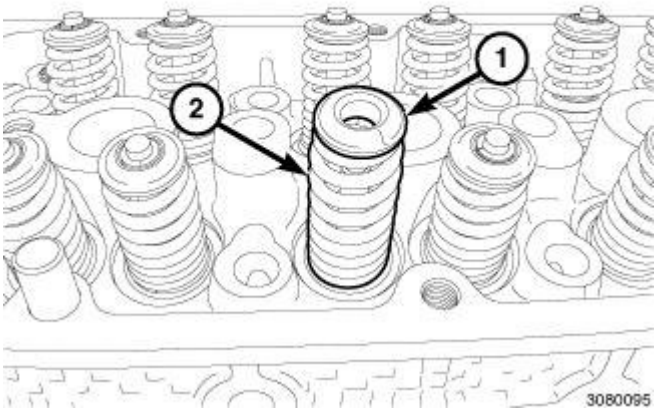


Fig. 253: Valve Spring & Retainer
Courtesy of CHRYSLER GROUP, LLC

NOTE: If the valve springs are being reused, reassemble them into their original locations. Number 2 cylinder exhaust valve spring shown in illustration, all other valves similar.

3. Install the valve spring (2) and valve spring retainer (1).

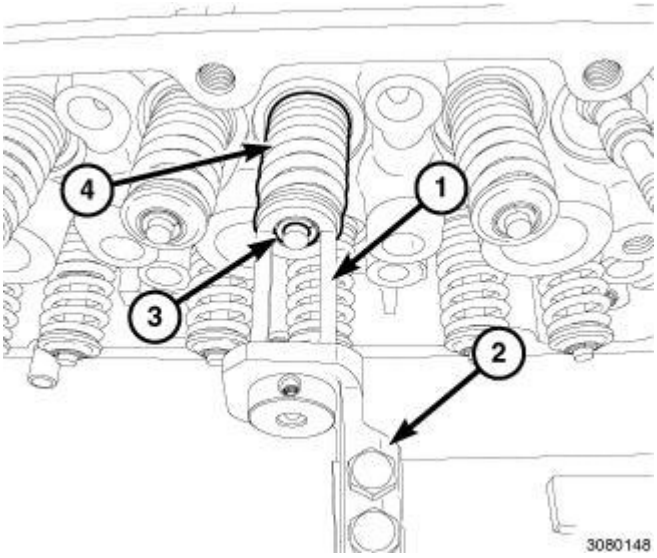


Fig. 254: Valve Spring Adapter, Valve Spring Compressor, Retaining Locks & Valve Springs
Courtesy of CHRYSLER GROUP, LLC

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NOTE: Number 3 cylinder exhaust valve spring compression shown in illustration, all other valves similar. If the valves or valve seats have been refinished, verify that the installed height of the valve springs is within specification. Refer to SPECIFICATIONS .

4. Compress valve springs (4) with the (special tool #10224, Adapter, Valve Spring) (1) mounted in the (special tool #C-3422-D, Compressor, Valve Spring) (2). Install the retaining locks (3) and release the valve spring compression.
5. Install the cylinder head. Refer to **CYLINDER HEAD, INSTALLATION**.

TUBE, SPARK PLUG

REMOVAL

REMOVAL

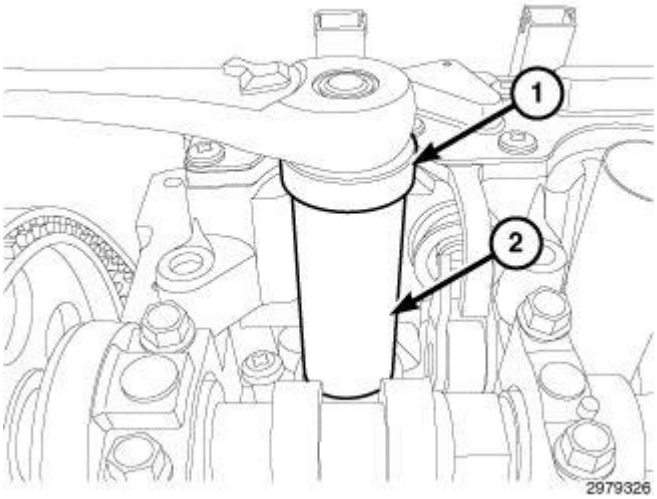


Fig. 255: Spark Plug Tube Remover/Installer & Tube
Courtesy of CHRYSLER GROUP, LLC

NOTE: Number 1 cylinder spark plug tube shown in illustration, all others similar.

1. Disconnect and isolate the negative battery cable.
2. Remove the cylinder head cover. Refer to **COVER(S), CYLINDER HEAD, REMOVAL**.
3. Using the (special tool #10280, Remover/Installer, Spark Plug Tube) (1), remove the tube (2) from the cylinder head and discard the tube.
4. Clean the area around the spark plug tube mounting with Mopar® Parts Cleaner or equivalent.

INSTALLATION

INSTALLATION

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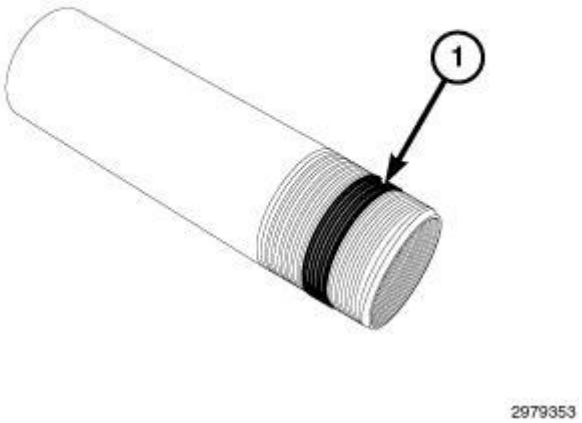


Fig. 256: Spark Plug Tube Sealant
Courtesy of CHRYSLER GROUP, LLC

NOTE: The spark plug tube is pre-treated with sealant (1), therefore it must be replaced each time it is removed. Do not add any additional sealant to the threads.

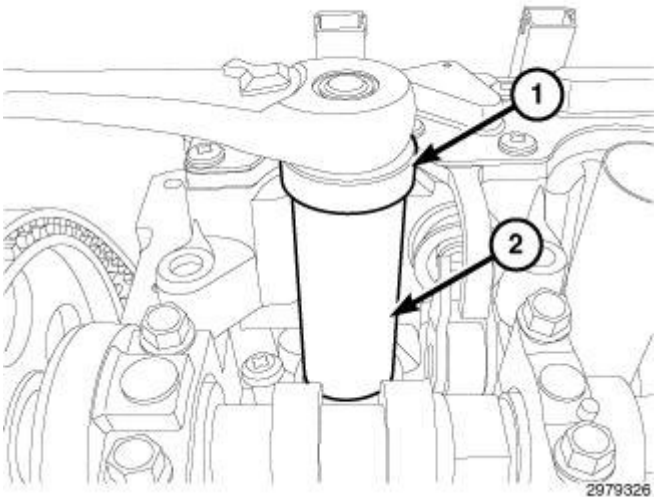


Fig. 257: Spark Plug Tube Remover/Installer & Tube
Courtesy of CHRYSLER GROUP, LLC

1. Position the spark plug tube (2) into the cylinder head. Using the (special tool #10280, Remover/Installer, Spark Plug Tube) (1), tighten the tube to 41 N.m (30 ft. lbs.).

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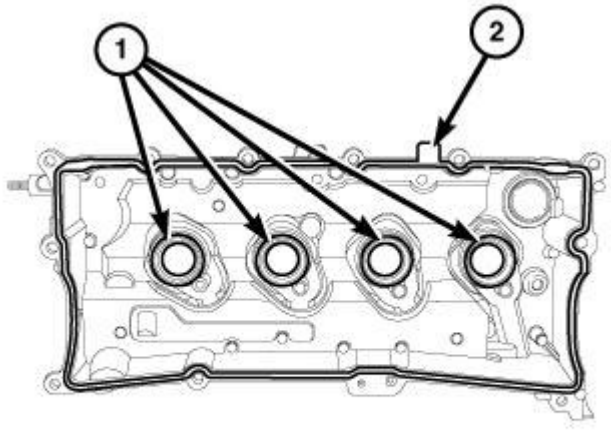


Fig. 258: Cylinder Head Cover Gasket & Spark Plug Tube Seals
Courtesy of CHRYSLER GROUP, LLC

2. If required, install a new spark plug tube seal (1).
3. Install the cylinder head cover. Refer to **COVER(S), CYLINDER HEAD, INSTALLATION**.

Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).

VALVES, INTAKE AND EXHAUST

DESCRIPTION

DESCRIPTION

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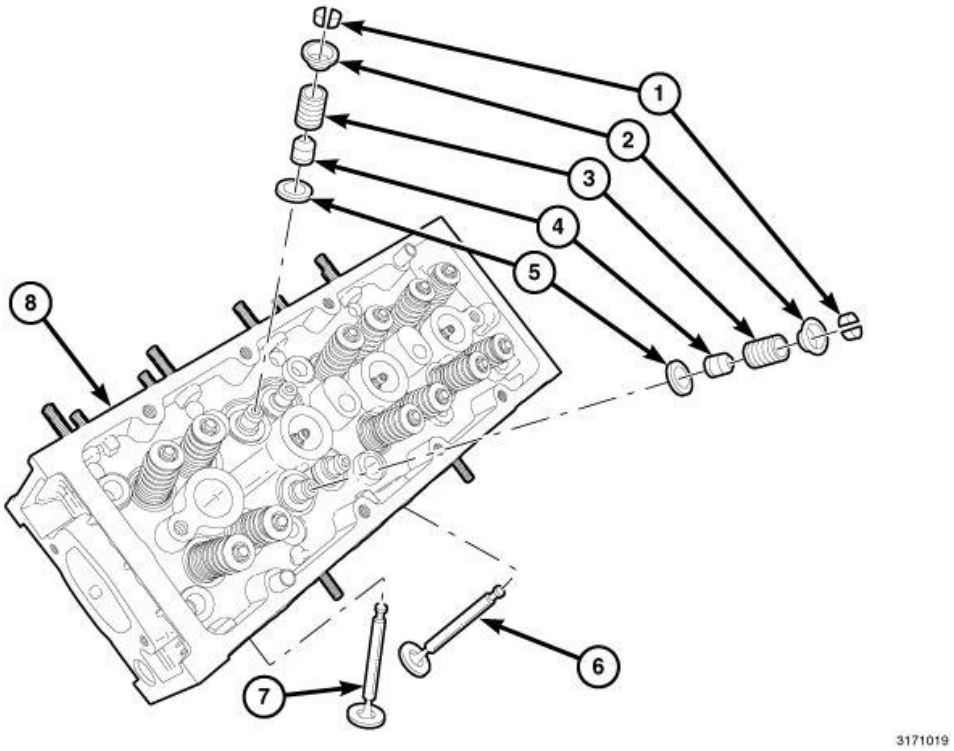


Fig. 259: Intake & Exhaust Valves Assembly
Courtesy of CHRYSLER GROUP, LLC

Each of the four combustion chambers contains four valves, two intake and two exhaust, for a total of 16 valves. The intake valves (6) are opened by the variable valve actuation assembly. The exhaust valves (7) are opened directly by the camshaft through hydraulic bucket style cam followers. All valves use three bead lock keepers (1) to retain springs (3) and to promote valve rotation.

STANDARD PROCEDURE

STANDARD PROCEDURE - REFACING - INTAKE AND EXHAUST VALVES

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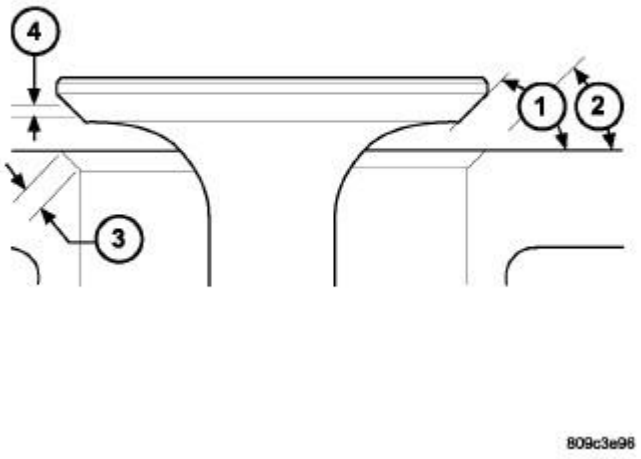


Fig. 260: Valve Face & Seat
Courtesy of CHRYSLER GROUP, LLC

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

The intake and exhaust valves have a 44.5 to 45 degree face angle (1). The valve seats (2) have a 45 to 45.5 degree face angle.

VALVES

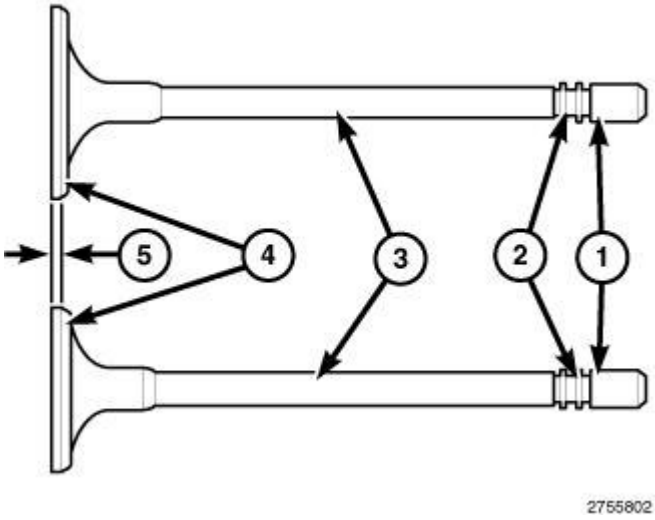


Fig. 261: Inspecting Valve Margin
Courtesy of CHRYSLER GROUP, LLC

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Inspect the remaining margin (5) after the valves are refaced. Refer to **SPECIFICATIONS** .

VALVE SEATS

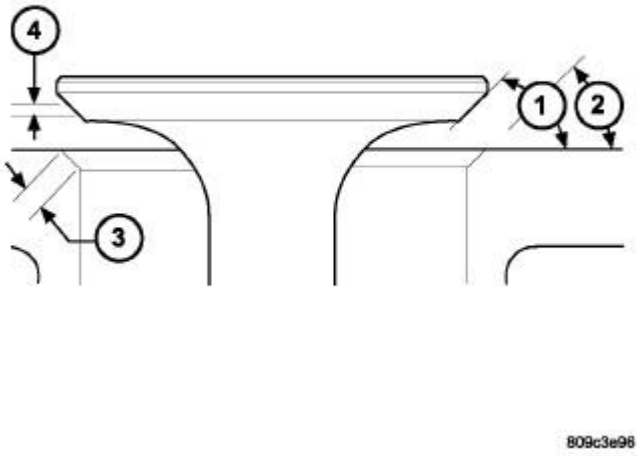


Fig. 262: Valve Face & Seat
Courtesy of CHRYSLER GROUP, LLC

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

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

1. Measure the concentricity of the valve seat using a dial indicator. Refer to **SPECIFICATIONS** .
2. Inspect the valve seat (3) with Prussian blue to determine where the valve contacts the seat. To do this, coat the valve seat (3) **LIGHTLY** with Prussian blue then set the valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of the valve face (4), contact is satisfactory. If the blue is transferred to the top edge of the valve face, then lower the valve seat with a 15 degree stone. If the blue is transferred to the bottom edge of the valve face, then raise the valve seat with a 65 degree stone.

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

3. When the seat is properly positioned the width of the intake and exhaust seats should be within

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specification. Refer to **SPECIFICATIONS** .

VALVE AND SPRING INSTALLED HEIGHT

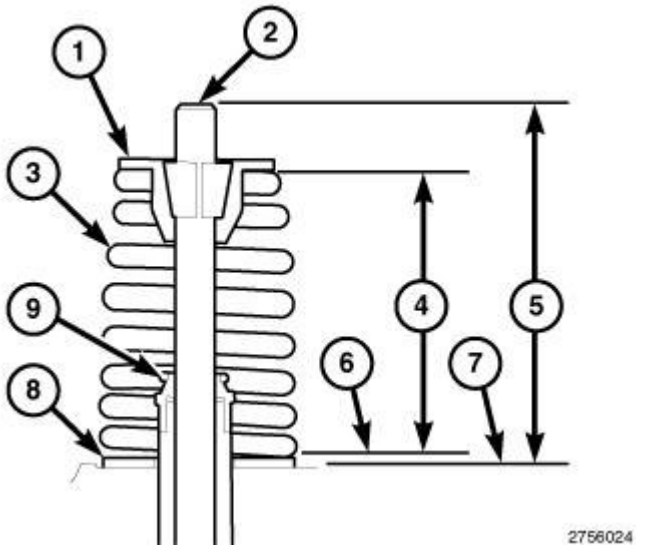
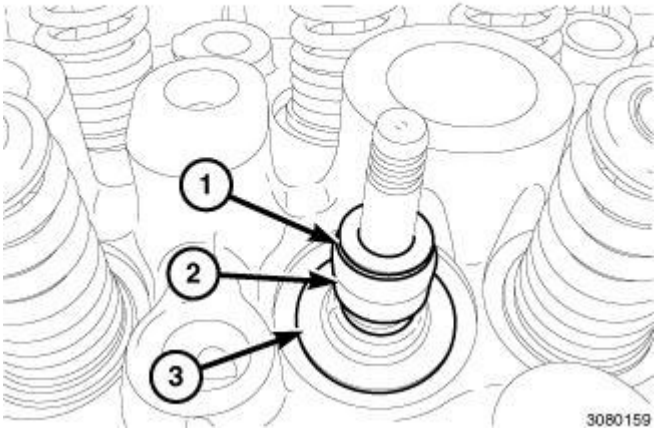


Fig. 263: Checking Valve Spring Installed Height
Courtesy of CHRYSLER GROUP, LLC

1. Coat the valve stems (2) with clean engine oil and install the valves into the cylinder head.

   NOTE: If the valves are being reused, reassemble them into their original locations.

2. If the valves or valve seats have been refinished, check the valve tip height (5). If the valve tip height (5) exceeds the specification, grind the valve tip until it is within specification. Refer to **SPECIFICATIONS** . Make sure the measurement is taken from the cylinder head surface (7) to the top of the valve stem (2).



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Fig. 264: Garter Spring, Valve Guide Seal & Spring Seat
Courtesy of CHRYSLER GROUP, LLC

3. If removed, install the spring seat (3) and valve guide seal (2) over the valve guide. Refer to **SEAL(S), VALVE GUIDE, INSTALLATION**.

NOTE: Ensure that the garter spring (1) is intact around the top of the valve guide seal (2). Number 2 cylinder exhaust valve guide seal shown in illustration, all other valves similar.

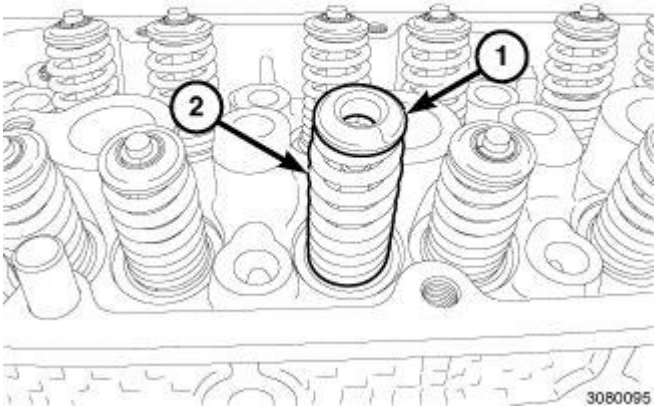


Fig. 265: Valve Spring & Retainer
Courtesy of CHRYSLER GROUP, LLC

NOTE: If the valve springs are being reused, reassemble them into their original locations. Number 2 cylinder exhaust valve spring shown in illustration, all other valves similar.

4. Install the valve spring (2) and valve spring retainer (1).

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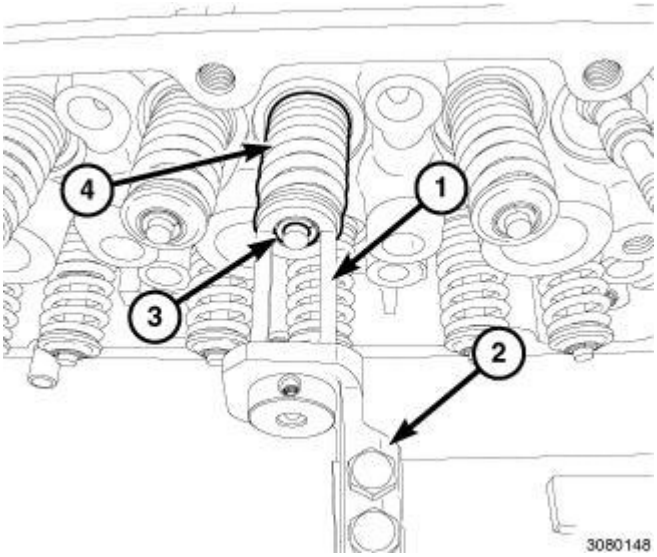


Fig. 266: Valve Spring Adapter, Valve Spring Compressor, Retaining Locks & Valve Springs
Courtesy of CHRYSLER GROUP, LLC

NOTE: Number 3 cylinder exhaust valve spring compression shown in illustration, all other valves similar.

5. Compress valve springs (4) with the Valve Spring Compressor Adapter (special tool #10224, Adapter, Valve Spring) (1) mounted in the Valve Spring Compressor (special tool #C-3422-D, Compressor, Valve Spring) (2). Install the retaining locks (3) and release the valve spring compression.

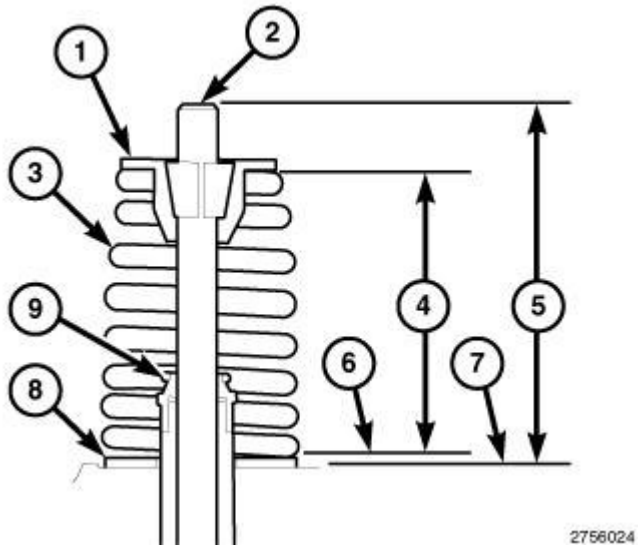


Fig. 267: Checking Valve Spring Installed Height
Courtesy of CHRYSLER GROUP, LLC

6. If the valves or valve seats have been refinished, check the installed height of the valve springs (4). Make sure the measurement is taken from the top of spring seat (6) to the bottom surface of spring retainer (1). Refer to **SPECIFICATIONS** .

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REMOVAL

REMOVAL

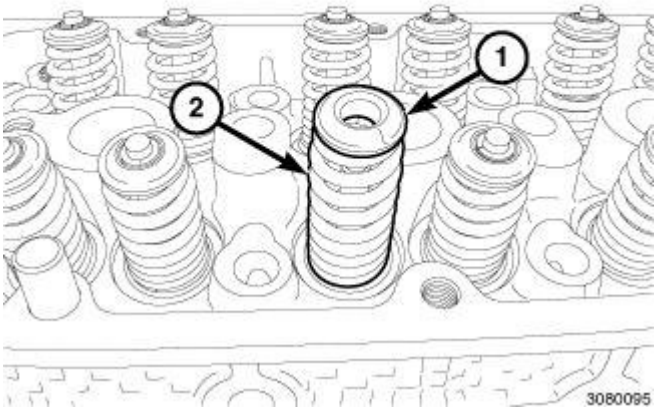


Fig. 268: Valve Spring & Retainer
Courtesy of CHRYSLER GROUP, LLC

1. Remove the cylinder head. Refer to **CYLINDER HEAD, REMOVAL**.

NOTE: **If the springs are to be reused, identify their positions so that they can be reassembled into their original locations. Number 2 cylinder exhaust valve spring shown in illustration, all other valve springs similar.**

2. Remove the valve spring(s) (2). Refer to **SPRING(S), VALVE, REMOVAL**.

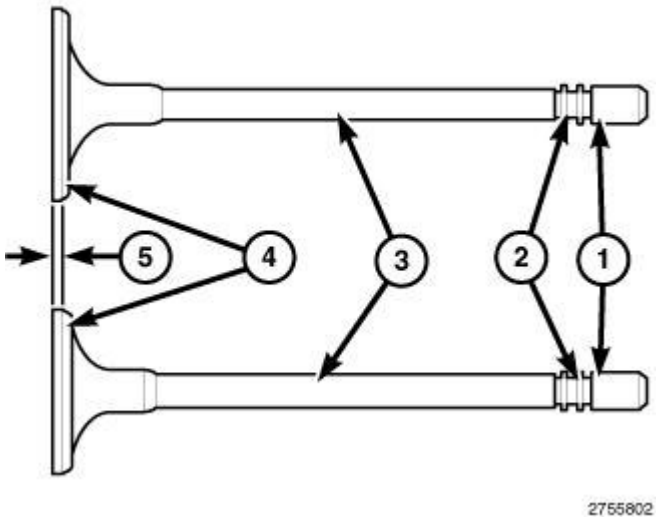


Fig. 269: Inspecting Valve Margin

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Courtesy of CHRYSLER GROUP, LLC

CAUTION: Before removing the valves, remove any burrs from the valve stem retainer lock grooves (2) and stem tip (1) to prevent damage to the valve guides.

3. Remove the valve(s). Identify each valve to ensure installation in the original location.

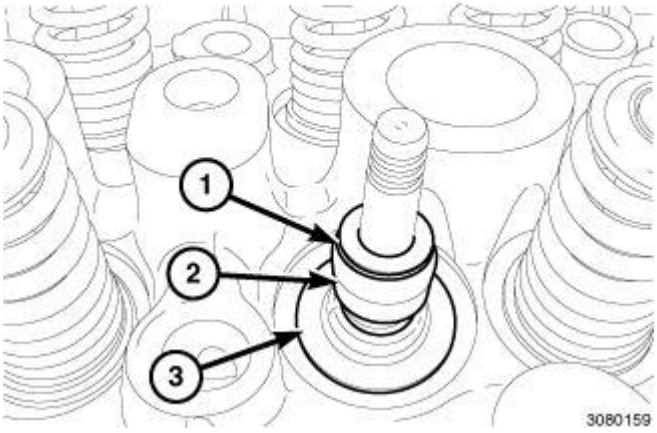


Fig. 270: Garter Spring, Valve Guide Seal & Spring Seat
Courtesy of CHRYSLER GROUP, LLC

4. If required, remove the valve guide seal (2) and spring seat (3). Refer to **SEAL(S), VALVE GUIDE, REMOVAL**.

INSPECTION

INSPECTION

VALVES

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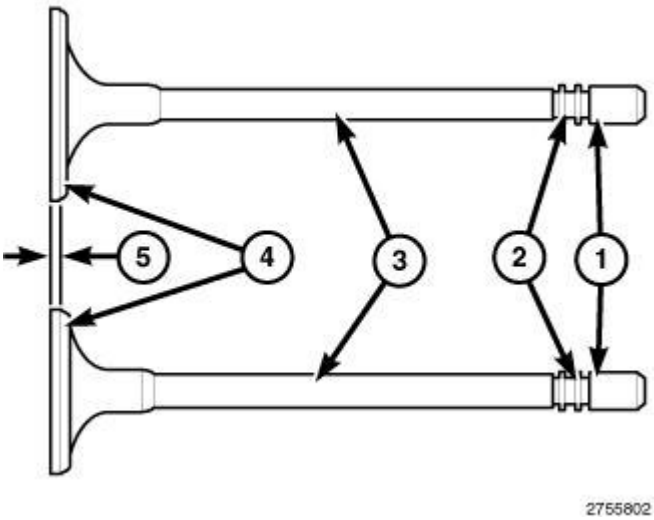


Fig. 271: Inspecting Valve Margin
Courtesy of CHRYSLER GROUP, LLC

1. Clean and inspect the valves thoroughly. Replace burned, warped and cracked valves.
2. Inspect the retainer lock grooves for wear or damage (2).
3. Inspect the valve face (4) for wear and pitting.
4. Measure the valve stems (3) and margins (5) for wear. Refer to **SPECIFICATIONS** .

VALVE GUIDES

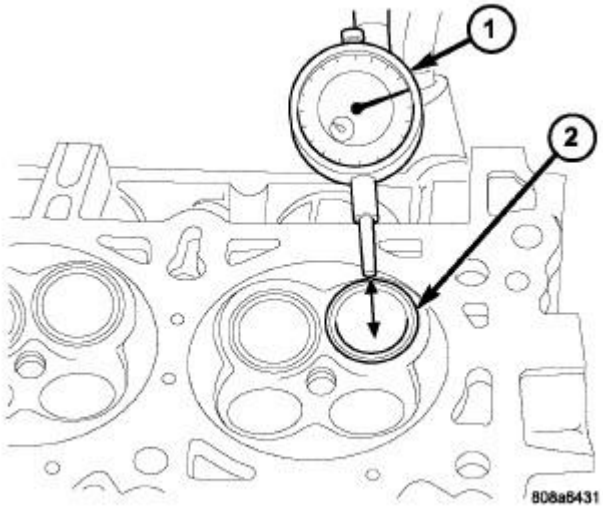


Fig. 272: Measuring Valve Guide Wear - Typical
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical cylinder head shown in illustration.

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1. Remove carbon and varnish deposits from inside of the valve guides with a reliable guide cleaner.
2. Measure valve stem-to-guide clearance as follows:
3. Install the valve (2) into the cylinder head so that it is 15 mm (0.590 inch.) off of the valve seat. A small piece of hose may be used to hold the valve in place.
4. Attach the Dial Indicator Set (special tool #C-3339A, Set, Dial Indicator) (1) to the cylinder head and set it at a right angle to the valve stem being measured.
5. Move the valve to and from the indicator. Compare this reading to the specification. Refer to **SPECIFICATIONS** .

NOTE: If stem-to-guide clearance exceeds specifications, you must measure the valve stem. If the valve stem is within specification or if the valve guide is loose in the cylinder head, replace the cylinder head.

INSTALLATION

INSTALLATION

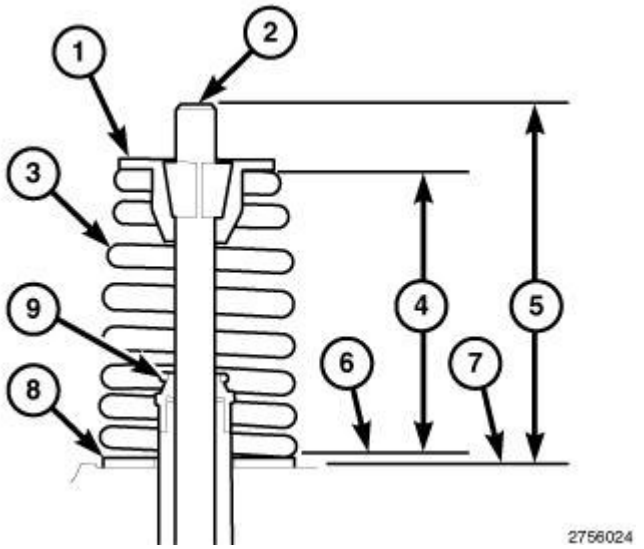


Fig. 273: Checking Valve Spring Installed Height
Courtesy of CHRYSLER GROUP, LLC

1. Coat the valve stems (2) with clean engine oil and install the valves into the cylinder head.

NOTE: If the valves are being reused, reassemble them into their original locations.

2. If the valves or valve seats have been refinished, check the valve tip height (5). If the valve tip height (5) exceeds the specification, grind the valve tip until it is within specification. Refer to **SPECIFICATIONS** . Make sure the measurement is taken from the cylinder head surface (7) to the top of the valve stem (2).

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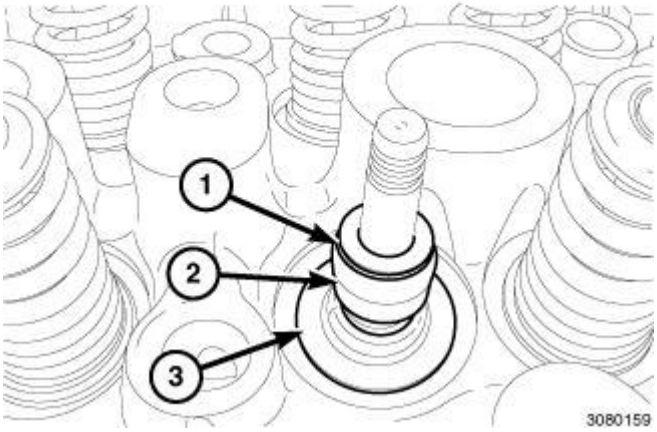


Fig. 274: Garter Spring, Valve Guide Seal & Spring Seat
Courtesy of CHRYSLER GROUP, LLC

3. If removed, install the spring seat (3) and valve guide seal (2) over the valve guide. Refer to **SEAL(S), VALVE GUIDE, INSTALLATION**.

NOTE: Make sure that the garter spring (1) is intact around the top of the valve guide seal (2). Number 2 cylinder exhaust valve guide seal shown in illustration, all other valves similar.

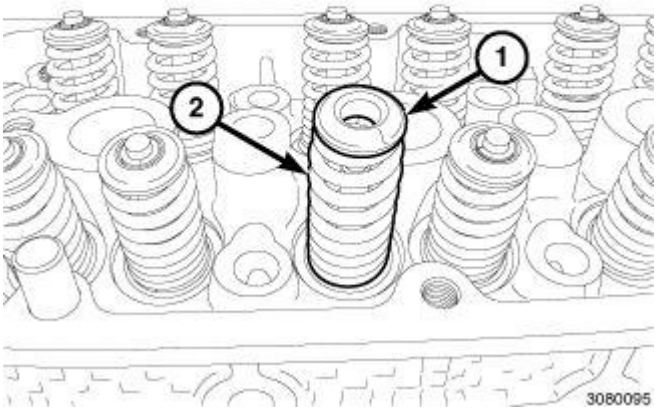


Fig. 275: Valve Spring & Retainer
Courtesy of CHRYSLER GROUP, LLC

4. Install the valve spring(s) (2). Refer to **SPRING(S), VALVE, INSTALLATION**.

NOTE: Reassemble the valves springs into their original locations. If the valves or

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valve seats have been refinished, verify that the valve spring installed height is within specification. Refer to SPECIFICATIONS . Number 2 cylinder exhaust valve spring shown in illustration, all other valves springs similar.

5. Install the cylinder head. Refer to **CYLINDER HEAD, INSTALLATION**.

ENGINE BLOCK

DESCRIPTION

DESCRIPTION

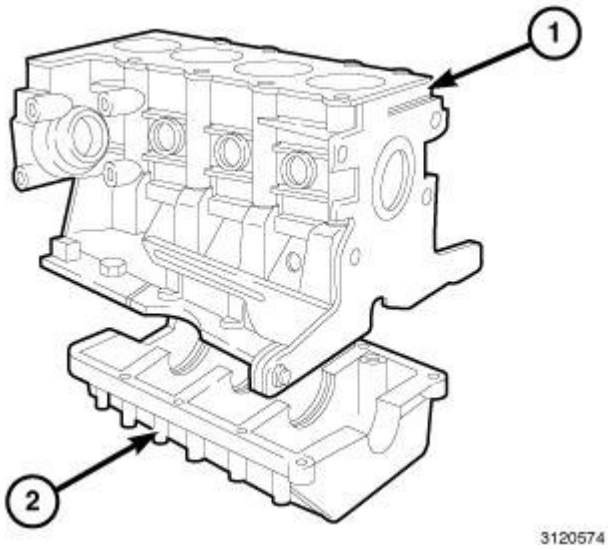


Fig. 276: Engine Block & Bedplate
Courtesy of CHRYSLER GROUP, LLC

The engine block (1) is made from cast iron. The crankshaft is supported by five main bearings. The thrust bearings are attached to the center upper main bearing. The cylinder block has four piston cooling jets located under the main bearing shells. The cylinders are formed directly into the engine block and are divided into three size categories. Special channels formed in the crankcase walls allow the passage of coolant and lubrication oil. A knock sensor is located on the left side of the block.

The bedplate (2) is made from die-cast aluminium alloy and has cast iron cast-in bearing caps. The supports and main bearing caps are machined while assembled together with the engine block. Bolts and locating dowels are used to assure precision assembly of the bedplate and engine block. There is a bead of sealant between the bedplate and engine block to prevent oil leaks.

The function of the bedplate is to:

- form the load carrying structure with the engine block
- support the crankshaft

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- allow return of the engine lubrication oil to the pan
- support the engine oil pan

STANDARD PROCEDURE

MEASURING BEARING CLEARANCE USING PLASTIGAGE

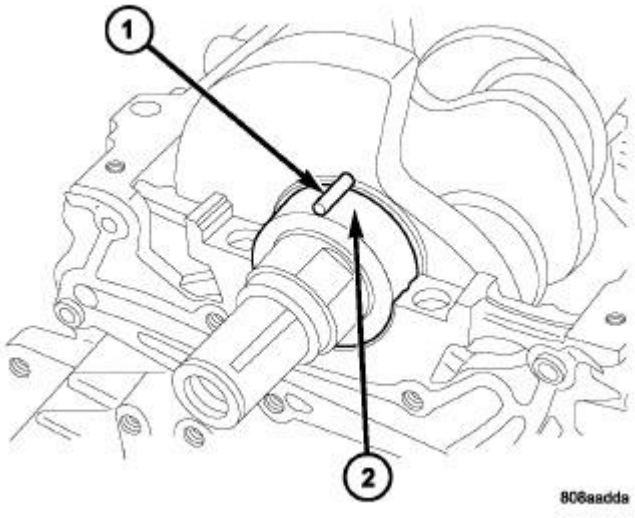


Fig. 277: Plastigage Placed In Lower Shell-Typical
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical crankshaft journal shown in illustration.

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

1. Remove the oil film from surface to be checked. Plastigage is soluble in oil.
2. Place a piece of Plastigage (1) across the entire width of the journal (In addition, suspected areas can be checked by placing the Plastigage in the suspected area). Plastigage must not crumble in use. If brittle, obtain fresh stock.
3. Torque the bearing cap bolts of the bearing being checked to the proper specifications. Refer to **TORQUE SPECIFICATIONS** .

NOTE: DO NOT rotate the crankshaft. Plastigage will smear, causing inaccurate results.

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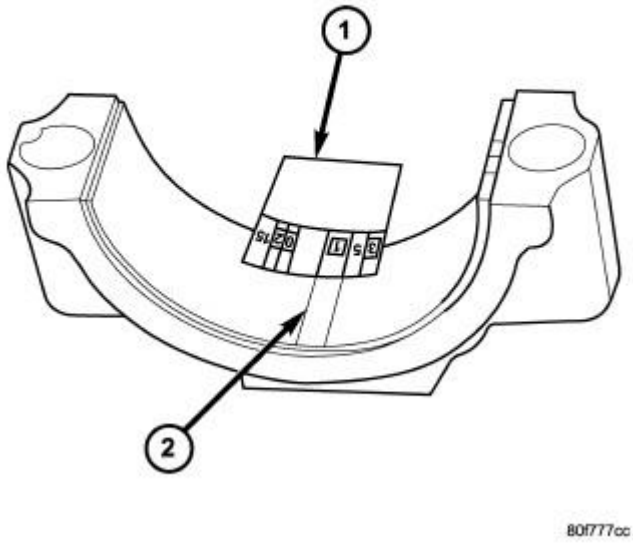


Fig. 278: Measuring Bearing Clearance With Plastigage
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical connecting rod cap shown in illustration.

4. Remove the bearing cap and compare the width of the flattened Plastigage (2) with the scale provided on the package (1). Locate the band closest to the same width. This band shows the amount of clearance. Differences in readings between the ends indicate the amount of taper present or the possibility of foreign material trapped under the bearing insert.
5. Record all readings taken. Compare clearance measurements to engine specifications. Refer to **SPECIFICATIONS** .

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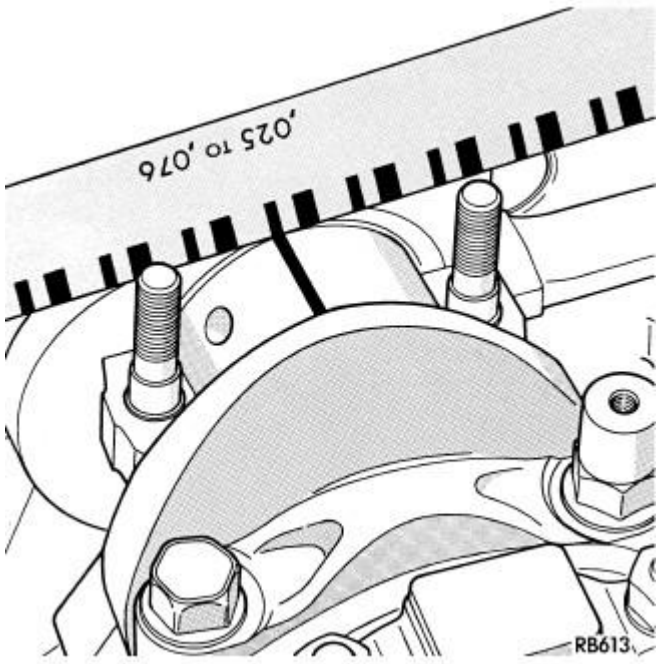


Fig. 279: Checking Connecting Rod Bearing Clearance-Typical
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical connecting rod journal shown in illustration.

NOTE: Plastigage is available in a variety of clearance ranges. Use the most appropriate range for the specifications you are checking. Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.

6. Install the proper bearings to achieve the specified bearing clearances.
7. Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.

CYLINDER BORE HONING

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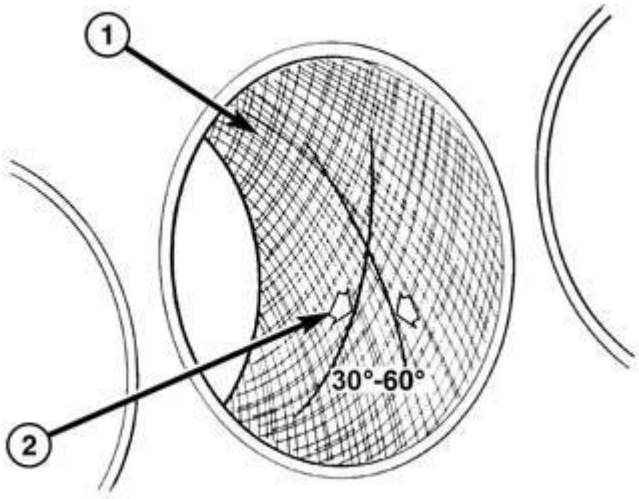


Fig. 280: Identifying Cylinder Bore Crosshatch Pattern
Courtesy of CHRYSLER GROUP, LLC

Before honing, stuff plenty of clean shop towels under the bores and over the crankshaft to keep abrasive materials from entering the crankshaft area.

1. Used carefully, a cylinder bore sizing hone equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round, as well as removing light scuffing, scoring and scratches. Usually, a few strokes will clean up a bore and maintain the required limits.

CAUTION: DO NOT use rigid type hones to remove cylinder wall glaze.

2. Deglazing of the cylinder walls may be done if the cylinder bore is straight and round. Use of a cylinder surfacing hone equipped with 280 grit stones, about 20-60 strokes, depending on the bore condition, will be sufficient to provide a satisfactory surface. Use a light honing oil, available from major oil distributors.

CAUTION: DO NOT use engine or transmission oil, mineral spirits, or kerosene.

3. Honing should be done by moving the hone up and down fast enough to get a crosshatch pattern. The hone marks should INTERSECT at 50° to 60° for proper seating of rings.
4. A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle (1). The number of up and down strokes per minute can be regulated to get the desired 50° to 60° angle (2). Faster up and down strokes increase the crosshatch angle.
5. After honing, it is necessary that the block be cleaned to remove all traces of abrasive. Use a brush to

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wash parts with a solution of hot water and detergent. Dry parts thoroughly. Use a clean, white, lint-free cloth to check that the bore is clean. Oil the bores after cleaning to prevent rusting.

INSPECTION

INSPECTION

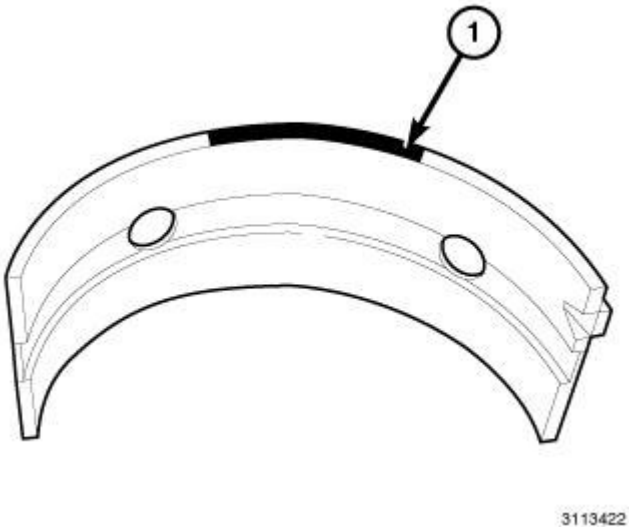
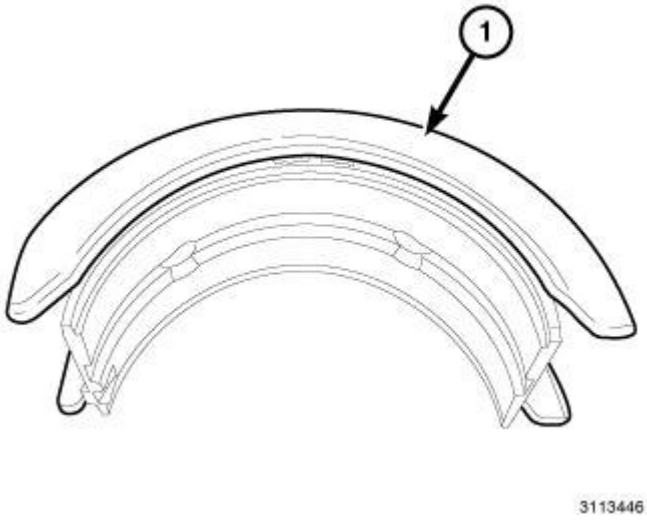


Fig. 281: Main Bearing Inserts
Courtesy of CHRYSLER GROUP, LLC

1. Wipe the main bearing inserts (1) clean.
2. Inspect the inserts for abnormal wear patterns, scoring, grooving, fatigue, pitting and for metal or other foreign material imbedded in the lining.
3. Inspect the back of the inserts for fractures, scrapes, or irregular wear patterns.
4. Inspect the insert locking tabs for damage.



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Fig. 282: Crankshaft Thrust Washers
Courtesy of CHRYSLER GROUP, LLC

5. Inspect the crankshaft thrust washers (1) for scoring, scratches, wear or blueing.
6. Replace any bearing that shows abnormal wear. Refer to **STANDARD PROCEDURE** .
7. Inspect the main bearing bores for signs of scoring, nicks and burrs.
8. If the cylinder block main bearing bores show damage the engine block must be replaced.

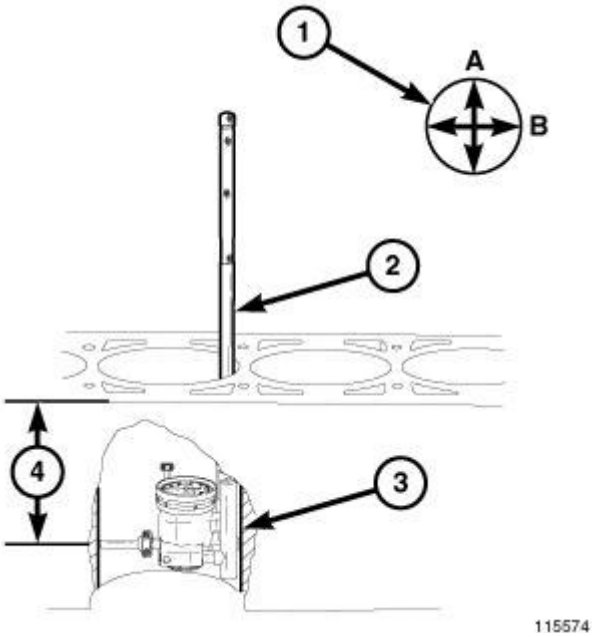


Fig. 283: Measuring Cylinder Bore Diameter
Courtesy of CHRYSLER GROUP, LLC

9. Use Cylinder Indicator (special tool #C-119, Cylinder Indicator) (2) to correctly measure the inside diameter of the cylinder bore (3). A cylinder bore gauge capable of reading in 0.003 mm (0.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.
10. Measure the inside diameter of the cylinder bore at three levels below the top of the bore (4). Start at the top of the bore, perpendicular (across or at 90 degrees) to the axis of the crankshaft at point A (1).
11. Repeat the measurement near the middle of the bore, then repeat the measurement near the bottom of the bore.
12. Determine taper by subtracting the smaller diameter from the larger diameter.
13. Rotate measuring device 90° to point B (1) and repeat the three measurements. Verify that the maximum taper is within specifications. Refer to **SPECIFICATIONS** .
14. Determine out-of-roundness by comparing the difference between A and B at each of the three levels. Verify that the maximum out of round is within specifications. Refer to **SPECIFICATIONS** .
15. If cylinder bore taper and out-of-roundness are within specification, the cylinder bore can be honed. Refer to **STANDARD PROCEDURE** . If the cylinder bore taper or out-of-round condition exceeds the maximum limits, the cylinder block must be replaced.

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NOTE: A slight amount of taper always exists in the cylinder bore after the engine has been in use for a period of time.

BEARING(S), CONNECTING ROD

STANDARD PROCEDURE

STANDARD PROCEDURE - CONNECTING ROD BEARING REPLACEMENT

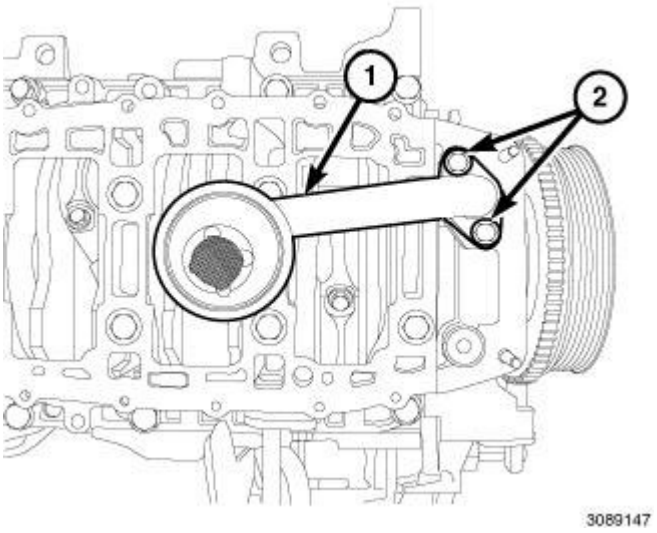


Fig. 284: Oil Pick-Up Tube & Bolts
Courtesy of CHRYSLER GROUP, LLC

The connecting rod bearings must be replaced one-at-a-time in order to prevent the pistons from contacting the valves.

1. Remove the spark plugs. Refer to **SPARK PLUG, REMOVAL** .
2. Remove the oil pan and oil pump pick-up (1). Refer to **PICK-UP, OIL PUMP, REMOVAL**.

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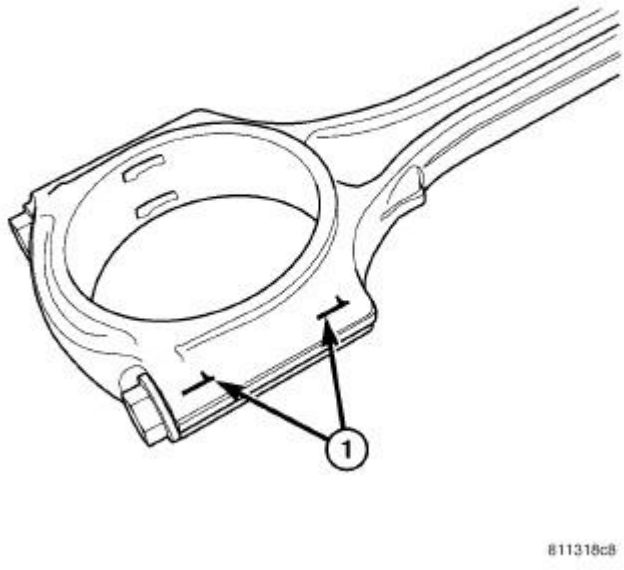
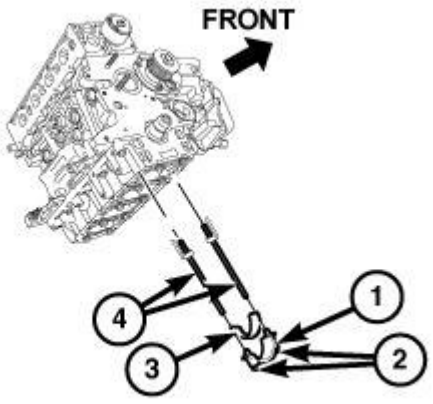


Fig. 285: Connecting Rod To Cylinder Identification
Courtesy of CHRYSLER GROUP, LLC

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods or caps, as damage to connecting rods could occur

NOTE: Connecting rods and bearing caps are not interchangeable and should be marked before removing to ensure correct reassembly.

3. Mark connecting rod and bearing cap positions (1) using a permanent ink marker or scribe tool.



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Fig. 286: Connecting Rod Cap, Cap Bolts, Bearing Shell & Connecting Rod Guide Pins
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Replace only one connecting rod bearing at a time while all other connecting rod bearing caps remain properly tightened. If all connecting rod bearing caps are removed, crankshaft rotation will result in valve and/or piston damage.

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

4. Remove the connecting rod cap bolts (2) and the connecting rod cap (1). Discard the cap bolts.
5. Install the Connecting Rod Guides (special tool #10281, Pins, Connecting Rod Guide) (4) on the connecting rod.

CAUTION: Care must be taken not to nick crankshaft journals, as engine damage may occur.

6. Rotate the crankshaft away from the connecting rod and remove the bearing shell from the connecting rod.
7. Install the replacement bearing shell on the connecting rod with the tang inserted into the machined groove in the rod. Lubricate the bearing surface with clean engine oil.
8. Rotate the crankshaft while guiding the connecting rod into position over the rod journal.

CAUTION: The connecting rod bolts must not be reused. Always replace the connecting rod bolts whenever they are loosened or removed.

9. Install the replacement bearing shell (3) on the connecting rod cap (1) with the tang inserted into the machined groove in the cap. Lubricate the bearing surface with clean engine oil.

NOTE: Do not lubricate the threads of the connecting rod cap bolts (2).

10. Install the connecting rod cap and bearing with the tang on the same side as the rod. Tighten the **NEW** connecting rod cap bolts (5) to 20 N.m (15 ft. lbs.) plus 40°.
11. If required, check the connecting rod side clearance. Refer to **STANDARD PROCEDURE** .
12. Repeat the previous steps for each connecting rod bearing being replaced.

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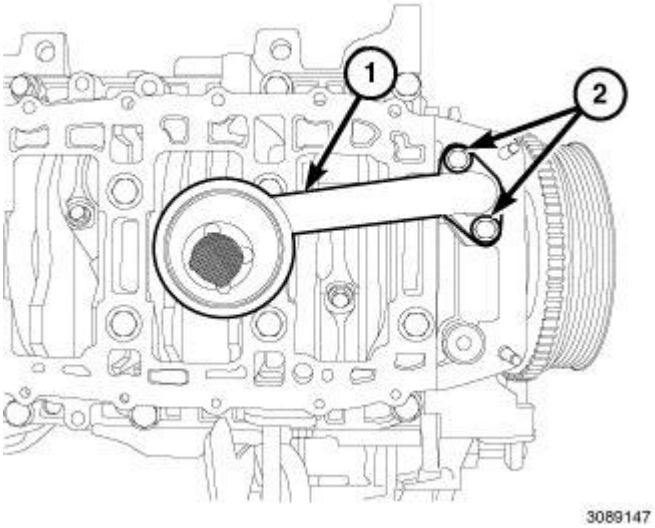


Fig. 287: Oil Pick-Up Tube & Bolts
Courtesy of CHRYSLER GROUP, LLC

13. Install the oil pump pick-up (1) and oil pan. Refer to **PICK-UP, OIL PUMP, INSTALLATION**.
14. Install the spark plugs and ignition coils. Refer to **SPARK PLUG, INSTALLATION** .
15. If removed, install the oil filter and fill the engine crankcase with the proper oil to the correct level. Refer to **STANDARD PROCEDURE** .
16. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
17. Start and run the engine until it reaches normal operating temperature.

PLUG, CORE

REMOVAL

REMOVAL

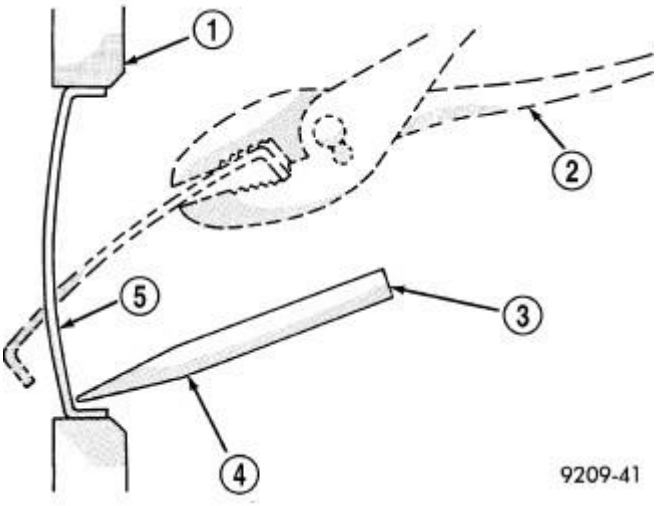


Fig. 288: Removing Core Plug

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Courtesy of CHRYSLER GROUP, LLC

1 - CYLINDER BLOCK 2 - REMOVE PLUG WITH PLIERS 3 - STRIKE HERE WITH HAMMER 4 - DRIFT PUNCH 5 - CUP PLUG

1. Drain the cooling system. Refer to **STANDARD PROCEDURE** .
2. Using a blunt tool such as a drift or a screw driver and a hammer, strike the bottom edge of the cup plug (5).
3. Using a suitable pair of pliers, grasp the core plug (5) and remove.

INSTALLATION

INSTALLATION

NOTE: Thoroughly clean core plug bore, remove all of the old sealer.

1. Coat the edges of the engine core plug and the core plug bore with Mopar Gasket Maker, or equivalent.

   NOTE: It is not necessary to wait for the sealant to cure on the core plugs. The cooling system can be filled and the vehicle returned to service immediately.

2. Using proper plug driver, drive core plug into the core plug bore. The sharp edge of the core plug should be at least 0.50 mm (0.020 in.) inside the lead in chamfer.
3. Refill the cooling system. Refer to **STANDARD PROCEDURE** .

BEARING(S), CRANKSHAFT, MAIN

STANDARD PROCEDURE

MAIN BEARING FITTING

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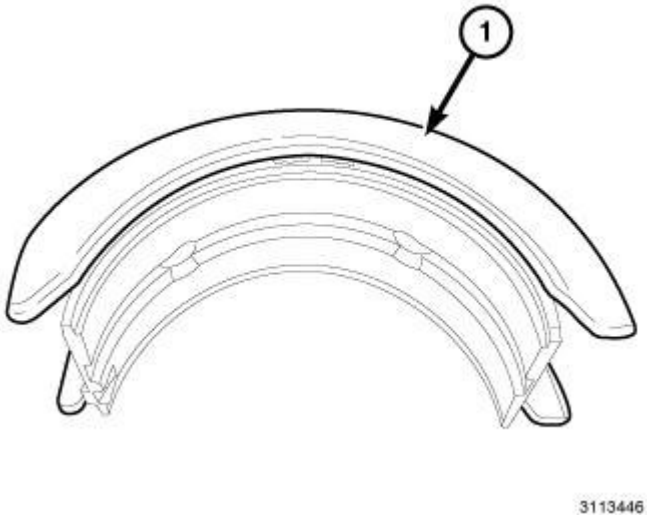


Fig. 289: Crankshaft Thrust Washers
Courtesy of CHRYSLER GROUP, LLC

NOTE: Crankshaft thrust washers are not selectable and are only available in a single thickness as part of the center upper main bearing.

Bearing oil clearance can also be determined by using Plastigage or equivalent. Refer to **STANDARD PROCEDURE** .

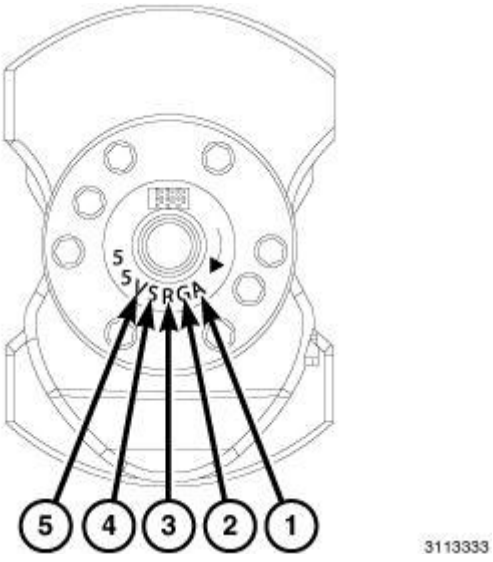


Fig. 290: Crankshaft Grade Markings
Courtesy of CHRYSLER GROUP, LLC

The upper and lower main bearings are "select fit" to achieve proper oil clearances. Crankshaft main bearing journal diameter grade markings are stamped into the rear of the crankshaft. These marks are read from right to left, corresponding with journal number 1, 2, 3, 4, 5.

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Crankshaft main bearing journal diameter grade markings correspond to specific journal diameters. The chart below identifies the 19 crankshaft grade markings and their associated journal diameters.

Crankshaft Marking	Journal Size mm (in.)	Crankshaft Marking	Journal Size mm (in.)
A	48.000 mm (1.8898 in.)	**M**	47.990 mm (1.8894 in.)
B	47.999 mm (1.8897 in.)	**N**	47.989 mm (1.8893 in.)
C	47.998 mm (1.8897 in.)	**P**	47.988 mm (1.8893 in.)
D	47.997 mm (1.8896 in.)	**R**	47.987 mm (1.8892 in.)
E	47.996 mm (1.8896 in.)	**S**	47.986 mm (1.8892 in.)
F	47.995 mm (1.8896 in.)	**T**	47.985 mm (1.8892 in.)
G	47.994 mm (1.8895 in.)	**U**	47.984 mm (1.8891 in.)
H	47.993 mm (1.8895 in.)	**V**	47.983 mm (1.8891 in.)
K	47.992 mm (1.8894 in.)	**W**	47.982 mm (1.8890 in.)
L	47.991 mm (1.8894 in.)		

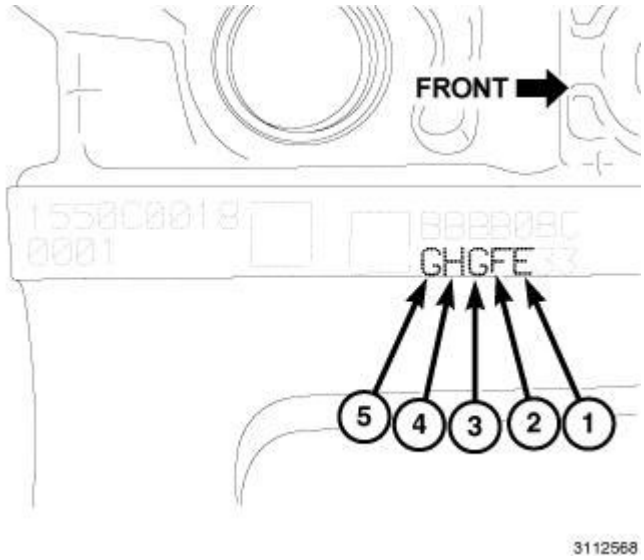


Fig. 291: Block Main Bearing Bore Diameter Grade Markings
Courtesy of CHRYSLER GROUP, LLC

Engine block main bearing bore diameter grade markings are stamped into the right side of the engine block. These marks are read from front to rear, corresponding with journal number 1, 2, 3, 4, 5.

Engine block main bearing bore grade markings correspond to specific bore diameters. The chart below identifies the 14 engine block grade markings and their associated bore diameters.

Engine Block Marking	Bore Size mm (in.)	Engine Block Marking	Bore Size mm (in.)
A	51.705 mm (2.0356 in.)	**H**	51.712 mm (2.0359 in.)
B	51.706 mm (2.0357 in.)	**K**	51.713 mm (2.0359 in.)
C	51.707 mm (2.0357 in.)	**L**	51.714 mm (2.0360 in.)
D	51.708 mm (2.0357 in.)	**M**	51.715 mm (2.0360 in.)

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E	51.709 mm (2.0358 in.)	**N**	51.716 mm (2.0361 in.)
F	51.710 mm (2.0358 in.)	**P**	51.717 mm (2.0361 in.)
G	51.711 mm (2.0359 in.)	**R**	51.718 mm (2.0361 in.)

For upper and lower main bearing selection, obtain the grade identification marks from the crankshaft and engine block. Main bearings are available in three sizes (red, blue, yellow). Upper and lower sizes can be mixed on a journal in order to achieve the desired oil clearance. The chart below identifies the three sizes available and how they should be selected based on crankshaft and engine block grade markings.

Crankshaft Marking	**Engine Block Marking**													
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**K**	**L**	**M**	**N**	**P**	**R**
A	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/B	R/B	R/B	R/B	R/B	R/B	R/B
B	R/R	R/R	R/R	R/R	R/R	R/R	R/B	R/B	R/B	R/B	R/B	R/B	R/B	B/B
C	R/R	R/R	R/R	R/R	R/R	R/B	R/B	R/B	R/B	R/B	R/B	R/B	B/B	B/B
D	R/R	R/R	R/R	R/R	R/B	R/B	R/B	R/B	R/B	R/B	R/B	B/B	B/B	B/B
E	R/R	R/R	R/R	R/B	R/B	R/B	R/B	R/B	R/B	R/B	B/B	B/B	B/B	B/B
F	R/R	R/R	R/B	R/B	R/B	R/B	R/B	R/B	R/B	B/B	B/B	B/B	B/B	B/B
G	R/R	R/B	R/B	R/B	R/B	R/B	R/B	R/B	B/B	B/B	B/B	B/B	B/B	B/Y
H	R/B	R/B	R/B	R/B	R/B	R/B	R/B	B/B	B/B	B/B	B/B	B/B	B/Y	B/Y
K	R/B	R/B	R/B	R/B	R/B	R/B	B/B	B/B	B/B	B/B	B/B	B/Y	B/Y	B/Y
L	R/B	R/B	R/B	R/B	R/B	B/B	B/B	B/B	B/B	B/B	B/Y	B/Y	B/Y	B/Y
M	R/B	R/B	R/B	R/B	B/B	B/B	B/B	B/B	B/B	B/Y	B/Y	B/Y	B/Y	B/Y
N	R/B	R/B	R/B	B/B	B/B	B/B	B/B	B/B	B/Y	B/Y	B/Y	B/Y	B/Y	Y/Y
P	R/B	R/B	B/B	B/B	B/B	B/B	B/B	B/Y	B/Y	B/Y	B/Y	B/Y	Y/Y	Y/Y
R	R/B	B/B	B/B	B/B	B/B	B/B	B/Y	B/Y	B/Y	B/Y	B/Y	Y/Y	Y/Y	Y/Y
S	B/B	B/B	B/B	B/B	B/B	B/Y	B/Y	B/Y	B/Y	B/Y	Y/Y	Y/Y	Y/Y	Y/Y
T	B/B	B/B	B/B	B/B	B/Y	B/Y	B/Y	B/Y	B/Y	Y/Y	Y/Y	Y/Y	Y/Y	Y/Y
U	B/B	B/B	B/B	B/Y	B/Y	B/Y	B/Y	B/Y	Y/Y	Y/Y	Y/Y	Y/Y	Y/Y	Y/Y
V	B/B	B/B	B/Y	B/Y	B/Y	B/Y	B/Y	Y/Y	Y/Y	Y/Y	Y/Y	Y/Y	Y/Y	Y/Y
W	B/B	B/Y	B/Y	B/Y	B/Y	B/Y	Y/Y	Y/Y	Y/Y	Y/Y	Y/Y	Y/Y	Y/Y	Y/Y
R=RED B=BLUE Y=YELLOW UPPER/LOWER Main Bearings to Achieve 0.025 - 0.040 mm (0.0010 - 0.0016 in.) Oil Clearance														

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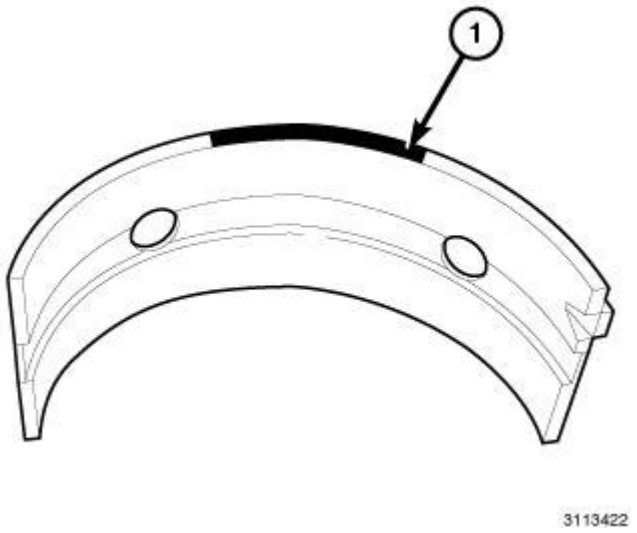


Fig. 292: Main Bearing Inserts
Courtesy of CHRYSLER GROUP, LLC

The main bearing shells are color coded (1) on the edge of the bearing. The bearings are available in three different sizes and can be mixed on a journal in order to achieve the proper oil clearance.

Main bearing shells are available in three sizes. The chart below identifies the three bearing sizes.

Bearing Marking	Size mm (in.)
RED	1.838 mm (0.0724 in.)
BLUE	1.845 mm (0.0726 in.)
YELLOW	1.850 mm (0.0728 in.)

MAIN BEARING REPLACEMENT

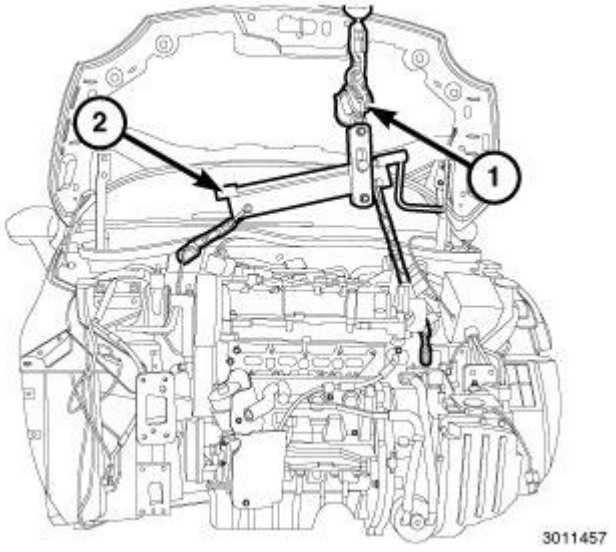


Fig. 293: Engine Hoist & Load-Leveling Lifting Sling

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Courtesy of CHRYSLER GROUP, LLC

The main bearings must be replaced one-at-a-time in order to properly support the crankshaft. The upper and lower main bearing shells are NOT interchangeable. The upper and lower main bearings are "select fit" to achieve proper oil clearances. Refer to **STANDARD PROCEDURE** .

NOTE: To replace the main bearings, the engine must be removed from the vehicle.

1. Remove the engine. Refer to **REMOVAL**.
2. Remove the rear crankshaft oil seal. Refer to **SEAL, CRANKSHAFT OIL, REAR, REMOVAL**.

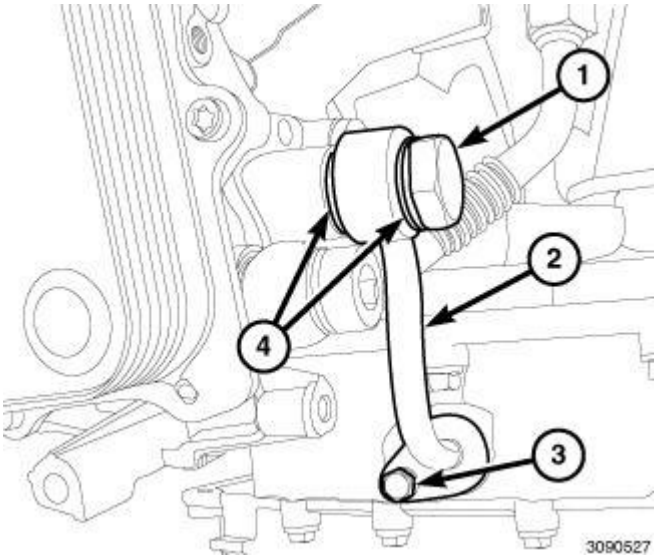


Fig. 294: Oil Filter Housing Oil Return Tube, Gaskets & Bolts
Courtesy of CHRYSLER GROUP, LLC

3. Remove the engine oil pump. Refer to **PUMP, ENGINE OIL, REMOVAL**.
4. Remove the two bolts (1 and 3) and the oil filter housing oil return tube (2).

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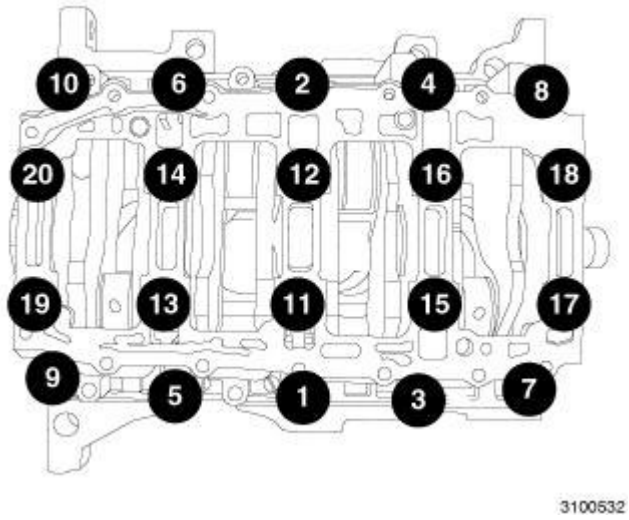


Fig. 295: Bedplate Cap Bolt Removal Sequence
Courtesy of CHRYSLER GROUP, LLC

5. Remove the twenty bedplate cap bolts in the sequence shown in illustration and remove the bedplate.
6. Remove all residual sealant from the cylinder block and bedplate.

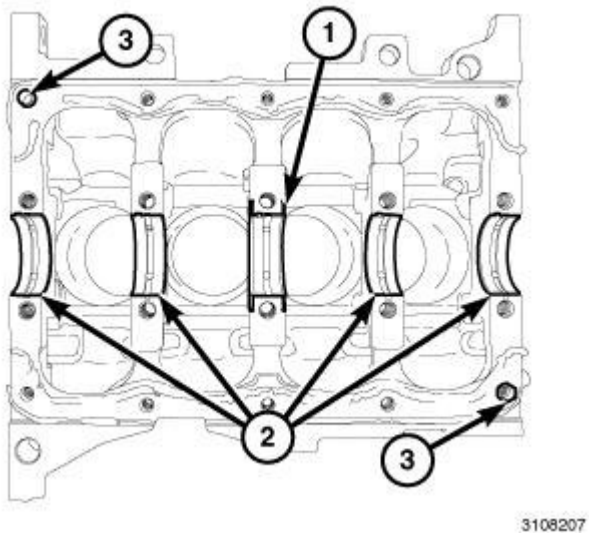


Fig. 296: Upper Main Bearings & Bedplate Locating Dowels
Courtesy of CHRYSLER GROUP, LLC

NOTE: Graphic shows crankshaft removed for clarity. The upper center main bearing (1) has the thrust washers attached. Replace only one upper main bearing (1 and 2) at a time.

7. Slide the upper main bearing half (1 and 2) out from between the crankshaft and the engine block.
8. If required, select fit new main bearings to the engine block. Refer to **STANDARD PROCEDURE** .

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9. Lubricate the upper main bearing half (1 and 2) with clean engine oil and slide the bearing into position.
10. Install two bedplate locating dowels (3).

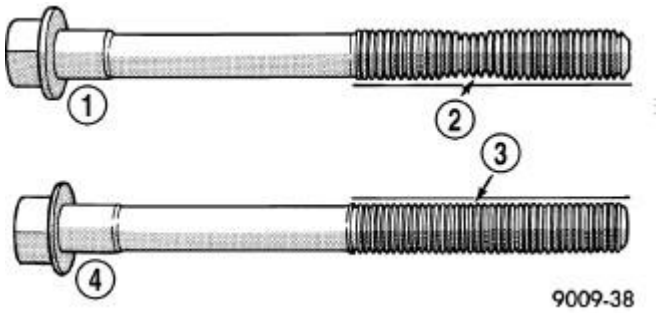


Fig. 297: Identifying Cylinder Head Bolts
Courtesy of CHRYSLER GROUP, LLC

CAUTION: The bedplate bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down the bolts must be replaced.

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

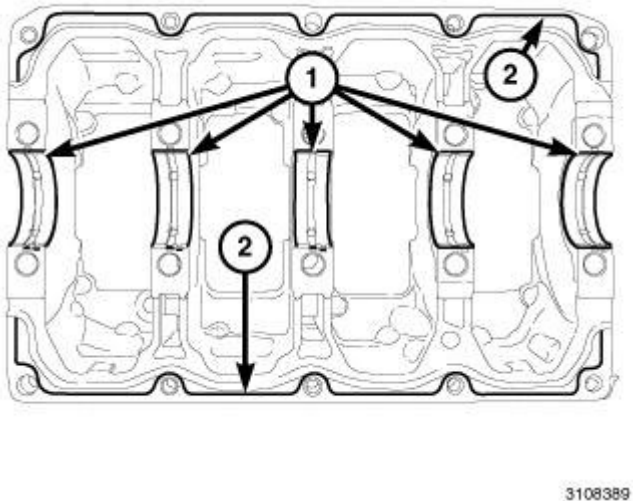


Fig. 298: Lower Main Bearings & Sealant
Courtesy of CHRYSLER GROUP, LLC

12. Lubricate and install the lower main bearing halves (1) into the bedplate.
13. Clean the cylinder block and bedplate mating surfaces with isopropyl alcohol in preparation for sealant application.

CAUTION: Engine assembly requires the use of a unique sealant that is

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compatible with engine oil. Using a sealant other than Mopar® Engine RTV GEN II may result in engine fluid leakage.

CAUTION: Following the application of Mopar® Engine RTV GEN II to the gasket surfaces, the components must be assembled within 10 minutes and the attaching fasteners must be tightened to specification within the next 10 minutes. Prolonged exposure to the air prior to assembly may result in engine fluid leakage.

14. Apply a 2 to 3 mm wide bead of Mopar® Engine RTV GEN II sealant (2) to the bedplate as shown in illustration.

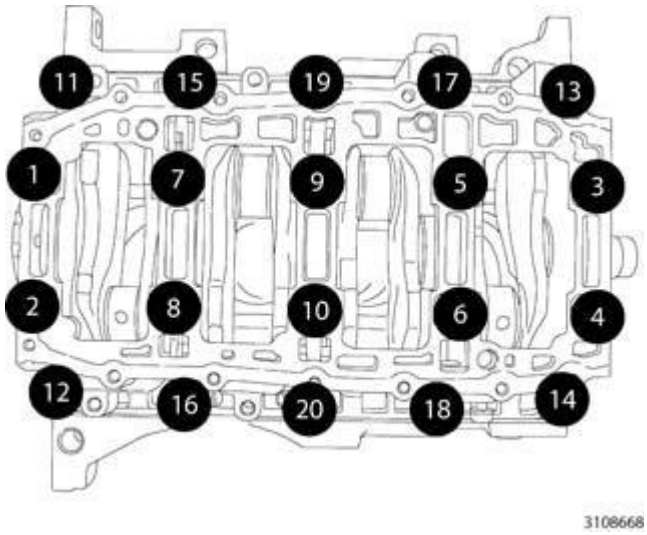


Fig. 299: Bedplate Cap Bolt Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

15. Position the bedplate onto the cylinder block. Make sure the bedplate seats fully over the locating dowels.
16. Install the twenty bedplate bolts finger tight.
17. Tighten the bedplate bolts in the sequence shown in illustration, following this 5 step torque plus angle method. Tighten according to the following torque values:
    - Step 1: 1 through 10 to 20 N.m (15 ft. lbs.).
    - Step 2: 11 through 20 to 15 N.m (11 ft. lbs.).
    - Step 3: 1 through 10 again to 20 N.m (15 ft. lbs.).
    - Step 4: 1 through 10 + 80° Turn **Do not use a torque wrench for this step.**
    - Step 5: 11 through 20 to 32 N.m (27 ft. lbs.).
18. Measure crankshaft end play. Refer to **STANDARD PROCEDURE** .

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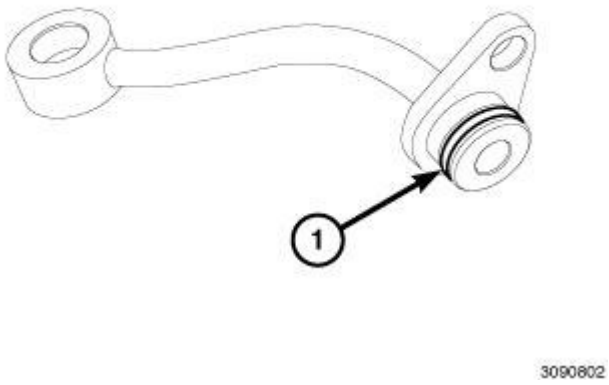


Fig. 300: Oil Return Tube O-Ring Seal
Courtesy of CHRYSLER GROUP, LLC

19. Install a new oil filter housing oil return tube O-ring seal (1).

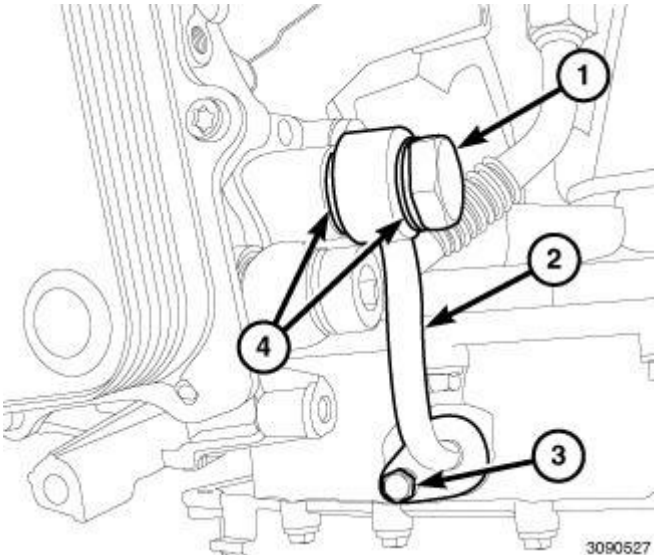


Fig. 301: Oil Filter Housing Oil Return Tube, Gaskets & Bolts
Courtesy of CHRYSLER GROUP, LLC

20. Install the oil filter housing oil return tube (2) between the bedplate and oil filter housing with two gaskets (4). Tighten the bolt (3) to 9 N.m (80 in. lbs.) and tighten the bolt (1) to 33 N.m (24 ft. lbs.).
21. Install the engine oil pump, timing belt and sprockets. Refer to **PUMP, ENGINE OIL, INSTALLATION**.
22. Install the rear crankshaft oil seal and transmission. Refer to **SEAL, CRANKSHAFT OIL, REAR, INSTALLATION**.

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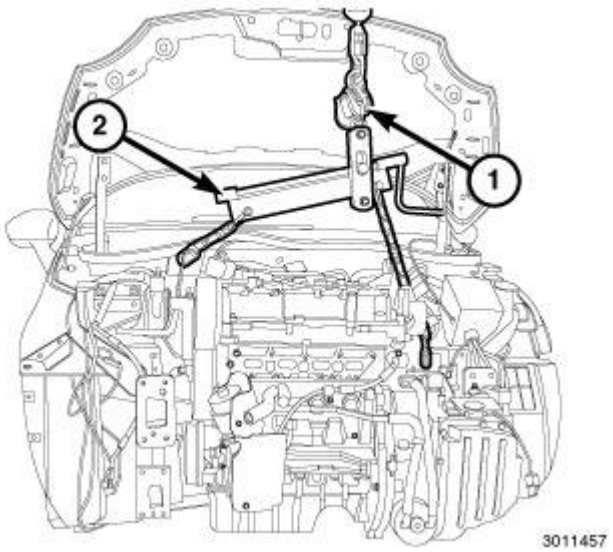


Fig. 302: Engine Hoist & Load-Leveling Lifting Sling
Courtesy of CHRYSLER GROUP, LLC

23. Install the engine. Refer to **INSTALLATION**.
24. If removed, install the oil filter and fill the engine crankcase with the proper oil to the correct level. Refer to **STANDARD PROCEDURE** .
25. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
26. Fill the cooling system. Refer to **STANDARD PROCEDURE** .
27. Run the engine until it reaches normal operating temperature. Check cooling system for correct fluid level. Refer to **STANDARD PROCEDURE** .

CRANKSHAFT

DESCRIPTION

DESCRIPTION

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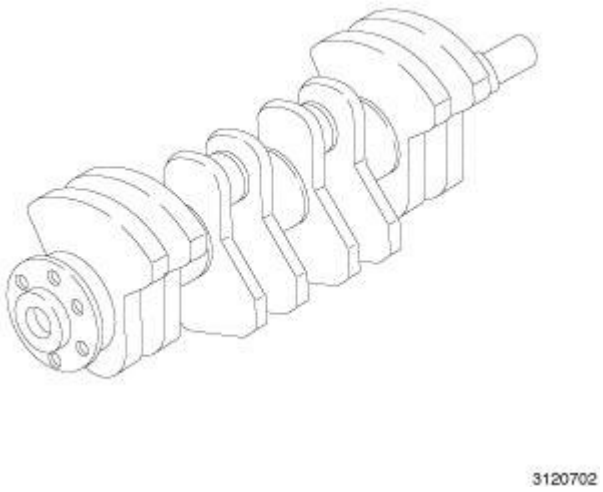


Fig. 303: Crankshaft
Courtesy of CHRYSLER GROUP, LLC

The crankshaft is made from induction hardened forged steel. Eight counterweights at 180° balance the crankshaft rotary mass. The main journals are crossed drilled for rod bearing lubrication. The crankshaft is supported by five select fit main bearings with the center bearing serving as the thrust washer location. Both the front and rear seals are a single piece design and are mounted to the oil pump and cylinder block.

STANDARD PROCEDURE

STANDARD PROCEDURE - END PLAY

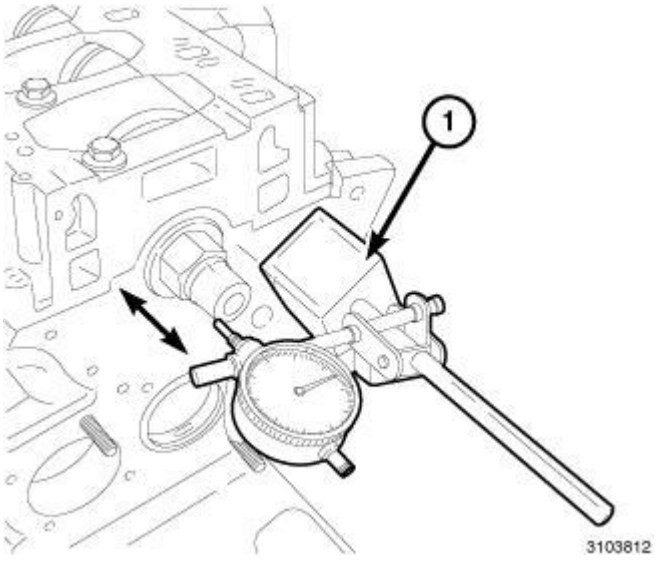


Fig. 304: Measuring Crankshaft End Play
Courtesy of CHRYSLER GROUP, LLC

1. Mount Dial Indicator Set (special tool #C-3339A, Set, Dial Indicator) (1) to a stationary point at the front of the engine. Locate the probe perpendicular against the nose of the crankshaft.

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2. Move the crankshaft all the way to the rear of its travel.
3. Zero the dial indicator.
4. Move the crankshaft forward to the limit of travel and read the dial indicator. Compare the measured end play to the specification. Refer to **SPECIFICATIONS** .

NOTE: Crankshaft thrust washers are not selectable and are only available in a single thickness.

REMOVAL

REMOVAL

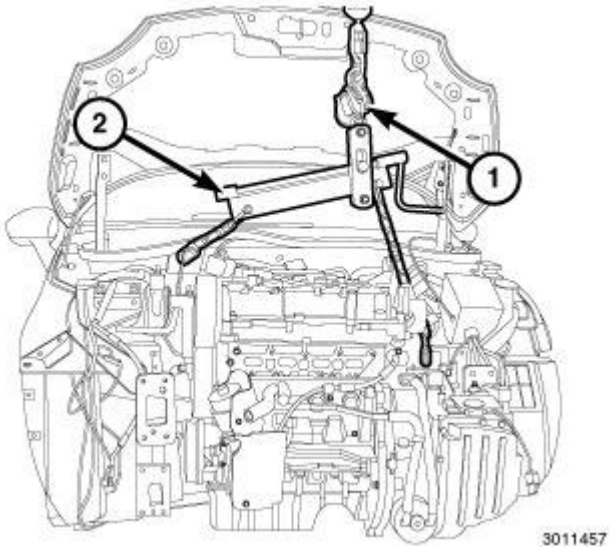


Fig. 305: Engine Hoist & Load-Leveling Lifting Sling
Courtesy of CHRYSLER GROUP, LLC

NOTE: To remove the crankshaft from the engine, the engine must be removed from the vehicle.

1. Remove the engine. Refer to **REMOVAL**.
2. Remove the rear crankshaft oil seal. Refer to **SEAL, CRANKSHAFT OIL, REAR, REMOVAL**.

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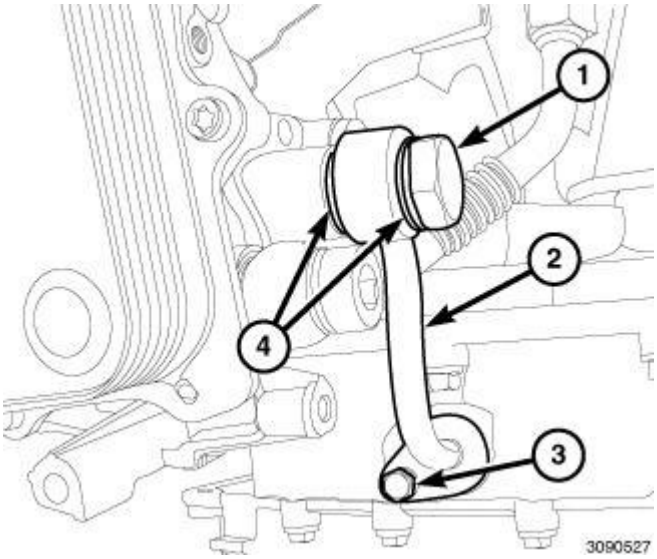


Fig. 306: Oil Filter Housing Oil Return Tube, Gaskets & Bolts
Courtesy of CHRYSLER GROUP, LLC

3. Remove the engine oil pump. Refer to **PUMP, ENGINE OIL, REMOVAL**.
4. Remove the two bolts (1 and 3) and the oil filter housing oil return tube (2).

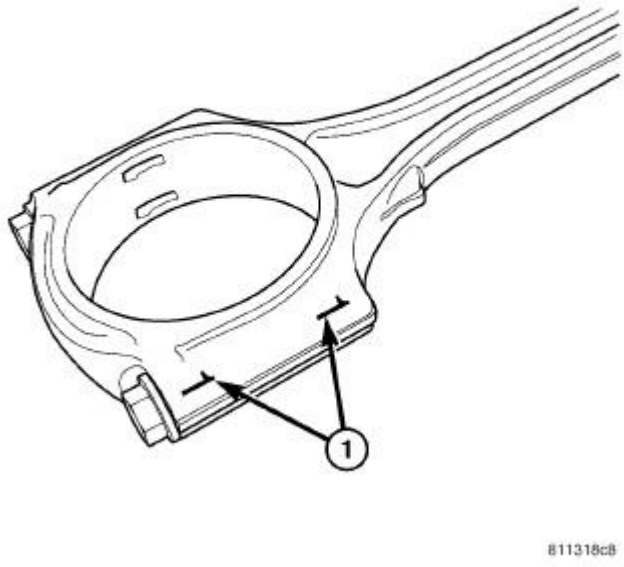


Fig. 307: Connecting Rod To Cylinder Identification
Courtesy of CHRYSLER GROUP, LLC

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods or caps, as damage to connecting rods could occur

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NOTE: Connecting rods and bearing caps are not interchangeable and should be marked before removing to ensure correct reassembly.

5. Mark connecting rod and bearing cap positions (1) using a permanent ink marker or scribe tool.

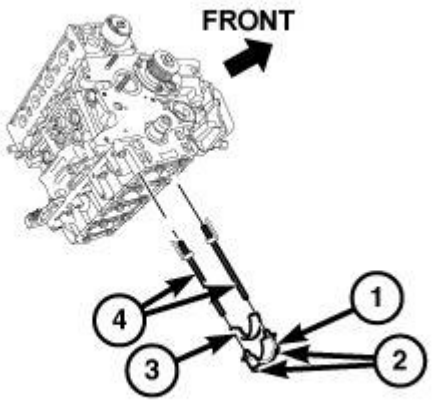


Fig. 308: Connecting Rod Cap, Cap Bolts, Bearing Shell & Connecting Rod Guide Pins
Courtesy of CHRYSLER GROUP, LLC

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

6. Remove the connecting rod cap bolts (2) and the connecting rod caps (1). Discard the cap bolts.
7. Install the (special tool #10281, Pins, Connecting Rod Guide) (4) on the connecting rod.

CAUTION: Care must be taken not to nick crankshaft journals, as engine damage may occur.

8. Push the connecting rod and piston into the cylinder until the connecting rod is clear of the crankshaft journal. Remove the connecting rod guides (4). Repeat this procedure at each cylinder until all of the connecting rods are clear of the crankshaft.

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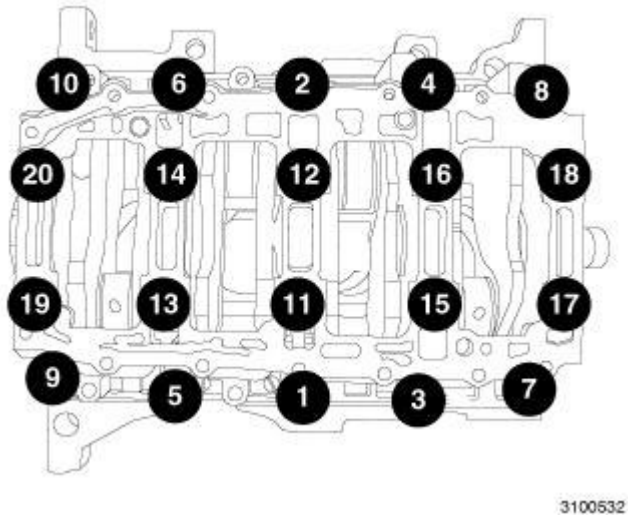


Fig. 309: Bedplate Cap Bolt Removal Sequence
Courtesy of CHRYSLER GROUP, LLC

9. Remove the twenty bedplate cap bolts in the sequence shown in illustration and remove the bedplate.

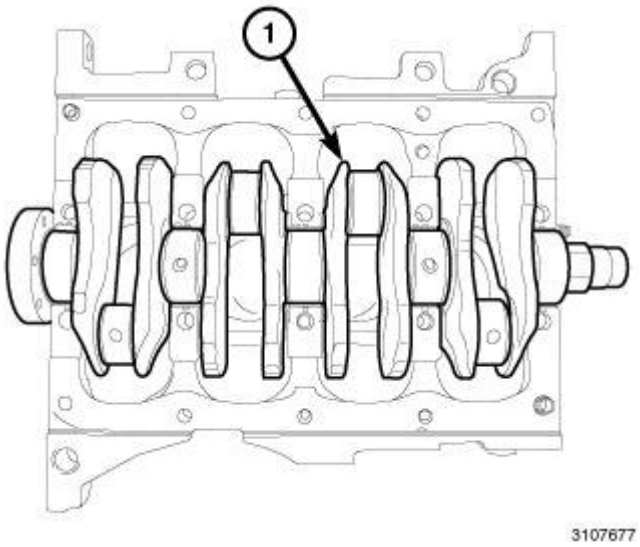


Fig. 310: Crankshaft
Courtesy of CHRYSLER GROUP, LLC

10. Remove the crankshaft (1) from the engine block.
11. If required, remove the piston oil cooler jet(s). Refer to **JET, PISTON OIL COOLER, REMOVAL**.
12. Remove all residual sealant from the cylinder block and bedplate.

INSPECTION

INSPECTION

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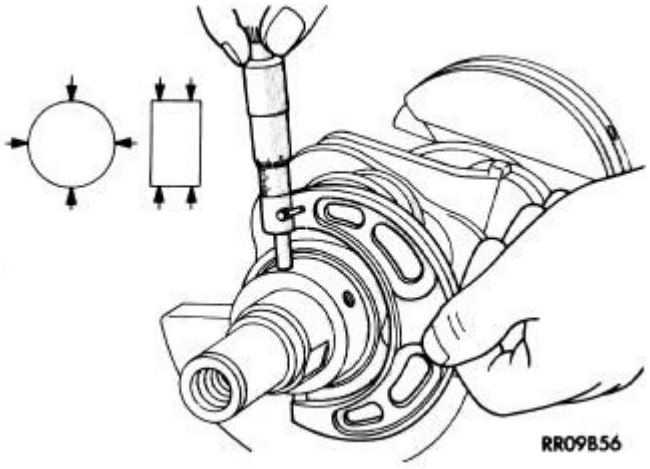


Fig. 311: Crankshaft Journal Measurements - Typical
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical crankshaft journal measurements shown in illustration.

1. Clean the oil off the bearing journals.
2. Determine the maximum diameter of the journals with a micrometer. Measure at two locations 90° apart at each end of the journals.
3. Compare the measured main bearing journal diameter to the crankshaft main bearing journal diameter grade marking chart Obtain the main bearing journal grade identification marks from the engine block and select the upper and lower main bearing sizes that will provide the proper oil clearance. Refer to **STANDARD PROCEDURE** .
4. For connecting rod journals, verify that the diameter, maximum taper and maximum out of round are within specifications. Refer to **SPECIFICATIONS** .
5. For main bearing journals, verify that the maximum taper and maximum out of round are within specifications. Refer to **SPECIFICATIONS** .

INSTALLATION

INSTALLATION

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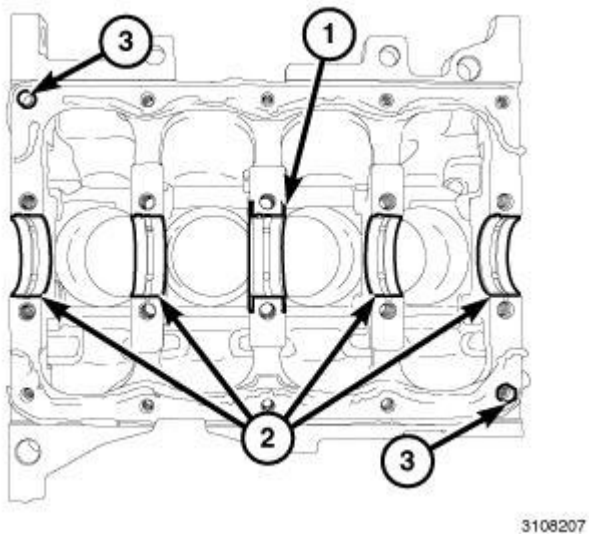


Fig. 312: Upper Main Bearings & Bedplate Locating Dowels
Courtesy of CHRYSLER GROUP, LLC

1. If removed, install the piston oil cooler jet(s). Refer to **JET, PISTON OIL COOLER, INSTALLATION**.
2. If required, select and fit new crankshaft main bearings to the engine block. Refer to **STANDARD PROCEDURE** .
3. If required, select and fit new bearings to the connecting rod. Refer to **STANDARD PROCEDURE** .

NOTE: The upper center main bearing (1) has the thrust washers attached.

4. If removed, lubricate and install the upper main bearing halves (1 and 2) into the engine block.
5. Install two bedplate locating dowels (3).

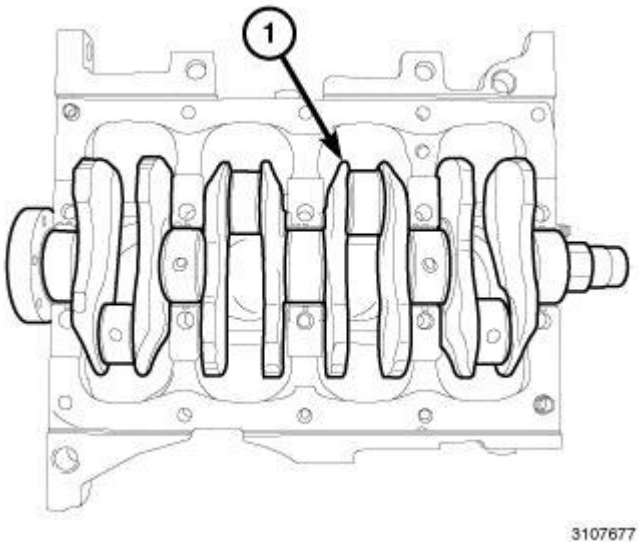


Fig. 313: Crankshaft

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Courtesy of CHRYSLER GROUP, LLC

CAUTION: When installing the crankshaft, use care not to damage bearing surfaces on the crankshaft.

6. Install the crankshaft (1) into the engine block.

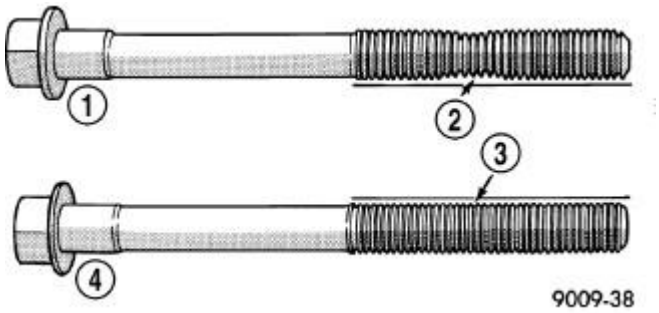


Fig. 314: Identifying Cylinder Head Bolts
Courtesy of CHRYSLER GROUP, LLC

CAUTION: The bedplate bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down the bolts must be replaced.

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

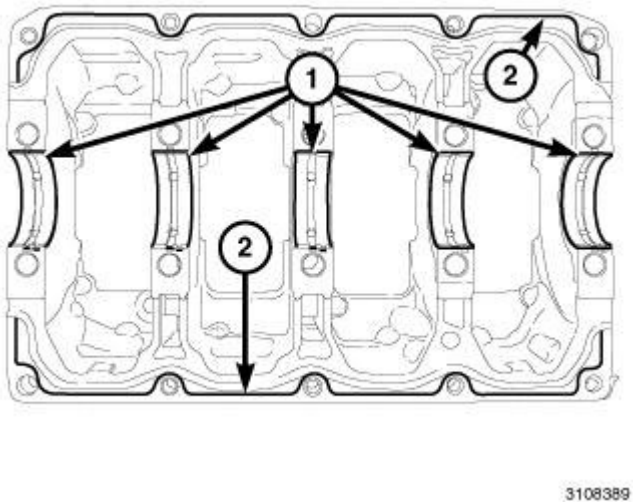


Fig. 315: Lower Main Bearings & Sealant
Courtesy of CHRYSLER GROUP, LLC

8. If removed, lubricate and install the lower main bearing halves (1) into the bedplate.

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9. Clean the cylinder block and bedplate mating surfaces with isopropyl alcohol in preparation for sealant application.

CAUTION: Engine assembly requires the use of a unique sealant that is compatible with engine oil. Using a sealant other than Mopar® Engine RTV GEN II may result in engine fluid leakage.

CAUTION: Following the application of Mopar® Engine RTV GEN II to the gasket surfaces, the components must be assembled within 10 minutes and the attaching fasteners must be tightened to specification within the next 10 minutes. Prolonged exposure to the air prior to assembly may result in engine fluid leakage.

10. Apply a 2 to 3 mm wide bead of Mopar® Engine RTV GEN II sealant (2) to the bedplate as shown in illustration.

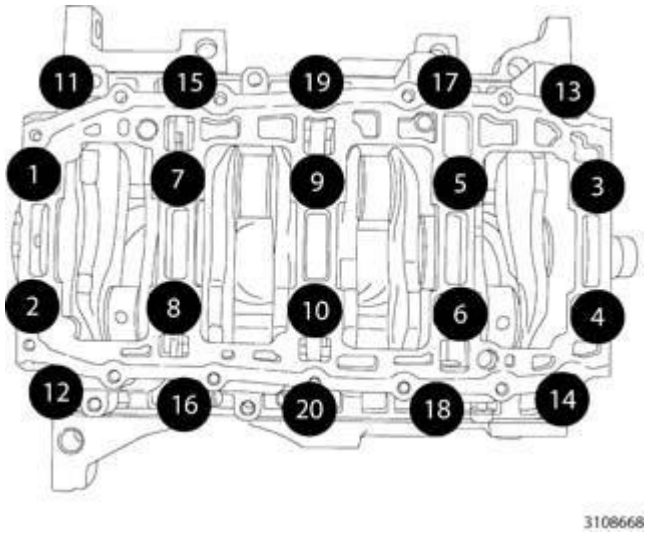


Fig. 316: Bedplate Cap Bolt Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

11. Position the bedplate onto the cylinder block. Make sure the bedplate seats fully over the locating dowels.
12. Install the twenty bedplate bolts finger tight.
13. Tighten the bedplate bolts in the sequence shown in illustration, following this 5 step torque plus angle method. Tighten according to the following torque values:
    - Step 1: 1 through 10 to 20 N.m (15 ft. lbs.).
    - Step 2: 11 through 20 to 15 N.m (11 ft. lbs.).
    - Step 3: 1 through 10 again to 20 N.m (15 ft. lbs.).
    - Step 4: 1 through 10 + 80° Turn **Do not use a torque wrench for this step.**
    - Step 5: 11 through 20 to 32 N.m (27 ft. lbs.).
14. Measure crankshaft end play. Refer to **STANDARD PROCEDURE** .

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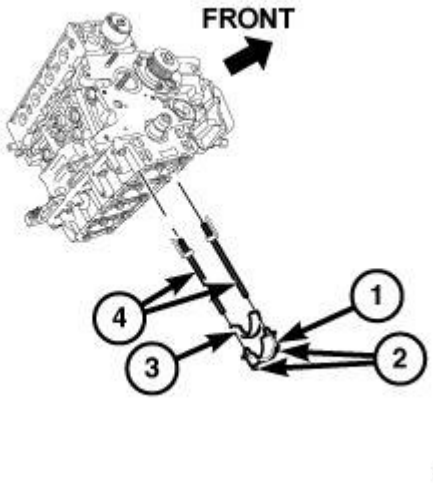


Fig. 317: Connecting Rod Cap, Cap Bolts, Bearing Shell & Connecting Rod Guide Pins
Courtesy of CHRYSLER GROUP, LLC

15. If removed, install the bearing shell on the connecting rod with the tang inserted into the machined groove in the rod. Lubricate the bearing surface with clean engine oil.
16. Install the (special tool #10281, Pins, Connecting Rod Guide) (4) on the connecting rod.

CAUTION: Care must be taken not to nick crankshaft journals, as engine damage may occur.

17. Pull the connecting rod and piston toward the crankshaft until the connecting rod is seated on the crankshaft journal. Remove the connecting rod guides.

CAUTION: The connecting rod bolts must not be reused. Always replace the connecting rod bolts whenever they are loosened or removed.

18. If removed, install the bearing shell (3) on the connecting rod cap (1) with the tang inserted into the machined groove in the cap. Lubricate the bearing surface with clean engine oil.

NOTE: Do not lubricate the threads of the connecting rod cap bolts (5).

19. Install the connecting rod cap and bearing with the tang on the same side as the rod. Tighten the **NEW** connecting rod cap bolts (2) to 20 N.m (15 ft. lbs.) plus 40 degrees.
20. If required, check the connecting rod side clearance. Refer to **STANDARD PROCEDURE** .
21. Repeat the previous steps for the remaining connecting rods.

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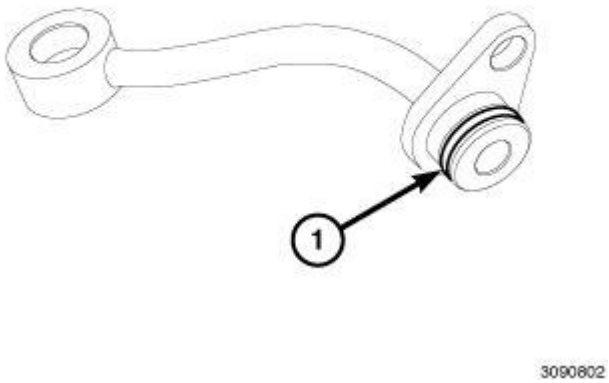


Fig. 318: Oil Return Tube O-Ring Seal
Courtesy of CHRYSLER GROUP, LLC

22. Install a new oil filter housing oil return tube O-ring seal (1).

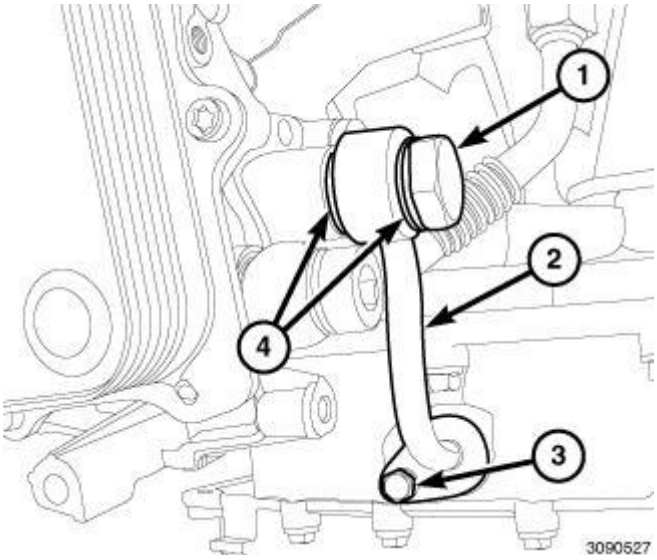


Fig. 319: Oil Filter Housing Oil Return Tube, Gaskets & Bolts
Courtesy of CHRYSLER GROUP, LLC

23. Install the oil filter housing oil return tube (2) between the bedplate and oil filter housing with two gaskets (4). Tighten the bolt (3) to 9 N.m (80 in. lbs.) and tighten the bolt (1) to 33 N.m (24 ft. lbs.).
24. Install the engine oil pump, timing belt and sprockets. Refer to **PUMP, ENGINE OIL, INSTALLATION**.
25. Install the rear crankshaft oil seal and transmission. Refer to **SEAL, CRANKSHAFT OIL, REAR, INSTALLATION**.

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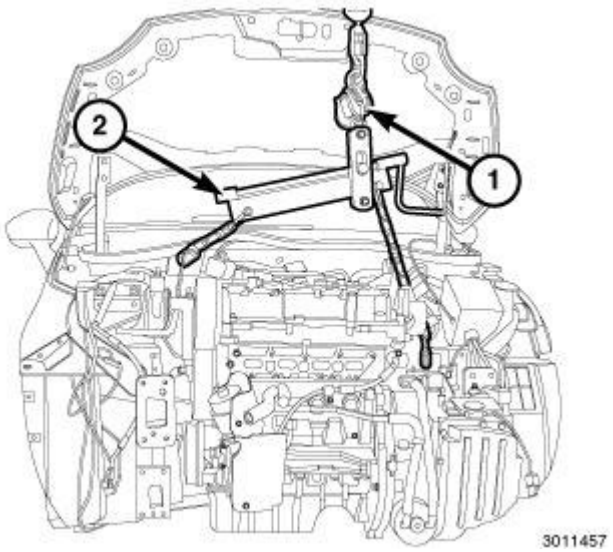


Fig. 320: Engine Hoist & Load-Leveling Lifting Sling
Courtesy of CHRYSLER GROUP, LLC

26. Install the engine. Refer to **INSTALLATION**.
27. If removed, install the oil filter and fill the engine crankcase with the proper oil to the correct level. Refer to **STANDARD PROCEDURE** .
28. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
29. Fill the cooling system. Refer to **STANDARD PROCEDURE** .
30. Operate the engine until it reaches normal operating temperature. Check cooling system for correct fluid level. Refer to **STANDARD PROCEDURE** .

NOTE: The Cam/Crank Variation Relearn procedure must be performed using the scan tool anytime there has been a repair/replacement made to a powertrain system, for example: flywheel, valvetrain, camshaft and/or crankshaft sensors or components. Refer to the appropriate Diagnostic Information.

DAMPER, VIBRATION

REMOVAL

REMOVAL

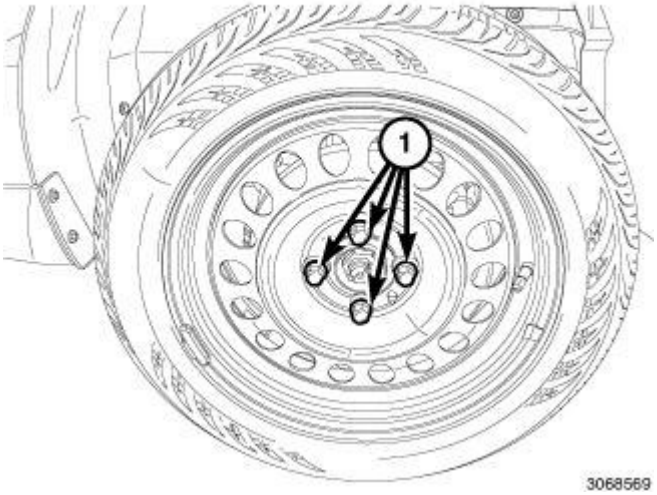


Fig. 321: Wheel Lug Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
2. Remove the right front wheel and tire assembly. Refer to **REMOVAL** .

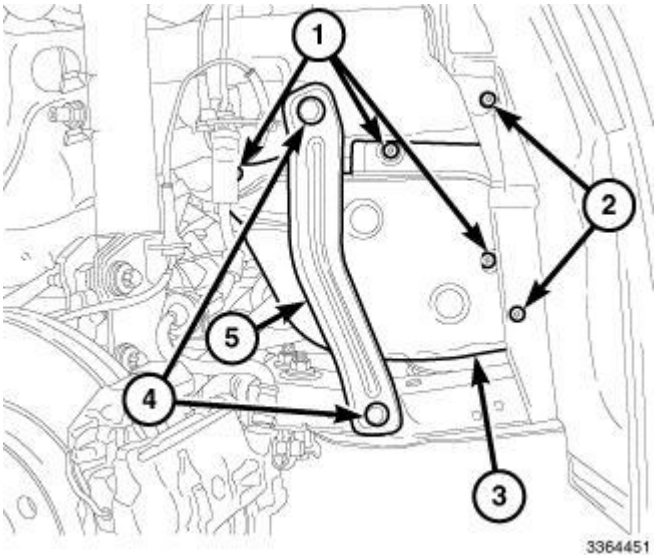


Fig. 322: Right Vertical Brace, Frame Splash Shield & Fasteners
Courtesy of CHRYSLER GROUP, LLC

3. Remove two bolts (4) and the right vertical brace (5).
4. Remove two screws (2) from the front wheelhouse splash shield.
5. Remove three screws (1) and the frame splash shield (3).

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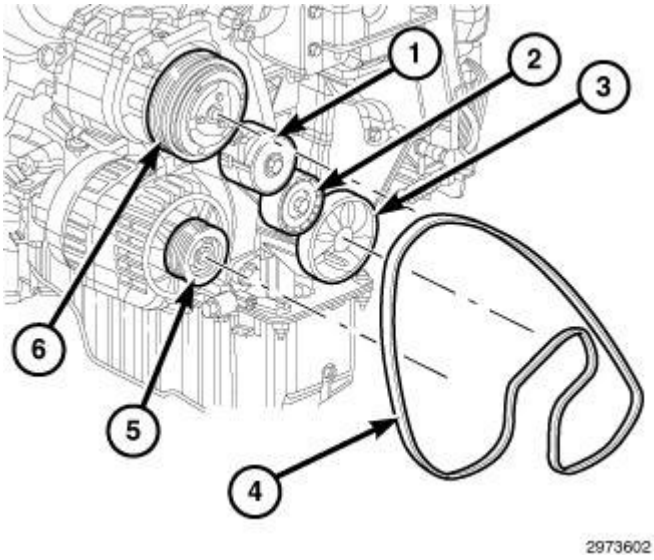


Fig. 323: Drive Belt Tensioners & Assembly With Drive Belt Routing
Courtesy of CHRYSLER GROUP, LLC

6. Remove the accessory drive belt (4). Refer to **BELT, SERPENTINE, REMOVAL** .

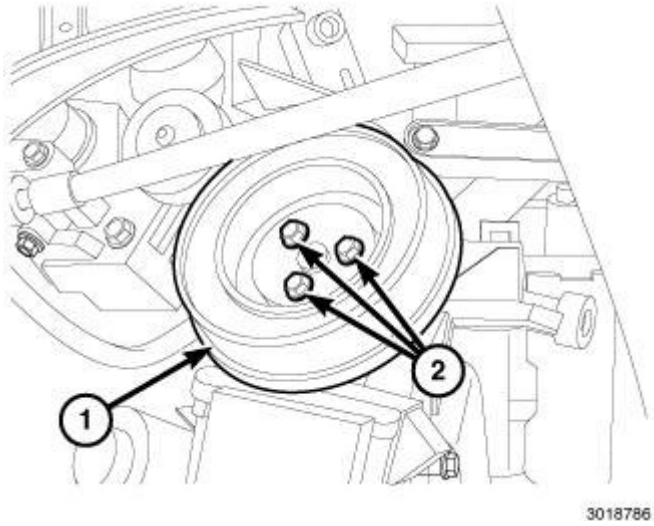


Fig. 324: Vibration Damper & Bolts
Courtesy of CHRYSLER GROUP, LLC

7. Remove the three bolts (2) and the vibration damper (1).

INSTALLATION

INSTALLATION

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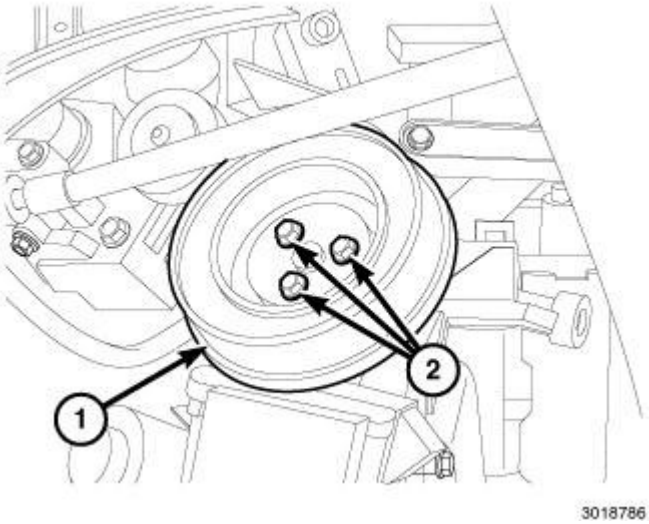


Fig. 325: Vibration Damper & Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Align the locator pin on the crankshaft sprocket with the hole in the vibration damper (1). Install the vibration damper (1) with three bolts (2) tightened to 25 N.m (19 ft. lbs.).

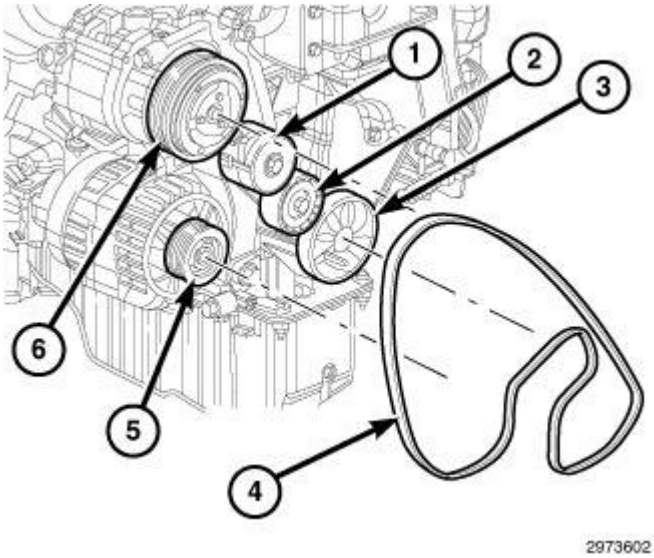


Fig. 326: Drive Belt Tensioners & Assembly With Drive Belt Routing
Courtesy of CHRYSLER GROUP, LLC

2. Install the accessory drive belt (4). Refer to **BELT, SERPENTINE, INSTALLATION** .

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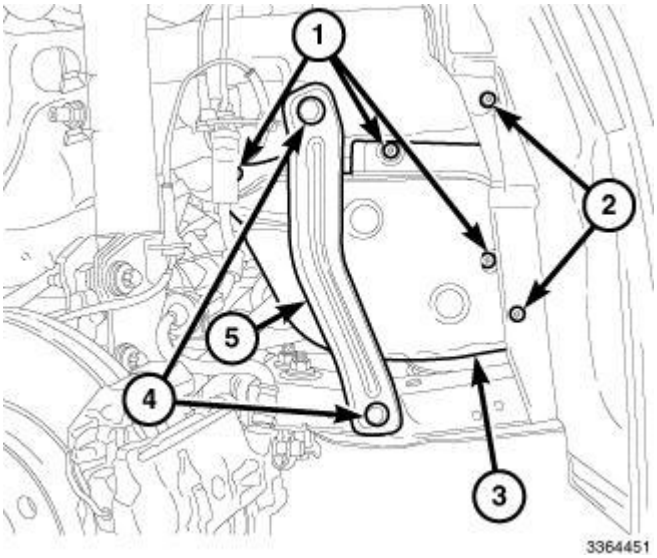


Fig. 327: Right Vertical Brace, Frame Splash Shield & Fasteners
Courtesy of CHRYSLER GROUP, LLC

3. Install the frame splash shield (3) with three screws (1).
4. Install two screws (2) to the front wheelhouse splash shield.
5. Install the right vertical brace (5) with two bolts (4) tightened to 45 N.m (33 ft. lbs.).

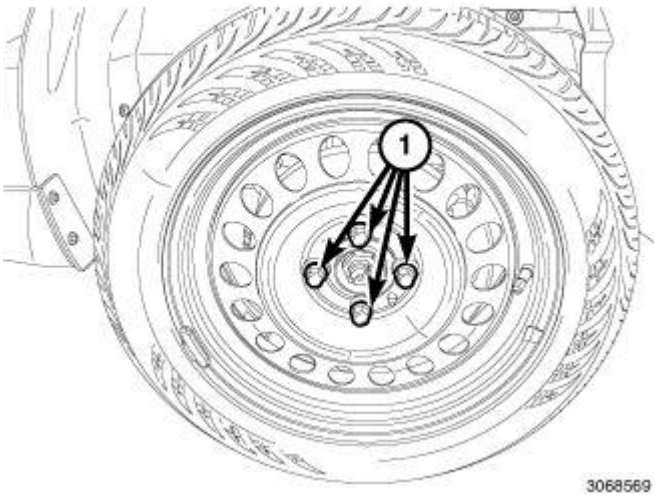


Fig. 328: Wheel Lug Bolts
Courtesy of CHRYSLER GROUP, LLC

6. Install the right front wheel and tire assembly. Refer to **INSTALLATION** .

NOTE: The Cam/Crank Variation Relearn procedure must be performed using the scan tool anytime there has been a repair/replacement made to a powertrain system, for example: flywheel, valvetrain, camshaft and/or crankshaft sensors or components. Refer to the appropriate Diagnostic Information .

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RING(S), PISTON

STANDARD PROCEDURE

STANDARD PROCEDURE - PISTON RING FITTING

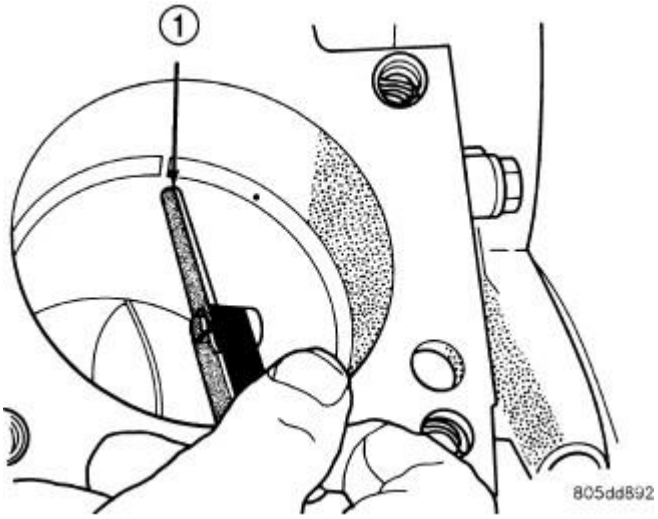


Fig. 329: Measuring Piston Ring End Gap
Courtesy of CHRYSLER GROUP, LLC

1. Wipe the cylinder bore clean.
2. Using a piston, to ensure that the ring is squared in the cylinder bore, slide the ring downward into the cylinder to a position 12 mm (0.50 in.) from the bottom of the cylinder bore.
3. Using a feeler gauge (1), check the ring end gap. Replace any rings not within specification.

Ring Position	Ring End Gap
No. 1 Ring (Top)	0.20 - 0.35 mm (0.008 - 0.014 in.)
No. 2 Ring (Center)	0.40 - 0.60 mm (0.016 - 0.024 in.)
Oil Control Ring (Bottom)	0.20 - 0.40 mm (0.008 - 0.016 in.)

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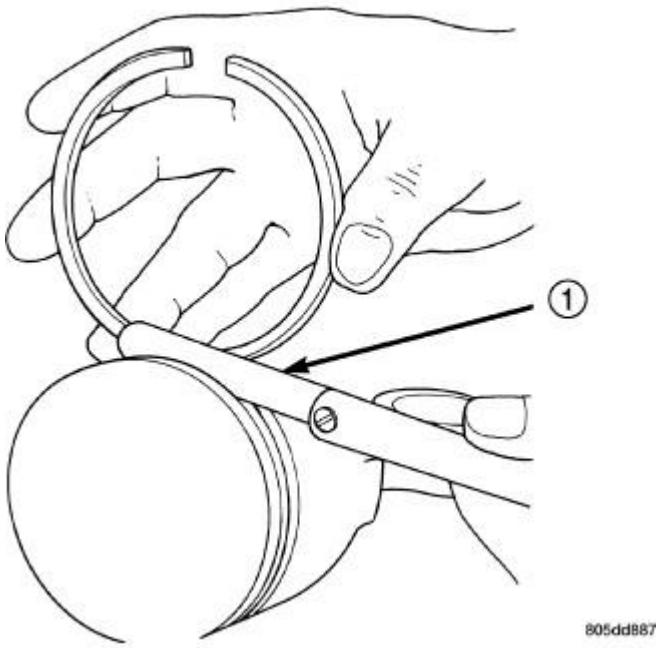


Fig. 330: Checking Piston Ring Grooves Clearances
Courtesy of CHRYSLER GROUP, LLC

4. Clean the piston ring grooves. Remove any nicks or burrs.
5. Measure the ring side clearance as shown in illustration. Make sure the feeler gauge (1) fits snugly between the ring land and the ring. Replace any ring not within specification.

Ring Position	Ring Side Clearance
No. 1 Ring (Top)	0.030 - 0.070 mm (0.0012 - 0.0028 in.)
No. 2 Ring (Center)	0.020 - 0.060 mm (0.0008 - 0.0024 in.)
Oil Control Ring (Bottom)	0.020 - 0.055 mm (0.0008 - 0.0022 in.)

REMOVAL

REMOVAL

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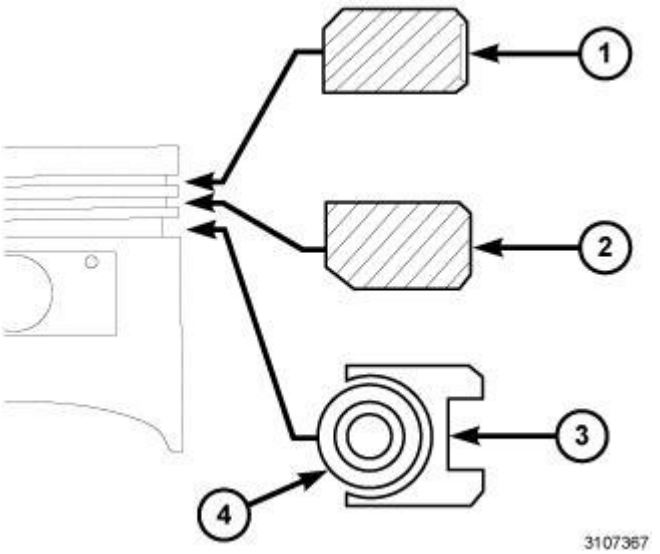


Fig. 331: Piston Ring Removal/Installation Sequence
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical piston shown in illustration.

1. Remove the piston and connecting rod(s). Refer to **ROD, PISTON AND CONNECTING, REMOVAL**.

CAUTION: To avoid damage to the piston rings, they must be removed in the following order:

- **No. 1 (upper) piston ring (1)**
- **No. 2 (intermediate) piston ring (2)**
- **Oil control ring (3)**
- **Oil control ring expander (4)**

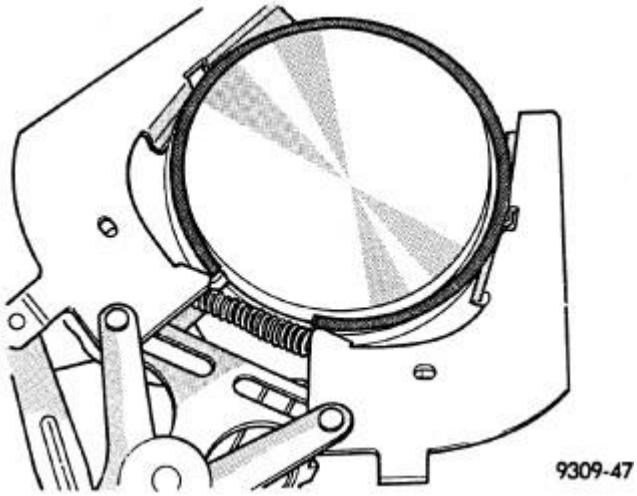


Fig. 332: Installing Intermediate Piston Ring

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Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical piston shown in illustration.

2. Remove the No. 1 (upper) piston ring using a ring expander tool.
3. Remove the No. 2 (intermediate) piston ring using a ring expander tool.

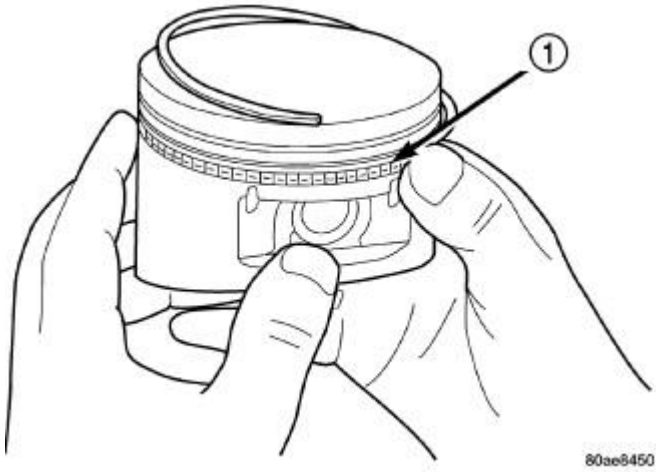


Fig. 333: Installing Piston Ring Side Rail
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical piston shown in illustration. Do not use a piston ring expander to remove the oil control ring (1).

4. Remove the oil control ring (1).
5. Remove the oil control ring expander.

INSTALLATION

INSTALLATION

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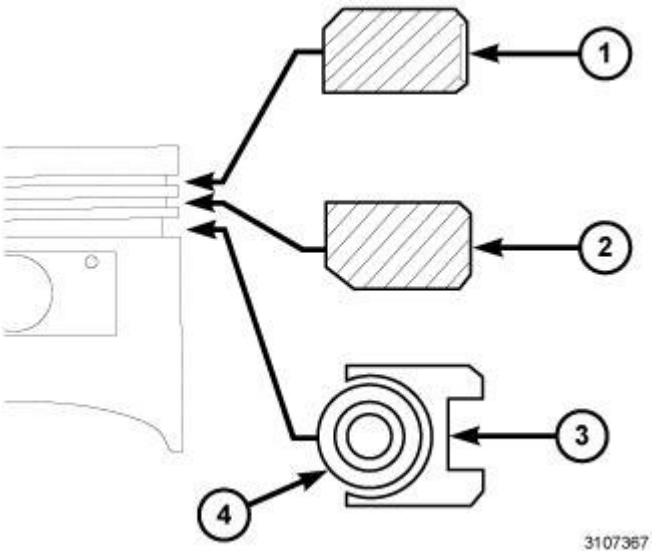


Fig. 334: Piston Ring Removal/Installation Sequence
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical piston shown in illustration.

1. If required, fit new rings to the piston. Refer to **STANDARD PROCEDURE** .

CAUTION: To avoid damage to the piston rings, they must be installed in the following order:

- **Oil control ring expander (4)**
- **Oil control ring (3)**
- **No. 2 (intermediate) piston ring (2)**
- **No. 1 (upper) piston ring (1)**

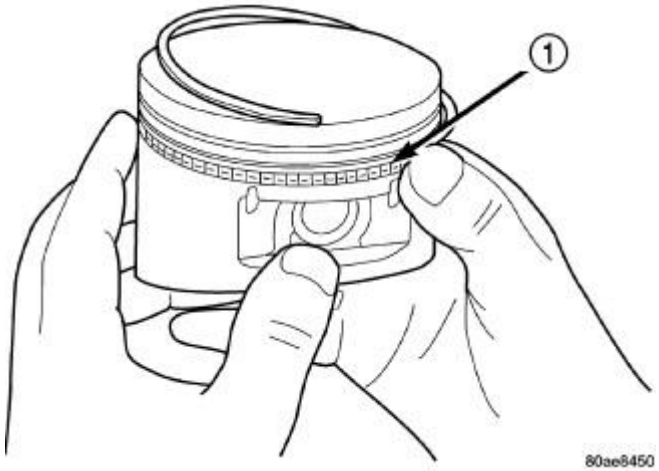


Fig. 335: Installing Piston Ring Side Rail
Courtesy of CHRYSLER GROUP, LLC

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NOTE: Typical piston shown in illustration. Do not use a piston ring expander to install the oil control ring (1).

2. Install the oil control ring expander.
3. Install the oil control ring (1) over the ring expander.

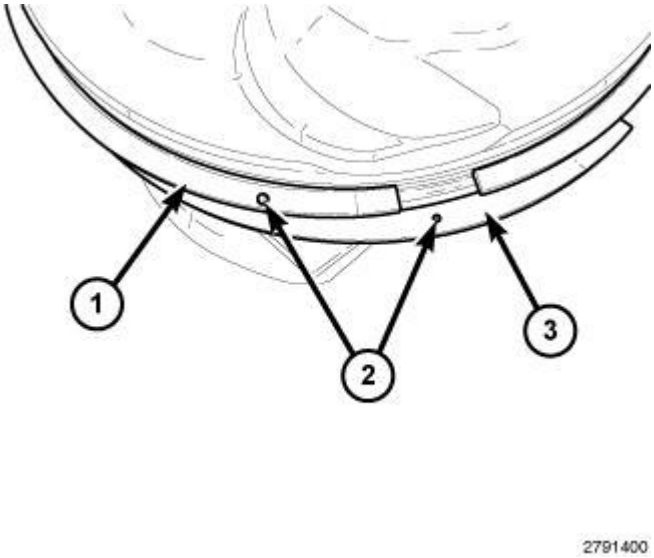


Fig. 336: Identifying Dot Marks On Piston Rings
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical piston shown in illustration. The No. 1 (upper) piston ring (1) and No. 2 (intermediate) piston ring (3) have a different cross section thickness. Install the rings with manufacturers I.D. mark (dot) (2) facing up, towards the top of the piston.

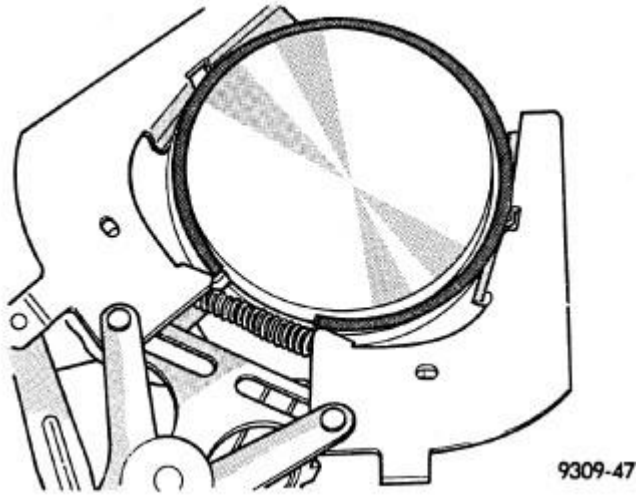


Fig. 337: Installing Intermediate Piston Ring
Courtesy of CHRYSLER GROUP, LLC

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NOTE: Typical piston shown in illustration.

4. Install the No. 2 (intermediate) piston ring using a ring expander tool.
5. Install the No. 1 (upper) piston ring using a ring expander tool.
6. Rotate the rings around the piston, the rings must rotate in the grooves without binding.

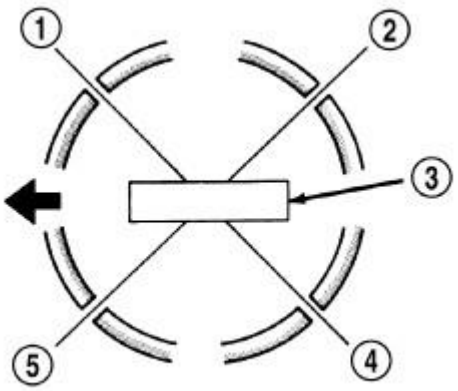


Fig. 338: Piston Ring End Gap Position
Courtesy of CHRYSLER GROUP, LLC

7. Position the piston ring end gaps as follows:
   - Oil control ring expander gap (5)
   - Oil control ring end gap (2)
   - No. 2 (intermediate) ring end gap (4)
   - No. 1 (upper) ring end gap (1)
8. Install the piston and connecting rod(s). Refer to **ROD, PISTON AND CONNECTING, INSTALLATION**.

ROD, PISTON AND CONNECTING

DESCRIPTION

DESCRIPTION

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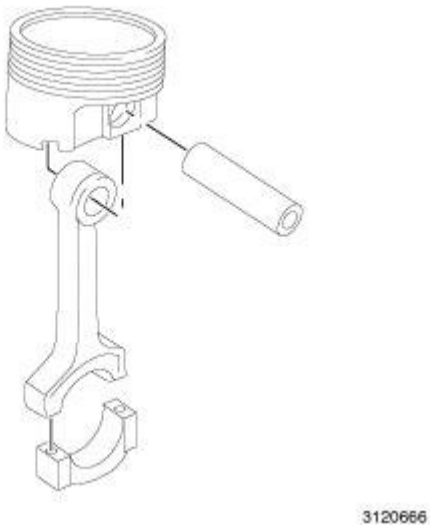


Fig. 339: Piston, Connecting Rod & Pin
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Do not use a metal stamp to mark connecting rods as damage may result, instead use ink or a scratch awl.

The pistons are a lightweight design with low tension piston rings for improved fuel economy. The pistons are made of a high strength silicon aluminum alloy and the piston skirt has a Moly® coating. The piston pin is a press fit into the rod. The connecting rod is forged steel with a bolted cracked cap design. The connecting rod bolts are not reusable. Pistons are available in three different diameters with grade markings for each bore indicated on the side of the cylinder block. The piston rings have a dot or a mark that must face the top of the piston. The pistons have an arrow stamped on the crown for assembly. Piston, pins and rods are only available as an assembly.

STANDARD PROCEDURE

PISTON FITTING

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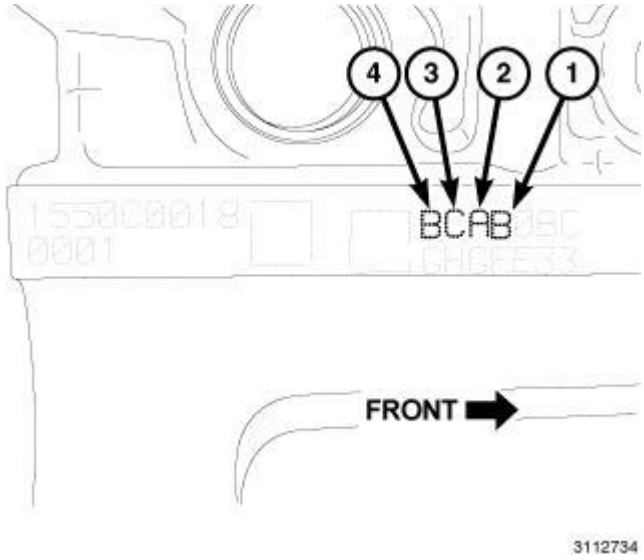
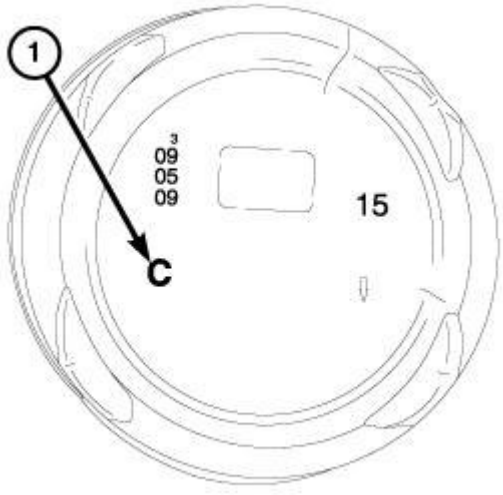


Fig. 340: Engine Block Cylinder Bore Diameter Grade Markings
Courtesy of CHRYSLER GROUP, LLC

The pistons are "select fit" to achieve proper oil clearance. Engine block cylinder bore diameter grade markings are stamped into the right side of the engine block. These marks are read from front to rear, corresponding with cylinder number 1, 2, 3, 4.

Engine block cylinder bore diameter grade markings correspond to specific cylinder bore diameters. The chart below identifies the three engine block grade markings and their associated cylinder bore diameters.

Engine Block Marking	Cylinder Bore Size mm (in.)	
	Metric	Standard
A	72.000 - 72.010 mm	2.8346 - 2.8350 in.
B	72.010 - 72.020 mm	2.8350 - 2.8354 in.
C	72.020 - 72.030 mm	2.8354 - 2.8358 in.



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Fig. 341: Piston Size Mark
Courtesy of CHRYSLER GROUP, LLC

The piston is marked with the piston size (1) on the piston crown. The pistons are available in three different sizes in order to achieve the desired oil clearance. Select the piston size that corresponds to the engine block cylinder bore diameter grade markings for each cylinder.

Pistons are available in three sizes. The chart below identifies the three piston sizes.

Piston Marking	Piston Size mm (in.)	
	Metric	Standard
A	71.960 - 71.970 mm	2.8331 - 2.8835 in.
B	71.970 - 71.980 mm	2.8835 - 2.8339 in.
C	71.980 - 71.990 mm	2.8339 - 2.8342 in.

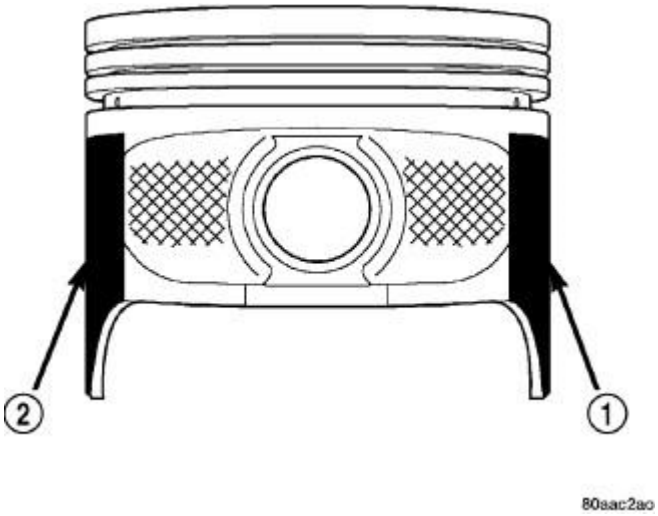


Fig. 342: Identifying Coating Material On Piston
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical coated piston shown in illustration.

The coated pistons are serviced with the piston pin and connecting rod pre-assembled. The coating material (1 and 2) is applied to the piston after the final piston machining process. Piston installation into the cylinder bore requires slightly more pressure than that required for non-coated pistons. The bonded coating on the piston will give the appearance of a line-to-line fit with the cylinder bore.

CONNECTING ROD SIDE CLEARANCE

DIAL INDICATOR

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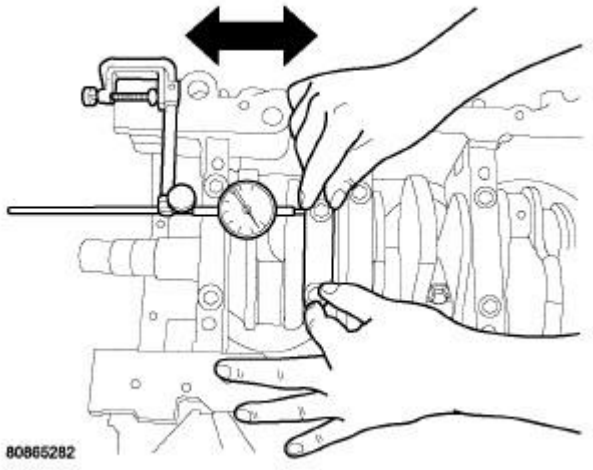


Fig. 343: Measuring Connecting Rod Side Clearance
Courtesy of CHRYSLER GROUP, LLC

1. Mount Dial Indicator Set (special tool #C-3339A, Set, Dial Indicator) to a stationary point on the engine. Locate the probe perpendicular to and resting against the connecting rod cap being checked.
2. Move the connecting rod all the way to the rear of its travel.
3. Zero the dial indicator.
4. Move the connecting rod forward to the limit of travel and read the dial indicator. Compare the measured side clearance to the specification. Refer to **SPECIFICATIONS** .
5. Repeat this procedure for each connecting rod. Rotate the crankshaft for connecting rod accessibility.

FEELER GAUGE

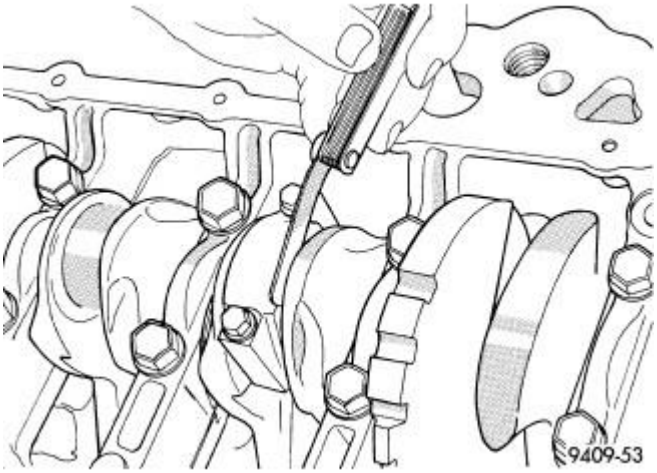


Fig. 344: Connecting Rod Side Clearance
Courtesy of CHRYSLER GROUP, LLC

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NOTE: Typical four cylinder engine shown in illustration.

1. Slide a snug-fitting feeler gauge between the connecting rod and crankshaft journal flange. Compare the measured side clearance to the specification. Refer to **SPECIFICATIONS** .
2. Repeat this procedure for each connecting rod. Rotate the crankshaft for connecting rod accessibility.

REMOVAL

REMOVAL

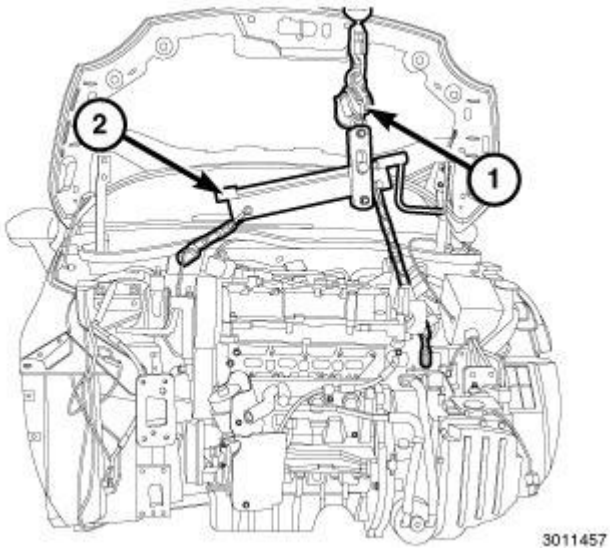


Fig. 345: Engine Hoist & Load-Leveling Lifting Sling
Courtesy of CHRYSLER GROUP, LLC

NOTE: To remove the pistons and connecting rods from the engine, the engine must be removed from the vehicle.

1. Remove the engine. Refer to **REMOVAL**.
2. Remove the cylinder head. Refer to **CYLINDER HEAD, REMOVAL**.
3. Remove the oil pan and oil pump pick-up. Refer to **PICK-UP, OIL PUMP, REMOVAL**.

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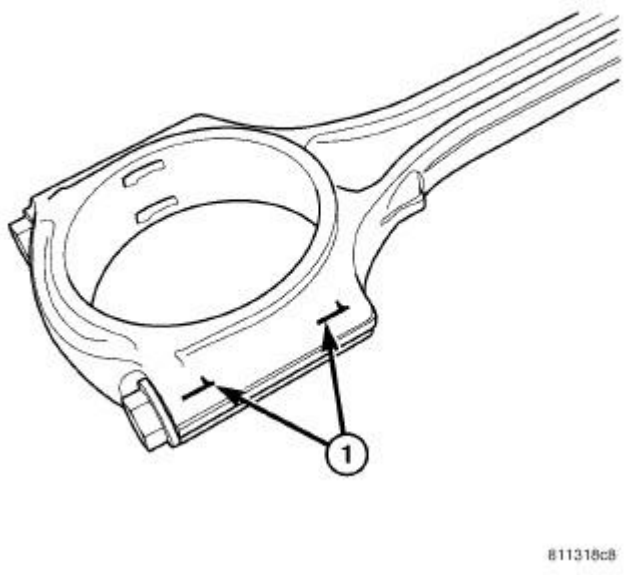


Fig. 346: Connecting Rod To Cylinder Identification
Courtesy of CHRYSLER GROUP, LLC

4. If necessary, remove the top ridge of the cylinder bores with a reliable ridge reamer before removing the pistons from the engine block. **Make sure to keep the tops of pistons covered during this operation.** Pistons and connecting rods must be removed from the top of the engine block. When removing piston and connecting rod assemblies from the engine, rotate the crankshaft CW so that each connecting rod is centered in the cylinder bore.

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods or caps, as damage to connecting rods could occur

NOTE: Connecting rods and bearing caps are not interchangeable and should be marked before removing to ensure correct reassembly.

5. Mark connecting rod and bearing cap positions (1) using a permanent ink marker or scribe tool.

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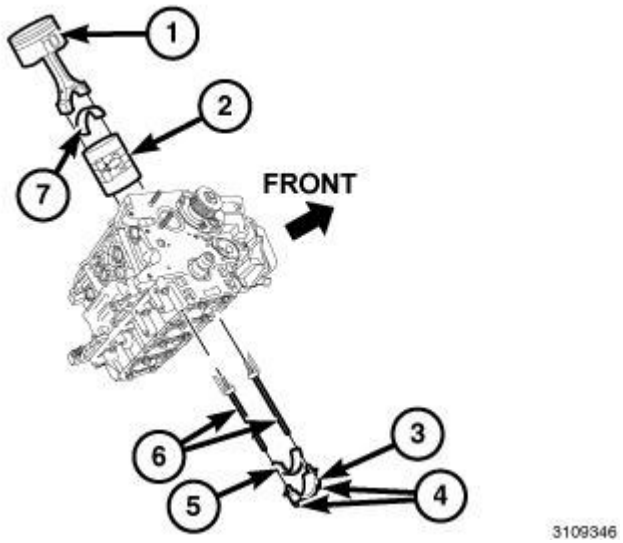


Fig. 347: Piston, Connecting Rod Cap, Bolts, Plastic Guide Plates & Guide Pins
Courtesy of CHRYSLER GROUP, LLC

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

6. Remove the connecting rod cap bolts (4) and the connecting rod cap (3). Discard the cap bolts.
7. Install the (special tool #10281, Pins, Connecting Rod Guide) (6) on the connecting rod.

CAUTION: Care must be taken not to nick crankshaft journals, as engine damage may occur.

8. Remove the piston and connecting rod (1) from cylinder bore.
9. Repeat the previous steps for each piston being removed.
10. Immediately after piston and connecting rod removal, reinstall the bearing cap (3) on the mating connecting rod to prevent damage to the fractured cap and rod surfaces.
11. If required, remove the piston rings. Refer to **RING(S), PISTON, REMOVAL**.
12. Repeat the previous steps for each piston being removed.

CLEANING

CLEANING

CAUTION: DO NOT use a wire wheel or other abrasive cleaning devise to clean the pistons or connecting rods. The pistons have a Moly coating, this coating must not be damaged.

CAUTION: Do not remove the piston pin from the piston and connecting rod assembly.

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1. Using a suitable cleaning solvent clean the pistons in warm water and towel dry.
2. Use a wood or plastic scraper to clean the ring land grooves.

INSPECTION

INSPECTION

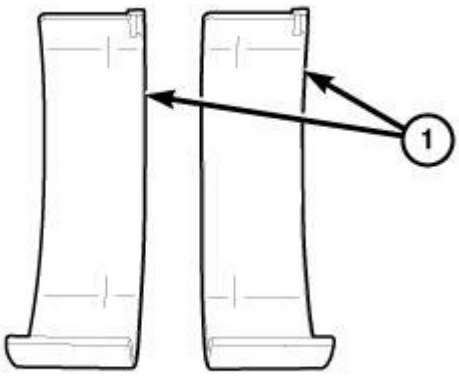


Fig. 348: Inserts
Courtesy of CHRYSLER GROUP, LLC

1. Wipe the inserts (1) clean.
2. Inspect the inserts for abnormal wear patterns, scoring, grooving, fatigue, pitting and for metal or other foreign material imbedded in the lining.
3. Inspect the back of the inserts for fractures, scrapes, or irregular wear patterns.
4. Inspect the insert locking tabs for damage.
5. Replace any bearing that shows abnormal wear. Refer to **STANDARD PROCEDURE** .

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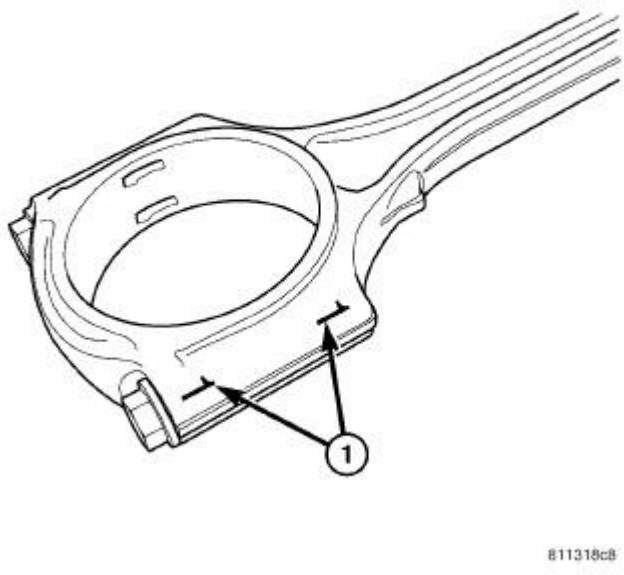


Fig. 349: Connecting Rod To Cylinder Identification
Courtesy of CHRYSLER GROUP, LLC

6. Inspect the connecting rod bearing bores for signs of scoring, nicks and burrs.

NOTE: Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod alignment.

7. Replace misaligned, bent or twisted connecting rods.

NOTE: Connecting rods are serviced with the piston pre-assembled. The pistons are "select fit" to achieve proper oil clearance. Refer to STANDARD PROCEDURE .

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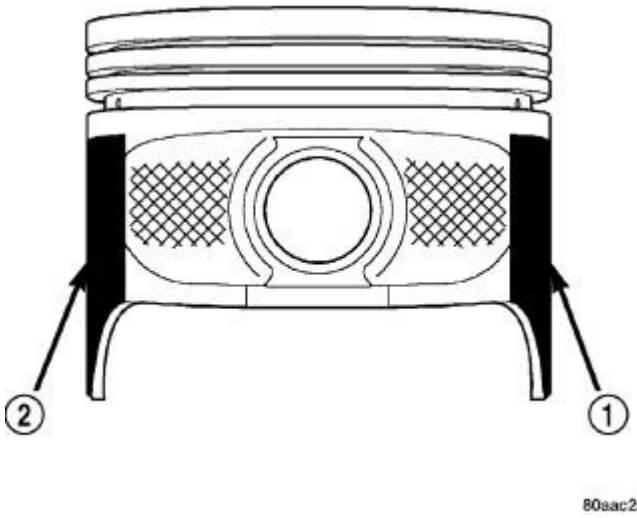


Fig. 350: Identifying Coating Material On Piston
Courtesy of CHRYSLER GROUP, LLC

NOTE: Typical coated piston shown in illustration.

8. Inspect the piston for scoring or scraping marks in the piston skirts. Check the ring lands for cracks and/or deterioration.

NOTE: The coating material (1 and 2) is applied to the piston after the final piston machining process. This coating may affect the outside diameter measurement of a coated piston may not provide accurate results.

9. Check the piston for taper and out of round shape.

NOTE: Piston installation into the cylinder bore may require slightly more pressure than that required for non-coated pistons. The bonded coating on the piston will give the appearance of a line-to-line fit with the cylinder bore.

NOTE: The coated pistons will be serviced with the piston pin and connecting rod pre-assembled.

INSTALLATION

INSTALLATION

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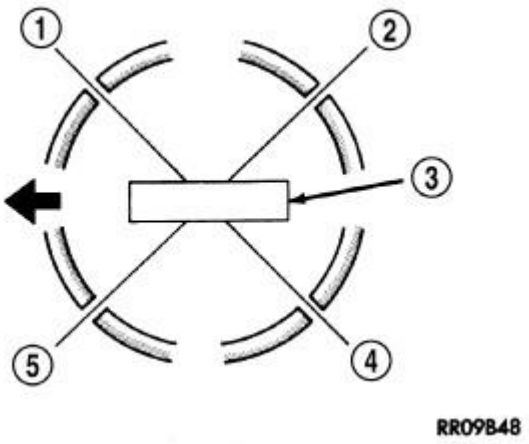


Fig. 351: Piston Ring End Gap Position
Courtesy of CHRYSLER GROUP, LLC

1. If required, select and fit new piston and connecting rod assemblies to the engine block. Refer to **STANDARD PROCEDURE** .
2. If required, hone the cylinder bores. Refer to **STANDARD PROCEDURE** .
3. If removed, install the piston rings. Refer to **RING(S), PISTON, INSTALLATION**.
4. Position the piston ring end gaps as follows:
    - Oil control ring expander gap (5)
    - Oil control ring end gap (2)
    - No. 2 (intermediate) ring end gap (4)
    - No. 1 (upper) ring end gap (1)

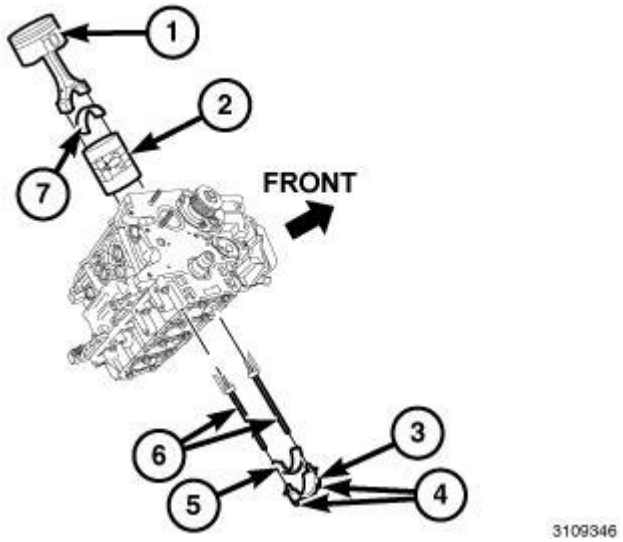


Fig. 352: Piston, Connecting Rod Cap, Bolts, Plastic Guide Plates & Guide Pins
Courtesy of CHRYSLER GROUP, LLC

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NOTE: Make sure the position of the ring end gaps does not change when installing the ring compressor.

5. Lubricate the piston rings with clean engine oil. Position the (special tool #C-385, Compressor, Piston) (2) over the piston and rings. Tighten the compressor (2).

NOTE: Install the rod bearings in pairs. Do not mix sizes or use a new bearing half with an old bearing half.

6. Install the bearing shell (7) on the connecting rod with the tang inserted into the machined groove in the rod. Lubricate the bearing surface with clean engine oil.
7. Install the (special tool #10281, Pins, Connecting Rod Guide) (6) on the connecting rod.

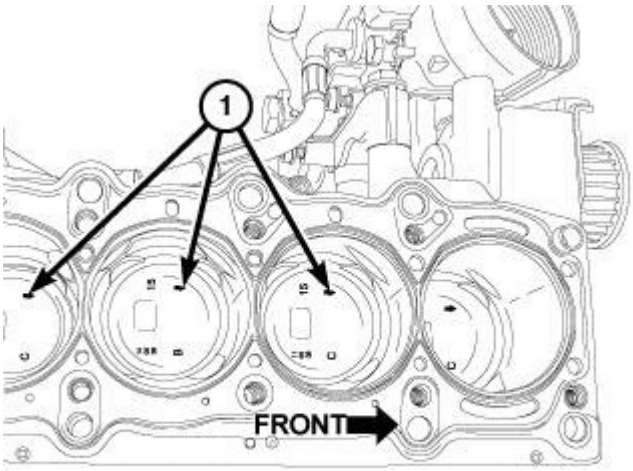


Fig. 353: Arrowheads Stamped On Pistons Crowns
Courtesy of CHRYSLER GROUP, LLC

8. The pistons crowns are stamped with an arrowhead (1) indicating installation position. The arrowhead must point toward the front of engine.
9. Wipe the cylinder bore clean and lubricate with clean engine oil.
10. Rotate the crankshaft until the connecting rod journal is on the center of cylinder bore. Insert the piston and connecting rod into the cylinder bore and carefully position the guide pins over the crankshaft journal.
11. Tap the piston down in the cylinder bore using a hammer handle while guiding the connecting rod into position over the rod journal.

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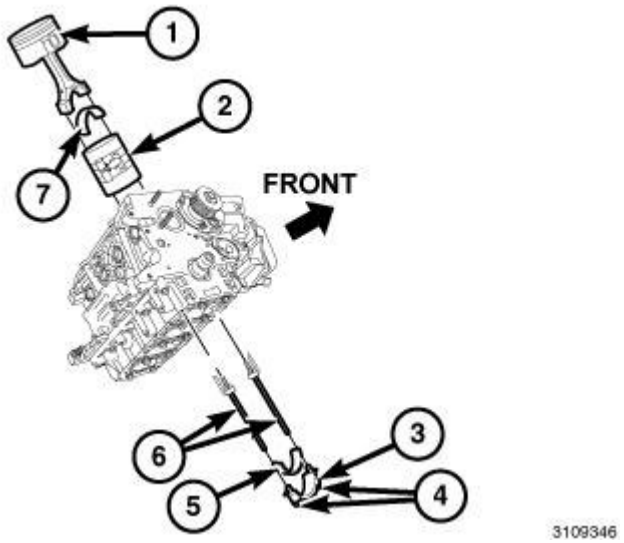


Fig. 354: Piston, Connecting Rod Cap, Bolts, Plastic Guide Plates & Guide Pins
Courtesy of CHRYSLER GROUP, LLC

CAUTION: The connecting rod bolts must not be reused. Always replace the connecting rod bolts whenever they are loosened or removed.

12. Install the bearing shell (5) on the connecting rod cap (3) with the tang inserted into the machined groove in the cap. Lubricate the bearing surface with clean engine oil.

NOTE: Do not lubricate the threads of the connecting rod cap bolts (4).

13. Install the connecting rod cap and bearing with the tang on the same side as the rod. Tighten the **NEW** connecting rod cap bolts (4) to 20 N.m (15 ft. lbs.) plus 40 degrees.
14. If required, check the connecting rod side clearance. Refer to **STANDARD PROCEDURE** .
15. Repeat the previous steps for each piston being installed.

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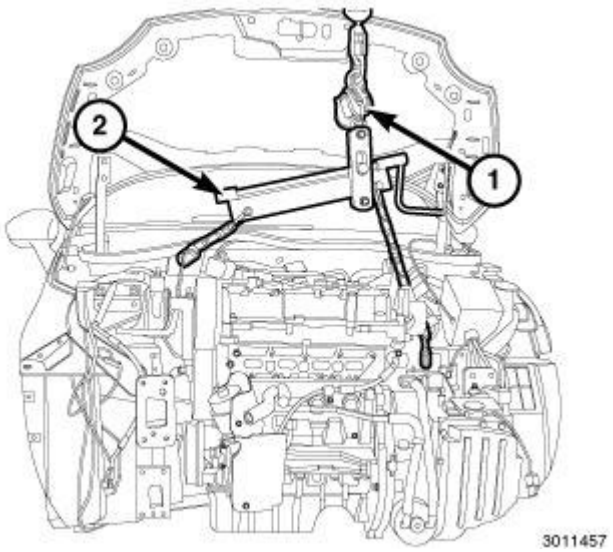


Fig. 355: Engine Hoist & Load-Leveling Lifting Sling
Courtesy of CHRYSLER GROUP, LLC

16. Install the oil pump pick-up and oil pan. Refer to **PICK-UP, OIL PUMP, INSTALLATION**.
17. Install the cylinder head, timing belt and sprockets. Refer to **CYLINDER HEAD, INSTALLATION**.
18. Install the engine. Refer to **INSTALLATION**.
19. If removed, install the oil filter and fill the engine crankcase with the proper oil to the correct level. Refer to **STANDARD PROCEDURE** .
20. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
21. Fill the cooling system. Refer to **STANDARD PROCEDURE** .
22. Run the engine until it reaches normal operating temperature. Check cooling system for correct fluid level. Refer to **STANDARD PROCEDURE** .

SEAL, CRANKSHAFT OIL, FRONT

REMOVAL

REMOVAL

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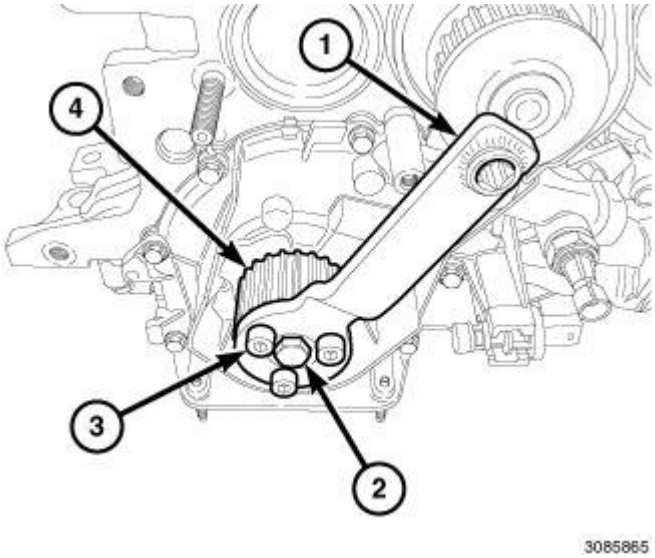


Fig. 356: Crankshaft Sprocket, Holder & Bolts
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When the timing belt is removed and the cylinder head is still installed, DO NOT rotate the camshaft or crankshaft without first locating the proper crankshaft position. Failure to do so will result in valve and/or piston damage.

1. Remove the crankshaft sprocket (4). Refer to **SPROCKET(S), TIMING BELT AND CHAIN, REMOVAL**.

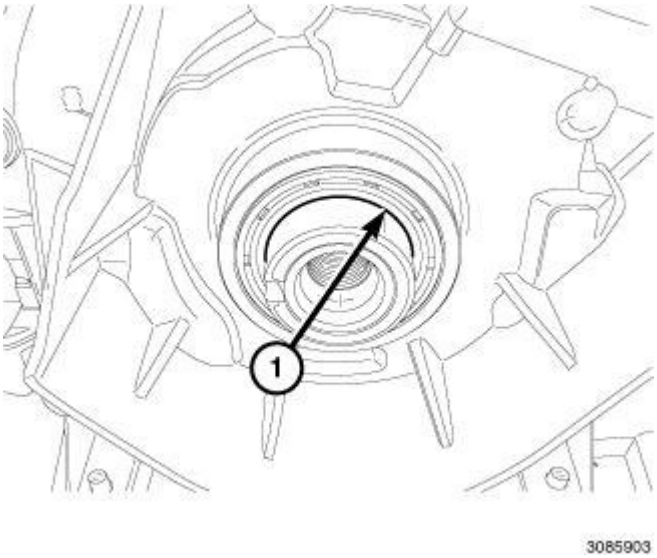


Fig. 357: Front Crankshaft Seal
Courtesy of CHRYSLER GROUP, LLC

2. Remove the front crankshaft seal (1).

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INSTALLATION

INSTALLATION

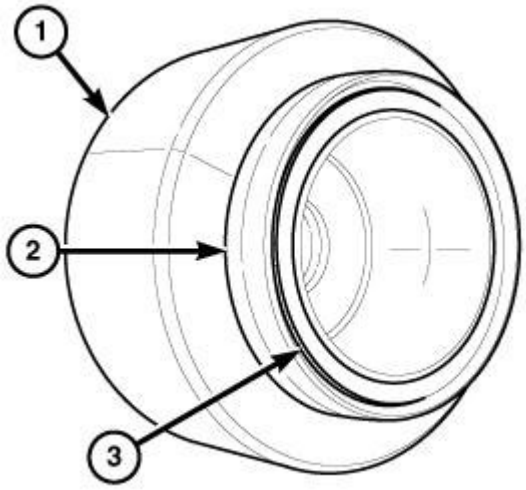


Fig. 358: Crankshaft Front Oil Seal Installer, Front Crankshaft Front Oil Seal & Garter Spring
Courtesy of CHRYSLER GROUP, LLC

1. Apply engine oil to the seal pilot diameter of the (special tool #10273, Installer, Crankshaft Front Oil Seal) (1) and to the inside diameter of the front crankshaft oil seal (2).
2. Carefully install the oil seal onto the seal installer.

NOTE: Make sure that the garter spring (3) is intact around the inside of the oil seal lip.

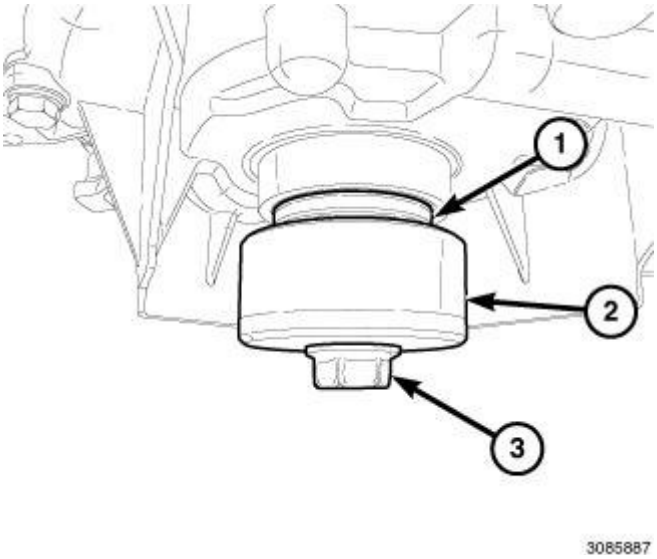


Fig. 359: Oil Seal, Installer & Bolt
Courtesy of CHRYSLER GROUP, LLC

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3. Apply engine oil to the outside diameter of the oil seal (1).
4. Position the seal installer (2) on the crankshaft and install the crankshaft sprocket bolt (3).

CAUTION: Only tighten the crankshaft sprocket bolt until the oil seal is seated in the oil pump. Overtightening of the bolt can crack the oil pump.

5. Tighten the crankshaft sprocket bolt (3) until the crankshaft oil seal is seated in the oil pump.

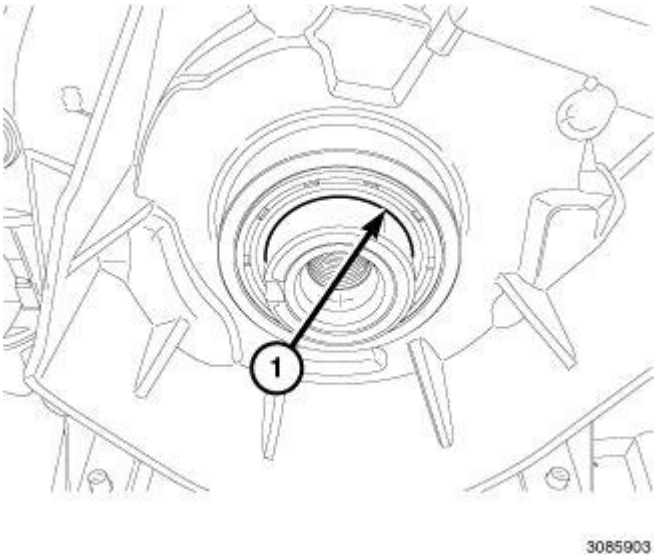


Fig. 360: Front Crankshaft Seal
Courtesy of CHRYSLER GROUP, LLC

6. Verify that the oil seal is uniformly seated and that the seal lip (1) is not curled inward toward the engine.
7. Install the timing belt and sprockets. Refer to **SPROCKET(S), TIMING BELT AND CHAIN, INSTALLATION**.

SEAL, CRANKSHAFT OIL, REAR

REMOVAL

REMOVAL

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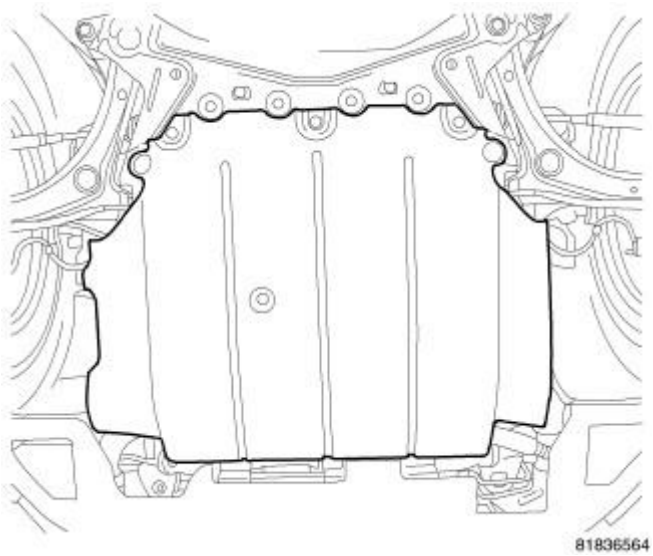


Fig. 361: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect and isolate the negative battery cable.
2. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
3. Remove the belly pan. Refer to **BELLY PAN, REMOVAL** .
4. Drain the engine oil. Refer to **STANDARD PROCEDURE**.

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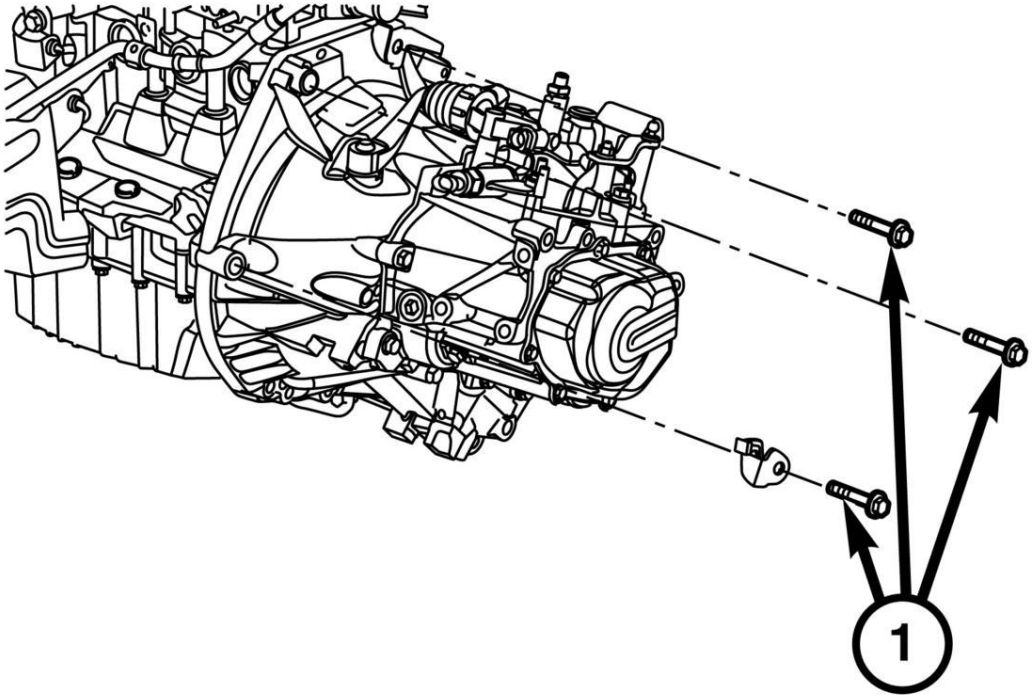


Fig. 362: Upper Bell Housing Bolts
Courtesy of CHRYSLER GROUP, LLC

5. Remove the manual transmission from the vehicle. Refer to **REMOVAL** .

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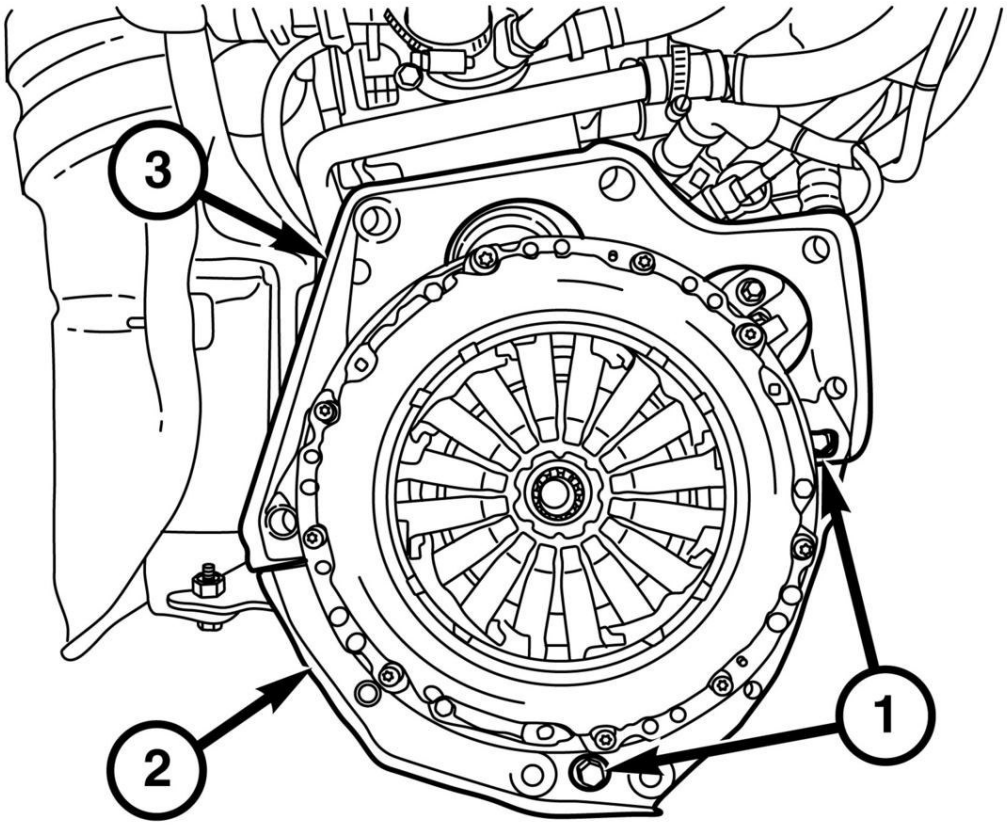


Fig. 363: Flywheel Dust Covers & Bolts
Courtesy of CHRYSLER GROUP, LLC

6. Remove the two bolts (1) and the flywheel dust covers (2 and 3).

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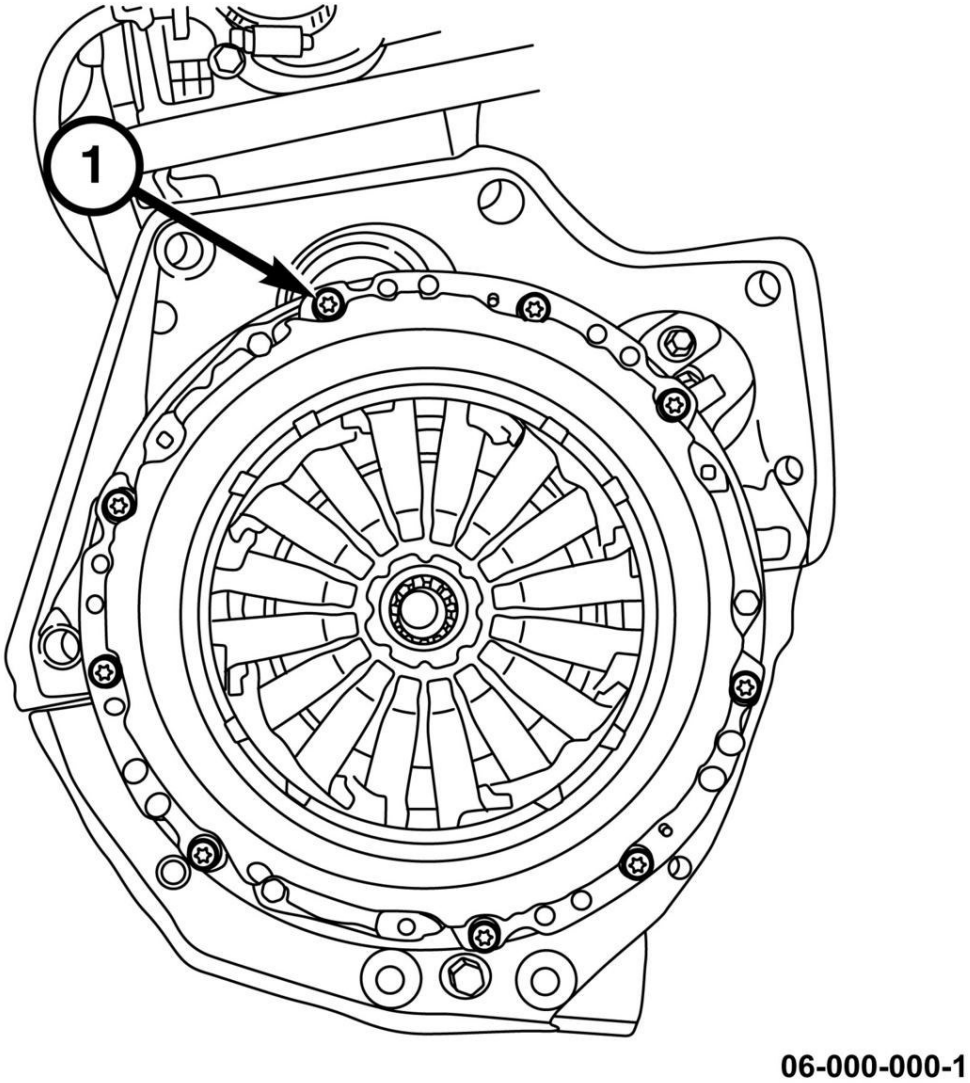


Fig. 364: Pressure Plate Bolts
Courtesy of CHRYSLER GROUP, LLC

7. Remove the clutch and flywheel. Refer to **FLYWHEEL, REMOVAL** .

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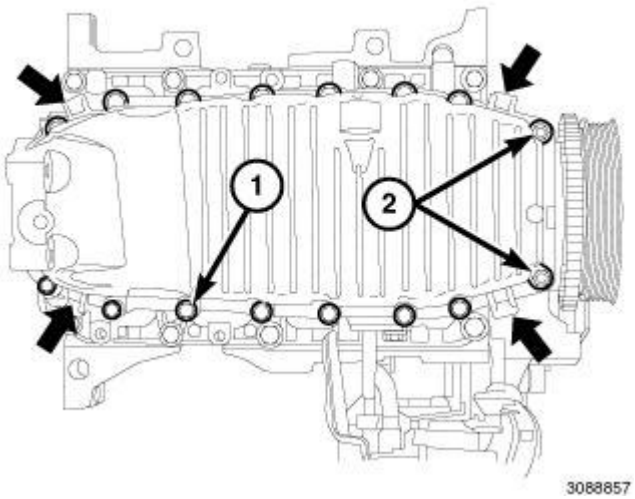


Fig. 365: Oil Pan Flange Fasteners
Courtesy of CHRYSLER GROUP, LLC

8. Remove fourteen bolts (1), two nuts and two studs (2) from the flange of the oil pan.
9. Using the four indicated pry points, carefully remove the oil pan and flywheel dust cover.

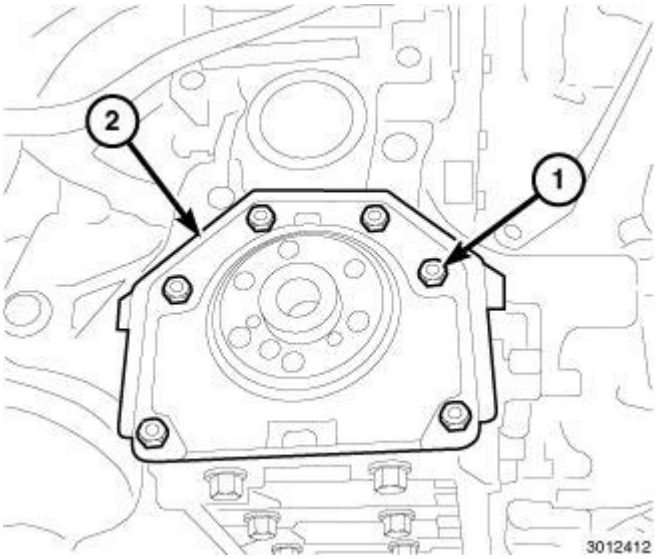


Fig. 366: Seal Retainer Attaching Screws & Seal Retainer
Courtesy of CHRYSLER GROUP, LLC

10. Remove the six seal retainer attaching screws (1).
11. Remove and discard the seal retainer (2).

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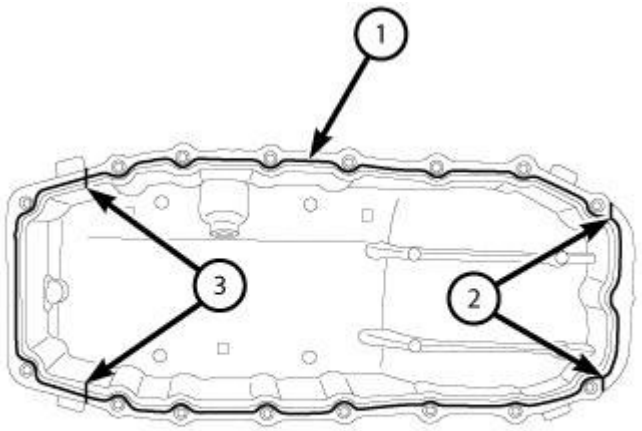


Fig. 367: Oil Pan Sealant Locations
Courtesy of CHRYSLER GROUP, LLC

12. Remove all residual sealant (1) from the oil pan, engine block and oil pump. Refer to **PAN, OIL, CLEANING**.

INSTALLATION

INSTALLATION

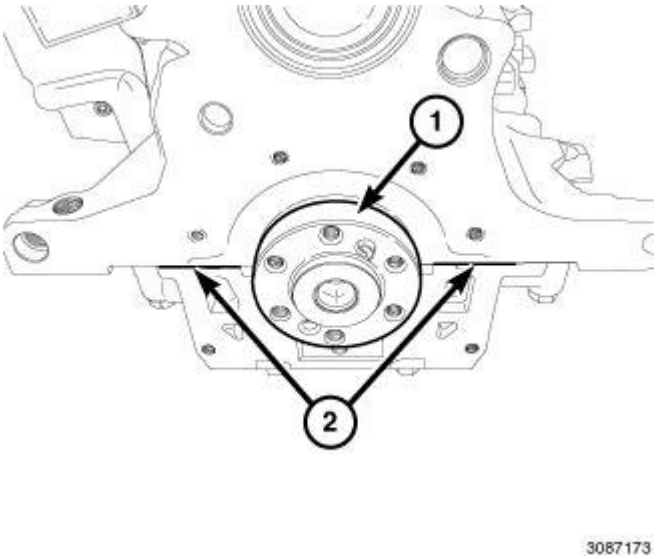


Fig. 368: Crankshaft Seal Surface & Sealant Locations
Courtesy of CHRYSLER GROUP, LLC

CAUTION: Whenever the crankshaft is replaced, the rear crankshaft oil seal must also be replaced. Failure to do so may result in engine fluid leakage.

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1. Inspect the crankshaft to make sure there are no nicks or burrs on the seal surface (1).
2. Clean the seal retainer, cylinder block and bedplate mating surfaces with isopropyl alcohol in preparation for sealant application.

CAUTION: Engine assembly requires the use of a unique sealant that is compatible with engine oil. Using a sealant other than Mopar® Engine RTV GEN II may result in engine fluid leakage.

CAUTION: Following the application of Mopar® Engine RTV GEN II to the gasket surfaces, the components must be assembled within 10 minutes and the attaching fasteners must be tightened to specification within the next 10 minutes. Prolonged exposure to the air prior to assembly may result in engine fluid leakage.

3. Apply a 2 to 3 mm wide bead of Mopar® Engine RTV GEN II sealant (1) to the two cylinder block to bedplate T-joints as shown in illustration.

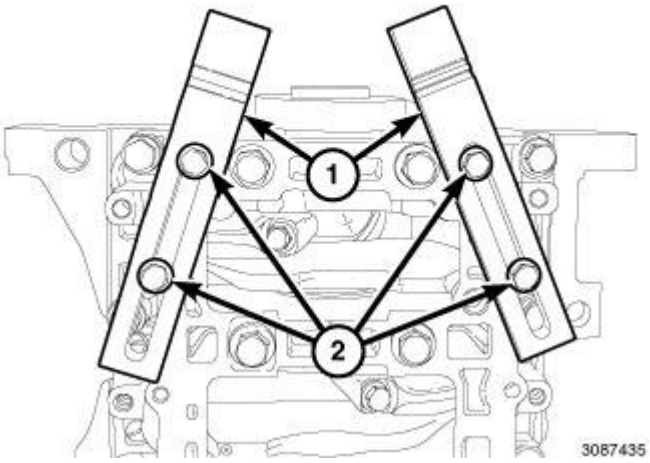


Fig. 369: Alignment Fixture & Bolts
Courtesy of CHRYSLER GROUP, LLC

4. Attach the (special tool #8225, Alignment Fixture) (1) to the oil pan mounting flange using the oil pan bolts (2). Tighten the bolts to 9 N.m (80 in. lbs.).

NOTE: Make sure that the "2.7L" stamped on the alignment fixture is facing the cylinder block (flat side of tools against oil pan mounting flange).

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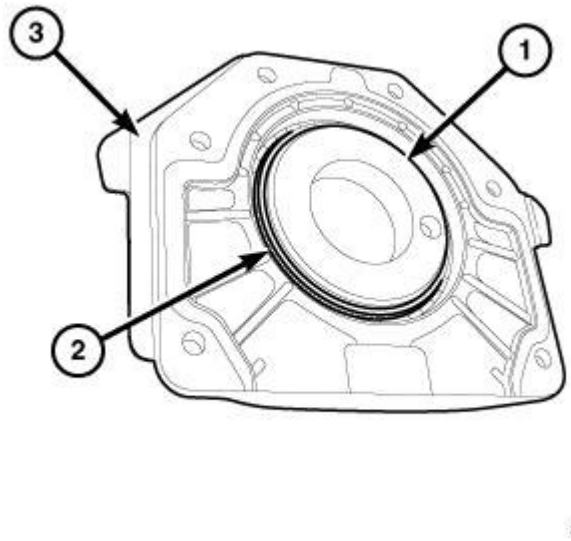


Fig. 370: Rear Crankshaft Oil Seal Guide, Garter Spring & Rear Seal Retainer
Courtesy of CHRYSLER GROUP, LLC

NOTE: It is not necessary to lubricate the seal or the crankshaft when installing the seal retainer. Residual oil following installation can be mistaken for seal leakage.

5. Carefully install the (special tool #10306, Guide, Rear Crankshaft Oil Seal) (1) into the rear seal retainer (3).

NOTE: Make sure that the garter spring (2) is intact around the inside of the oil seal lip.

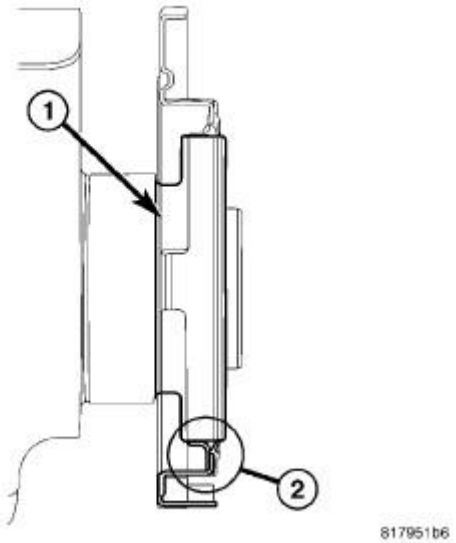


Fig. 371: Rear Seal Installed

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Courtesy of CHRYSLER GROUP, LLC

6. Carefully position the seal retainer and seal installer on the crankshaft and push firmly into place on the engine block (during this step, the seal installer will be pushed from the oil seal as a result of installing the seal retainer).
7. Verify that the seal lip (2) on the retainer is uniformly curled inward toward the engine on the crankshaft (1).

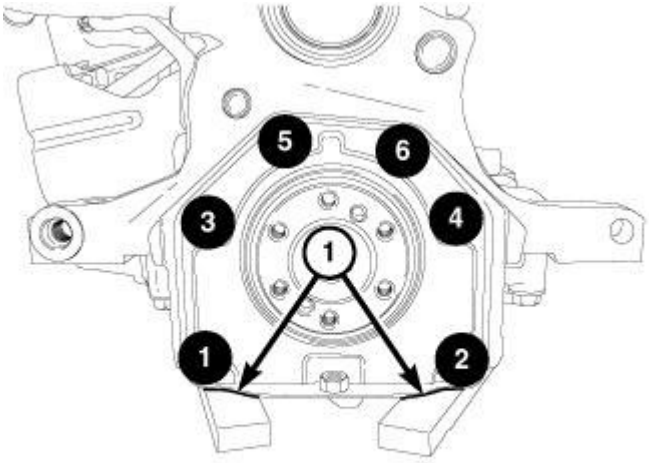


Fig. 372: Seal Retainer Flange Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

8. Allow the seal retainer to center itself on the crankshaft and position the seal retainer so that the distance between the seal retainer flange and the alignment fixture is equal on both sides (1).

NOTE: Do not force the seal retainer flange down against the alignment fixture.

9. While maintaining this alignment, install the six seal retainer bolts. Tighten the six bolts in two steps following the sequence shown in illustration:
   - Step 1: All to 5 N.m (44 in. lbs.).
   - Step 2: All to 9 N.m (80 in. lbs.).

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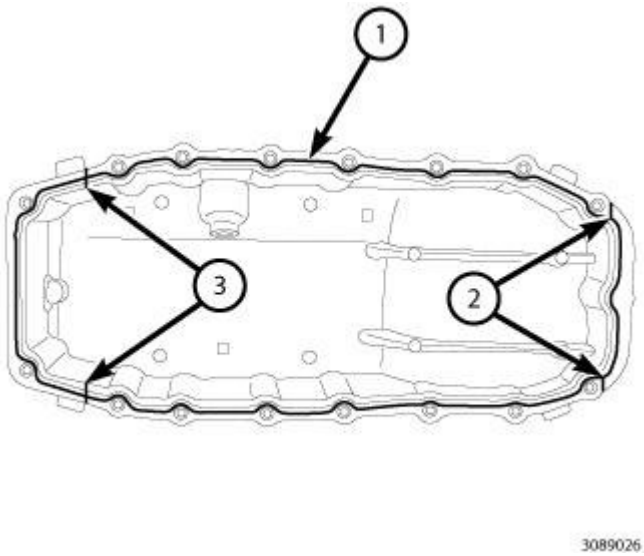


Fig. 373: Oil Pan Sealant Locations
Courtesy of CHRYSLER GROUP, LLC

10. Clean the oil pan, engine block, oil pump and rear seal retainer mating surfaces with isopropyl alcohol in preparation for sealant application.

CAUTION: Engine assembly requires the use of a unique sealant that is compatible with engine oil. Using a sealant other than Mopar® Engine RTV GEN II may result in engine fluid leakage.

CAUTION: Following the application of Mopar® Engine RTV GEN II to the gasket surfaces, the components must be assembled within 10 minutes and the attaching fasteners must be tightened to specification within the next 10 minutes. Prolonged exposure to the air prior to assembly may result in engine fluid leakage.

11. Apply a 2 to 3 mm wide bead of Mopar® Engine RTV GEN II sealant to the oil pan as shown in illustration in the following locations:
    - Oil pan to engine block flange (1)
    - Two oil pump to engine block T-joints (3)
    - Two rear seal retainer to engine block T-joints (2)

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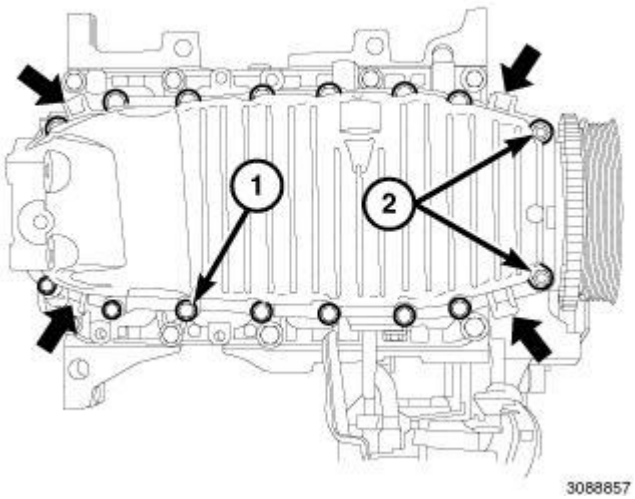


Fig. 374: Oil Pan Flange Fasteners
Courtesy of CHRYSLER GROUP, LLC

12. Install the oil pan with fourteen bolts (1), two studs and two nuts (2) hand tight.

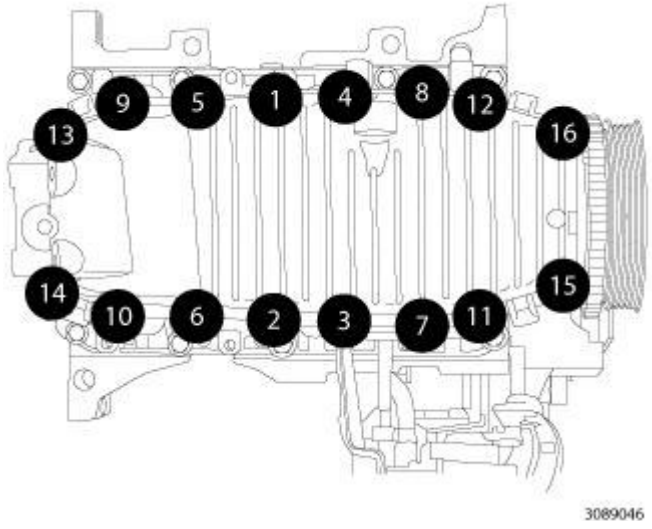


Fig. 375: Oil Pan Fastener Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

13. Tighten the sixteen oil pan fasteners in two steps following the sequence shown in illustration:
    - Step 1: All to 4 N.m (35 in. lbs.).
    - Step 2: All to 9 N.m (80 in. lbs.).

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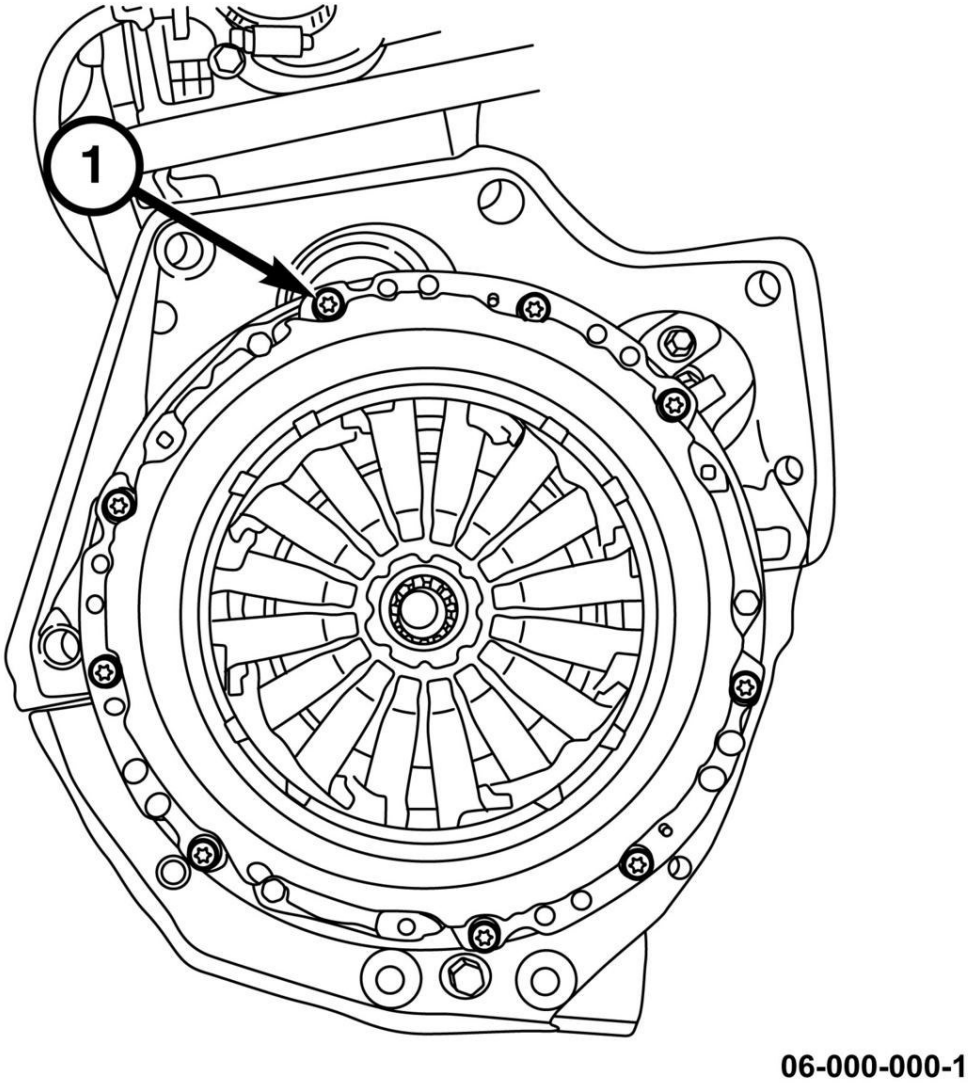


Fig. 376: Pressure Plate Bolts
Courtesy of CHRYSLER GROUP, LLC

14. Install the flywheel and clutch. Refer to **FLYWHEEL, INSTALLATION** .

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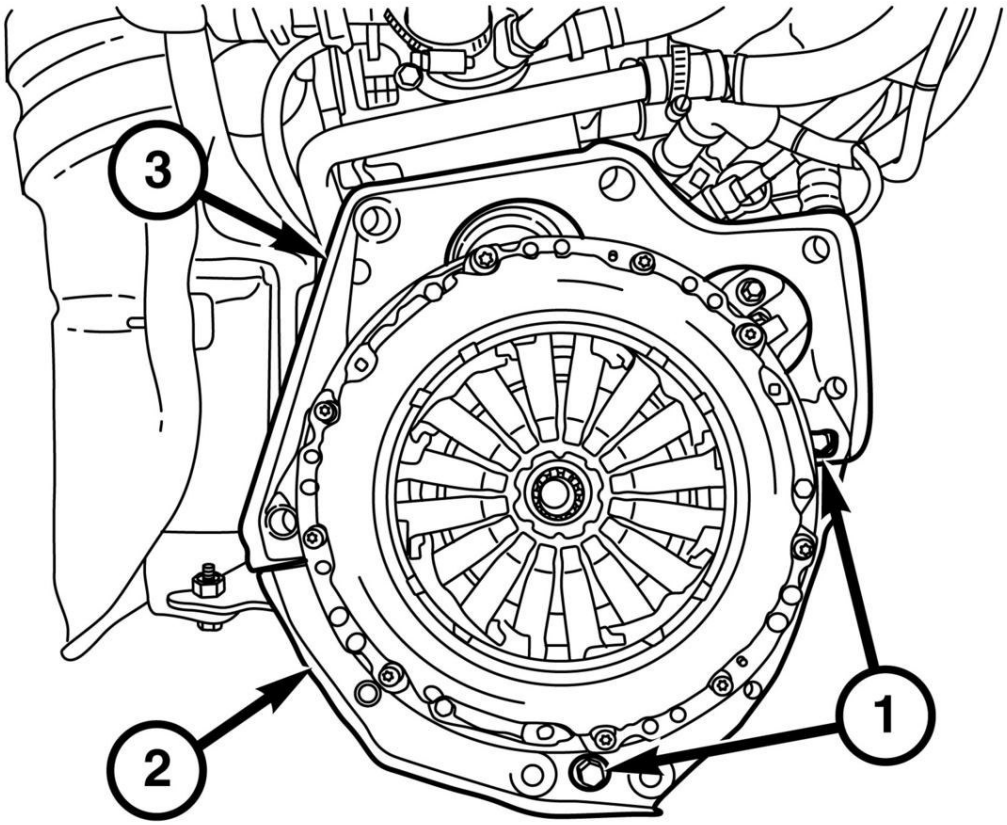


Fig. 377: Flywheel Dust Covers & Bolts
Courtesy of CHRYSLER GROUP, LLC

15. Install the flywheel dust covers (2 and 3) with two bolts (1) tightened to 9 N.m (80 in. lbs.).

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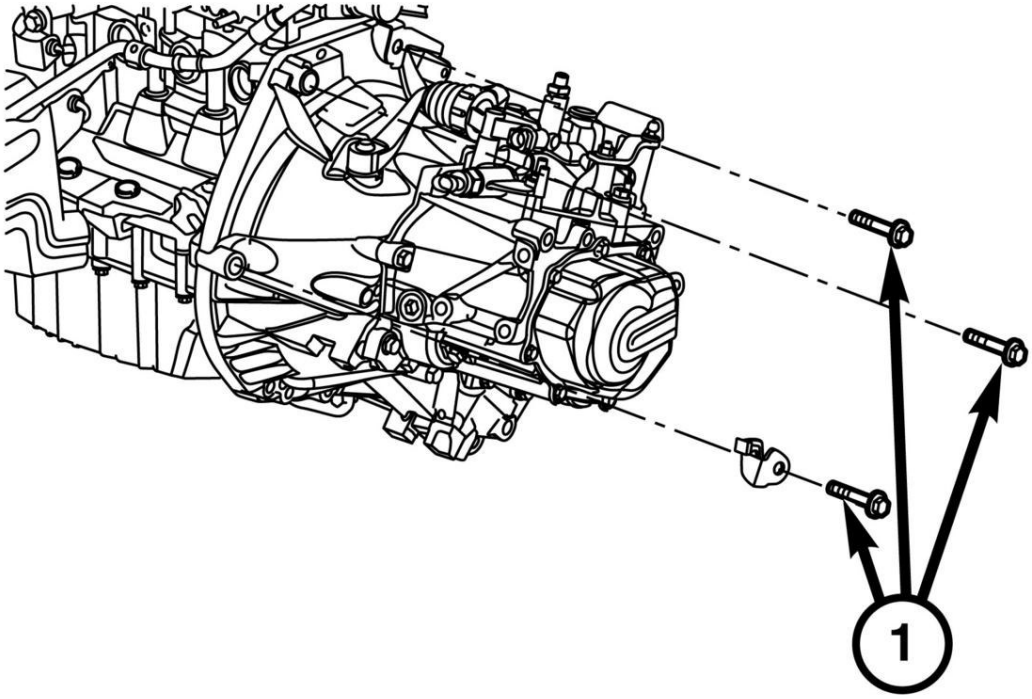


Fig. 378: Upper Bell Housing Bolts
Courtesy of CHRYSLER GROUP, LLC

16. Install the manual transmission in the vehicle. Refer to **INSTALLATION** .

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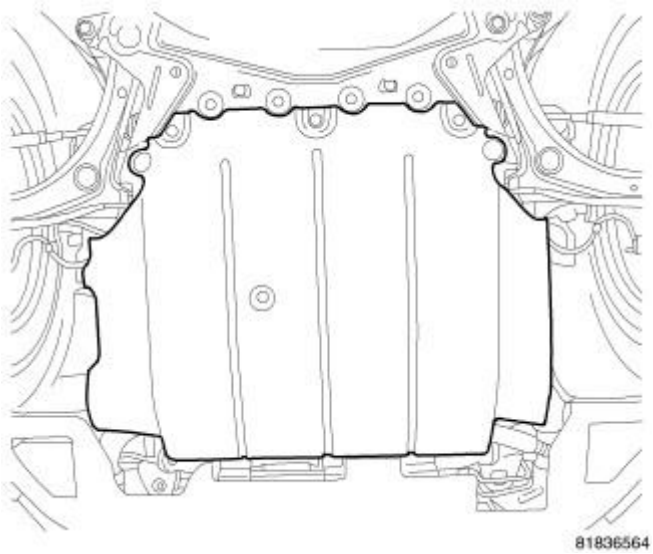


Fig. 379: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

17. Fill the transmission with the proper fluid to the correct level. Refer to **FLUID, STANDARD PROCEDURE** .
18. If removed, install the oil filter and fill the engine crankcase with the proper oil to the correct level. Refer to **STANDARD PROCEDURE** .
19. Install the belly pan. Refer to **BELLY PAN, INSTALLATION** .
20. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
21. Start and run the engine until it reaches normal operating temperature.

ENGINE MOUNTING

BRACKET, ENGINE MOUNT, RIGHT

REMOVAL

REMOVAL

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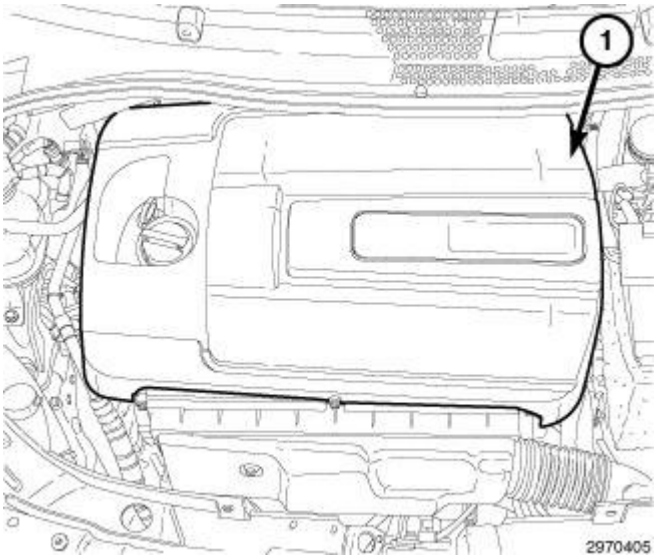


Fig. 380: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

1. Perform the fuel pressure release procedure. Refer to **FUEL DELIVERY, GAS, STANDARD PROCEDURE** .
2. Disconnect and isolate the negative battery cable.
3. Remove the engine cover (1).

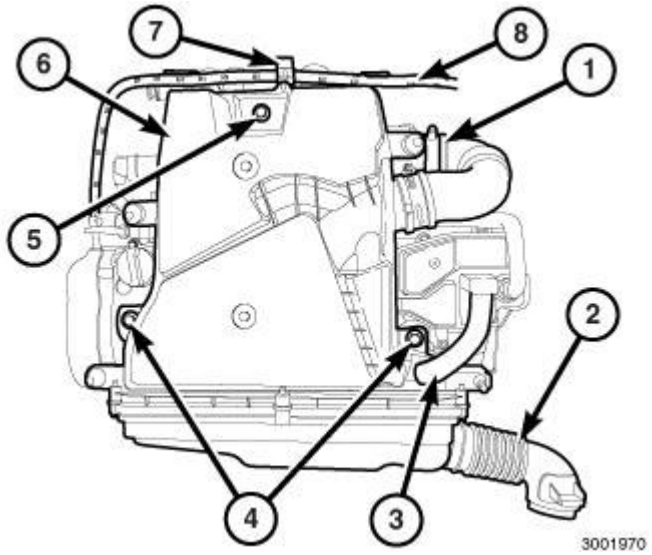


Fig. 381: Air Cleaner Body Assembly
Courtesy of CHRYSLER GROUP, LLC

4. Remove the air cleaner body (6). Refer to **BODY, AIR CLEANER, REMOVAL**.

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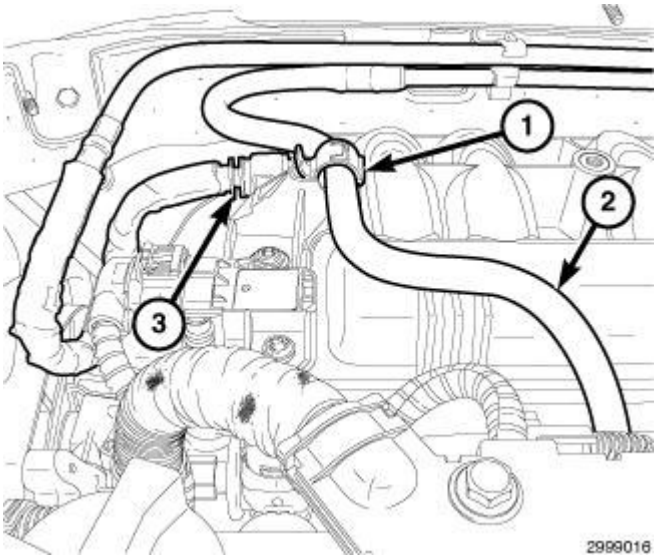


Fig. 382: Fuel Line, Hose Retainer & Fuel Vapor Purge Hose
Courtesy of CHRYSLER GROUP, LLC

5. Disconnect the fuel vapor hose (3) from the intake manifold.
6. Open the hose retainer (1). Disconnect the fuel line (2) from the fuel rail. Refer to **FITTING, QUICK CONNECT, STANDARD PROCEDURE** .

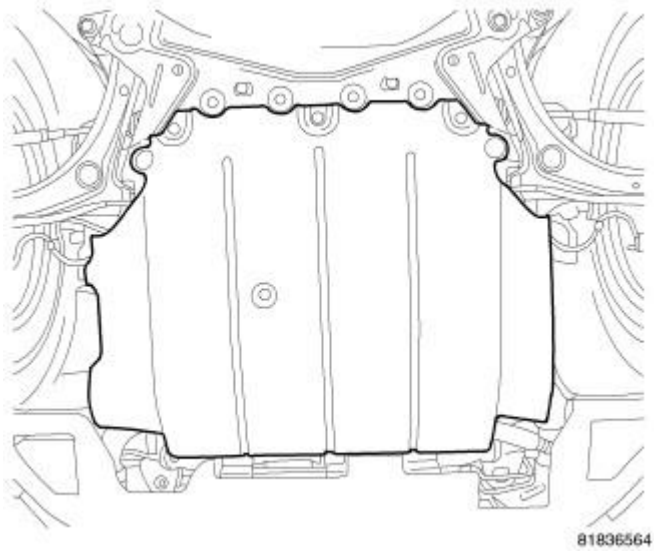


Fig. 383: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

7. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
8. Remove the belly pan. Refer to **BELLY PAN, REMOVAL** .

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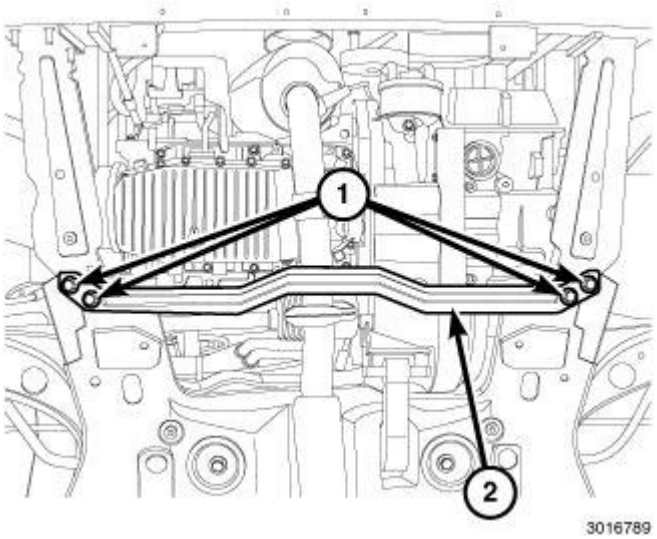


Fig. 384: Tunnel Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

9. Remove four bolts (1) and the tunnel support brace (2).

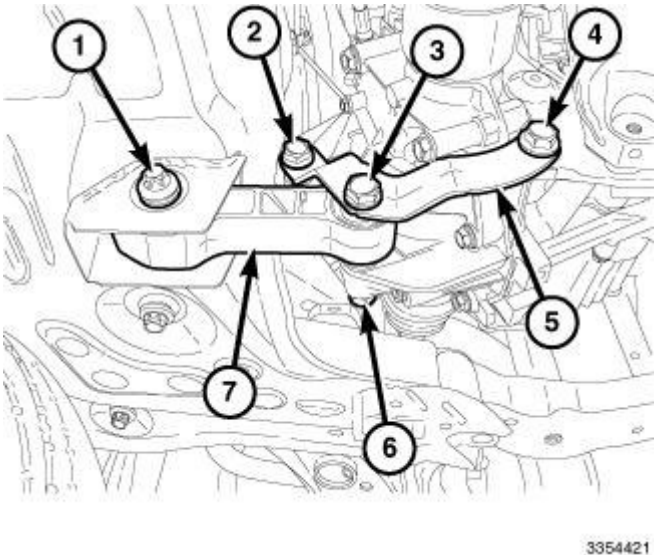


Fig. 385: Rear Engine Mount Bracket, Isolator & Fasteners
Courtesy of CHRYSLER GROUP, LLC

10. If equipped with a manual transmission, remove the rear engine mount bracket bolt (3) and nut (6), loosen the isolator bolt (1) and reposition the rear engine mount isolator (7) away from the bracket (5).

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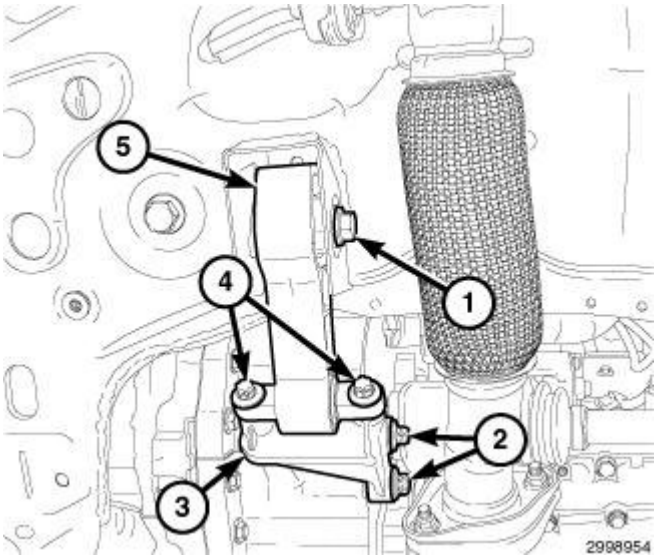


Fig. 386: Two Bolts Of Lower Transmission Mount
Courtesy of CHRYSLER GROUP, LLC

11. If equipped with an automatic transmission, remove two bolts (4) from the rear engine mount bracket (3), loosen the bolt (1) and reposition the rear engine mount link (5) away from the bracket (3).

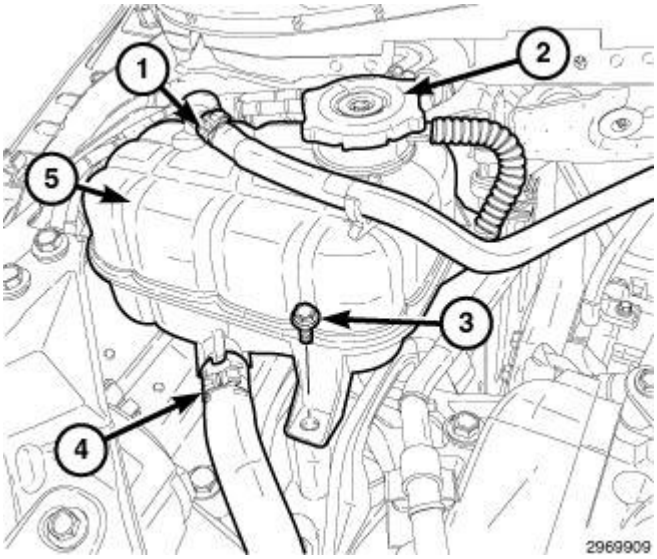


Fig. 387: Return Hose, Lower Supply Hose, Mounting Screw & Coolant Recovery Bottle
Courtesy of CHRYSLER GROUP, LLC

12. Lower the vehicle.
13. Reposition the coolant recovery bottle (5). Refer to **BOTTLE, PRESSURIZED COOLANT, REMOVAL** .

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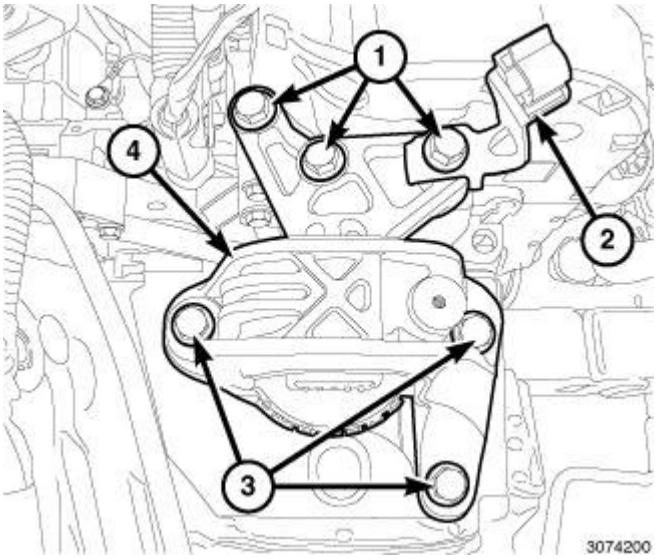


Fig. 388: Three Right Side Engine Mount Support Bolts
Courtesy of CHRYSLER GROUP, LLC

14. Support the engine with a floor jack positioned under the oil pan.
15. Remove six bolts (1 and 3) and the RH engine mount isolator (4).

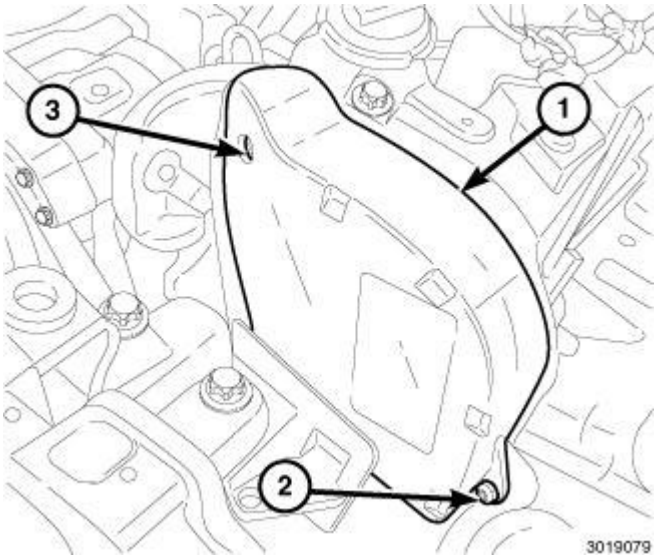


Fig. 389: Upper Timing Belt Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

16. Remove the bolts (2 and 3) and the upper timing belt cover (1).

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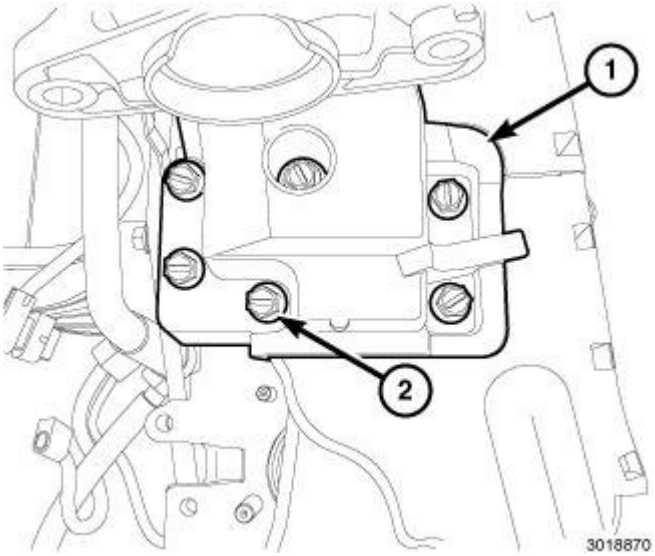


Fig. 390: RH Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

17. Carefully raise the front of the engine and remove the six bolts (2) and the RH engine mount bracket (1).

INSTALLATION

INSTALLATION

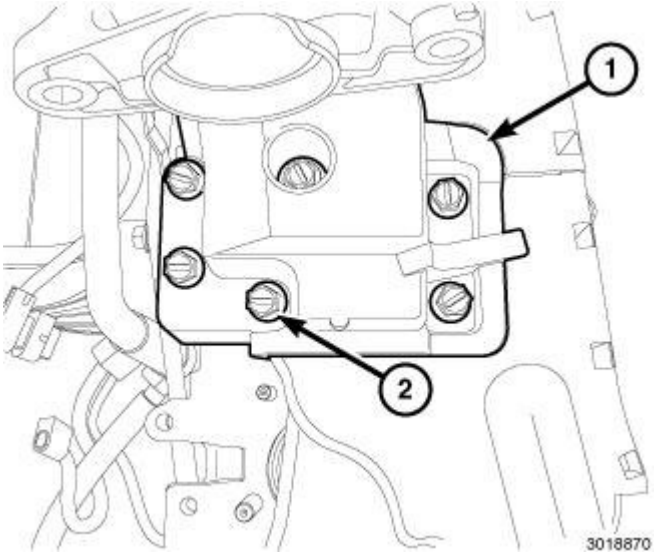


Fig. 391: RH Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Install the RH engine mount bracket (1) with six bolts (2) tightened to 25 N.m (18 ft. lbs.).

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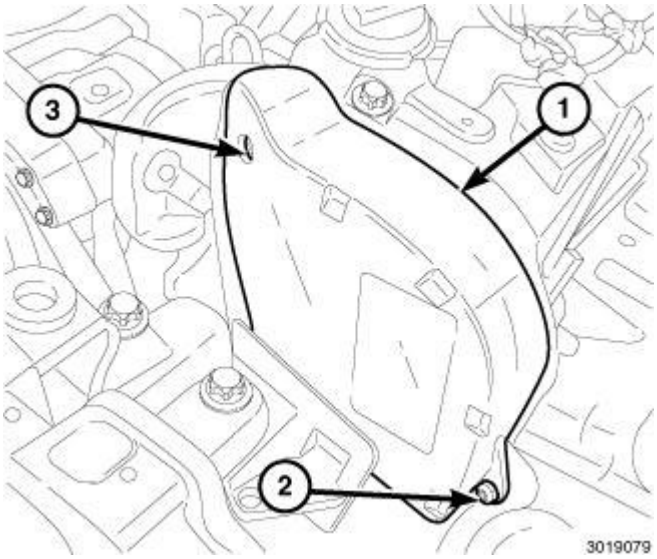


Fig. 392: Upper Timing Belt Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

2. Install the upper timing belt cover (1) with two bolts (2 and 3) tightened to 9 N.m (80 in. lbs.).

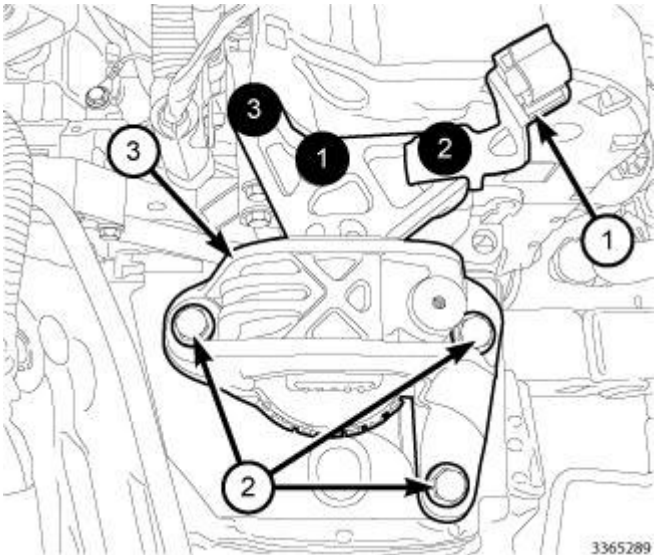


Fig. 393: RH Engine Mount Isolator, Support Bracket & Bolts With Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

3. Install the RH engine mount isolator (3) and support bracket (1) to the engine mount bracket with three bolts. Tighten the isolator to engine bracket bolts in the sequence shown in illustration to 60 N.m (44 ft. lbs.).
4. Install the RH engine mount isolator (3) to the body with three bolts (2). Tighten the isolator to body bolts (2) to 60 N.m (44 ft. lbs.).

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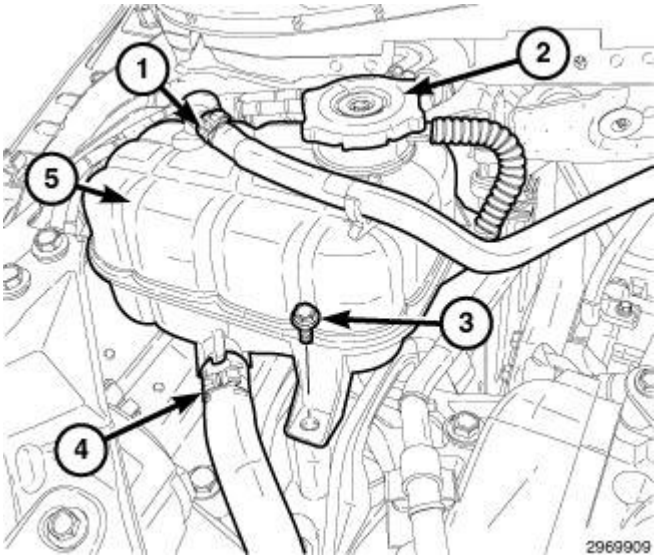


Fig. 394: Return Hose, Lower Supply Hose, Mounting Screw & Coolant Recovery Bottle
Courtesy of CHRYSLER GROUP, LLC

5. Install the pressurized coolant bottle (5). Refer to **BOTTLE, PRESSURIZED COOLANT, INSTALLATION** .

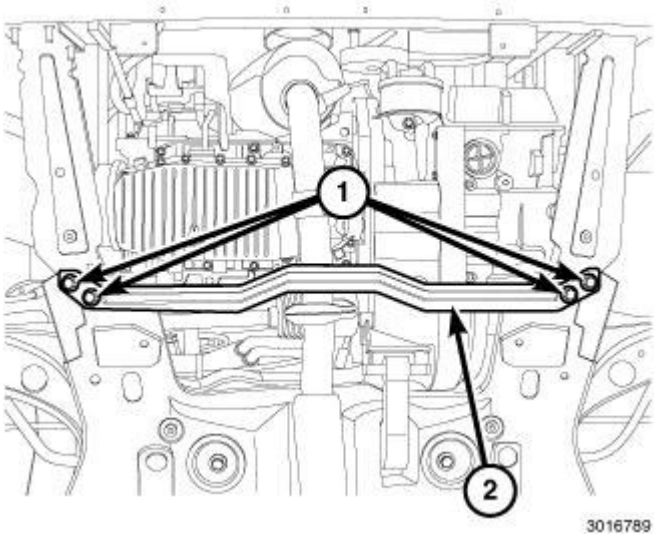


Fig. 395: Tunnel Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

6. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
7. Install the tunnel support brace (2) with four bolts (1) tightened to 90 N.m (60 ft. lb.).

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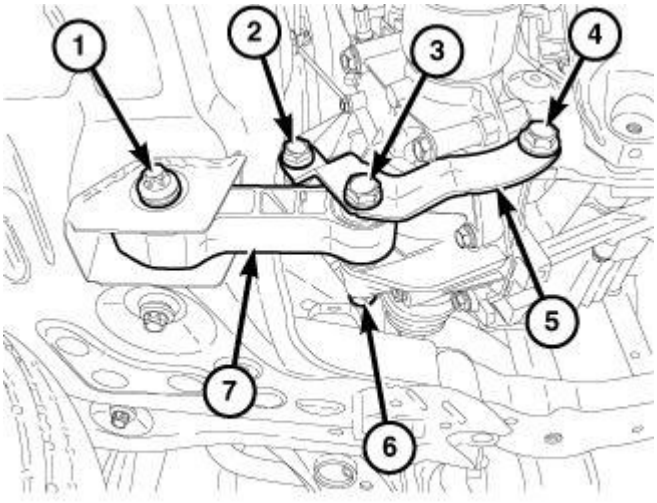


Fig. 396: Rear Engine Mount Bracket, Isolator & Fasteners
Courtesy of CHRYSLER GROUP, LLC

8. If equipped with a manual transmission, install the rear engine mount isolator (7) to the transmission with the rear engine mount bracket bolt (3) and nut (6) tightened to 80 N.m (59 ft. lbs.) and tighten the isolator bolt (1) to 130 N.m (96 ft. lbs.).

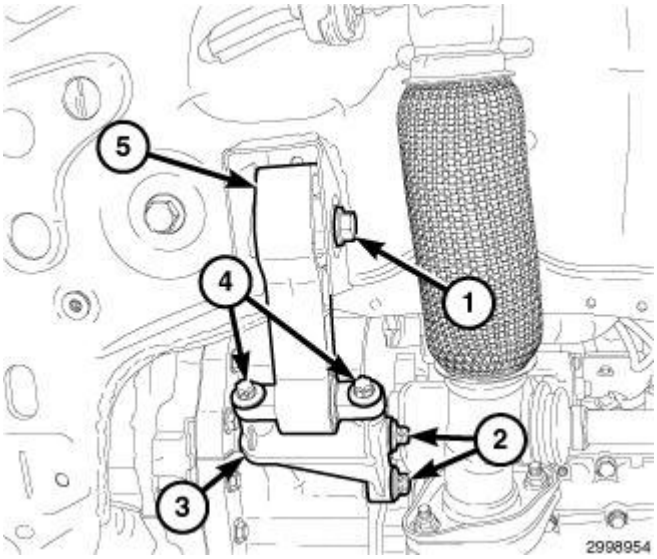


Fig. 397: Two Bolts Of Lower Transmission Mount
Courtesy of CHRYSLER GROUP, LLC

9. If equipped with an automatic transmission, install the rear engine mount isolator (5) in the bracket (3) with two bolts (4) tighten to 60 N.m (44 ft. lbs.). Install the isolator bolt (1) and tighten to 130 N.m (96 ft. lbs.).

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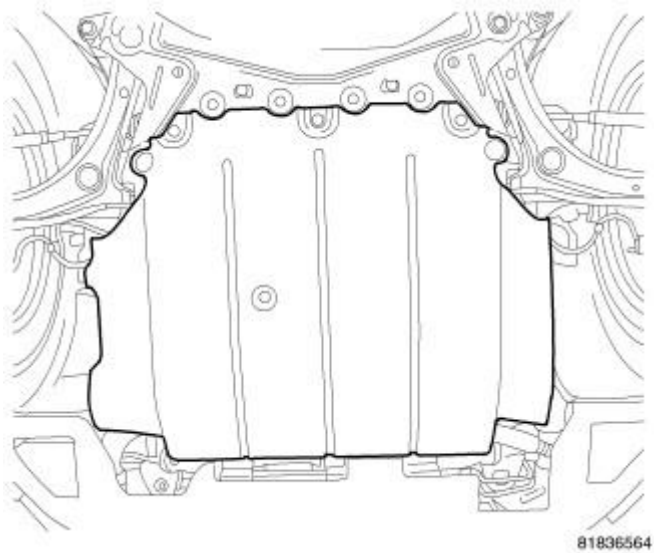


Fig. 398: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

10. Install the belly pan. Refer to **BELLY PAN, INSTALLATION** .

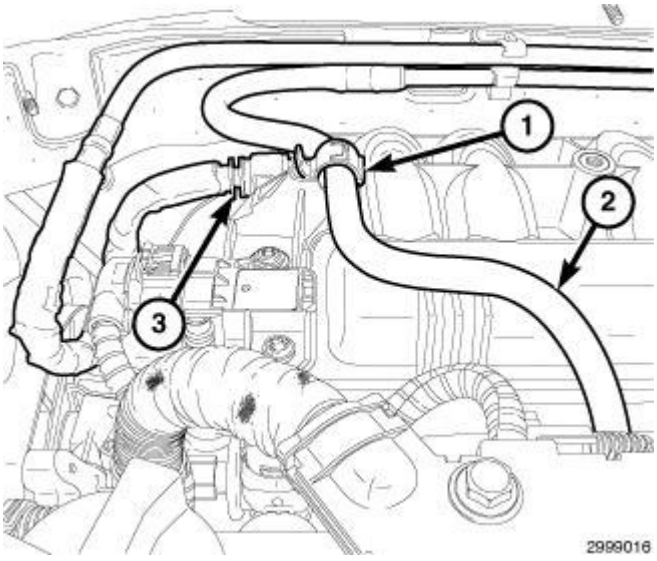


Fig. 399: Fuel Line, Hose Retainer & Fuel Vapor Purge Hose
Courtesy of CHRYSLER GROUP, LLC

11. Lower the vehicle.
12. Connect the fuel vapor purge hose (3) to the intake manifold.
13. Connect the fuel line (2) to the fuel rail and close the hose retainer (1). Refer to **FITTING, QUICK CONNECT, STANDARD PROCEDURE** .

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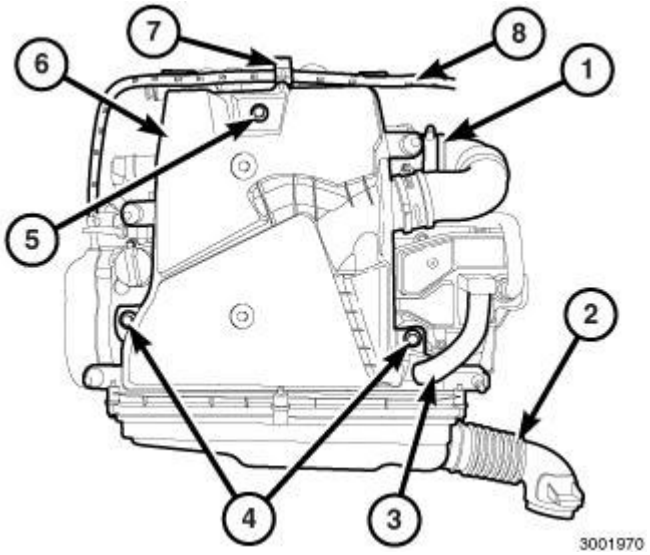


Fig. 400: Air Cleaner Body Assembly
Courtesy of CHRYSLER GROUP, LLC

14. Install the air cleaner body (6). Refer to **BODY, AIR CLEANER, INSTALLATION**.

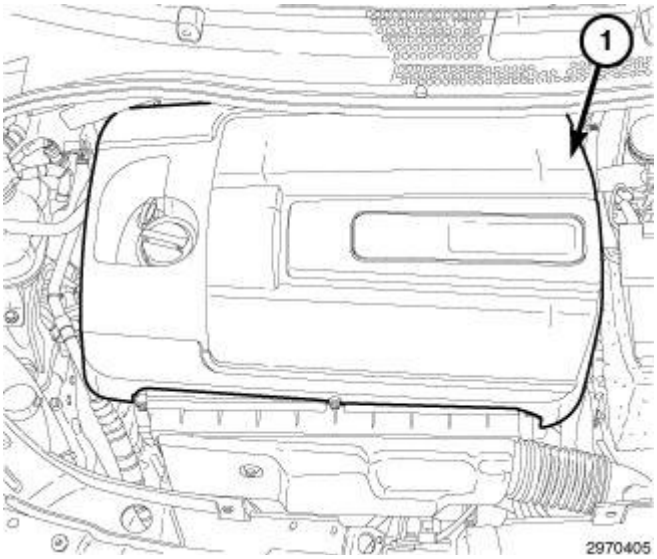


Fig. 401: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

15. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lb.).
16. Install the engine cover (1).
17. Run the engine until it reaches normal operating temperature. Check cooling system for correct fluid level. Refer to **STANDARD PROCEDURE** .

INSULATOR, ENGINE MOUNT, LEFT

REMOVAL

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REMOVAL

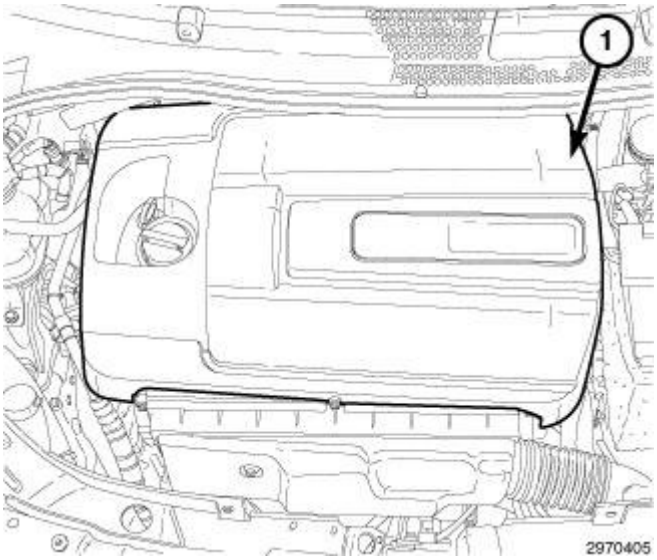


Fig. 402: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

1. Remove the engine cover (1).

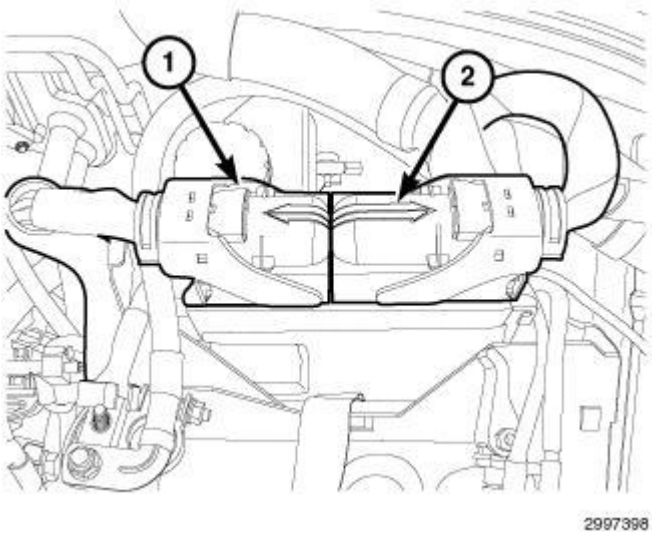


Fig. 403: PCM Electrical Connectors
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When servicing components near the vacuum pump, avoid contact with the plastic nipple that connects the vacuum pump to the brake booster hose. It is possible to crack the plastic nipple resulting in a brake booster vacuum leak.

2. Disconnect and remove the battery. Refer to **BATTERY, REMOVAL** .

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3. Disconnect the Powertrain Control Module (PCM) harness connectors (1 and 2).

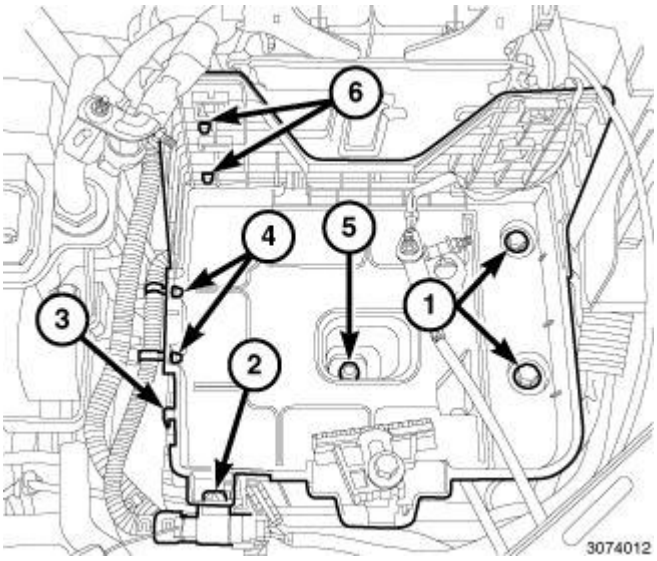


Fig. 404: Battery Tray, Connectors, Retainers, Nut & Bolts
Courtesy of CHRYSLER GROUP, LLC

4. Disengage two starter wire harness retainers (6) from the battery tray (3).
5. Disengage two engine wire harness retainers (4) from the battery tray (3).
6. Disengage the engine wire harness connector (2) from the battery tray (3) and reposition the wire harness.
7. Remove the nut (5) and two bolts (1).

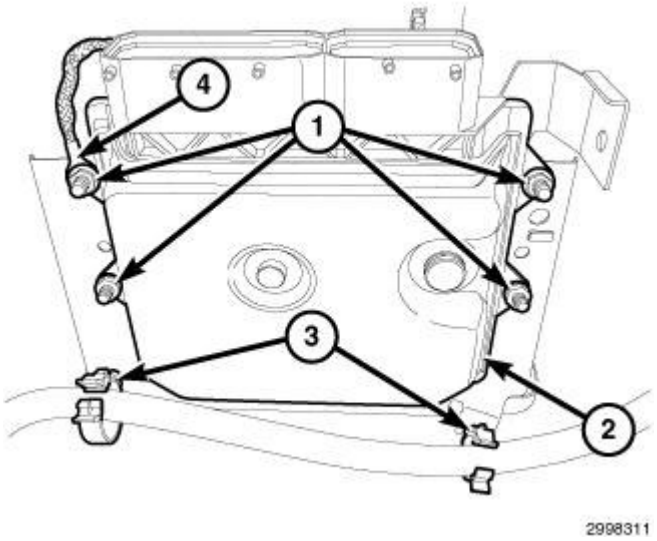


Fig. 405: PCM, Retainers, Ground Strap & Nuts
Courtesy of CHRYSLER GROUP, LLC

8. Open the two wire harness retainers (3) and reposition the wire harness.
9. Remove the nut (1) and the ground strap (4).

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10. Remove the battery tray with the PCM (2) attached.

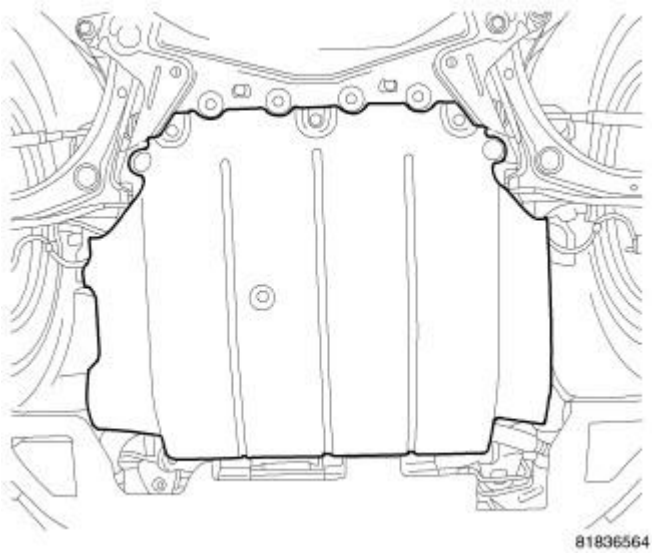


Fig. 406: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

11. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
12. Remove the belly pan. Refer to **BELLY PAN, REMOVAL** .

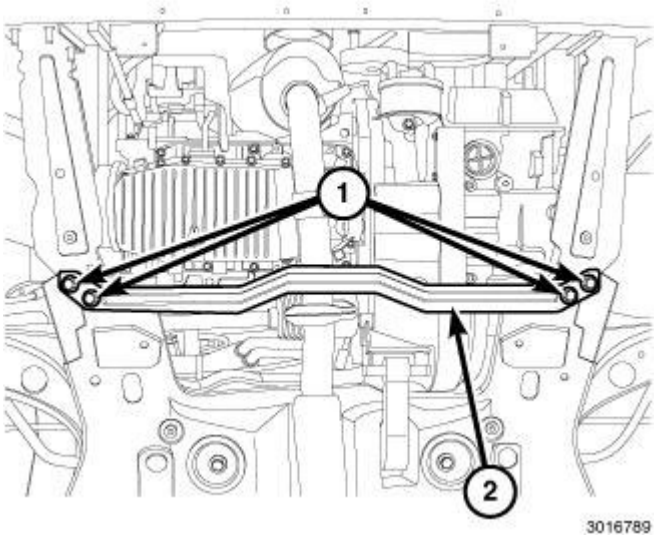


Fig. 407: Tunnel Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

13. Remove four bolts (1) and the tunnel support brace (2).

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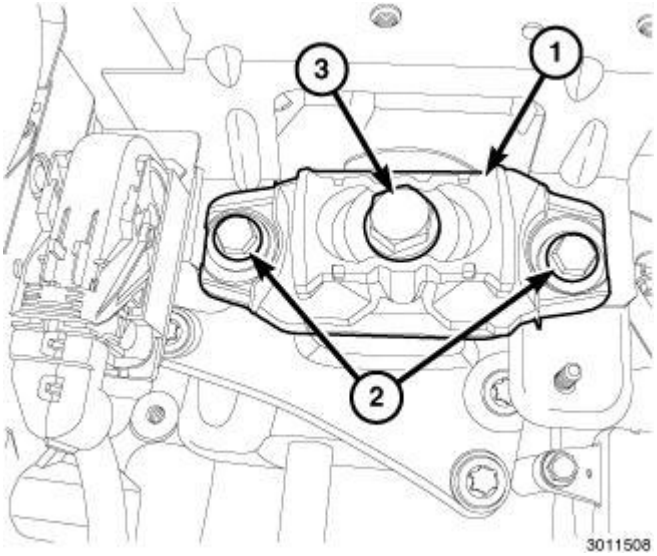


Fig. 408: LH Engine Mount Isolator & Bolts
Courtesy of CHRYSLER GROUP, LLC

NOTE: Automatic transmission equipped engine mount shown in illustration, manual transmission equipped engine mount similar.

14. Support the engine with a floor jack positioned under the transmission.
15. Remove three bolts (2 and 3) and the LH engine mount isolator (1).

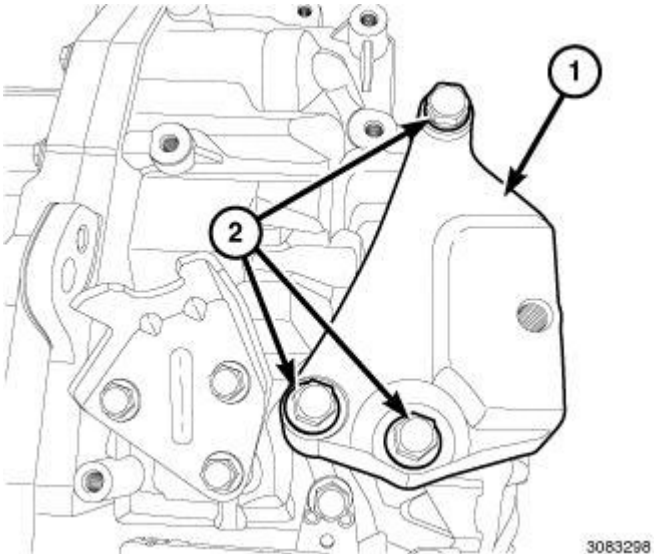


Fig. 409: Left Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

16. If required, remove the three bolts (2) and the left engine mount bracket (1) from the automatic transmission.

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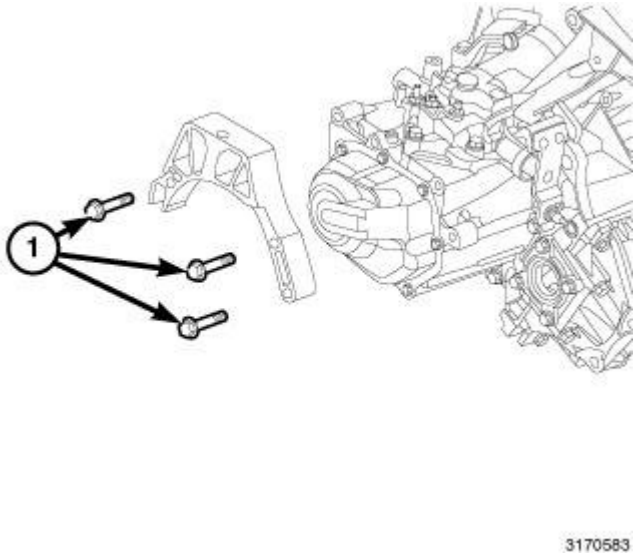


Fig. 410: Left Side Mount Bolts
Courtesy of CHRYSLER GROUP, LLC

17. If required, remove the three bolts (1) and the left engine mount bracket from the manual transmission.

INSTALLATION

INSTALLATION

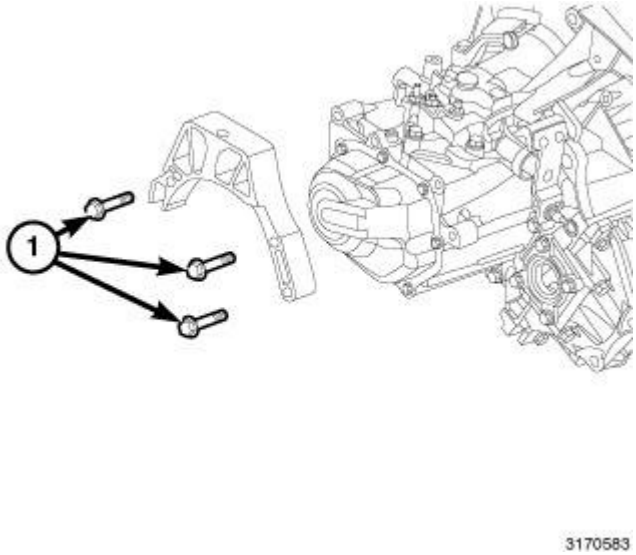


Fig. 411: Left Side Mount Bolts
Courtesy of CHRYSLER GROUP, LLC

1. If removed, install the left engine mount bracket to the manual transmission with three bolts (1) tightened to 50 N.m (37 ft. lbs.).

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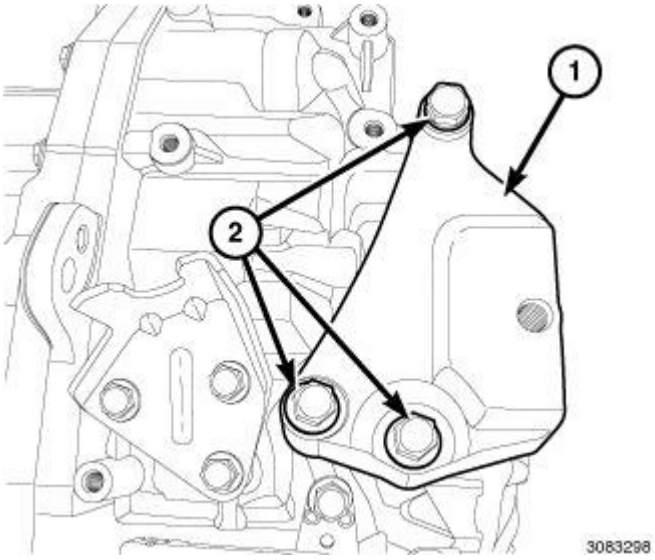


Fig. 412: Left Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

2. If removed, install the left engine mount bracket (1) to the automatic transmission with three bolts (2) tightened to 60 N.m (44 ft. lbs.).

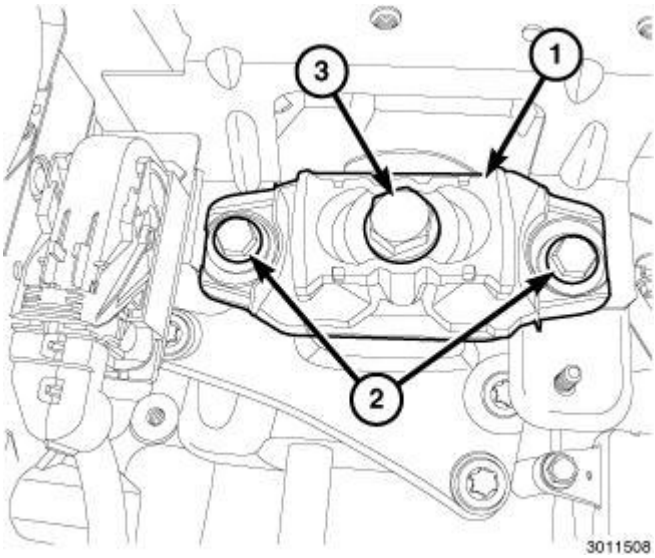


Fig. 413: LH Engine Mount Isolator & Bolts
Courtesy of CHRYSLER GROUP, LLC

NOTE: Automatic transmission equipped engine mount shown in illustration, manual transmission equipped engine mount similar.

3. Install the LH engine mount isolator (1) with three bolts (2 and 3). First tighten the isolator to engine bracket bolt (3) to 110 N.m (81 ft. lbs.) and then tighten the isolator to body bolts (2) to 50 N.m (37 ft. lbs.).

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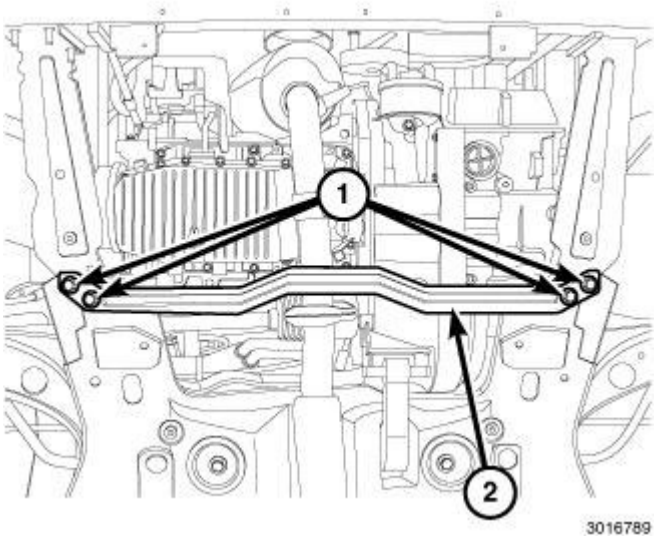


Fig. 414: Tunnel Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

4. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
5. Install the tunnel support brace (2) with four bolts (1) tightened to 90 N.m (60 ft. lb.).

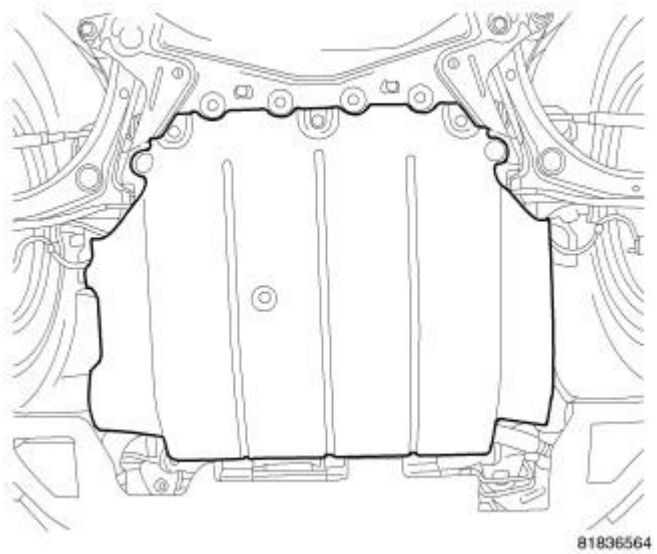


Fig. 415: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

6. Install the belly pan. Refer to **BELLY PAN, INSTALLATION** .

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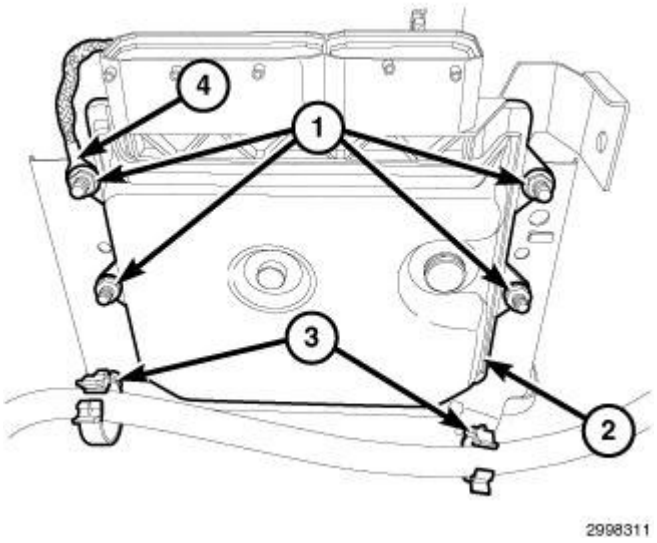


Fig. 416: PCM, Retainers, Ground Strap & Nuts
Courtesy of CHRYSLER GROUP, LLC

7. Position the battery tray and PCM in the vehicle. Route the wire harness and close the wire harness retainers (3).
8. Install the ground strap (4) with nut (1) tightened to 5 N.m (44 in. lbs.).

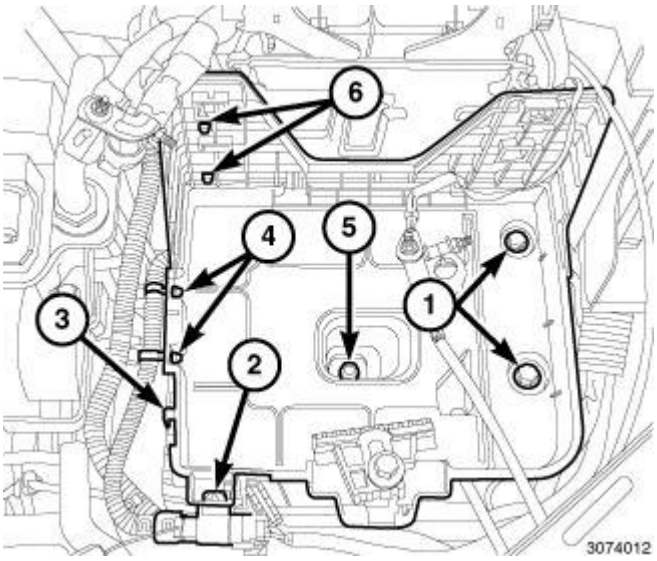


Fig. 417: Battery Tray, Connectors, Retainers, Nut & Bolts
Courtesy of CHRYSLER GROUP, LLC

9. Install the battery tray (3) with one nut (5) and two bolts (1) tightened to 25 N.m (18 ft. lbs.).
10. Engage the engine wire harness connector (2) to the battery tray (3).
11. Engage two engine wire harness retainers (4) to the battery tray (3).
12. Engage two starter wire harness retainers (6) to the battery tray (3).

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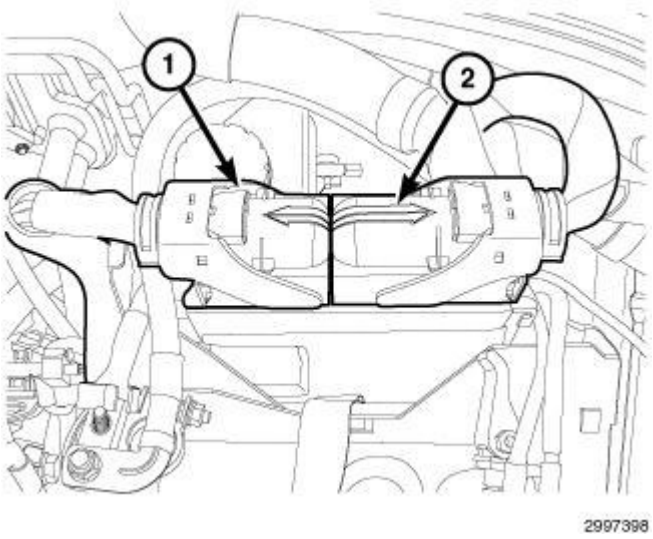


Fig. 418: PCM Electrical Connectors
Courtesy of CHRYSLER GROUP, LLC

13. Connect the Powertrain Control Module (PCM) harness connectors (1 and 2).

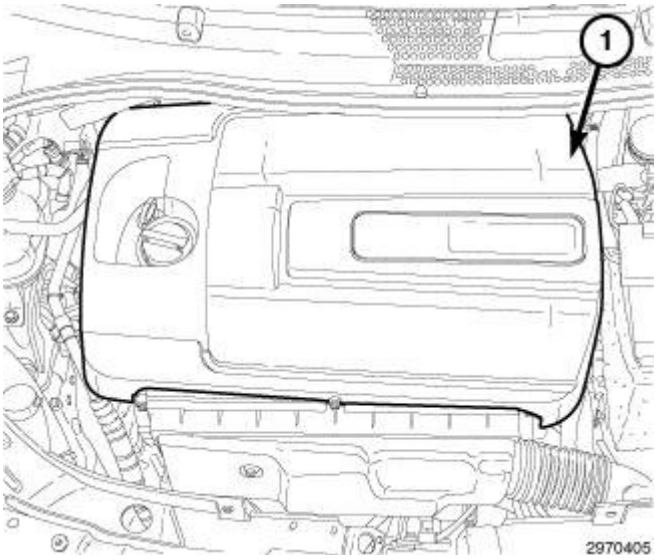


Fig. 419: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

14. Install and connect the battery. Refer to **BATTERY, INSTALLATION** .
15. Install the engine cover (1).

INSULATOR, ENGINE MOUNT, REAR

REMOVAL

MANUAL TRANSMISSION

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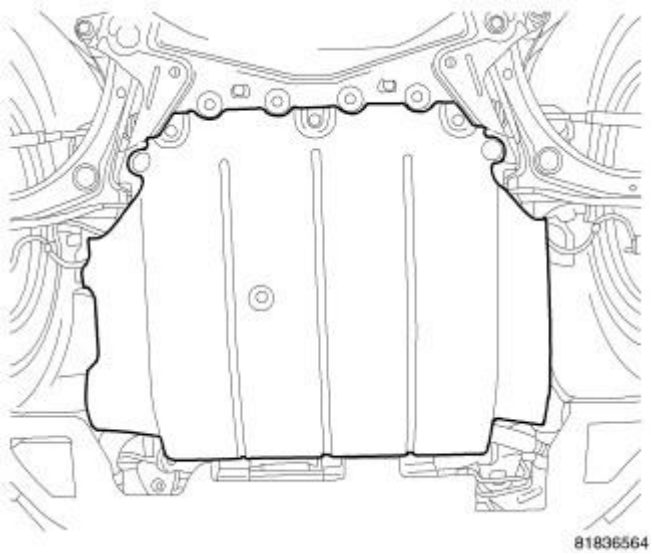


Fig. 420: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

1. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
2. Remove the belly pan. Refer to **BELLY PAN, REMOVAL** .

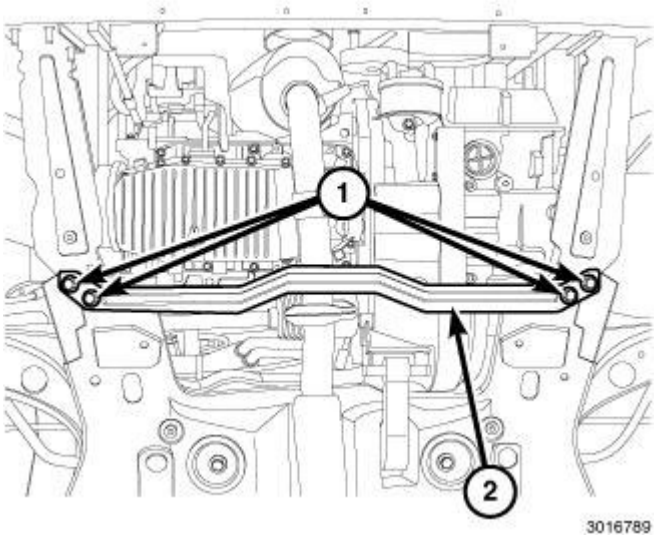


Fig. 421: Tunnel Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

3. Remove four bolts (1) and the tunnel support brace (2).

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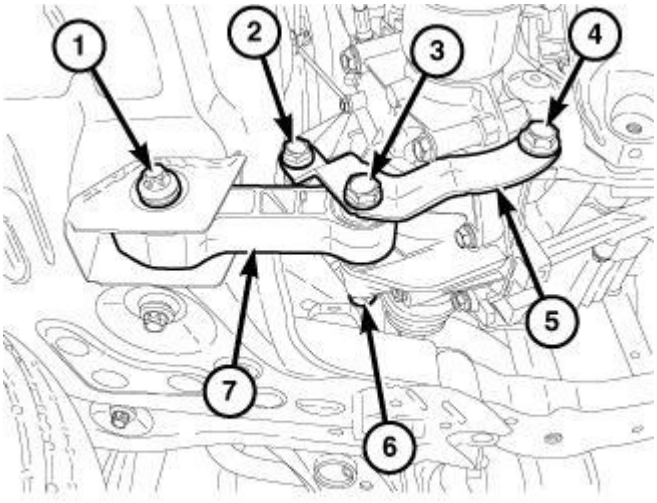


Fig. 422: Rear Engine Mount Bracket, Isolator & Fasteners
Courtesy of CHRYSLER GROUP, LLC

4. Remove the rear engine mount bracket bolt (3) and nut (6).
5. Remove the bolt (1) and remove the rear engine mount isolator (7).
6. If required, remove the two bolts (2 and 4) and the rear engine mount bracket (5).

INSTALLATION

AUTOMATIC TRANSMISSION

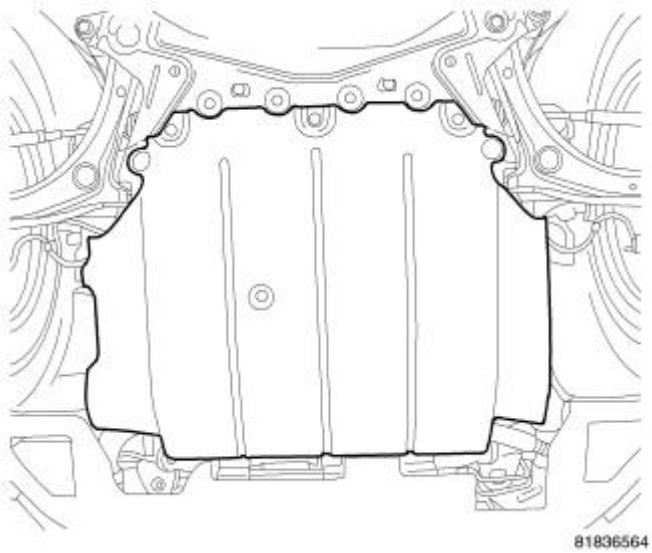


Fig. 423: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

1. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
2. Remove the belly pan. Refer to **BELLY PAN, REMOVAL** .

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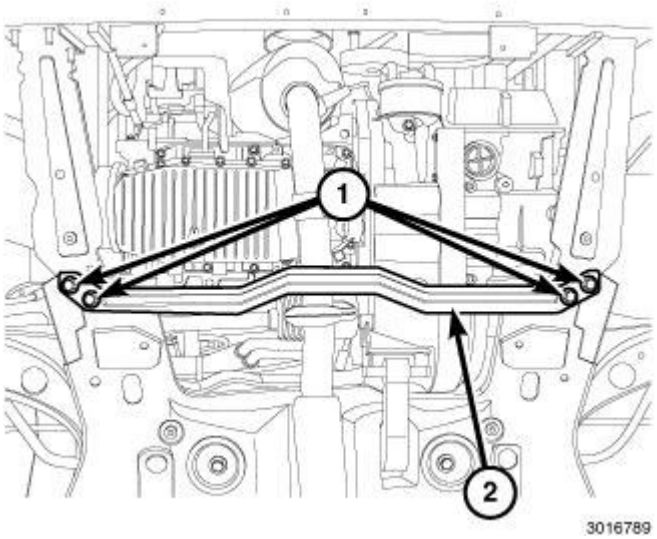


Fig. 424: Tunnel Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

3. Remove four bolts (1) and the tunnel support brace (2).

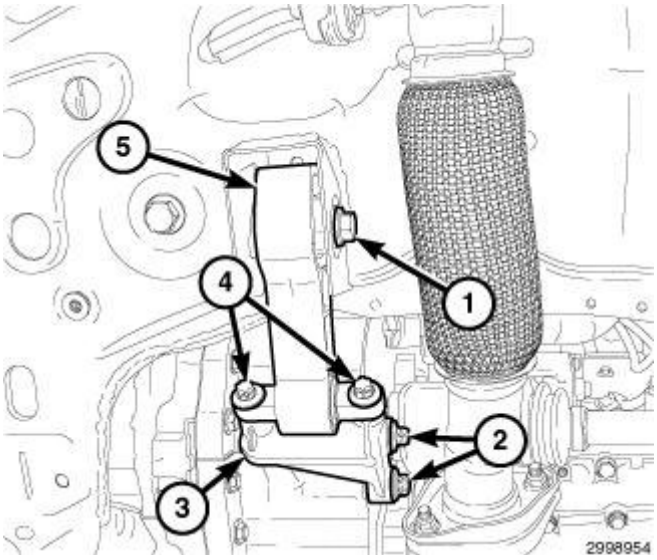


Fig. 425: Two Bolts Of Lower Transmission Mount
Courtesy of CHRYSLER GROUP, LLC

4. Remove two bolts (4) from the rear engine mount bracket (3).
5. Remove the bolt (1) and remove the rear engine mount isolator (5).
6. If required, remove the two bolts (2) and the rear engine mount bracket (3).

INSULATOR, ENGINE MOUNT, RIGHT

REMOVAL

REMOVAL

1. Remove the engine cover.
2. Remove the air cleaner assembly. Refer to **BODY, AIR CLEANER, REMOVAL**.
3. Drain the coolant from the coolant reservoir.

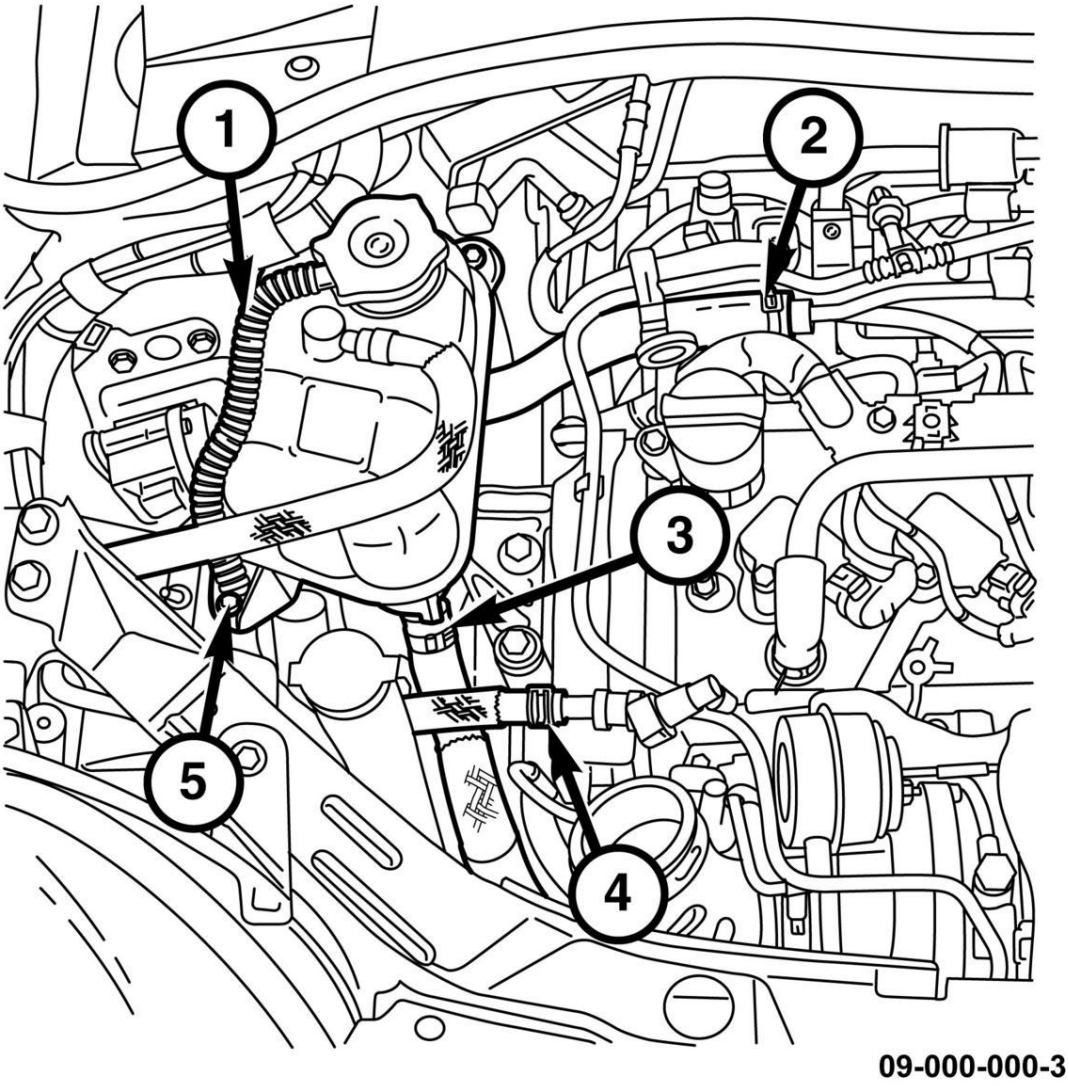


Fig. 426: Pressurized Coolant Bottle, Reservoir Hose & Coolant Reservoir Bolts
Courtesy of CHRYSLER GROUP, LLC

4. Disconnect the reservoir hose (3).
5. Remove the coolant reservoir bolts (5) and set the bottle aside.
6. Remove the wiring harness retainer from the top of the engine mount.
7. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
8. Remove the belly pan. Refer to **BELLY PAN, REMOVAL** .

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9. Lower the vehicle to a workable height.
10. Support the powertrain with a suitable jack. Lift the engine slightly to unload the isolator.

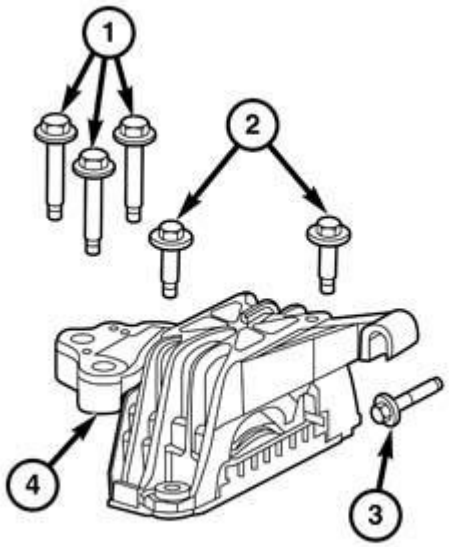


Fig. 427: Engine Mount & Bolts
Courtesy of CHRYSLER GROUP, LLC

11. Remove the three mount (4) to timing cover bolts (1).
12. Remove the two mount (4) to frame bolts (2).
13. Loosen, **but do not remove** the mount (4) to strut tower bolt (3).
14. Remove the engine mount (4).

INSTALLATION

INSTALLATION

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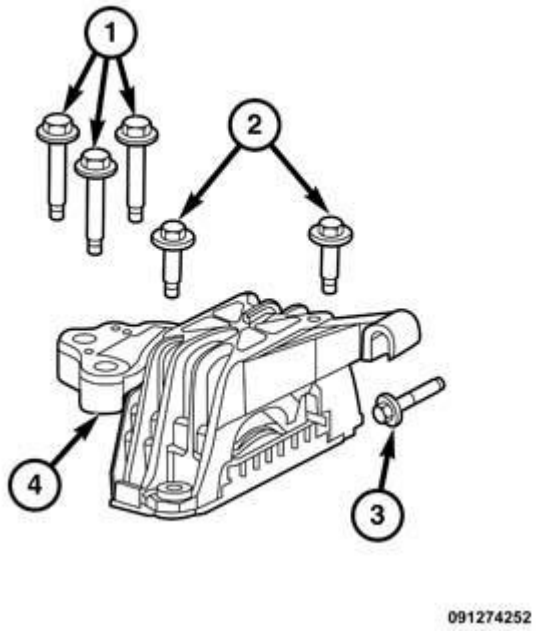


Fig. 428: Engine Mount & Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Set the mount (4) into position.
2. Tighten the right mount to strut tower bolt (3) finger tight.
3. Install engine mount to frame retaining bolts (2). Finger tighten the bolts.
4. Install the right mount to timing cover bolts (1). Finger tighten the bolts.
5. Tighten the right mount to strut tower bolt (3) to 50 N.m (37 ft. lbs.).
6. Tighten the right mount to frame rail bolts (2) to 63 N.m (46 ft. lbs.).
7. Tighten the right mount to timing cover bolts (1) to 63 N.m (46 ft. lbs.).
8. Insert the wire harness retainer into the mount.
9. Remove the floor jack supporting the engine.

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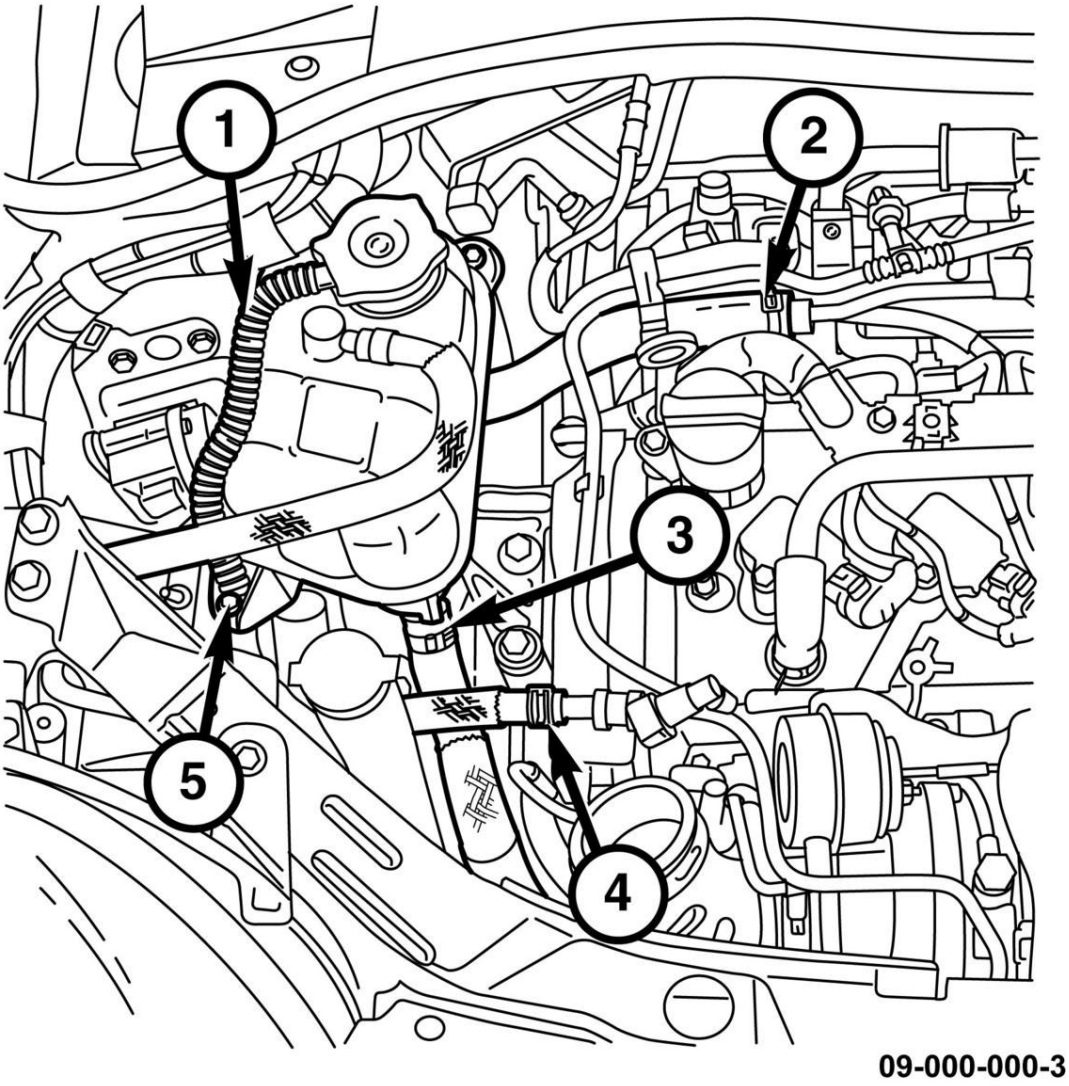


Fig. 429: Pressurized Coolant Bottle, Reservoir Hose & Coolant Reservoir Bolts
Courtesy of CHRYSLER GROUP, LLC

10. Install the pressurized coolant bottle (1). Tighten bolts (5) to 8 N.m (71 in. lbs.).
11. Connect the coolant hose (3) to the pressurized coolant bottle (1).
12. Install the belly pan. Refer to **BELLY PAN, INSTALLATION** .
13. Install the air cleaner body. Refer to **BODY, AIR CLEANER, INSTALLATION**.
14. Fill cooling system. Refer to **STANDARD PROCEDURE** .
15. Start and run the engine until it reaches normal operating temperature. Check cooling system for correct fluid level. Refer to **STANDARD PROCEDURE** .

LUBRICATION

DESCRIPTION

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DESCRIPTION

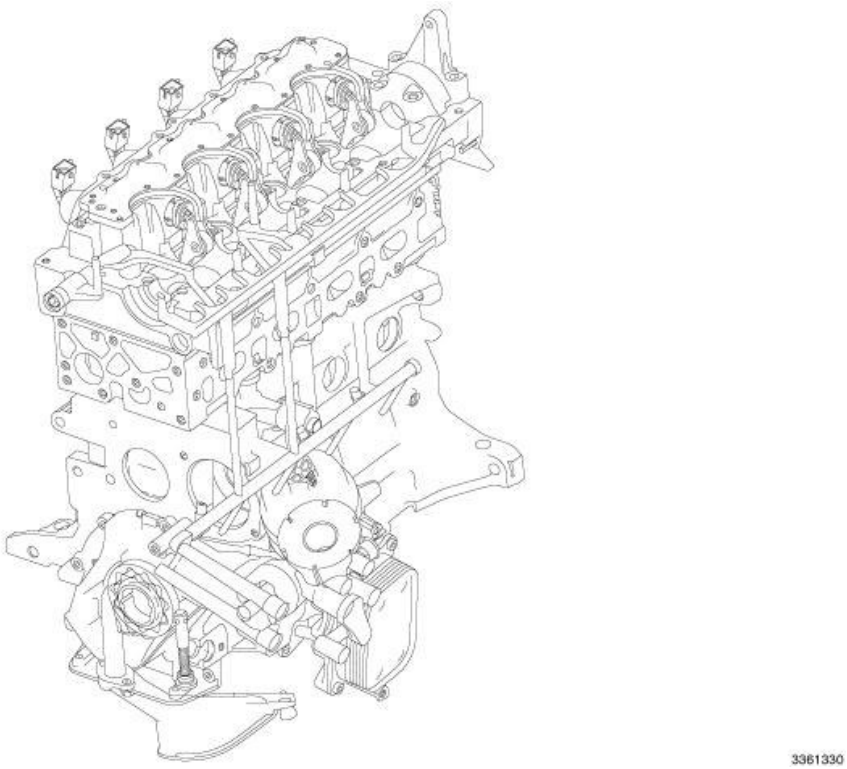


Fig. 430: Engine Lubrication System
Courtesy of CHRYSLER GROUP, LLC

The lubrication system features pressure regulated full flow filtration. The lubrication system consists of the following components:

- Oil pump pick-up tube attached to the oil pump
- Oil pump that is directly coupled to the crankshaft and is mounted to the front of the engine as part of the oil pump housing
- Pressure relief valve in the oil pump that controls system pressure
- Oil filter housing that supports the oil filter and oil cooler
- Oil cooler mounted to the oil filter housing
- Oil filter located in the oil filter housing
- Four piston oil cooler jets mounted to the engine block
- Filter screen mounted in the variable valve actuation assembly
- Variable valve actuation assembly that uses pressurized engine oil to open the intake valves
- Oil pressure switch located on the oil pump housing
- Oil temperature sensor located on the variable valve actuation assembly

OPERATION

OPERATION

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The oil from the oil pan is pumped by a gerotor type oil pump mounted to the front of the cylinder block that is part of the oil pump housing. The oil from the pump travels to the oil cooler assembly and then to the oil filter element. After the oil has been filtered and cooled, the oil enters the main oil gallery. The pressurized oil travels through the main gallery to the five main journals to lubricate the crankshaft main bearings and supply oil to four piston oil cooling jets. The pressurized oil travels through the crankshaft main journals to cross-drilling supplying oil to the connecting rod journals. From the cylinder block the oil flows into the cylinder head. Cylinder head oil is supplied to the camshaft journals and hydraulic lash adjusters. Oil also flows through a filter screen and into the variable valve actuation assembly to open the intake valves.

ENGINE LUBRICATION FLOW CHART

FROM	TO
Oil Pickup Tube	Oil Pump
Oil Pump	Oil Cooler
Oil Cooler	Oil Filter
Oil Filter	Block Main Oil Gallery
Block Main Oil Gallery	Crankshaft Main Journals Piston Cooling Jets Cylinder Head
Crankshaft Main Journals	Crankshaft Rod Journals
Cylinder Head	Hydraulic Lash Adjusters Camshaft Journals Filter screen
Filter screen	Variable valve actuation assembly

DIAGNOSIS AND TESTING

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 de-grease 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 the 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 the 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 the 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

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1. Disconnect the fresh air make-up hose from the oil filler neck. Cap or plug the make-up air hose nipple.
2. Remove the PCV hose from the PCV valve. Cap or plug the PCV valve nipple.
3. Attach an air hose with a 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 increase air pressure from 7 kPa (1 psi) to 17 kPa (2.5 psi) maximum while applying soapy water at the suspected leak source. Adjust the regulator to a suitable test pressure within this range that provides the best bubble generation 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 crankshaft oil seal area, follow the procedures for rear seal area leaks. Refer to **DIAGNOSIS AND TESTING** .
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 and make-up air hoses.
7. Clean the oil off of 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.

CHECKING ENGINE OIL PRESSURE

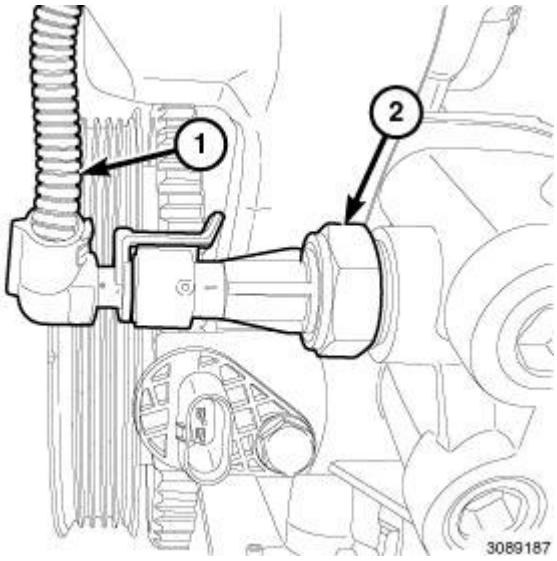


Fig. 431: Oil Pressure Switch & Connector
Courtesy of CHRYSLER GROUP, LLC

NOTE: The oil pressure switch has a lock patch on the threads and if removed can not be reinstalled.

1. Disconnect and isolate the negative battery cable.
2. Remove the oil pressure switch (2) from the oil pump. Refer to **SWITCH, OIL PRESSURE, REMOVAL**.

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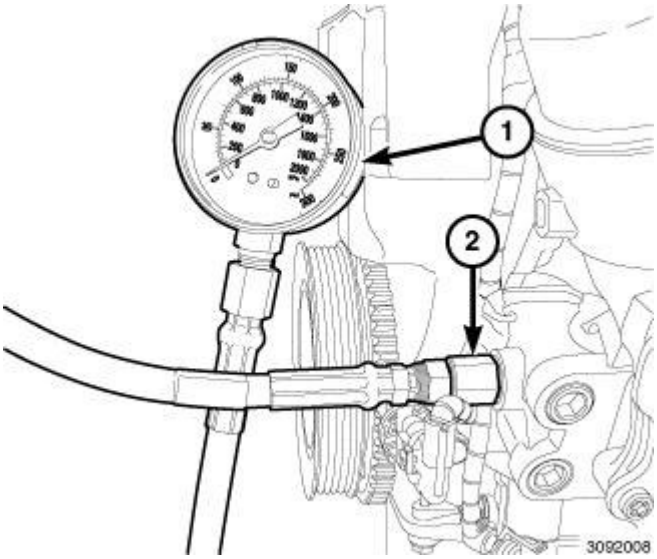


Fig. 432: Oil Pressure Gauge & Adapter
Courtesy of CHRYSLER GROUP, LLC

3. Install the Oil Pressure Gauge Adapter (special tool #10282, Adapter, Engine Oil Pressure) (2) to the oil pressure port. Tighten to 32 N.m (24 ft. lbs.).
4. Install the Oil Pressure Gauge (special tool #C-3292A, Gauge, Pressure) (1) to the adapter (2). Tighten to 20 N.m (177 in. lbs.).
5. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
6. Start and idle the engine. If oil pressure is 0 at idle, shut off the engine and consult the Engine Lubrication and Diagnostic Table. Refer to **ENGINE LUBRICATION DIAGNOSTIC TABLE** .
7. Run the engine until it reaches normal operating temperature.
8. Verify that the engine has acceptable oil pressure. Refer to **SPECIFICATIONS** .

COOLER, OIL

DESCRIPTION

DESCRIPTION

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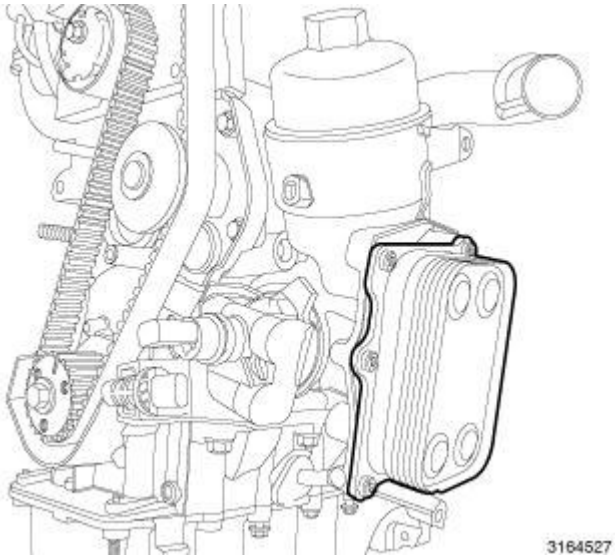


Fig. 433: Oil Cooler
Courtesy of CHRYSLER GROUP, LLC

The oil cooler is attached to the side of the oil filter housing which is located on the left side of the cylinder block. The oil cooler is a plate style coolant-to-oil heat exchanger.

OPERATION

OPERATION

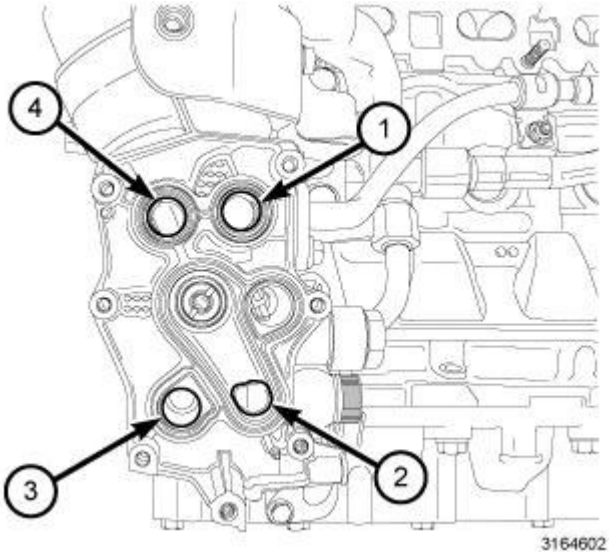


Fig. 434: Oil Cooler Coolant & Oil Passages
Courtesy of CHRYSLER GROUP, LLC

Oil flows from the oil pump, through the oil filter housing and into the oil cooler (2). After the oil is cooled it travels back to the oil filter housing (4) where it is filtered and returned to the oil pump housing and the main engine oil gallery.

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Engine coolant from the thermostat housing flows through the oil filter housing into the oil cooler (1). The coolant exits the oil cooler (3) and is returned to the water pump inlet.

REMOVAL

REMOVAL

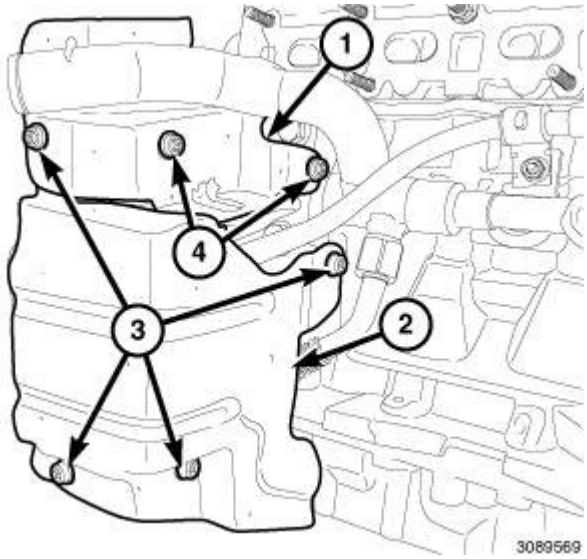


Fig. 435: Upper And Lower Oil Cooler Housing Heat Shields & Fasteners
Courtesy of CHRYSLER GROUP, LLC

NOTE: The oil cooler can not be cleaned out. In the event that the engine requires rebuilding or replacement, replace the oil cooler.

1. Disconnect and isolate the negative battery cable.
2. Drain the engine oil. Refer to **STANDARD PROCEDURE** .
3. Drain the cooling system. Refer to **STANDARD PROCEDURE** .
4. Remove four bolts (3) and the lower oil cooler housing heat shield (2).

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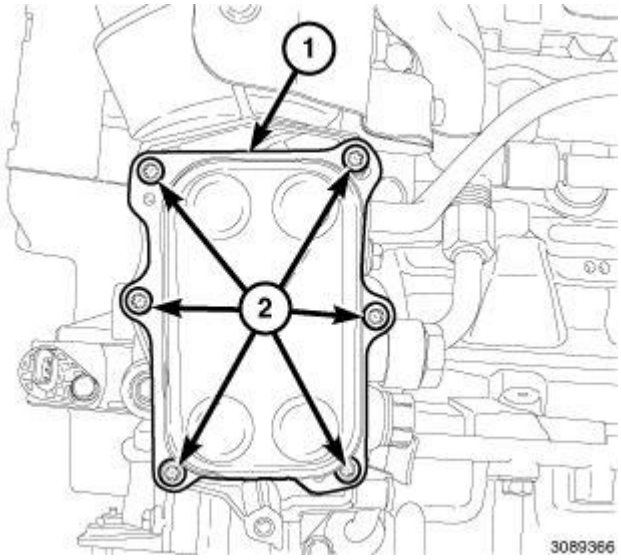


Fig. 436: Oil Cooler & Bolts
Courtesy of CHRYSLER GROUP, LLC

5. Remove six bolts (2).
6. Remove the oil cooler (1).

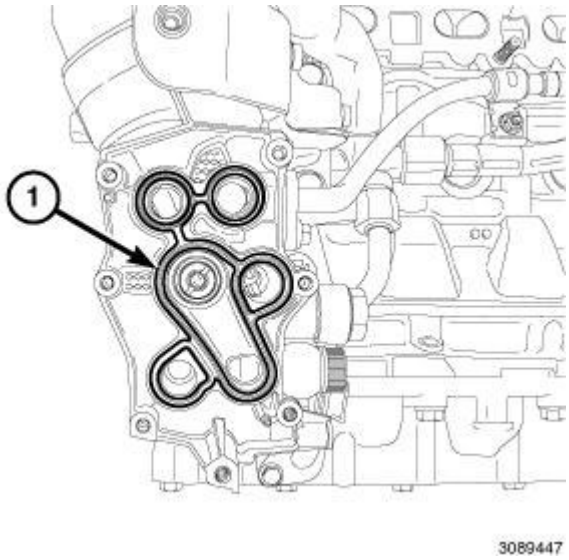


Fig. 437: Oil Cooler Seal
Courtesy of CHRYSLER GROUP, LLC

7. Remove and discard the oil cooler seal (1).

INSTALLATION

INSTALLATION

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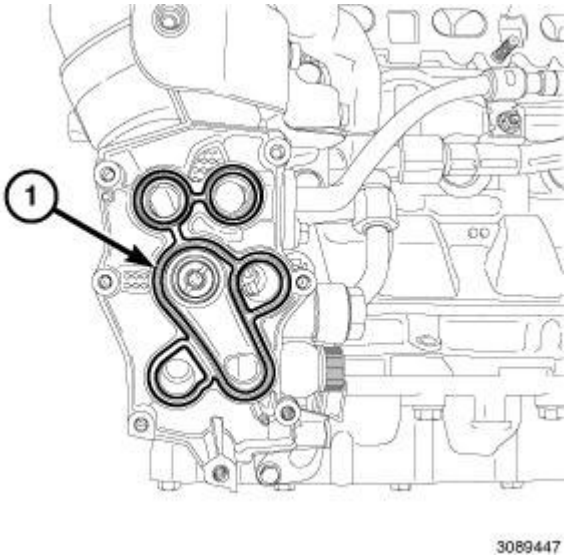


Fig. 438: Oil Cooler Seal
Courtesy of CHRYSLER GROUP, LLC

1. Install the new oil cooler seal (1) onto the oil filter housing.

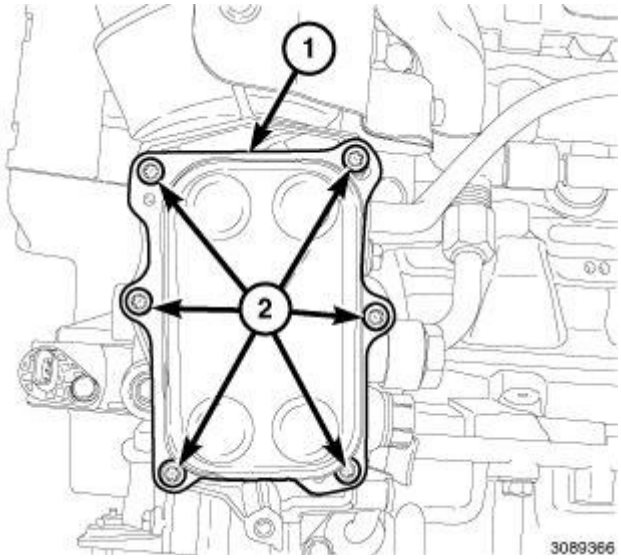


Fig. 439: Oil Cooler & Bolts
Courtesy of CHRYSLER GROUP, LLC

2. Position the oil cooler (1) on the oil filter housing.
3. Install six bolts (2) and tighten to 9 N.m (80 in. lbs.).

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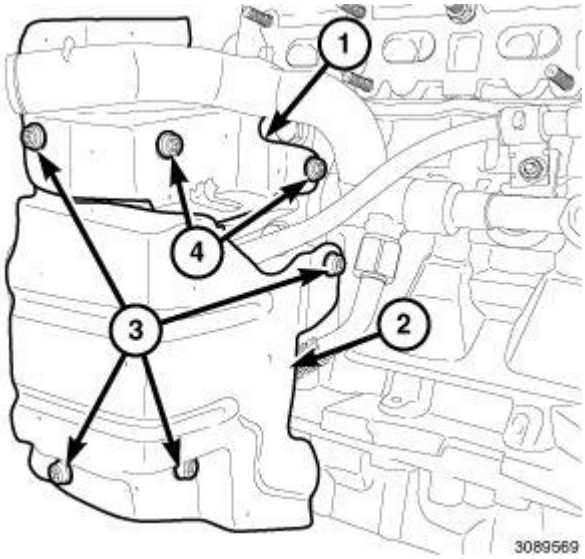


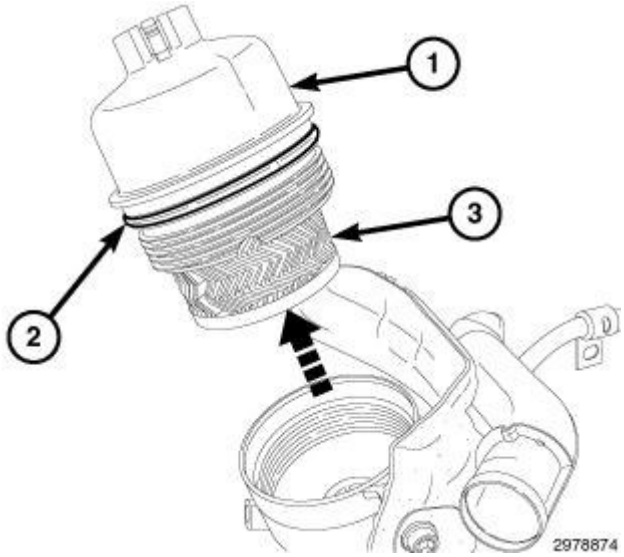
Fig. 440: Upper And Lower Oil Cooler Housing Heat Shields & Fasteners
Courtesy of CHRYSLER GROUP, LLC

4. Install the lower oil cooler housing heatshield (2) with four bolts (3) tightened to 3 N.m (26 in. lbs.).
5. Fill the engine crankcase with the proper oil to the correct level. Refer to **STANDARD PROCEDURE** .
6. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
7. Fill the cooling system. Refer to **STANDARD PROCEDURE** .
8. Operate the engine until it reaches normal operating temperature. Check cooling system for correct fluid level. Refer to **STANDARD PROCEDURE** .

FILTER, ENGINE OIL

REMOVAL

REMOVAL



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Fig. 441: Oil Filter Cap, O-Ring Seal & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

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

CAUTION: When performing an engine oil change, the oil filter cap must be removed. Removing the oil filter cap releases oil held within the oil filter cavity and allows it to drain into the sump. Failure to remove the cap prior to reinstallation of the drain plug will not allow complete draining of the used engine oil.

1. Place an oil absorbent cloth around the oil filter housing at the base of the oil filter cap.

NOTE: The oil filter (3) is attached to the oil filter cap (2).

2. Rotate the oil filter cap (1) counterclockwise and remove the cap (1) and filter (3) from the oil filter housing.

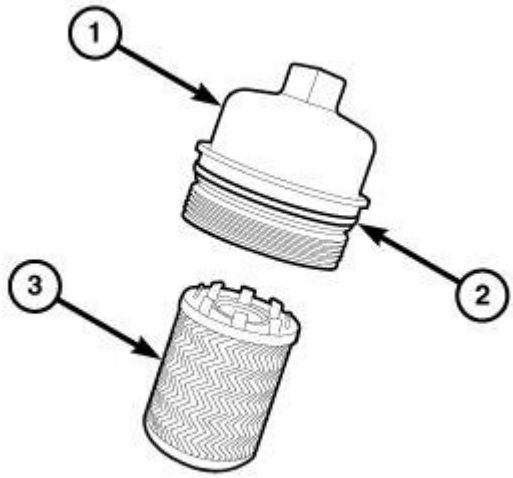


Fig. 442: Oil Filter Cap, O-Ring Seal & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

3. Remove the oil filter (3) from the oil filter cap (1).
4. Remove and discard the O-ring seal (2).

INSTALLATION

INSTALLATION

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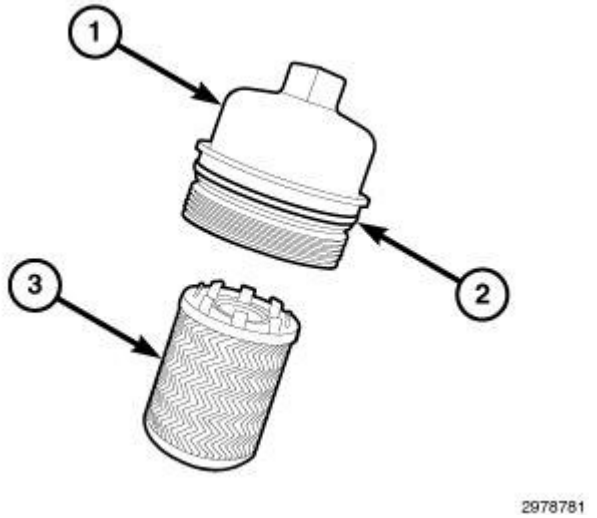


Fig. 443: Oil Filter Cap, O-Ring Seal & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

NOTE: It is not necessary to pre-oil the oil filter or fill the oil filter housing.

1. Lightly lubricate the new O-ring seal (2) with clean engine oil.
2. Install the O-ring seal (2) on the filter cap (1).
3. Install the new oil filter (3) into the oil filter cap (1).

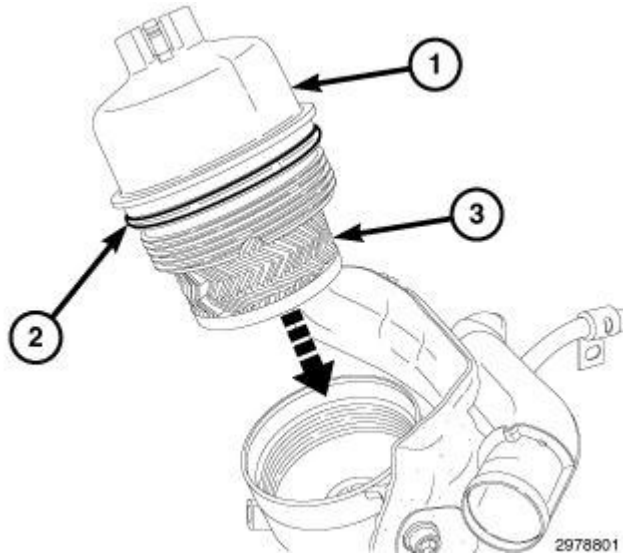


Fig. 444: Oil Filter Cap, O-Ring Seal & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

4. Thread the oil filter cap (1) into the oil filter housing and tighten to 25 N.m (18 ft. lbs.).
5. Add oil, verify crankcase oil level and start engine. Inspect for oil leaks. Refer to **STANDARD PROCEDURE** .

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JET, PISTON OIL COOLER

DESCRIPTION

DESCRIPTION

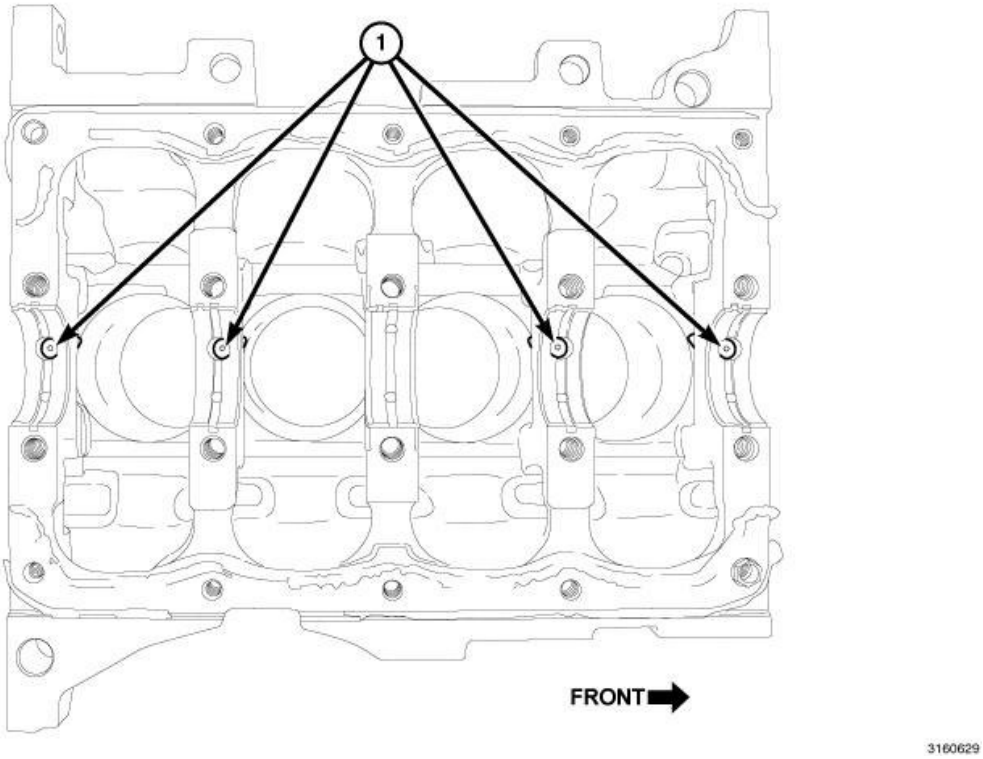


Fig. 445: Piston Oil Cooler Jets
Courtesy of CHRYSLER GROUP, LLC

The 1.4L engine has four engine blocked-mounted oil jets (1) installed to cool the underside of each piston. The oil jets are fed by the main oil gallery, and spray upward on the bottom of the pistons and cylinder walls. Each jet has a check valve which closes to maintain ample oil pressure at idle. All four oil jets are identical and are a press fit to the engine block.

REMOVAL

REMOVAL

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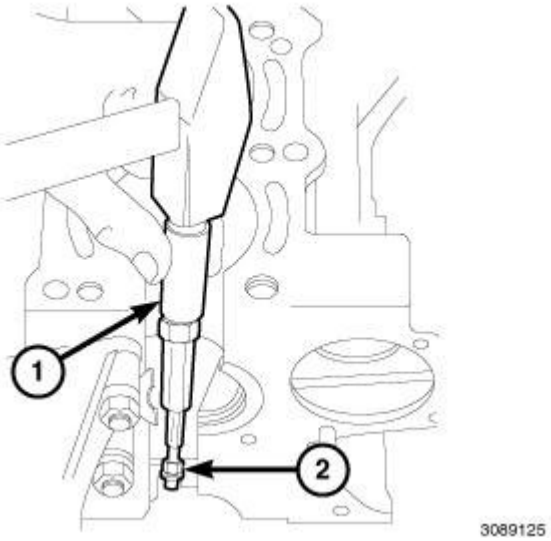


Fig. 446: Driving Out Piston Oil Cooler Jet
Courtesy of CHRYSLER GROUP, LLC

NOTE: Piston oil cooler jet for cylinder one shown in illustration. Piston oil cooler jets for cylinders two, three and four are similar.

1. Remove the piston and connecting rod(s). Refer to **ROD, PISTON AND CONNECTING, REMOVAL**.
2. Remove the crankshaft. Refer to **CRANKSHAFT, REMOVAL**.
3. Using a suitable drift (1), drive the piston oil cooler jet(s) (2) from the engine block.
4. Discard the piston oil cooler jet(s), they are not reusable.

INSTALLATION

INSTALLATION

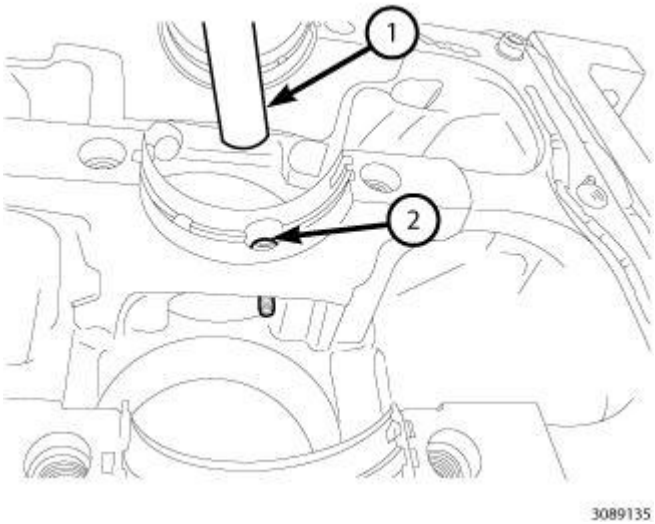


Fig. 447: Driving In Piston Oil Cooler Jet

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Courtesy of CHRYSLER GROUP, LLC

NOTE: Piston oil cooler jet for cylinder three shown in illustration. Piston oil cooler jets for cylinders one, two and four are similar.

1. Using a suitable driver (1), install the piston oil cooler jet(s) (2) into the engine block.
2. Install the crankshaft. Refer to **CRANKSHAFT, INSTALLATION**.
3. Install the piston and connecting rod(s). Refer to **ROD, PISTON AND CONNECTING, INSTALLATION**.
4. If removed, install the oil filter and fill the engine crankcase with the proper oil to the correct level. Refer to **STANDARD PROCEDURE** .
5. Fill the cooling system. Refer to **STANDARD PROCEDURE** .
6. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
7. Run the engine until it reaches normal operating temperature. Check cooling system for correct fluid level. Refer to **STANDARD PROCEDURE** .

FILTER, MULTIAIR ACTUATOR OIL SUPPLY

REMOVAL

REMOVAL

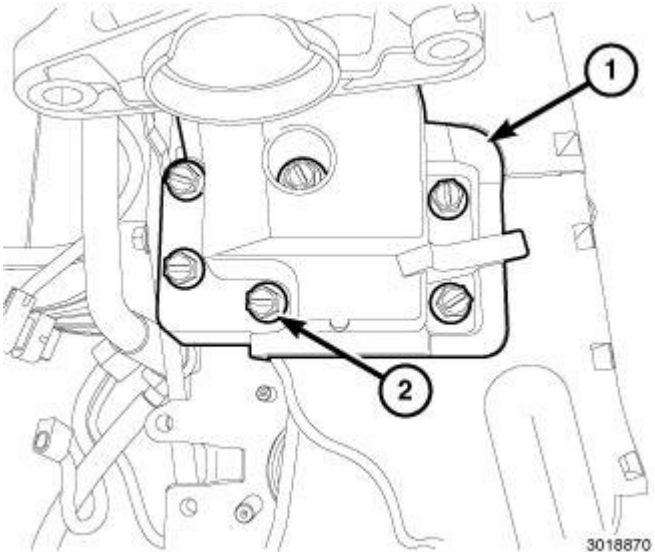


Fig. 448: RH Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Remove the RH engine mount bracket (1). Refer to **BRACKET, ENGINE MOUNT, RIGHT, REMOVAL**.

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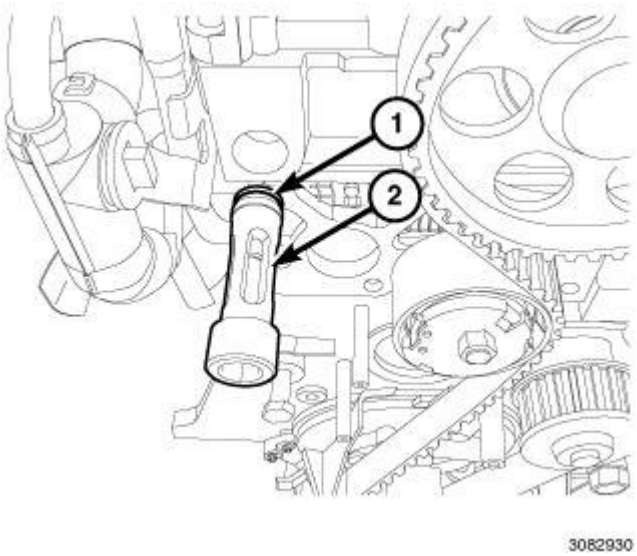


Fig. 449: MultiAir Actuator Oil Supply Filter & O-Ring
Courtesy of CHRYSLER GROUP, LLC

2. Remove the Multiair actuator oil supply filter (2) from the camshaft bearing housing.

INSTALLATION

INSTALLATION

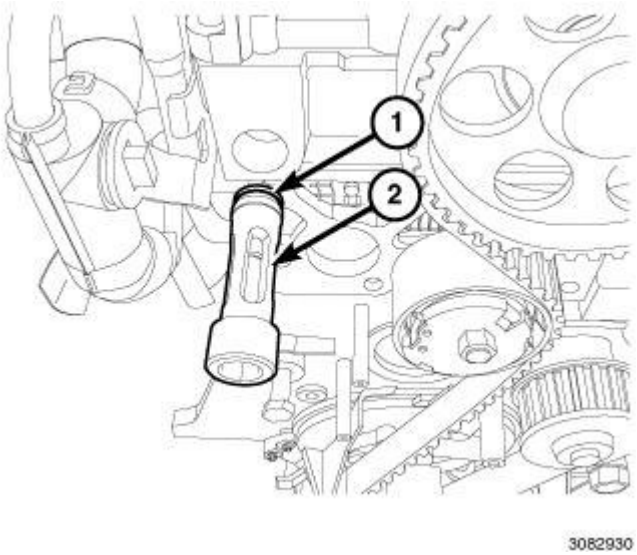


Fig. 450: MultiAir Actuator Oil Supply Filter & O-Ring
Courtesy of CHRYSLER GROUP, LLC

1. Install a new O-ring (1) lubricated with engine oil on the Multiair actuator oil supply filter (2). Install the filter into the camshaft bearing housing and tighten to 27 N.m (20 ft. lbs.).

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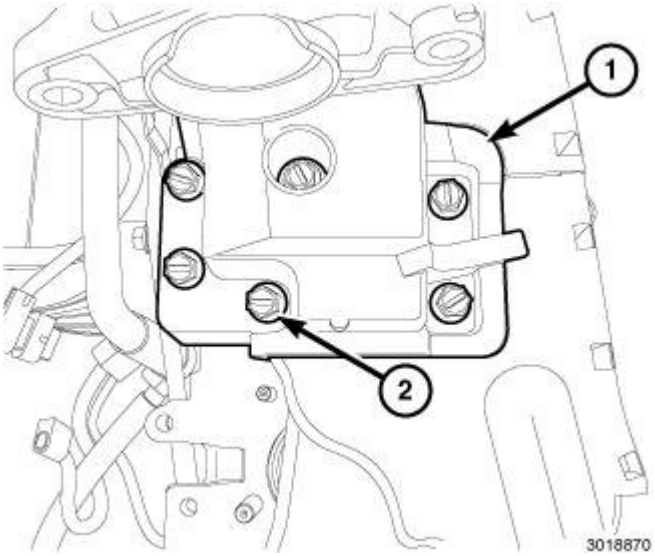


Fig. 451: RH Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

2. Install the RH engine mount bracket (1). Refer to **BRACKET, ENGINE MOUNT, RIGHT, INSTALLATION**.
3. If removed, install the oil filter and fill the engine crankcase with the proper oil to the correct level. Refer to **STANDARD PROCEDURE** .

HOUSING, OIL FILTER

DESCRIPTION

DESCRIPTION

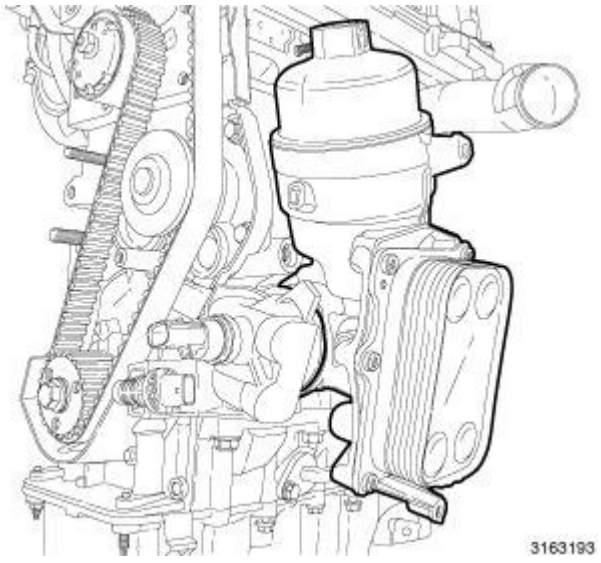


Fig. 452: Oil Filter Housing
Courtesy of CHRYSLER GROUP, LLC

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The oil filter housing is located on the left side of the cylinder block and is connected to the oil pump. The oil filter element is located within the housing and the engine oil cooler is attached to the side of the housing.

OPERATION

OPERATION

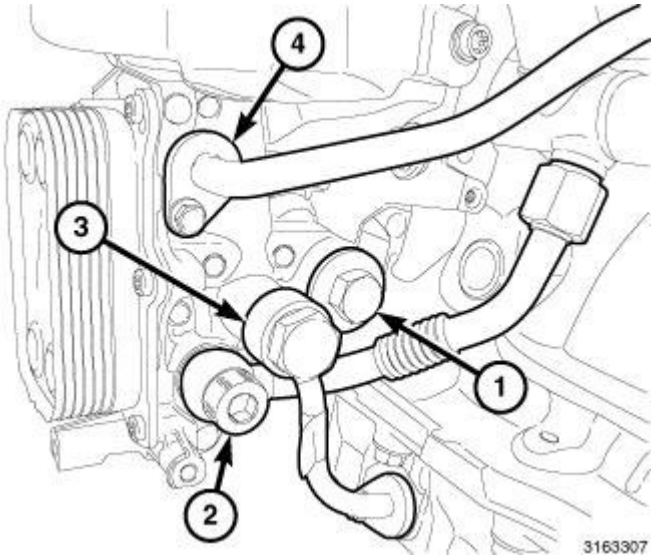


Fig. 453: Oil Filter Housing Coolant & Oil Lines
Courtesy of CHRYSLER GROUP, LLC

Oil flows from the oil pump housing through the oil pump/oil filter housing interface (1) and into the oil filter housing. Within the oil filter housing the oil first travels through the oil cooler and then through the oil filter. After the oil is filtered and cooled it travels back to the oil pump housing through the oil pump/oil filter housing interface (1) and to the main engine oil gallery. Removing the oil filter cap from the housing allows oil to drain from the oil filter cavity into to the crankcase (3).

Engine coolant flows from the thermostat housing into the oil filter housing (4) and into the oil cooler. The coolant flows through the oil cooler and exits the housing (2) where it is returned to the water pump inlet.

REMOVAL

REMOVAL

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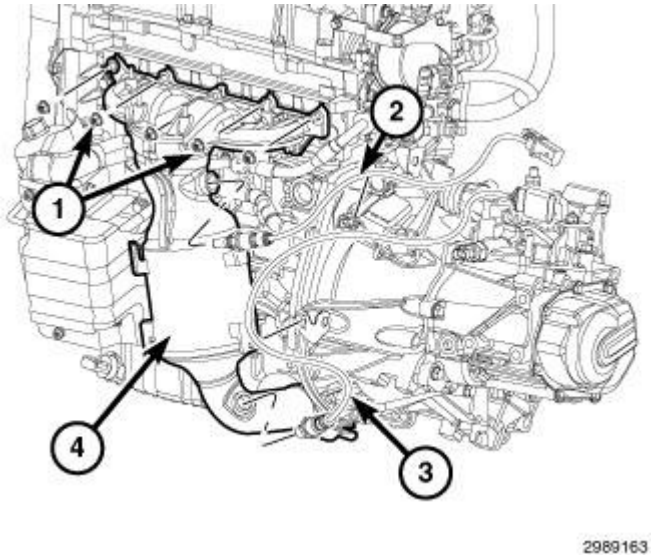


Fig. 454: Upstream And Downstream Oxygen Sensors, Maniverter & Fasteners
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect and isolate the negative battery cable.
2. Drain the engine oil. Refer to **STANDARD PROCEDURE** .
3. Remove the maniverter (4). Refer to **MANIFOLD, EXHAUST, REMOVAL**.

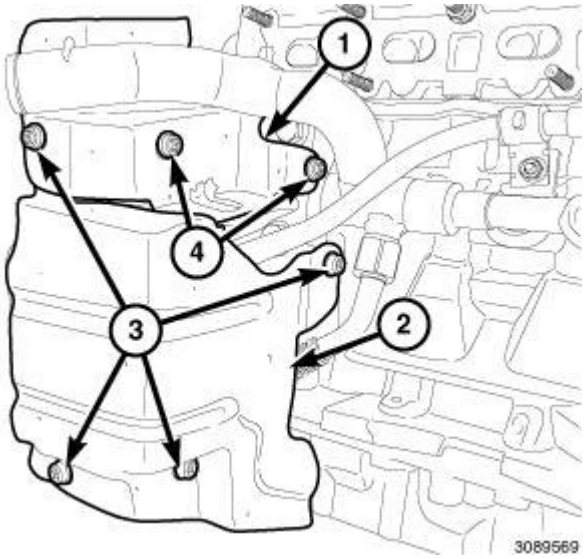


Fig. 455: Upper And Lower Oil Cooler Housing Heat Shields & Fasteners
Courtesy of CHRYSLER GROUP, LLC

4. Remove six bolts (3 and 4) and the upper (1) and lower (2) oil cooler housing heat shields.

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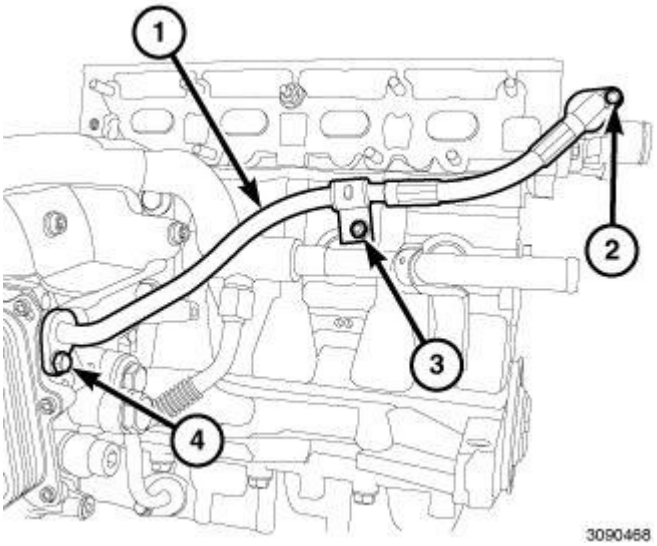


Fig. 456: Oil Filter Housing Coolant Supply Tube & Fasteners
Courtesy of CHRYSLER GROUP, LLC

5. Remove the nut (3) from the support bracket on the water pump coolant inlet tube.
6. Remove the two bolts (2 and 4) and remove the oil filter housing coolant supply tube (1).

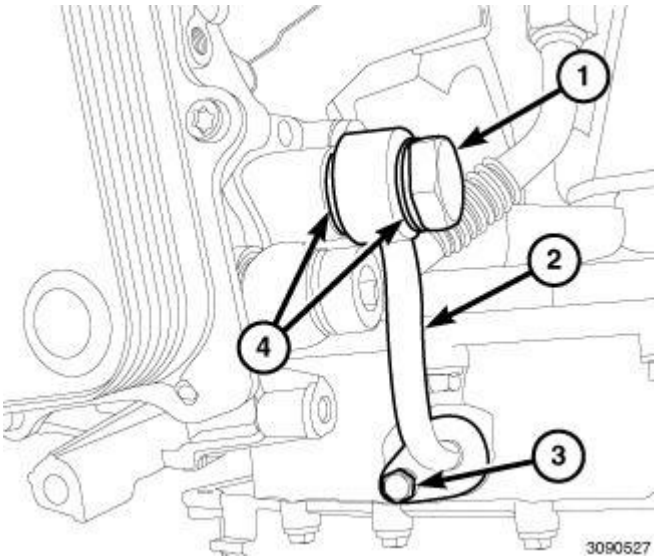


Fig. 457: Oil Filter Housing Oil Return Tube, Gaskets & Bolts
Courtesy of CHRYSLER GROUP, LLC

7. Remove the two bolts (1 and 3) and the oil filter housing oil return tube (2).

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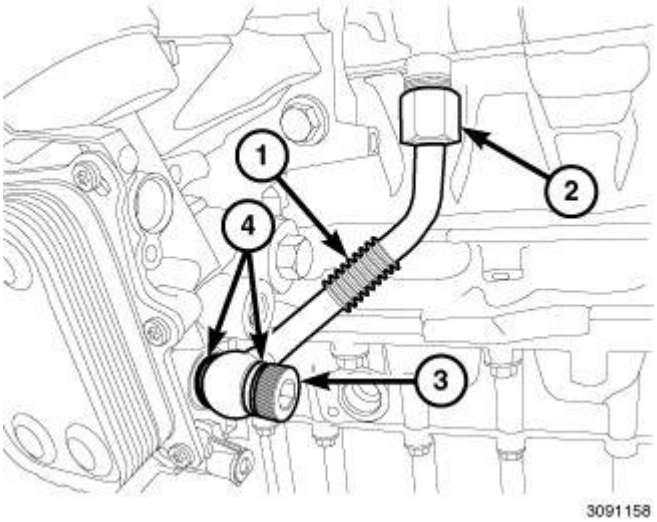


Fig. 458: Oil Filter Housing Coolant Return Tube, Fasteners & Gaskets
Courtesy of CHRYSLER GROUP, LLC

8. Loosen the nut (2), remove the bolt (3) and remove the oil filter housing coolant return tube (1).

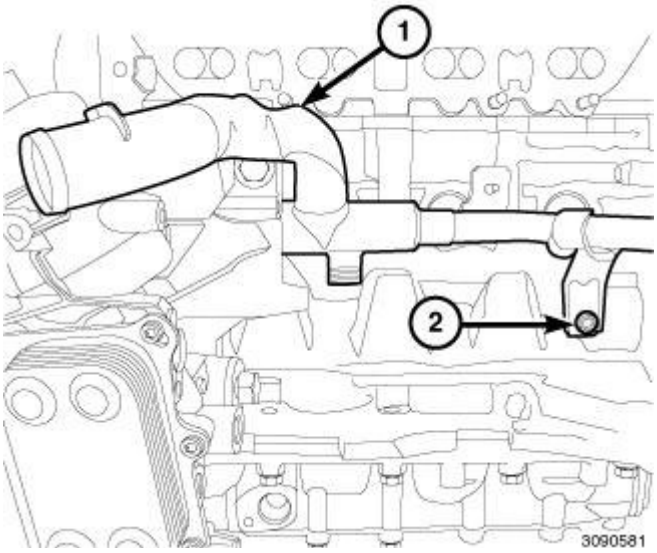


Fig. 459: Water Pump Coolant Inlet Tube & Bolt
Courtesy of CHRYSLER GROUP, LLC

9. Remove bolt (2) and the water pump coolant inlet tube (1).

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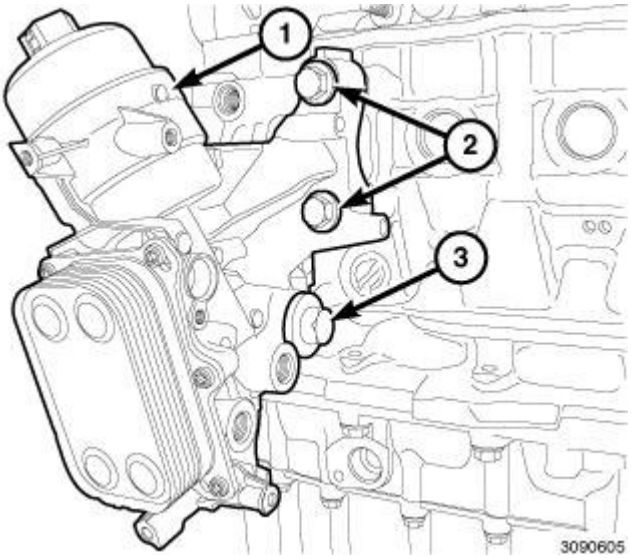


Fig. 460: Oil Filter Housing & Bolts
Courtesy of CHRYSLER GROUP, LLC

10. Remove the three bolts (2 and 3) and the oil filter housing (1).

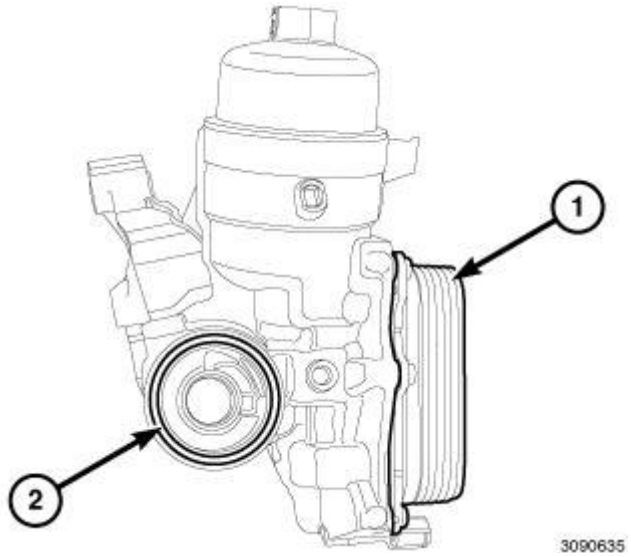


Fig. 461: Oil Cooler & Oil Filter Housing Seal
Courtesy of CHRYSLER GROUP, LLC

11. Remove and discard the oil filter housing seal (2).
12. If required, remove the oil cooler (1) from the oil filter housing. Refer to **COOLER, OIL, REMOVAL**.

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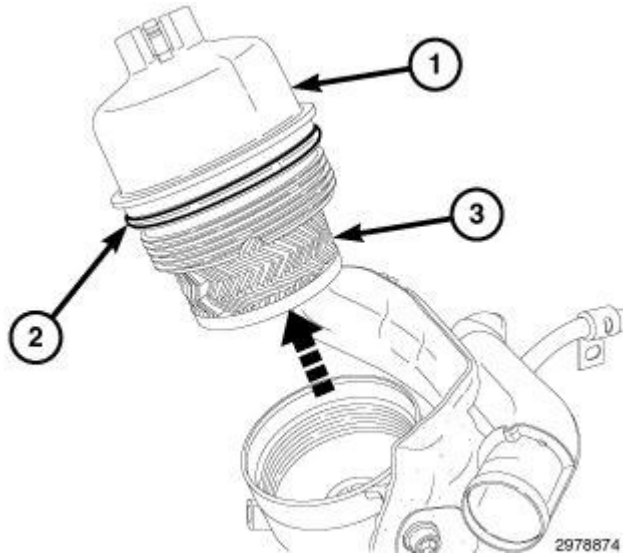


Fig. 462: Oil Filter Cap, O-Ring Seal & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

13. If required, remove the oil filter (3) from the oil filter housing. Refer to **FILTER, ENGINE OIL, REMOVAL**.

INSTALLATION

INSTALLATION

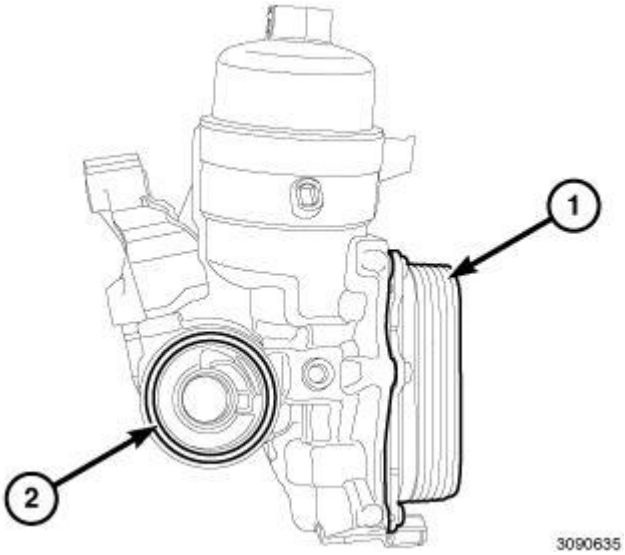


Fig. 463: Oil Cooler & Oil Filter Housing Seal
Courtesy of CHRYSLER GROUP, LLC

1. If removed, install the oil cooler (1) onto the oil filter housing. Refer to **COOLER, OIL, INSTALLATION**.
2. Install a new oil filter housing seal (2) onto the oil filter housing.

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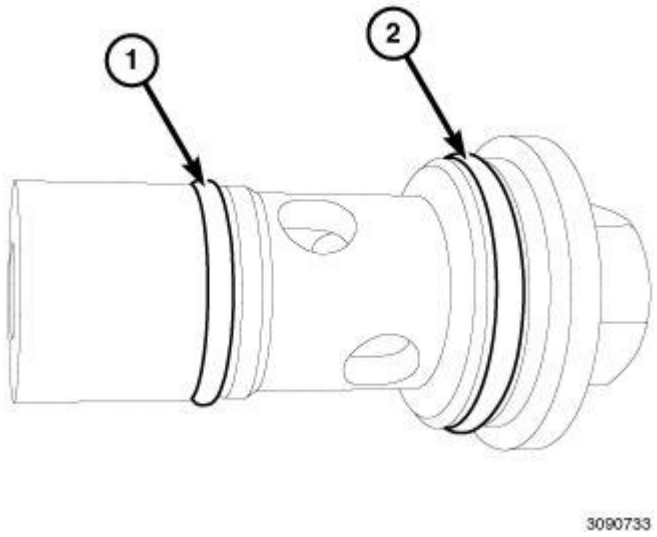


Fig. 464: O-Ring Seals
Courtesy of CHRYSLER GROUP, LLC

3. Install new O-ring seals (1 and 2) on the oil filter housing to oil pump bolt.

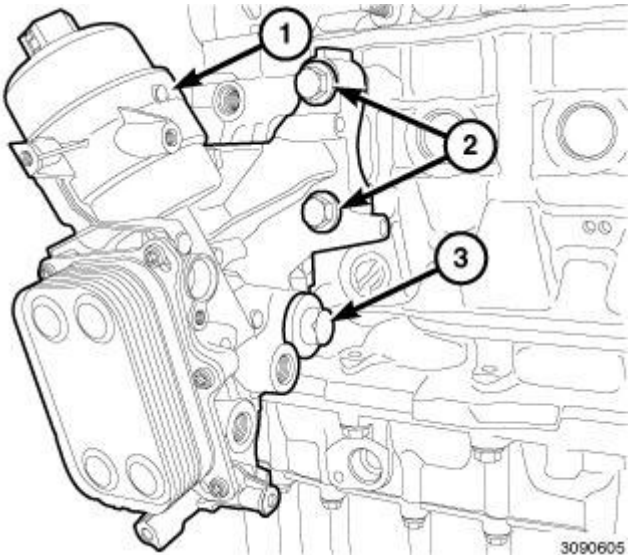


Fig. 465: Oil Filter Housing & Bolts
Courtesy of CHRYSLER GROUP, LLC

4. Position the oil filter housing (1) on the engine block.
5. Install the oil filter housing to oil pump bolt (3) and the two oil filter housing to engine block bolts (2). Tighten the oil filter housing to oil pump bolt (3) first to 45 N.m (33 ft. lbs.) then tighten the two oil filter housing to engine block bolts (2) to 50 N.m (37 ft. lbs.).

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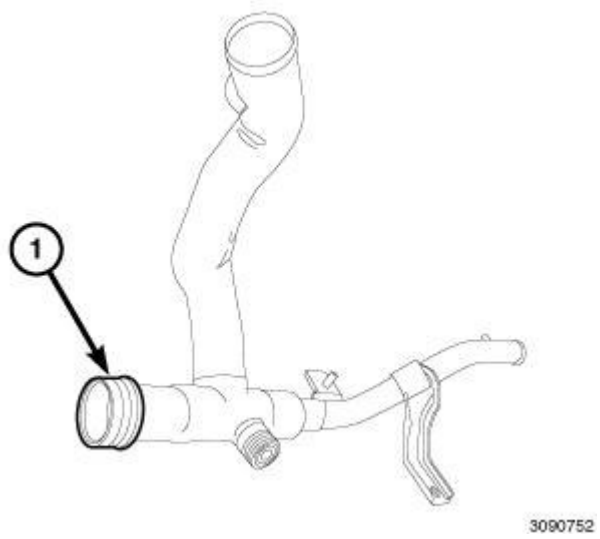


Fig. 466: Water Pump Inlet Tube Seal
Courtesy of CHRYSLER GROUP, LLC

6. Install a new seal (1) on the water pump inlet tube.

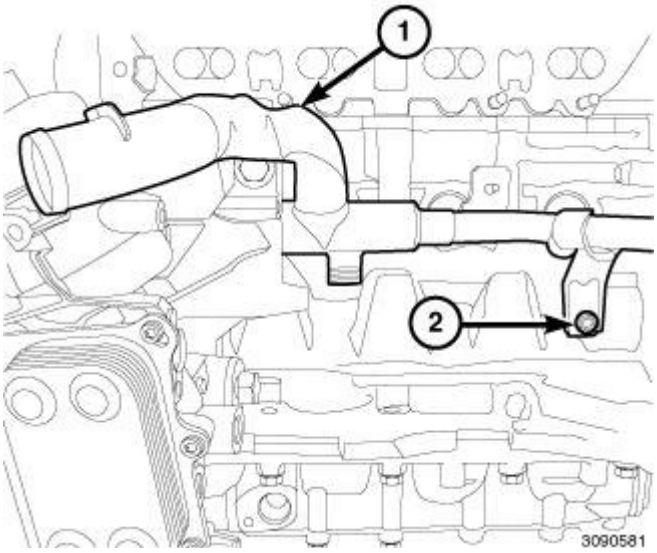


Fig. 467: Water Pump Coolant Inlet Tube & Bolt
Courtesy of CHRYSLER GROUP, LLC

7. Install the water pump inlet tube (1) to the engine block. Tighten the bolt (2) to 9 N.m (80 in. lbs.).

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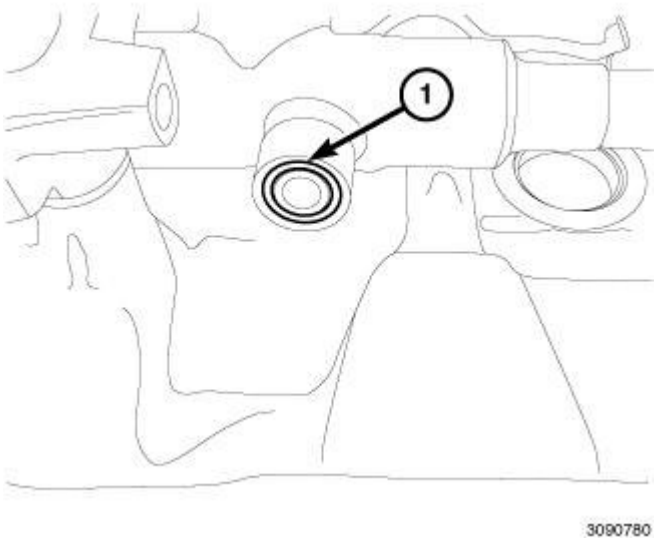


Fig. 468: Water Pump Inlet Tube O-Ring Seal
Courtesy of CHRYSLER GROUP, LLC

8. Install the oil filter housing coolant return tube O-ring seal (1) in the water pump inlet tube.

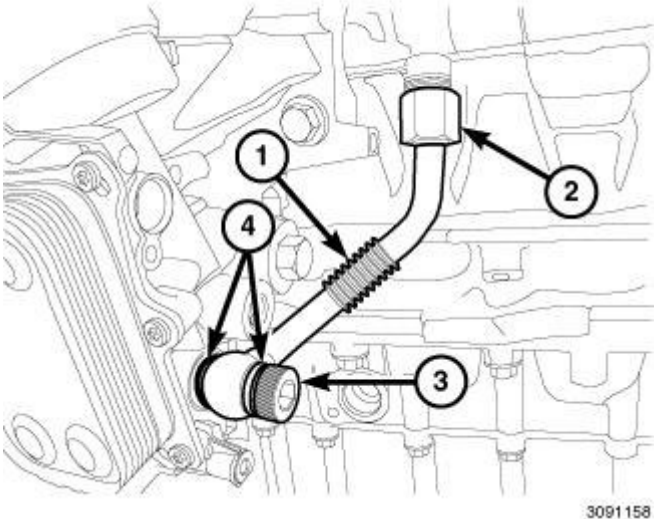


Fig. 469: Oil Filter Housing Coolant Return Tube, Fasteners & Gaskets
Courtesy of CHRYSLER GROUP, LLC

9. Install the oil filter housing coolant return tube (1) between the water pump coolant inlet tube and oil filter housing with two gaskets (4). Tighten the nut (2) to 33 N.m (24 ft. lbs.) and tighten the bolt (3) to 33 N.m (24 ft. lbs.).

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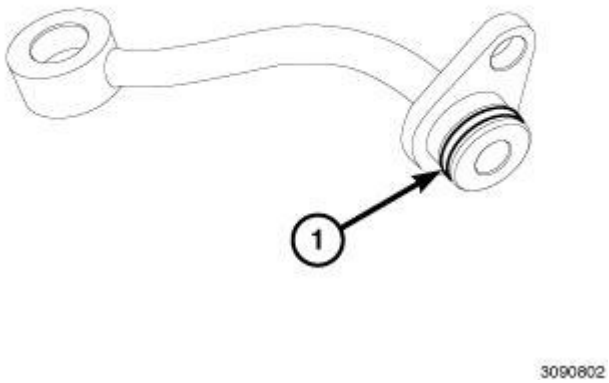


Fig. 470: Oil Return Tube O-Ring Seal
Courtesy of CHRYSLER GROUP, LLC

10. Install a new oil filter housing oil return tube O-ring seal (1).

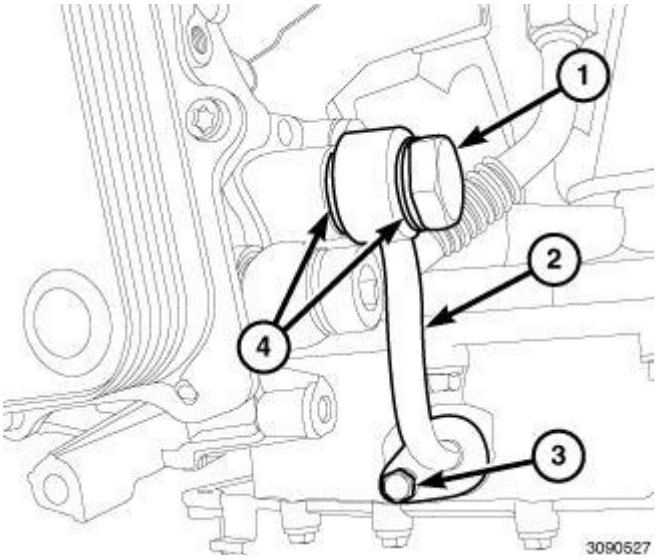


Fig. 471: Oil Filter Housing Oil Return Tube, Gaskets & Bolts
Courtesy of CHRYSLER GROUP, LLC

11. Install the oil filter housing oil return tube (2) between the bedplate and oil filter housing with two gaskets (4). Tighten the bolt (3) to 9 N.m (80 in. lbs.) and tighten the bolt (1) to 33 N.m (24 ft. lbs.).

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Fig. 472: Oil Filter Housing Coolant Supply Tube O-Ring Seals
Courtesy of CHRYSLER GROUP, LLC

12. Install the oil filter housing coolant supply tube O-ring seals (1 and 2).

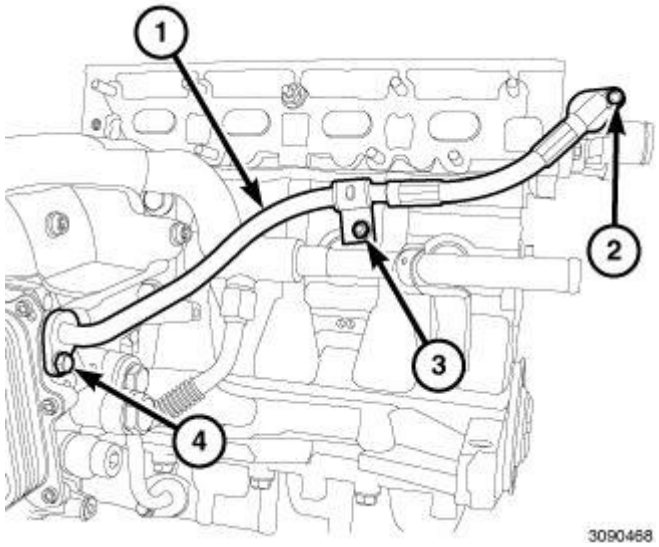


Fig. 473: Oil Filter Housing Coolant Supply Tube & Fasteners
Courtesy of CHRYSLER GROUP, LLC

13. Install the oil filter housing coolant supply tube (1) between the thermostat housing and the oil filter housing with a bolt at each end (2 and 4) tightened to 9 N.m (80 in. lbs.). Secure the support bracket to the water pump coolant inlet tube with a nut (3) tightened to 9 N.m (80 in. lbs.).

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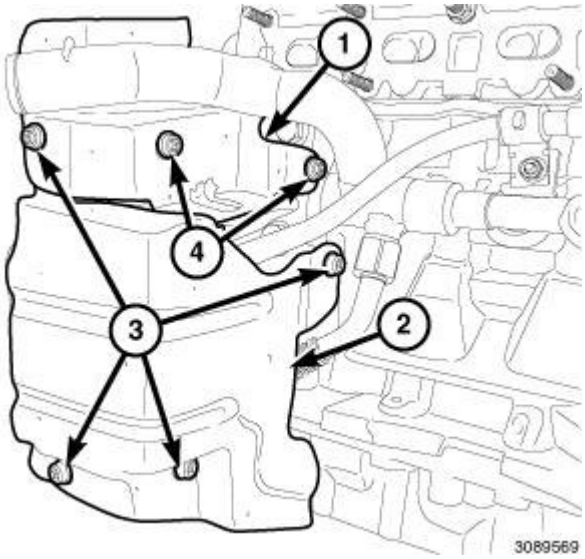


Fig. 474: Upper And Lower Oil Cooler Housing Heat Shields & Fasteners
Courtesy of CHRYSLER GROUP, LLC

14. Install the upper (1) and lower (2) oil cooler housing heat shields with six bolts (3 and 4) tightened to 3 N.m (26 in. lbs.).

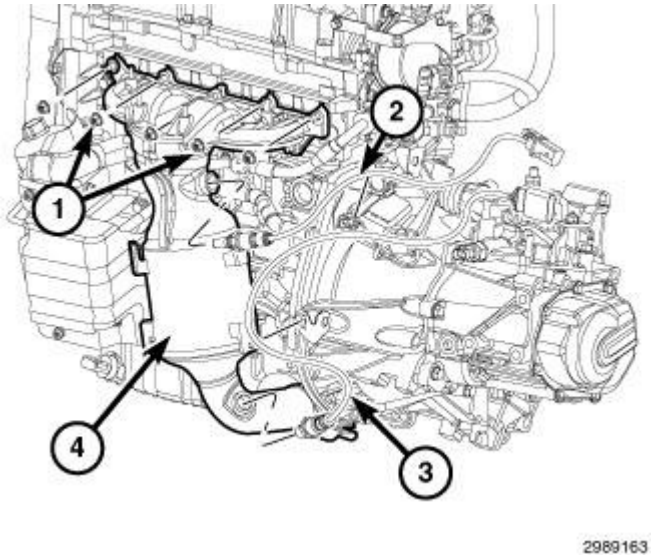


Fig. 475: Upstream And Downstream Oxygen Sensors, Maniverter & Fasteners
Courtesy of CHRYSLER GROUP, LLC

15. Install the maniverter. Refer to **MANIFOLD, EXHAUST, INSTALLATION**.
16. If removed, install the oil filter and fill the engine crankcase with the proper oil to the correct level. Refer to **STANDARD PROCEDURE** .
17. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
18. Fill the cooling system. Refer to **STANDARD PROCEDURE** .
19. Start and run the engine until it reaches normal operating temperature. Check cooling system for correct

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fluid level. Refer to **STANDARD PROCEDURE** .

OIL

STANDARD PROCEDURE

STANDARD PROCEDURE - 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 the engine oil and filter at mileage and time intervals described in the Maintenance Schedule. Refer to **MAINTENANCE SCHEDULES, DESCRIPTION** .

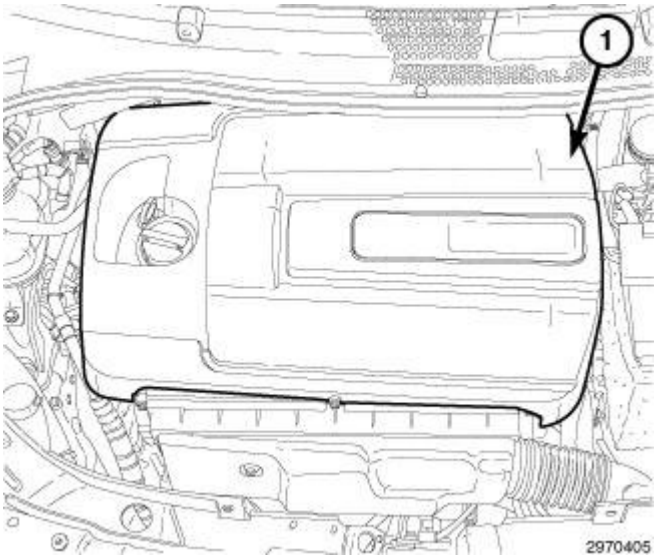


Fig. 476: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

1. Run the engine until achieving normal operating temperature.
2. Position the vehicle on a level surface and turn the engine off.
3. Remove the engine cover (1).

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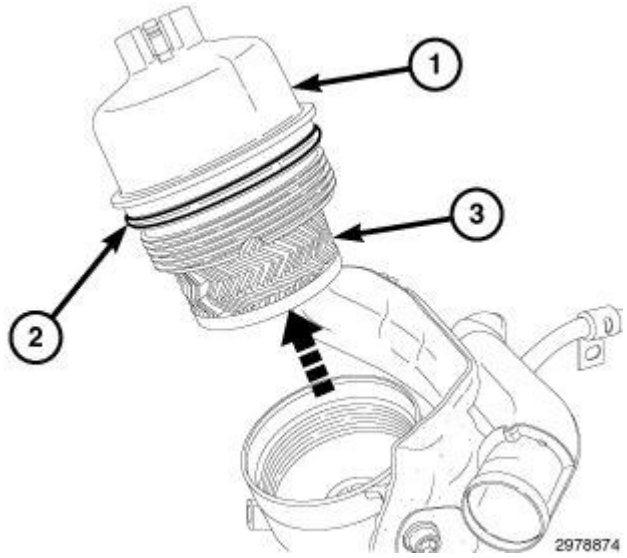


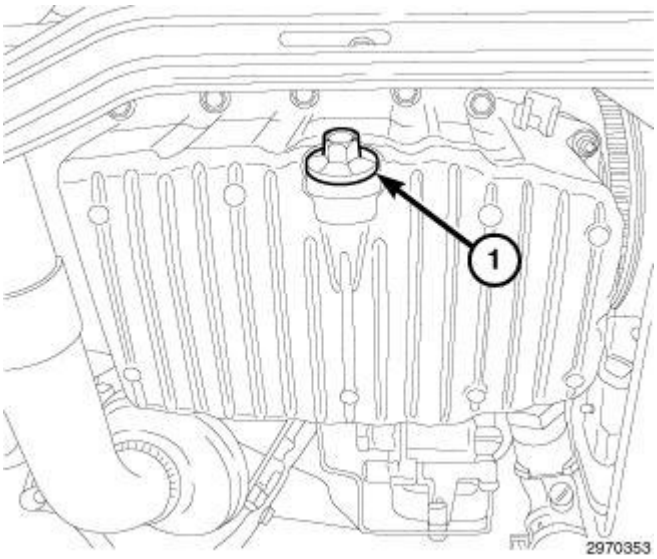
Fig. 477: Oil Filter Cap, O-Ring Seal & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When performing an engine oil change, the oil filter cap must be removed. Removing the oil filter cap releases oil held within the oil filter cavity and allows it to drain into the sump. Failure to remove the cap prior to reinstallation of the drain plug will not allow complete draining of the used engine oil.

4. Place an oil absorbent cloth around the oil filter housing at the base of the oil filter cap.

NOTE: The oil filter (3) is attached to the oil filter cap (1).

5. Rotate the oil filter cap (1) counterclockwise and remove the cap (1) and filter (3) from the oil filter housing.



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Fig. 478: Drain Plug
Courtesy of CHRYSLER GROUP, LLC

6. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
7. Place a suitable drain pan under the crankcase drain plug (1).
8. Remove the drain plug (1) from oil pan and allow the oil to drain into the pan. Inspect the drain plug threads for stretching or other damage. Replace the drain plug and gasket if damaged.
9. Install the drain plug (1) in the oil pan and tighten to 27 N.m (20 ft. lbs.).

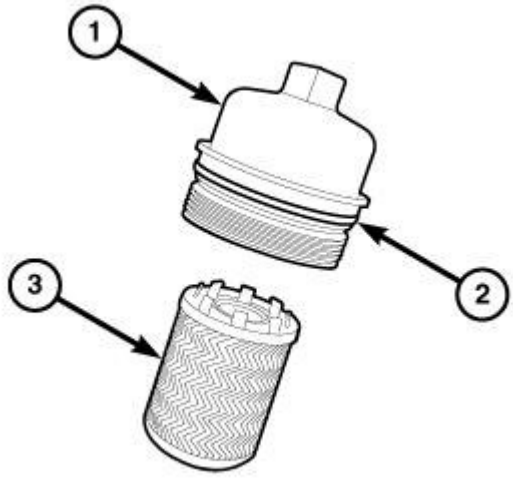


Fig. 479: Oil Filter Cap, O-Ring Seal & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

10. Lower the vehicle.
11. Remove the oil filter (3) from the oil filter cap (1).
12. Remove and discard the O-ring seal (2).

NOTE: It is not necessary to pre-oil the oil filter or fill the oil filter housing.

13. Lightly lubricate the new O-ring seal (2) with clean engine oil.
14. Install the O-ring seal (2) on the filter cap (1).
15. Install the new oil filter (3) into the oil filter cap (1).

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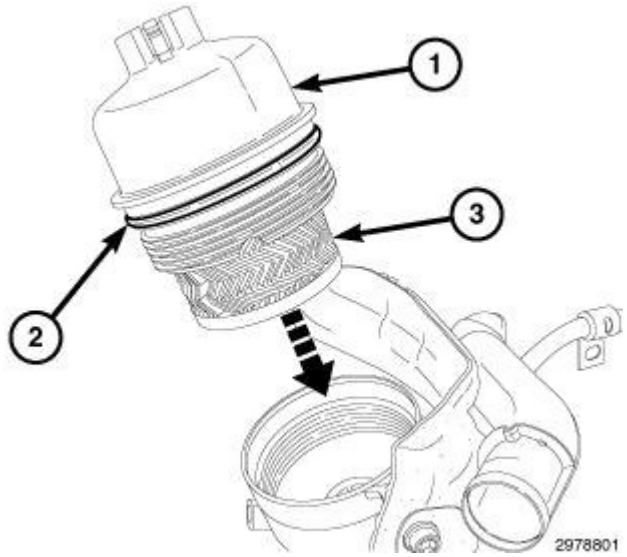


Fig. 480: Oil Filter Cap, O-Ring Seal & Oil Filter
Courtesy of CHRYSLER GROUP, LLC

16. Thread the oil filter cap (1) into the oil filter housing and tighten to 25 N.m (18 ft. lbs.).

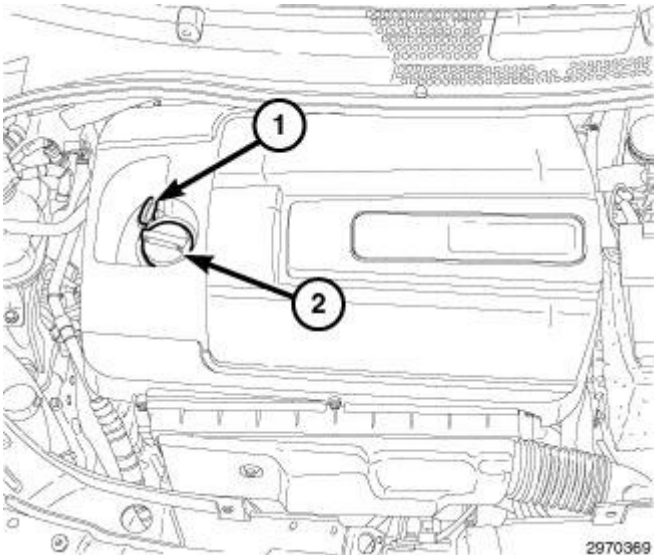


Fig. 481: Oil Level Dipstick & Oil Fill Cap
Courtesy of CHRYSLER GROUP, LLC

17. Remove the oil fill cap (2). Fill the crankcase with the specified type and amount of engine oil. Refer to **CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS** .
18. Install the oil fill cap (2).
19. Start the engine and inspect for leaks.
20. Stop the engine and check the oil level (1).
21. Install the engine cover.

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PAN, OIL

DESCRIPTION

DESCRIPTION

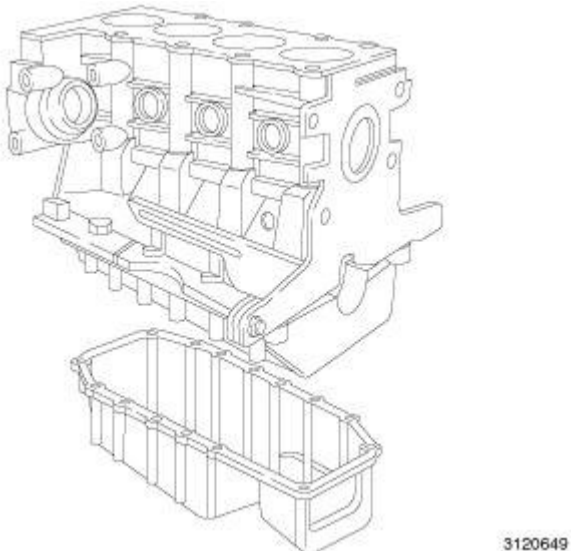
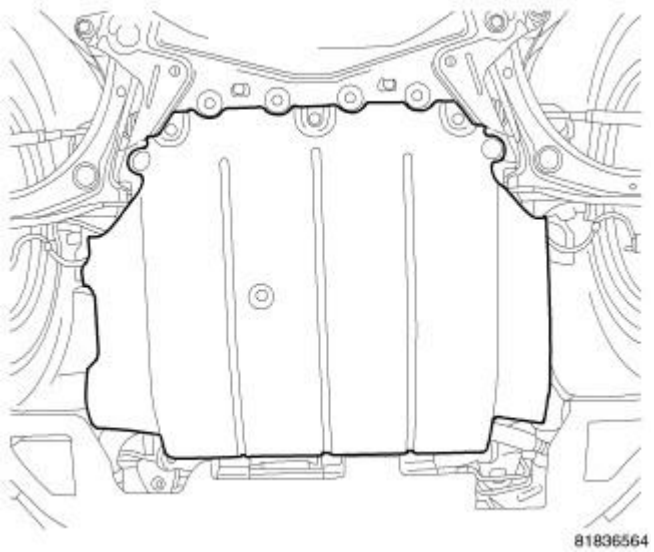


Fig. 482: Engine Block & Oil Pan
Courtesy of CHRYSLER GROUP, LLC

The function of the oil pan is to contain the engine lubrication oil and is made from aluminum. The oil pan has a threaded oil drainage opening and a threaded port for an oil viscosity sensor. The oil pan is sealed to the engine block using Mopar® Engine RTV GEN II Sealant.

REMOVAL

REMOVAL



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Fig. 483: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect and isolate the battery negative cable.
2. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
3. Remove the belly pan. Refer to **BELLY PAN, REMOVAL** .
4. Drain the engine oil. Refer to **STANDARD PROCEDURE** .
5. Remove the exhaust crossunder pipe. Refer to **PIPE, EXHAUST CROSSUNDER, REMOVAL** .

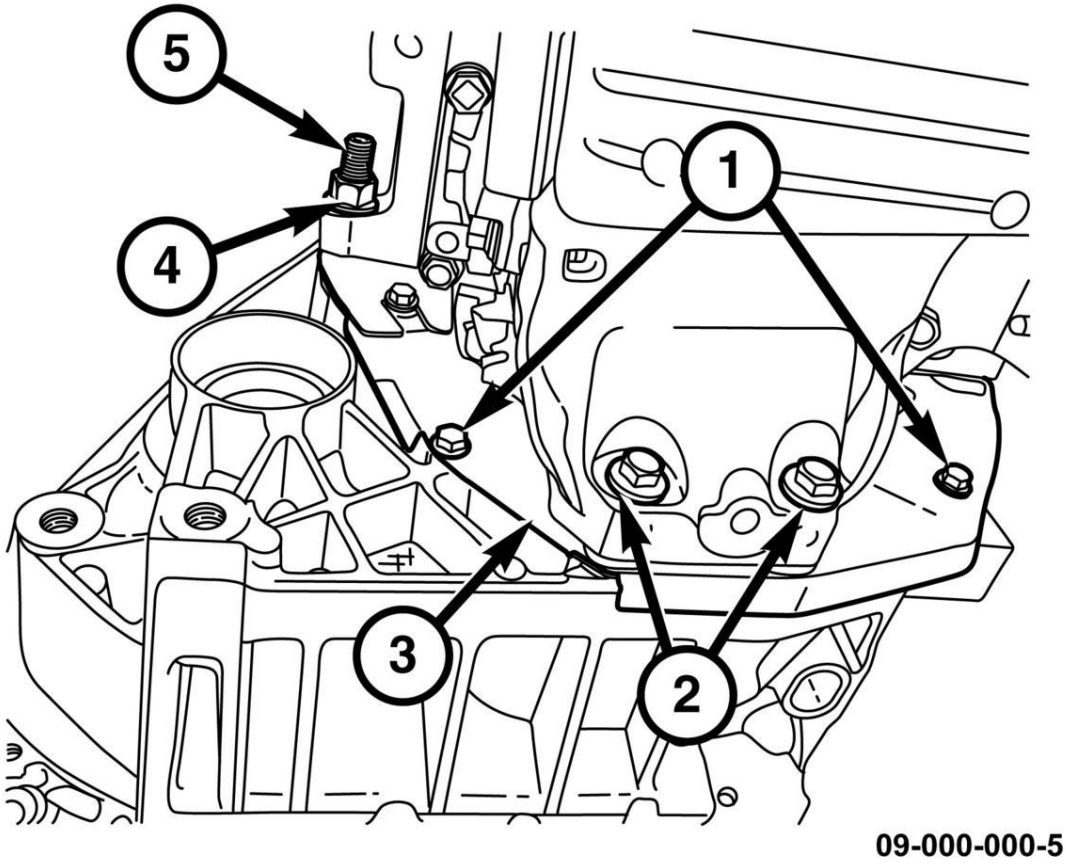


Fig. 484: Transmission Bell Housing Bolts, Transmission Stud, Flywheel Dust Cover & Nut
Courtesy of CHRYSLER GROUP, LLC

6. Remove three bolts (1) from the flywheel dust cover.
7. Remove the two lower transmission bell housing bolts (2).

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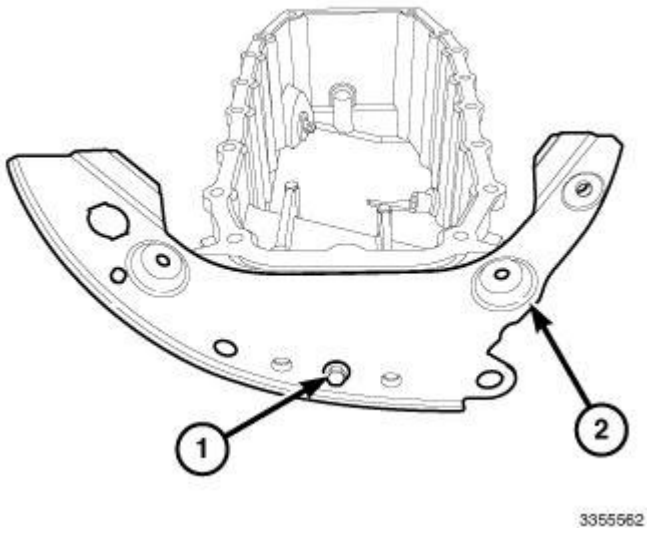


Fig. 485: Flywheel Dust Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

NOTE: The flywheel dust cover (2) is bolted to the oil pan and cannot be removed at this time.

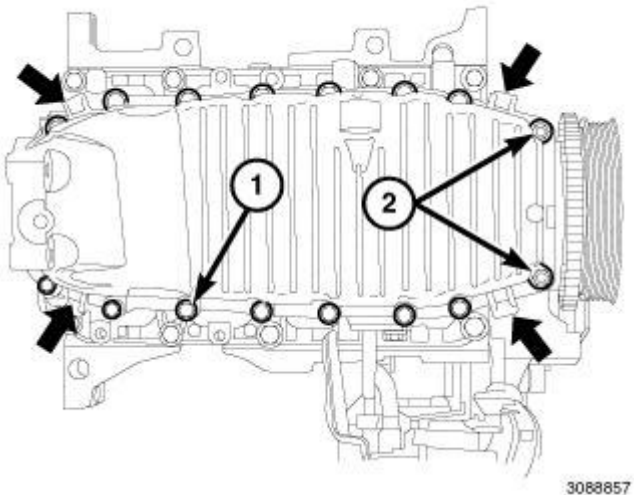


Fig. 486: Oil Pan Flange Fasteners
Courtesy of CHRYSLER GROUP, LLC

8. Remove fourteen bolts (1), two nuts and two studs (2) from the flange of the oil pan.
9. Using the four indicated pry points, carefully remove the oil pan and flywheel dust cover.

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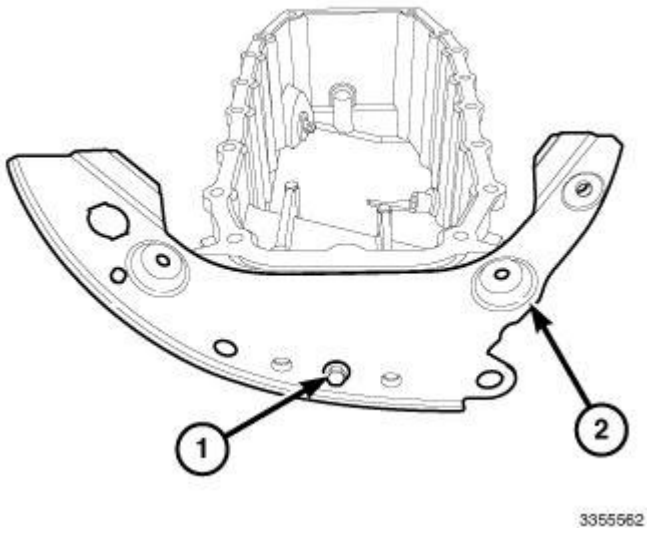


Fig. 487: Flywheel Dust Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

10. Remove the bolt (1) and the flywheel dust cover (2) from the oil pan.

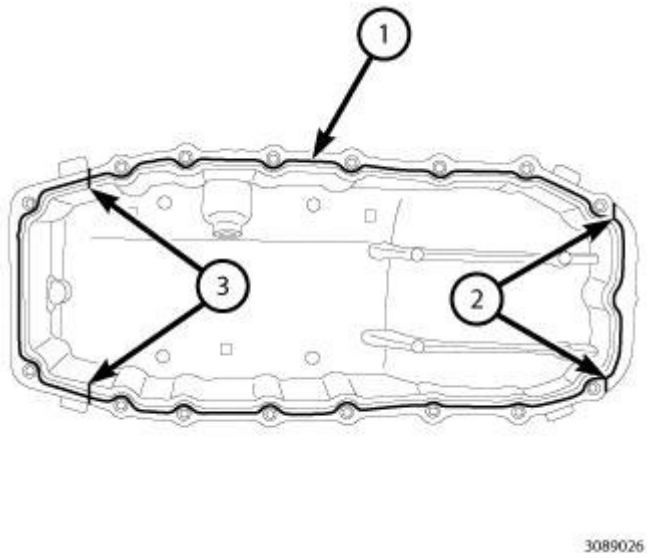


Fig. 488: Oil Pan Sealant Locations
Courtesy of CHRYSLER GROUP, LLC

11. Remove all residual sealant (1) from the oil pan, engine block, oil pump and rear seal retainer. Refer to **PAN, OIL, CLEANING**.

CLEANING

CLEANING

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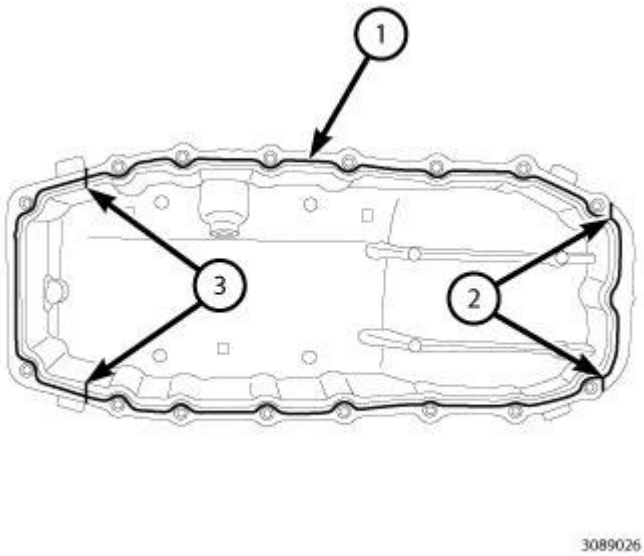


Fig. 489: Oil Pan Sealant Locations
Courtesy of CHRYSLER GROUP, LLC

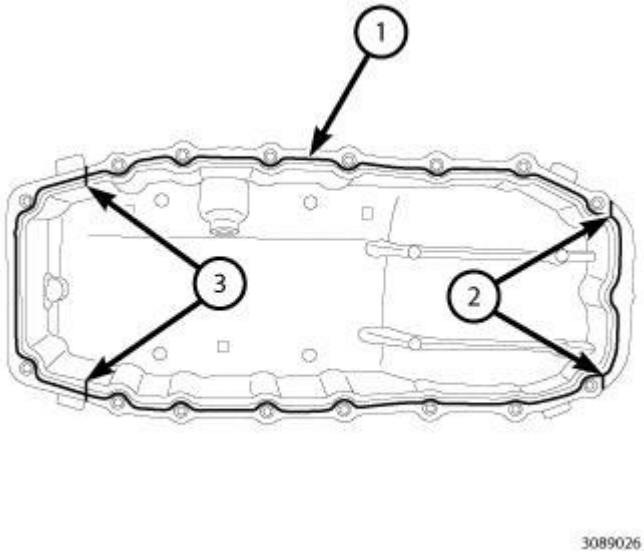
1. Clean the oil pan in solvent and wipe dry with a clean cloth.

CAUTION: Do not use oil based liquids, wire brushes, abrasive wheels or metal scrapers to clean the engine gasket surfaces. Use only isopropyl (rubbing) alcohol, along with plastic or wooden scrapers. Improper gasket surface preparation may result in engine fluid leakage.

2. Remove all residual sealant (1) from the oil pan. Refer to **ENGINE GASKET SURFACE PREPARATION** .

INSTALLATION

INSTALLATION



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Fig. 490: Oil Pan Sealant Locations
Courtesy of CHRYSLER GROUP, LLC

1. Clean the oil pan, engine block, oil pump and rear seal retainer mating surfaces with isopropyl alcohol in preparation for sealant application.

CAUTION: Engine assembly requires the use of a unique sealant that is compatible with engine oil. Using a sealant other than Mopar® Engine RTV GEN II may result in engine fluid leakage.

CAUTION: Following the application of Mopar® Engine RTV GEN II to the gasket surfaces, the components must be assembled within 10 minutes and the attaching fasteners must be tightened to specification within the next 10 minutes. Prolonged exposure to the air prior to assembly may result in engine fluid leakage.

2. Apply a 2 to 3 mm wide bead of Mopar® Engine RTV GEN II sealant to the oil pan as shown in illustration in the following locations:
   - Oil pan to engine block flange (1)
   - Two oil pump to engine block T-joints (3)
   - Two rear seal retainer to engine block T-joints (2)

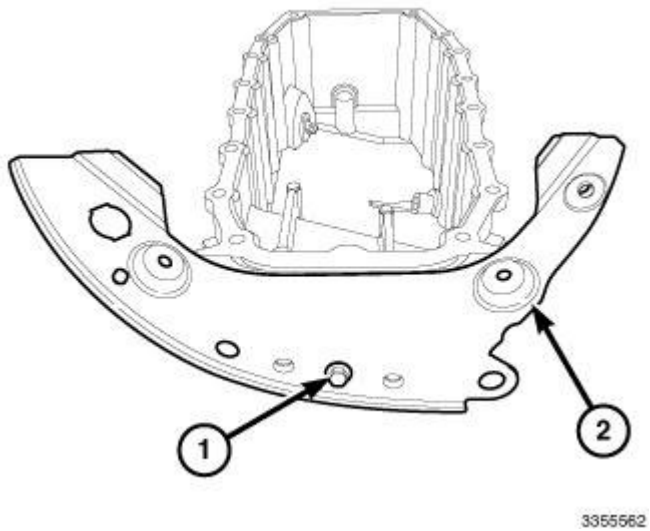


Fig. 491: Flywheel Dust Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

3. Install the flywheel dust cover (2) to the oil pan. Tighten the bolt (1) to 9 N.m (80 in. lbs.).

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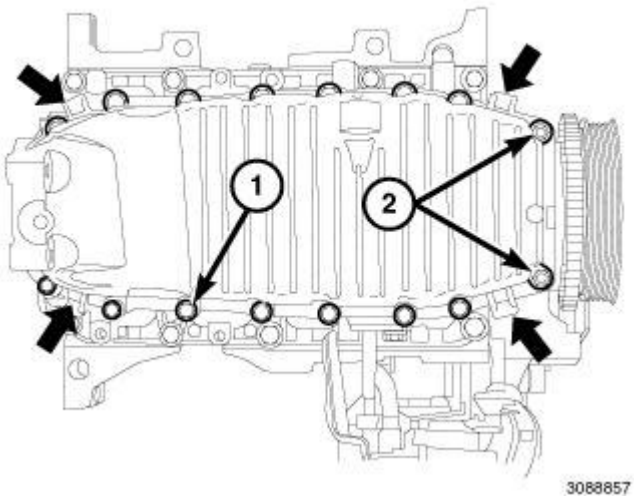


Fig. 492: Oil Pan Flange Fasteners
Courtesy of CHRYSLER GROUP, LLC

4. Install the oil pan with fourteen bolts (1), two studs and two nuts (2) hand tight.

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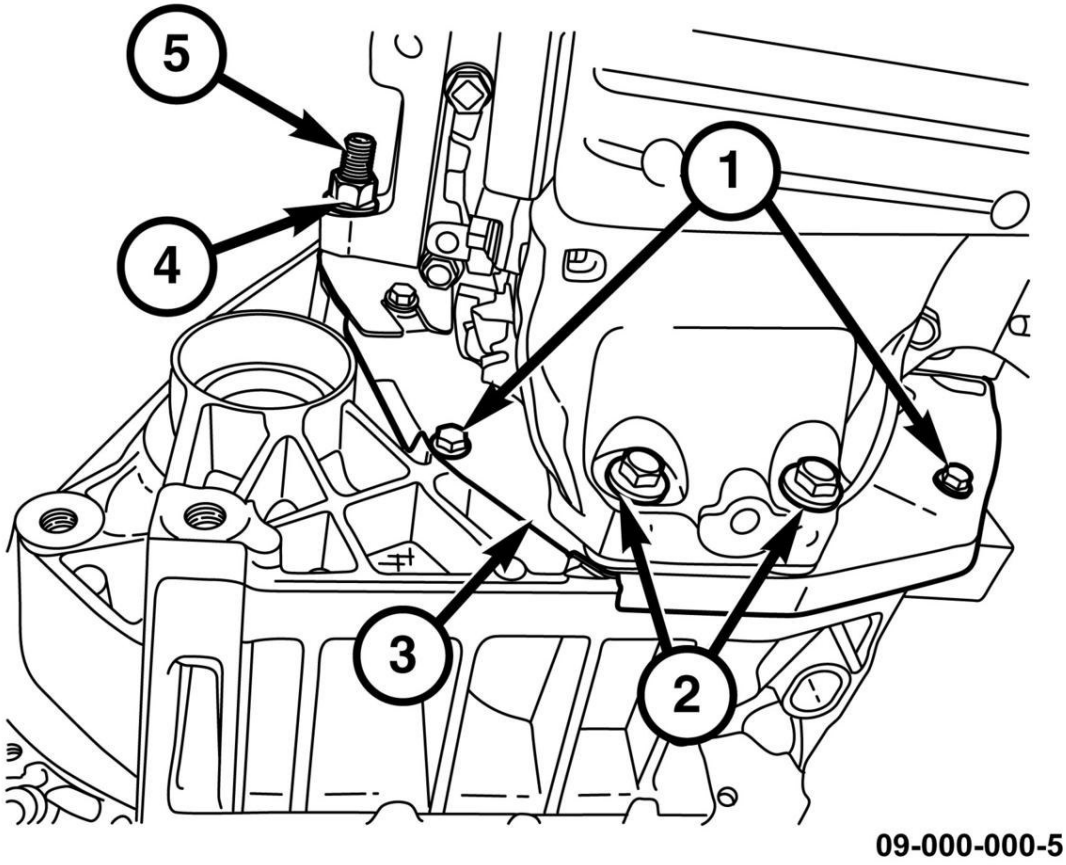


Fig. 493: Transmission Bell Housing Bolts, Transmission Stud, Flywheel Dust Cover & Nut
Courtesy of CHRYSLER GROUP, LLC

5. Install the two lower transmission bell housing bolts (2) and tighten to 40 N.m (30 ft. lbs.).
6. Install the three bolts (1) to the flywheel dust cover and tighten to 9 N.m (80 in. lbs.).

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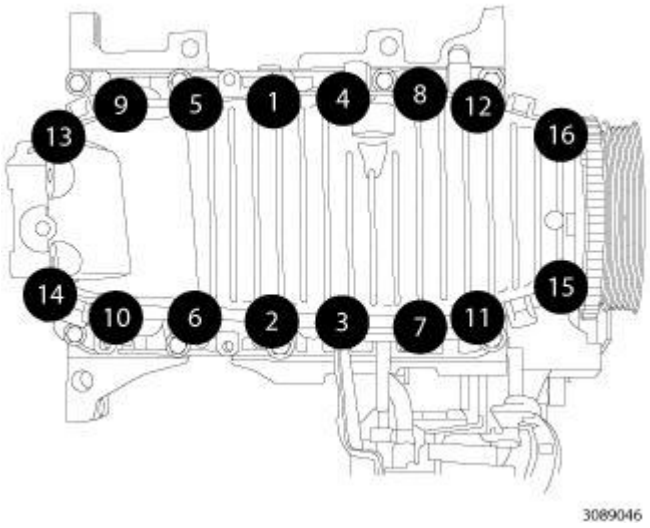


Fig. 494: Oil Pan Fastener Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

7. Tighten the sixteen oil pan fasteners in two steps following the sequence shown in illustration:
   - Step 1: All to 4 N.m (35 in. lbs.).
   - Step 2: All to 9 N.m (80 in. lbs.).
8. Install the exhaust crossunder pipe. Refer to **PIPE, EXHAUST CROSSUNDER, INSTALLATION** .

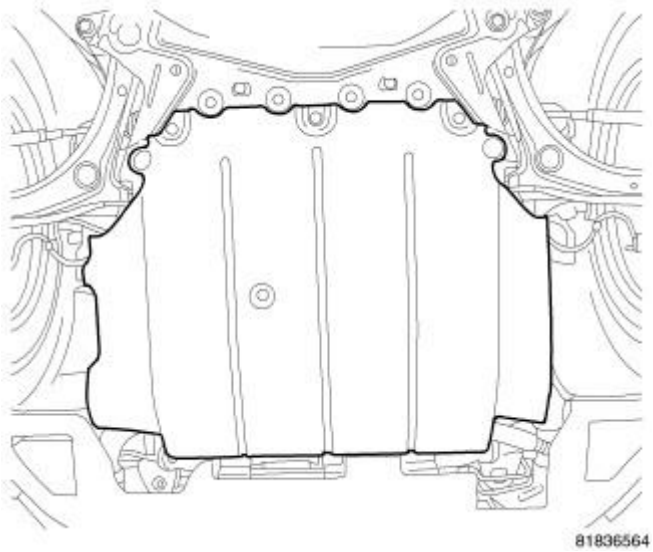


Fig. 495: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

9. Install the belly pan. Refer to **BELLY PAN, INSTALLATION** .
10. If removed, install the oil filter and fill the engine crankcase with the proper oil to the correct level. Refer to **STANDARD PROCEDURE** .
11. Connect the battery negative cable and tighten nut to 5 N.m (45 in. lbs.).

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12. Start and run the engine until it reaches normal operating temperature.

PICK-UP, OIL PUMP

REMOVAL

REMOVAL

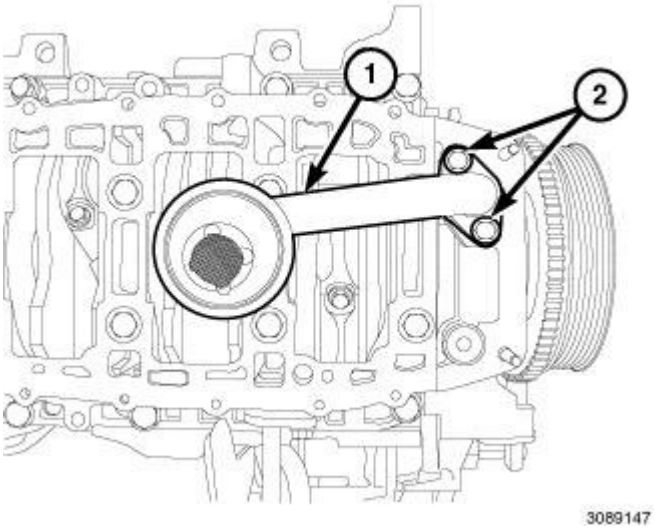


Fig. 496: Oil Pick-Up Tube & Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect and isolate the negative battery cable.
2. Remove the oil pan. Refer to **PAN, OIL, REMOVAL**.
3. Remove the bolts (2) from the oil pick-up tube and remove the oil pick-up tube (1) from the oil pump.

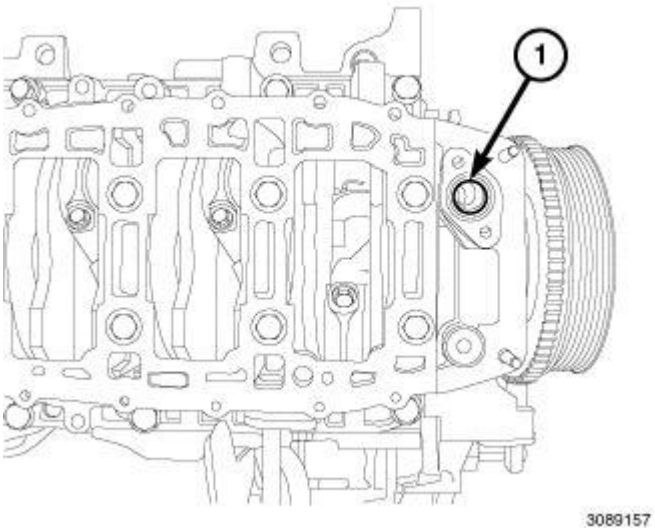


Fig. 497: Oil Pump O-Ring Seal

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Courtesy of CHRYSLER GROUP, LLC

4. Remove and discard the O-ring seal (1) from the oil pump.

INSTALLATION

INSTALLATION

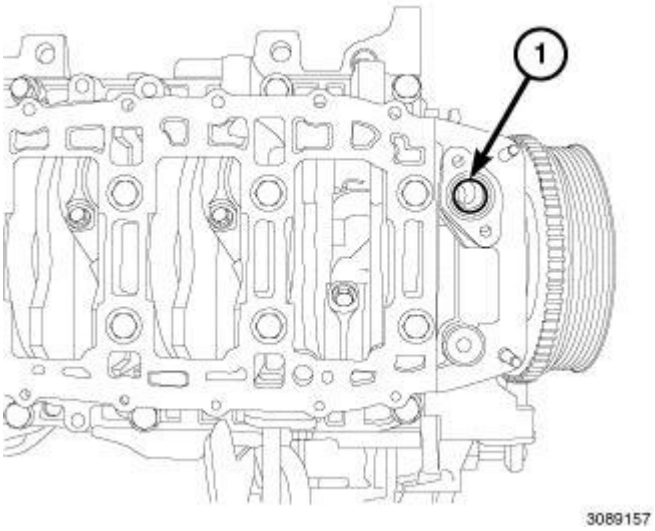


Fig. 498: Oil Pump O-Ring Seal
Courtesy of CHRYSLER GROUP, LLC

1. Lightly lubricate the new O-ring seal (1) with engine oil and install on the oil pump.

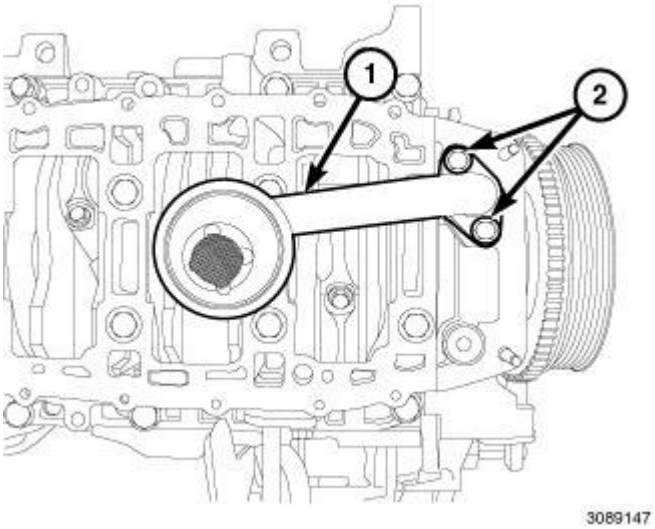


Fig. 499: Oil Pick-Up Tube & Bolts
Courtesy of CHRYSLER GROUP, LLC

2. Install the oil pick-up tube (1) with two bolts (2). Tighten the bolts to 10 N.m (89 in. lbs.).

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3. Install the oil pan. Refer to **PAN, OIL, INSTALLATION**.
4. If removed, install the oil filter and fill the engine crankcase with the proper oil to the correct level. Refer to **STANDARD PROCEDURE** .
5. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
6. Run the engine until it reaches normal operating temperature.

PUMP, ENGINE OIL

DESCRIPTION

DESCRIPTION

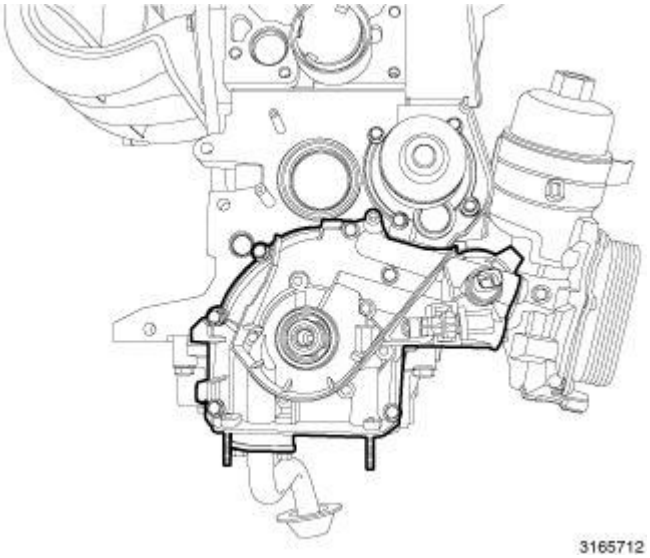


Fig. 500: Oil Pump
Courtesy of CHRYSLER GROUP, LLC

The gerotor type engine oil pump is mounted to the front of the engine as part of the oil pump housing. The oil pump is directly coupled to the crankshaft.

The oil pump housing provides mounting points for the following components:

- Oil pick-up tube
- Front crankshaft oil seal
- Crankshaft Position (CKP) sensor
- Oil pressure switch

The oil pump housing is also coupled to the oil filter housing where the pressurized oil is filtered and cooled.

OPERATION

OPERATION

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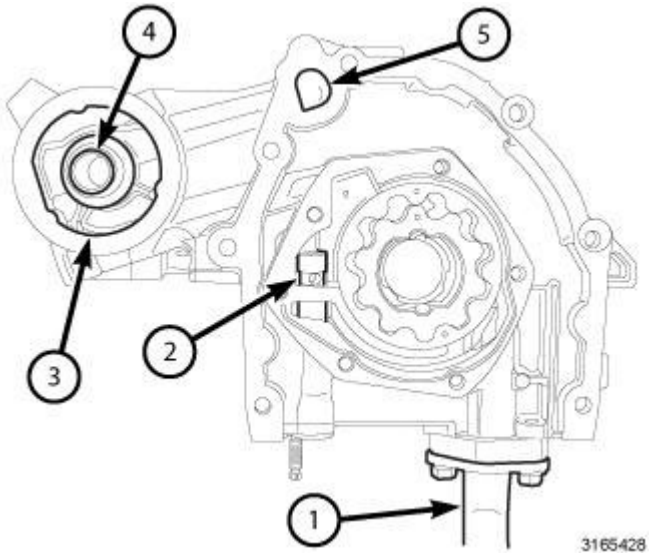


Fig. 501: Oil Pump Assembly
Courtesy of CHRYSLER GROUP, LLC

NOTE: Pump cover removed for clarity.

The gerotor type engine oil pump is part of the oil pump housing. The oil pump is directly coupled to the crankshaft.

Engine oil is drawn up from the sump through the oil pick-up tube (1). An internal mechanical plunger (2) and spring type pressure relief valve diverts excess oil from the pump outlet back to the pump inlet. The pressure controlled oil flows through the oil pump/oil filter housing interface (3) and into the oil filter housing. After the oil is filtered and cooled it travels back to the oil pump housing through the oil pump/oil filter housing interface (4) where it is routed to the main engine oil gallery (5).

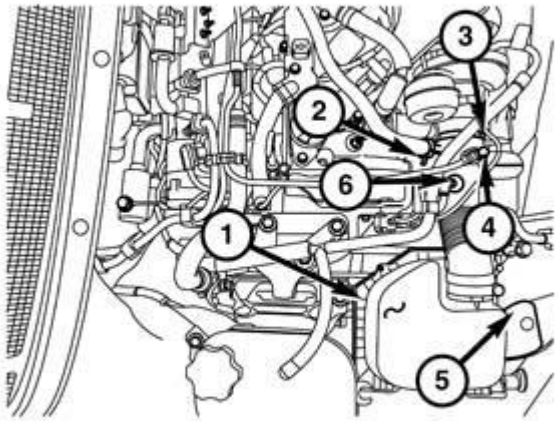
The gerotor pump is not to be disassembled. The gerotor pump is a non-serviceable component of the oil pump housing and is replaced as a complete assembly. The pressure relief valve is serviceable and can be removed and inspected.

REMOVAL

MANUAL TRANSMISSION

1. Perform the fuel pressure release procedure. Refer to **FUEL DELIVERY, GAS, STANDARD PROCEDURE** .
2. Remove the engine cover.

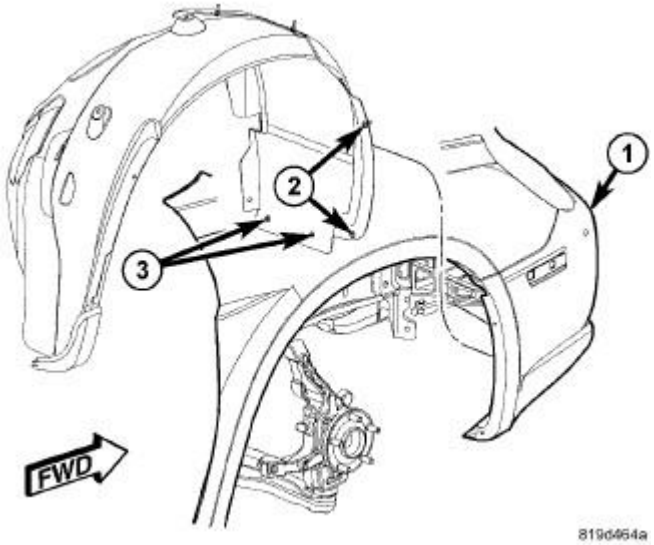
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Fig. 502: EVAP Hose Quick Release Fitting, Wastegate Solenoid Vent Hose, Clamps, Screws & Bolts
Courtesy of CHRYSLER GROUP, LLC

3. Disconnect the battery negative cable.
4. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
5. Remove the belly pan. Refer to **BELLY PAN, REMOVAL** .
6. Drain the engine oil. Refer to **STANDARD PROCEDURE** .
7. Remove the right front wheel and tire assembly. Refer to **REMOVAL** .



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Fig. 503: Removing/Installing Front Splash Shields
Courtesy of CHRYSLER GROUP, LLC

8. Remove two screws (2) from the front wheelhouse splash shield.
9. Remove three screws and the frame splash shield.

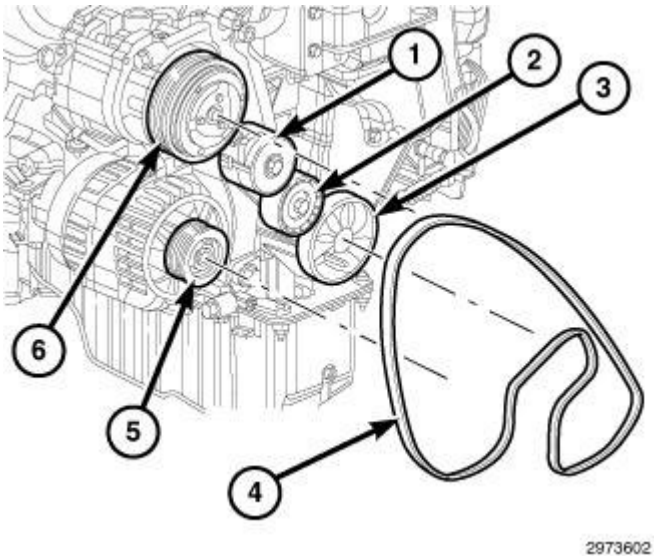


Fig. 504: Drive Belt Tensioners & Assembly With Drive Belt Routing
Courtesy of CHRYSLER GROUP, LLC

10. Remove the accessory drive belt (4). Refer to **BELT, SERPENTINE, REMOVAL** .

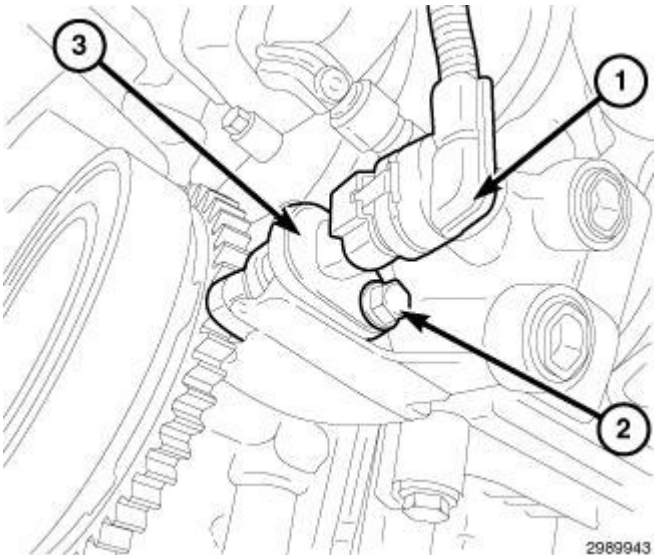


Fig. 505: Crankshaft Position Sensor, Connector & Bolt
Courtesy of CHRYSLER GROUP, LLC

11. Remove the crankshaft position sensor electrical connector (1).
12. Remove the mounting bolt (2) and crankshaft position sensor (3).

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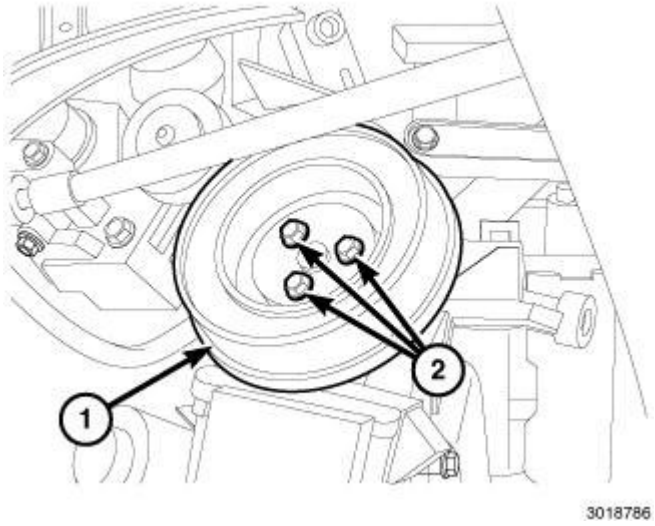


Fig. 506: Vibration Damper & Bolts
Courtesy of CHRYSLER GROUP, LLC

13. Remove the vibration damper (1). Refer to **DAMPER, VIBRATION, REMOVAL**.

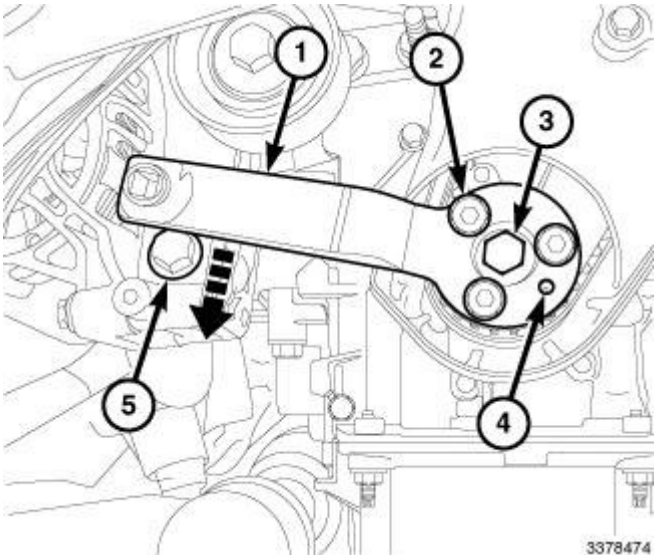


Fig. 507: Crankshaft Sprocket Holder, Clearance Hole & Bolts
Courtesy of CHRYSLER GROUP, LLC

14. Position the (special tool #10307, Holder, Crankshaft Sprocket) (1) as shown in illustration.
15. Rotate the crankshaft until the vibration damper locating pin is centered in the clearance hole (4).
16. Install the (special tool #10307, Holder, Crankshaft Sprocket) (1) with three bolts (2) tightened to 25 N.m (15 ft. lbs.).
17. With the (special tool #10307, Holder, Crankshaft Sprocket) (1) resting against the accessory bracket bolt (5), loosen **but do not remove** the crankshaft bolt (3).
18. Remove the exhaust crossunder pipe. Refer to **PIPE, EXHAUST CROSSUNDER, REMOVAL** .

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19. Lower the vehicle.
20. Remove the catalytic converter. Refer to **CONVERTER, CATALYTIC, REMOVAL** .

CAUTION: The maniverter studs are installed in the cylinder head with a thread sealant. If the studs rotate during service this indicates that the seal is broken and the stud must be replaced. Failure to replace the studs can result in engine oil leaking onto the exhaust manifold.

21. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .

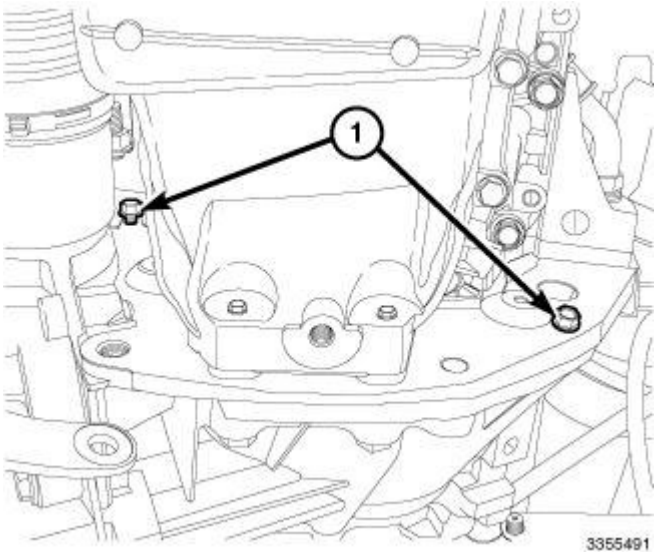


Fig. 508: Flywheel Dust Cover Bolts
Courtesy of CHRYSLER GROUP, LLC

22. Remove the two bolts (1) from the flywheel dust cover.

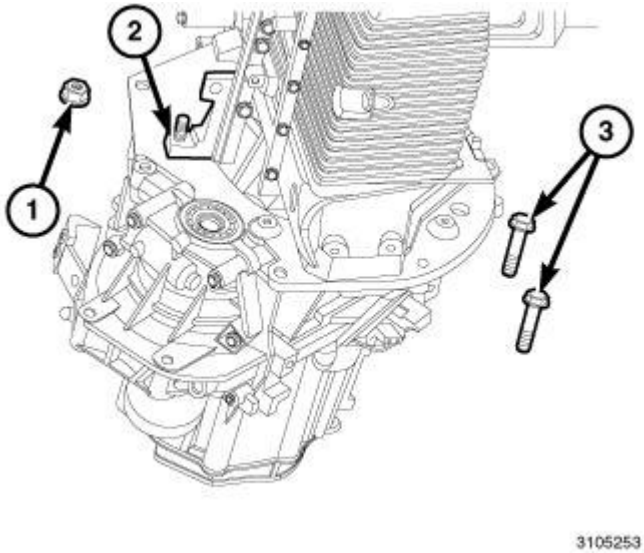


Fig. 509: Transmission Bell Housing Bolts, Nut & Stud

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Courtesy of CHRYSLER GROUP, LLC

23. Remove the two lower transmission bell housing bolts (3).

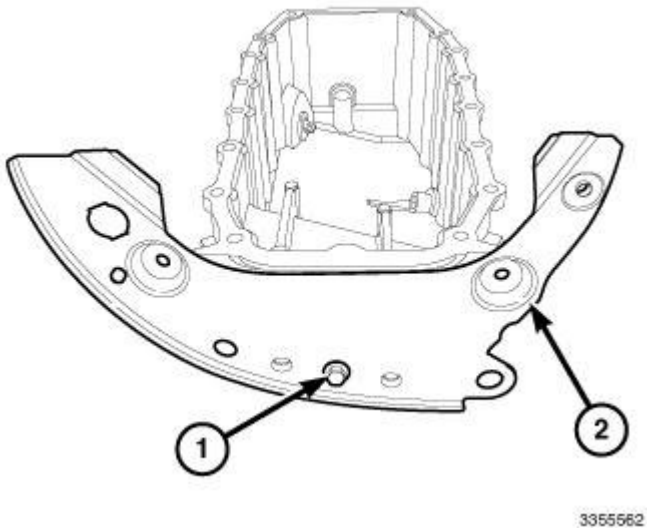


Fig. 510: Flywheel Dust Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

NOTE: The flywheel dust cover is bolted to the oil pan and cannot be removed at this time.

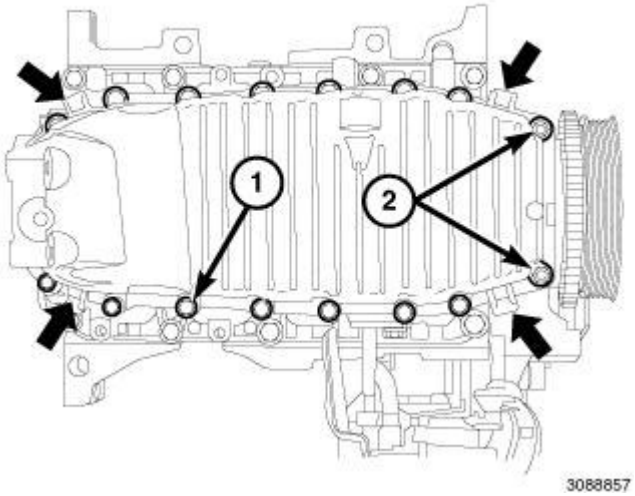


Fig. 511: Oil Pan Flange Fasteners
Courtesy of CHRYSLER GROUP, LLC

24. Remove 14 bolts (1), 2 nuts and 2 studs (2) from the flange of the oil pan.
25. Using the four indicated pry points, carefully remove the oil pan and flywheel dust cover.

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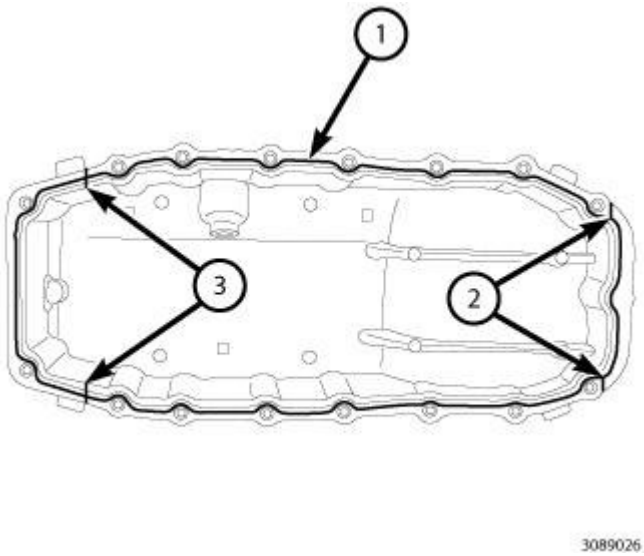


Fig. 512: Oil Pan Sealant Locations
Courtesy of CHRYSLER GROUP, LLC

26. Remove all residual sealant (1) from the oil pan, engine block, oil pump and rear seal retainer. Refer to **PAN, OIL, CLEANING**.

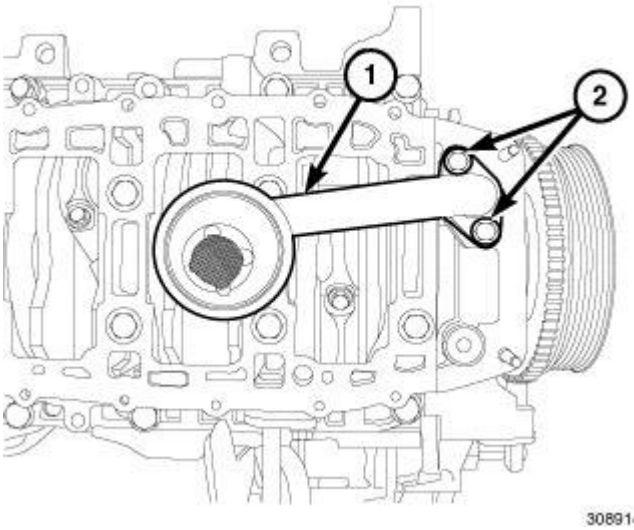


Fig. 513: Oil Pick-Up Tube & Bolts
Courtesy of CHRYSLER GROUP, LLC

27. Remove the bolts (2) and remove the oil pump pick-up tube (1) from the oil pump.

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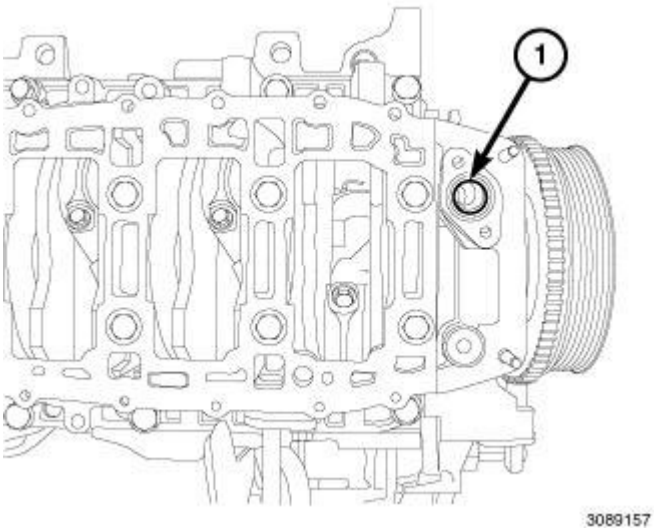


Fig. 514: Oil Pump O-Ring Seal
Courtesy of CHRYSLER GROUP, LLC

28. Remove and discard the O-ring seal (1) from the oil pump.
29. Lower the vehicle.

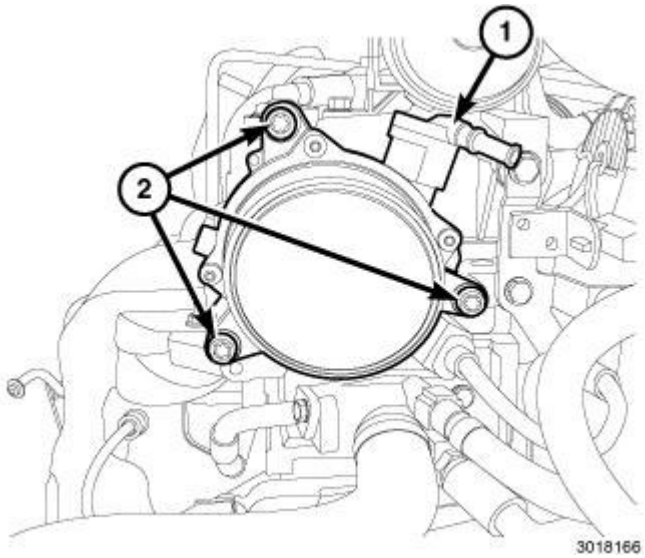


Fig. 515: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

NOTE: Oil may leak from the vacuum pump drive when the pump is removed. Place a shop towel under the pump to prevent oil leakage onto the engine or transmission assembly.

30. Disconnect the vacuum line at the pump (1).
31. Remove the vacuum pump mounting bolts (2) and the vacuum pump (1).

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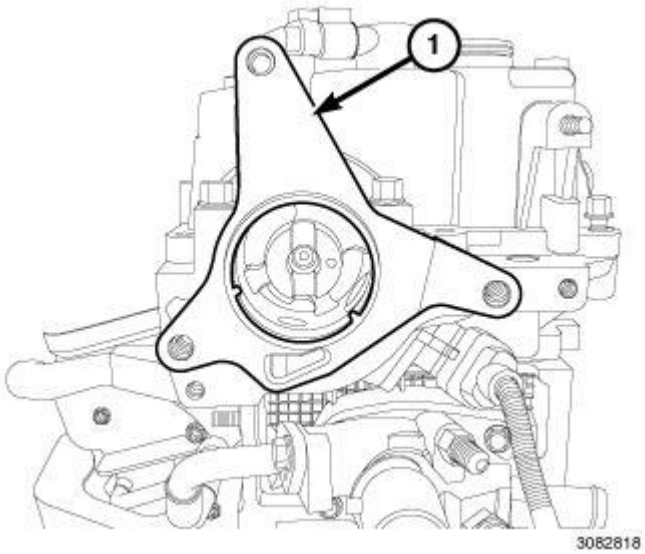


Fig. 516: Vacuum Pump Gasket
Courtesy of CHRYSLER GROUP, LLC

32. Remove and discard the vacuum pump gasket (1). Note the location of the pump drive tab.

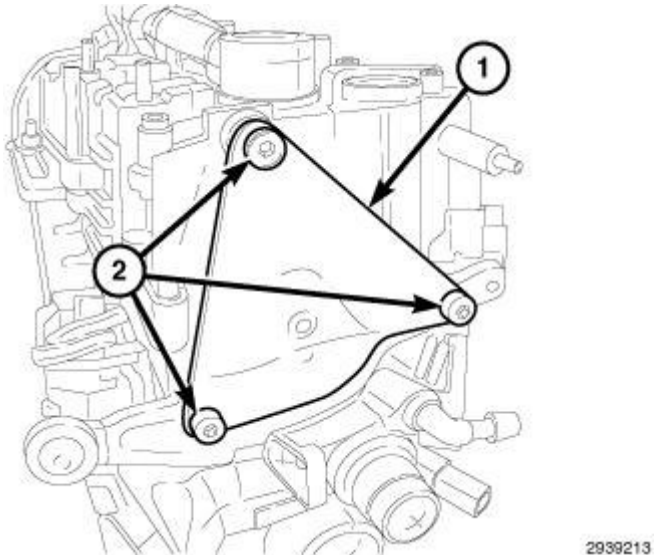


Fig. 517: Camshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

33. Install the (special tool #10277, Tool, Camshaft Timing Locking) (1) to the rear of the camshaft. Rotate the crankshaft clockwise to align the tool with the vacuum pump mounting. Install three bolts (2) and tighten to 20 N.m (15 ft. lbs.).

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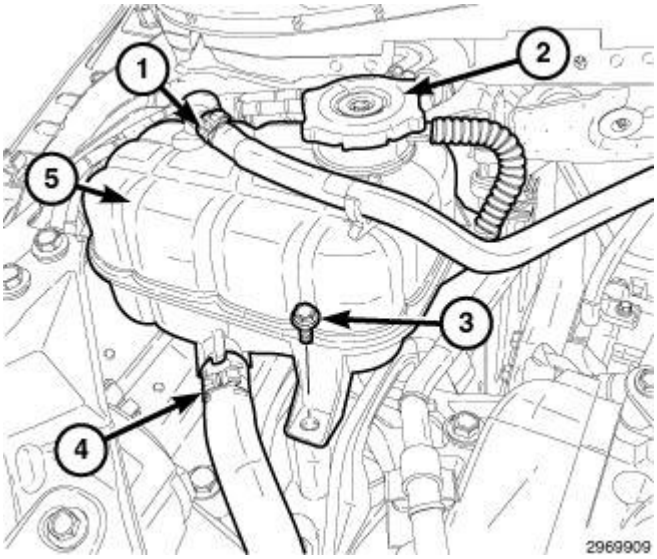


Fig. 518: Return Hose, Lower Supply Hose, Mounting Screw & Coolant Recovery Bottle
Courtesy of CHRYSLER GROUP, LLC

34. Reposition the coolant recovery bottle (5). Refer to **BOTTLE, PRESSURIZED COOLANT, REMOVAL** .
35. Support the engine with a floor jack positioned under the bedplate.
36. Remove six bolts (1 and 3) and the RH engine mount isolator (4).

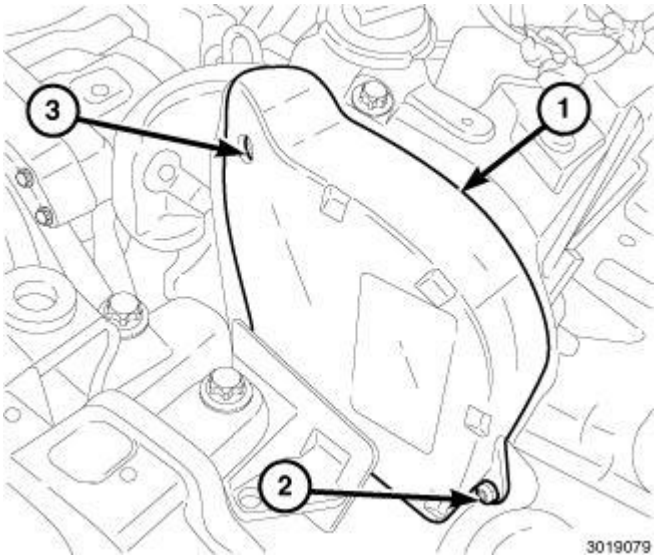


Fig. 519: Upper Timing Belt Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

37. Remove the bolts (2 and 3) and the upper timing belt cover (1).
38. Remove the right engine mount bracket. Refer to **BRACKET, ENGINE MOUNT, RIGHT, REMOVAL**.

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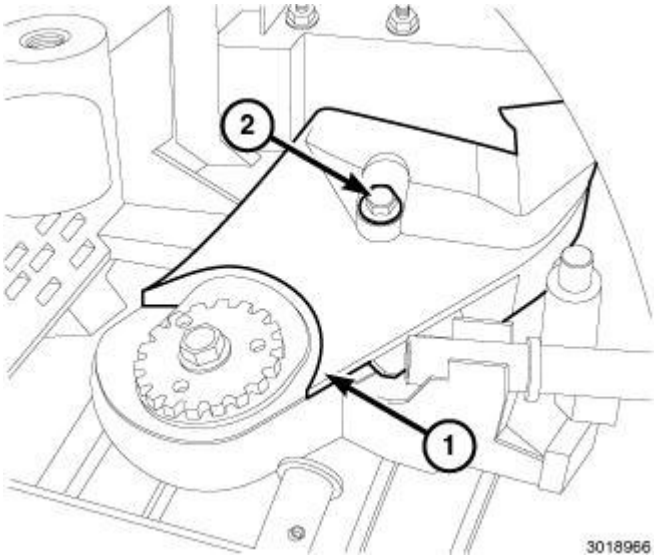


Fig. 520: Lower Timing Belt Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

39. Remove the bolt (2) and the lower timing belt cover (1).

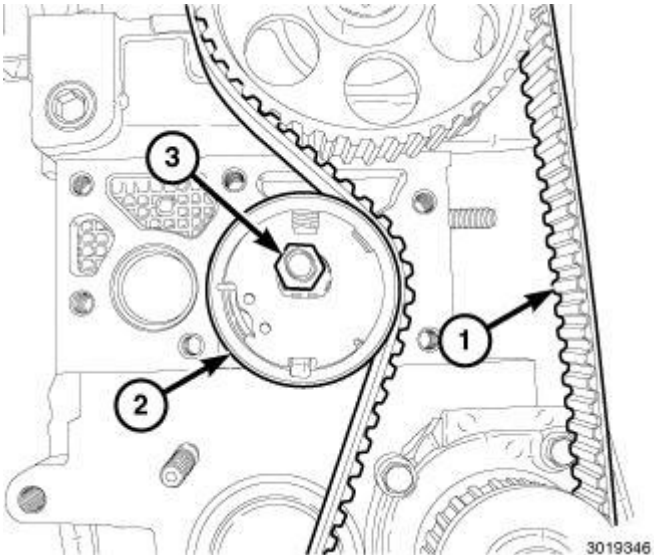


Fig. 521: Timing Belt, Tensioner & Lock Nut
Courtesy of CHRYSLER GROUP, LLC

NOTE: If the timing belt is to be reused, mark the direction of rotation using a paint pen or equivalent to aid in reassembly.

40. Loosen the tensioner lock nut (3) and remove the timing belt (1).
41. Temporarily reinstall the RH engine mount bracket with two bolts hand tight.

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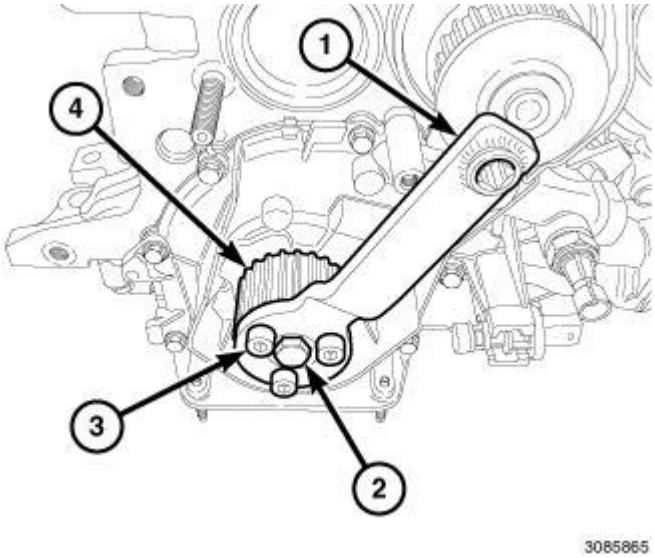
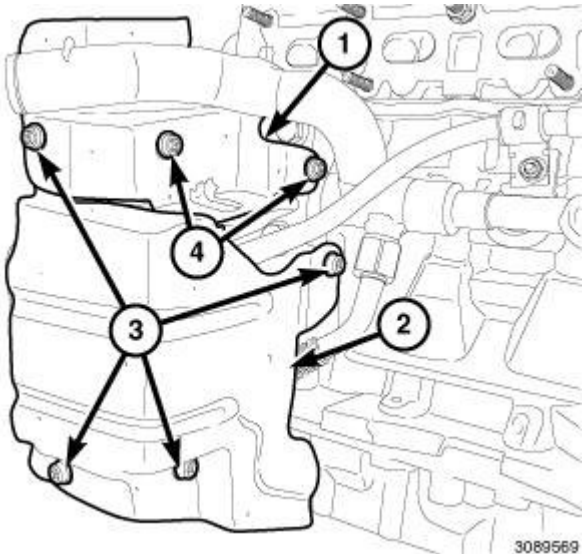


Fig. 522: Crankshaft Sprocket, Holder & Bolts
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When the timing belt is removed and the cylinder head is still installed, DO NOT rotate the camshaft or crankshaft without first locating the proper crankshaft position. Failure to do so will result in valve and/or piston damage.

42. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
43. Remove the crankshaft sprocket (4):
    - If required, install (special tool #10307, Holder, Crankshaft Sprocket) (1) with three bolts (3) tightened to 25 N.m (15 ft. lbs.) and remove the bolt (2).
    - Remove the crankshaft sprocket (4).
    - Discard the bolt (2).



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Fig. 523: Upper And Lower Oil Cooler Housing Heat Shields & Fasteners
Courtesy of CHRYSLER GROUP, LLC

44. Remove four bolts (3) and the lower oil cooler housing heat shield (2).

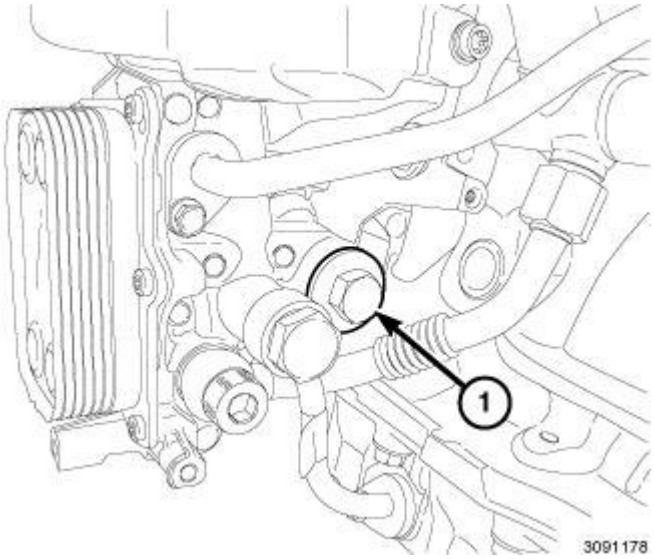


Fig. 524: Oil Pump Bolt
Courtesy of CHRYSLER GROUP, LLC

45. Remove the oil filter housing to oil pump bolt (1).

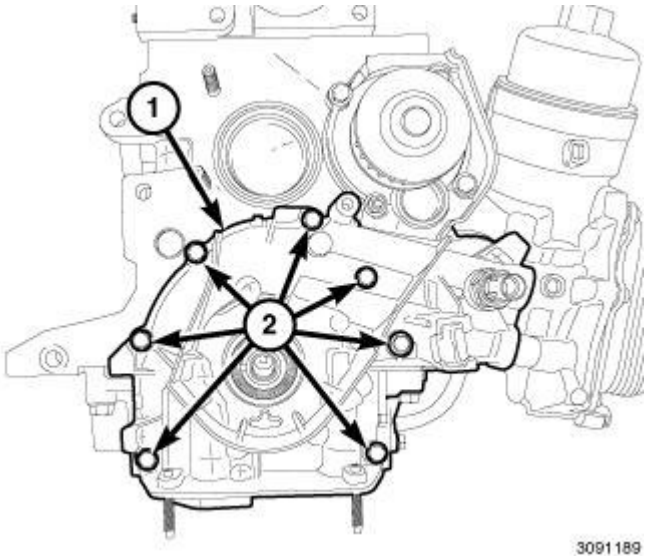


Fig. 525: Oil Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

46. Remove the seven oil pump bolts (2) and remove the oil pump (1).

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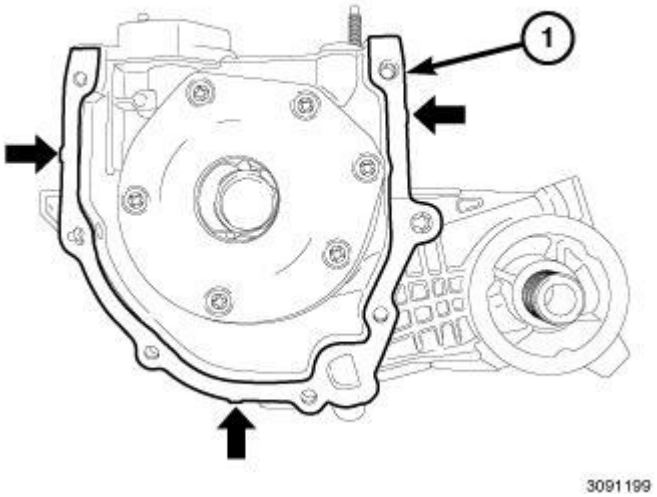


Fig. 526: Oil Pump Gasket
Courtesy of CHRYSLER GROUP, LLC

47. Remove and discard the oil pump gasket (1).

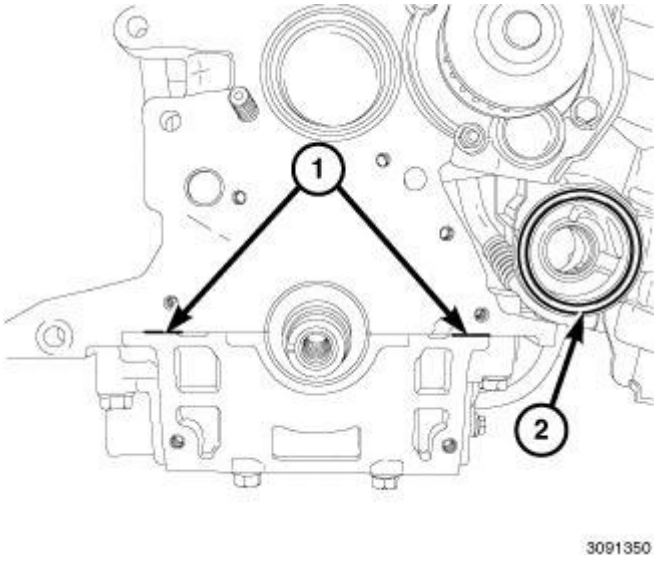


Fig. 527: RTV Sealant & Oil Filter Housing Seal
Courtesy of CHRYSLER GROUP, LLC

48. Remove and discard the oil filter housing seal (2).
49. Remove all residual sealant (1) from the engine block, bedplate and oil pump.

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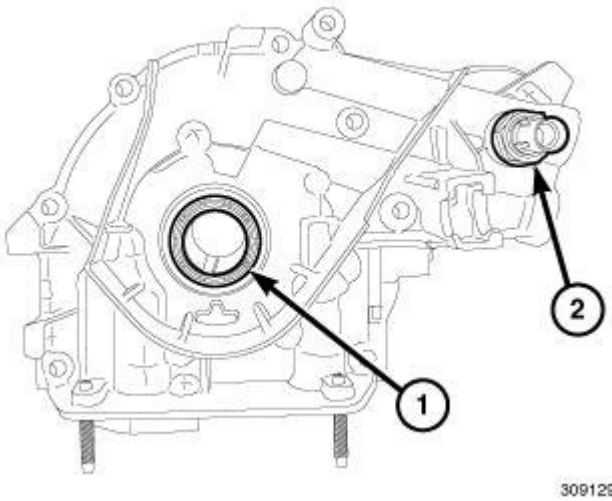


Fig. 528: Front Crankshaft Oil Seal & Oil Pressure Switch
Courtesy of CHRYSLER GROUP, LLC

50. If required. remove the front crankshaft oil seal (1).

NOTE: The oil pressure switch has a lock patch on the threads and if removed can not be reinstalled.

51. If required, remove and discard the oil pressure switch (2). Refer to **SWITCH, OIL PRESSURE, REMOVAL**.

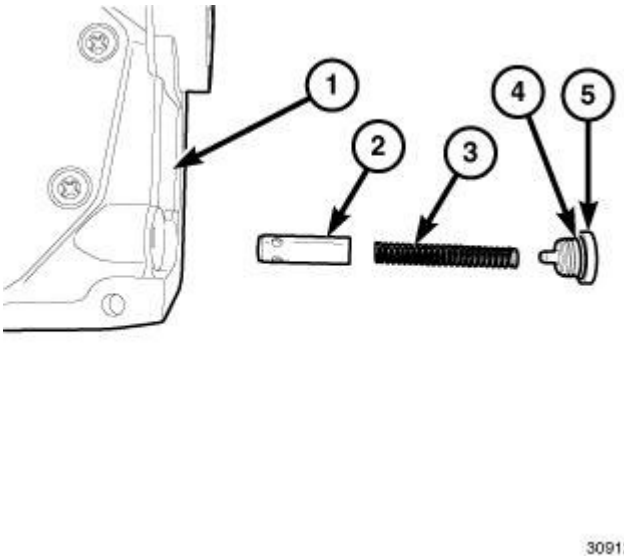


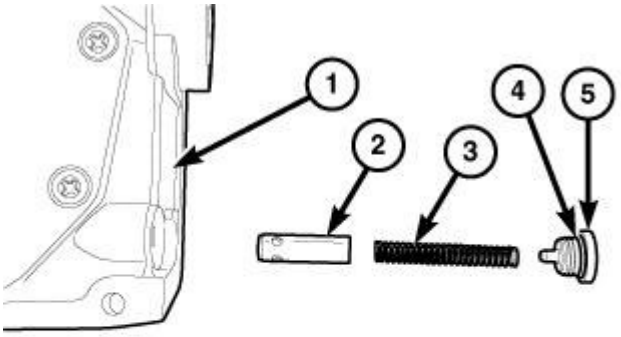
Fig. 529: Oil Pump, Plunger, Spring, O-Ring Seal & Oil Pressure Regulator Cap
Courtesy of CHRYSLER GROUP, LLC

52. If required, remove the oil pressure regulator cap (5), spring (3) and plunger (2) from the oil pump (1).

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INSTALLATION

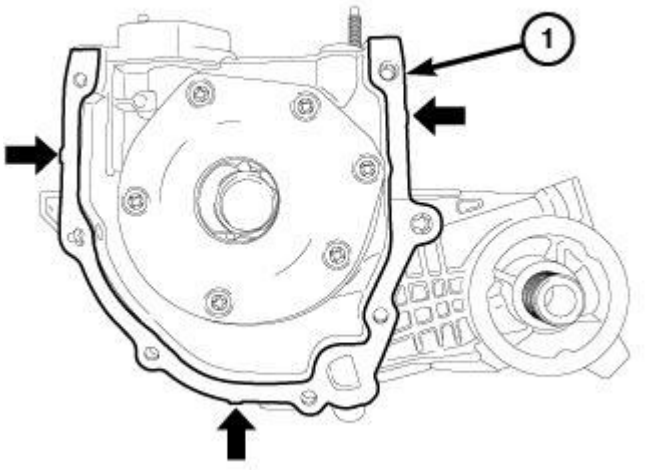
MANUAL TRANSMISSION



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Fig. 530: Oil Pump, Plunger, Spring, O-Ring Seal & Oil Pressure Regulator Cap
Courtesy of CHRYSLER GROUP, LLC

1. If removed, install the plunger (2), spring (3) and oil pressure regulator cap (5) with a new O-ring seal (4) to the oil pump (1).



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Fig. 531: Oil Pump Gasket
Courtesy of CHRYSLER GROUP, LLC

2. Install a new oil pump gasket (1) to the oil pump. Roll the three gasket retaining tabs over the pump flange at the indicated locations.

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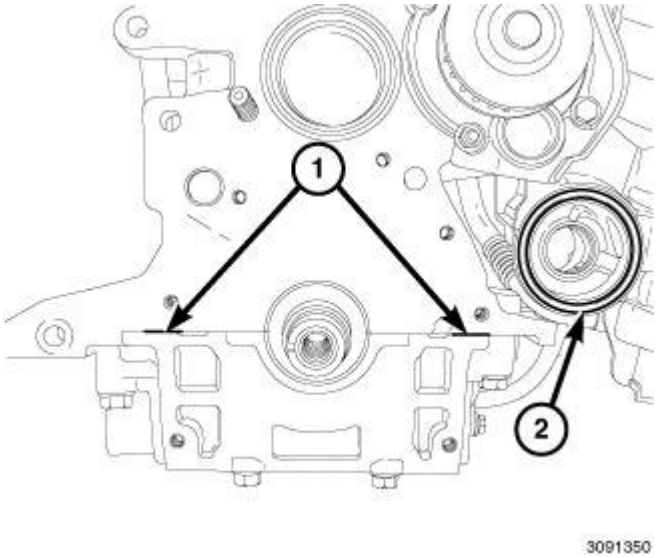


Fig. 532: RTV Sealant & Oil Filter Housing Seal
Courtesy of CHRYSLER GROUP, LLC

3. Install a new oil filter housing seal (2) onto the oil filter housing.
4. Clean the cylinder block and bedplate mating surfaces with isopropyl alcohol in preparation for sealant application.

CAUTION: Engine assembly requires the use of a unique sealant that is compatible with engine oil. Using a sealant other than Mopar® Engine RTV GEN II may result in engine fluid leakage.

CAUTION: Following the application of Mopar® Engine RTV GEN II to the gasket surfaces, the components must be assembled within 10 minutes and the attaching fasteners must be tightened to specification within the next 10 minutes. Prolonged exposure to the air prior to assembly may result in engine fluid leakage.

5. Apply a 2 to 3 mm wide bead of Mopar® Engine RTV GEN II sealant (1) to the two cylinder block to bedplate T-joints as shown in illustration.

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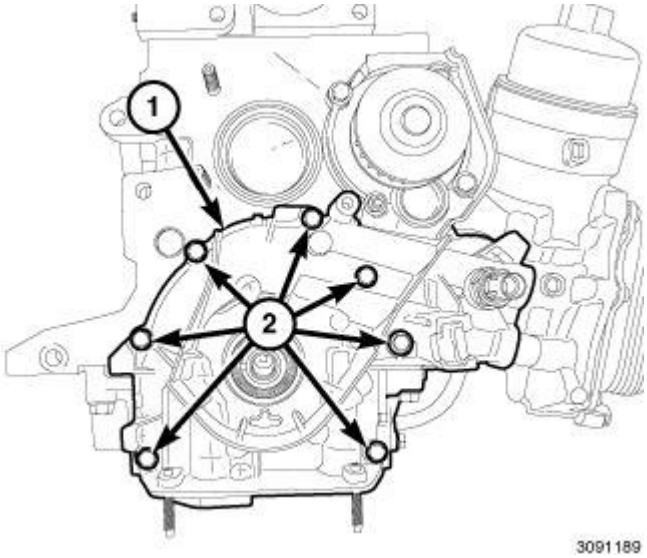


Fig. 533: Oil Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

6. Install the oil pump and gasket (1) with seven bolts (2) hand tight.

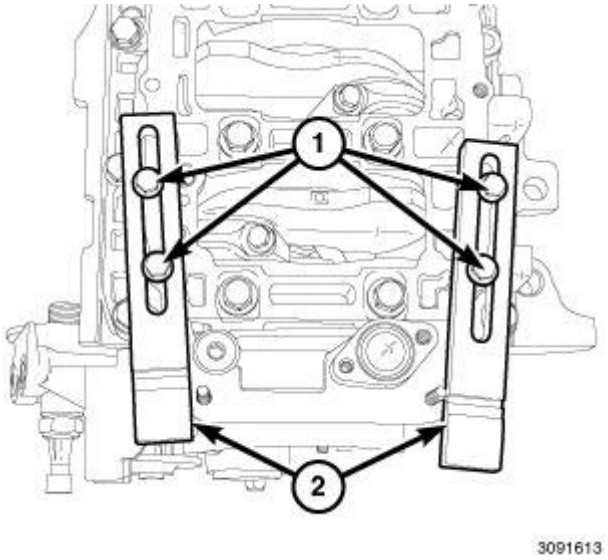


Fig. 534: Alignment Fixture & Bolts
Courtesy of CHRYSLER GROUP, LLC

7. Attach the (special tool #8225, Alignment Fixture) (2) to the oil pan mounting flange using the oil pan bolts (1). Tighten the bolts to 9 N.m (80 in. lbs.).

NOTE: Make sure that the "2.7L" stamped on the alignment fixture is facing the cylinder block (flat side of tools against oil pan mounting flange).

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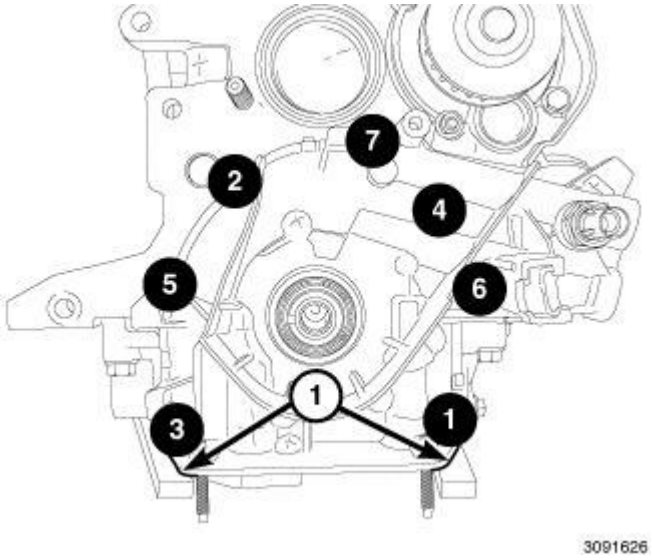


Fig. 535: Oil Pump Flange Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

8. Allow the oil pump to center itself on the crankshaft and position the oil pump so that the distance between the oil pump flange and the alignment fixture is equal on both sides (1).

NOTE: Do not force the oil pump flange down against the alignment fixture.

9. While maintaining this alignment, tighten the seven bolts in the sequence shown in illustration to 10 N.m (89 in. lbs.).

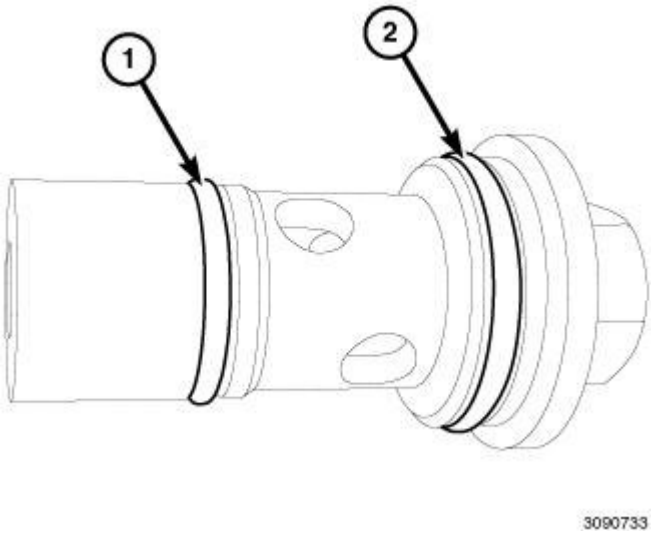


Fig. 536: O-Ring Seals
Courtesy of CHRYSLER GROUP, LLC

10. Install new O-ring seals (1 and 2) on the oil filter housing to oil pump bolt.

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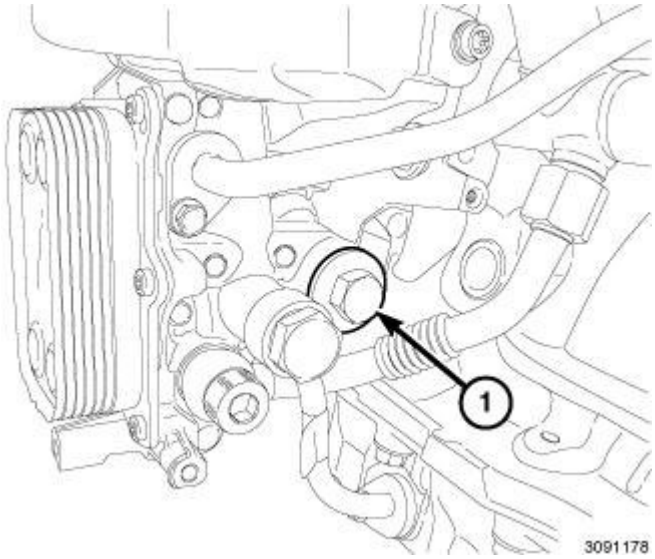


Fig. 537: Oil Pump Bolt
Courtesy of CHRYSLER GROUP, LLC

11. Install the oil filter housing to oil pump bolt (1) and tighten to 45 N.m (33 ft. lbs.).

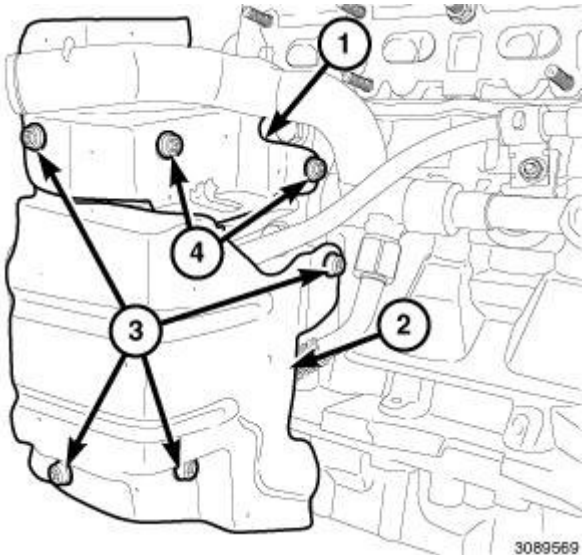


Fig. 538: Upper And Lower Oil Cooler Housing Heat Shields & Fasteners
Courtesy of CHRYSLER GROUP, LLC

12. Install the lower oil cooler housing heatshield (2) with four bolts tightened to 3 N.m (26 in. lbs.).

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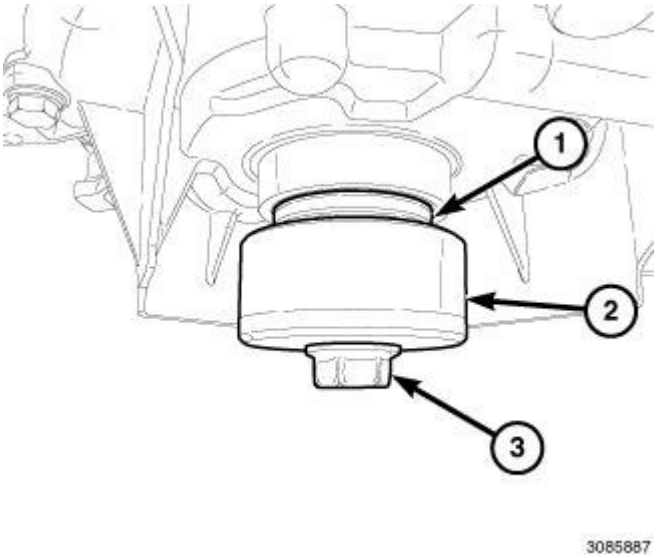


Fig. 539: Oil Seal, Installer & Bolt
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When the timing belt is removed and the cylinder head is still installed, DO NOT rotate the camshaft or crankshaft without first locating the proper crankshaft position. Failure to do so will result in valve and/or piston damage.

13. If removed, install the front crankshaft oil seal (1). Refer to **SEAL, CRANKSHAFT OIL, FRONT, INSTALLATION**.

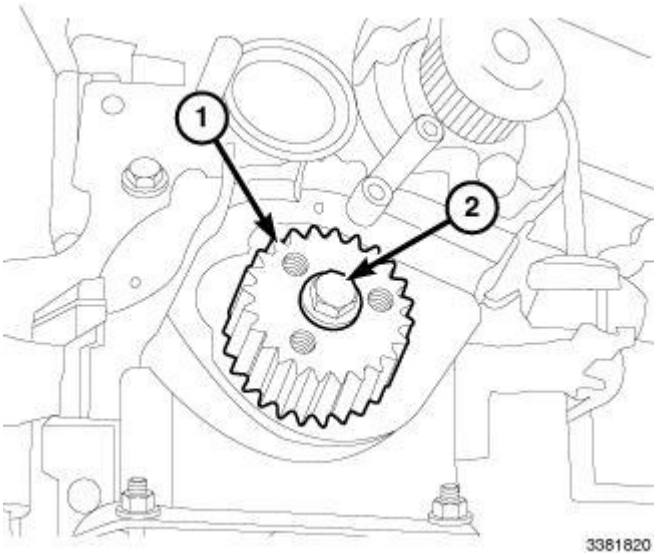


Fig. 540: Crankshaft Sprocket & Bolt
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When the timing belt is removed and the cylinder head is still installed, DO NOT rotate the camshaft or crankshaft without first

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locating the proper crankshaft position. Failure to do so will result in valve and/or piston damage.

14. Align the crankshaft sprocket locator key to the crankshaft keyway and install the sprocket (1) with a new bolt (2) on the crankshaft. Hand tighten the bolt (2) at this time. The bolt (2) will be tightened to specification after the timing belt is installed.

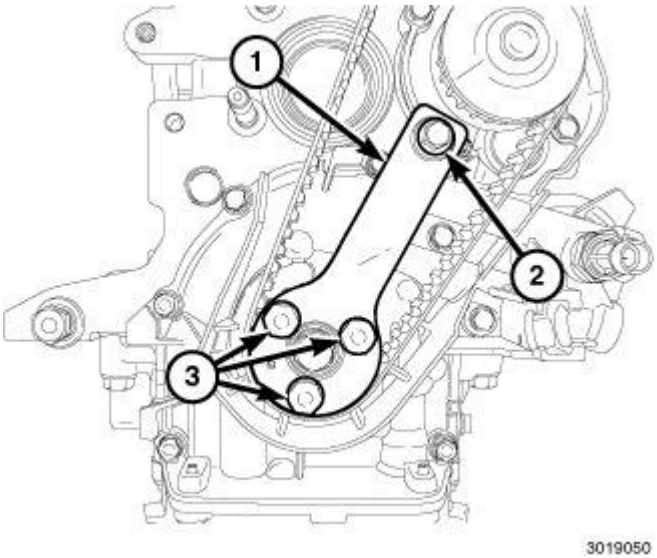


Fig. 541: Crankshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

15. Install the (special tool #10276, Tool, Crankshaft Timing Locking) (1) with three bolts (3) tightened to 25 N.m (18 ft. lbs.) and one bolt (2) tightened to 9 N.m (80 in. lbs.).

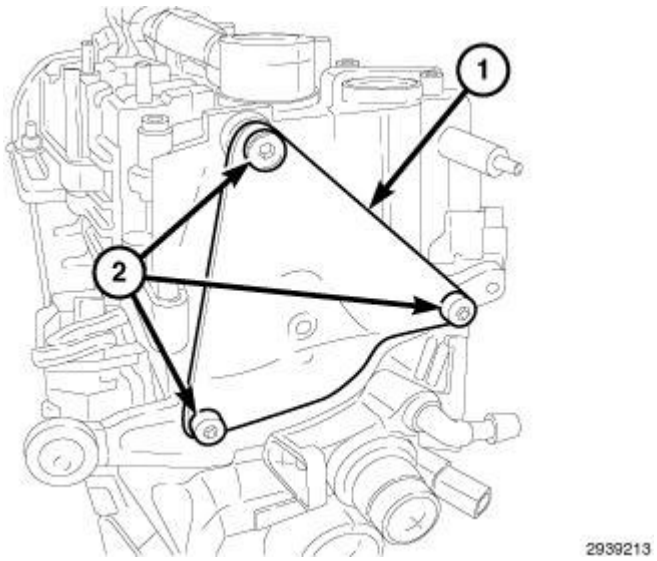


Fig. 542: Camshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

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16. If removed, install the (special tool #10277, Tool, Camshaft Timing Locking) (1) to the rear of the camshaft. Install three bolts (2) and tighten to 20 N.m (15 ft. lbs.).
17. Support the engine with a floor jack positioned under the bedplate.
18. Carefully raise the front of the engine and remove the bolts and the RH engine mount bracket that were temporarily reinstalled at disassembly.

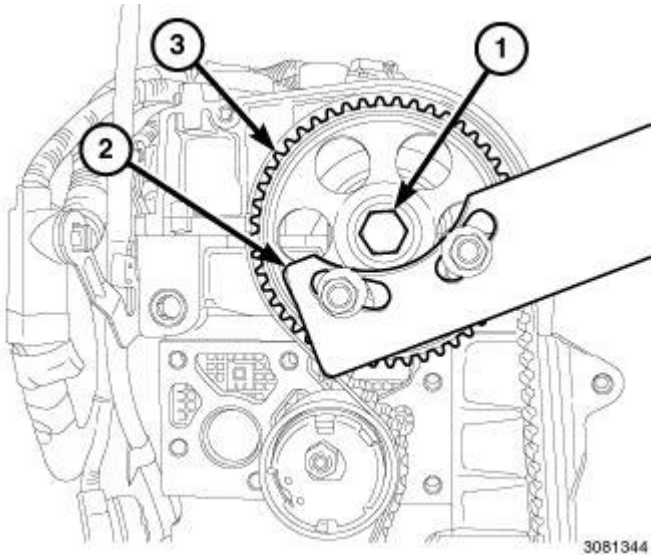


Fig. 543: Camshaft Sprocket, Holder & Bolt
Courtesy of CHRYSLER GROUP, LLC

19. Use the (special tool #6847, Holder, Camshaft Sprocket) (2) to hold the camshaft sprocket (3) and loosen the bolt (1). The camshaft sprocket (3) should now be free to rotate on the camshaft.

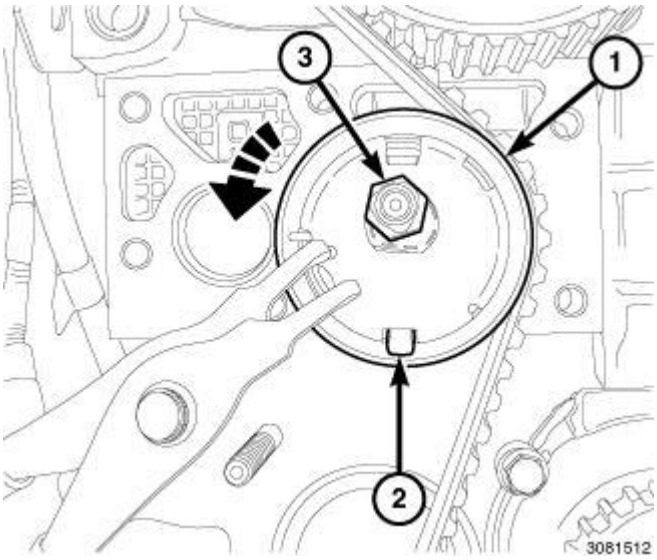


Fig. 544: Timing Belt Tensioner, Silver Tab & Lock Nut
Courtesy of CHRYSLER GROUP, LLC

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NOTE: If the original timing belt (1) is being reused, install the belt so that it maintains the same direction of rotation as when it was removed.

20. Install the timing belt starting with the crankshaft sprocket, then the water pump sprocket, finishing with the camshaft sprocket.
21. Install the timing belt tensioner (1) and adjust the tensioner so that the silver tab (2) is centered in the middle of the window. Tighten the lock nut (3) to 28 N.m (21 ft. lbs.).

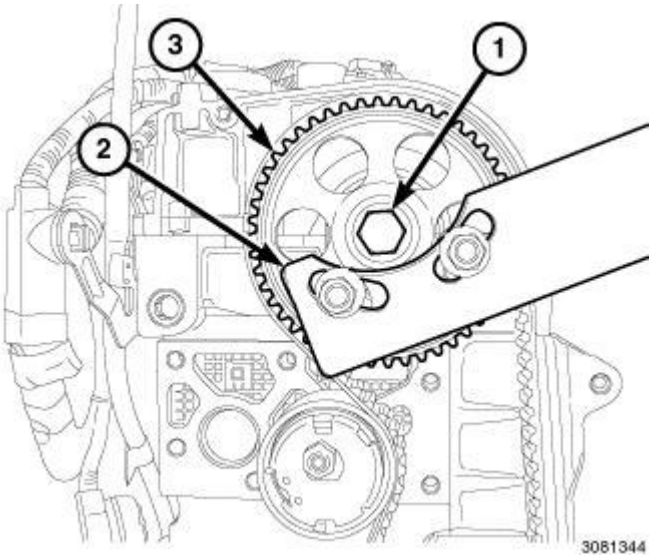


Fig. 545: Camshaft Sprocket, Holder & Bolt
Courtesy of CHRYSLER GROUP, LLC

22. Use the (special tool #6847, Holder, Camshaft Sprocket) (2) to hold the camshaft sprocket (3) and tighten the camshaft sprocket bolt (1) to 120 N.m (88 ft. lbs.).

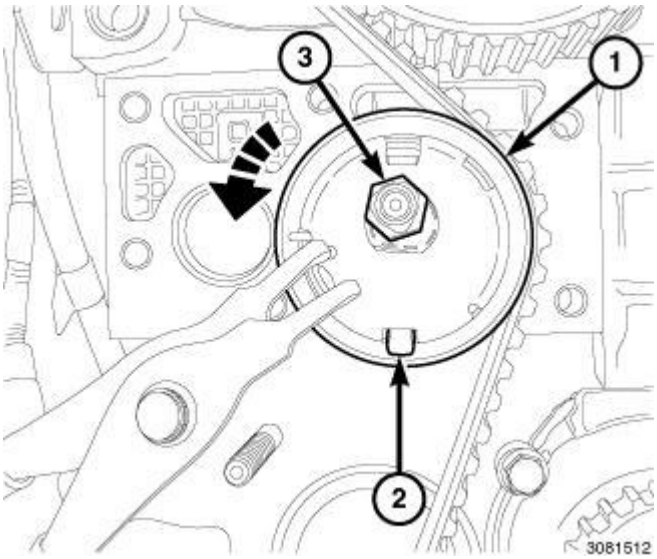


Fig. 546: Timing Belt Tensioner, Silver Tab & Lock Nut
Courtesy of CHRYSLER GROUP, LLC

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23. Remove the (special tool #10277, Tool, Camshaft Timing Locking) and the (special tool #10276, Tool, Crankshaft Timing Locking).
24. Rotate the crankshaft clockwise at least two complete revolutions to center the timing belt on the sprockets.
25. Verify that the silver tab (2) is still centered in the middle of the window. If required, loosen the tensioner lock nut (3), readjust the timing belt tensioner (2) and tighten the lock nut (3) to 28 N.m (21 ft. lbs.).

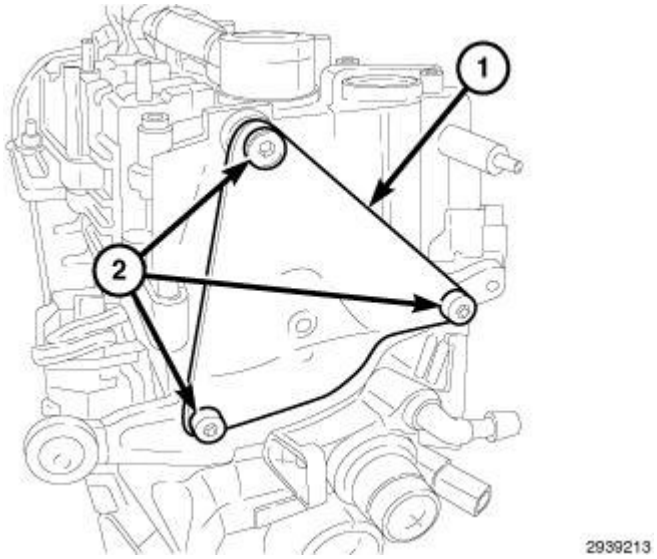
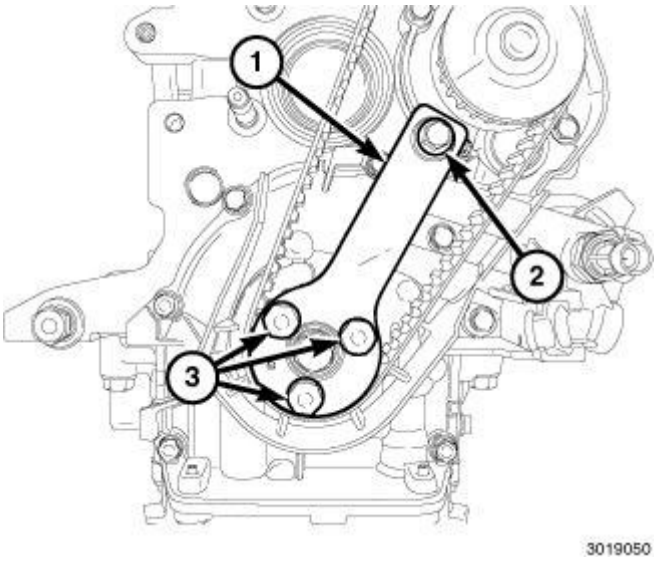


Fig. 547: Camshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

NOTE: Reinstall the timing locking tools to verify correct camshaft timing.

26. Install the (special tool #10277, Tool, Camshaft Timing Locking) (1) to the rear of the camshaft. Install three bolts (2) and tighten to 20 N.m (15 ft. lbs.).



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Fig. 548: Crankshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

27. Install the (special tool #10276, Tool, Crankshaft Timing Locking) (1) with three bolts (3) tightened to 25 N.m (18 ft. lbs.) and one bolt (2) tightened to 9 N.m (80 in. lbs.).

NOTE: If the bolt (2) does not align with the lower timing belt cover mounting boss, the camshaft timing is not correct. Loosen the tensioner lock nut and the camshaft sprocket bolt and repeat this procedure.

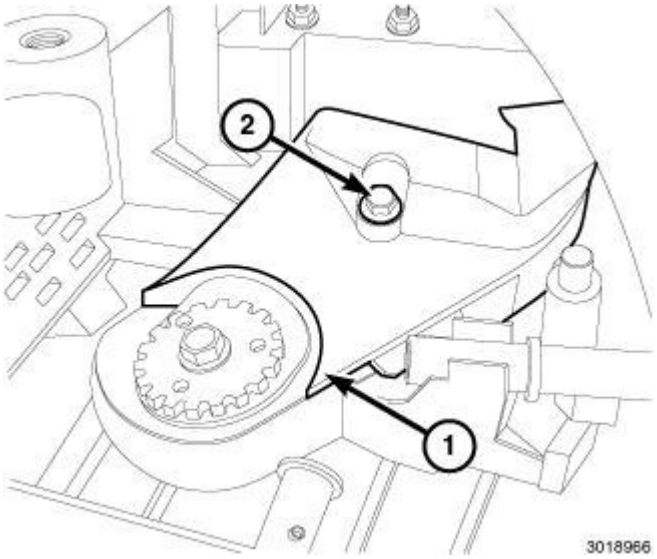


Fig. 549: Lower Timing Belt Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

28. Remove the (special tool #10277, Tool, Camshaft Timing Locking) and the (special tool #10276, Tool, Crankshaft Timing Locking).
29. Install the lower timing belt cover (1) with bolt (2) tightened to 9 N.m (80 in. lbs.).
30. Install the RH engine mount bracket. Refer to **BRACKET, ENGINE MOUNT, RIGHT, INSTALLATION**.

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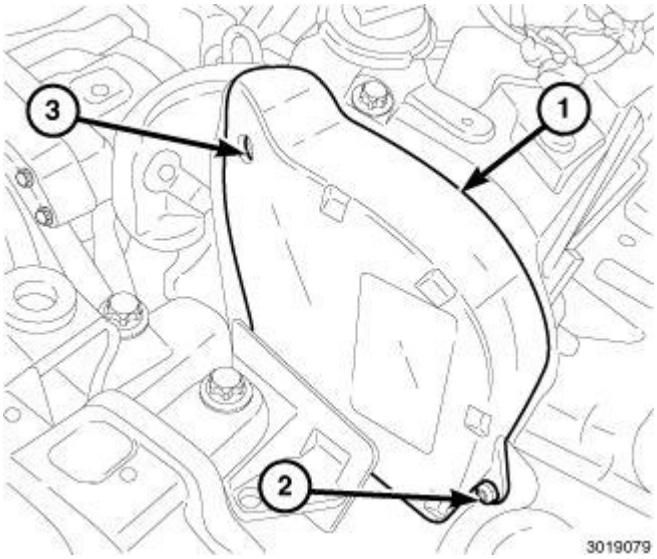


Fig. 550: Upper Timing Belt Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

31. Install the upper timing belt cover (1) with two bolts (2 and 3) tightened to 9 N.m (80 in. lbs.).

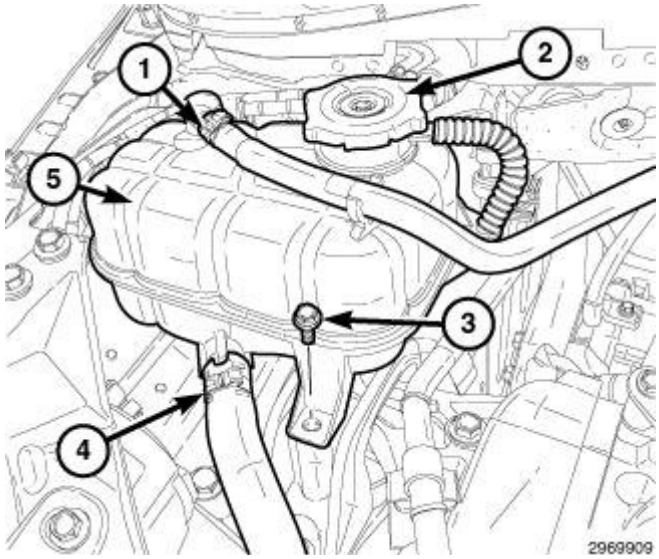


Fig. 551: Return Hose, Lower Supply Hose, Mounting Screw & Coolant Recovery Bottle
Courtesy of CHRYSLER GROUP, LLC

32. Install the pressurized coolant bottle (5). Refer to **BOTTLE, PRESSURIZED COOLANT, INSTALLATION** .

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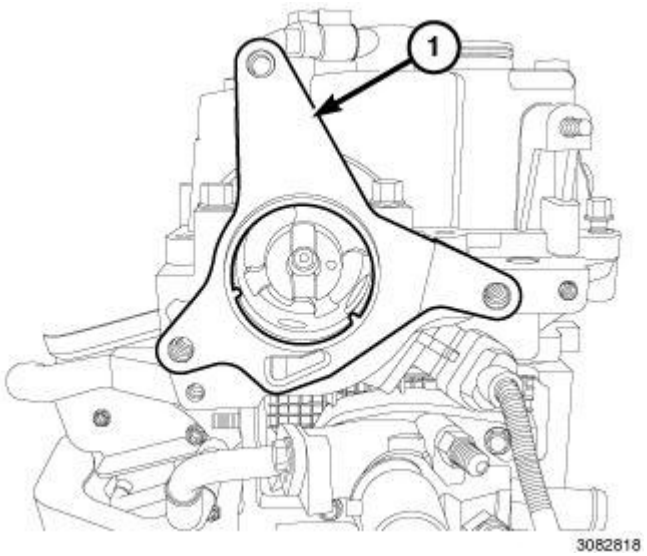


Fig. 552: Vacuum Pump Gasket
Courtesy of CHRYSLER GROUP, LLC

33. Clean the mating surfaces of the cylinder head and the vacuum pump. Install a new vacuum pump gasket (1).

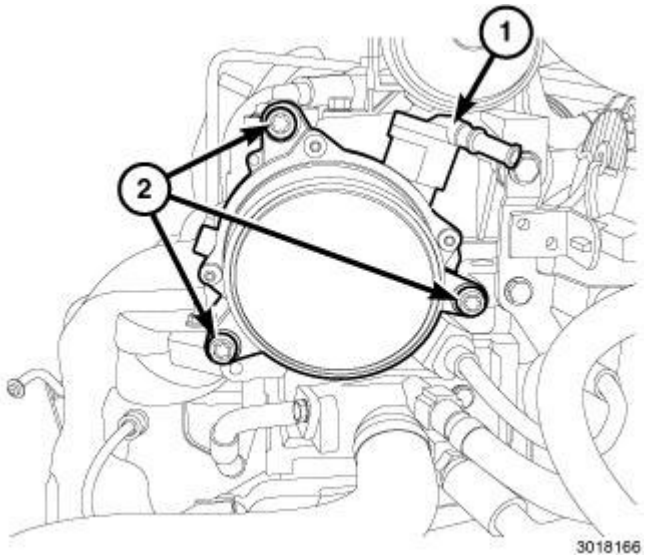


Fig. 553: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

34. Align the pump drive tab with the pump drive slot located on the cam shaft.
35. Install the vacuum pump mounting bolts (2). Tighten the bolts to 20 N.m (15 ft. lbs.).
36. Connect the vacuum supply line to the pump (1).

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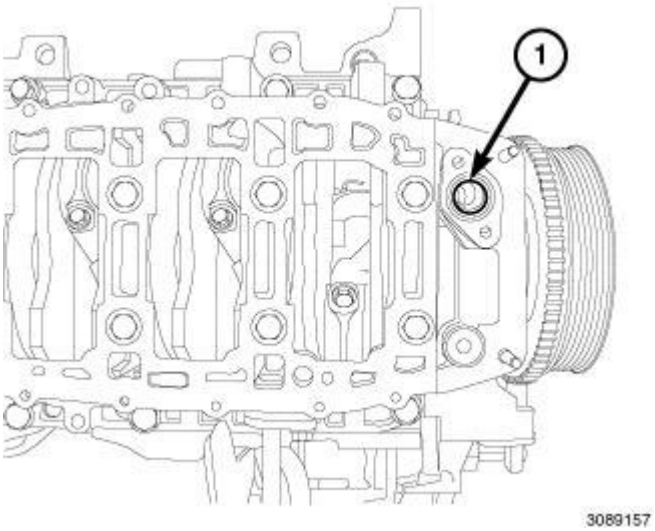


Fig. 554: Oil Pump O-Ring Seal
Courtesy of CHRYSLER GROUP, LLC

37. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
38. Lightly lubricate the new O-ring seal (1) with engine oil and install on the oil pump.

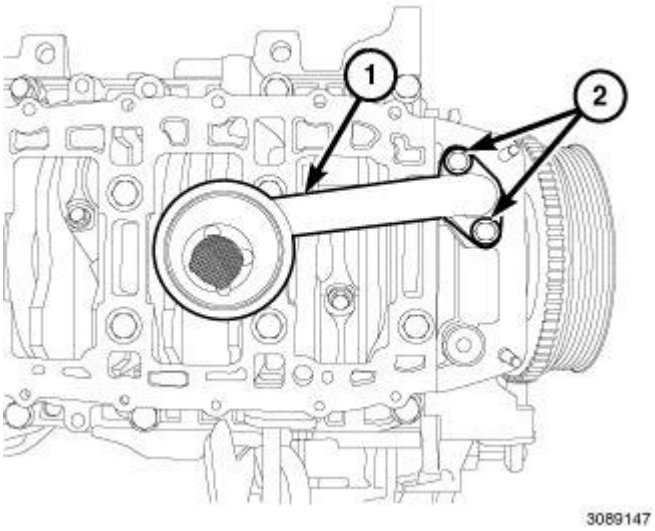


Fig. 555: Oil Pick-Up Tube & Bolts
Courtesy of CHRYSLER GROUP, LLC

39. Install the oil pick-up tube (1) with two bolts (2) tightened to 10 N.m (89 in. lbs.).

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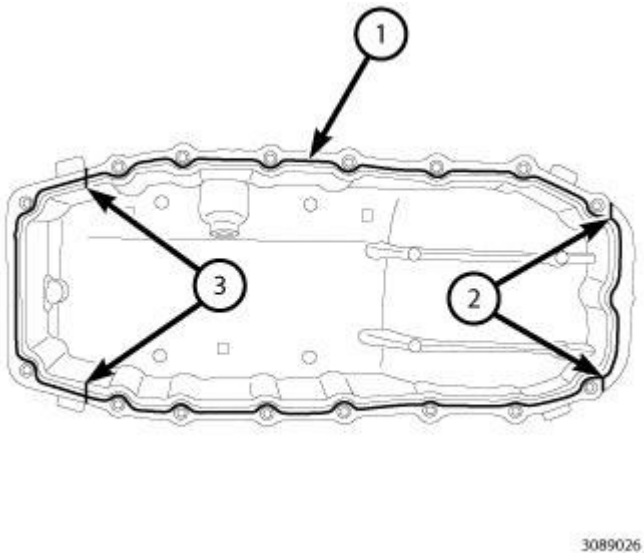


Fig. 556: Oil Pan Sealant Locations
Courtesy of CHRYSLER GROUP, LLC

40. Clean the oil pan, engine block, oil pump and rear seal retainer mating surfaces with isopropyl alcohol in preparation for sealant application.

CAUTION: Engine assembly requires the use of a unique sealant that is compatible with engine oil. Using a sealant other than Mopar® Engine RTV GEN II may result in engine fluid leakage.

CAUTION: Following the application of Mopar® Engine RTV GEN II to the gasket surfaces, the components must be assembled within 10 minutes and the attaching fasteners must be tightened to specification within the next 10 minutes. Prolonged exposure to the air prior to assembly may result in engine fluid leakage.

41. Apply a 2 to 3 mm wide bead of Mopar® Engine RTV GEN II sealant to the oil pan as shown in illustration in the following locations:
    - Oil pan to engine block flange (1)
    - Two oil pump to engine block T-joints (3)
    - Two rear seal retainer to engine block T-joints (2)

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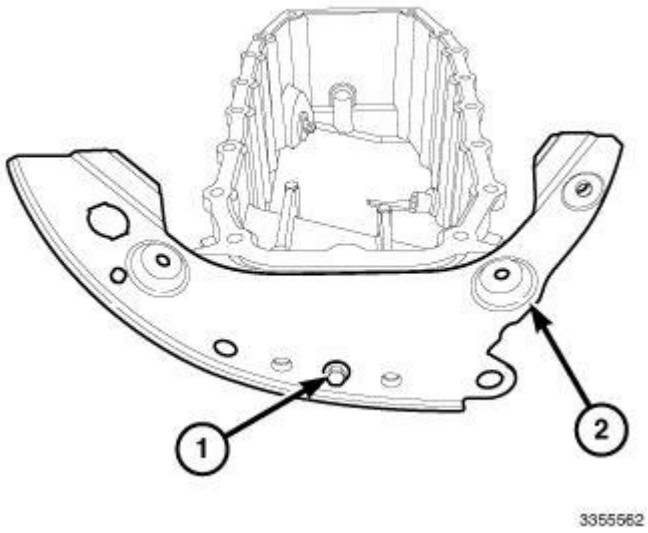


Fig. 557: Flywheel Dust Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

42. Install the flywheel dust cover (2) to the oil pan. Tighten the bolt (1) to 9 N.m (80 in. lbs.).

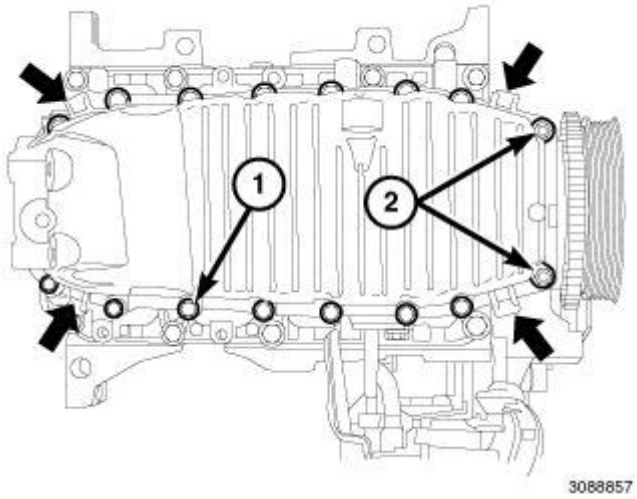


Fig. 558: Oil Pan Flange Fasteners
Courtesy of CHRYSLER GROUP, LLC

43. Install the oil pan with fourteen bolts (1), two studs and two nuts (2) hand tight.

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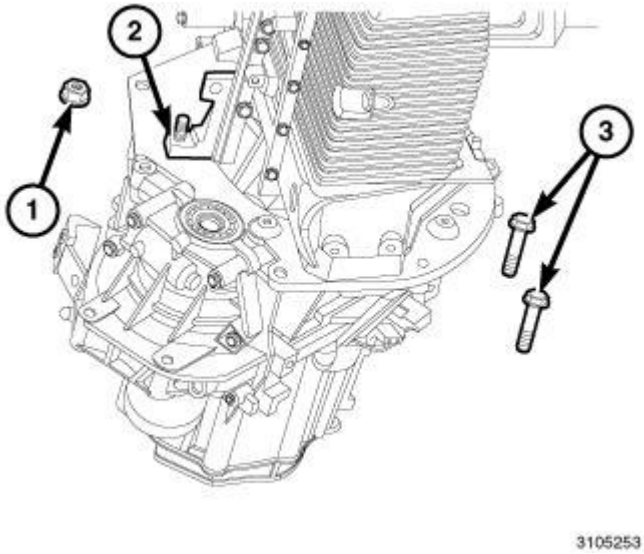


Fig. 559: Transmission Bell Housing Bolts, Nut & Stud
Courtesy of CHRYSLER GROUP, LLC

44. Install the two lower transmission bell housing bolts (3) and tighten to 40 N.m (30 ft. lbs.).

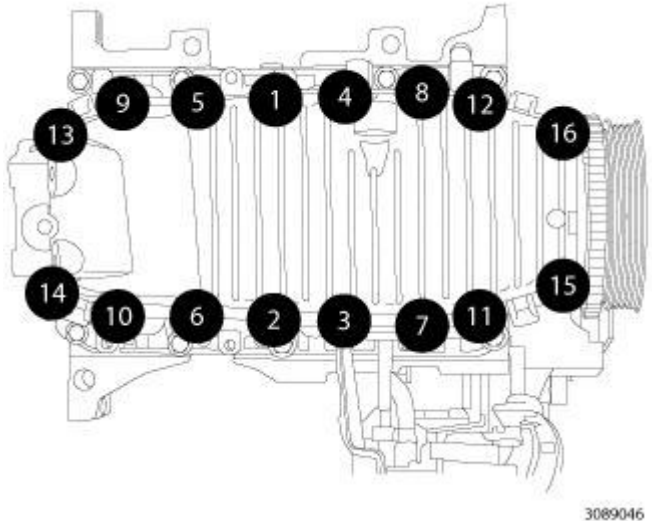


Fig. 560: Oil Pan Fastener Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

45. Tighten the sixteen oil pan fasteners in two steps following the sequence shown in illustration:
    - Step 1: All to 4 N.m (35 in. lbs.).
    - Step 2: All to 9 N.m (80 in. lbs.).

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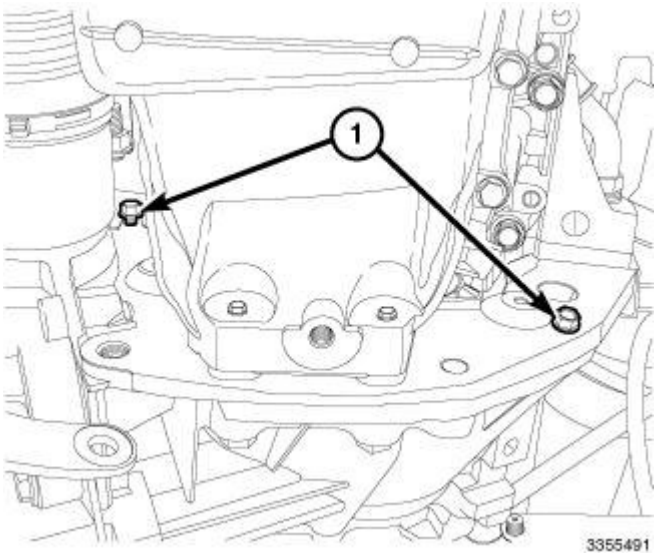


Fig. 561: Flywheel Dust Cover Bolts
Courtesy of CHRYSLER GROUP, LLC

46. Install the two bolts (1) to the flywheel dust cover and tighten to 9 N.m (80 in. lbs.).
47. Lower the vehicle.
48. Install the catalytic converter. Refer to **CONVERTER, CATALYTIC, INSTALLATION** .
49. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
50. Install the exhaust crossunder pipe. Refer to **PIPE, EXHAUST CROSSUNDER, INSTALLATION** .

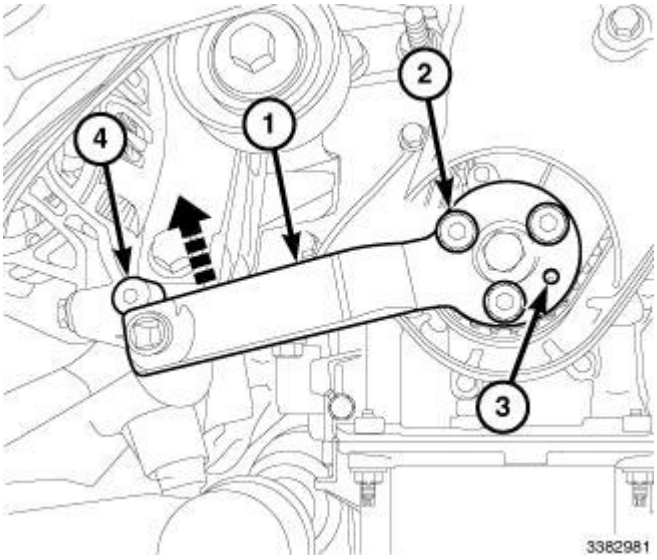


Fig. 562: Crankshaft Sprocket Holder, Clearance Hole & Bolts
Courtesy of CHRYSLER GROUP, LLC

51. Position the (special tool #10307, Holder, Crankshaft Sprocket) (1) against the accessory bracket boss (4) as shown in illustration.
52. Rotate the crankshaft until the vibration damper locating pin is centered in the clearance hole (3).

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53. Install the (special tool #10307, Holder, Crankshaft Sprocket) (1) with three bolts (2) tightened to 25 N.m (15 ft. lbs.).

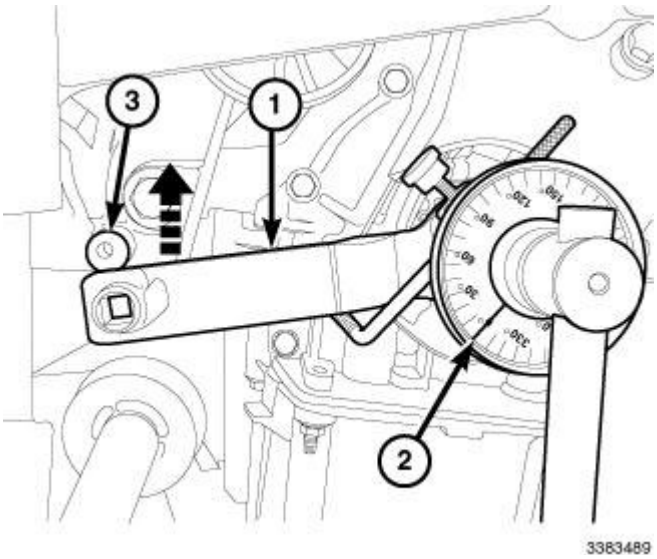


Fig. 563: Tightening Crankshaft Bolt An Additional 110 Degrees
Courtesy of CHRYSLER GROUP, LLC

54. With the (special tool #10307, Holder, Crankshaft Sprocket) (1) resting against the accessory bracket boss (3), initially tighten the crankshaft bolt to 20 N.m (15 ft. lbs.).
55. Using a torque angle measuring device, such as OTC Torque Angle Gauge 4554 (2), tighten the crankshaft bolt an additional 110 degrees.

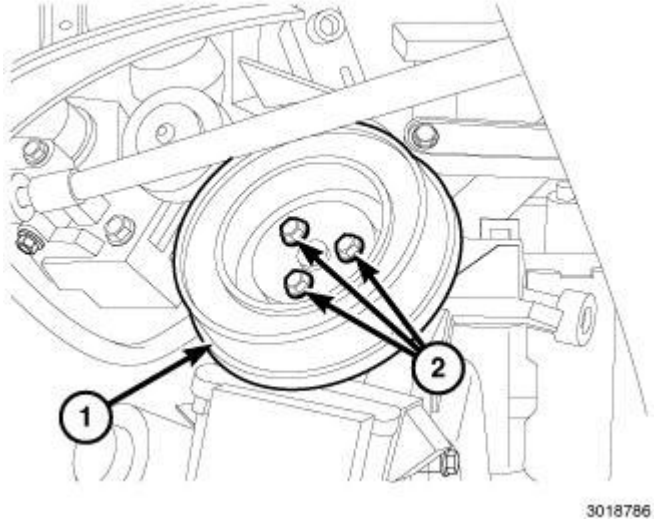


Fig. 564: Vibration Damper & Bolts
Courtesy of CHRYSLER GROUP, LLC

56. Align the locator pin on the crankshaft sprocket with the hole in the vibration damper (1). Install the vibration damper (1) with three bolts (2) tightened to 25 N.m (19 ft. lbs.).

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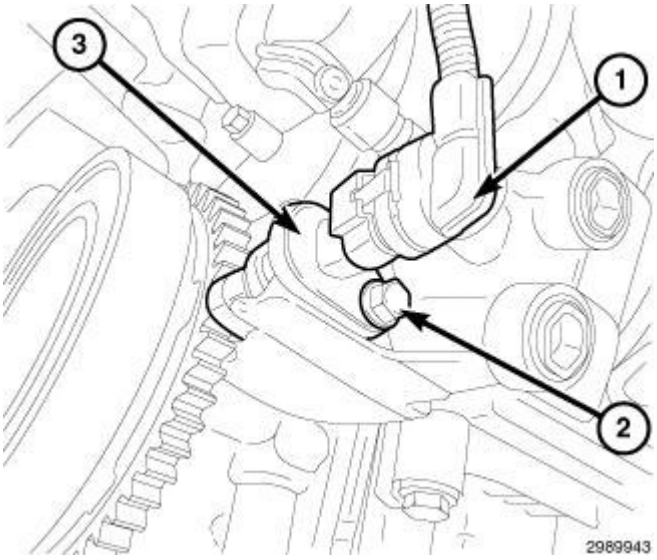


Fig. 565: Crankshaft Position Sensor, Connector & Bolt
Courtesy of CHRYSLER GROUP, LLC

57. Install the crankshaft position sensor (3) with mounting bolt (2). Tighten the mounting bolt to 9 N.m (80 in. lbs.).
58. Connect the electrical connector (1).

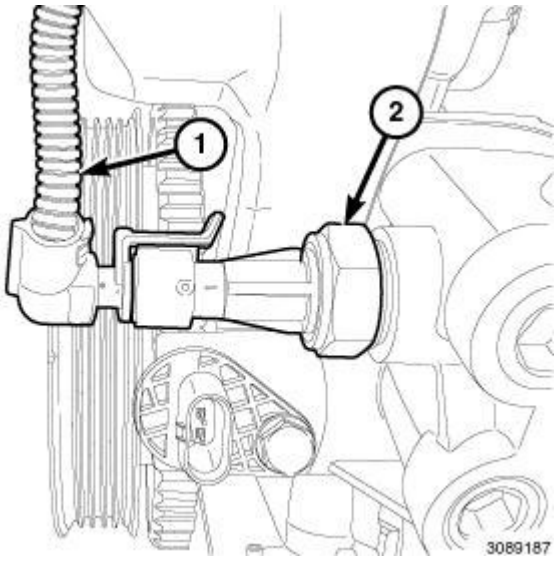


Fig. 566: Oil Pressure Switch & Connector
Courtesy of CHRYSLER GROUP, LLC

NOTE: The oil pressure switch has a lock patch on the threads and if removed can not be reinstalled.

59. Install a new oil pressure switch (2) and tighten to 32 N.m (24 ft. lbs.).
60. Connect the oil pressure switch electrical connector (1).

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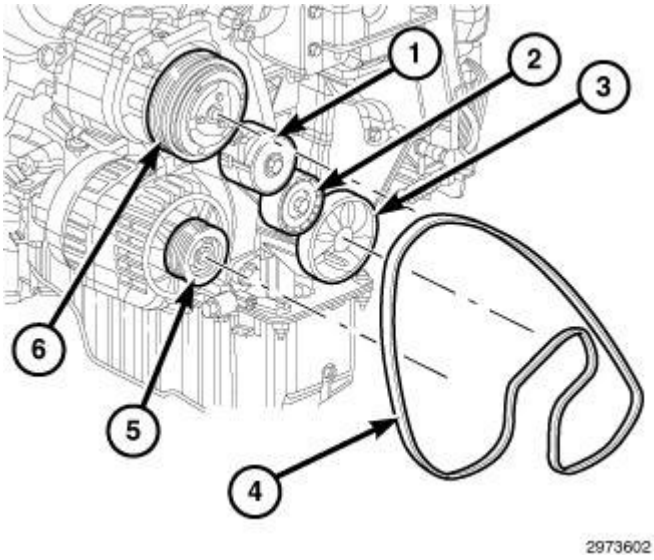


Fig. 567: Drive Belt Tensioners & Assembly With Drive Belt Routing
Courtesy of CHRYSLER GROUP, LLC

61. Install the accessory drive belt (4). Refer to **BELT, SERPENTINE, INSTALLATION** .

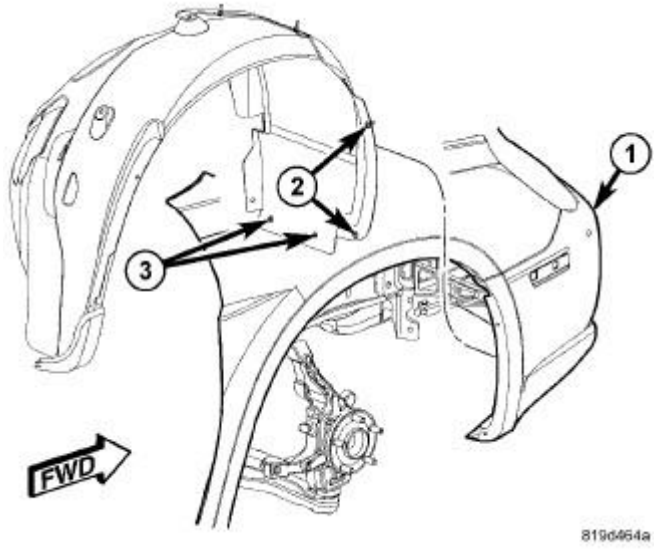


Fig. 568: Removing/Installing Front Splash Shields
Courtesy of CHRYSLER GROUP, LLC

62. Install the wheel well liner. Install the push pins (3) and the screws (2).
63. Install the right front wheel and tire assembly. Refer to **INSTALLATION** .

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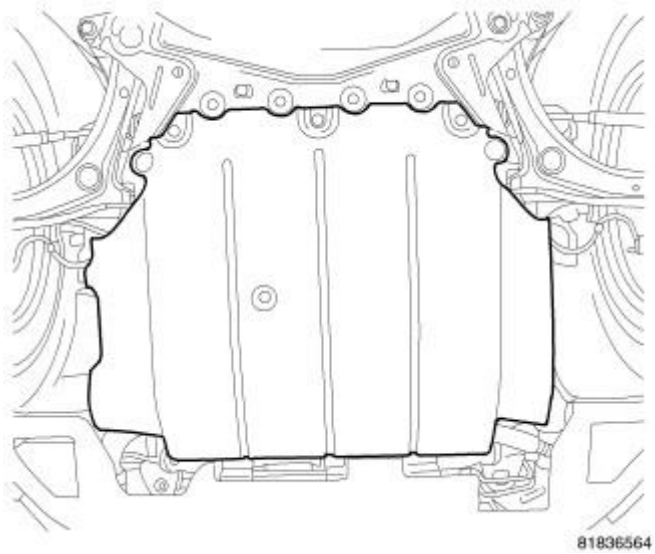


Fig. 569: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

64. Install the belly pan. Refer to **BELLY PAN, INSTALLATION** .
65. Lower the vehicle.

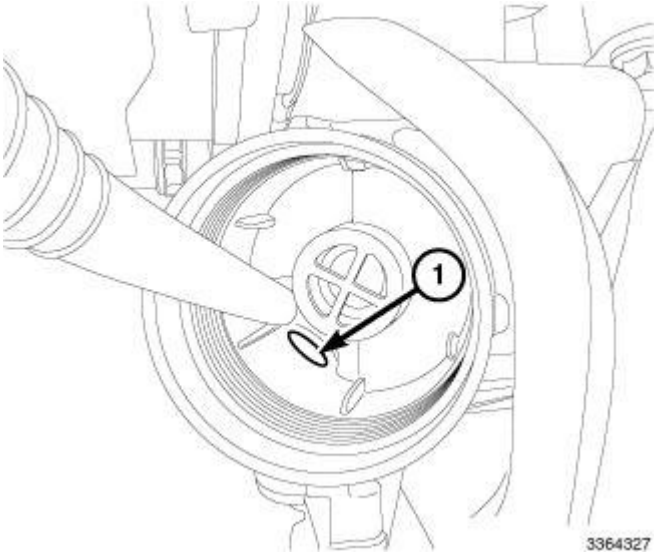


Fig. 570: Side Port (Filter Inlet)
Courtesy of CHRYSLER GROUP, LLC

NOTE: A new engine oil pump must be primed with oil before engine operation.

66. If installing a new engine oil pump, remove the oil filter and prime the new pump through the oil filter housing with approximately 0.5 liter (0.5 quart) of engine oil. Direct the oil into the side port (filter inlet) (1) as shown in illustration and not the center port (filter outlet). Refer to **FILTER, ENGINE OIL, REMOVAL**.
67. Install the air cleaner body (6). Refer to **BODY, AIR CLEANER, INSTALLATION**.

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68. If removed, install the oil filter and fill the engine crankcase with the proper oil to the correct level. Refer to **STANDARD PROCEDURE** .
69. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
70. Install the engine cover.
71. Start and run the engine until it reaches normal operating temperature. Check cooling system for correct fluid level. Refer to **STANDARD PROCEDURE** .

NOTE: The Cam/Crank Variation Relearn procedure must be performed using the scan tool anytime there has been a repair/replacement made to a powertrain system, for example: flywheel, valvetrain, camshaft and/or crankshaft sensors or components. Refer to the appropriate Diagnostic Information .

SENSOR, OIL TEMPERATURE

DESCRIPTION

DESCRIPTION

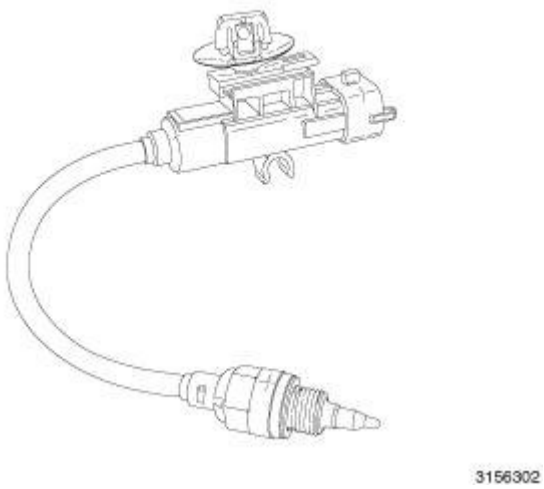


Fig. 571: Oil Temperature Sensor
Courtesy of CHRYSLER GROUP, LLC

The oil temperature sensor is a two wire sensor located on the variable valve actuation assembly. The sensor probe is mounted to the variable valve actuation assembly through an access hole. A compression washer seals the oil temperature sensor to the variable valve actuation assembly.

OPERATION

OPERATION

The oil temperature sensor is a variable resistor that measures the temperature of the engine oil. The Powertrain Control Module (PCM) supplies a 5 volt reference and a ground to the sensors low reference signal circuit.

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When the oil temperature is low, the sensor resistance is high. When the oil temperature is high, the sensor resistance is low.

REMOVAL

REMOVAL

1. Remove the air cleaner body. Refer to **BODY, AIR CLEANER, REMOVAL**.

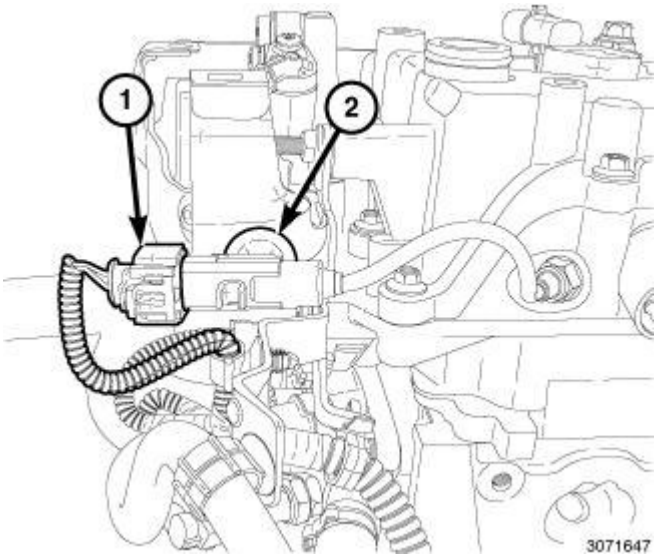


Fig. 572: Oil Temperature Sensor Electrical Connector & Bracket
Courtesy of CHRYSLER GROUP, LLC

2. Unlock and disconnect the oil temperature sensor harness connector (1).
3. Disengage the oil temperature harness connector from the bracket (2).

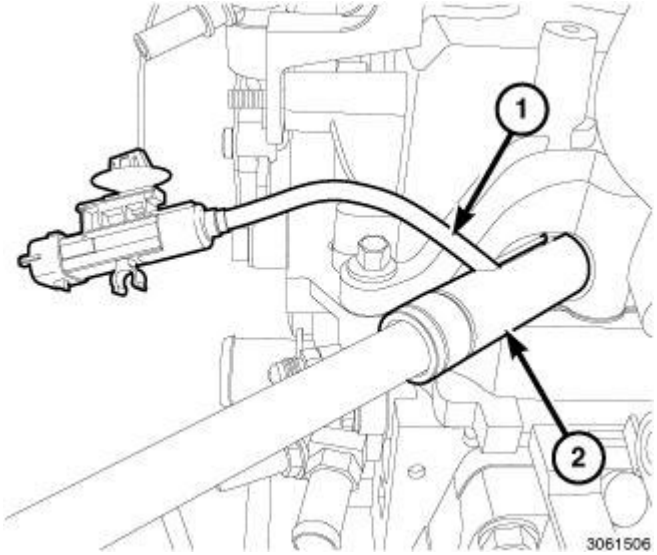


Fig. 573: Remove/Install Oil Temperature Sensor

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Courtesy of CHRYSLER GROUP, LLC

4. Use an appropriate socket (2) and remove the oil temperature sensor (1).

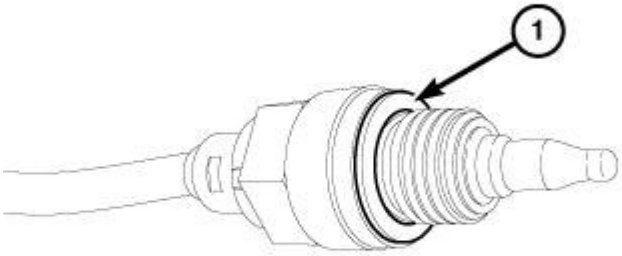


Fig. 574: Oil Temperature Sensor Gasket
Courtesy of CHRYSLER GROUP, LLC

5. The oil temperature sensor gasket (1) can be reused if not damaged.

INSTALLATION

INSTALLATION

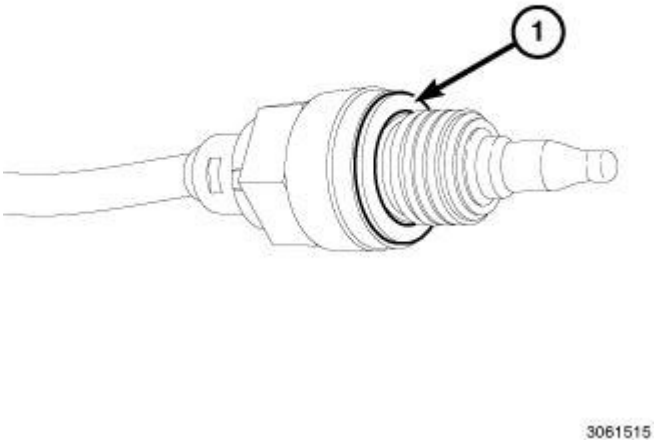


Fig. 575: Oil Temperature Sensor Gasket
Courtesy of CHRYSLER GROUP, LLC

1. The oil temperature sensor gasket (1) can be reused if not damaged. Lightly lubricate the sensor threads

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with clean engine oil.

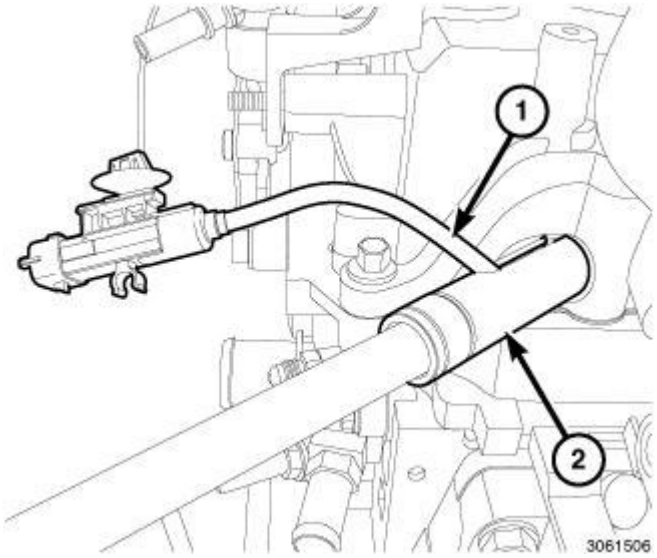


Fig. 576: Remove/Install Oil Temperature Sensor
Courtesy of CHRYSLER GROUP, LLC

2. Use an appropriate socket (2) and install the oil temperature sensor (1). Tighten the oil temperature sensor to 18 N.m (13 ft. lbs.).

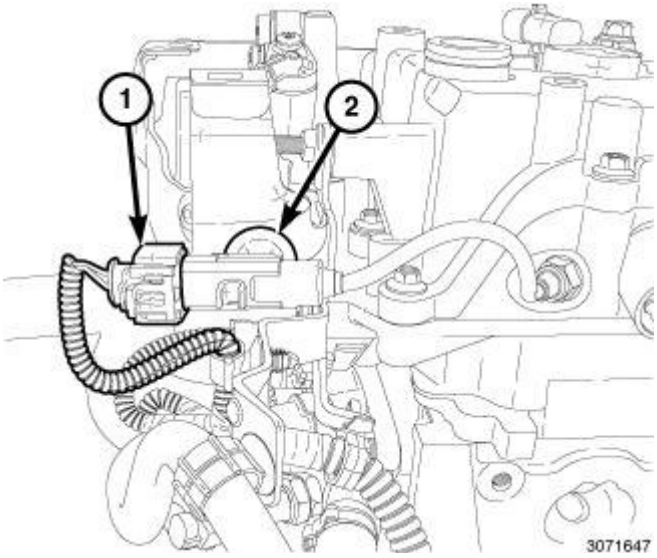


Fig. 577: Oil Temperature Sensor Electrical Connector & Bracket
Courtesy of CHRYSLER GROUP, LLC

3. Engage the oil temperature harness connector to the bracket (2).
4. Connect and lock the oil temperature sensor harness connector (1).
5. Install the air cleaner body. Refer to **BODY, AIR CLEANER, INSTALLATION**.

SWITCH, OIL PRESSURE

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DESCRIPTION

DESCRIPTION

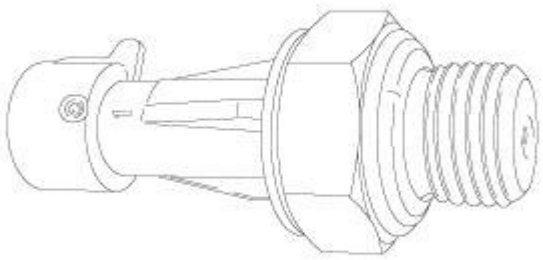


Fig. 578: Oil Pressure Switch
Courtesy of CHRYSLER GROUP, LLC

The oil pressure switch is mounted on the oil pump housing on the left front side of the engine. The oil pressure switch is a pressure sensitive switch that is activated by the engine's oil pressure. The switch is a two terminal device (one terminal is provided to the wiring harness and the other terminal is the switch's metal housing that screws into the engine block).

OPERATION

OPERATION

The oil pressure switch is normally "Closed." The switch changes from a "Closed" circuit to an "Open" circuit, on increasing pressure of 48 kPa (7 psig). The oil pressure switch changes from an "Open" circuit to a "Closed" circuit, on decreasing pressure, between 14 kPa (2 psig) and 28 kPa (4 psig).

REMOVAL

REMOVAL

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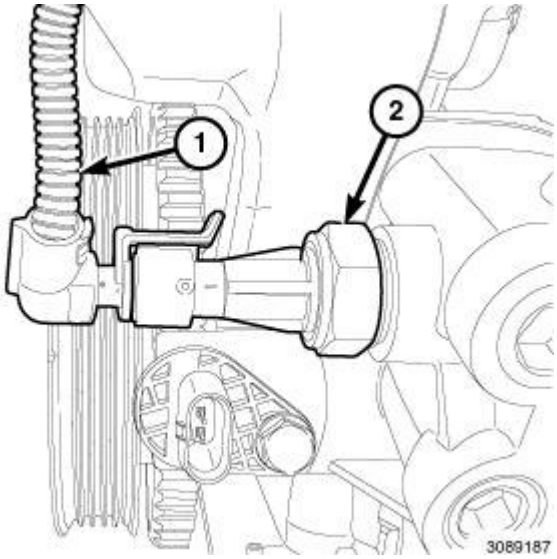


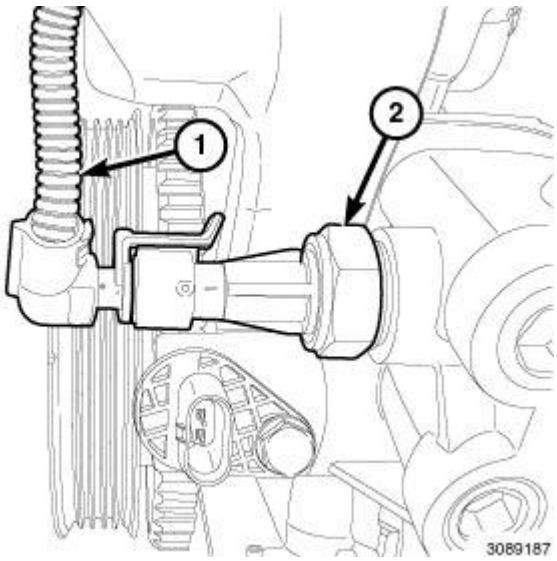
Fig. 579: Oil Pressure Switch & Connector
Courtesy of CHRYSLER GROUP, LLC

NOTE: The oil pressure switch has a lock patch on the threads and if removed can not be reinstalled.

1. Disconnect the battery cable.
2. Raise the vehicle.
3. If equipped, remove the lower belly pan.
4. Disconnect the oil pressure switch electrical connector (1).
5. Remove the oil pressure switch (2) from the oil pump housing.

INSTALLATION

INSTALLATION



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Fig. 580: Oil Pressure Switch & Connector
Courtesy of CHRYSLER GROUP, LLC

NOTE: The oil pressure switch has a lock patch on the threads and if removed can not be reinstalled.

1. Install the oil pressure switch (2) and tighten to 32 N.m (24 ft. lbs.).
2. Connect the oil pressure switch electrical connector (1).
3. If equipped, install the lower belly pan.
4. Lower the vehicle.
5. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).

MANIFOLDS

MANIFOLD, EXHAUST

REMOVAL

REMOVAL

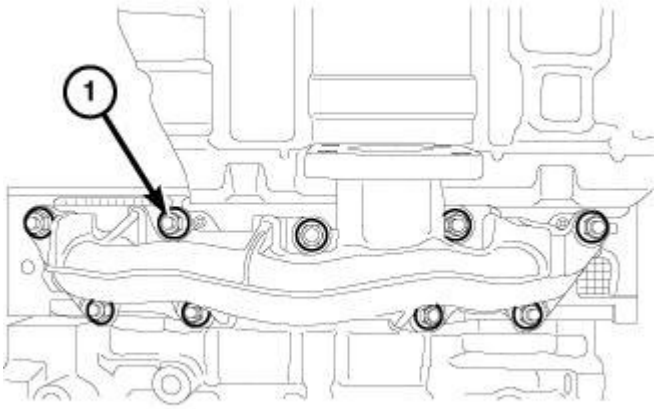


Fig. 581: Exhaust Manifold Nuts
Courtesy of CHRYSLER GROUP, LLC

NOTE: The turbocharger and exhaust manifold must be removed from the cylinder head as an assembly.

1. Remove the turbocharger.

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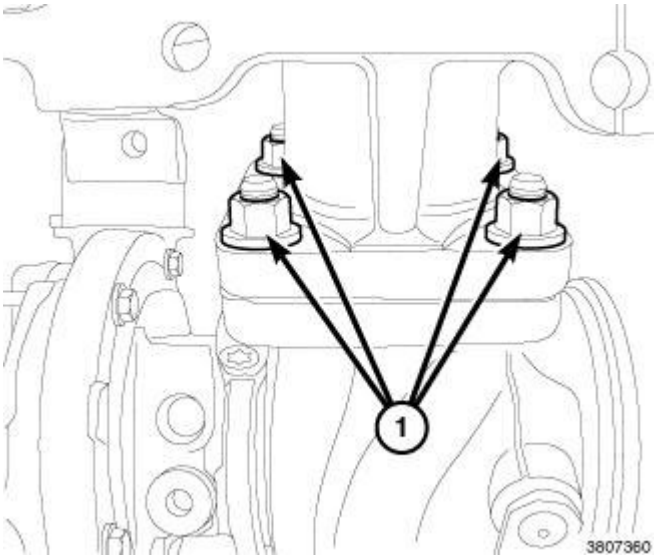


Fig. 582: Manifold/Turbocharger Nuts
Courtesy of CHRYSLER GROUP, LLC

2. Remove **and discard** the four nuts (1).
3. Lift the manifold up and off of the turbocharger. Remove and **discard** the gasket.

INSTALLATION

INSTALLATION

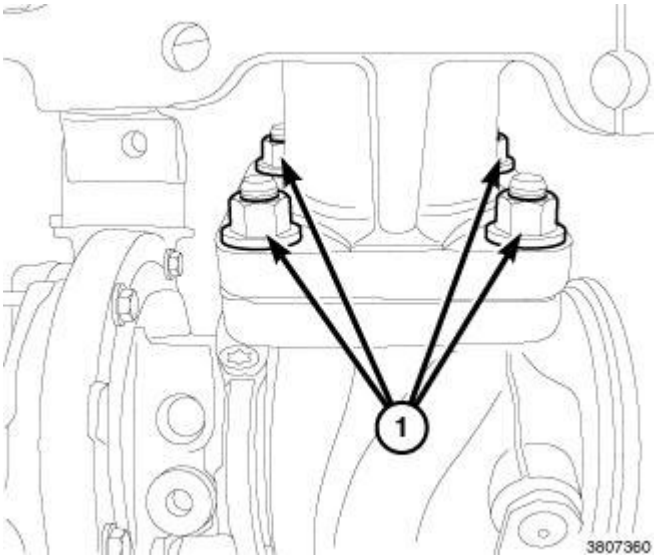


Fig. 583: Manifold/Turbocharger Nuts
Courtesy of CHRYSLER GROUP, LLC

NOTE: The turbocharger and exhaust manifold must be installed to the cylinder head as an assembly.

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1. Install a **new** gasket onto the manifold/turbocharger mating surface.
2. Set the manifold onto the turbocharger studs and install four **new** nuts (1) by hand.
3. Tighten the four nuts to 24 N.m (18 ft. lbs.).

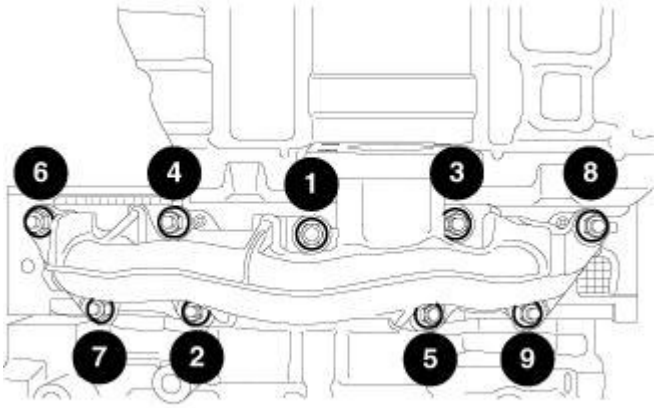


Fig. 584: Exhaust Manifold Fastener Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

4. Install the turbocharger and exhaust manifold to the cylinder head.

MANIFOLD, INTAKE

DESCRIPTION

DESCRIPTION

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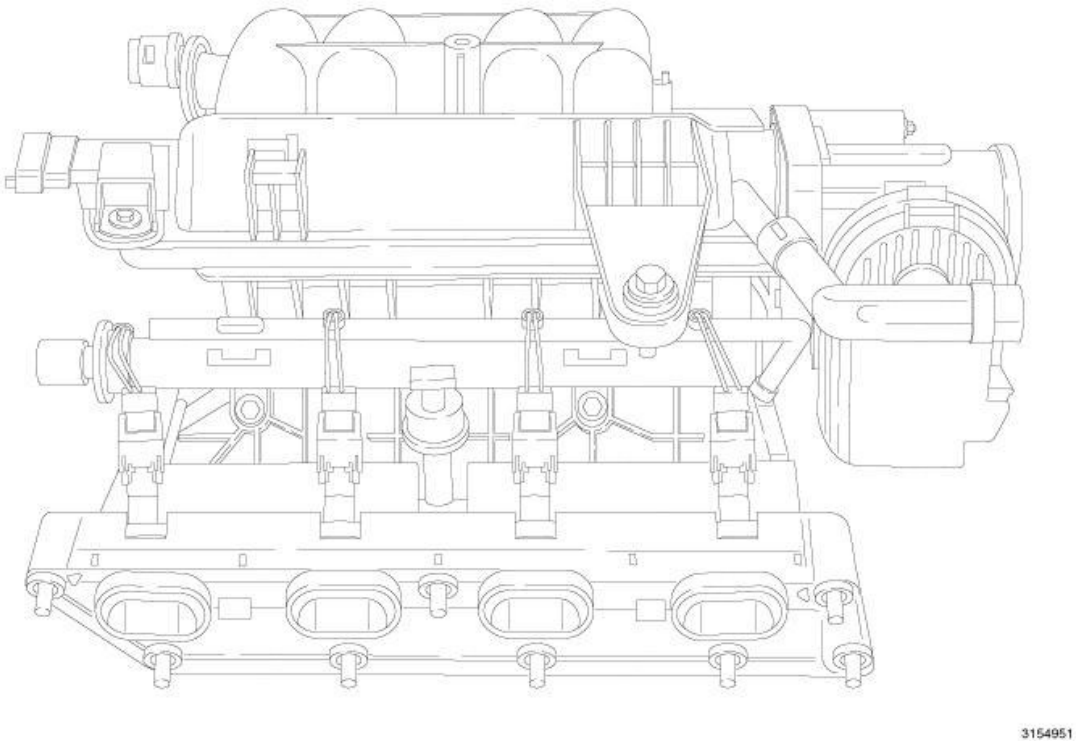


Fig. 585: Intake Manifold
Courtesy of CHRYSLER GROUP, LLC

The intake manifold is an injection molded nylon composite design. The intake manifold is sealed to the cylinder head using four individual press-in-place port silicone gaskets. Replace the gaskets whenever the intake manifold is removed from the engine. If the intake manifold is damaged or cracked, it must be replaced.

The intake manifold provides ports for Positive Crankcase Ventilation (PVC) and emissions control. The following components are attached to the intake manifold:

- Electronic Throttle Control (ETC)
- Fuel rail
- Fuel injectors
- Combination Manifold Air Pressure (MAP)/ Intake Air Temperature (IAT) sensor
- Evaporative emissions solenoid

The fuel injection fuel rail is made of high impact metal. The intake manifold can be serviced without removing the fuel injector rail. Always install new O-rings on the fuel injectors.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKS

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

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

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

REMOVAL

REMOVAL

1. Perform the fuel pressure release procedure. Refer to **FUEL DELIVERY, GAS, STANDARD PROCEDURE** .
2. Remove the engine cover assembly.
3. Recover the refrigerant from the refrigerant system. Refer to **PLUMBING, STANDARD PROCEDURE** .

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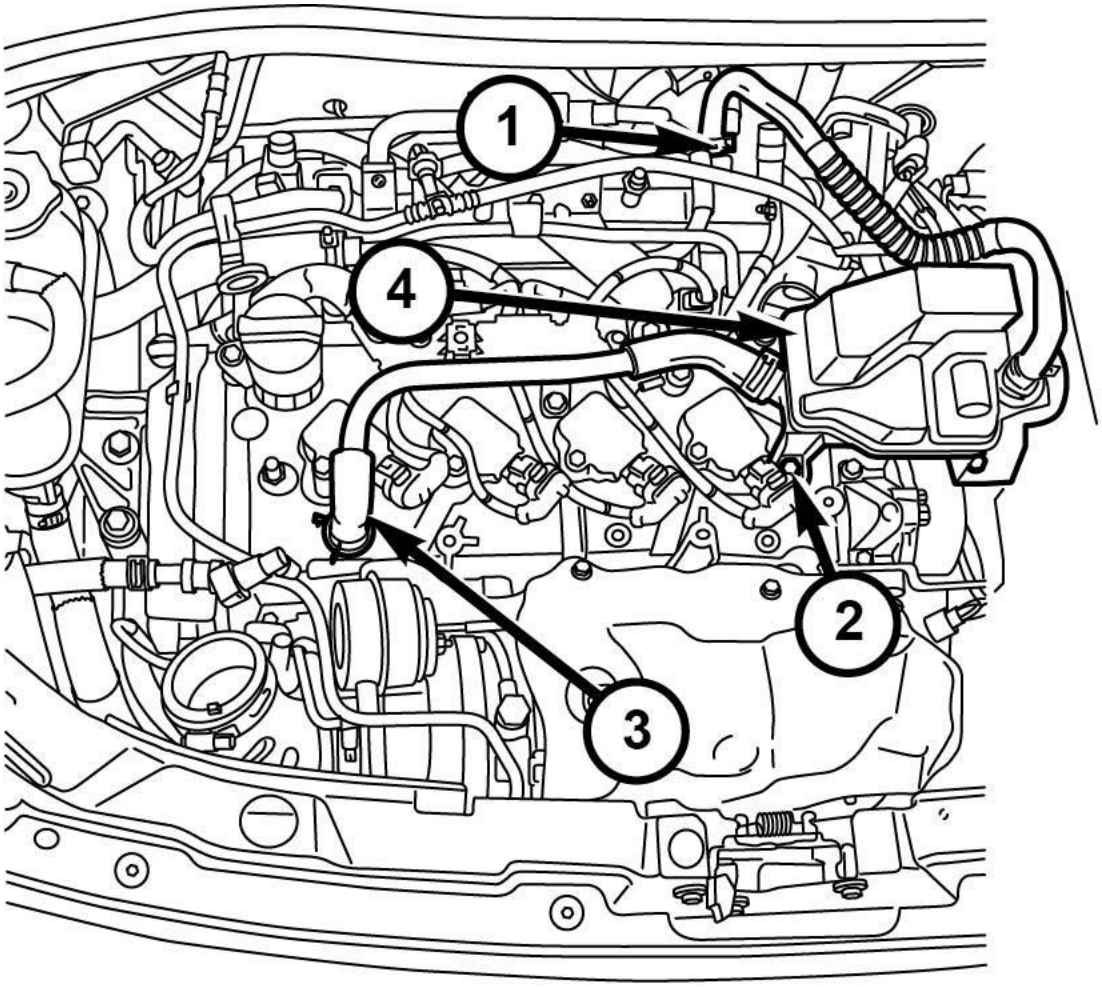


Fig. 586: PCV Hose, Vent Hose, Oil Separator Housing & Bolts
Courtesy of CHRYSLER GROUP, LLC

4. Disconnect the PCV hose (1) from the intake manifold.
5. Disconnect the vent hose (3) from the cylinder head cover.
6. Remove three bolts (2) and remove the oil separator housing (4) from the cylinder head cover.

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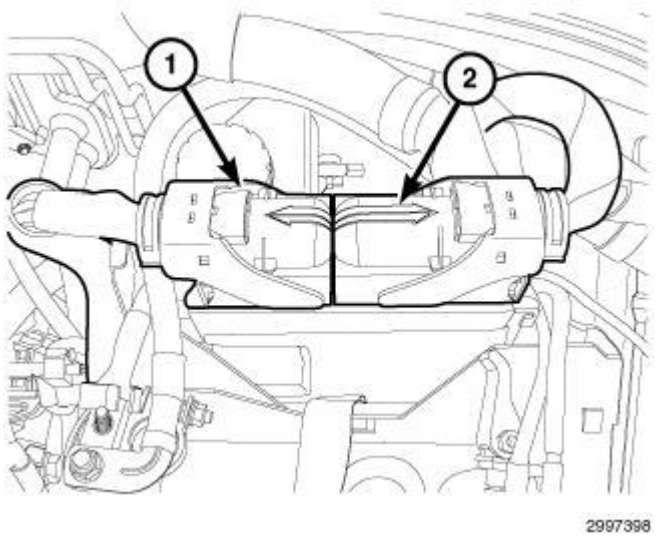


Fig. 587: PCM Electrical Connectors
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When servicing components near the vacuum pump, avoid contact with the plastic nipple that connects the vacuum pump to the brake booster hose. It is possible to crack the plastic nipple resulting in a brake booster vacuum leak.

7. Disconnect and remove the battery. Refer to **BATTERY, REMOVAL** .
8. Unlock and disconnect the Powertrain Control Module (PCM) harness connectors (1 and 2).

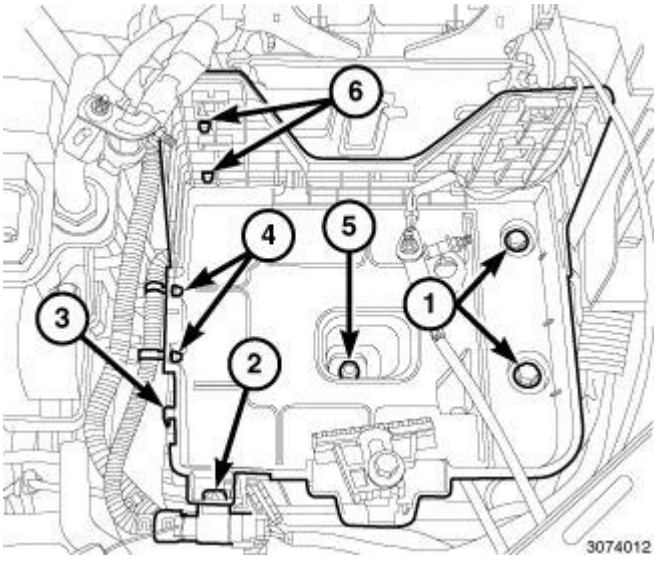


Fig. 588: Battery Tray, Connectors, Retainers, Nut & Bolts
Courtesy of CHRYSLER GROUP, LLC

9. Disengage two engine wire harness retainers (4) from the battery tray (3).
10. Disengage the engine wire harness connector (2) from the battery tray (3) and reposition the wire harness.

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11. Remove the nut (5) and two bolts (1) securing battery tray.
12. Remove the battery tray with the PCM (2) attached.

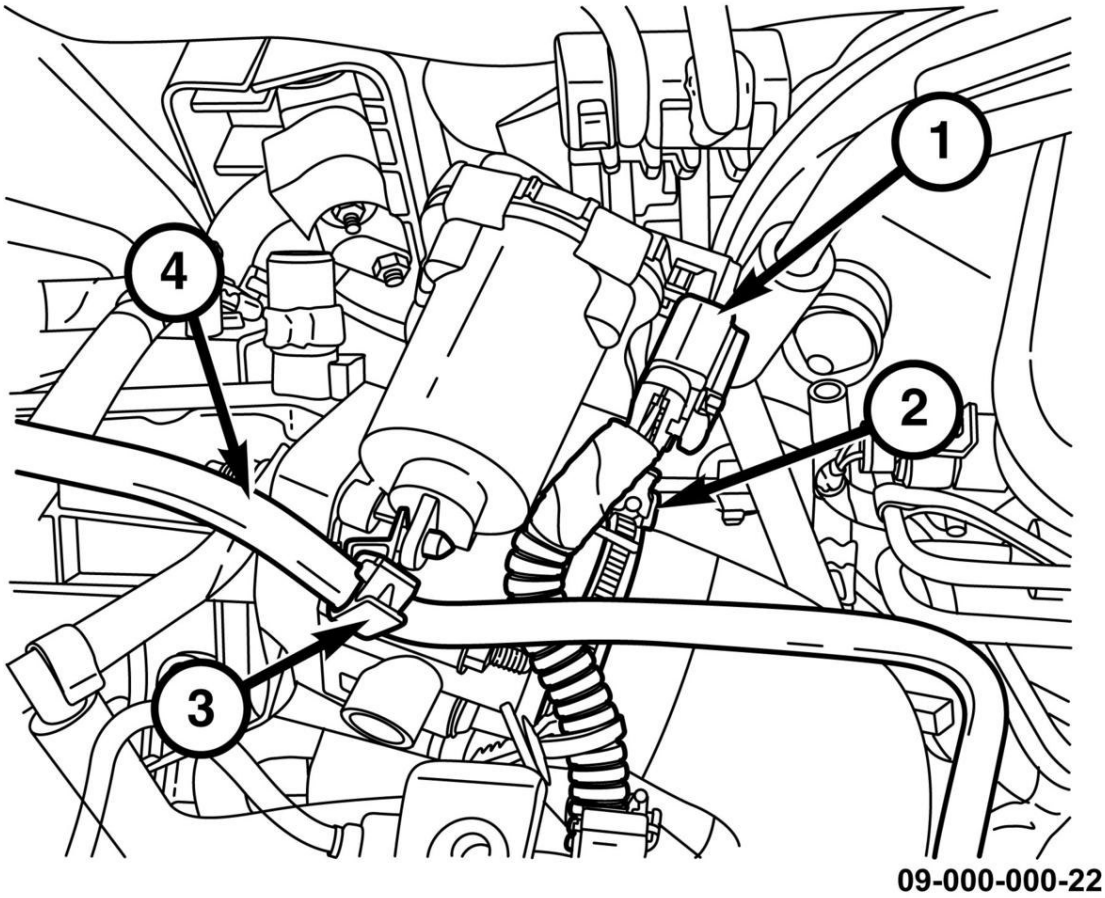


Fig. 589: EVAP Purge Hose, ETC Harness Connector, Retaining Clip & Clamp
Courtesy of CHRYSLER GROUP, LLC

13. Unlock and disconnect the harness connector (1) from the Electronic Throttle Control (ETC).
14. Disconnect the EVAP purge hose (4) from the retaining clip (3).
15. Loosen the clamp (2) securing the charge air cooler outlet hose to throttle body.

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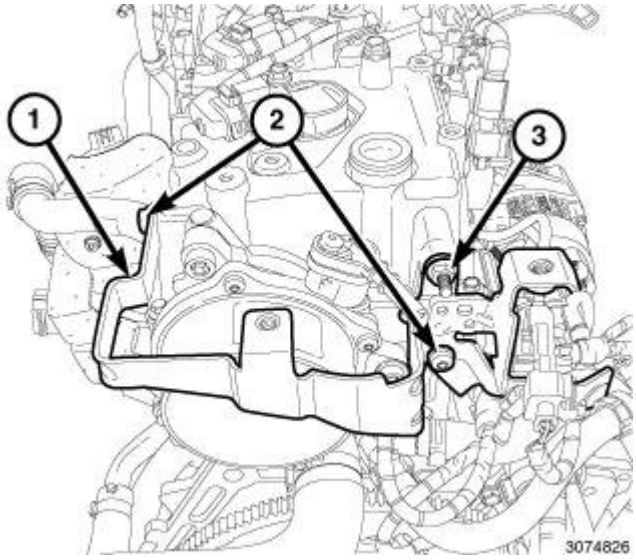


Fig. 590: Oil Separator Housing Bracket & Fasteners
Courtesy of CHRYSLER GROUP, LLC

16. Remove two bolts (2), one nut (3) and reposition the oil separator housing bracket (1).

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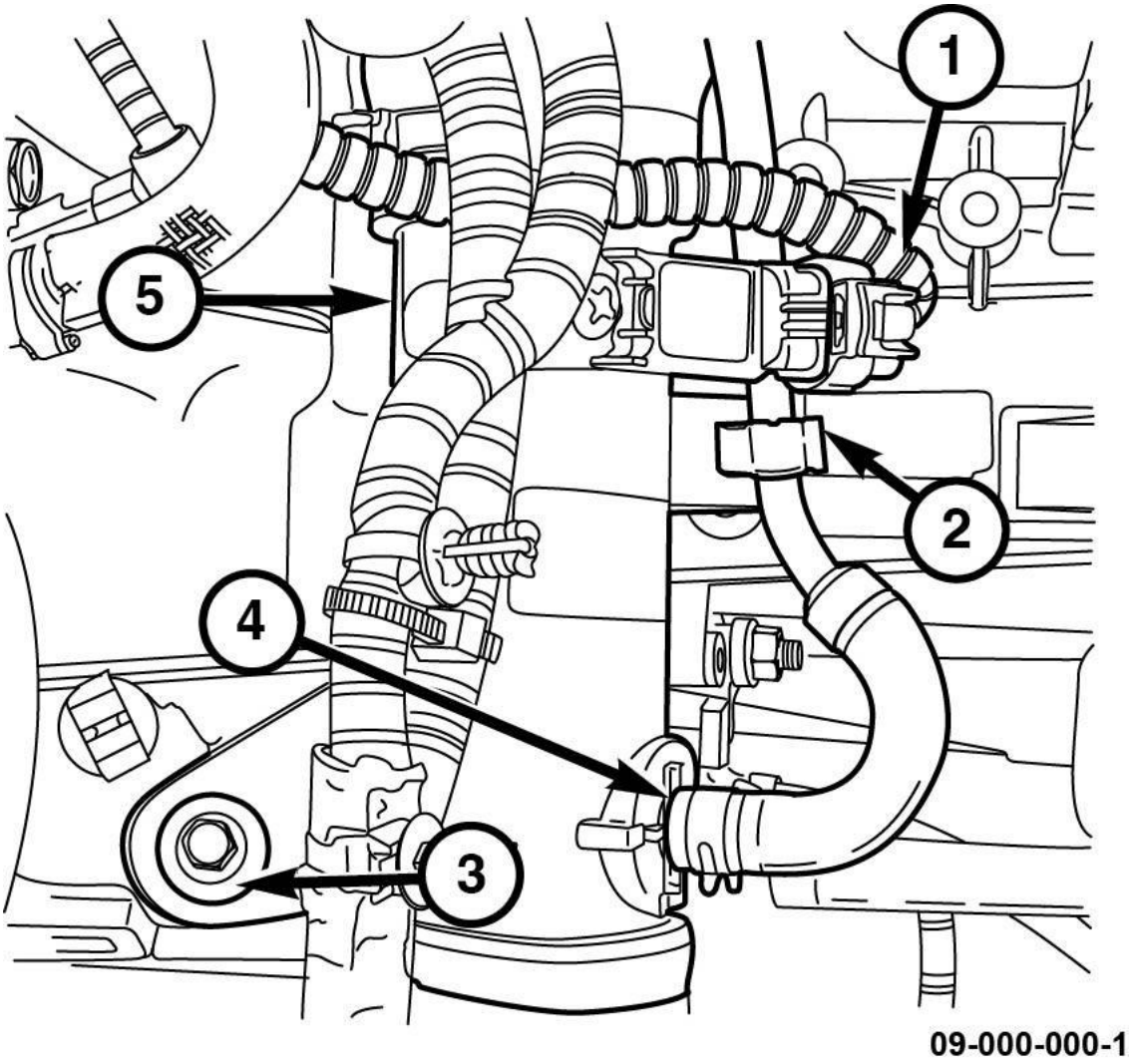


Fig. 591: EVAP Purge Hose, Charge Air Cooler Outlet Hose, Retaining Clip, Bolt & Wire Harness Connector
Courtesy of CHRYSLER GROUP, LLC

17. Disengage the EVAP purge hose (4) from the retaining clip (2) and remove the hose from the charge air cooler outlet hose (5).
18. Disconnect the boost pressure sensor wire harness connector (1).
19. Remove the bolts (3) from the charge air cooler outlet hose (5).
20. Disconnect the charge air cooler outlet hose (5) from the charge air outlet manifold and remove the hose from the vehicle.

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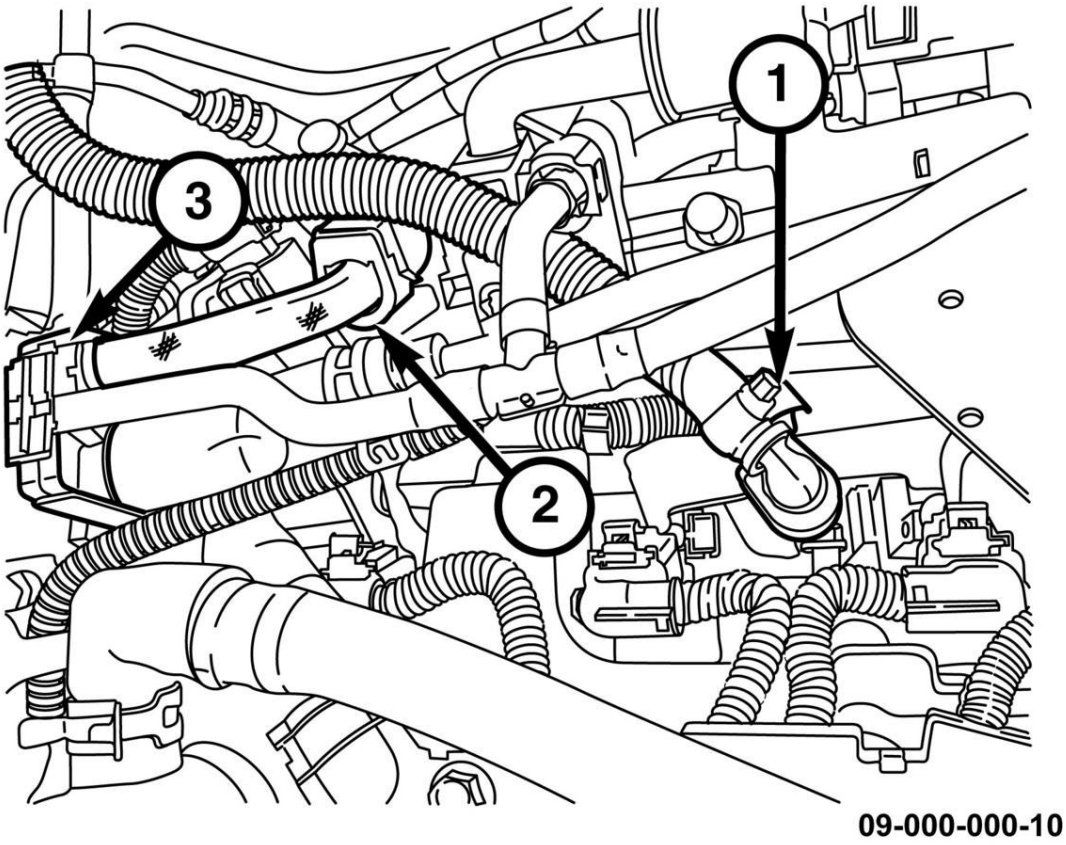


Fig. 592: Fuel Purge Hose & Hose Retainer
Courtesy of CHRYSLER GROUP, LLC

21. Open hose retainer (2) and disconnect the fuel vapor purge hose.
22. Disconnect the fuel line (1) from the fuel rail. Refer to **FITTING, QUICK CONNECT, STANDARD PROCEDURE** .

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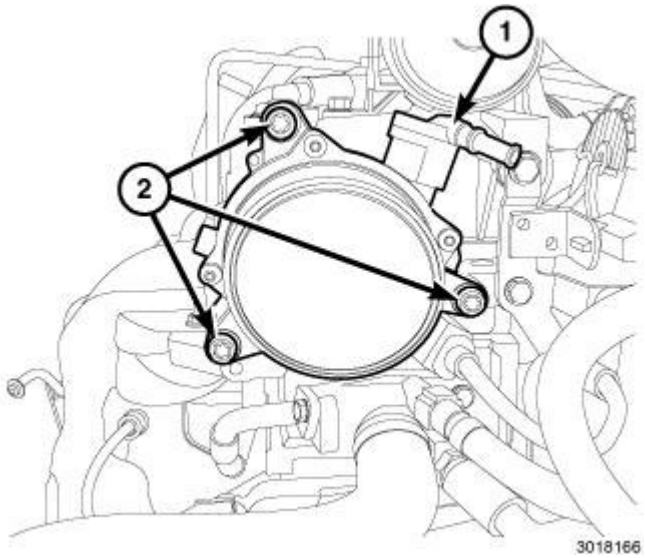


Fig. 593: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When servicing components near the vacuum pump, avoid contact with the plastic nipple that connects the vacuum pump to the brake booster hose. It is possible to crack the plastic nipple resulting in a brake booster vacuum leak.

23. Disconnect the vacuum line from the vacuum pump (1).

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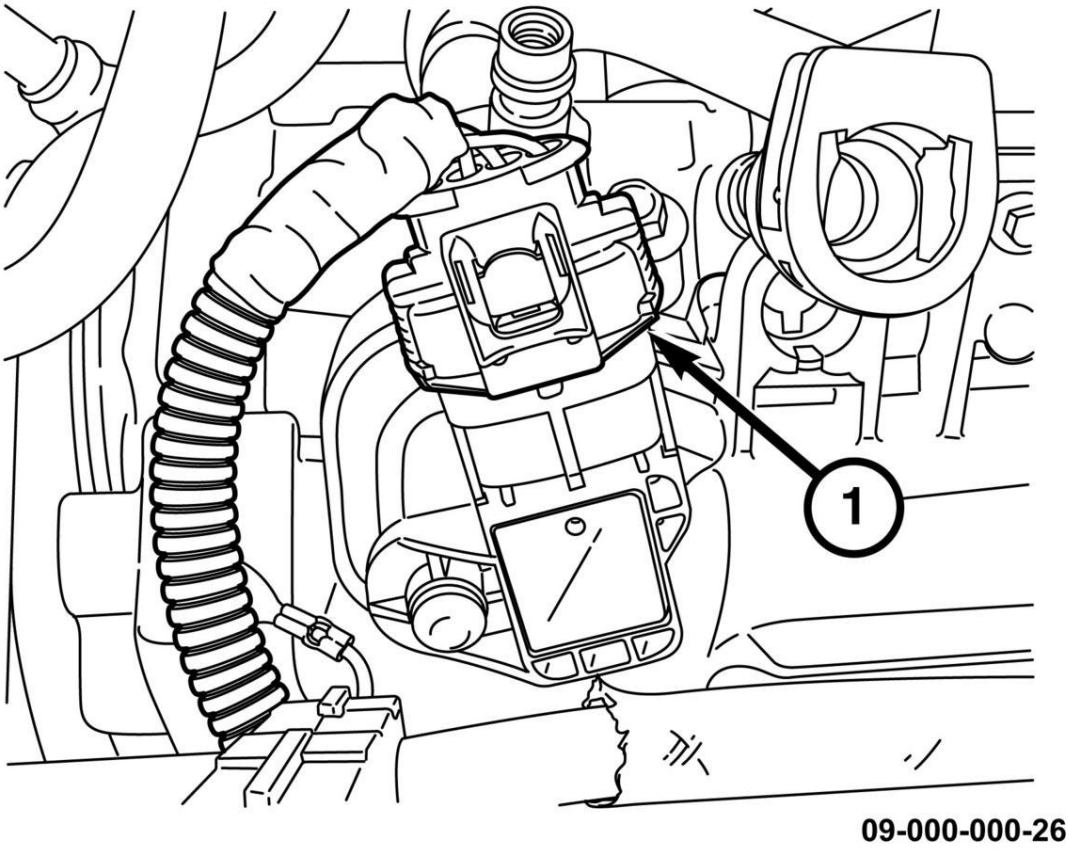


Fig. 594: IAT/MAP Sensor Harness Connector
Courtesy of CHRYSLER GROUP, LLC

24. Unlock and disconnect the IAT/MAP sensor harness connector (1).

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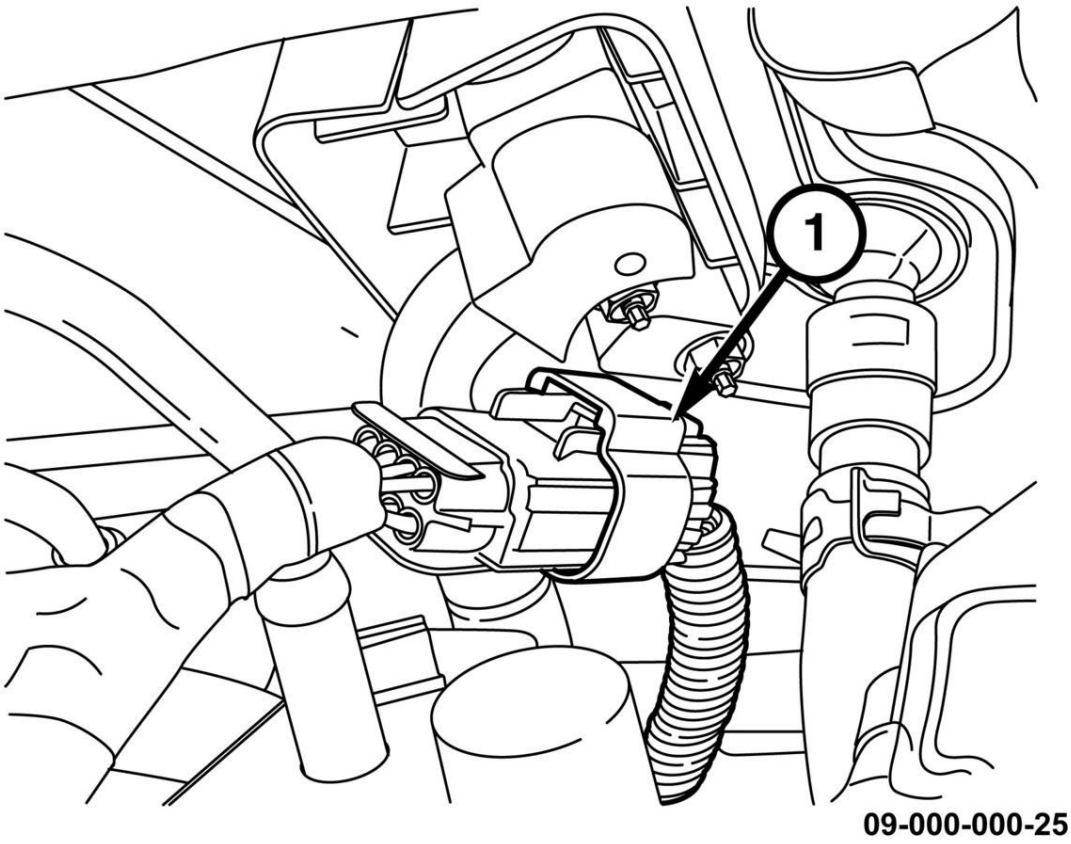


Fig. 595: Fuel Injector Wire Harness Connector
Courtesy of CHRYSLER GROUP, LLC

25. Unlock and disconnect the fuel injector wire harness connector (1).

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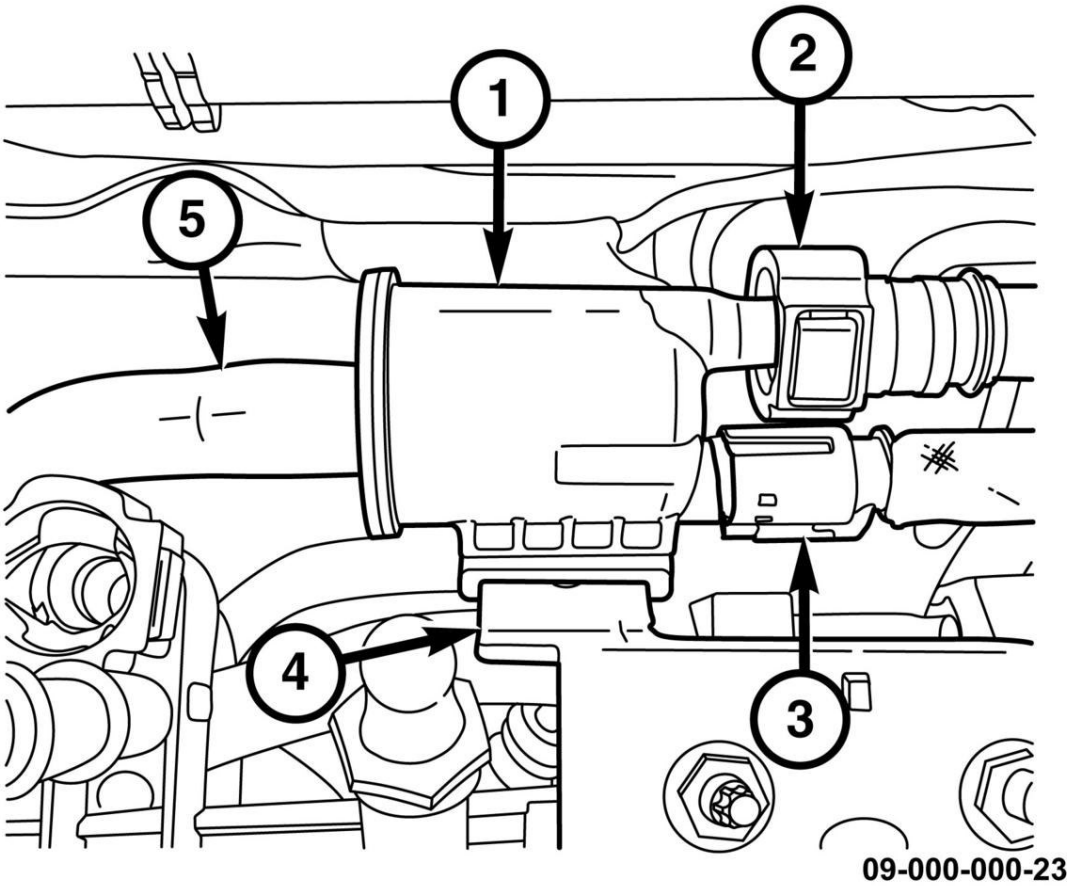


Fig. 596: Purge Flow Control Solenoid & Bracket
Courtesy of CHRYSLER GROUP, LLC

26. Disengage and reposition the purge flow control solenoid (1) from the bracket (4).

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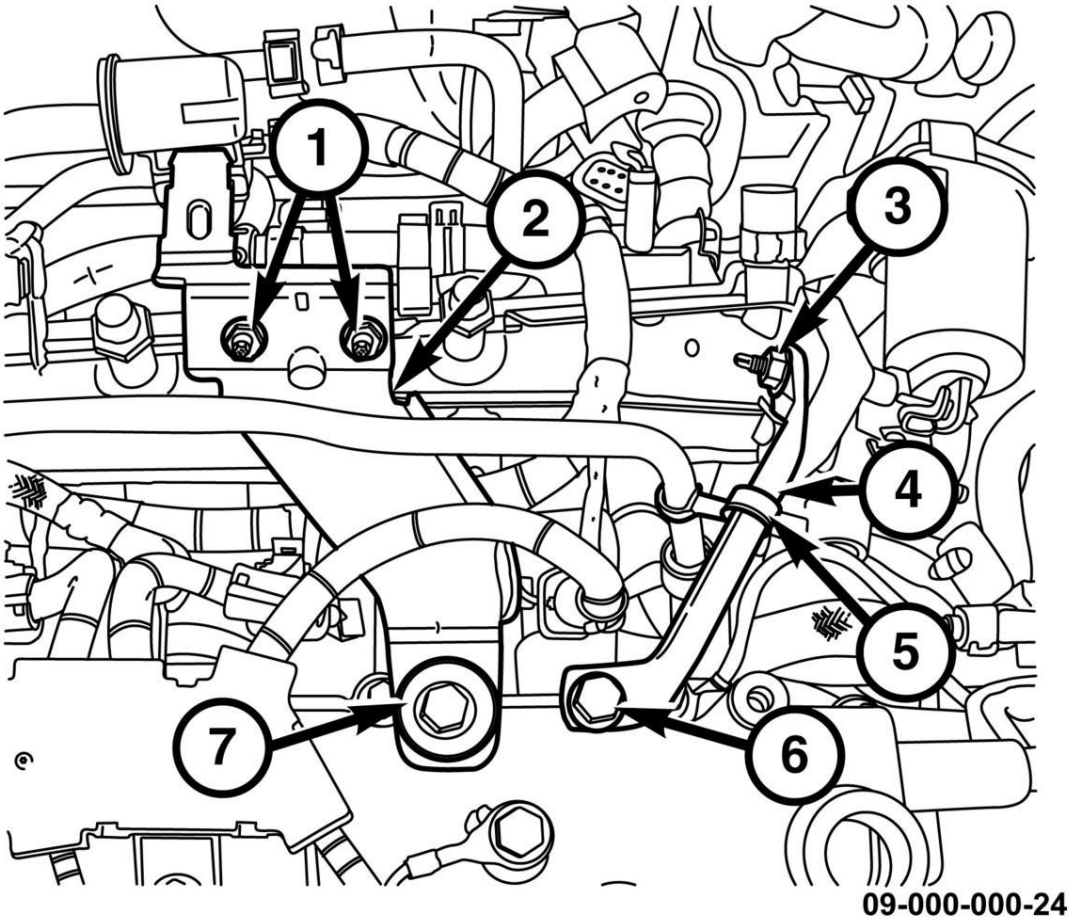


Fig. 597: Support Brackets, Bolts, Retainers & Nuts
Courtesy of CHRYSLER GROUP, LLC

27. Remove two nuts (1), bolt (7), and the bracket (2).
28. Disengage the retainers (5) from the support bracket (4).
29. Remove the nut (3), bolt (6), and the support bracket (4).
30. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .

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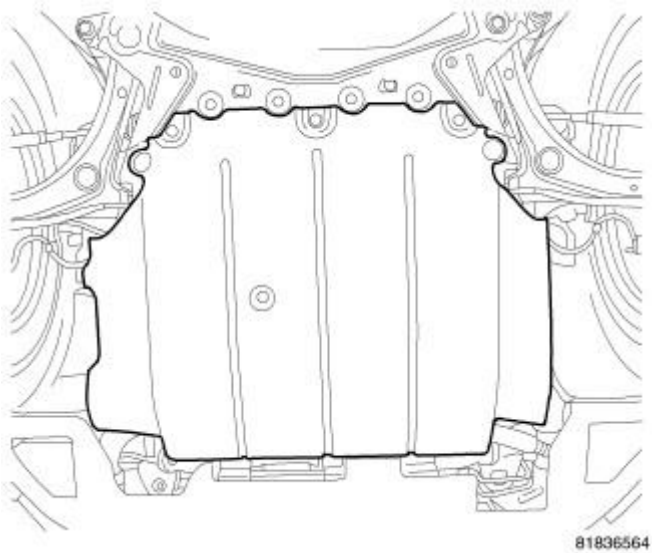


Fig. 598: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

31. Remove the belly pan. Refer to **BELLY PAN, REMOVAL** .
32. Drain the cooling system. Refer to **STANDARD PROCEDURE** .

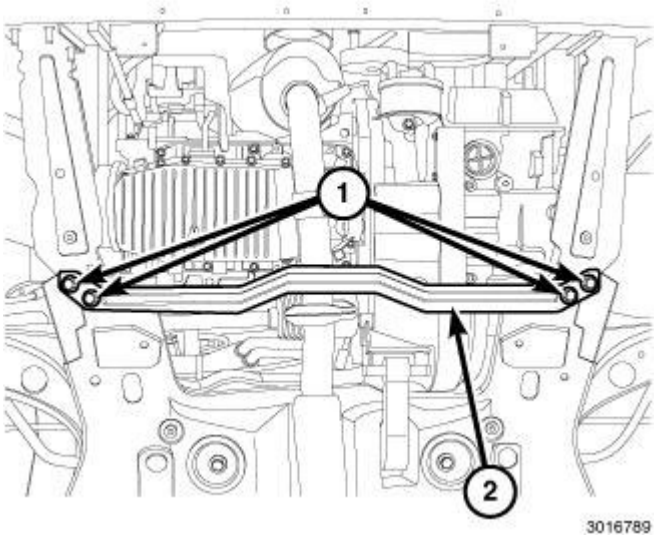


Fig. 599: Tunnel Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

33. Remove four bolts (1) and the tunnel support brace (2).
34. Remove both front wheels and tires. Refer to **REMOVAL** .

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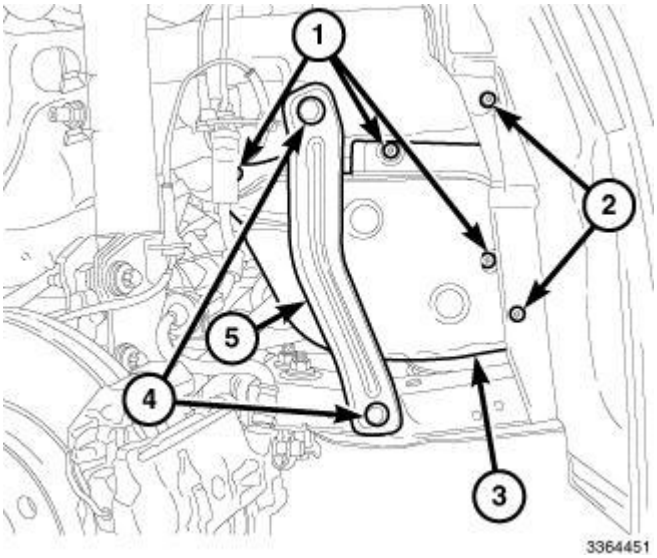


Fig. 600: Right Vertical Brace, Frame Splash Shield & Fasteners
Courtesy of CHRYSLER GROUP, LLC

35. Remove two bolts (4) and the right vertical brace (5).
36. Remove two screws (2) from the front wheelhouse splash shield.
37. Remove three screws (1) and the frame splash shield (3)

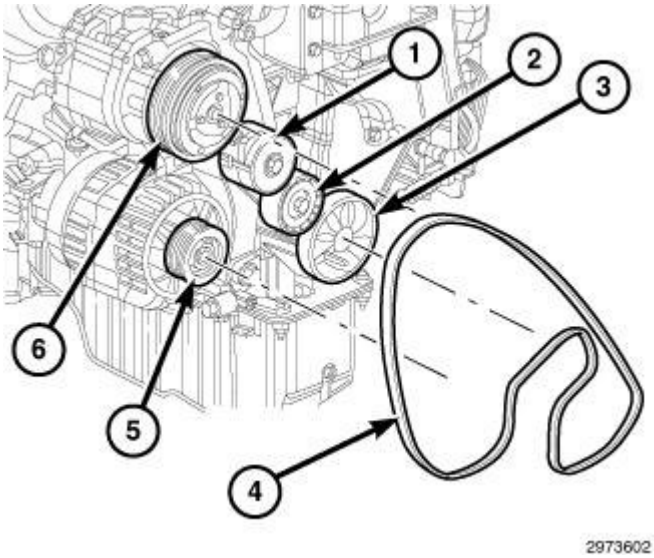


Fig. 601: Drive Belt Tensioners & Assembly With Drive Belt Routing
Courtesy of CHRYSLER GROUP, LLC

38. Remove the accessory drive belt (4). Refer to **BELT, SERPENTINE, REMOVAL** .
39. Lower the vehicle.

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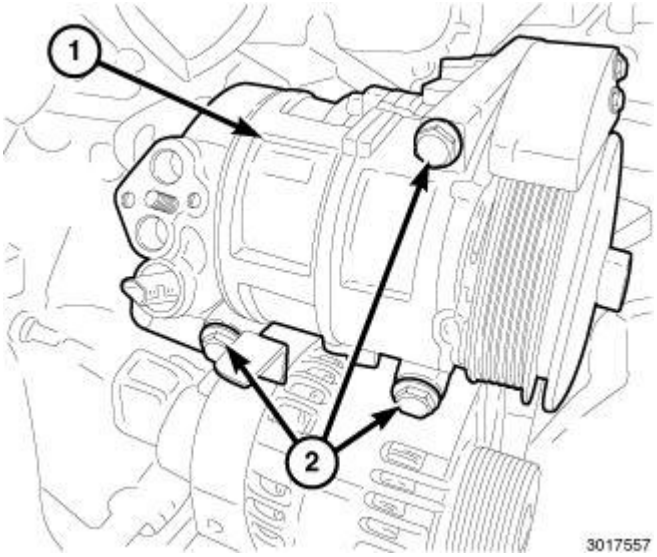


Fig. 602: A/C Compressor & Fasteners
Courtesy of CHRYSLER GROUP, LLC

40. Remove the A/C compressor (1). Refer to **COMPRESSOR, A/C, REMOVAL** .

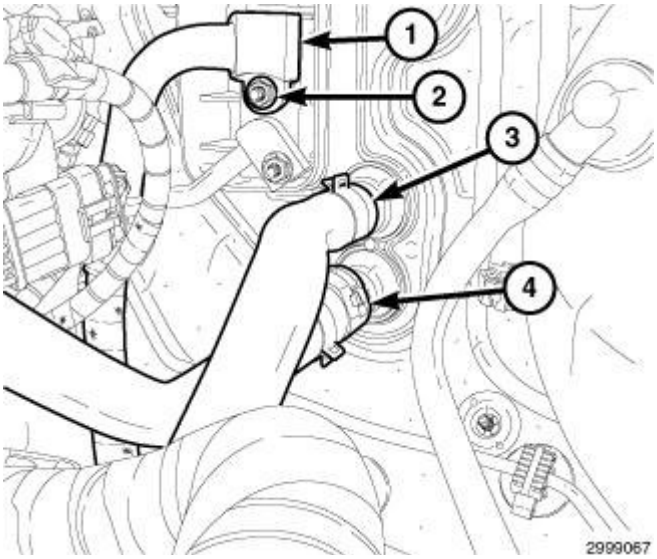


Fig. 603: A/C Suction Line, Nut, Heater Core Outlet Hose & Inlet Hose
Courtesy of CHRYSLER GROUP, LLC

41. Disconnect the heater core outlet hose (3) and inlet hose (4) from the heater core.

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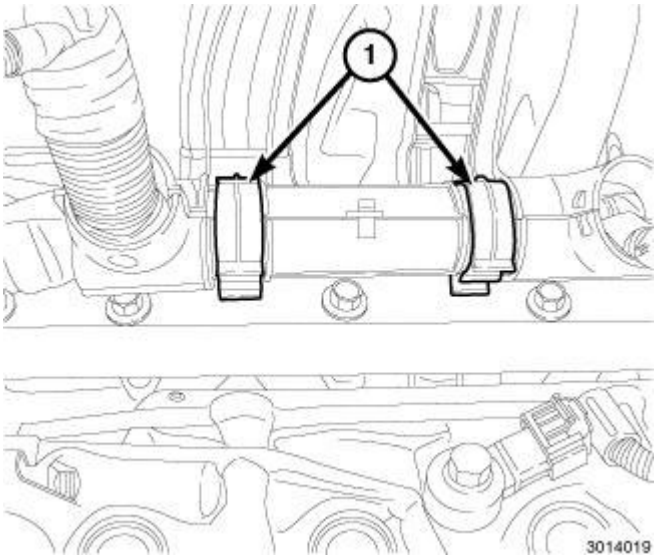
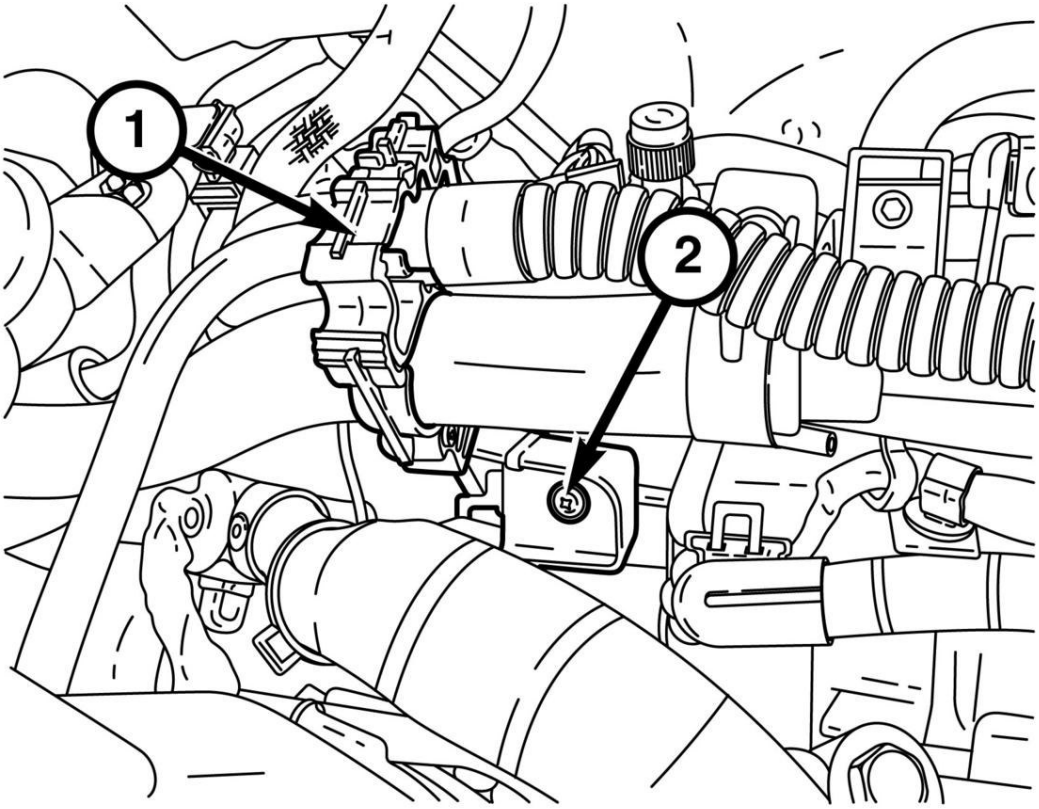


Fig. 604: Wire Harness Retainers
Courtesy of CHRYSLER GROUP, LLC

42. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
43. Open the two wire harness retainers (1) and reposition the wire harness.
44. Lower the vehicle.

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Fig. 605: Hose Retainer & Bolt
Courtesy of CHRYSLER GROUP, LLC

45. Remove the bolt (2) securing the hose retainer (1) to the intake manifold.

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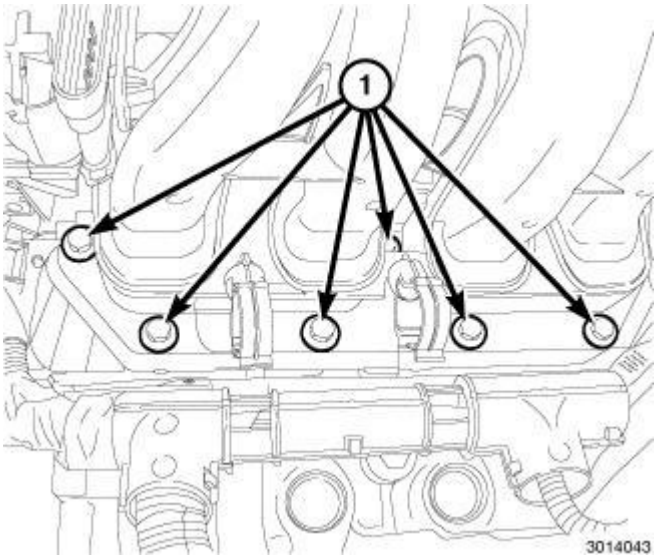


Fig. 606: Intake Manifold Flange Bolts
Courtesy of CHRYSLER GROUP, LLC

46. Remove the seven intake manifold flange bolts (1) and remove the intake manifold from vehicle.

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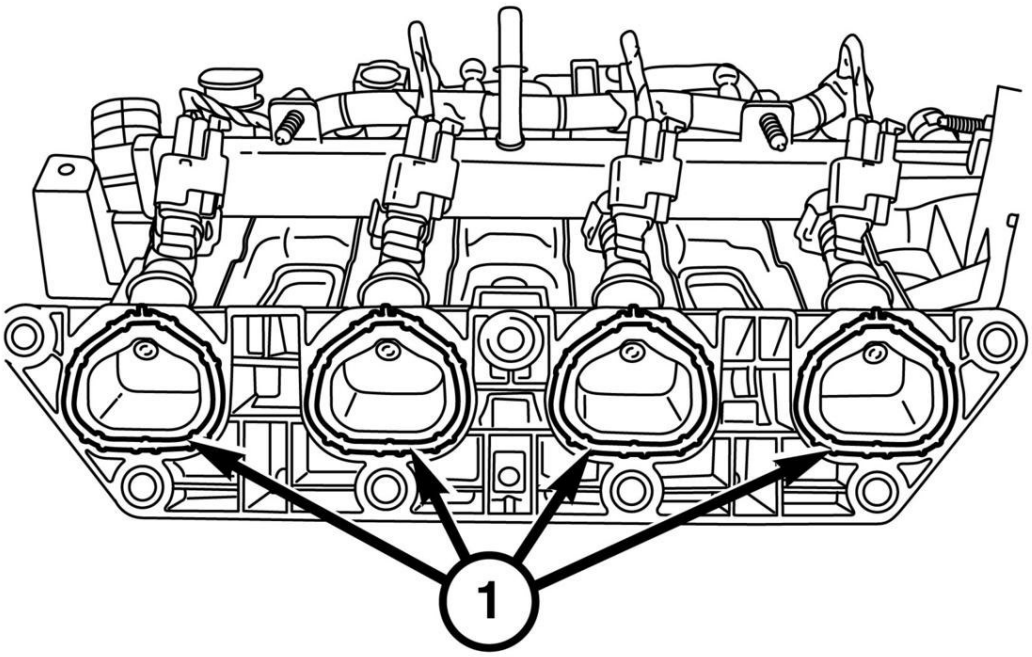


Fig. 607: Intake Manifold Seals
Courtesy of CHRYSLER GROUP, LLC

47. Remove and discard the four intake manifold seals (1).
48. Cover the open intake ports to prevent debris from entering the engine.
49. If required, remove the following components from the intake manifold:
    - Throttle body: Refer to **THROTTLE BODY, REMOVAL** .
    - Fuel rail: Refer to **RAIL, FUEL, REMOVAL** .
    - Fuel injector(s): Refer to **INJECTOR(S), FUEL, REMOVAL** .
    - Evaporative emissions purge valve.
    - IAT/MAP sensor: Refer to **SENSOR, MANIFOLD AIR PRESSURE (MAP), REMOVAL** .

INSPECTION

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INSPECTION

Check the intake manifold for:

- Damage and cracks
- Gasket surface damage or warpage
- Damaged fuel injector ports

If the intake manifold exhibits any damaged or warped conditions, replace the manifold.

INSTALLATION

INSTALLATION

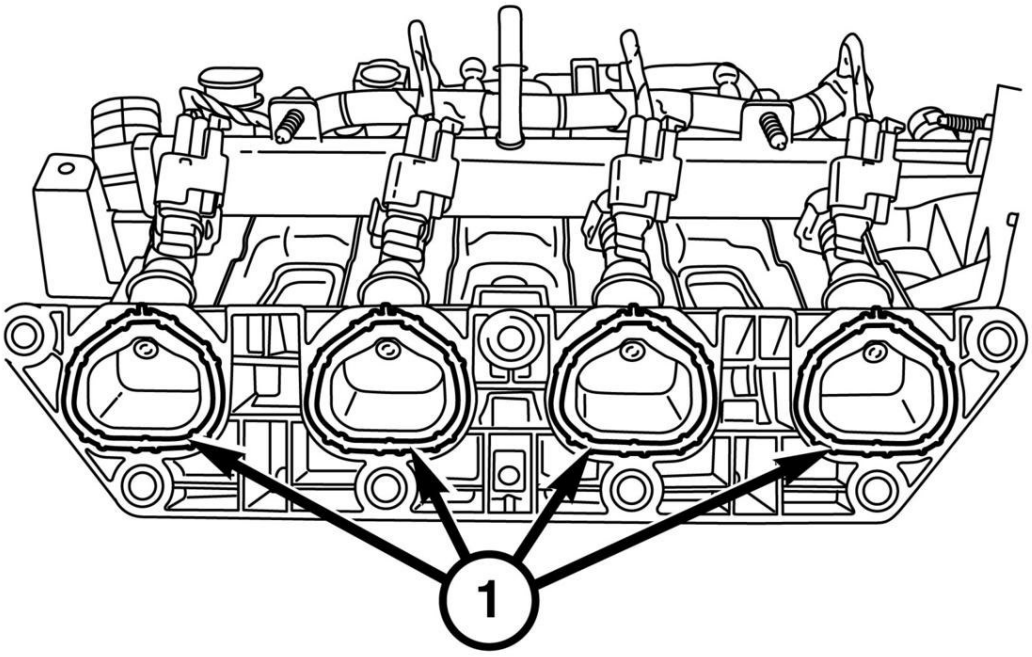


Fig. 608: Intake Manifold Seals
Courtesy of CHRYSLER GROUP, LLC

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1. If required, install the following components on the intake manifold:
   - Throttle body. Refer to **THROTTLE BODY, INSTALLATION** .
   - Fuel rail. Refer to **RAIL, FUEL, INSTALLATION** .
   - Fuel injector(s). Refer to **INJECTOR(S), FUEL, INSTALLATION** .
   - Evaporative emissions purge valve.
   - IAT/MAP sensor. Refer to **SENSOR, MANIFOLD AIR PRESSURE (MAP), INSTALLATION** .
2. Install four new intake manifold seals (1).

CAUTION: When servicing components near the vacuum pump, avoid contact with the plastic nipple that connects the vacuum pump to the brake booster hose. It is possible to crack the plastic nipple resulting in a brake booster vacuum leak.

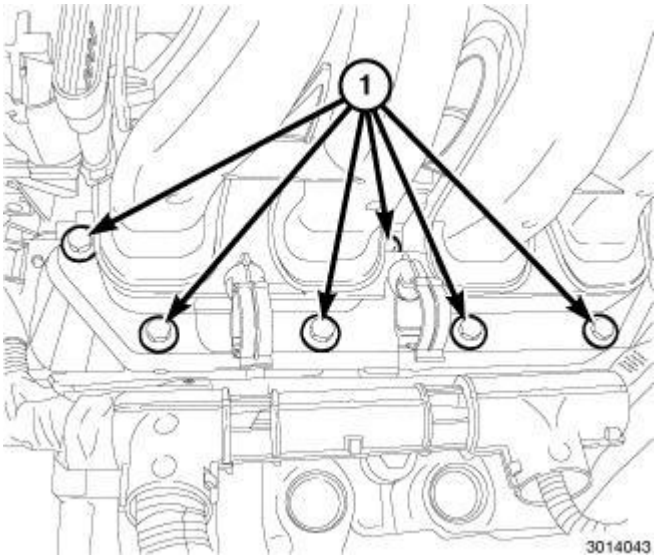
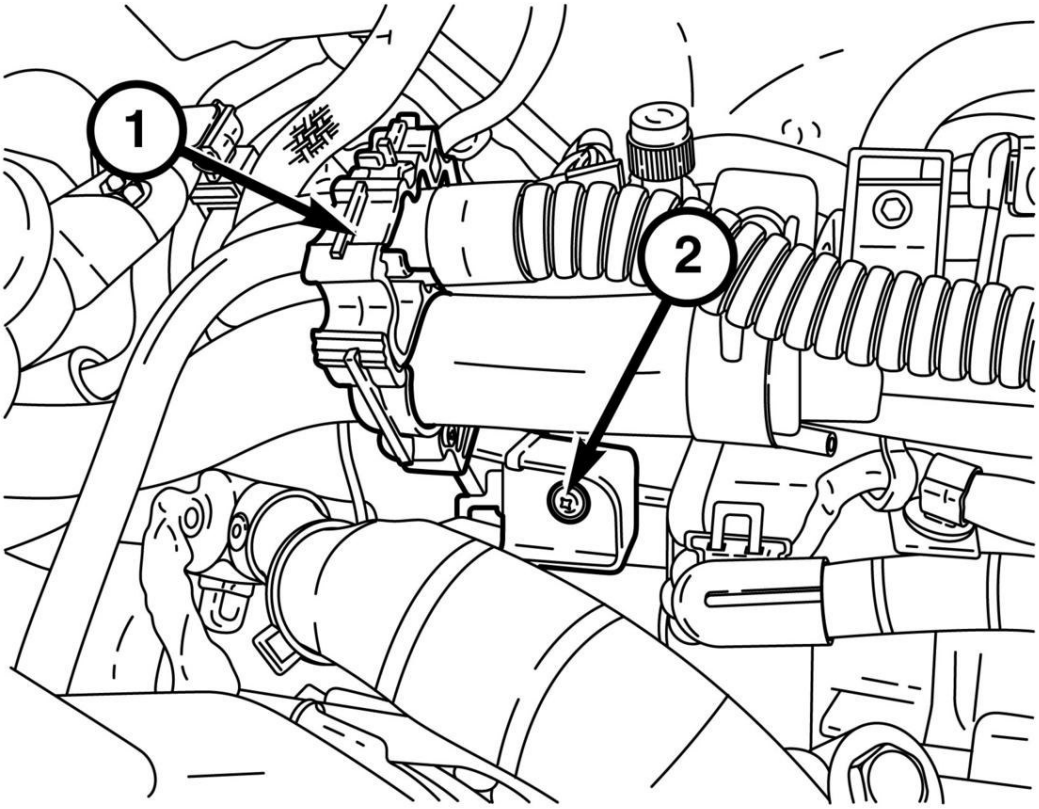


Fig. 609: Intake Manifold Flange Bolts
Courtesy of CHRYSLER GROUP, LLC

3. Install the intake manifold (1) to the engine through the space normally occupied by the battery. Loosely install an intake manifold flange bolt and the support bolt to hold the intake manifold in position.
4. Install the remaining six of the seven intake manifold flange bolts. Tighten all seven intake manifold flange bolts to 15 N.m (11 ft. lbs.).

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Fig. 610: Hose Retainer & Bolt
Courtesy of CHRYSLER GROUP, LLC

5. Install the bolt (2) securing the hose retainer (1) to the intake manifold and securely tighten.

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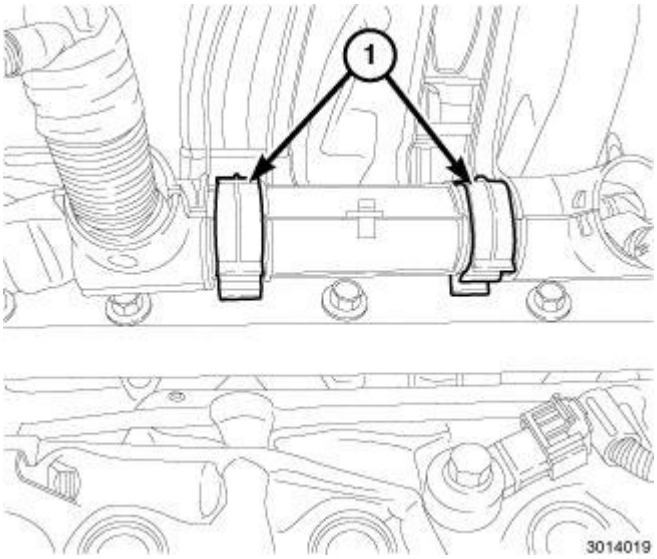


Fig. 611: Wire Harness Retainers
Courtesy of CHRYSLER GROUP, LLC

6. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
7. Position the wire harness into the two wire harness retainers (1) and close retainers.
8. Lower the vehicle.

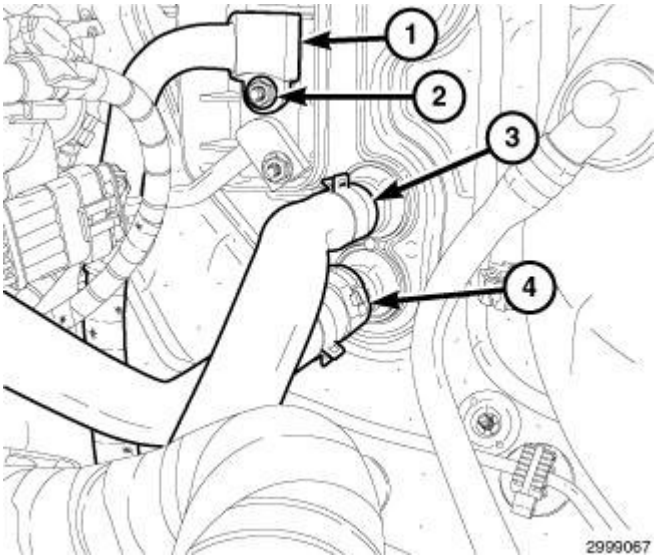


Fig. 612: A/C Suction Line, Nut, Heater Core Outlet Hose & Inlet Hose
Courtesy of CHRYSLER GROUP, LLC

9. Connect the heater core outlet hose (3) and inlet hose (4) to the heater core.

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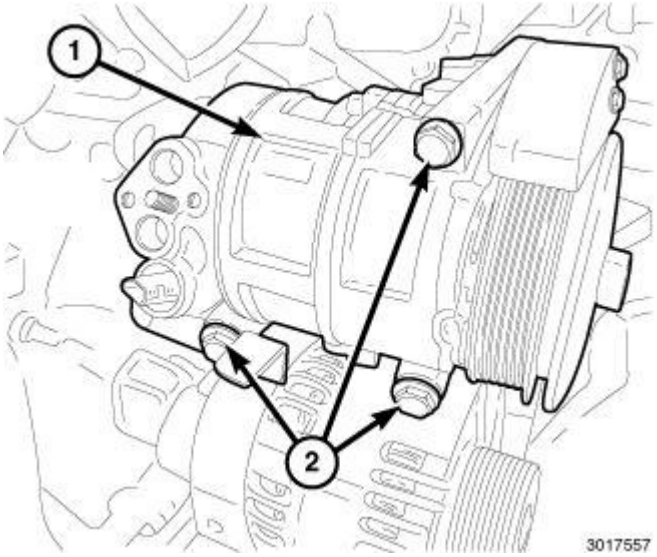


Fig. 613: A/C Compressor & Fasteners
Courtesy of CHRYSLER GROUP, LLC

10. Install the A/C compressor (1). Refer to **COMPRESSOR, A/C, INSTALLATION** .

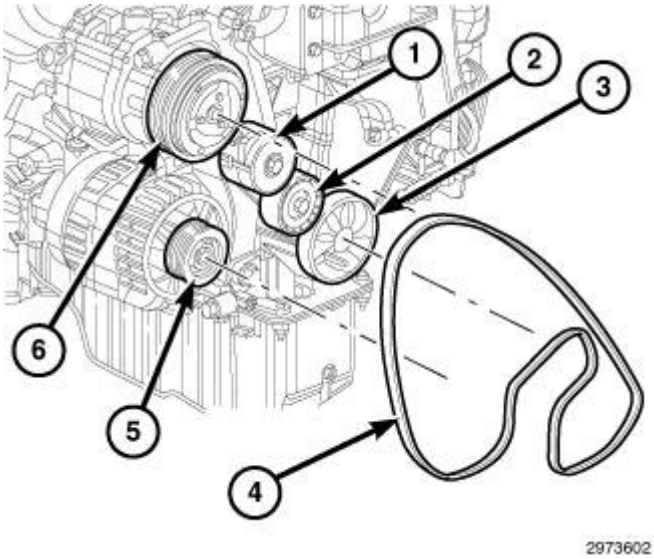


Fig. 614: Drive Belt Tensioners & Assembly With Drive Belt Routing
Courtesy of CHRYSLER GROUP, LLC

11. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
12. Install the accessory drive belt (4). Refer to **BELT, SERPENTINE, INSTALLATION** .

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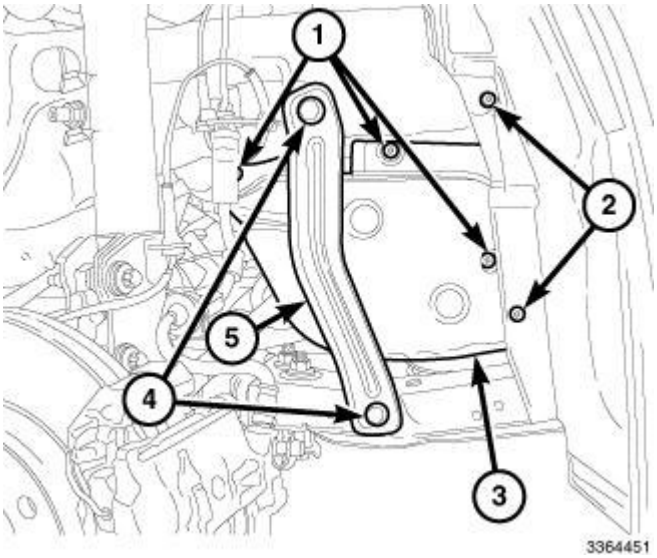


Fig. 615: Right Vertical Brace, Frame Splash Shield & Fasteners
Courtesy of CHRYSLER GROUP, LLC

13. Install the frame splash shield (3) with three screws (1).
14. Install two screws (2) to the front wheelhouse splash shield.
15. Install the right vertical brace (5) with two bolts (4) tightened to 45 N.m (33 ft. lbs.).

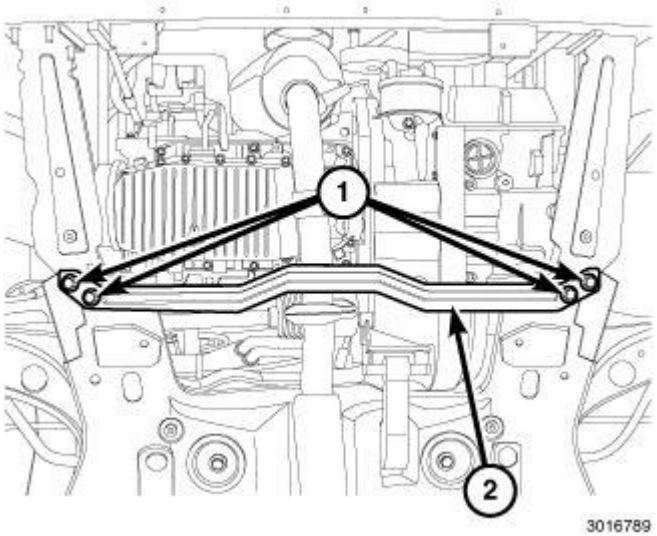


Fig. 616: Tunnel Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

16. Install both front wheels and tires. Refer to **INSTALLATION** .
17. Install the tunnel support brace (2). Tighten bolts (1) to 100 N.m (74 ft. lbs.).

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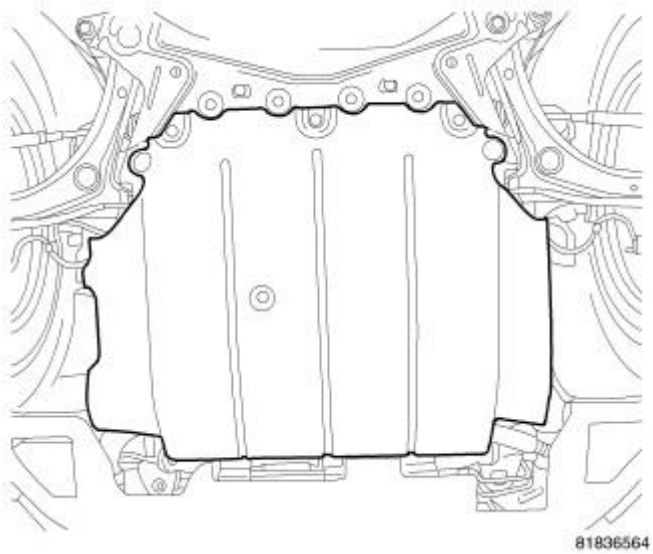


Fig. 617: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

18. Install the belly pan. Refer to **BELLY PAN, INSTALLATION** .
19. Lower the vehicle.

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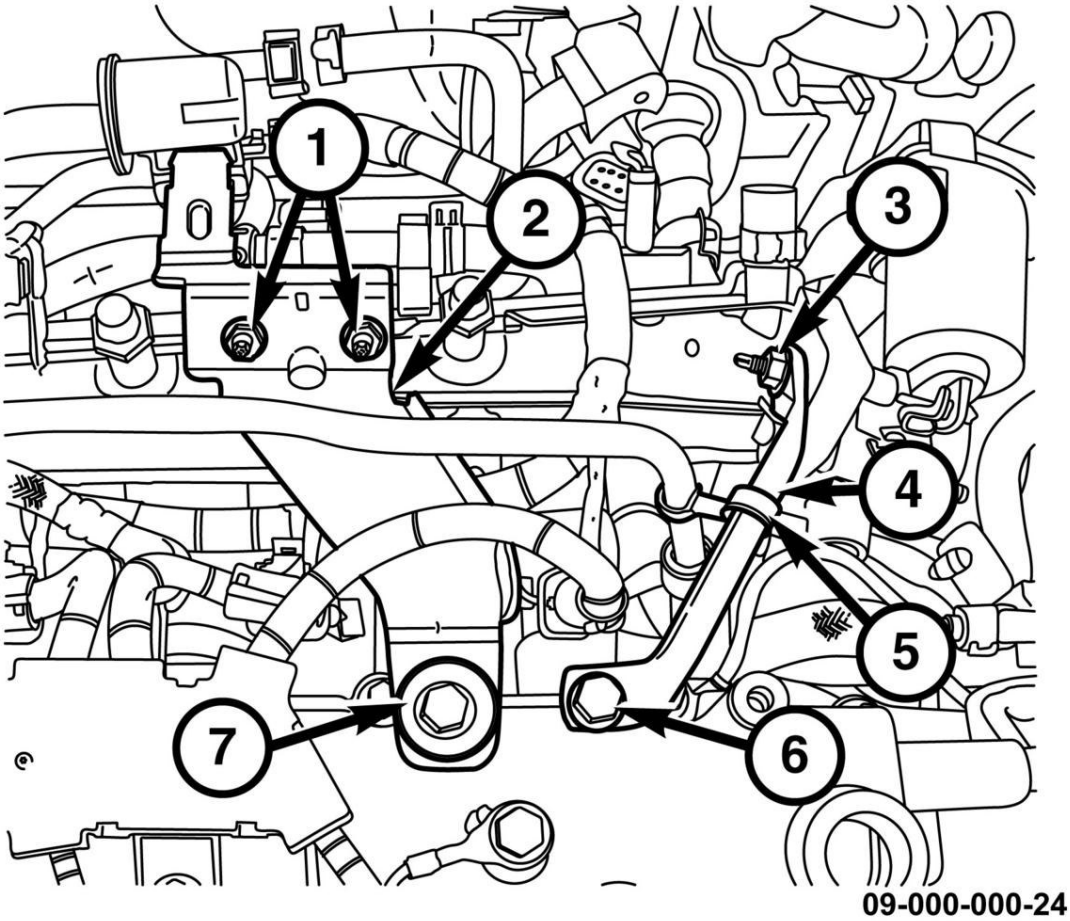


Fig. 618: Support Brackets, Bolts, Retainers & Nuts
Courtesy of CHRYSLER GROUP, LLC

20. Install the support bracket (4), nut (3), bolt (6), and tighten to 9 N.m (80 in. lbs.).
21. Engage the retainers (5) to the support bracket (4).
22. Install the bracket (2), two nuts (1), bolt (7), and tighten to N.m (80 in. lbs.).
23. Connect the vacuum supply line to the pump (1).

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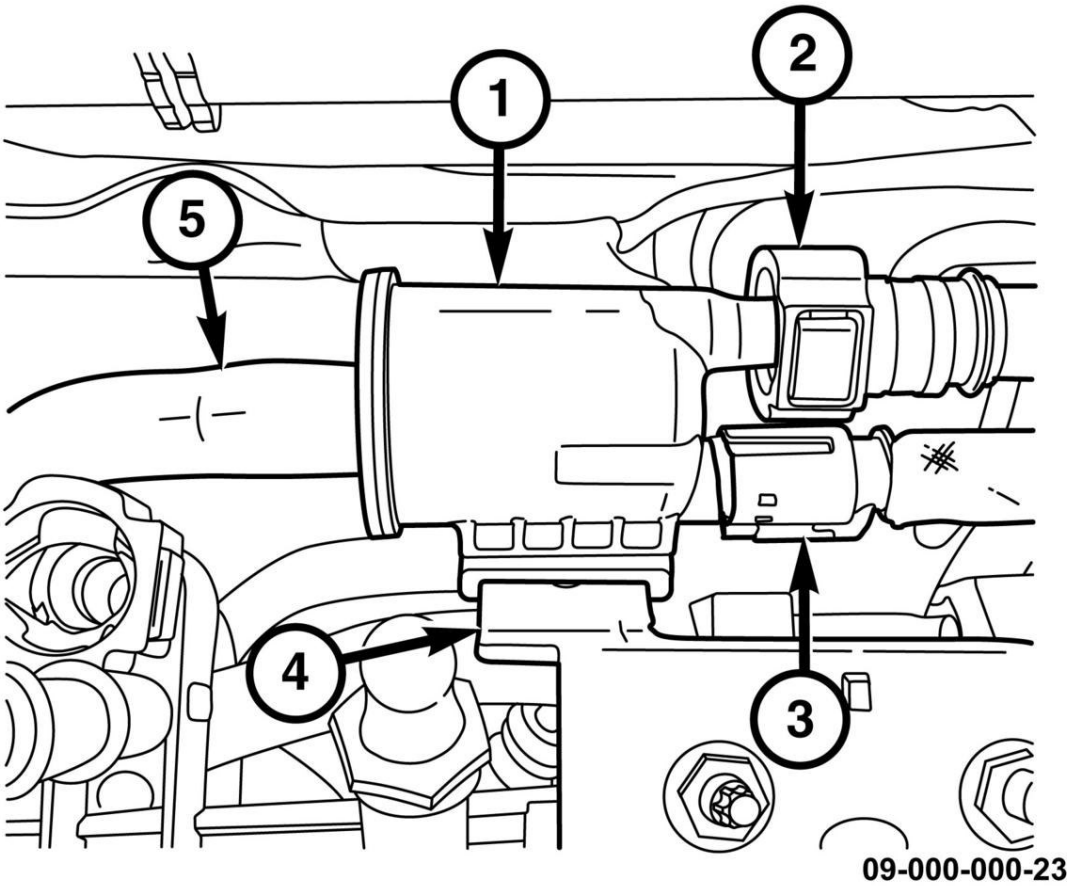


Fig. 619: Purge Flow Control Solenoid & Bracket
Courtesy of CHRYSLER GROUP, LLC

24. Reposition and engage the purge flow control solenoid (1) to the bracket (4).

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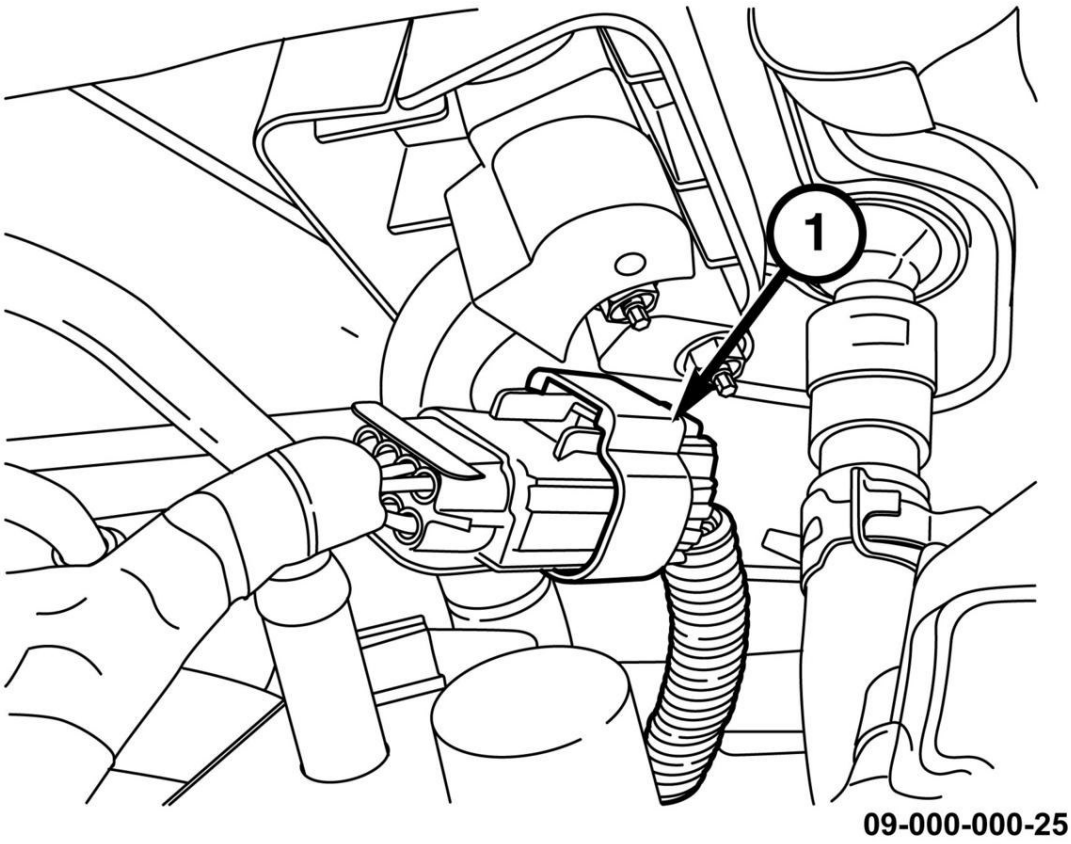


Fig. 620: Fuel Injector Wire Harness Connector
Courtesy of CHRYSLER GROUP, LLC

25. Connect and lock and the fuel injector wire harness connector (1).

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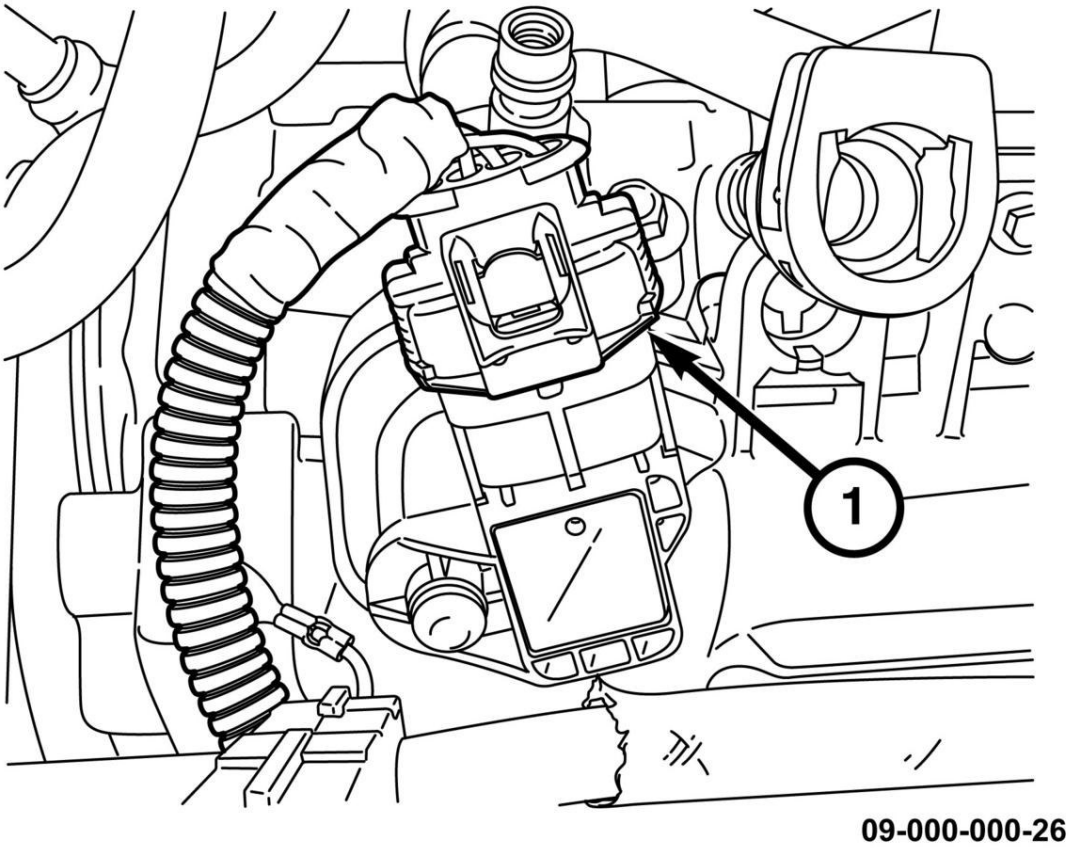


Fig. 621: IAT/MAP Sensor Harness Connector
Courtesy of CHRYSLER GROUP, LLC

26. Connect and lock the IAT/MAP sensor harness connector (1).

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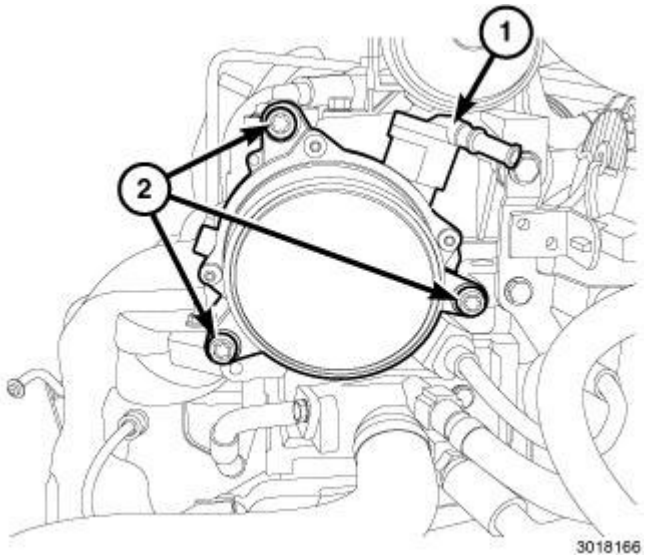


Fig. 622: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When servicing components near the vacuum pump, avoid contact with the plastic nipple that connects the vacuum pump to the brake booster hose. It is possible to crack the plastic nipple resulting in a brake booster vacuum leak.

27. Connect the vacuum line to the vacuum pump (1).

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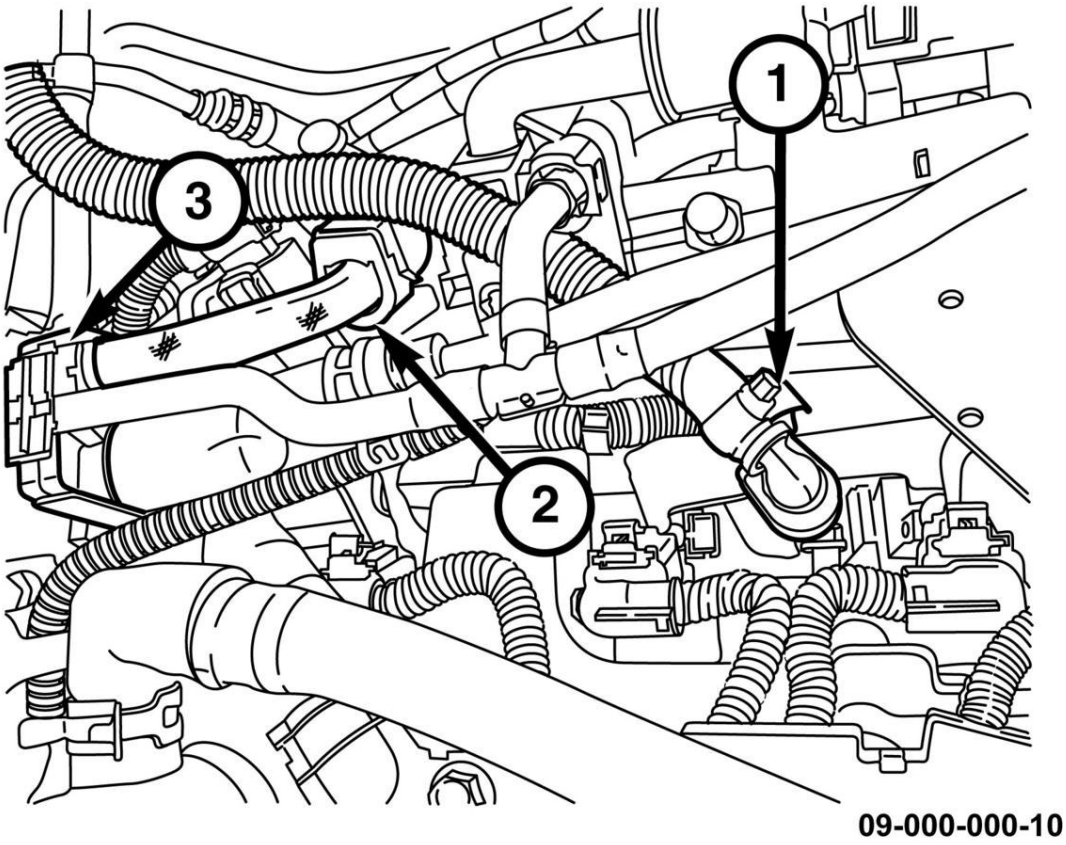


Fig. 623: Fuel Purge Hose & Hose Retainer
Courtesy of CHRYSLER GROUP, LLC

28. Connect the fuel vapor purge hose and close the hose retainer (2).
29. Connect the fuel line (1) to the fuel rail. Refer to **FITTING, QUICK CONNECT, STANDARD PROCEDURE** .

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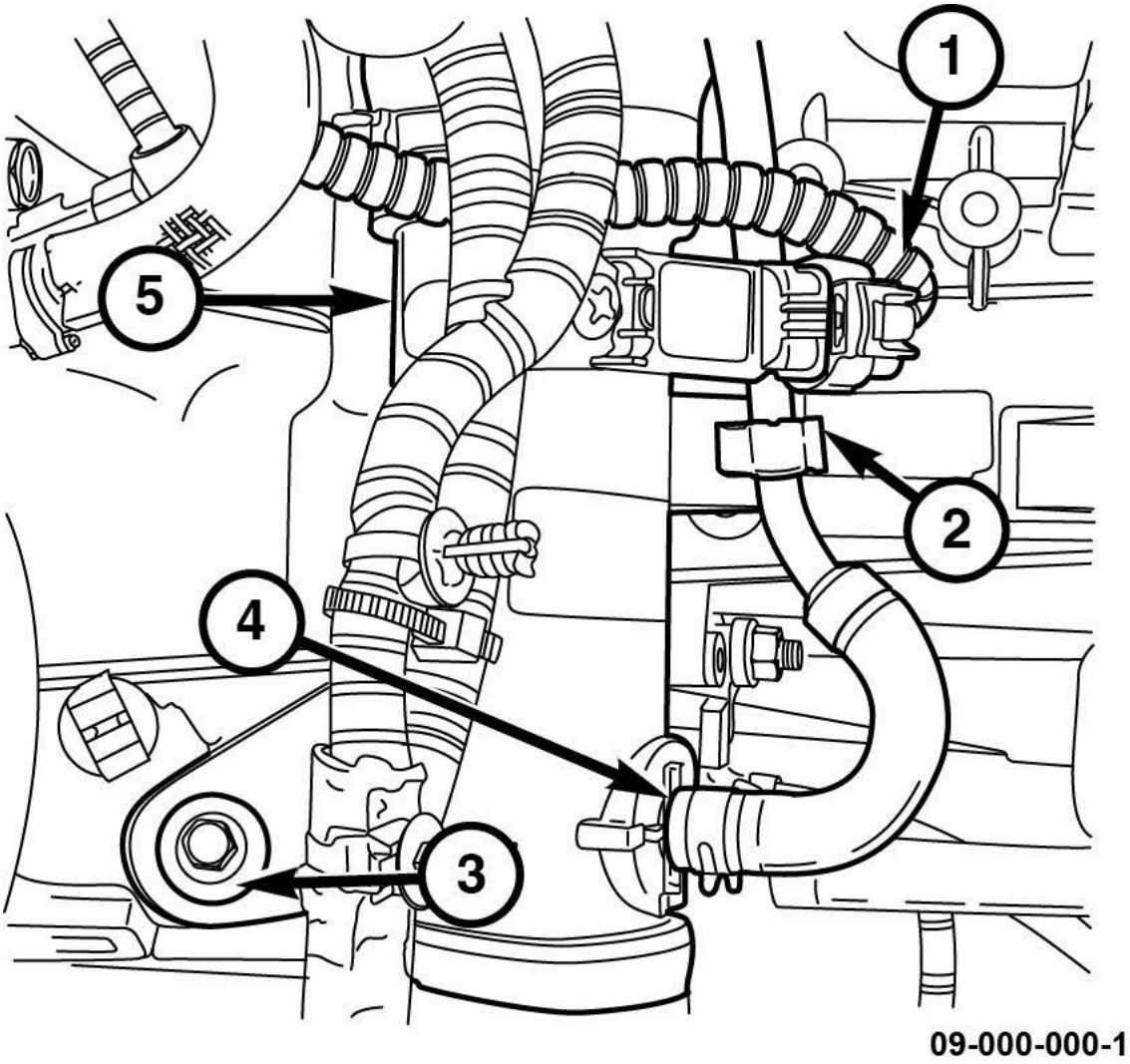


Fig. 624: EVAP Purge Hose, Charge Air Cooler Outlet Hose, Retaining Clip, Bolt & Wire Harness Connector
Courtesy of CHRYSLER GROUP, LLC

30. Install the hose and connect the charge air cooler outlet hose (5) to the charge air outlet manifold.
31. Install the bolts (3) to the charge air cooler outlet hose (5) and securely tighten
32. Connect the boost pressure sensor wire harness connector (1).
33. Install the hose to the charge air cooler outlet hose (5) and engage the EVAP purge hose (4) to the retaining clip (2).

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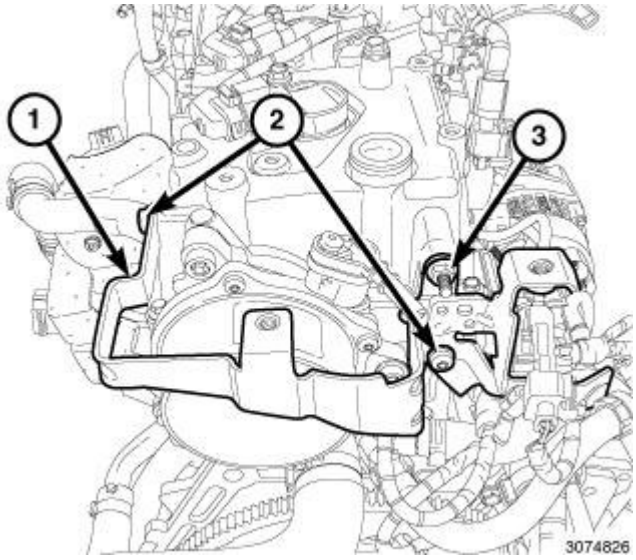


Fig. 625: Oil Separator Housing Bracket & Fasteners
Courtesy of CHRYSLER GROUP, LLC

34. Install the oil separator housing bracket (1) with two bolts (2) and one nut (3). Tighten the three fasteners to 13 N.m (115 in. lbs.).

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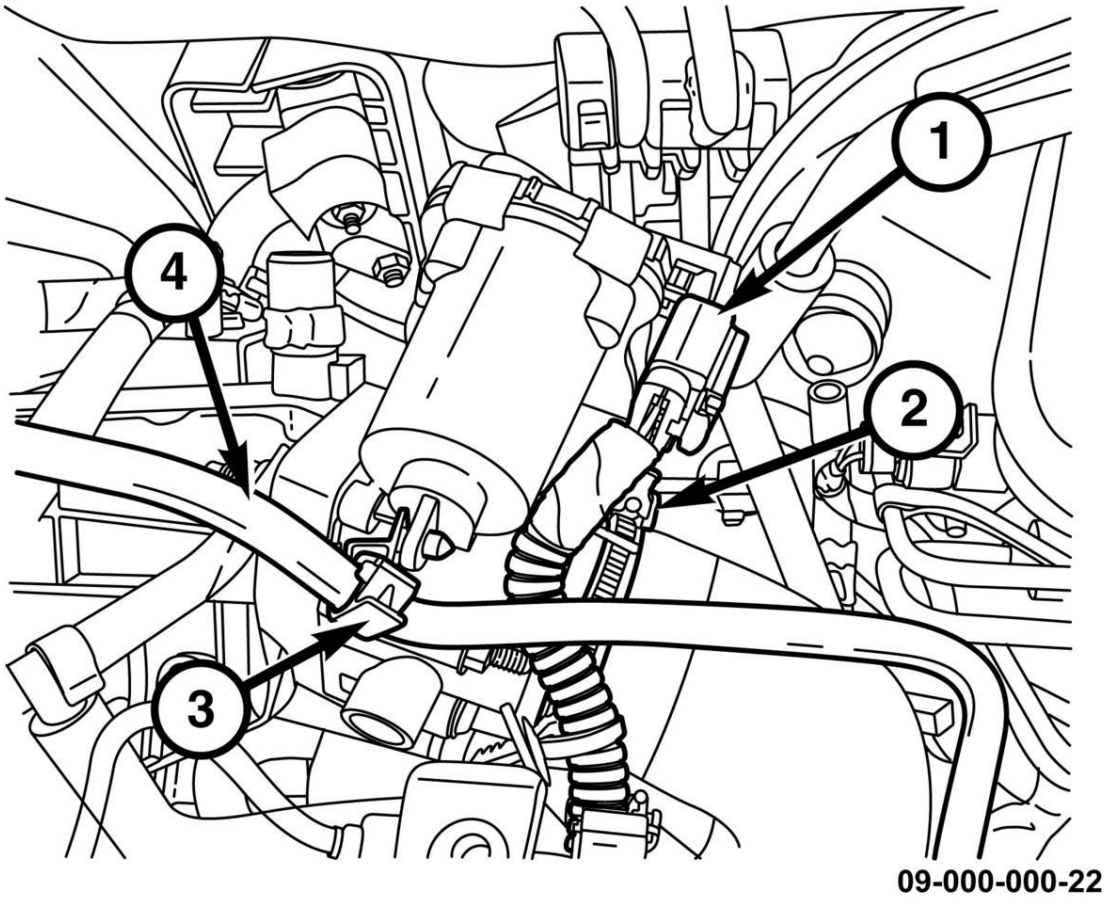


Fig. 626: EVAP Purge Hose, ETC Harness Connector, Retaining Clip & Clamp
Courtesy of CHRYSLER GROUP, LLC

35. Tighten the clamp (2) securing the charge air cooler outlet hose to throttle body.
36. Connect the EVAP purge hose (4) to the retaining clip (3).
37. Connect and lock the wire harness connector (3) to the Electronic Throttle Control (ETC).

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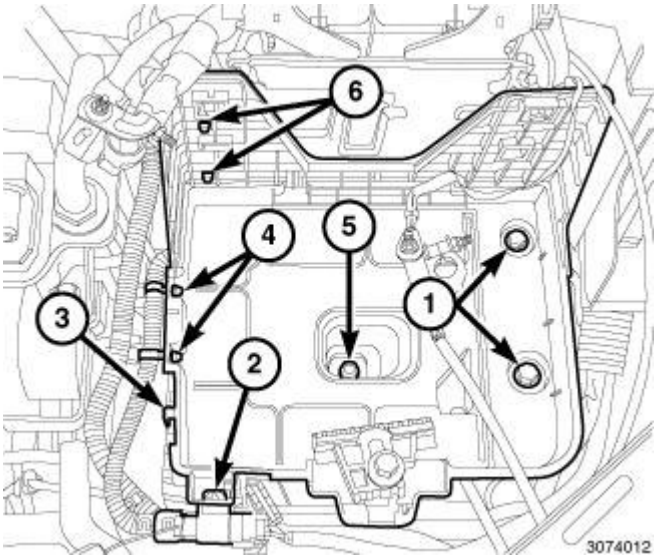


Fig. 627: Battery Tray, Connectors, Retainers, Nut & Bolts
Courtesy of CHRYSLER GROUP, LLC

38. Position the battery tray (3) and PCM in the vehicle.
39. Install the battery tray nut (5) and two bolts (1). Tighten all three fasteners to 25 N.m (18 ft. lbs.).
40. Engage the engine wire harness connector (2) to the battery tray (3).
41. Engage two engine wire harness retainers (4) to the battery tray (3).

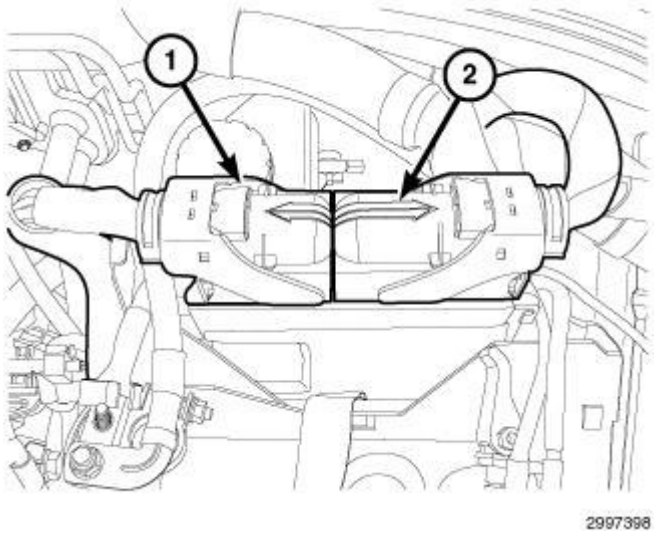


Fig. 628: PCM Electrical Connectors
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When servicing components near the vacuum pump, avoid contact with the plastic nipple that connects the vacuum pump to the brake booster hose. It is possible to crack the plastic nipple resulting in a brake booster vacuum leak.

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42. Connect the Powertrain Control Module (PCM) harness connectors (1 and 2).
43. Install the oil separator housing to the cylinder head cover with three bolts tightened to 13 N.m (115 in. lbs.).
44. Connect the vent hose to the cylinder head cover.
45. Connect the PCV hose to the intake manifold.
46. Install the engine cover assembly.
47. Evacuate and charge the refrigerant system. Refer to **PLUMBING, STANDARD PROCEDURE** .
48. Fill the cooling system. Refer to **STANDARD PROCEDURE** .
49. Install and connect the battery. Refer to **BATTERY, INSTALLATION** .
50. Run the engine until it reaches normal operating temperature. Check cooling system for correct fluid level. Refer to **STANDARD PROCEDURE** .

TURBOCHARGER SYSTEM

COOLER AND HOSES, CHARGE AIR

REMOVAL

REMOVAL

1. Disconnect the battery negative cable. Refer to **BATTERY, REMOVAL** .
2. Raise and support the vehicle.
3. Remove the from bumper fascia. Refer to **FASCIA, FRONT, REMOVAL** .

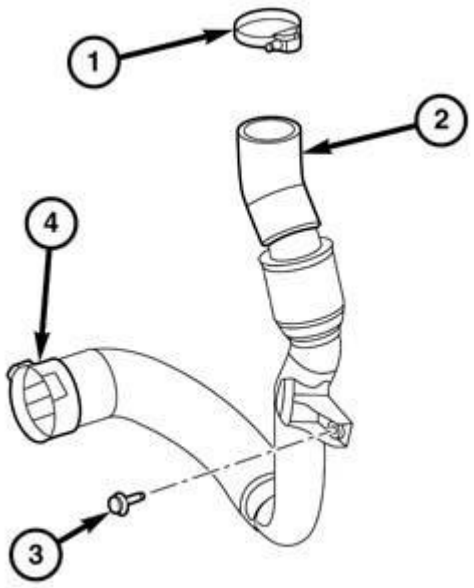


Fig. 629: Charge Air Cooler Hose, Inlet Quick Connect, Bolt & Clamp

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Courtesy of CHRYSLER GROUP, LLC

4. Disconnect charge air cooler hose (2) inlet quick connect (4).
5. Remove bolt (3) from charge air cooler hose (2).
6. Loosen clamp (1) at charge air cooler hose (2).
7. Carefully remove charge air cooler hose from vehicle.

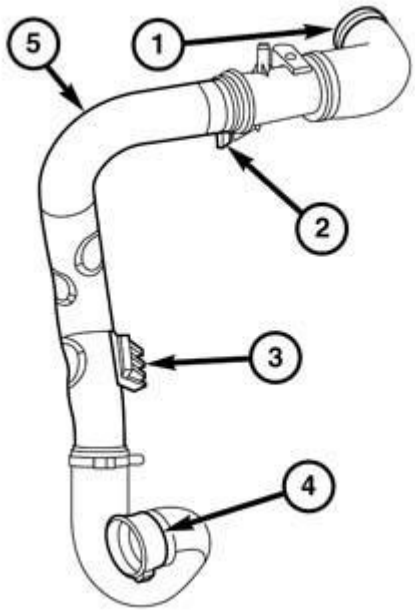


Fig. 630: Charge Air Cooler Outlet Hose, Outlet Quick Connect, Bolts & Clamp
Courtesy of CHRYSLER GROUP, LLC

8. Disconnect the evaporative purge hose from charge air cooler outlet hose (5).
9. Disconnect the pressure sensor from the charge air cooler outlet hose (5).
10. Remove the bolts (2 and 3) from the hose.
11. Disconnect the charge air cooler hose (5) outlet quick connect (4).
12. Loosen the clamp (1) at charge the air cooler hose (5).
13. Carefully remove the charge air cooler outlet hose (5) from the vehicle.

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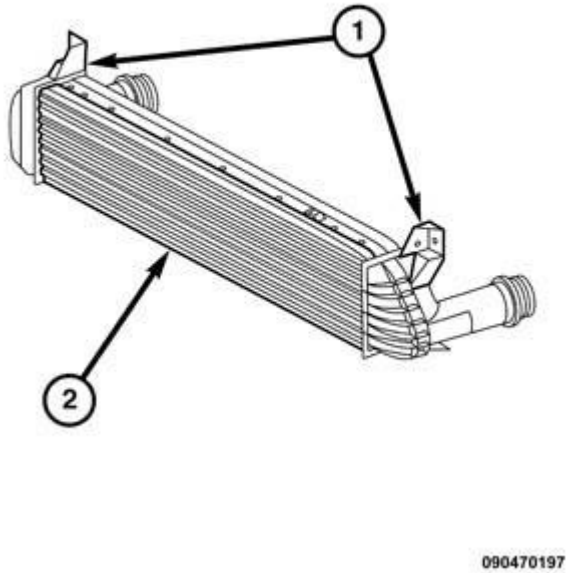


Fig. 631: Charge Air Cooler & Bolts
Courtesy of CHRYSLER GROUP, LLC

14. Remove the bolts (1) from the charge air cooler (2).
15. Lift the charge air cooler (2) out of the vehicle.

INSTALLATION

INSTALLATION

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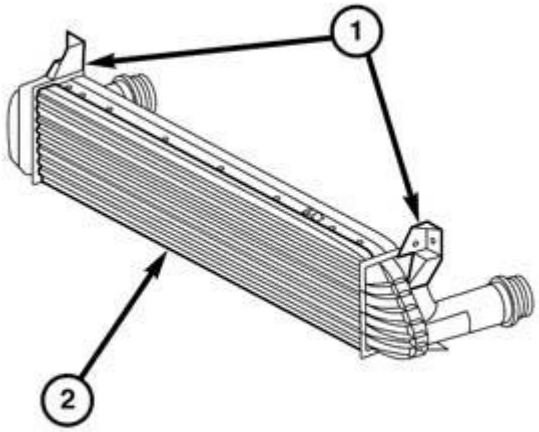


Fig. 632: Charge Air Cooler & Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Install the charge air cooler (2). Set the bottom of the cooler onto the tabs.
2. Install the bolts (1) and tighten to 9 N.m (80 in. lbs.).

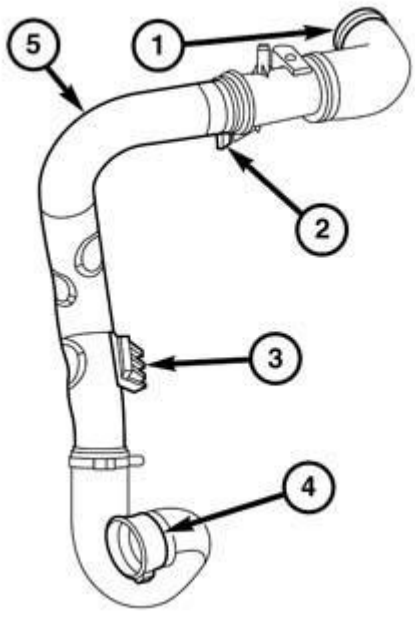
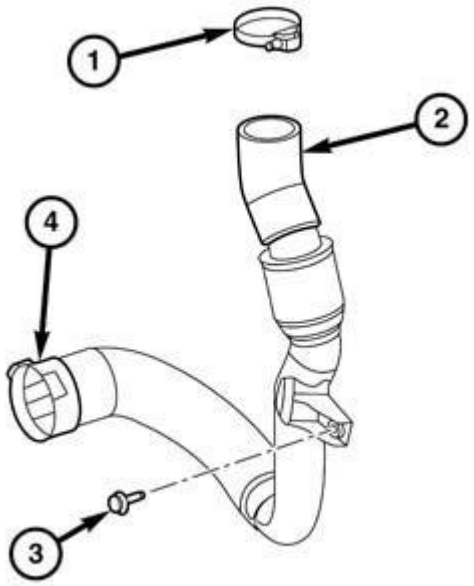


Fig. 633: Charge Air Cooler Outlet Hose, Outlet Quick Connect, Bolts & Clamp
Courtesy of CHRYSLER GROUP, LLC

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3. Install the outlet hose (5) onto the air charge cooler.
4. Seat the quick (4) onto charge air cooler outlet.
5. Tighten clamp (1) at the throttle body inlet.
6. Install the bolts (2 and 3) that secure the outlet hose. Tighten to 9 N.m (80 in. lbs.).
7. Connect the pressure sensor connector.
8. Install the evaporative purge hose onto the charge air cooler hose and set clamp in place.



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Fig. 634: Charge Air Cooler Hose, Inlet Quick Connect, Bolt & Clamp
Courtesy of CHRYSLER GROUP, LLC

9. Install the charge air cooler inlet hose.
10. Tighten the clamp (1) at the turbo charger outlet.
11. Seat the quick connect (4) at the cooler inlet.
12. Install bolt (3) and tighten to 9 N.m (80 in.
13. Install the front fascia. Refer to **FASCIA, FRONT, INSTALLATION** .
14. Lower the vehicle.
15. Connect the battery negative cable. Refer to **BATTERY, INSTALLATION** .

TURBOCHARGER

REMOVAL

REMOVAL

1. Disconnect and isolate the battery negative cable.

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2. Raise and support the vehicle.
3. Remove the engine cover.
4. Remove the air box. Refer to **BODY, AIR CLEANER, REMOVAL**
5. Remove the Charge Air Cooler (CAC) inlet hose. Refer to **COOLER AND HOSES, CHARGE AIR, REMOVAL**.
6. Drain the coolant. Refer to **STANDARD PROCEDURE** .
7. Remove the crossunder Pipe. Refer to **PIPE, EXHAUST CROSSUNDER, REMOVAL** .

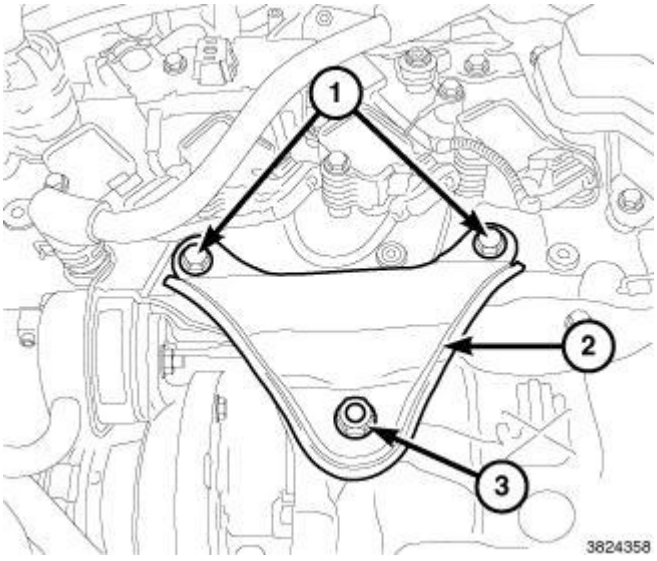
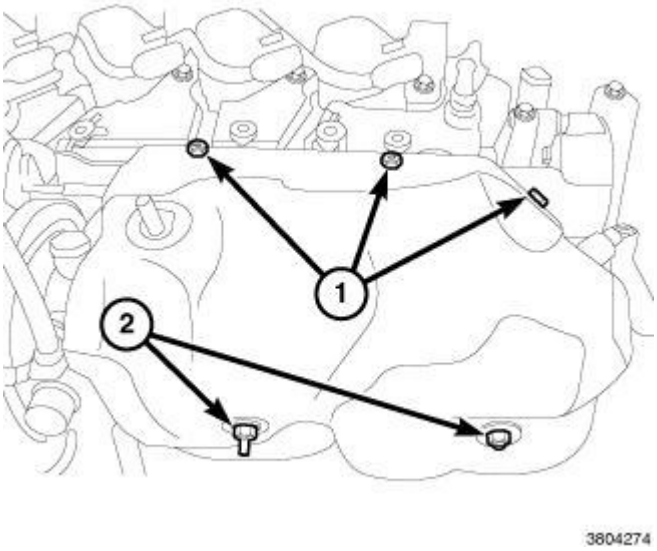


Fig. 635: Turbocharger Bracket & Fasteners
Courtesy of CHRYSLER GROUP, LLC

8. Remove the turbocharger bracket bolts (1).
9. Remove and **discard** the bracket nut (3).
10. Remove the turbocharger bracket (2).



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Fig. 636: Upper Heat Shield Bolts & Nuts
Courtesy of CHRYSLER GROUP, LLC

11. Remove the turbocharger upper heat shield bolts (1). Remove and **discard** the nuts (2).

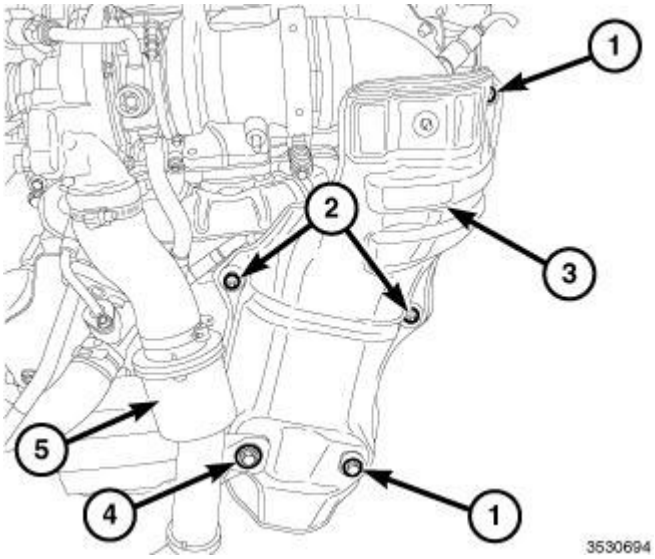


Fig. 637: Charge Air Cooler Supply Hose, Heat Shield, Nuts & Bolts
Courtesy of CHRYSLER GROUP, LLC

12. Remove the catalytic converter heat shield (3).

CAUTION: The oil supply and return lines MUST be replaced whenever the lines are loosened or removed.

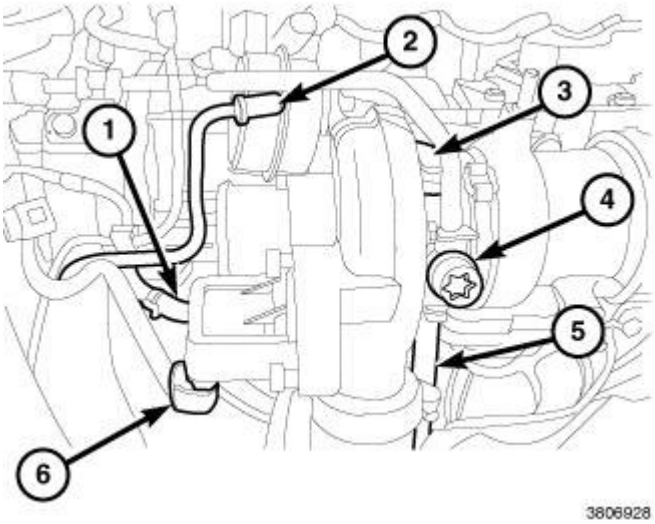


Fig. 638: Turbocharger Pressure Sensor Hose, Actuator Pump, Oil And Coolant Supply Line Banjo Bolt, Lower Oil Return Line & Turbocharger Surge Valve Connector
Courtesy of CHRYSLER GROUP, LLC

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13. Disconnect the wastegate supply line from the actuator pump (2).
14. Remove the coolant return line banjo bolt located on the rear side of the turbocharger. Discard the banjo washers.
15. Remove the coolant supply banjo bolt (4) and position the line aside. Discard the banjo washers.
16. Remove the oil supply line banjo bolt (3). Remove the line as an assembly. **The oil supply and return lines must be replaced. The oil line banjo bolts and banjo washers must be replaced.**
17. Remove the lower oil return line (5). **The oil supply and return lines must be replaced. The oil line banjo bolts and banjo washers must be replaced.**
18. Disconnect the turbocharger surge valve connector (6).

NOTE: Remove the surge valve from the turbocharger. It will be necessary to install the surge valve onto the new turbocharger assembly.

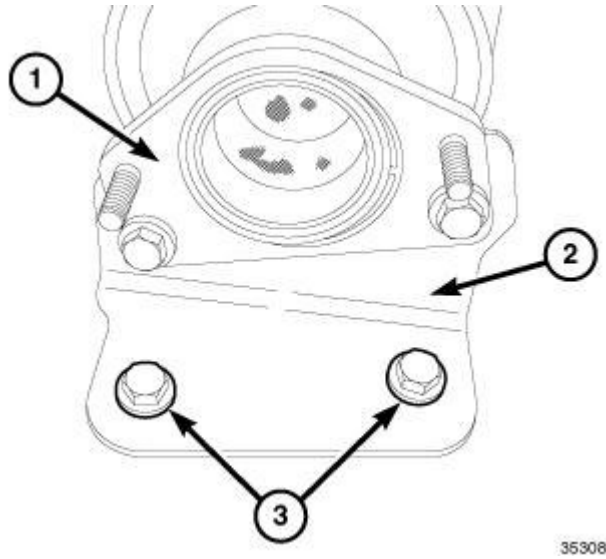


Fig. 639: Catalytic Converter, Support Mount & Bolts
Courtesy of CHRYSLER GROUP, LLC

19.
20. Remove the lower catalytic converter support mount (2).

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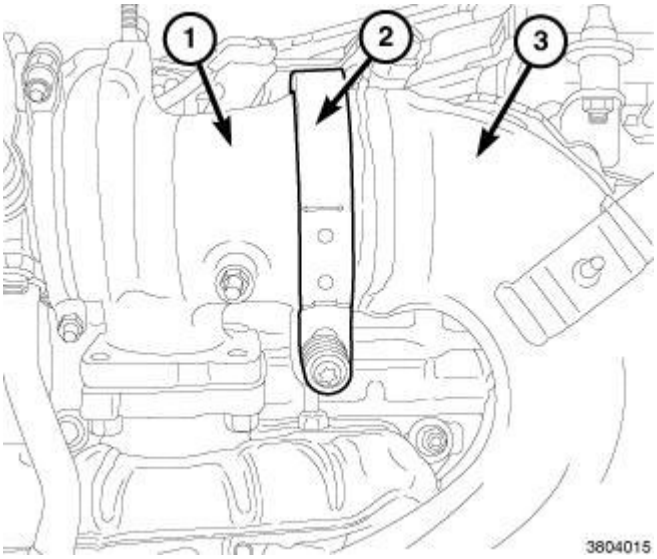


Fig. 640: Turbocharger, Catalytic Converter Clamp & Catalytic Converter Assembly
Courtesy of CHRYSLER GROUP, LLC

21. Disconnect the upstream oxygen sensor connector.
22. Loosen the catalytic converter clamp (2) at the turbocharger (1) and remove the converter assembly from vehicle.

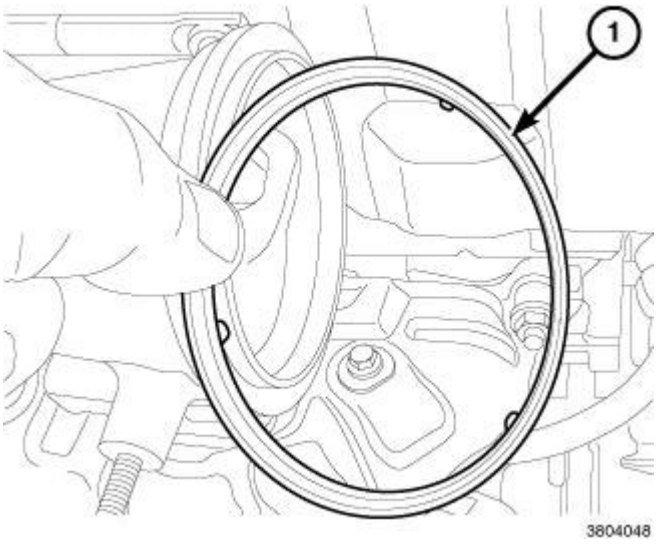


Fig. 641: Converter/Turbo Gasket Ring
Courtesy of CHRYSLER GROUP, LLC

23. Remove **and discard** the converter to turbo seal ring (1).

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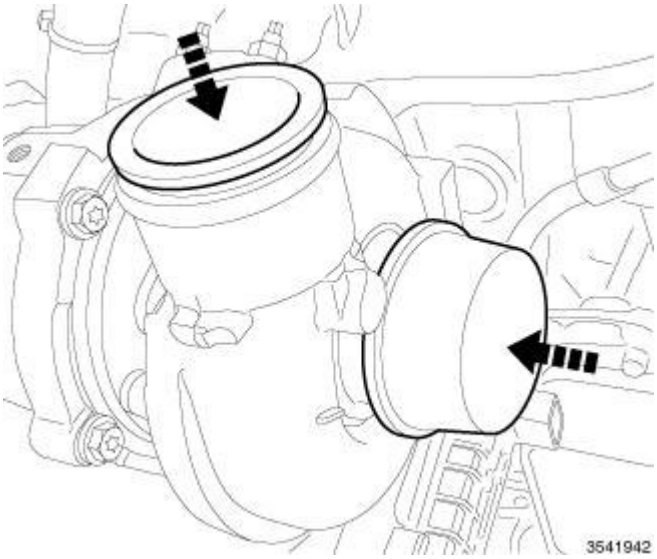


Fig. 642: Identifying Covers/Caps Applications
Courtesy of CHRYSLER GROUP, LLC

NOTE: Install the (special tool #10368, Set, Universal Protective Cap) into the open bores on the turbo to avoid any foreign material to enter the turbocharger.

24. Remove the two bolts that secure the shield to the exhaust manifold. Remove **and discard** the nut.
25. Remove the shield.

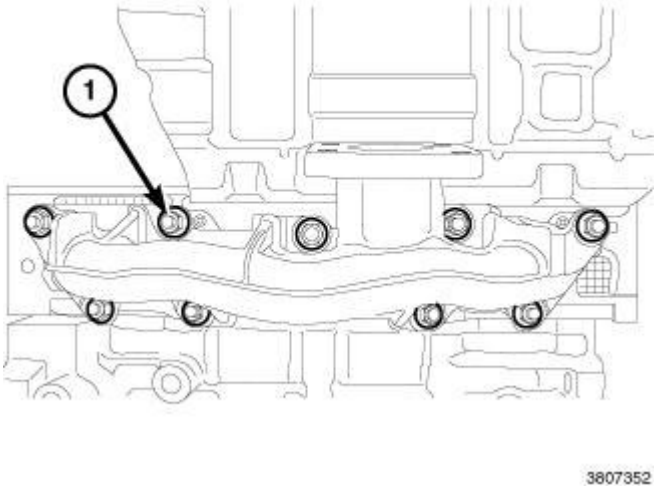


Fig. 643: Exhaust Manifold Nuts
Courtesy of CHRYSLER GROUP, LLC

NOTE: The turbocharger has been removed for clarity.

26. Remove **and discard** the nine exhaust manifold nuts (1). Remove the nine washers.

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27. Remove and **discard** the nine exhaust manifold studs.

NOTE: The exhaust manifold nuts and studs must be replaced. The washers can be reused. The exhaust manifold gasket and the turbocharger to manifold gasket must be replaced.

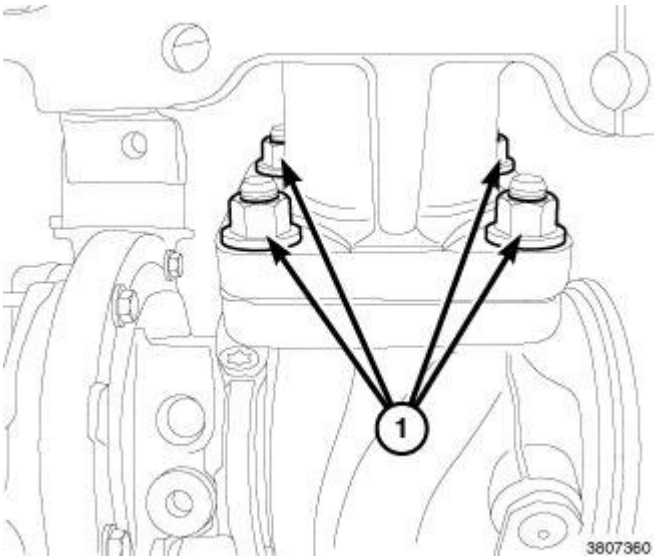


Fig. 644: Manifold/Turbocharger Nuts
Courtesy of CHRYSLER GROUP, LLC

28. With the manifold removed, invert the manifold and turbocharger as an assembly. Remove **and discard** the four nuts (1).

NOTE: The turbocharger mounting nuts must be replaced.

29. Lift the manifold up and off of the turbocharger. Remove and **discard** the gasket.

INSTALLATION

INSTALLATION

CAUTION: The oil supply and return lines MUST be replaced whenever the lines are loosened or removed.

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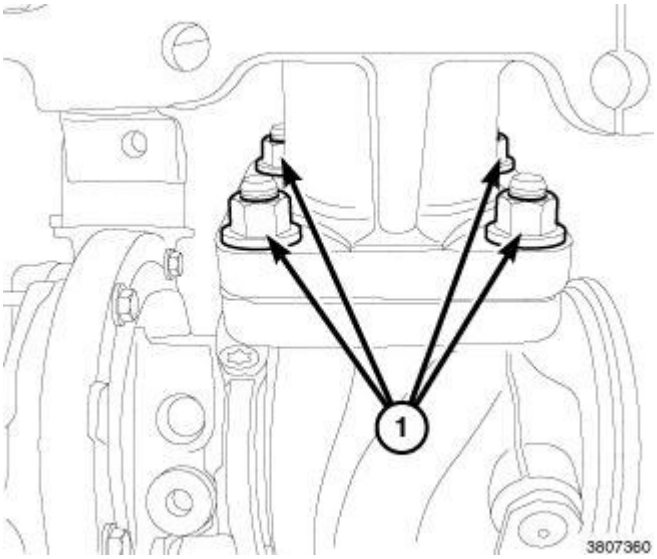
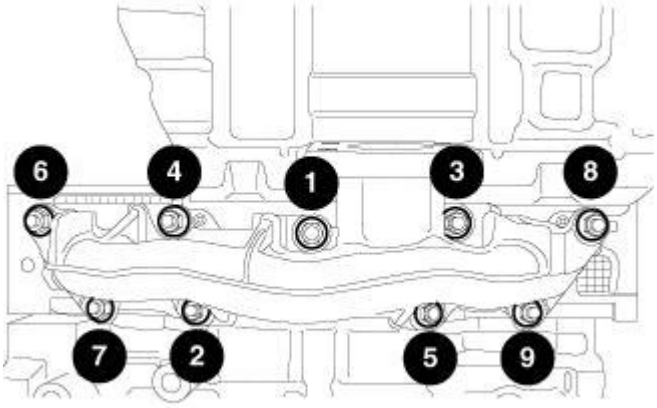


Fig. 645: Manifold/Turbocharger Nuts
Courtesy of CHRYSLER GROUP, LLC

1. With the manifold removed, invert the manifold and turbocharger.
2. Install a **new** gasket onto the manifold/turbocharger mating surface.
3. Set the manifold onto the turbocharger studs and install four **new** nuts (1) by hand.
4. Tighten the four nuts to 24 N.m (18 ft. lbs.).
5. After the nuts are tightened to 24 N.m (18 ft. lbs.) once, repeat the step to be sure that all nuts are at the proper torque.

NOTE: Replace any stud that loosens during removal. If a stud is to be replaced, tighten the new stud to 11 N.m (97 in. lbs.). Age of the vehicle and environment impact how many of the studs come out. Any that stay in the head also need to be checked for the 11 N.m (97 in. lbs.).



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Fig. 646: Exhaust Manifold Fastener Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

NOTE: The turbocharger has been removed for clarity.

NOTE: When screwing the studs into the head, install them dry. Do not apply any lubricants, adhesives, sealants or the like to the threads. The new studs have a locking adhesive impregnated into the threads.

6. Install new manifold studs. Tighten the studs to 11 N.m (97 in. lbs.).
7. Install a **new** manifold gasket/shield assembly.
8. Set the manifold and turbocharger assembly onto the cylinder head studs.
9. Install the nine exhaust manifold washers and **new** nuts (1).
10. 1) Tighten to 15 N.m (133 in. lbs.) in order from 1 to 9.
11. 2) Retighten to 15 N.m (133 in. lbs.) in order from **1 to 4 only** .
12. 3) Add additional 30 degrees (one 1/8 of a turn) of clockwise rotation to **all** in order from 1 to 9.

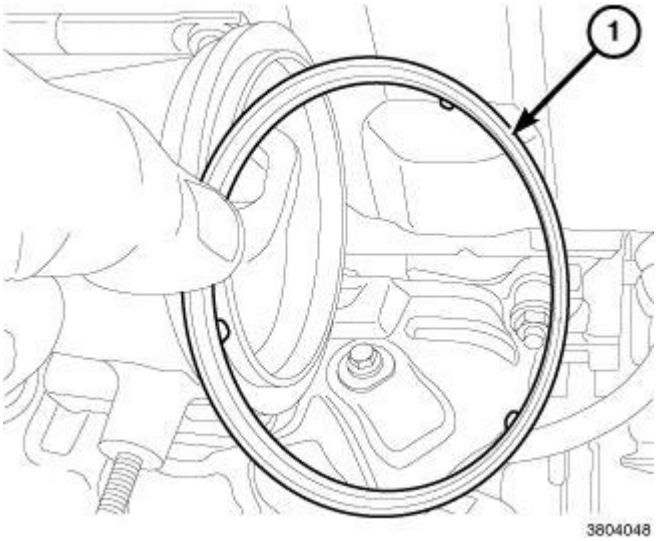


Fig. 647: Converter/Turbo Gasket Ring
Courtesy of CHRYSLER GROUP, LLC

13. Position the exhaust manifold shield and install the two bolts and one **new** nut.
14. Tighten the shield bolts to 9 N.m (80 in. lbs.).

CAUTION: Band clamps should never be tightened such that the two sides of the clamps are bottomed out against the hourglass shaped center block. Once this occurs, the clamp has lost clamping force and must be replaced.

15. Install the **new** converter to turbo seal ring (1).

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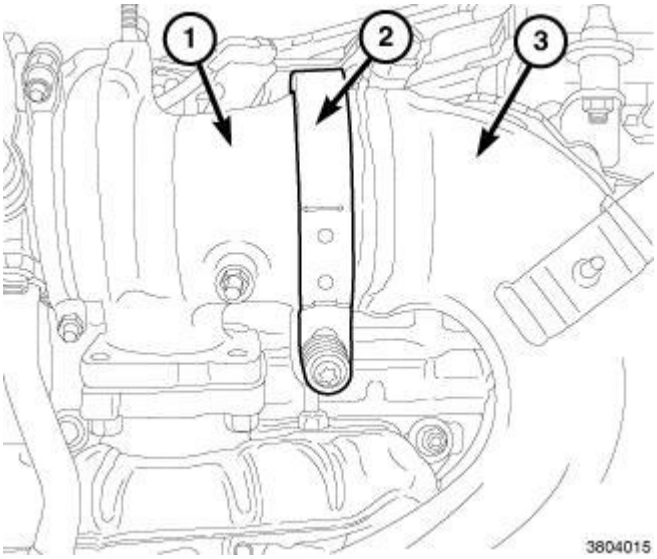


Fig. 648: Turbocharger, Catalytic Converter Clamp & Catalytic Converter Assembly
Courtesy of CHRYSLER GROUP, LLC

16. Install the catalytic converter assembly (3).
17. Install the catalytic converter v-clamp (2) at the turbocharger (1).
18. Tighten clamp to 8 N.m (71in. lb).
19. Connect the O2 sensor connector.

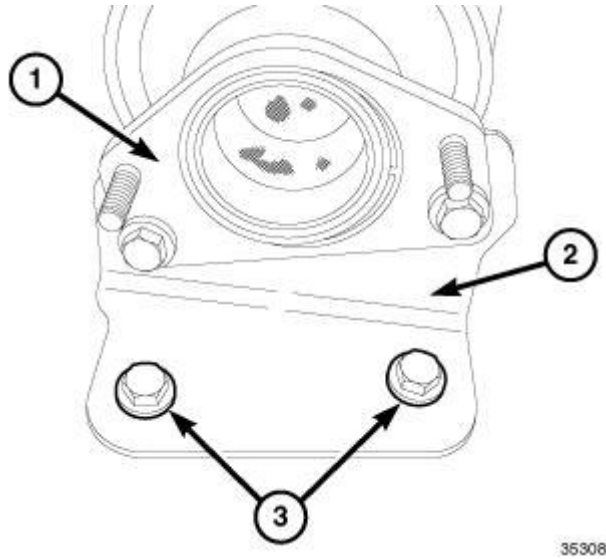


Fig. 649: Catalytic Converter, Support Mount & Bolts
Courtesy of CHRYSLER GROUP, LLC

20. Install the catalytic converter lower support bracket (2).
21. Install and tighten the bracket bolts (3) to 56 N.m (41 ft. lbs.).
22. Install a new converter to pipe gasket.
23. Install the crossunder pipe Refer to **PIPE, EXHAUST CROSSUNDER, INSTALLATION** .

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24. Install the nuts that secure the cross under pipe to the catalytic converter.
25. Tighten the front exhaust pipe nuts to 56 N.m (41 ft. lbs.).
26. Install the exhaust flange nuts (1). Tighten to 69 N.m (51 ft. lbs.).

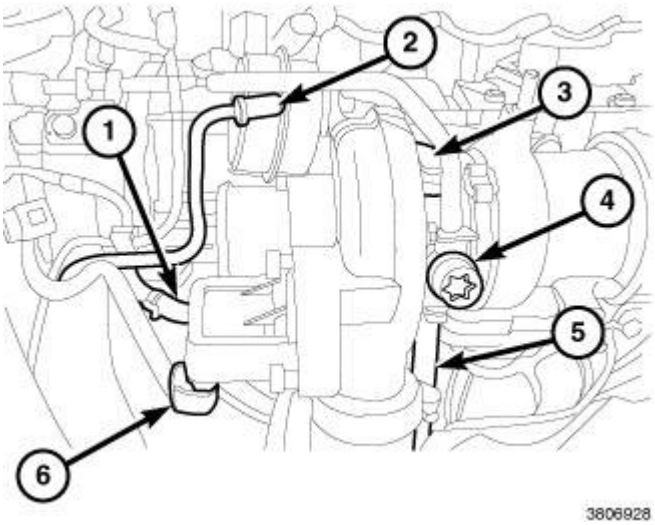


Fig. 650: Turbocharger Pressure Sensor Hose, Actuator Pump, Oil And Coolant Supply Line Banjo Bolt, Lower Oil Return Line & Turbocharger Surge Valve Connector
Courtesy of CHRYSLER GROUP, LLC

NOTE: Banjo bolts and banjo bolt gaskets must be replaced during assembly.

NOTE: The oil supply and return lines must be replaced during assembly or ANY TIME the fittings are loosened to prevent turbine bearing failure due to debris.

27. Connect the wastegate supply hose to the actuator pump (2).
28. Connect the turbocharger pressure sensor hose (1).
29. Install the coolant return line **with new washers** located on the rear side of the turbocharger. Tighten to 38 N.m (28 ft. lbs.).
30. Install the coolant supply banjo bolt (4) and **new** washers. Tighten to 38 N.m (28 ft. lbs.).
31. Install the **new** oil supply line, banjo bolts (3) and washers. Tighten to 30 N.m (22 ft. lbs.).
32. Install the lower **new** oil return line (5) and new upper gasket. Tighten the bolt to 14 N.m (124 in. lbs.).
33. Install the previously removed surge valve and tighten the bolts to 9 N.m (80 in. lbs.)
34. Connect the turbocharger surge valve connector (6).

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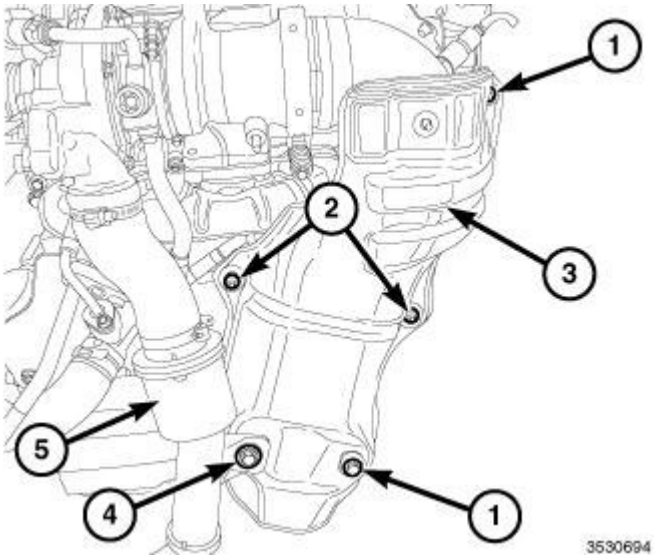


Fig. 651: Charge Air Cooler Supply Hose, Heat Shield, Nuts & Bolts
Courtesy of CHRYSLER GROUP, LLC

35. Install the Charge Air Cooler (CAC) inlet hose Refer to **COOLER AND HOSES, CHARGE AIR, INSTALLATION**.
36. Install the catalytic converter heat shield (3). Install the bolts and **new** nuts. Tighten the nuts and bolts to 8 N.m (71 in. lbs.).

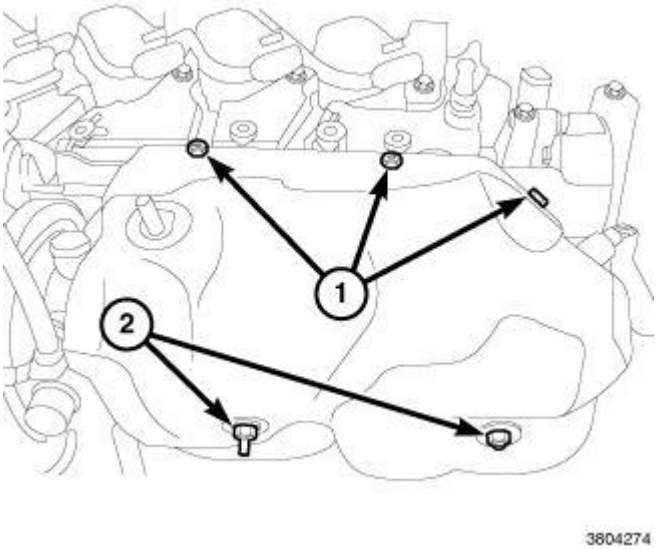


Fig. 652: Upper Heat Shield Bolts & Nuts
Courtesy of CHRYSLER GROUP, LLC

37. Install the upper heat shield. Install the three bolts and the two

    new

    nuts. Tighten the bolts and the nuts to 9 N.m (80 in. lbs.).

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Care must be taken when tightening the shield bolts. If torque value is not correct, noise will occur.

38. Connect the upstream and downstream oxygen sensor connectors.

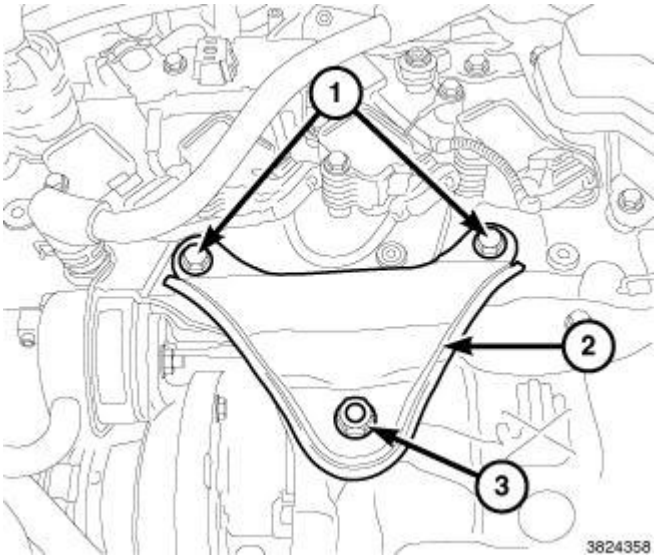


Fig. 653: Turbocharger Bracket & Fasteners
Courtesy of CHRYSLER GROUP, LLC

39. Install the turbocharger bracket (2), bolts (1) and **new** nut (3).
40. Tighten the bolts and nut to 25 N.m (18 ft. lbs.).
41. Install the air box. Refer to **BODY, AIR CLEANER, INSTALLATION**.
42. Install the engine cover.
43. Add any coolant that was lost during the repair. Refer to **STANDARD PROCEDURE** .

SOLENOID, WASTEGATE

REMOVAL

REMOVAL

1. Remove the air cleaner body. Refer to **BODY, AIR CLEANER, INSTALLATION**.
2. Disconnect the fresh air intake hose (2). Remove the air cleaner assembly.

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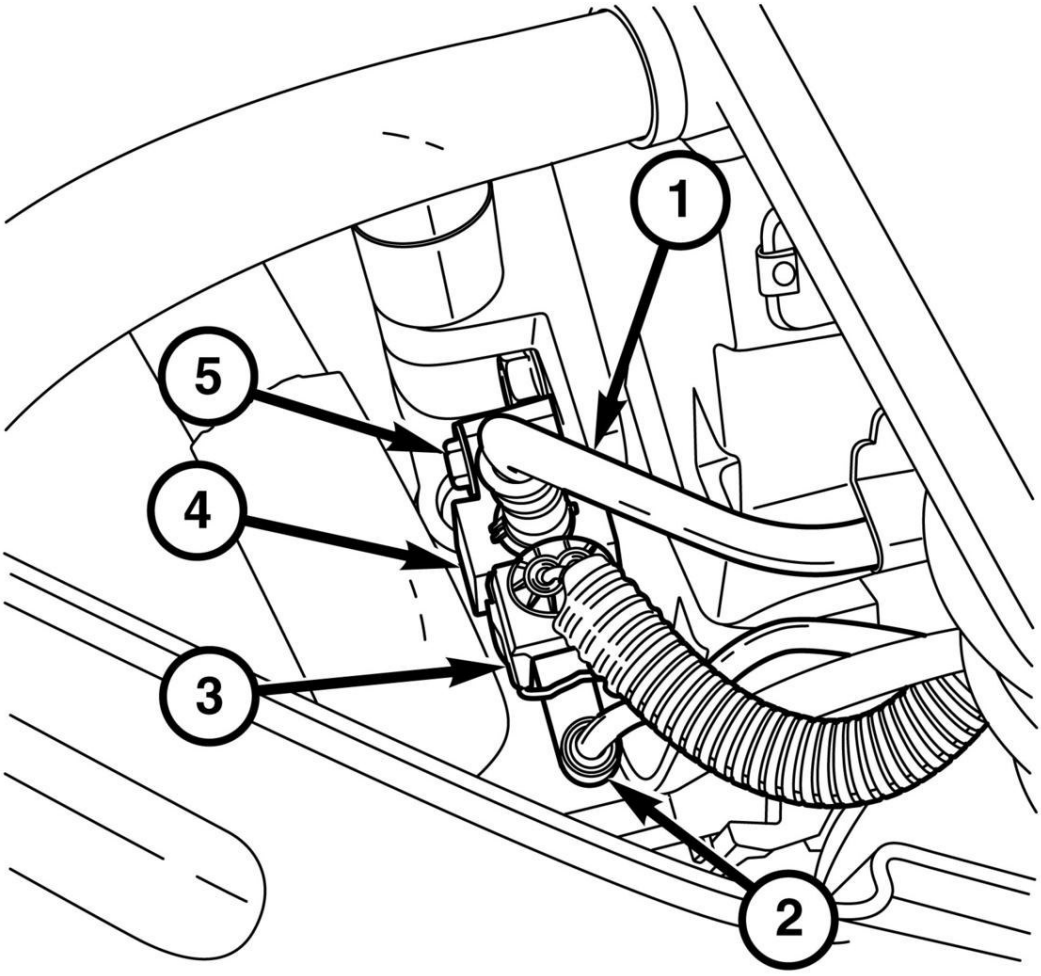


Fig. 654: Wastegate Actuator Hose, Solenoid, Electrical Connector, Vacuum Supply Hose & Nut
Courtesy of CHRYSLER GROUP, LLC

3. Disconnect the electrical connector (3).
4. Remove the vacuum supply (2) and wastegate actuator (1) hoses.
5. Remove the nut (5) securing the solenoid mounting bracket to the timing cover.
6. Remove the solenoid (4).

INSTALLATION

INSTALLATION

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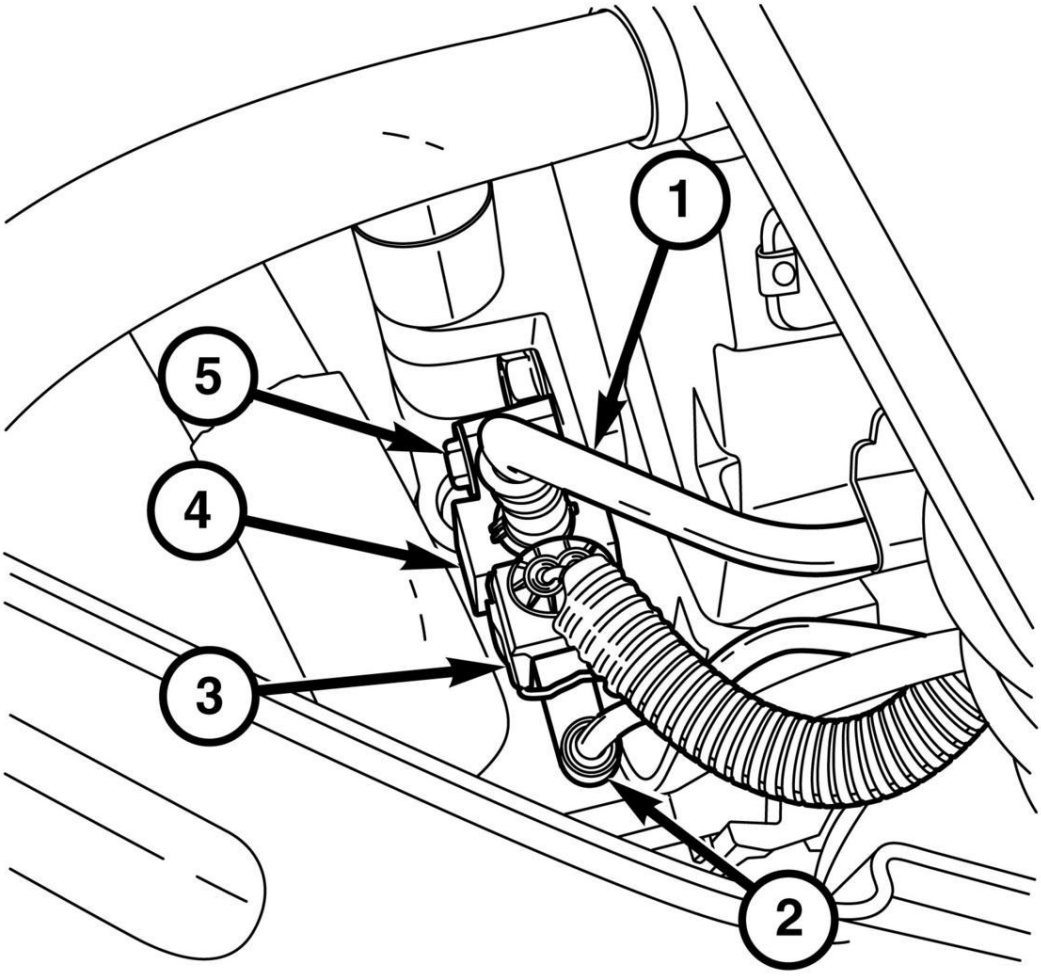


Fig. 655: Wastegate Actuator Hose, Solenoid, Electrical Connector, Vacuum Supply Hose & Nut
Courtesy of CHRYSLER GROUP, LLC

1. Install the wastegate actuator (4).
2. Install the nut (5). Tighten to 8 N.m (71 in. lbs.).
3. Install the air cleaner body. Refer to **BODY, AIR CLEANER, REMOVAL**.

SENSOR, TURBO BOOST PRESSURE

REMOVAL

REMOVAL

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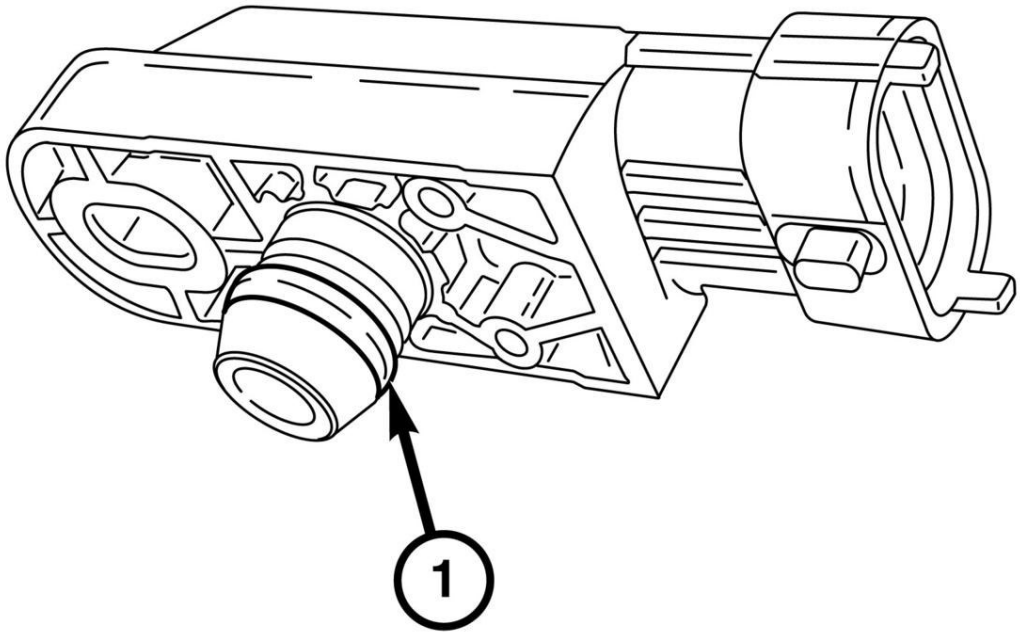


Fig. 656: Turbocharger Boost Pressure Sensor
Courtesy of CHRYSLER GROUP, LLC

1. The turbocharger boost pressure sensor (1) is mounted to the charge air cooler (CAC) duct near the throttle body inlet.
2. Disconnect battery cables.
3. Remove the battery from the tray.
4. Remove the battery tray.
5. Disconnect the boost pressure sensor connector.
6. Remove the screw securing the boost pressure sensor to the CAC duct.
7. Remove the boost pressure sensor.

INSTALLATION

INSTALLATION

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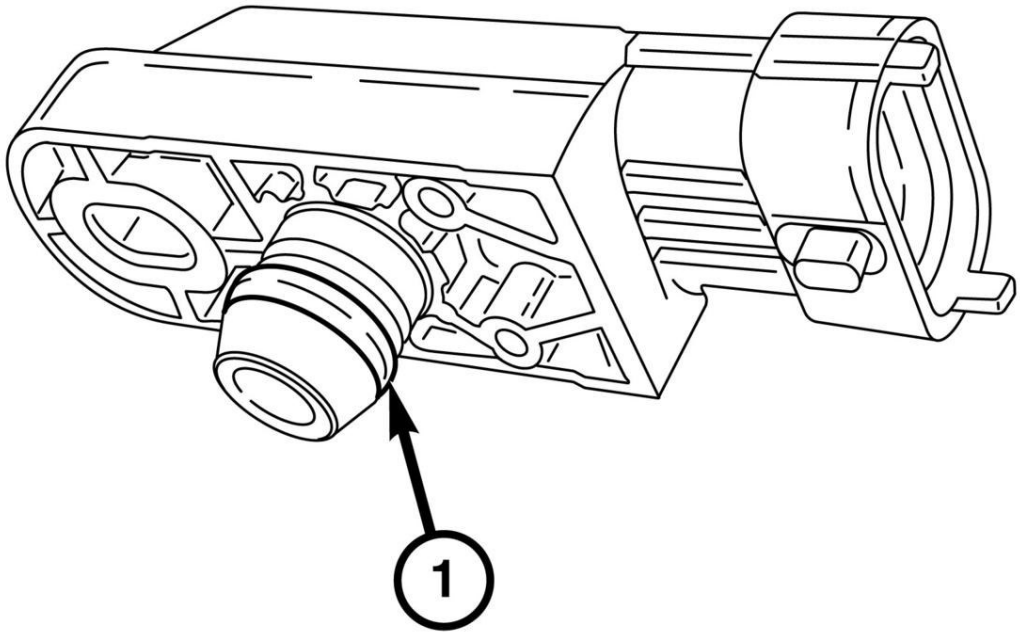


Fig. 657: Turbocharger Boost Pressure Sensor
Courtesy of CHRYSLER GROUP, LLC

1. Install the boost pressure sensor (1) into the duct.
2. Install the screw to secure the boost pressure sensor to the charge air cooler (CAC duct). Do not over tighten.
3. Install the battery tray.
4. Install the battery.
5. Connect the battery cables.

VALVE, SURGE

REMOVAL

REMOVAL

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1. Disconnect and isolate the negative battery cable.

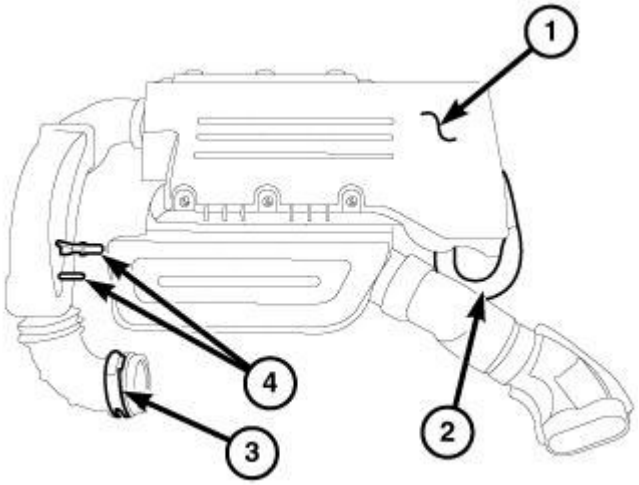


Fig. 658: Air Cleaner Assembly, Intake Hose, Fittings & Clamp
Courtesy of CHRYSLER GROUP, LLC

2. Disconnect the two vacuum fittings (4), loosen the clamp (3) at the air to turbocharger inlet tube.
3. Disconnect the fresh air intake hose (2).
4. Remove the air cleaner assembly (1).

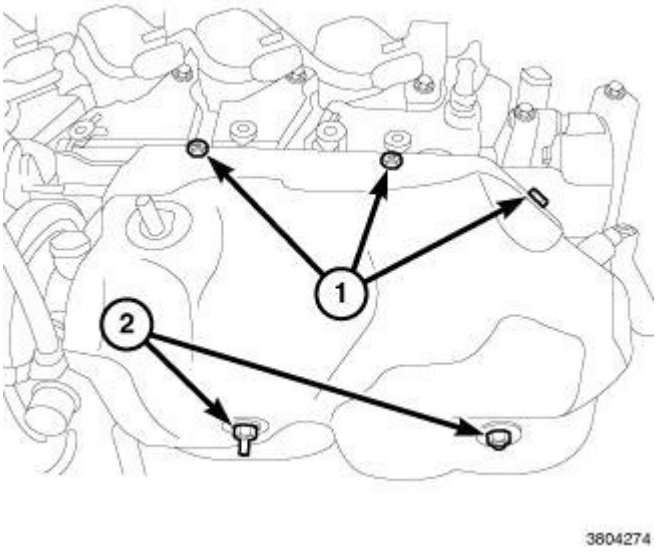


Fig. 659: Upper Heat Shield Bolts & Nuts
Courtesy of CHRYSLER GROUP, LLC

5. Remove and discard the two nuts (2) and three bolts (1) that secure the upper heat shield.

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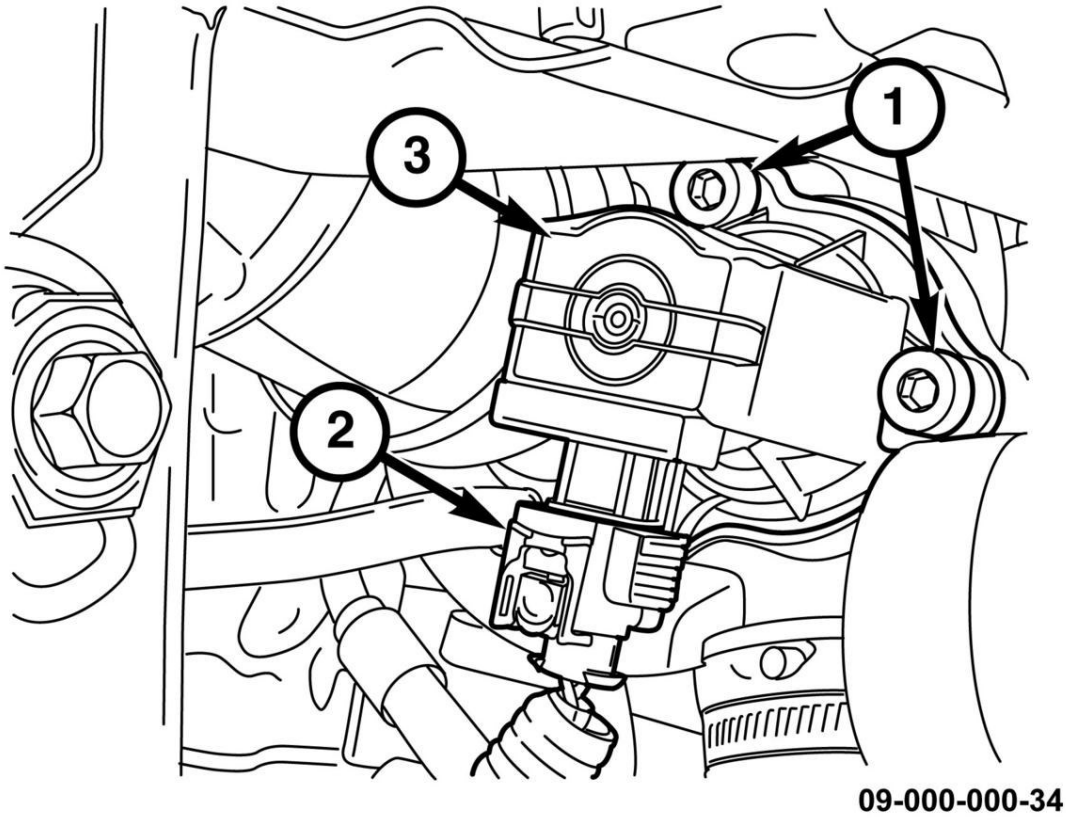


Fig. 660: Surge Valve, Connector & Bolts
Courtesy of CHRYSLER GROUP, LLC

6. Disconnect the surge valve connector (2)
7. Remove the three bolts (1).
8. Remove the surge valve (3).

INSTALLATION

INSTALLATION

1. Install the surge valve into the turbocharger housing.
2. Install the three bolts (1). Tighten the bolts and the nuts to 9 N.m (80 in. lbs.)
3. Connect the surge valve connector (2).

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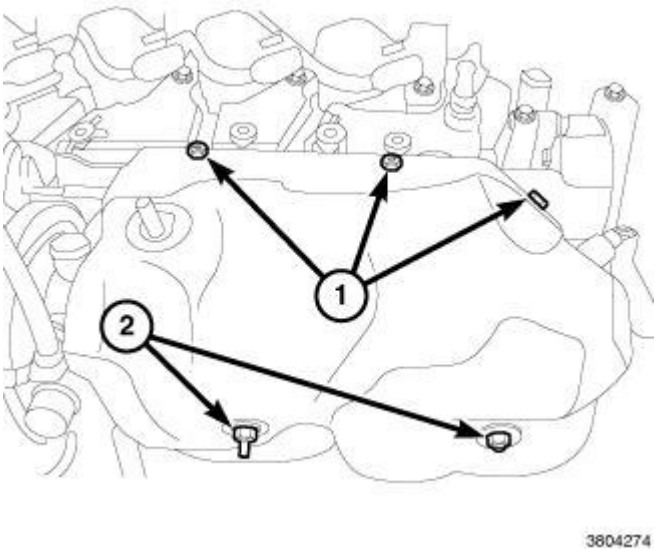


Fig. 661: Upper Heat Shield Bolts & Nuts
Courtesy of CHRYSLER GROUP, LLC

4. Install the upper heat shield.
5. Install the new nuts (2) and the three bolts (1). Tighten to 9 N.m (80 in. lbs.)

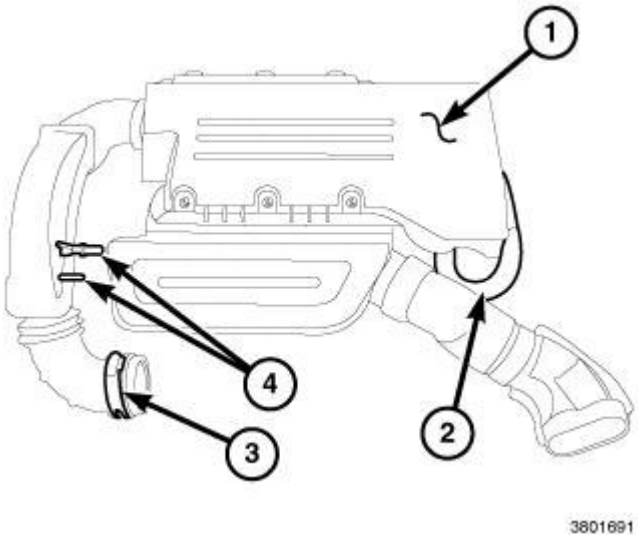


Fig. 662: Air Cleaner Assembly, Intake Hose, Fittings & Clamp
Courtesy of CHRYSLER GROUP, LLC

6. Install the air cleaner assembly (1)
7. Connect the two vacuum fittings (4), tighten the clamp (3) at the air to turbocharger inlet tube.
8. Connect the fresh air intake hose (2).

VALVE TIMING

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DESCRIPTION

DESCRIPTION

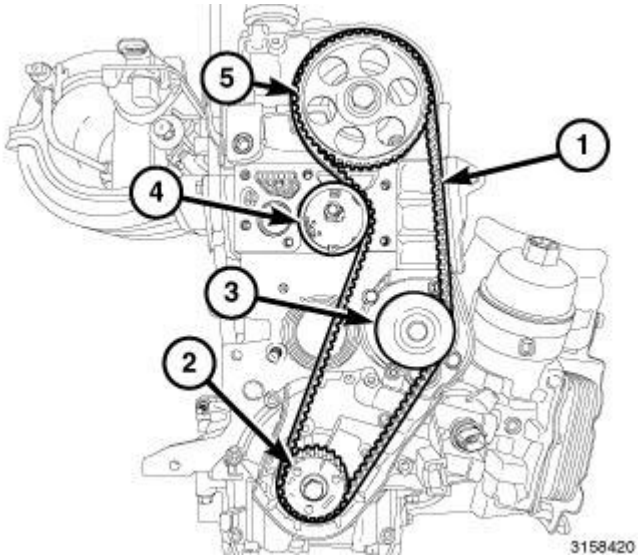


Fig. 663: Timing Belt Routing & Assembly
Courtesy of CHRYSLER GROUP, LLC

The timing drive system has been designed to provide quiet performance and reliability to support a **NON** free-wheeling engine.

The timing drive components include a crankshaft sprocket (2), camshaft sprocket (5), tensioner pulley (4) and a timing belt (1). The water pump (3) is also driven by the timing belt. The camshaft sprocket is not keyed to the camshaft.

STANDARD PROCEDURE

STANDARD PROCEDURE - ENGINE TIMING VERIFICATION

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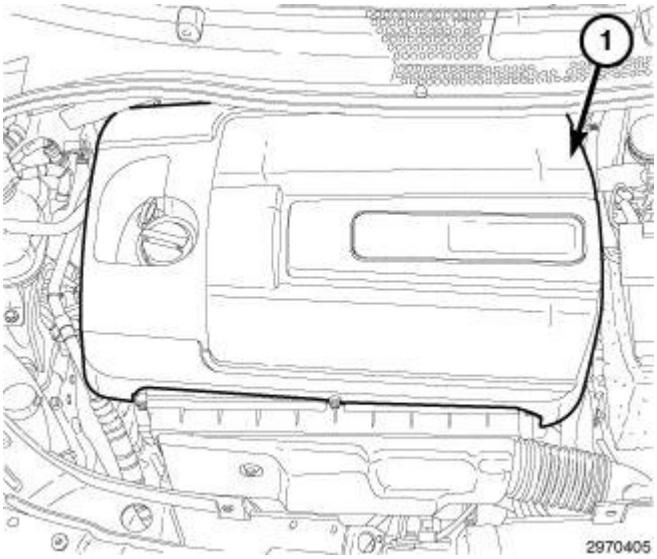


Fig. 664: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect and isolate the negative battery cable.
2. Remove the engine cover (1).

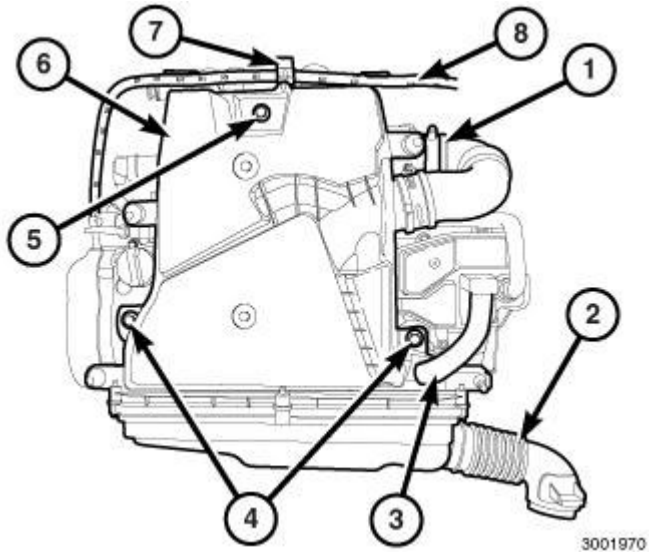


Fig. 665: Air Cleaner Body Assembly
Courtesy of CHRYSLER GROUP, LLC

3. Remove the air cleaner body (6). Refer to **BODY, AIR CLEANER, REMOVAL**.

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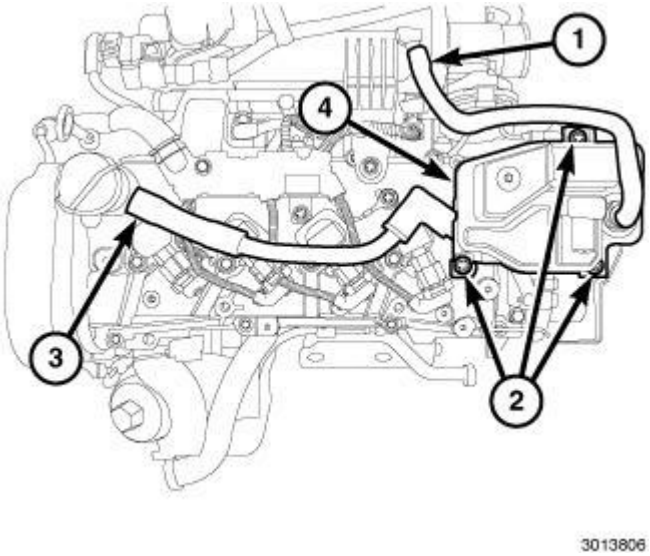


Fig. 666: PCV Hose, Bolts, Vent Hose & Oil Separator Housing
Courtesy of CHRYSLER GROUP, LLC

4. Disconnect the PCV hose (1) from the intake manifold.
5. Disconnect the vent hose (3) from the oil filler neck.
6. Remove three bolts (2) and remove the oil separator housing (4) from the cylinder head cover.

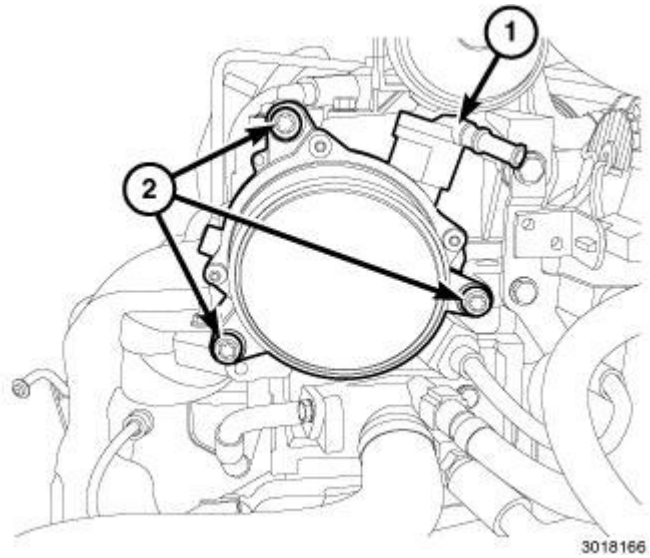


Fig. 667: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

7. Remove the vacuum pump (1). Refer to **PUMP, VACUUM, REMOVAL**.

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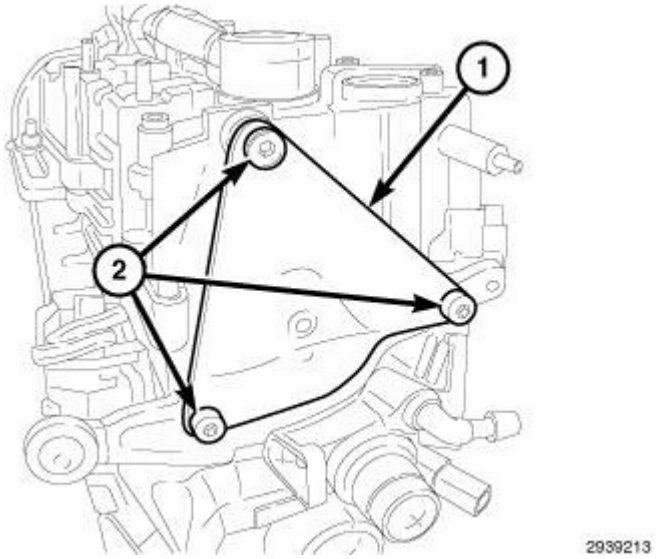


Fig. 668: Camshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

8. Install the Camshaft Timing Locking Tool (special tool #10277, Tool, Camshaft Timing Locking) (1) to the rear of the camshaft. Rotate the crankshaft vibration damper clockwise to align the tool with the vacuum pump mounting. Install three bolts (2) and tighten to 20 N.m (15 ft. lbs.).

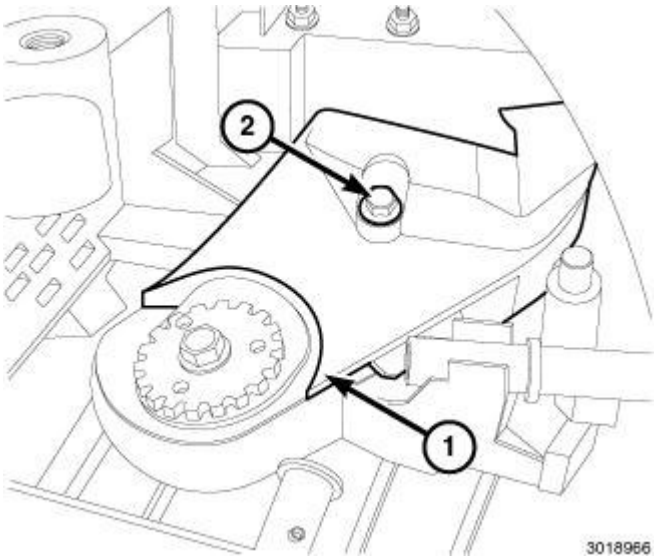


Fig. 669: Lower Timing Belt Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

9. Remove the lower timing belt cover (1). Refer to **COVER(S), ENGINE TIMING, REMOVAL**.

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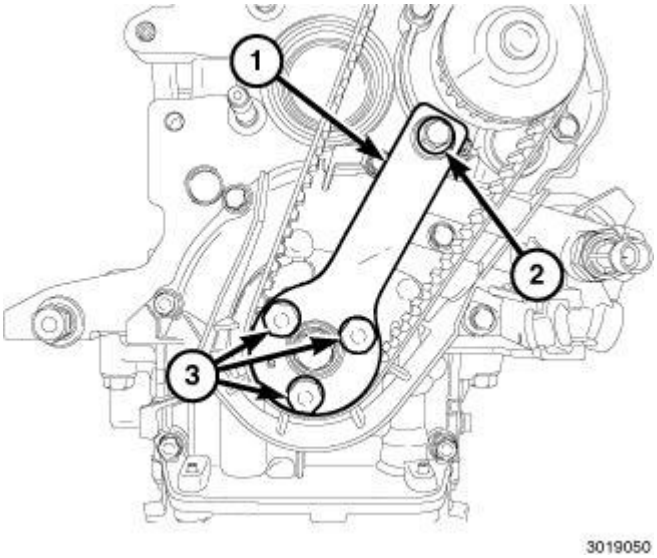


Fig. 670: Crankshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

10. Install the Crankshaft Timing Locking Tool (special tool #10276, Tool, Crankshaft Timing Locking) (1) with three bolts (3) tightened to 25 N.m (18 ft. lbs.) and one bolt (2) tightened to 9 N.m (80 in. lbs.).
11. If the bolt (2) does not align with the lower timing belt cover mounting boss, the camshaft timing is not correct. Proceed to the timing belt service procedures. Refer to **BELT, TIMING, REMOVAL**.

BELT, TIMING

REMOVAL

REMOVAL

1. Remove the engine cover.
2. Disconnect and isolate the battery negative cable.

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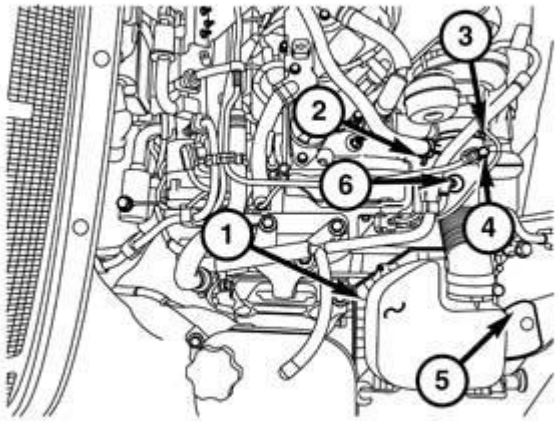


Fig. 671: EVAP Hose Quick Release Fitting, Wastegate Solenoid Vent Hose, Clamps, Screws & Bolts
Courtesy of CHRYSLER GROUP, LLC

3. Remove the air fitting hoses (2, 3, 4, and 6) from the intake snorkel.
4. Remove the air cleaner body (1). Refer to **BODY, AIR CLEANER, REMOVAL**.

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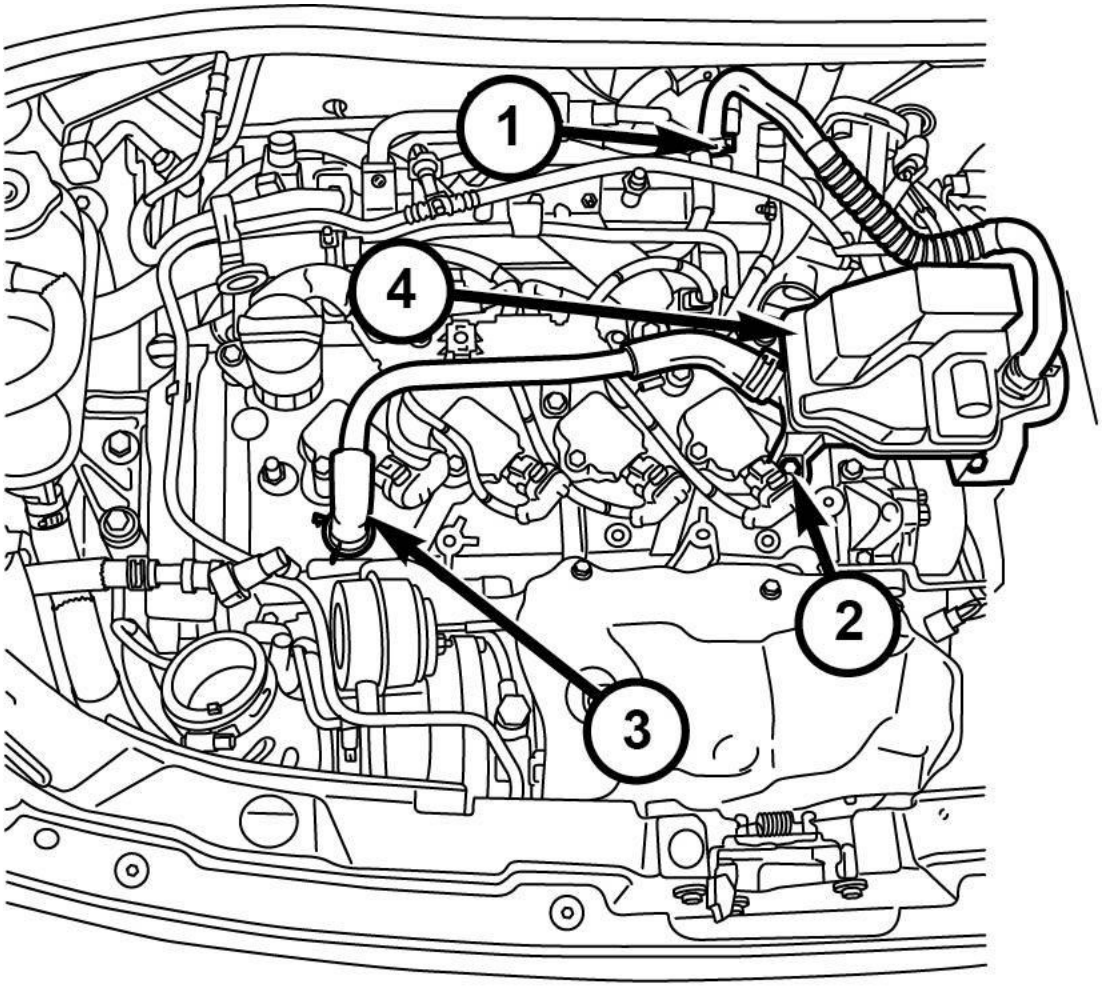


Fig. 672: PCV Hose, Vent Hose, Oil Separator Housing & Bolts
Courtesy of CHRYSLER GROUP, LLC

5. Disconnect the PCV hose (1) from the intake manifold.
6. Disconnect the vent hose (3) from the cylinder head cover.
7. Remove three bolts (2) and remove the oil separator housing (4) from the cylinder head cover.

CAUTION: When servicing components near the vacuum pump, avoid contact with the plastic nipple that connects the vacuum pump to the brake booster hose. It is possible to crack the plastic nipple resulting in a brake booster vacuum leak.

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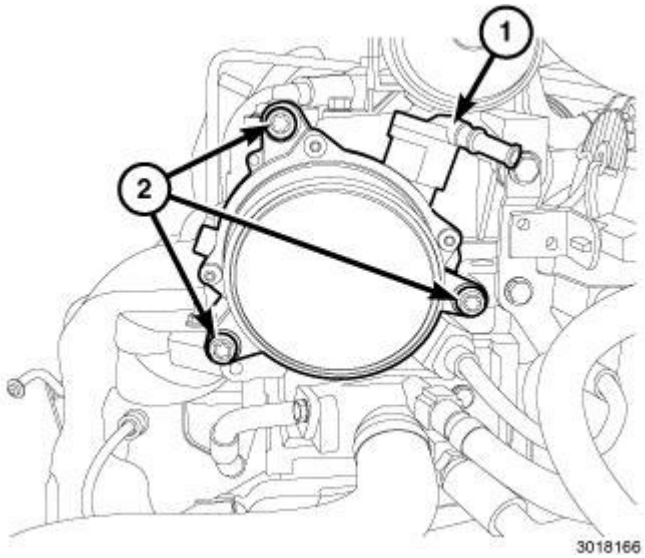


Fig. 673: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

8. Remove the vacuum pump (1).

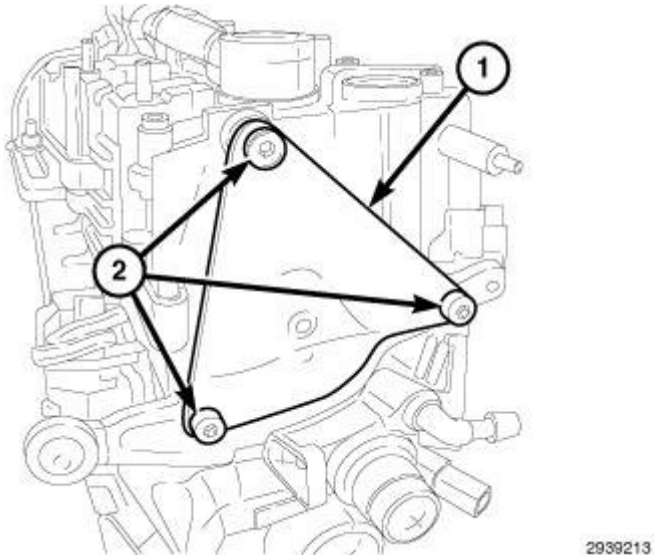


Fig. 674: Camshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

9. Install the (special tool #10277, Tool, Camshaft Timing Locking) (1) to the rear of the camshaft. Rotate the crankshaft vibration damper clockwise to align the tool with the vacuum pump mounting. Install three bolts (2) and tighten to 20 N.m (15 ft. lbs.).

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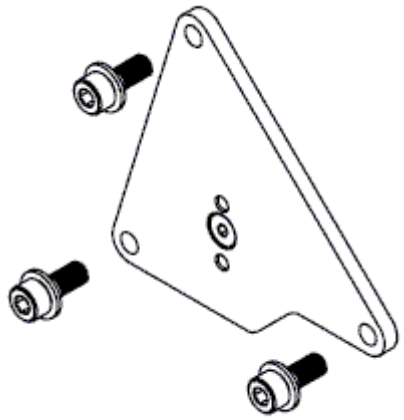


Fig. 675: Camshaft Timing Locking Tool
Courtesy of CHRYSLER GROUP, LLC

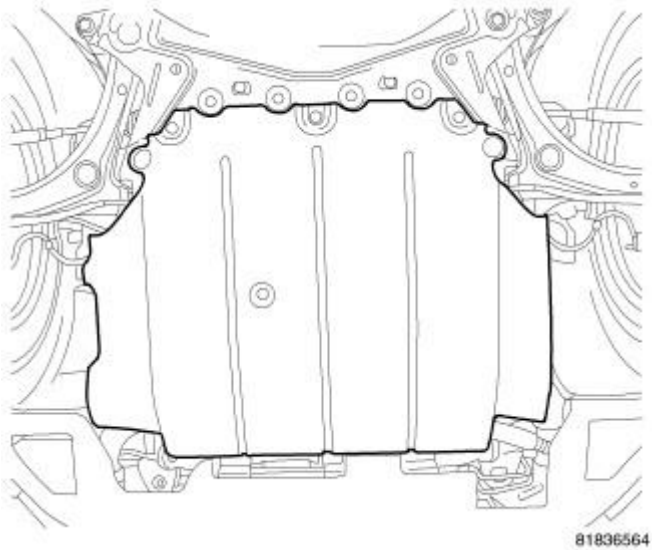


Fig. 676: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

10. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
11. Remove the belly pan. Refer to **BELLY PAN, REMOVAL** .
12. Drain the cooling system. Refer to **STANDARD PROCEDURE** .

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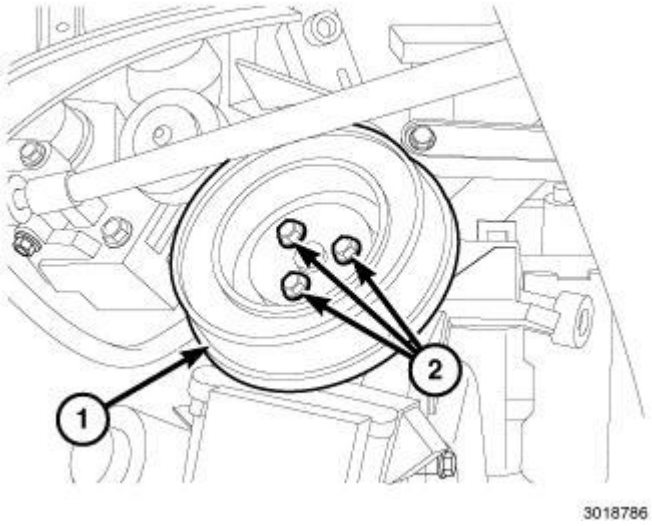


Fig. 677: Vibration Damper & Bolts
Courtesy of CHRYSLER GROUP, LLC

13. Remove the vibration damper (1). Refer to **DAMPER, VIBRATION, REMOVAL**.

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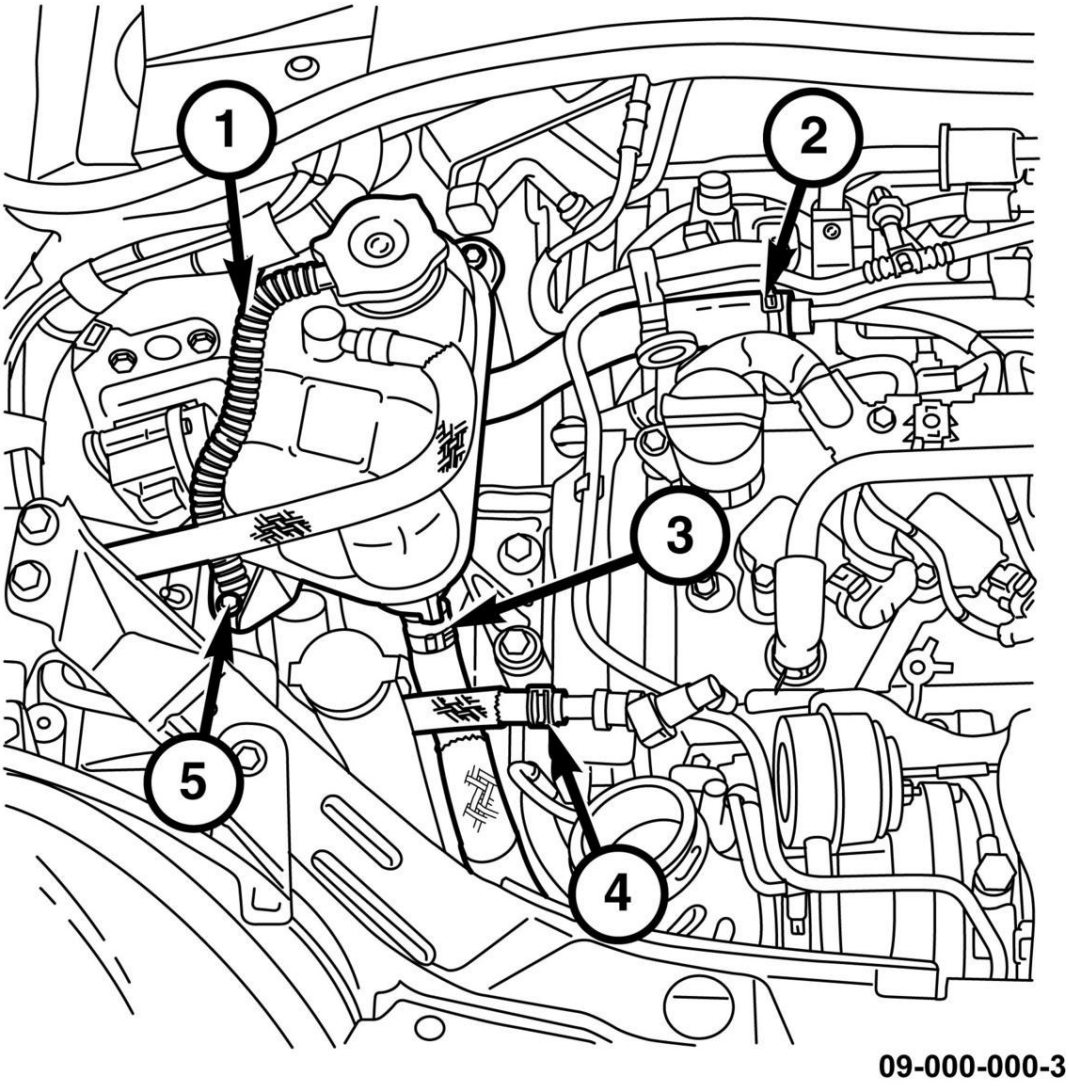


Fig. 678: Pressurized Coolant Bottle, Reservoir Hose & Coolant Reservoir Bolts
Courtesy of CHRYSLER GROUP, LLC

14. Lower the vehicle.
15. Disconnect the coolant hose (3) from the pressurized coolant bottle (1).
16. Remove the two bolts (5) and reposition the pressurized coolant bottle (1).

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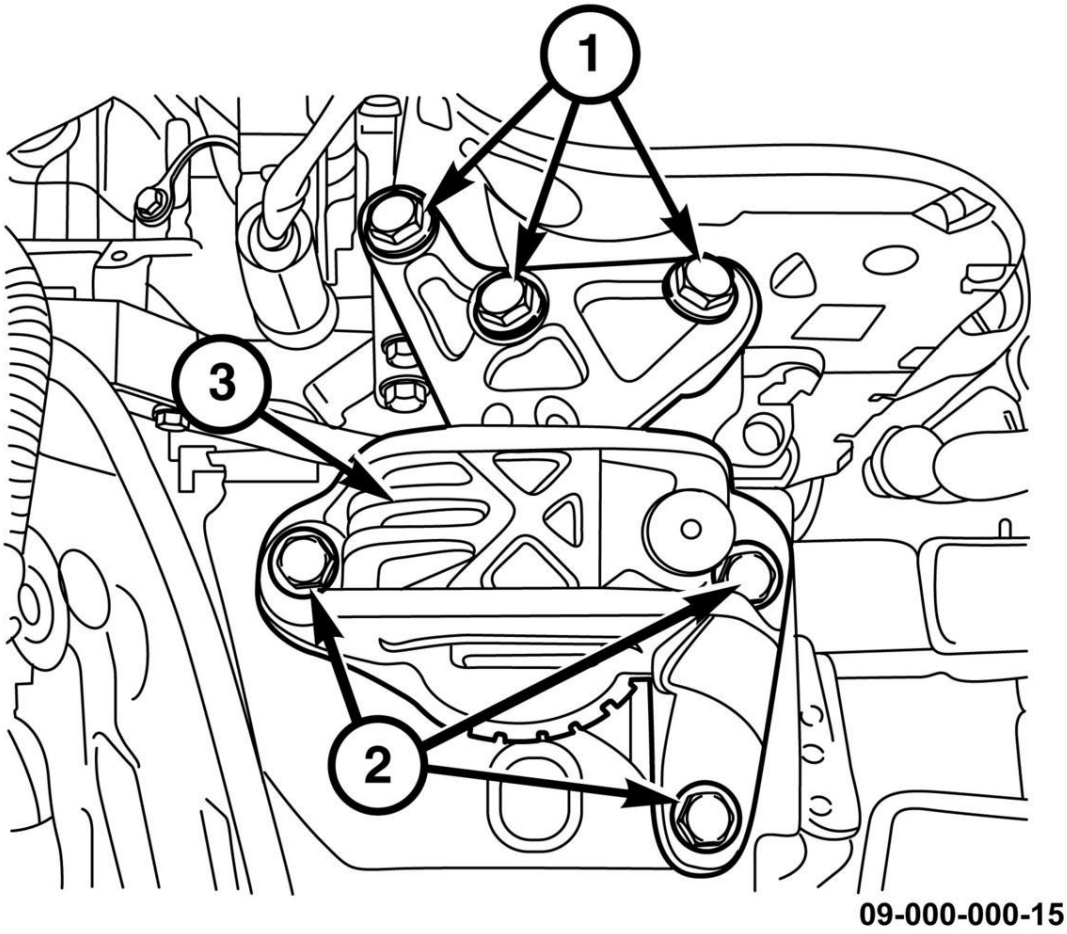


Fig. 679: Right Engine Mount Isolator & Bolts
Courtesy of CHRYSLER GROUP, LLC

17. Support the engine with a floor jack positioned under the oil pan.
18. Remove six bolts (1 and 2) and the right engine mount isolator (3).

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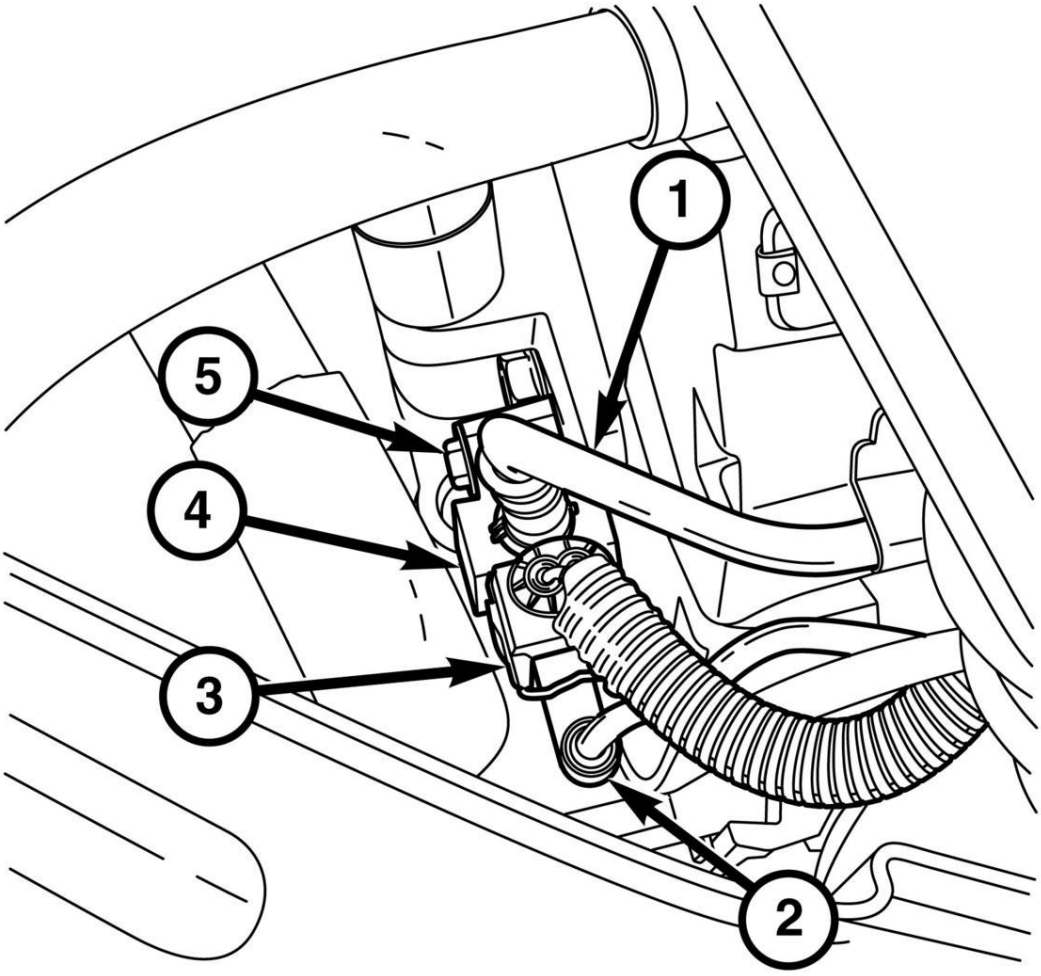


Fig. 680: Wastegate Actuator Hose, Solenoid, Electrical Connector, Vacuum Supply Hose & Nut
Courtesy of CHRYSLER GROUP, LLC

19. Remove the bolt (5) and reposition the turbocharger wastegate solenoid (4).

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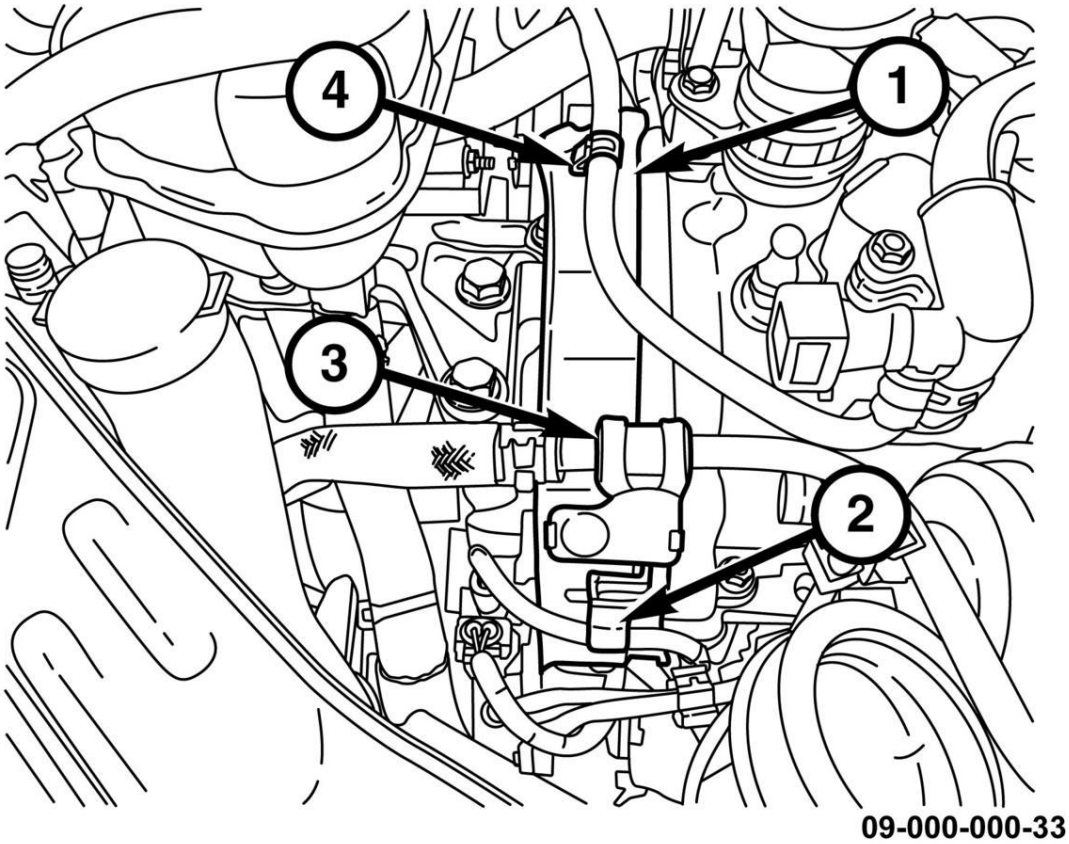


Fig. 681: Upper Timing Belt Cover, Evaporative Emissions Purge Hose, Coolant Pump Return Hose & Wastegate Solenoid Pressure Inlet Hose
Courtesy of CHRYSLER GROUP, LLC

20. Disengage the following retainers from the upper timing belt cover (1):
    - Evaporative emissions purge hose (4).
    - After run coolant pump return hose (3).
    - Wastegate solenoid pressure inlet hose (2).

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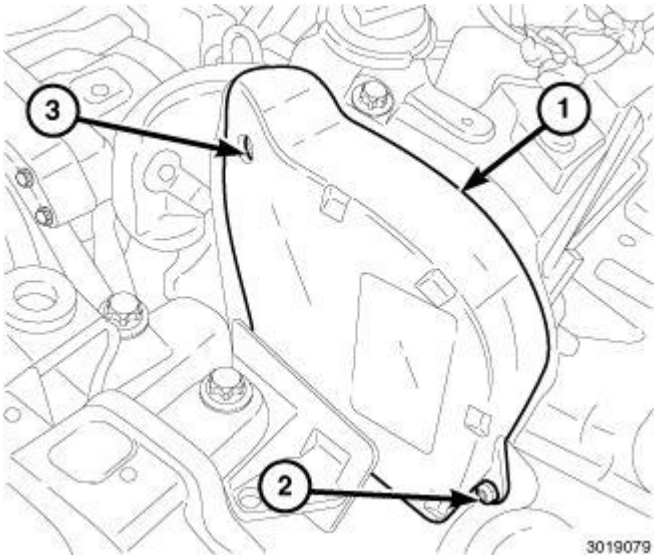


Fig. 682: Upper Timing Belt Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

21. Remove the bolts (2 and 3) and the upper timing belt cover (1).

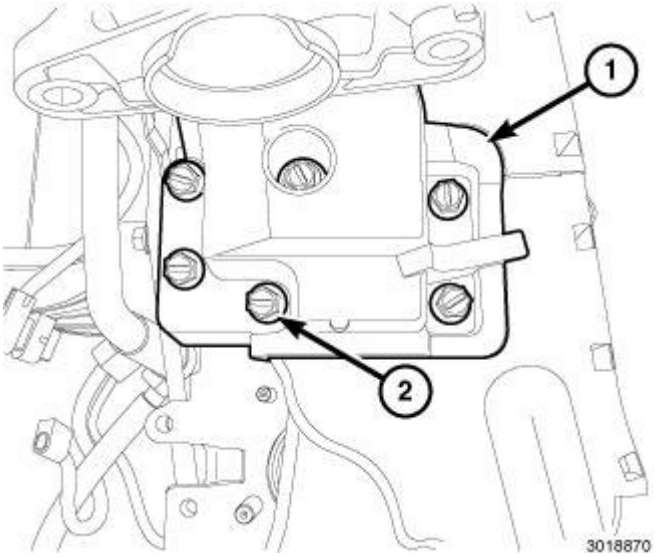


Fig. 683: RH Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

22. Carefully raise the front of the engine and remove the six bolts (2) and the right engine mount bracket (1).

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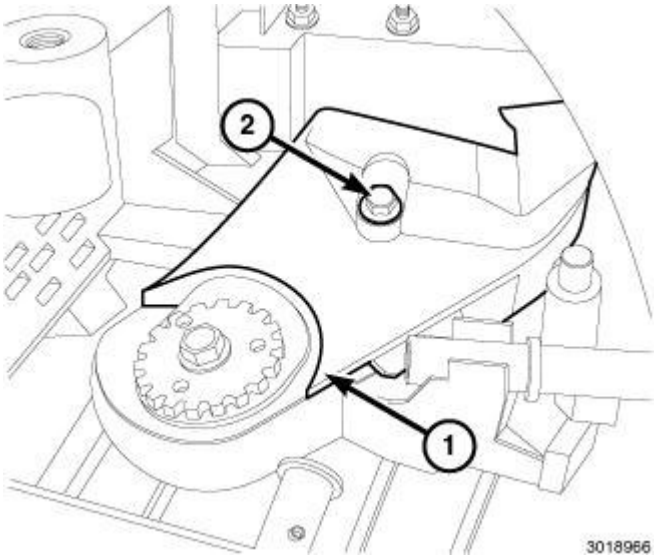


Fig. 684: Lower Timing Belt Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

23. Remove the bolt (2) and the lower timing belt cover (1).

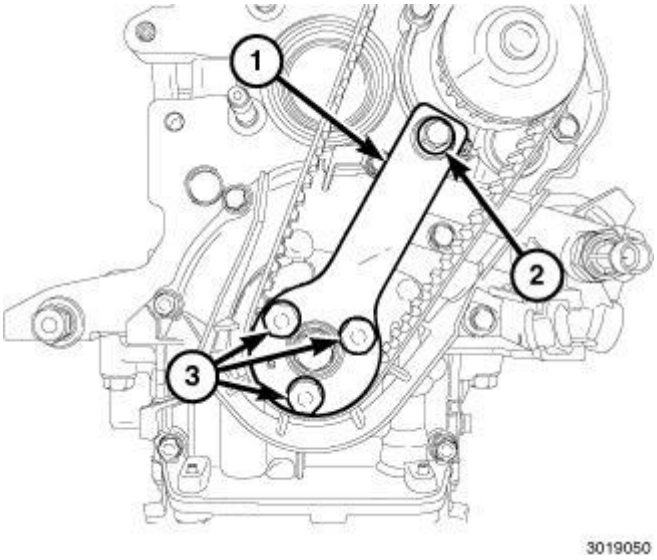


Fig. 685: Crankshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

24. Install the (special tool #10276, Tool, Crankshaft Timing Locking) (1) with three bolts (3) tightened to 25 N.m (18 ft. lbs.) and one bolt (2) tightened to 9 N.m (80 in. lbs.).

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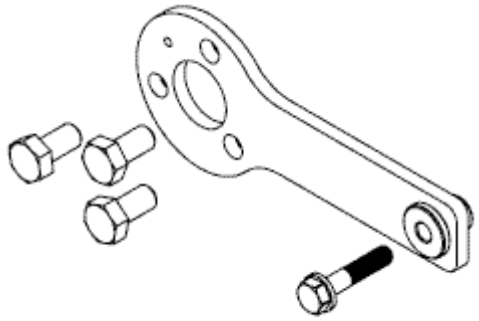


Fig. 686: Crankshaft Timing Locking Tool
Courtesy of CHRYSLER GROUP, LLC

NOTE: If the bolt (2) does not align with the lower timing belt cover mounting boss, the camshaft timing is not correct.

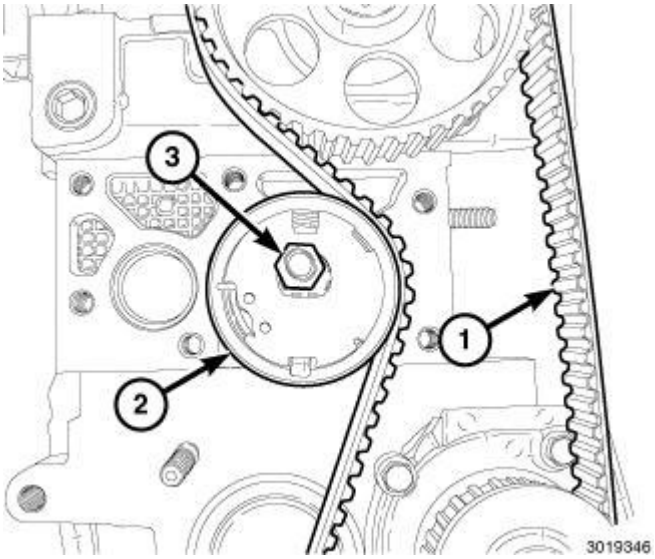


Fig. 687: Timing Belt, Tensioner & Lock Nut
Courtesy of CHRYSLER GROUP, LLC

NOTE: If the timing belt is to be reused, mark the direction of rotation using a paint pen or equivalent to aid in reassembly.

25. Loosen the tensioner lock nut (3) and remove the timing belt (1).

INSPECTION

INSPECTION

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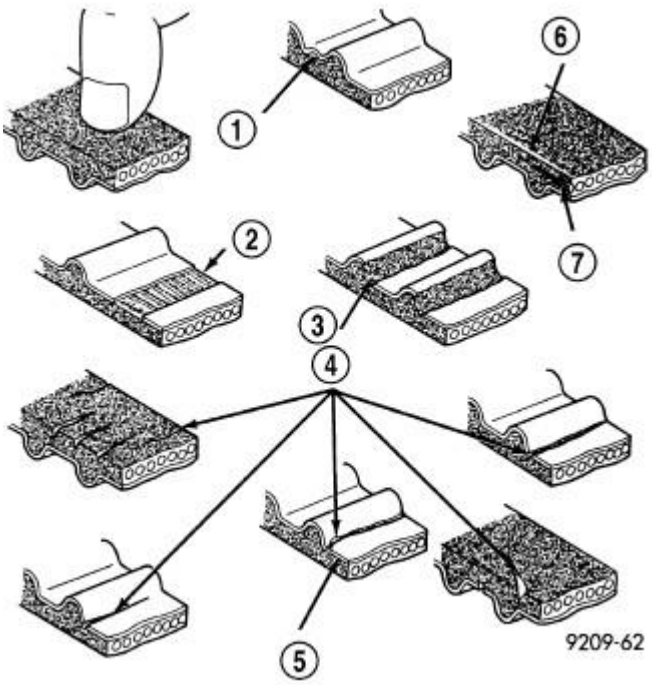


Fig. 688: Timing Belt Inspection
Courtesy of CHRYSLER GROUP, LLC

1 - PEELING
2 - TOOTH MISSING AND CANVAS FIBER EXPOSED
3 - RUBBER EXPOSED
4 - CRACKS
5 - PEELING
6 - ROUNDED EDGE
7 - ABNORMAL WEAR (FLUFFY STRAND)

1. Remove the upper timing belt cover. Refer to **COVER(S), ENGINE TIMING, REMOVAL**.
2. Inspect all four surfaces of the timing belt. The sides are normal if they are sharp as if cut by a knife. Replace the belt if any of the following conditions exist:
   - Vehicle mileage or time at component maintenance requirement. Refer to **MAINTENANCE SCHEDULES, DESCRIPTION** .
   - Back side rubber is glossy or hardening without resilience and leaves no indent when pressed with a fingernail.
   - Surface peeling (1 and 5).
   - Missing teeth (2).
   - Rubber exposed (3).
   - Any cracks (4) in rib root, belt sides or rubber back.
   - Rounded edge (6).
   - Exposed fluffy strands (7).

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3. If none of the above conditions are seen on the timing belt, the timing belt cover can be installed. Refer to **COVER(S), ENGINE TIMING, INSTALLATION**.
4. Replace the timing belt if it does not pass inspection. Refer to **BELT, TIMING, REMOVAL**.

INSTALLATION

INSTALLATION

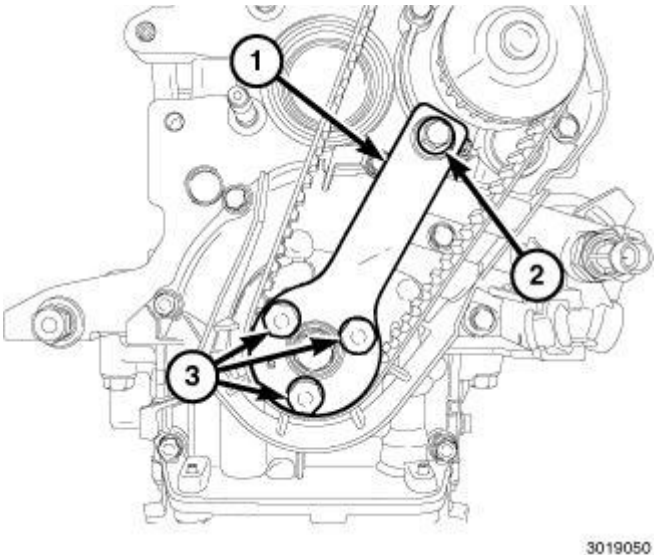


Fig. 689: Crankshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

1. If removed, install the (special tool #10276, Tool, Crankshaft Timing Locking) (1) with three bolts (3) tightened to 25 N.m (18 ft. lbs.) and one bolt (2) tightened to 9 N.m (80 in. lbs.).

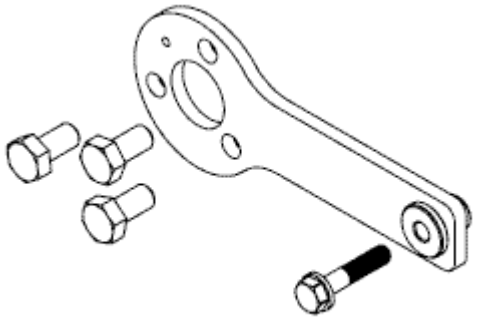


Fig. 690: Crankshaft Timing Locking Tool
Courtesy of CHRYSLER GROUP, LLC

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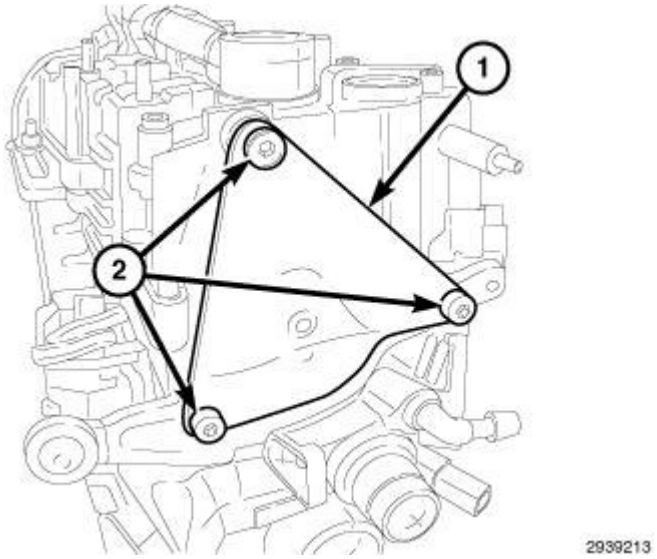


Fig. 691: Camshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

2. If removed, install the (special tool #10277, Tool, Camshaft Timing Locking) (1) to the rear of the camshaft. Install three bolts (2) and tighten to 20 N.m (15 ft. lbs.).

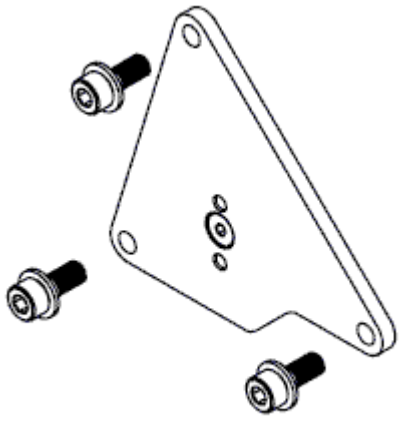


Fig. 692: Camshaft Timing Locking Tool
Courtesy of CHRYSLER GROUP, LLC

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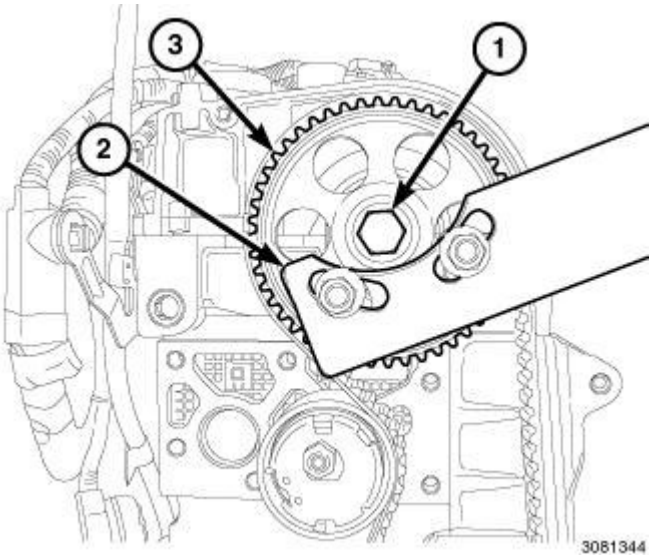


Fig. 693: Camshaft Sprocket, Holder & Bolt
Courtesy of CHRYSLER GROUP, LLC

3. Use the (special tool #6847, Holder, Camshaft Sprocket) (2) to hold the camshaft sprocket (3) and loosen the bolt (1). The camshaft sprocket (3) should now be free to rotate on the camshaft.

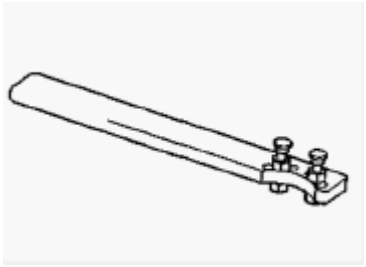
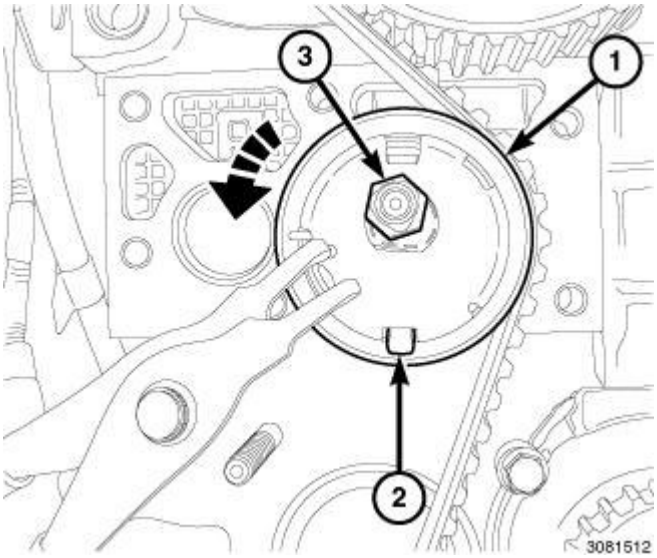


Fig. 694: Camshaft Sprocket Holder
Courtesy of CHRYSLER GROUP, LLC



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Fig. 695: Timing Belt Tensioner, Silver Tab & Lock Nut
Courtesy of CHRYSLER GROUP, LLC

NOTE: If the original timing belt (1) is being reused, install the belt so that it maintains the same direction of rotation as when it was removed.

4. Install the timing belt starting with the crankshaft sprocket, then the water pump sprocket, finishing with the camshaft sprocket.
5. Rotate and adjust the timing tensioner (1) so that the silver tab (2) is centered in the middle of the window. Tighten the lock nut (3) to 28 N.m (21 ft. lbs.).

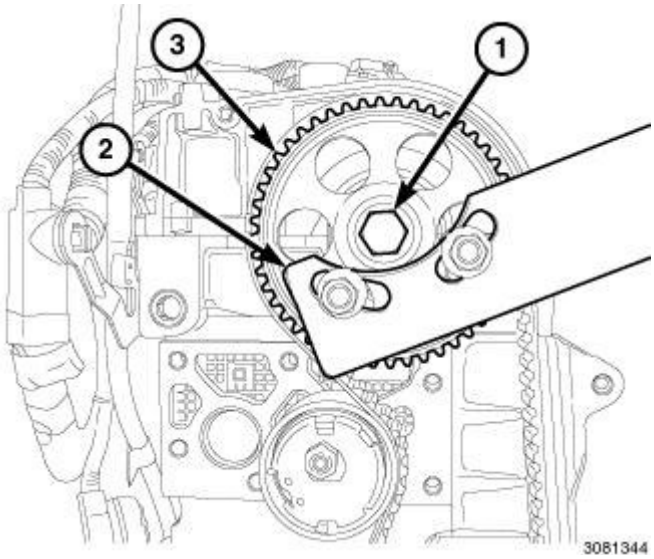


Fig. 696: Camshaft Sprocket, Holder & Bolt
Courtesy of CHRYSLER GROUP, LLC

6. Use the (special tool #6847, Holder, Camshaft Sprocket) (2) to hold the camshaft sprocket (3) and tighten the camshaft sprocket bolt (1) to 120 N.m (88 ft. lbs.).

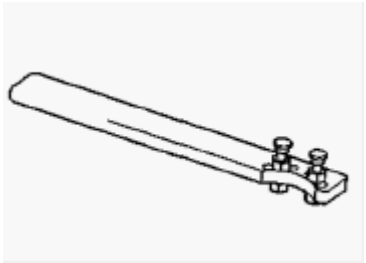


Fig. 697: Camshaft Sprocket Holder
Courtesy of CHRYSLER GROUP, LLC

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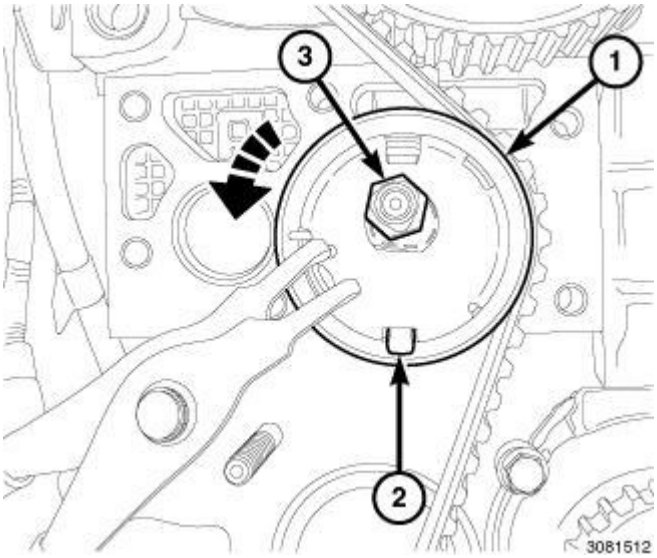


Fig. 698: Timing Belt Tensioner, Silver Tab & Lock Nut
Courtesy of CHRYSLER GROUP, LLC

7. Remove the (special tool #10277, Tool, Camshaft Timing Locking) and the (special tool #10276, Tool, Crankshaft Timing Locking).
8. Rotate the crankshaft clockwise at least two complete revolutions to center the timing belt on the sprockets.
9. Verify that the silver tab (2) is still centered in the middle of the window. If required, loosen the tensioner lock nut (3), readjust the timing belt tensioner (2) and tighten the lock nut (3) to 28 N.m (21 ft. lbs.).

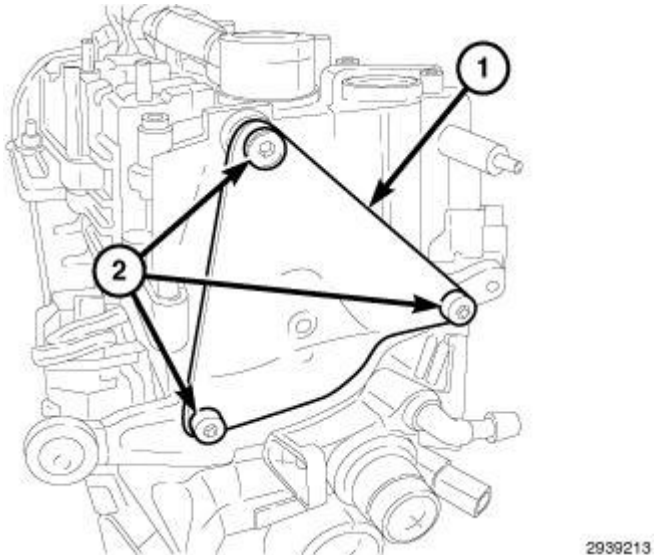


Fig. 699: Camshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

NOTE: Reinstall the timing locking tools to verify correct camshaft timing.

10. Install the (special tool #10277, Tool, Camshaft Timing Locking) (1) to the rear of the camshaft. Install

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three bolts (2) and tighten to 20 N.m (15 ft. lbs.).

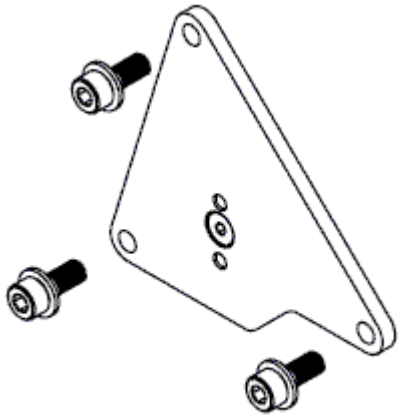


Fig. 700: Camshaft Timing Locking Tool
Courtesy of CHRYSLER GROUP, LLC

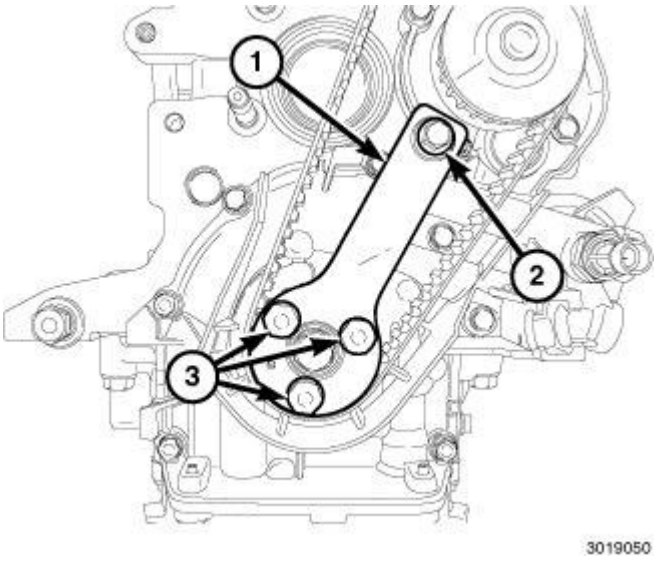


Fig. 701: Crankshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

11. Install the (special tool #10276, Tool, Crankshaft Timing Locking) (1) with three bolts (3) tightened to 25 N.m (18 ft. lbs.) and one bolt (2) tightened to 9 N.m (80 in. lbs.).

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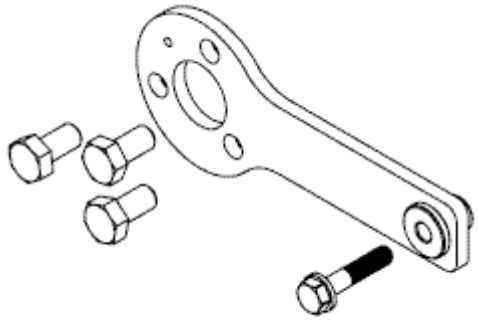


Fig. 702: Crankshaft Timing Locking Tool
Courtesy of CHRYSLER GROUP, LLC

NOTE: If the bolt (2) does not align with the lower timing belt cover mounting boss, the camshaft timing is not correct. Loosen the tensioner lock nut and the camshaft sprocket bolt and repeat this procedure.

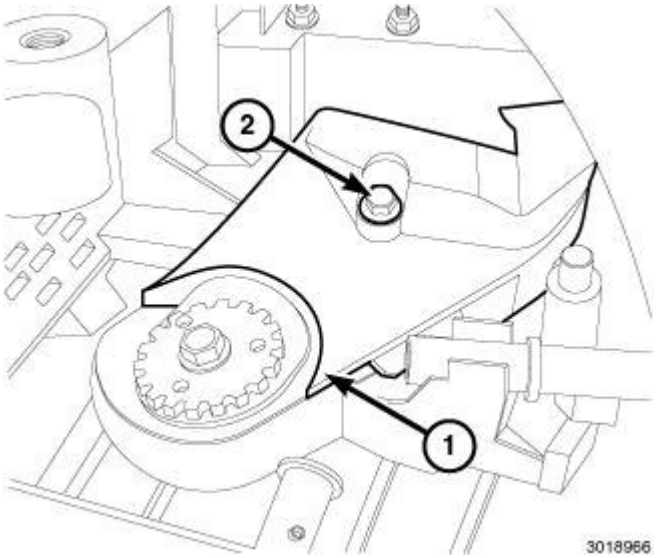


Fig. 703: Lower Timing Belt Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

12. Remove the (special tool #10277, Tool, Camshaft Timing Locking) and the (special tool #10276, Tool, Crankshaft Timing Locking).
13. Install the lower timing belt cover (1) with bolt (2) tightened to 9 N.m (80 in. lbs.).

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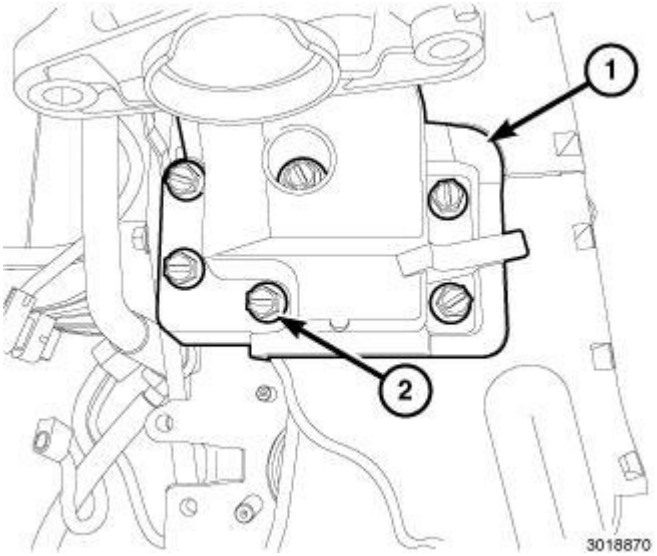


Fig. 704: RH Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

14. Install the right engine mount bracket (1) with six bolts (2) tightened to 25 N.m (18 ft. lbs.).

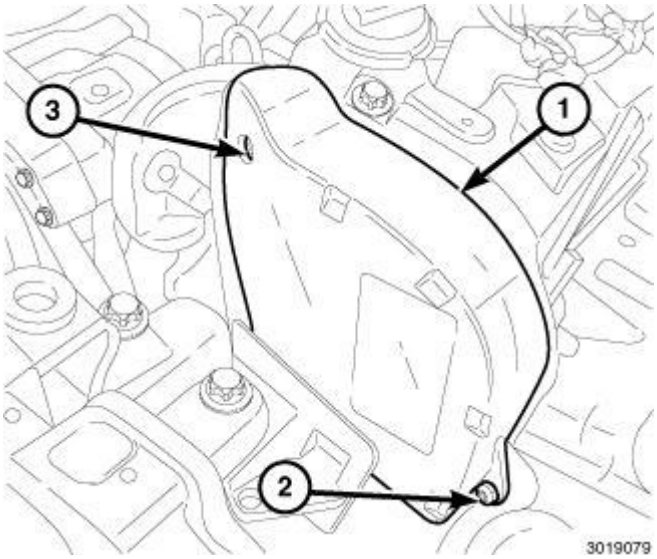


Fig. 705: Upper Timing Belt Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

15. Install the upper timing belt cover (1) with two bolts (2 and 3) tightened to 9 N.m (80 in. lbs.).

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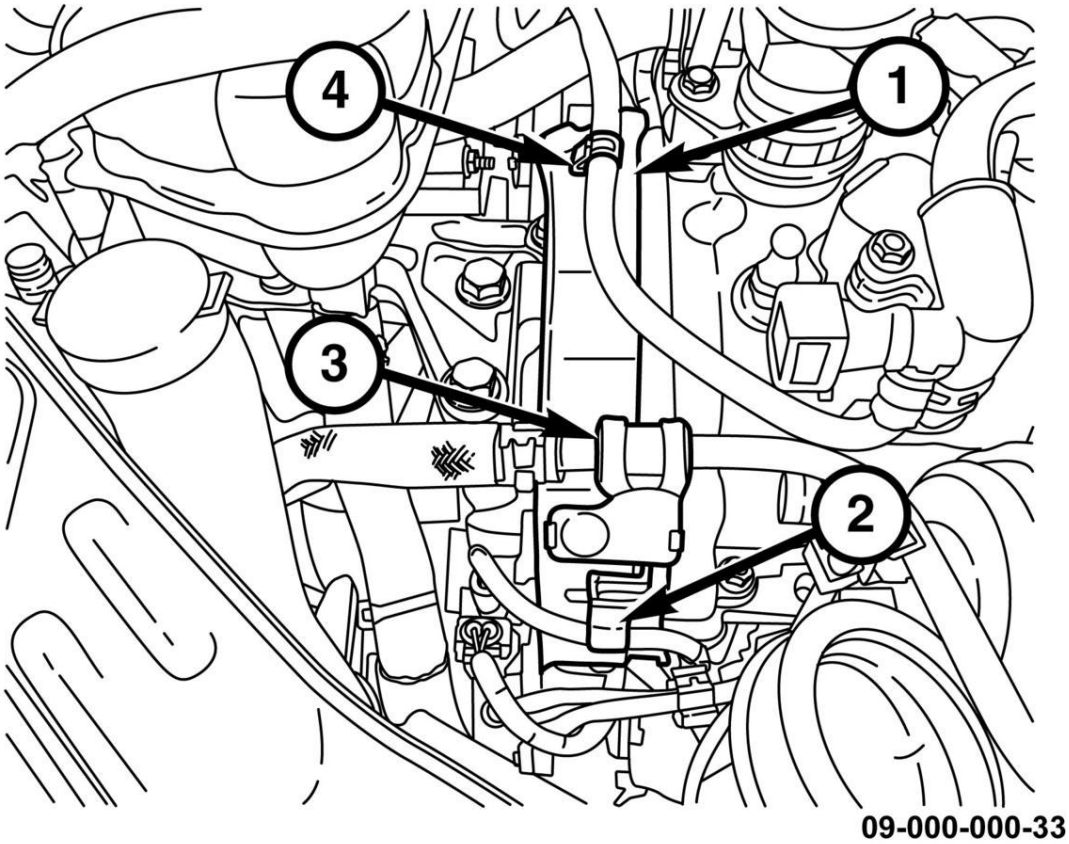


Fig. 706: Upper Timing Belt Cover, Evaporative Emissions Purge Hose, Coolant Pump Return Hose & Wastegate Solenoid Pressure Inlet Hose
Courtesy of CHRYSLER GROUP, LLC

16. Engage the following retainers to the upper timing belt cover (1):
    - Wastegate solenoid pressure inlet hose (2).
    - After run coolant pump return hose (3).
    - Evaporative emissions purge hose (4).

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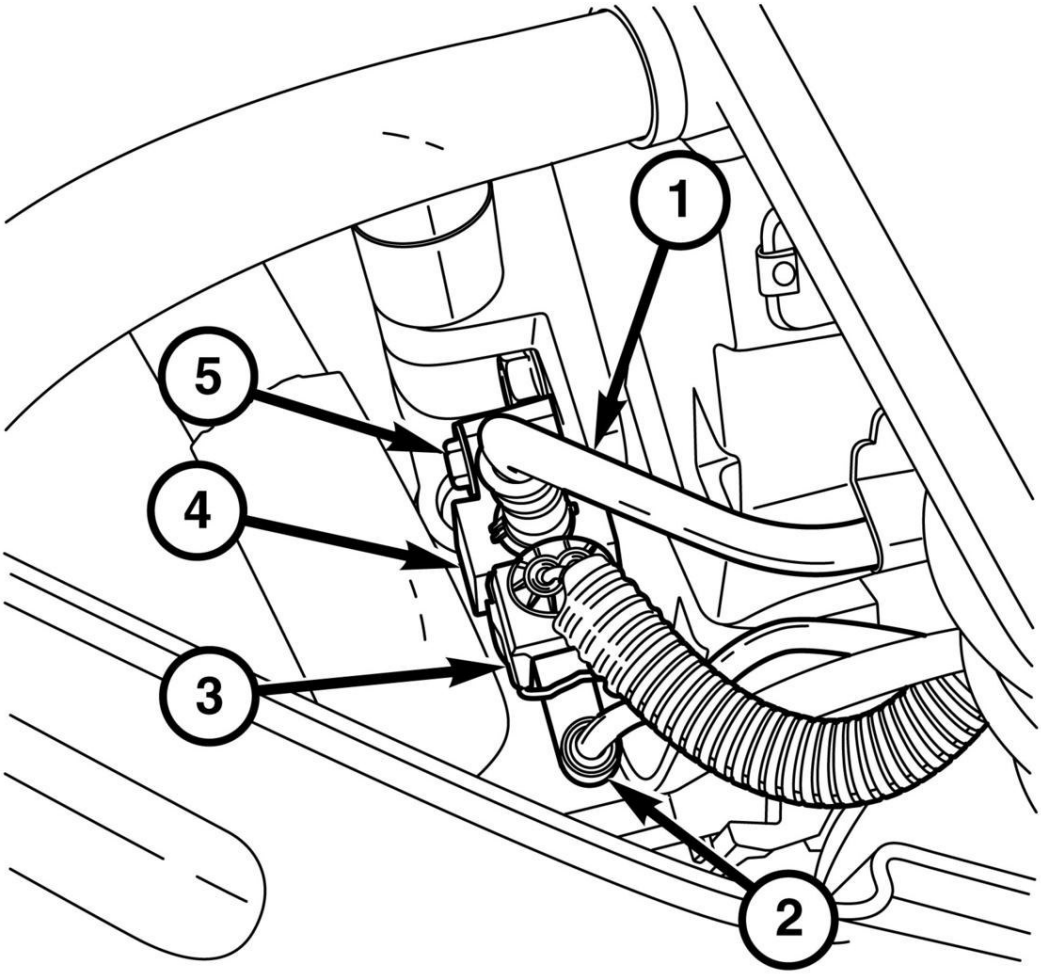


Fig. 707: Wastegate Actuator Hose, Solenoid, Electrical Connector, Vacuum Supply Hose & Nut
Courtesy of CHRYSLER GROUP, LLC

17. Position the turbocharger wastegate solenoid (4). Install the bolt (5) and tighten to 9 N.m (80 in. lbs.).

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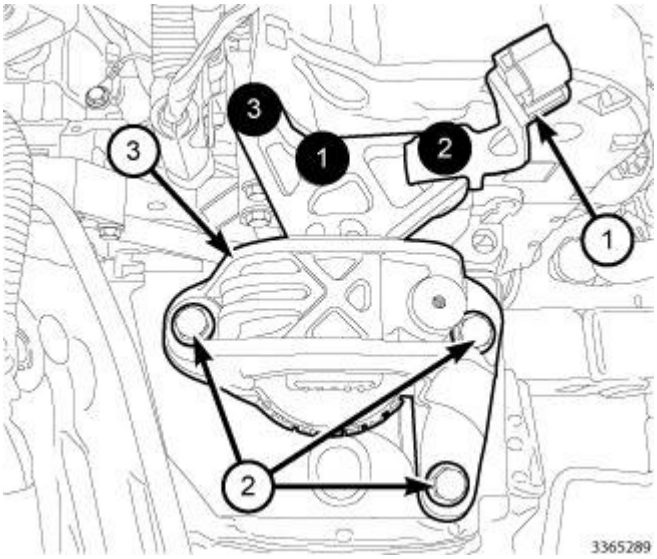


Fig. 708: RH Engine Mount Isolator, Support Bracket & Bolts With Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

18. Install the right engine mount isolator (3) to the engine mount bracket with three bolts. Tighten the isolator to engine bracket bolts in the sequence shown in illustration to 60 N.m (44 ft. lbs.).
19. Install the right engine mount isolator (3) to the body with three bolts (2). Tighten the isolator to body bolts (2) to 60 N.m (44 ft. lbs.).
20. Remove the floor jack supporting the engine.

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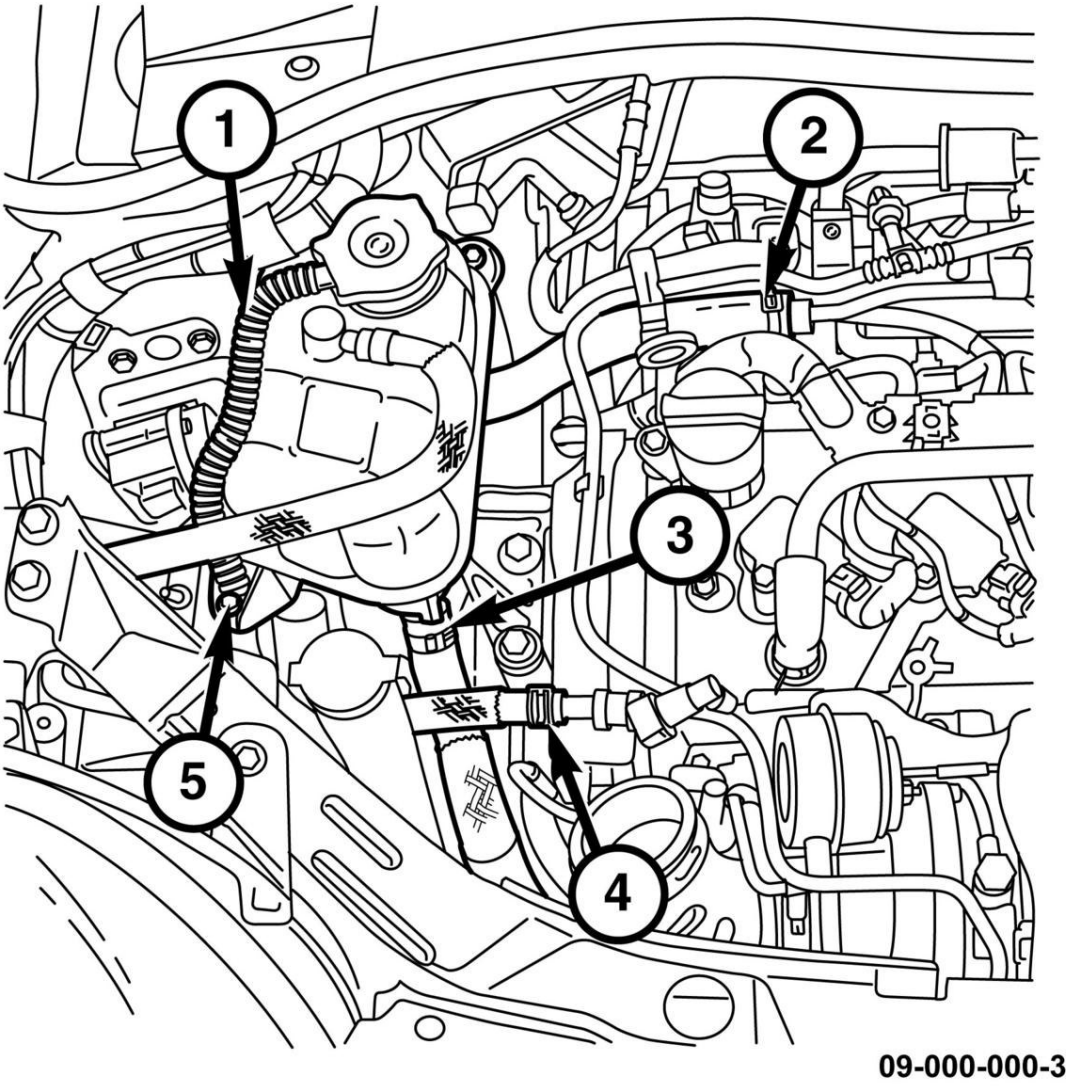


Fig. 709: Pressurized Coolant Bottle, Reservoir Hose & Coolant Reservoir Bolts
Courtesy of CHRYSLER GROUP, LLC

21. Install the pressurized coolant bottle (1). Tighten bolts (5) to 8 N.m (71 in. lbs.).
22. Connect the coolant hose (3) to the pressurized coolant bottle (1).

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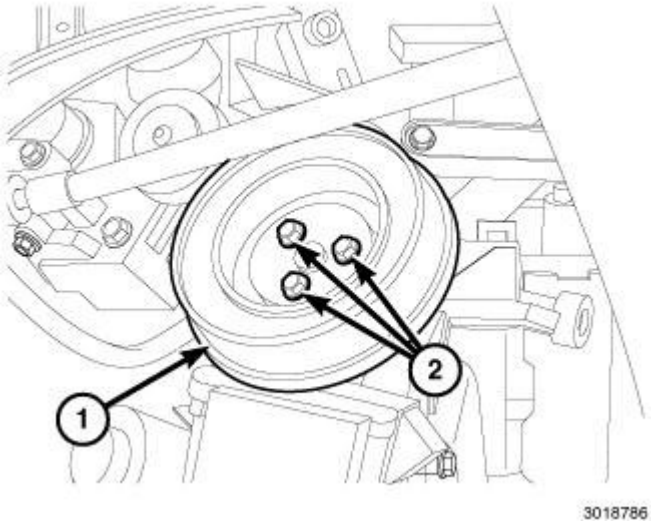


Fig. 710: Vibration Damper & Bolts
Courtesy of CHRYSLER GROUP, LLC

23. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
24. Install the vibration damper (1). Refer to **DAMPER, VIBRATION, INSTALLATION**.
25. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .

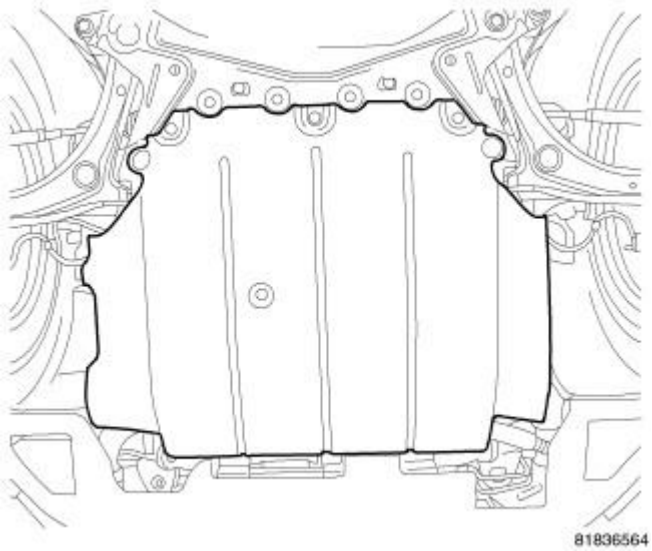


Fig. 711: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

26. Install the belly pan. Refer to **BELLY PAN, INSTALLATION** .
27. Lower the vehicle.

CAUTION: When servicing components near the vacuum pump, avoid contact with the plastic nipple that connects the vacuum pump to the brake

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booster hose. It is possible to crack the plastic nipple resulting in a brake booster vacuum leak.

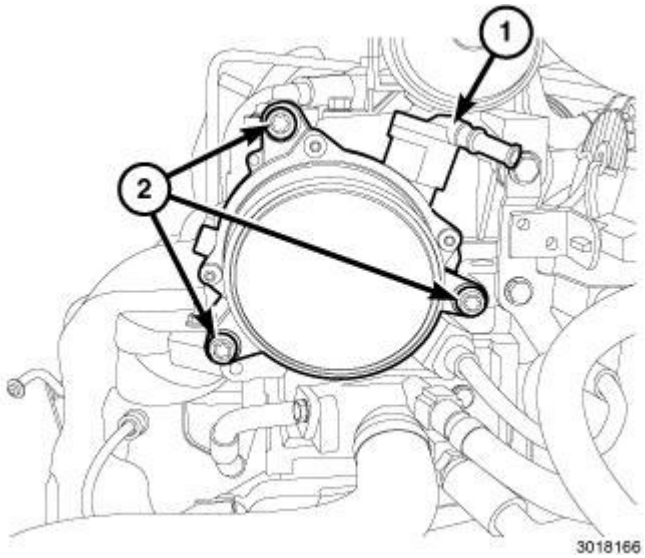


Fig. 712: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

28. Install the vacuum pump (1). Refer to **PUMP, VACUUM, INSTALLATION**.

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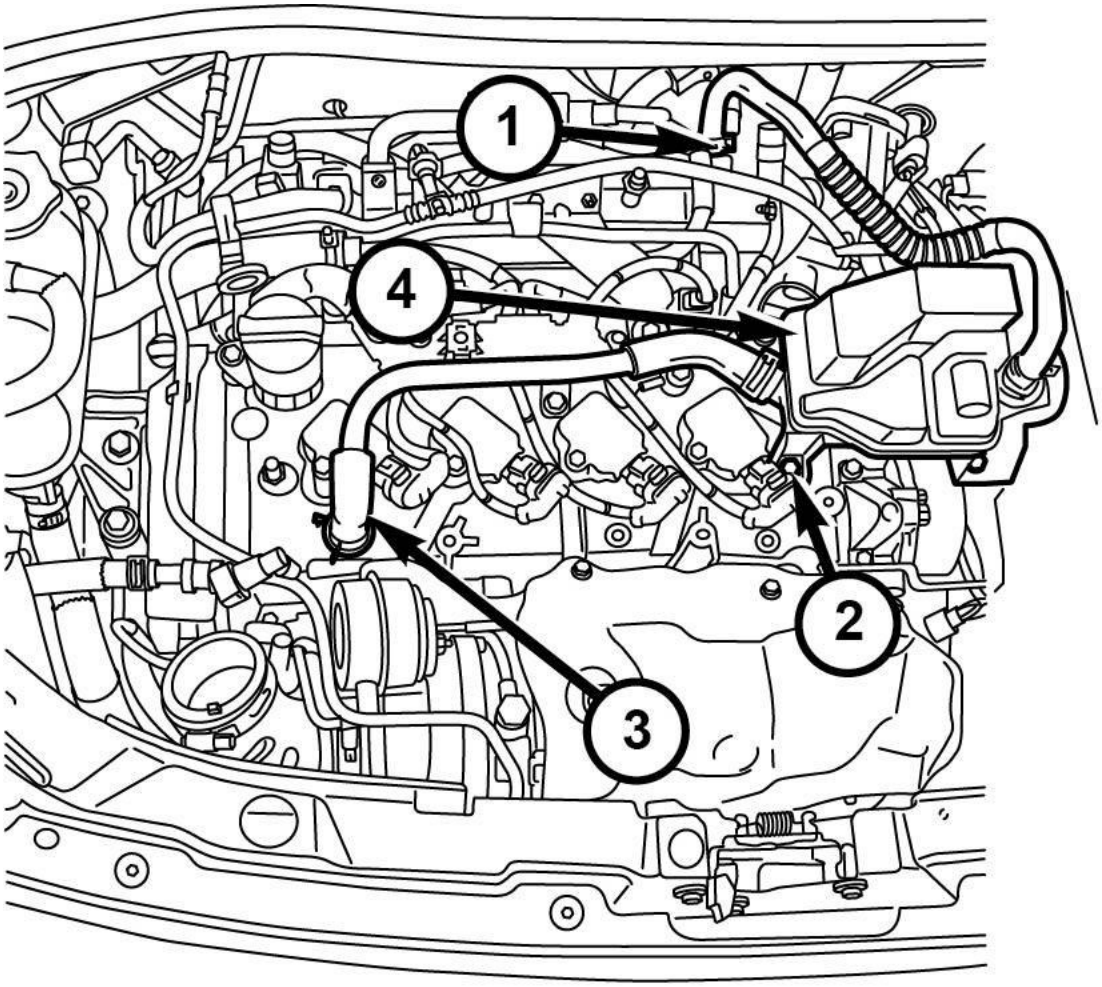
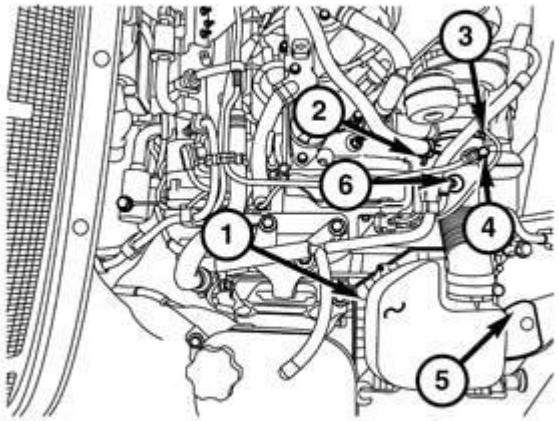


Fig. 713: PCV Hose, Vent Hose, Oil Separator Housing & Bolts
Courtesy of CHRYSLER GROUP, LLC

29. Install the oil separator housing (4) to the cylinder head cover with three bolts (2) tightened to 13 N.m (115 in. lbs.).
30. Connect the vent hose (3) to the cylinder head cover.
31. Connect the PCV hose (1) to the intake manifold.

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Fig. 714: EVAP Hose Quick Release Fitting, Wastegate Solenoid Vent Hose, Clamps, Screws & Bolts
Courtesy of CHRYSLER GROUP, LLC

32. Install the air cleaner body (1). Refer to **BODY, AIR CLEANER, INSTALLATION**.
33. Fill cooling system. Refer to **STANDARD PROCEDURE** .
34. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
35. Start and run the engine until it reaches normal operating temperature. Check cooling system for correct fluid level. Refer to **STANDARD PROCEDURE** .
36. The Cam/Crank Variation Relearn procedure must be performed using the scan tool anytime there has been a repair/replacement made to a powertrain system, for example: flywheel, valvetrain, camshaft and/or crankshaft sensors or components. Refer to the appropriate Diagnostic Information.

COVER(S), ENGINE TIMING

REMOVAL

REMOVAL

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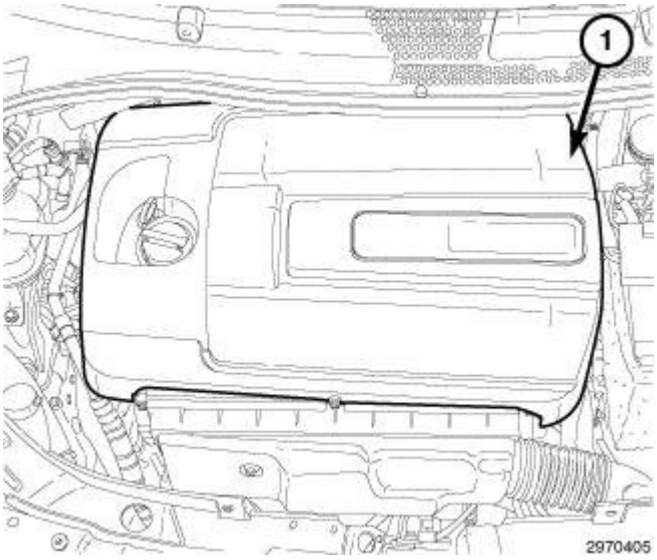


Fig. 715: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect and isolate the negative battery cable.
2. Remove the engine cover (1).

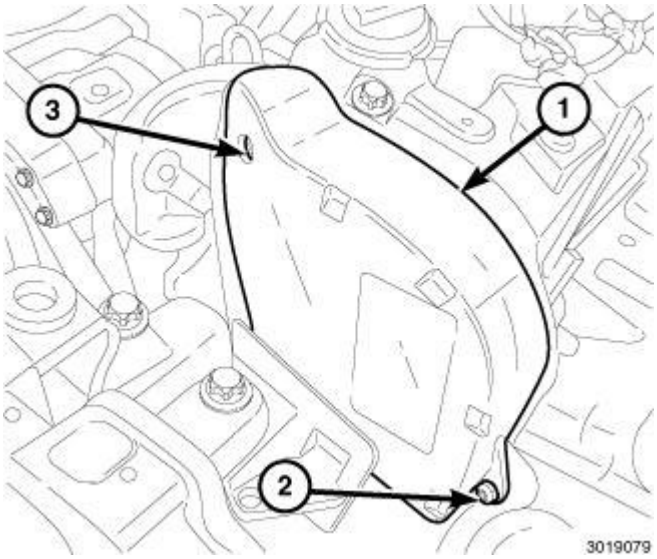


Fig. 716: Upper Timing Belt Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

3. Remove the bolts (2 and 3) and the upper timing belt cover (1).

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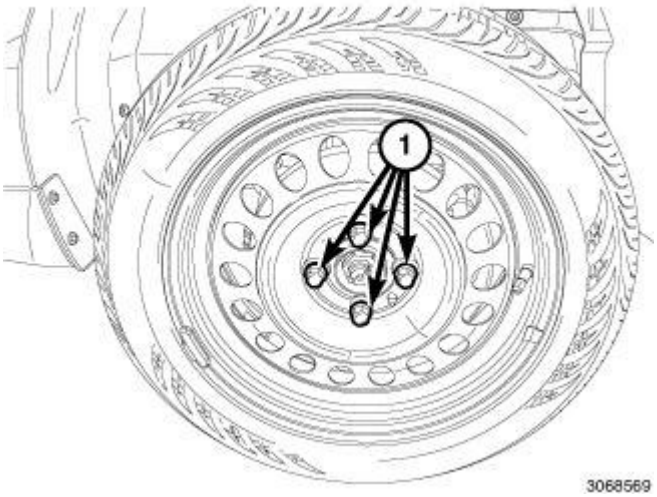


Fig. 717: Wheel Lug Bolts
Courtesy of CHRYSLER GROUP, LLC

4. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
5. Remove the right front wheel and tire assembly. Refer to **REMOVAL** .

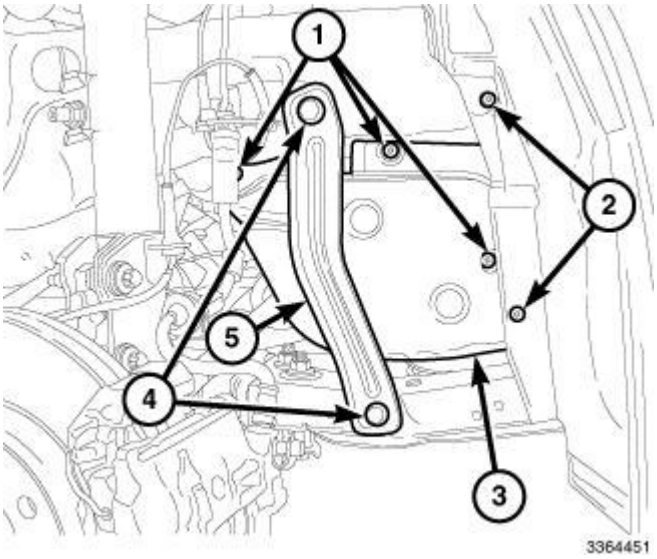


Fig. 718: Right Vertical Brace, Frame Splash Shield & Fasteners
Courtesy of CHRYSLER GROUP, LLC

6. Remove two bolts (4) and the right vertical brace (5).
7. Remove two screws (2) from the front wheelhouse splash shield.
8. Remove three screws (1) and the frame splash shield (3).

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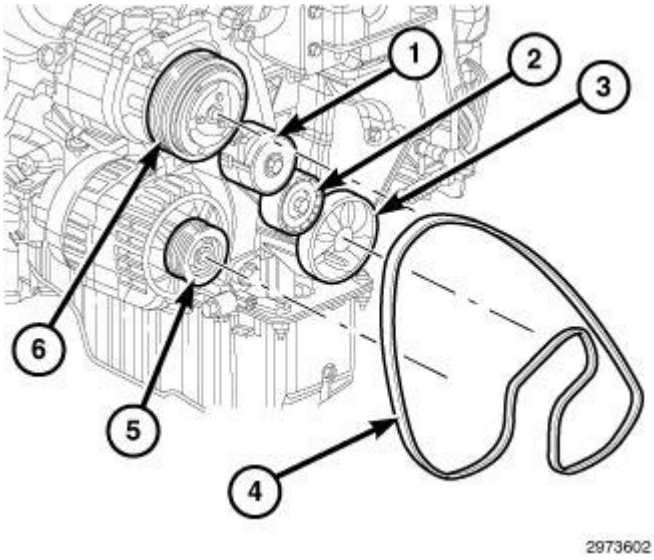


Fig. 719: Drive Belt Tensioners & Assembly With Drive Belt Routing
Courtesy of CHRYSLER GROUP, LLC

9. Remove the accessory drive belt (4). Refer to **BELT, SERPENTINE, REMOVAL** .

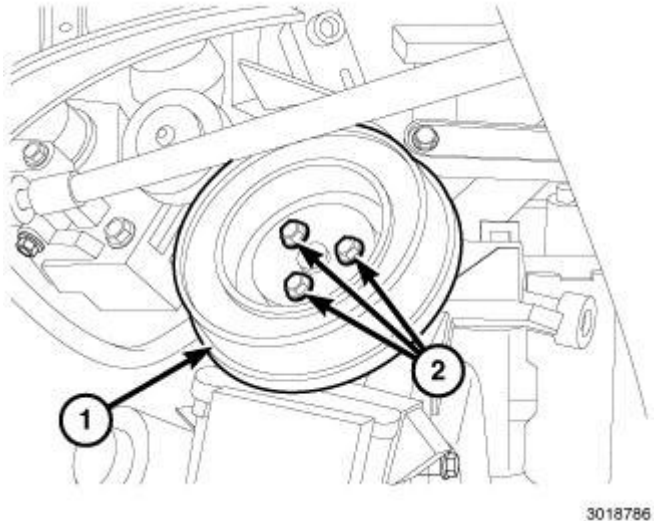


Fig. 720: Vibration Damper & Bolts
Courtesy of CHRYSLER GROUP, LLC

10. Remove the vibration damper (1). Refer to **DAMPER, VIBRATION, REMOVAL**.

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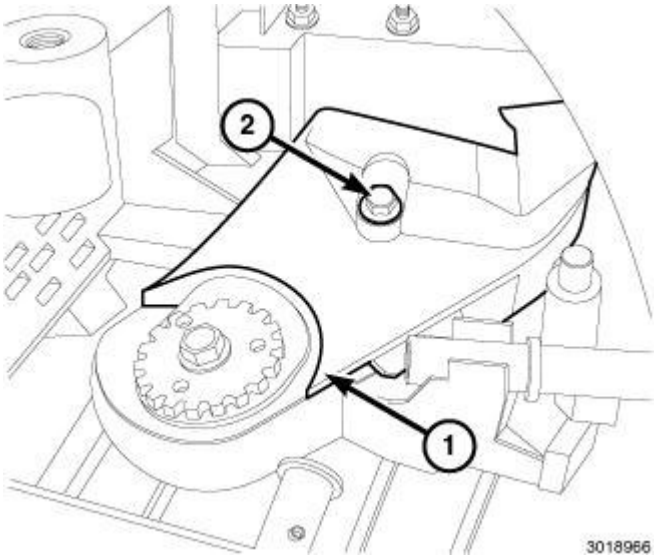


Fig. 721: Lower Timing Belt Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

11. Remove the bolt (2) and the lower timing belt cover (1).

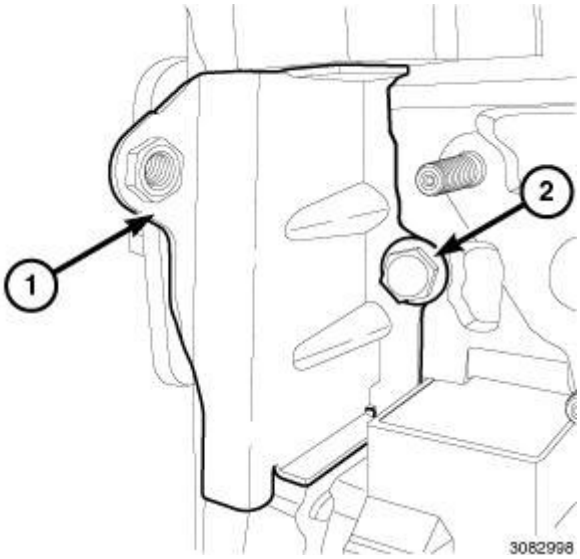


Fig. 722: Side Timing Belt Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

12. Remove the bolt (2) and the side timing belt cover (1).

INSTALLATION

INSTALLATION

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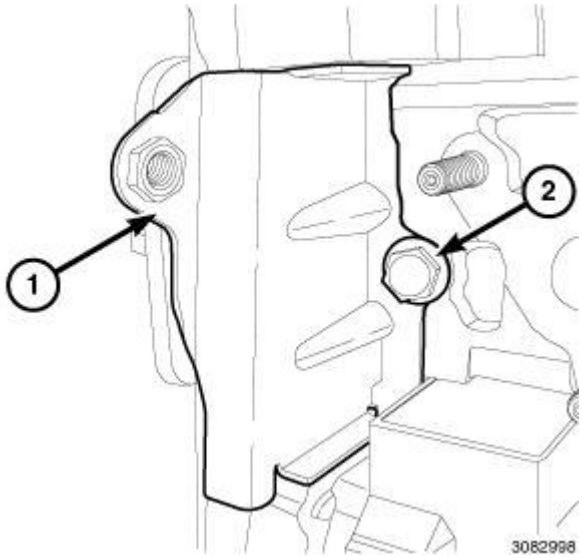


Fig. 723: Side Timing Belt Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

1. Install the side timing belt cover (1) with bolt (2) tightened to 25 N.m (18 ft. lbs.).

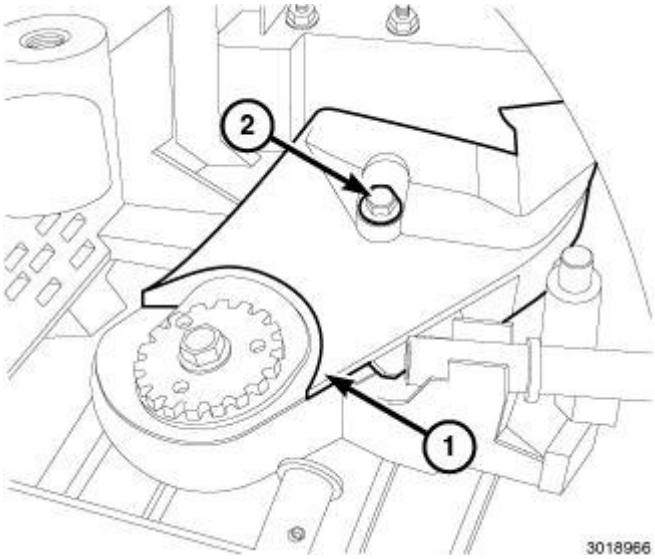


Fig. 724: Lower Timing Belt Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

2. Install the lower timing belt cover (1) with bolt (2) tightened to 9 N.m (80 in. lbs.).

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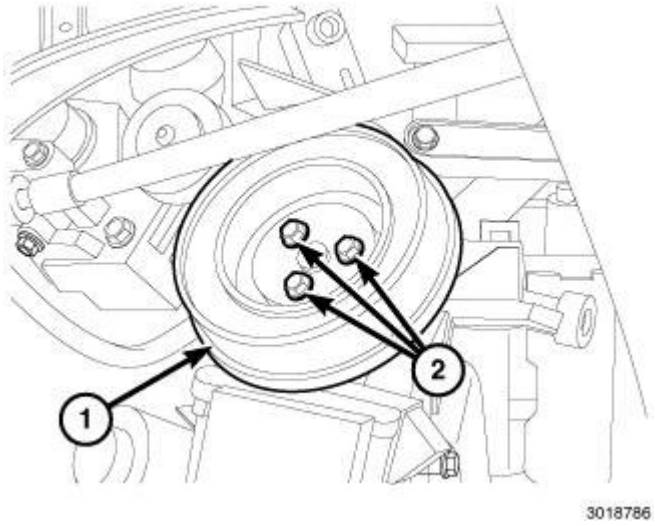


Fig. 725: Vibration Damper & Bolts
Courtesy of CHRYSLER GROUP, LLC

3. Install the vibration damper (1). Refer to **DAMPER, VIBRATION, INSTALLATION**.

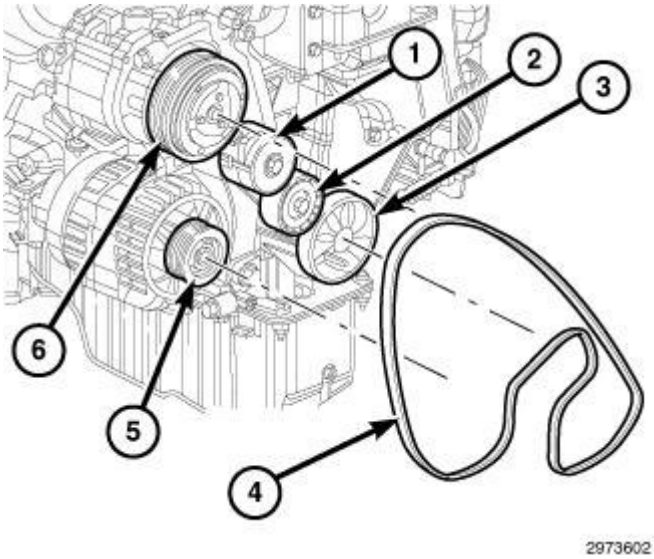


Fig. 726: Drive Belt Tensioners & Assembly With Drive Belt Routing
Courtesy of CHRYSLER GROUP, LLC

4. Install the accessory drive belt (4). Refer to **BELT, SERPENTINE, INSTALLATION** .

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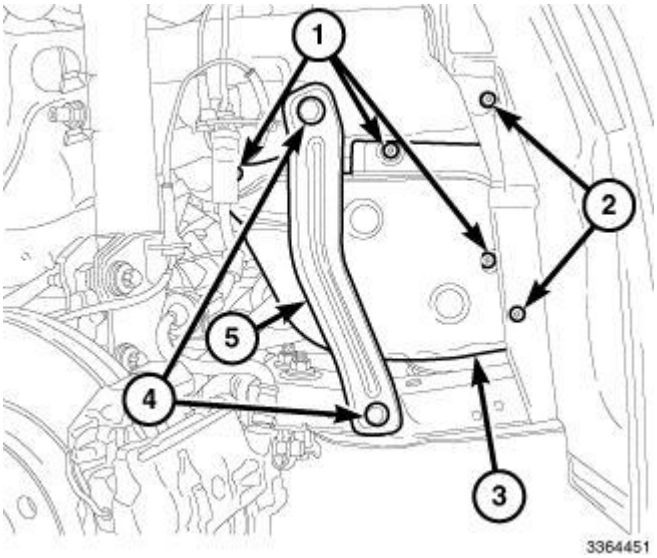


Fig. 727: Right Vertical Brace, Frame Splash Shield & Fasteners
Courtesy of CHRYSLER GROUP, LLC

5. Install the frame splash shield (3) with three screws (1).
6. Install two screws (2) to the front wheelhouse splash shield.
7. Install the right vertical brace (5) with two bolts (4) tightened to 45 N.m (33 ft. lbs.).

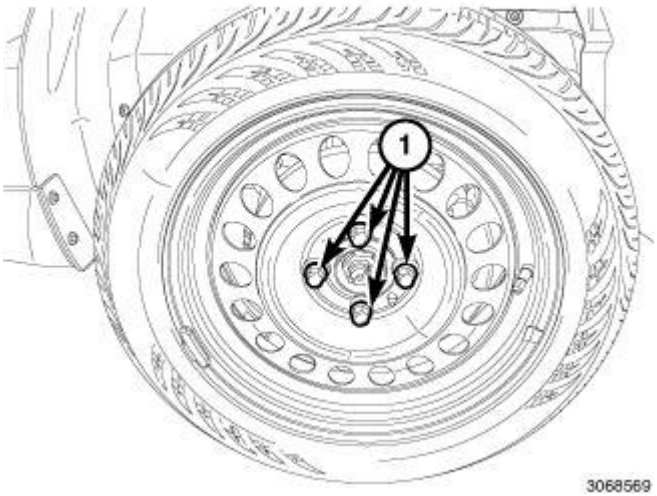


Fig. 728: Wheel Lug Bolts
Courtesy of CHRYSLER GROUP, LLC

8. Install the right front wheel and tire assembly. Refer to **INSTALLATION** .

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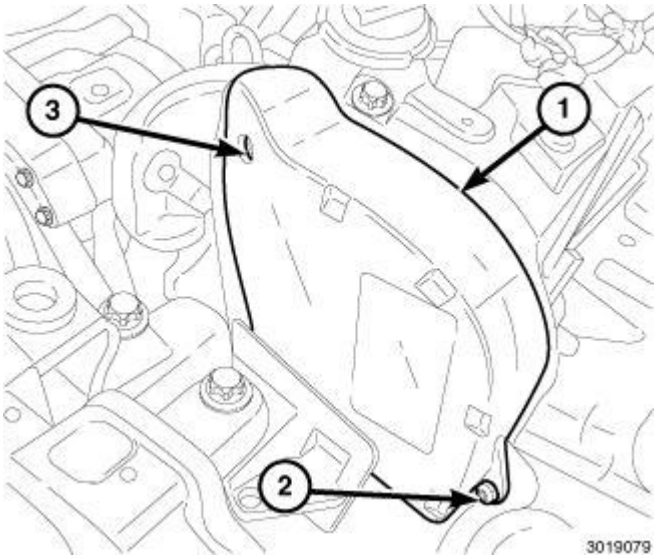


Fig. 729: Upper Timing Belt Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

9. Lower the vehicle.
10. Install the upper timing belt cover (1) with two bolts (2 and 3) tightened to 9 N.m (80 in. lbs.).

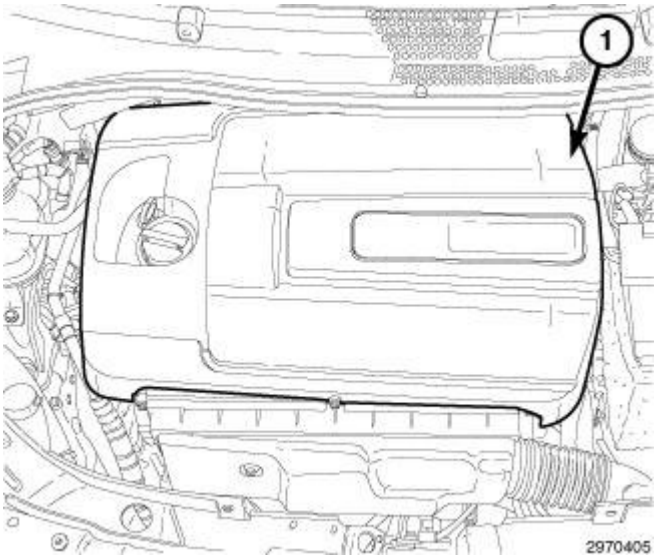


Fig. 730: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

11. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
12. Install the engine cover (1).

SPROCKET(S), TIMING BELT AND CHAIN

REMOVAL

REMOVAL

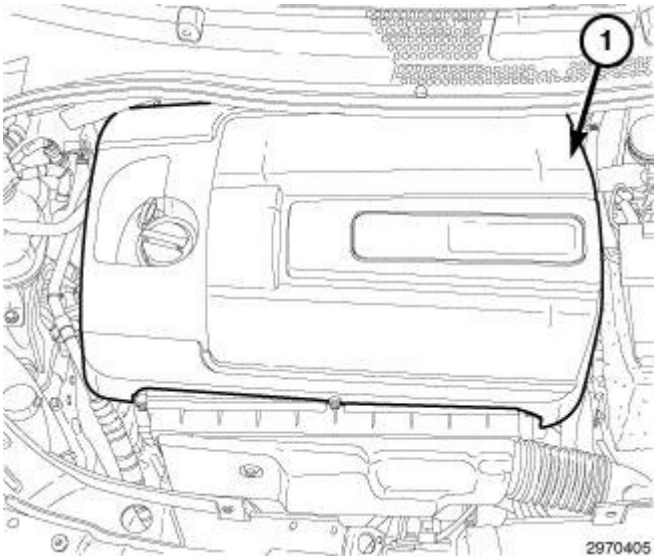


Fig. 731: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

1. Perform the fuel pressure release procedure. Refer to **FUEL DELIVERY, GAS, STANDARD PROCEDURE** .
2. Disconnect and isolate the negative battery cable.
3. Remove the engine cover (1).

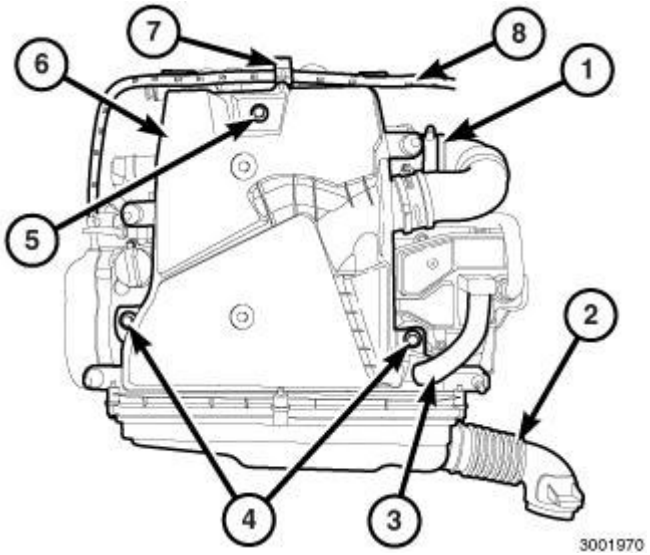


Fig. 732: Air Cleaner Body Assembly
Courtesy of CHRYSLER GROUP, LLC

4. Remove the air cleaner body (6). Refer to **BODY, AIR CLEANER, REMOVAL**.

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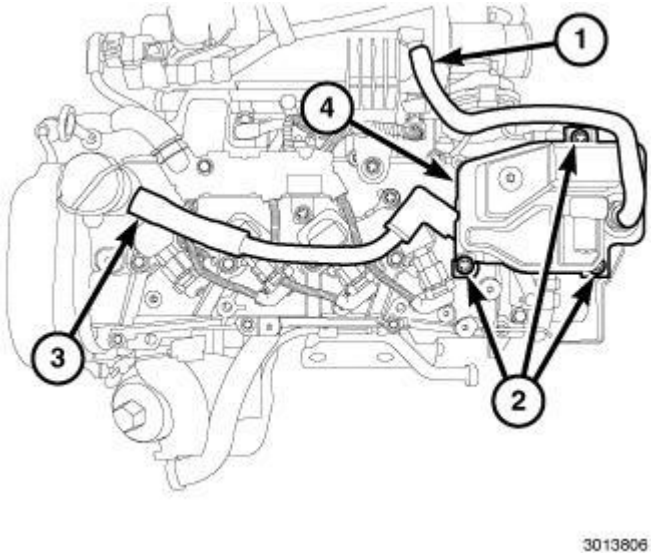


Fig. 733: PCV Hose, Bolts, Vent Hose & Oil Separator Housing
Courtesy of CHRYSLER GROUP, LLC

5. Disconnect the PCV hose (1) from the intake manifold.
6. Disconnect the vent hose (3) from the oil filler neck.
7. Remove three bolts (2) and remove the oil separator housing (4) from the cylinder head cover.

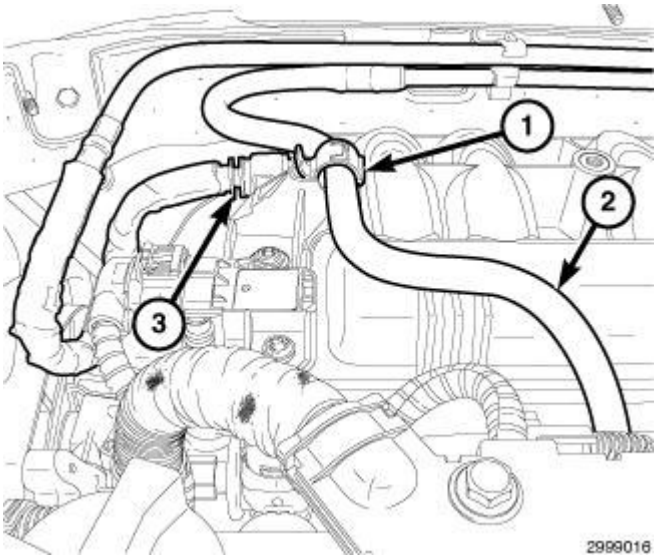


Fig. 734: Fuel Line, Hose Retainer & Fuel Vapor Purge Hose
Courtesy of CHRYSLER GROUP, LLC

8. Disconnect the fuel vapor hose (3) from the intake manifold.
9. Open the hose retainer (1) and disconnect the fuel line (2) from the fuel rail. Refer to **FITTING, QUICK CONNECT, STANDARD PROCEDURE** .

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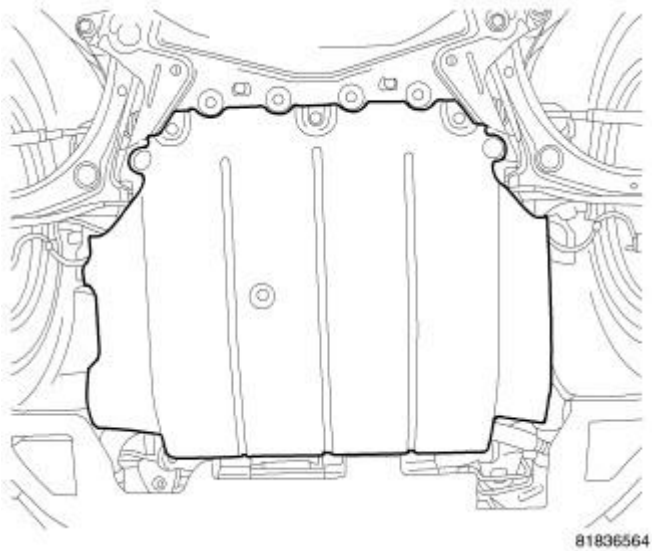


Fig. 735: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

10. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
11. Remove the belly pan. Refer to **BELLY PAN, REMOVAL** .

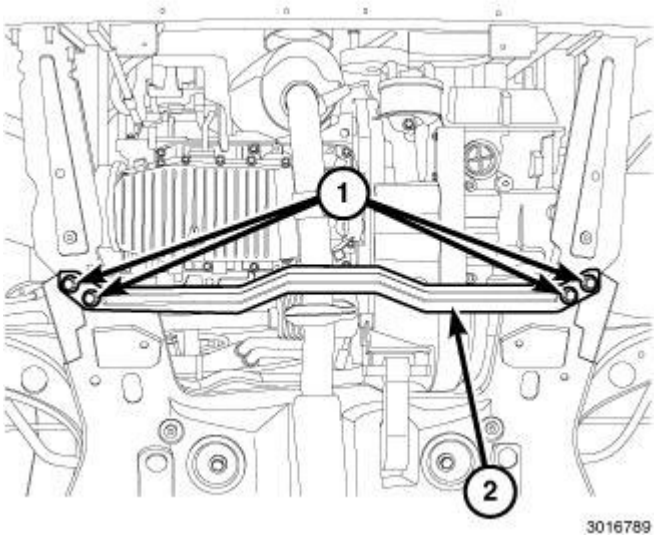


Fig. 736: Tunnel Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

12. Remove four bolts (1) and the tunnel support brace (2).

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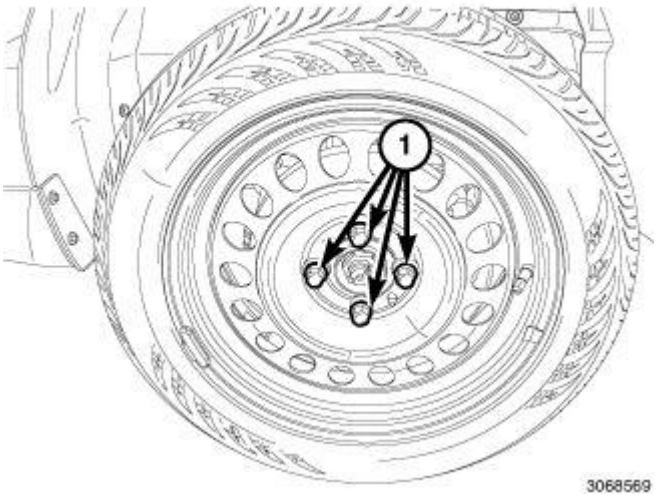


Fig. 737: Wheel Lug Bolts
Courtesy of CHRYSLER GROUP, LLC

13. Remove the right front wheel and tire assembly. Refer to **REMOVAL** .

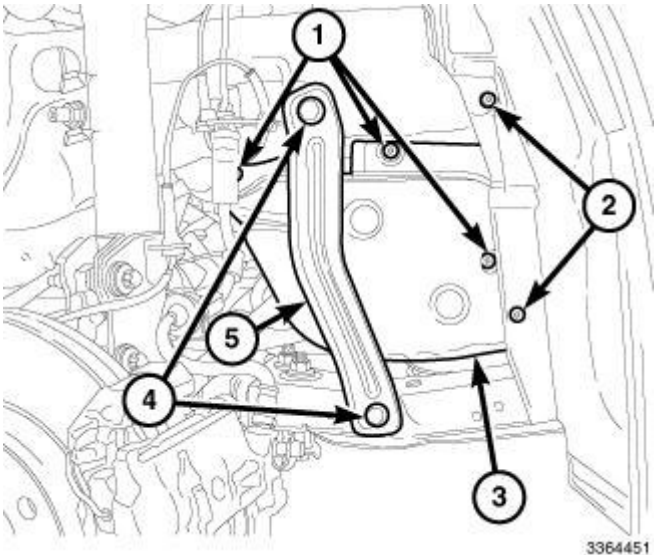


Fig. 738: Right Vertical Brace, Frame Splash Shield & Fasteners
Courtesy of CHRYSLER GROUP, LLC

14. Remove two bolts (4) and the right vertical brace (5).
15. Remove two screws (2) from the front wheelhouse splash shield.
16. Remove three screws (1) and the frame splash shield (3).

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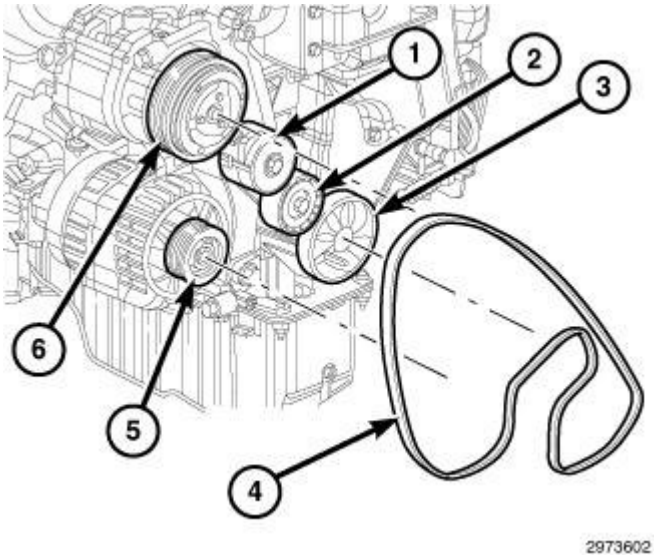


Fig. 739: Drive Belt Tensioners & Assembly With Drive Belt Routing
Courtesy of CHRYSLER GROUP, LLC

17. Remove the accessory drive belt (4). Refer to **BELT, SERPENTINE, REMOVAL** .

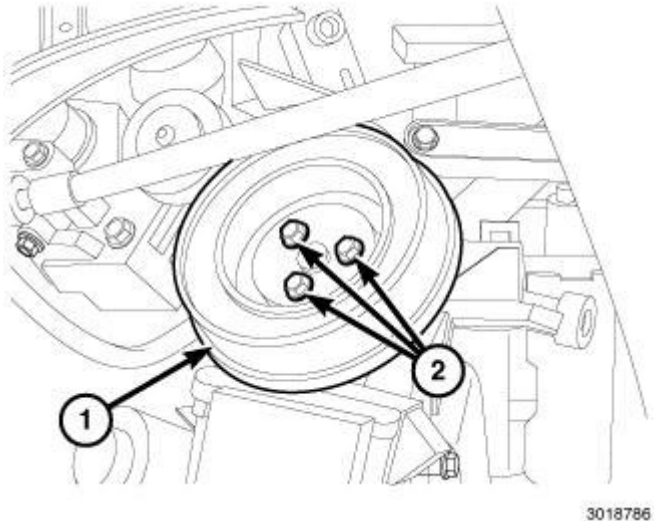


Fig. 740: Vibration Damper & Bolts
Courtesy of CHRYSLER GROUP, LLC

18. Remove the vibration damper (1). Refer to **DAMPER, VIBRATION, REMOVAL**.

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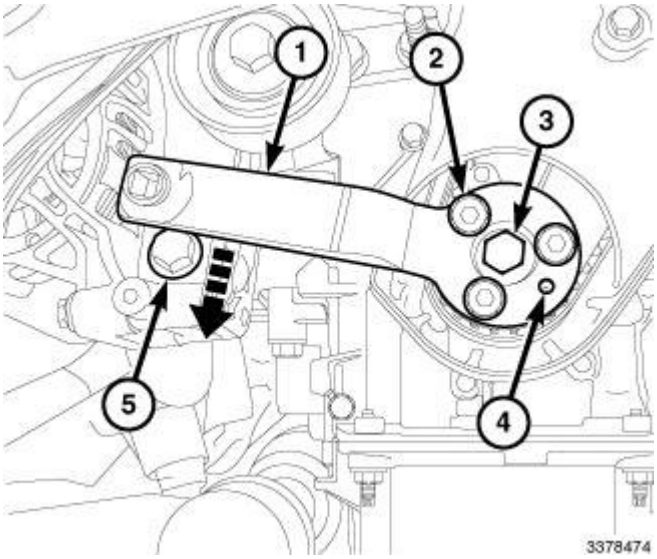


Fig. 741: Crankshaft Sprocket Holder, Clearance Hole & Bolts
Courtesy of CHRYSLER GROUP, LLC

19. Position the (special tool #10307, Holder, Crankshaft Sprocket) (1) as shown in illustration.
20. Rotate the crankshaft until the vibration damper locating pin is centered in the clearance hole (4).
21. Install the (special tool #10307, Holder, Crankshaft Sprocket) (1) with three bolts (2) tightened to 25 N.m (15 ft. lbs.).
22. With the (special tool #10307, Holder, Crankshaft Sprocket) (1) resting against the accessory bracket bolt (5), loosen **but do not remove** the crankshaft bolt (3).

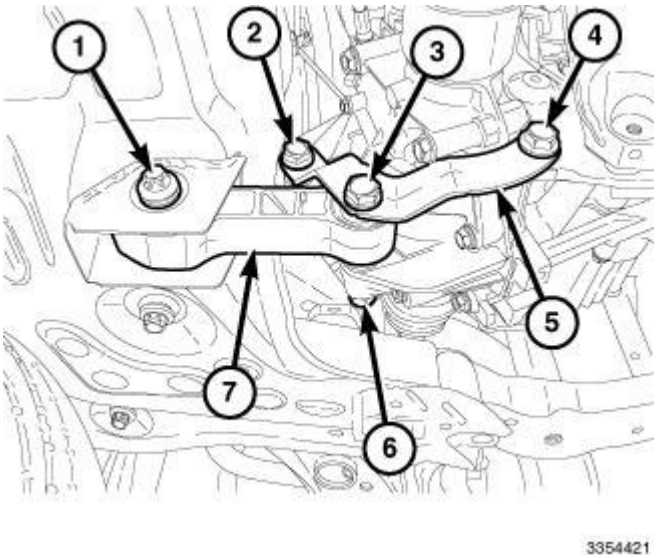


Fig. 742: Rear Engine Mount Bracket, Isolator & Fasteners
Courtesy of CHRYSLER GROUP, LLC

23. If equipped with a manual transmission, remove the rear engine mount bracket bolt (3) and nut (6), loosen the isolator bolt (1) and reposition the rear engine mount isolator (7) away from the bracket (5).

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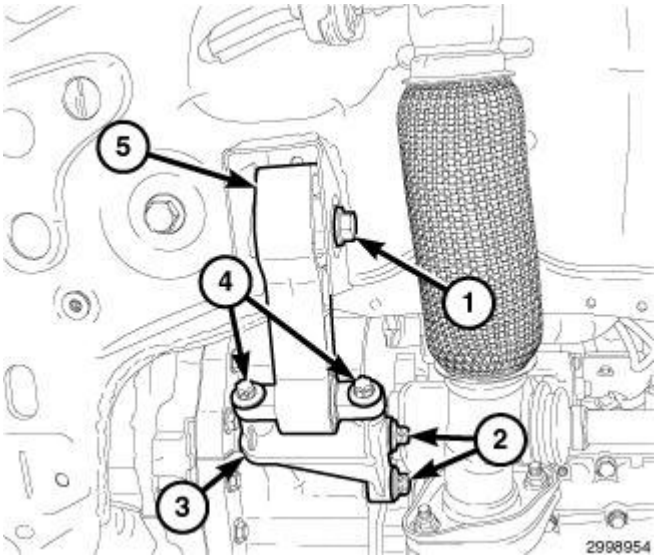


Fig. 743: Two Bolts Of Lower Transmission Mount
Courtesy of CHRYSLER GROUP, LLC

24. If equipped with an automatic transmission, remove two bolts (4) from the rear engine mount bracket (3), loosen the bolt (1) and reposition the rear engine mount link (5) away from the bracket (3).

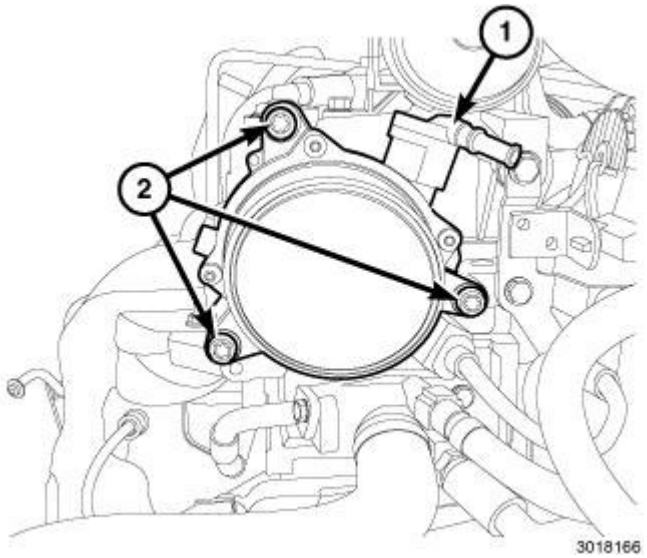


Fig. 744: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When servicing components near the vacuum pump, avoid contact with the plastic nipple that connects the vacuum pump to the brake booster hose. It is possible to crack the plastic nipple resulting in a brake booster vacuum leak.

25. Lower the vehicle.
26. Remove the vacuum pump (1). Refer to **PUMP, VACUUM, REMOVAL**.

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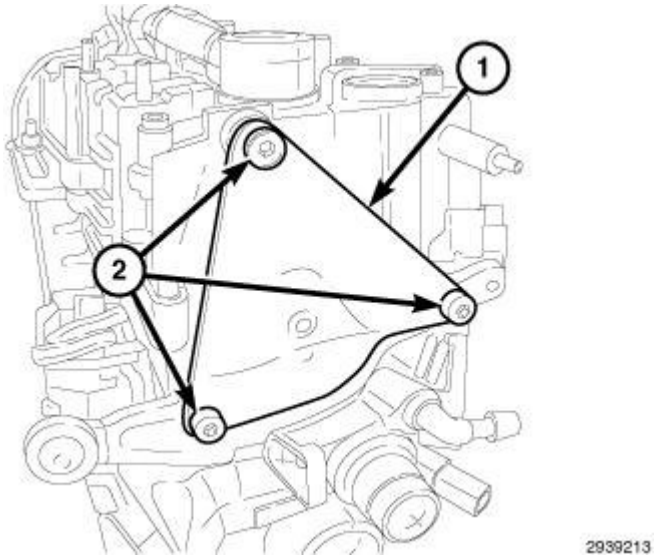


Fig. 745: Camshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

27. Install the (special tool #10277, Tool, Camshaft Timing Locking) (1) to the rear of the camshaft. Rotate the crankshaft clockwise to align the tool with the vacuum pump mounting. Install three bolts (2) and tighten to 20 N.m (15 ft. lbs.).

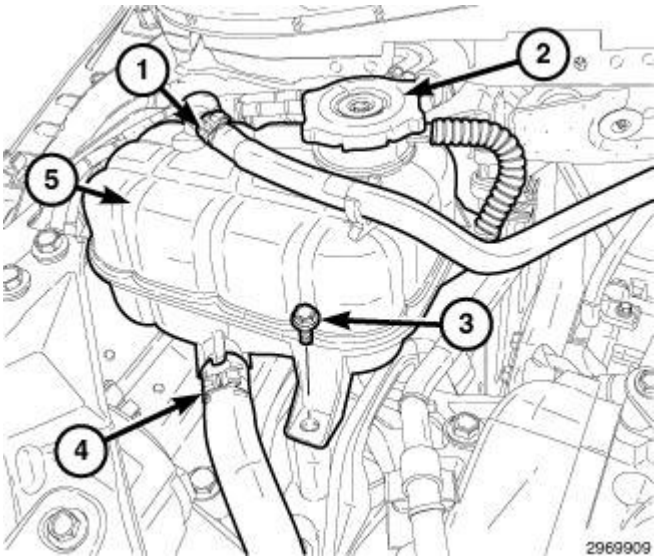


Fig. 746: Return Hose, Lower Supply Hose, Mounting Screw & Coolant Recovery Bottle
Courtesy of CHRYSLER GROUP, LLC

28. Reposition the coolant recovery bottle (5). Refer to **BOTTLE, PRESSURIZED COOLANT, REMOVAL** .

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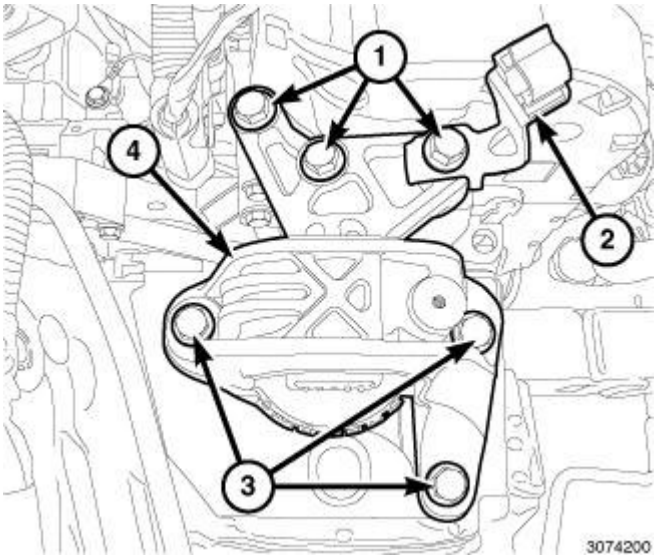


Fig. 747: Three Right Side Engine Mount Support Bolts
Courtesy of CHRYSLER GROUP, LLC

29. Support the engine with a floor jack positioned under the oil pan.
30. Remove six bolts (1 and 3) and the RH engine mount isolator (4).

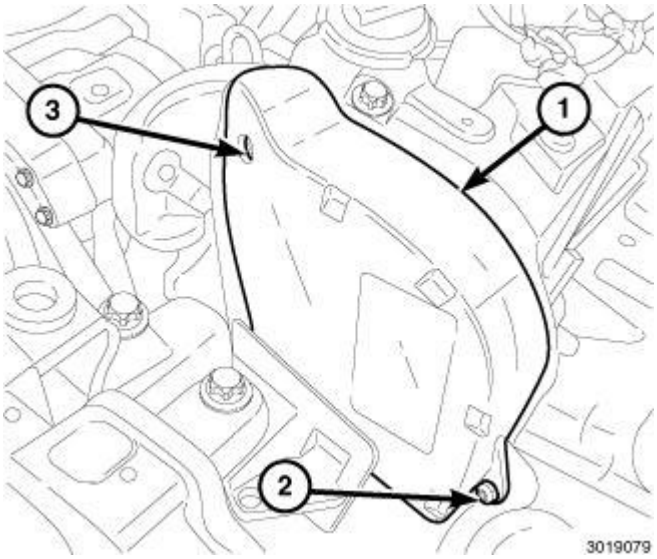


Fig. 748: Upper Timing Belt Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

31. Remove the bolts (2 and 3) and the upper timing belt cover (1).

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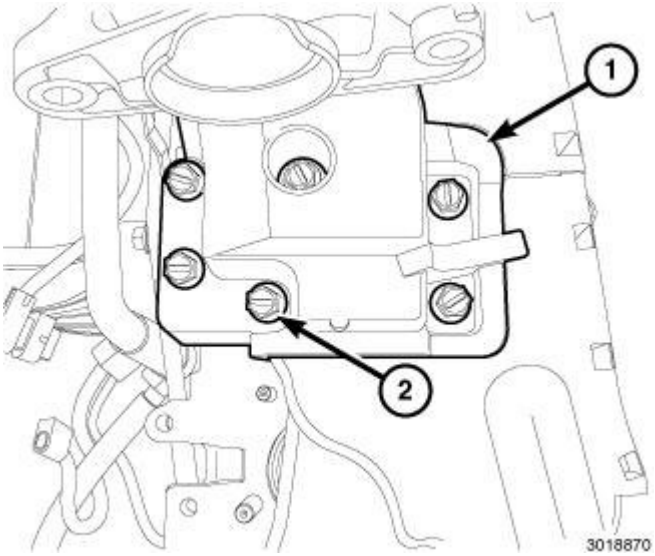


Fig. 749: RH Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

32. Carefully raise the front of the engine and remove the six bolts (2) and the RH engine mount bracket (1).

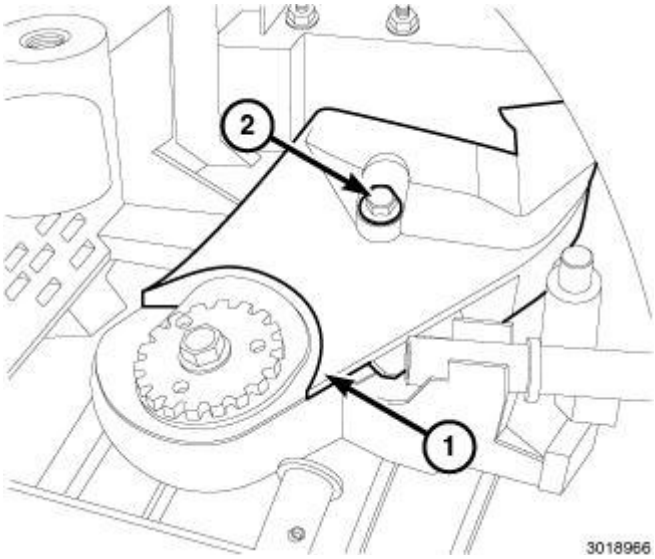


Fig. 750: Lower Timing Belt Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

33. Remove the bolt (2) and the lower timing belt cover (1).

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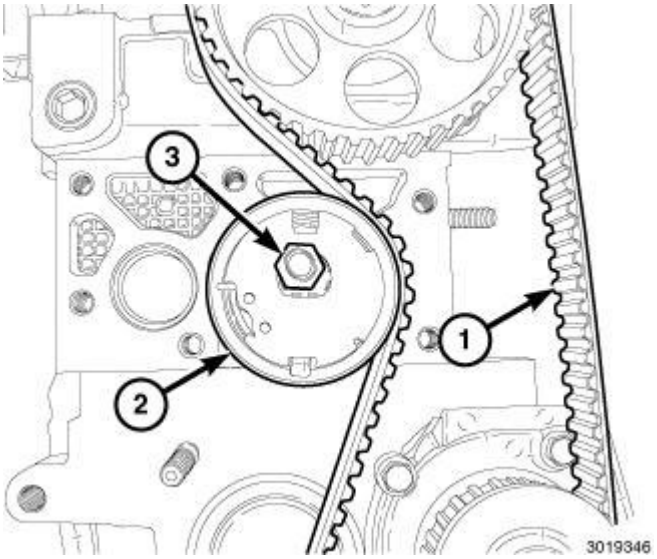


Fig. 751: Timing Belt, Tensioner & Lock Nut
Courtesy of CHRYSLER GROUP, LLC

NOTE: If the timing belt is to be reused, mark the direction of rotation using a paint pen or equivalent to aid in reassembly.

34. Loosen the tensioner lock nut (3) and remove the timing belt (1).

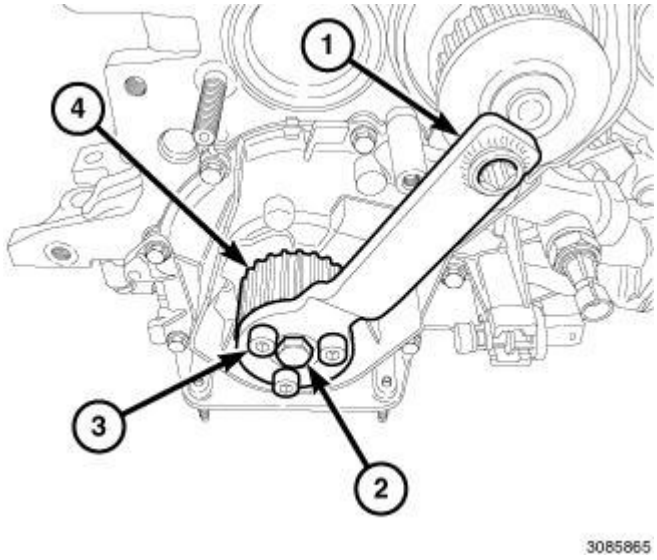


Fig. 752: Crankshaft Sprocket, Holder & Bolts
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When the timing belt is removed and the cylinder head is still installed, DO NOT rotate the camshaft or crankshaft without first locating the proper crankshaft position. Failure to do so will result in valve and/or piston damage.

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35. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
36. If required, remove the crankshaft sprocket (4):
    - Install the (special tool #10307, Holder, Crankshaft Sprocket) (1) with three bolts (3) tightened to 25 N.m (15 ft. lbs.).
    - Remove the bolt (2) and the crankshaft sprocket (4).
    - Discard the bolt (2).

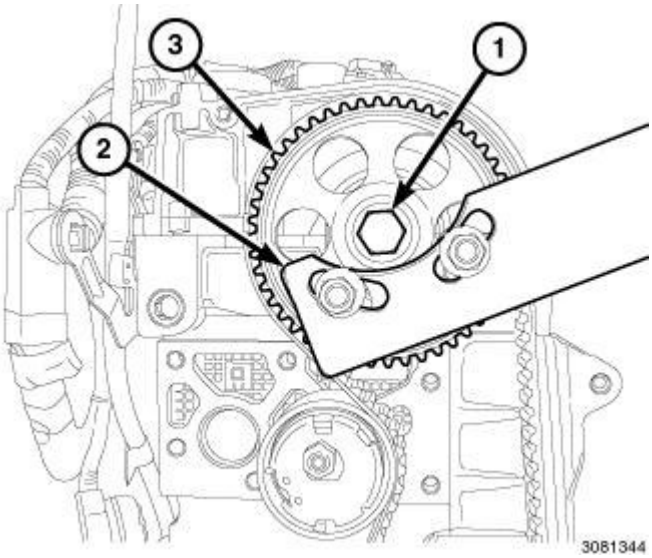


Fig. 753: Camshaft Sprocket, Holder & Bolt
Courtesy of CHRYSLER GROUP, LLC

37. Lower the vehicle.
38. If required, use (special tool #6847, Holder, Camshaft Sprocket) (2) and remove the bolt (1) and the camshaft sprocket (3).

INSTALLATION

INSTALLATION

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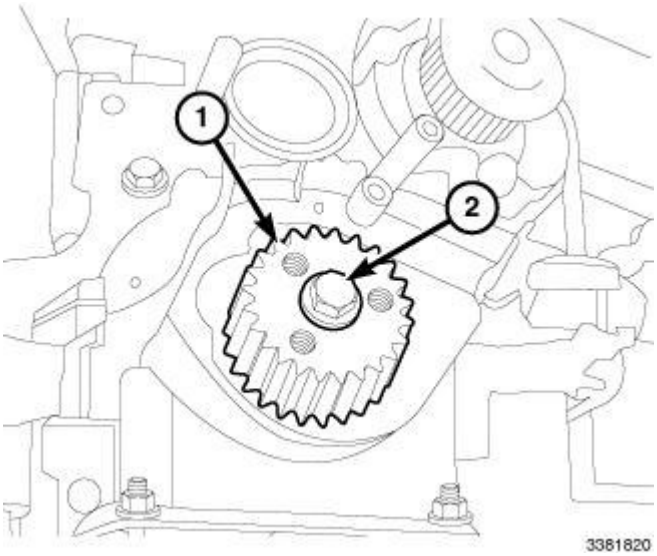


Fig. 754: Crankshaft Sprocket & Bolt
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When the timing belt is removed and the cylinder head is still installed, DO NOT rotate the camshaft or crankshaft without first locating the proper crankshaft position. Failure to do so will result in valve and/or piston damage.

1. Align the crankshaft sprocket locator key to the crankshaft keyway and install the sprocket (1) with a new bolt (2) on the crankshaft. Hand tighten the bolt (2) at this time. The bolt (2) will be tightened to specification after the timing belt is installed.

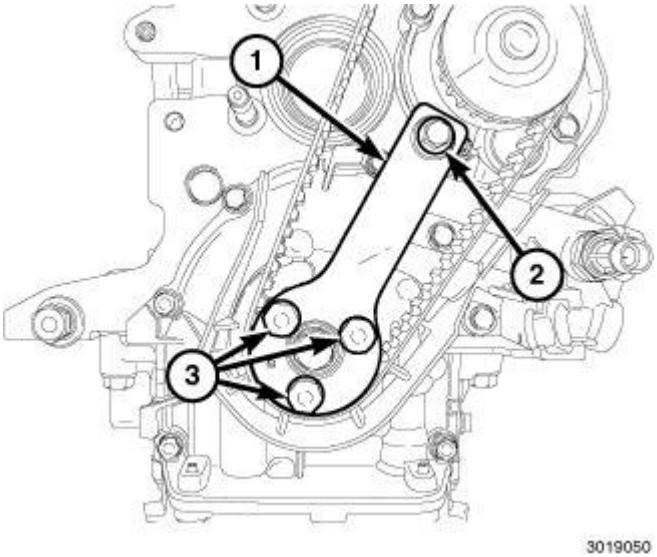


Fig. 755: Crankshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

2. Install the (special tool #10276, Tool, Crankshaft Timing Locking) (1) with three bolts (3) tightened to 25

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N.m (18 ft. lbs.) and one bolt (2) tightened to 9 N.m (80 in. lbs.).

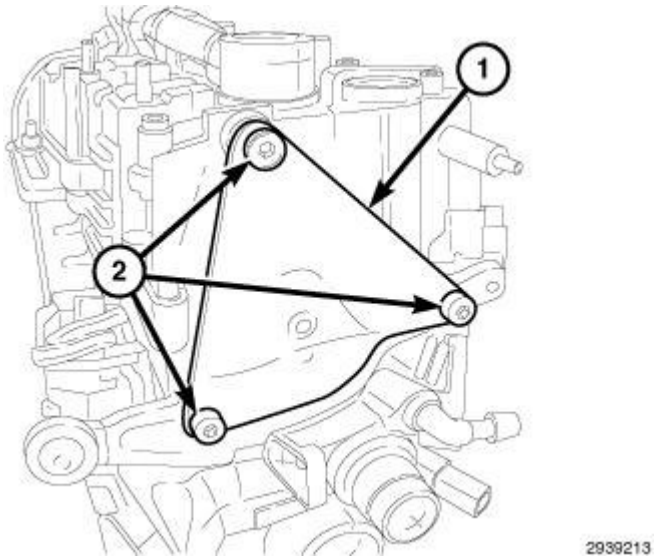


Fig. 756: Camshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

3. If removed, install the (special tool #10277, Tool, Camshaft Timing Locking) (1) to the rear of the camshaft. Install three bolts (2) and tighten to 20 N.m (15 ft. lbs.).

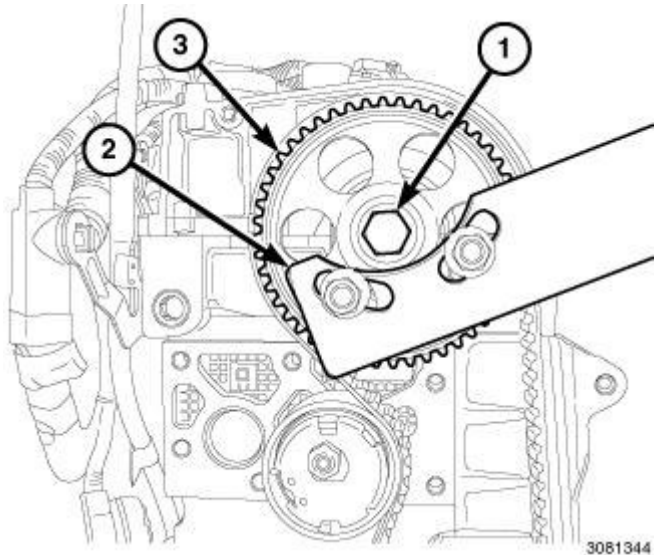


Fig. 757: Camshaft Sprocket, Holder & Bolt
Courtesy of CHRYSLER GROUP, LLC

4. Use the (special tool #6847, Holder, Camshaft Sprocket) (2) to hold the camshaft sprocket (3) and loosen the bolt (1). The camshaft sprocket (3) should now be free to rotate on the camshaft.

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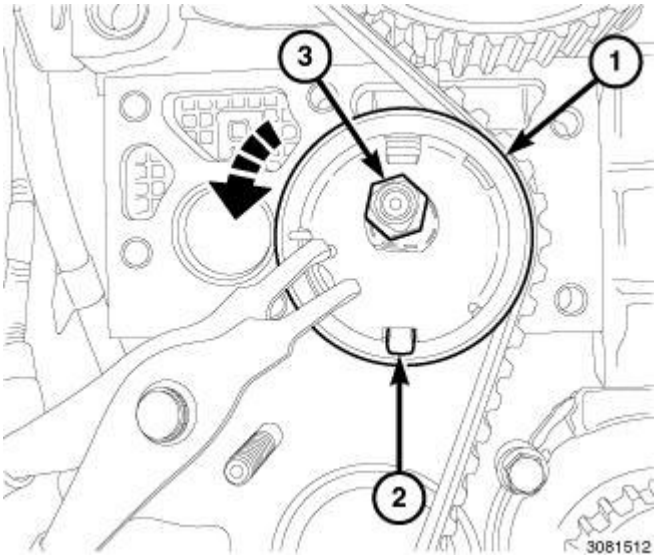


Fig. 758: Timing Belt Tensioner, Silver Tab & Lock Nut
Courtesy of CHRYSLER GROUP, LLC

NOTE: If the original timing belt (1) is being reused, install the belt so that it maintains the same direction of rotation as when it was removed.

5. Install the timing belt starting with the crankshaft sprocket, then the water pump sprocket, finishing with the camshaft sprocket.
6. Install the timing belt tensioner (1) and adjust the tensioner so that the silver tab (2) is centered in the middle of the window. Tighten the lock nut (3) to 28 N.m (21 ft. lbs.).

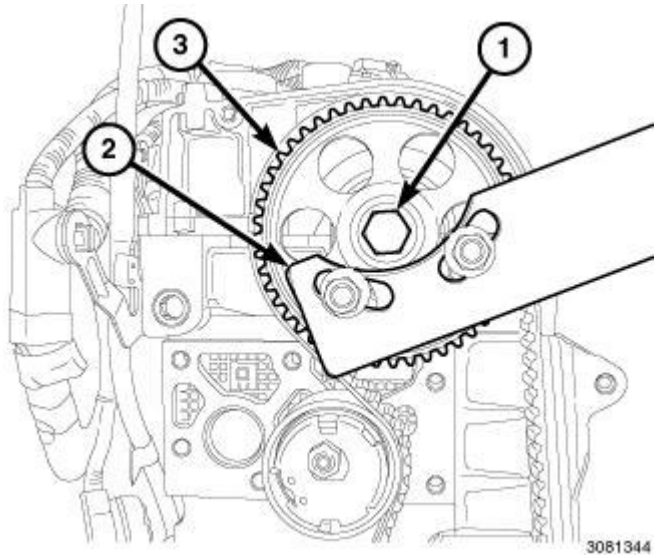


Fig. 759: Camshaft Sprocket, Holder & Bolt
Courtesy of CHRYSLER GROUP, LLC

7. Use the (special tool #6847, Holder, Camshaft Sprocket) (2) to hold the camshaft sprocket (3) and tighten the camshaft sprocket bolt (1) to 120 N.m (88 ft. lbs.).

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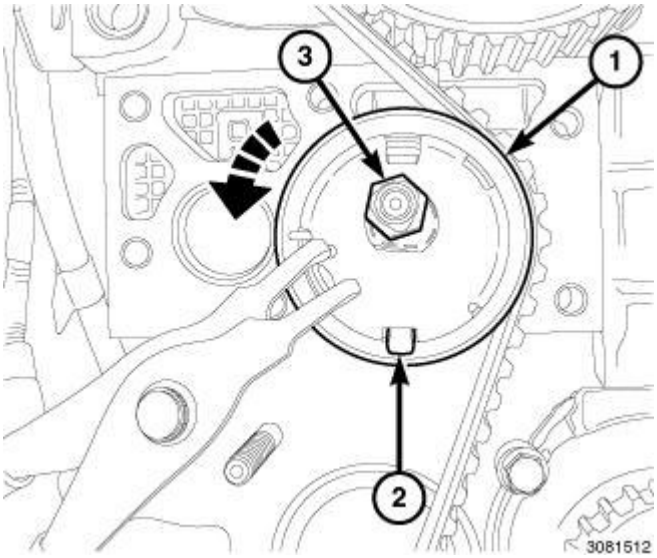


Fig. 760: Timing Belt Tensioner, Silver Tab & Lock Nut
Courtesy of CHRYSLER GROUP, LLC

8. Remove the (special tool #10277, Tool, Camshaft Timing Locking) and the (special tool #10276, Tool, Crankshaft Timing Locking).
9. Rotate the crankshaft clockwise at least two complete revolutions to center the timing belt on the sprockets.
10. Verify that the silver tab (2) is still centered in the middle of the window. If required, loosen the tensioner lock nut (3), readjust the timing belt tensioner (2) and tighten the lock nut (3) to 28 N.m (21 ft. lbs.).

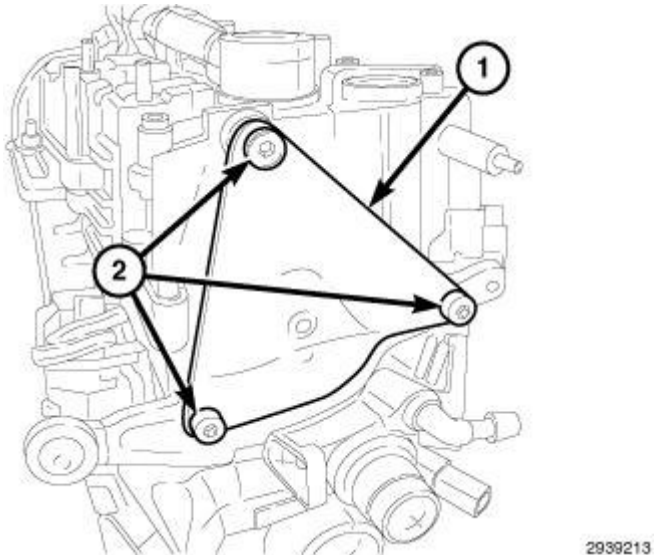


Fig. 761: Camshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

NOTE: Reinstall the timing locking tools to verify correct camshaft timing.

11. Install the (special tool #10277, Tool, Camshaft Timing Locking) (1) to the rear of the camshaft. Install

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three bolts (2) and tighten to 20 N.m (15 ft. lbs.).

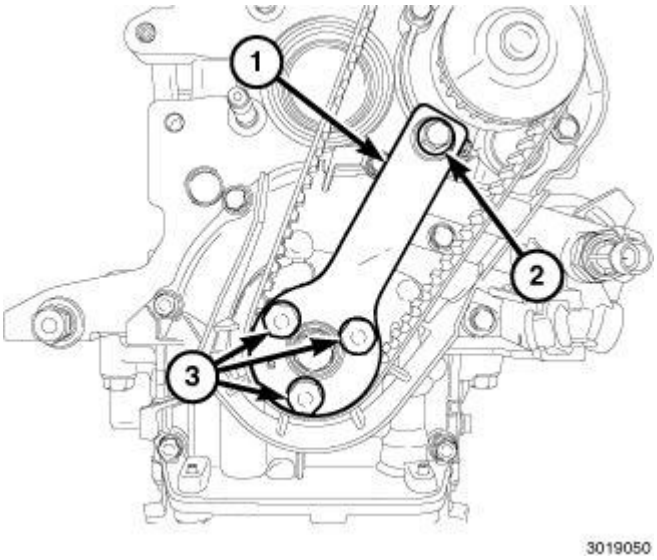


Fig. 762: Crankshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

12. Install the (special tool #10276, Tool, Crankshaft Timing Locking) (1) with three bolts (3) tightened to 25 N.m (18 ft. lbs.) and one bolt (2) tightened to 9 N.m (80 in. lbs.).

NOTE: If the bolt (2) does not align with the lower timing belt cover mounting boss, the camshaft timing is not correct. Loosen the tensioner lock nut and the camshaft sprocket bolt and repeat this procedure.

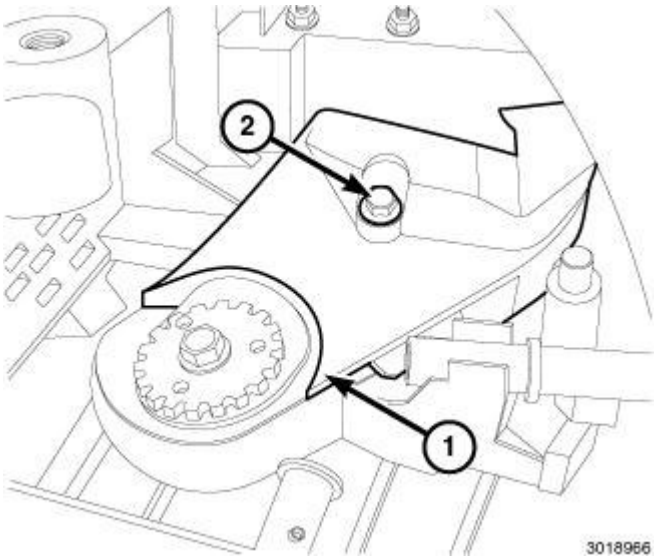


Fig. 763: Lower Timing Belt Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

13. Remove the (special tool #10277, Tool, Camshaft Timing Locking) and the (special tool #10276, Tool,

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Crankshaft Timing Locking).

14. Install the lower timing belt cover (1) with bolt (2) tightened to 9 N.m (80 in. lbs.).

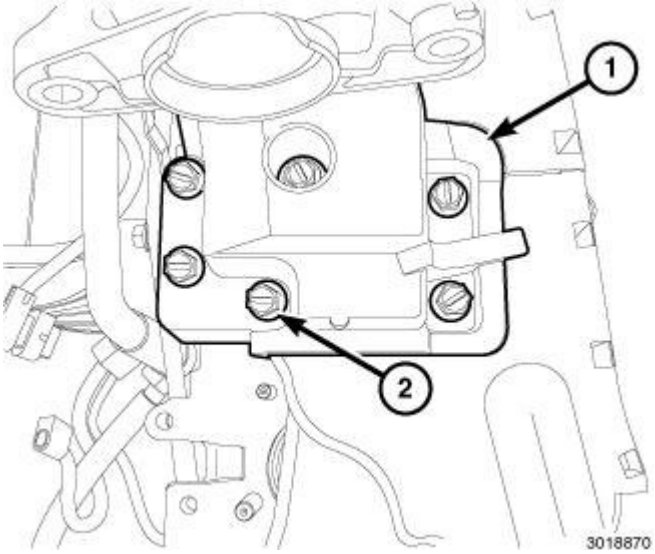


Fig. 764: RH Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

15. Install the RH engine mount bracket (1) with six bolts (2) tightened to 25 N.m (18 ft. lbs.).

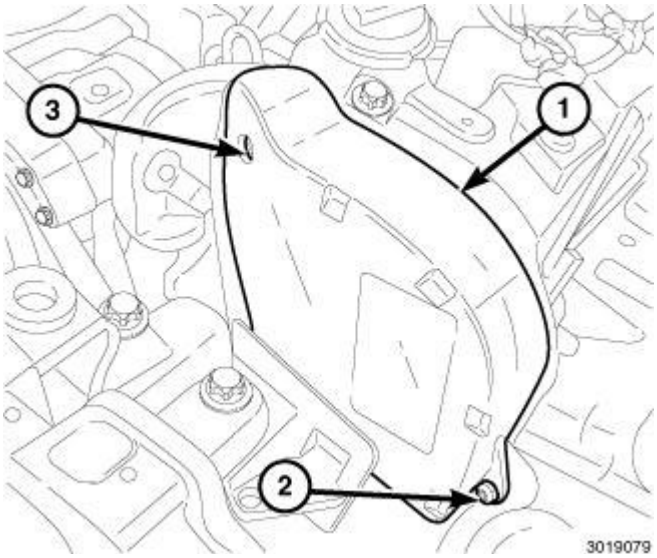


Fig. 765: Upper Timing Belt Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

16. Install the upper timing belt cover (1) with two bolts (2 and 3) tightened to 9 N.m (80 in. lbs.).

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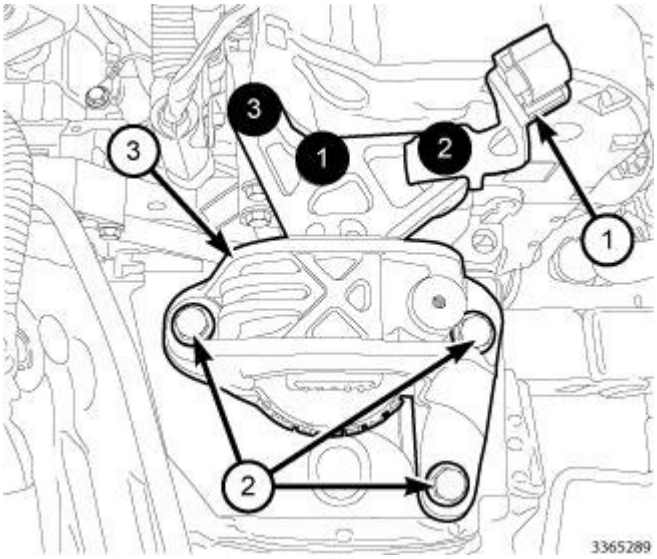


Fig. 766: RH Engine Mount Isolator, Support Bracket & Bolts With Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

17. Install the RH engine mount isolator (3) and support bracket (1) to the engine mount bracket with three bolts. Tighten the isolator to engine bracket bolts in the sequence shown in illustration to 60 N.m (44 ft. lbs.).
18. Install the RH engine mount isolator (3) to the body with three bolts (2). Tighten the isolator to body bolts (2) to 60 N.m (44 ft. lbs.).

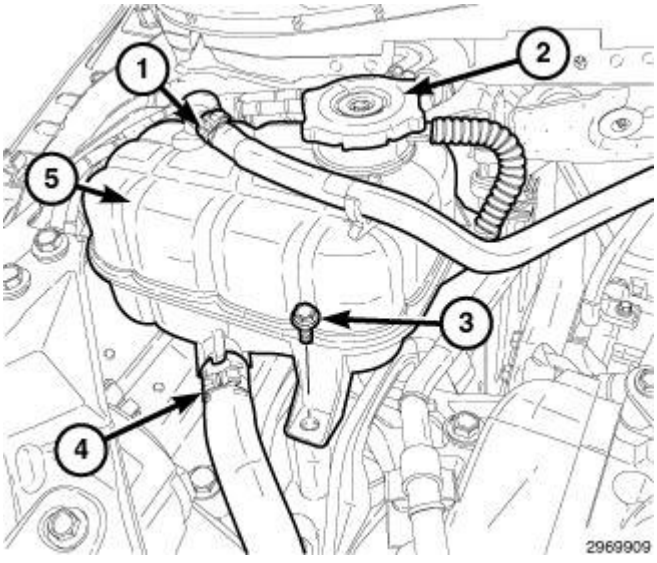


Fig. 767: Return Hose, Lower Supply Hose, Mounting Screw & Coolant Recovery Bottle
Courtesy of CHRYSLER GROUP, LLC

19. Install the pressurized coolant bottle (5). Refer to **BOTTLE, PRESSURIZED COOLANT, INSTALLATION** .

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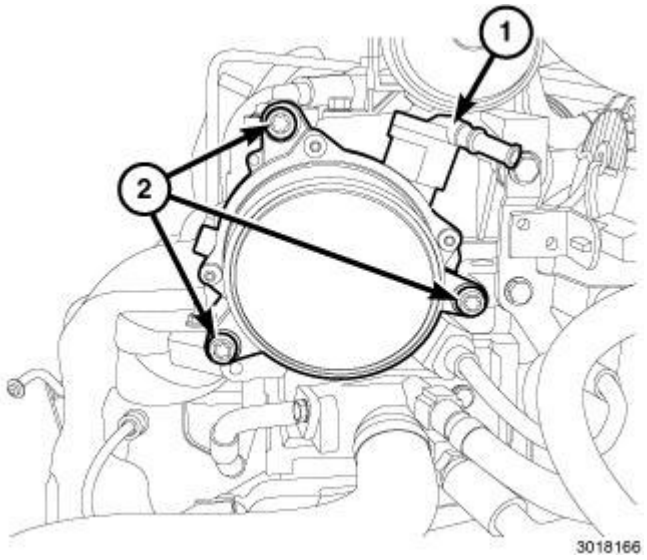


Fig. 768: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

20. Install the vacuum pump (1). Refer to **PUMP, VACUUM, REMOVAL**.

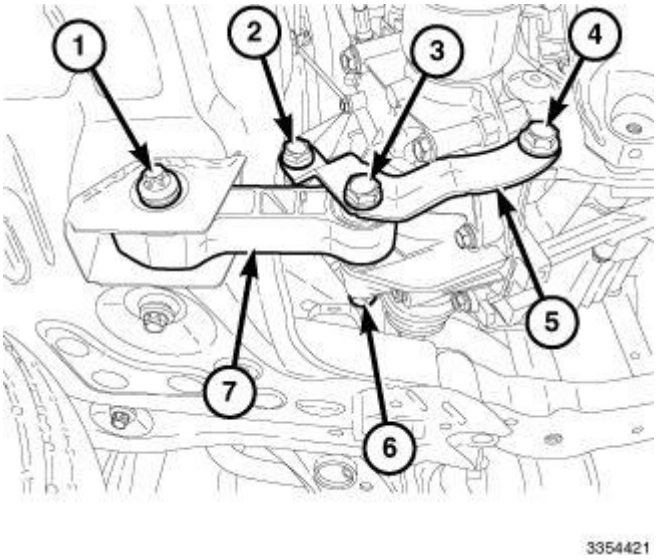


Fig. 769: Rear Engine Mount Bracket, Isolator & Fasteners
Courtesy of CHRYSLER GROUP, LLC

21. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
22. If equipped with a manual transmission, install the rear engine mount isolator (7) to the transmission with the rear engine mount bracket bolt (3) and nut (6) tightened to 80 N.m (59 ft. lbs.) and tighten the isolator bolt (1) to 130 N.m (96 ft. lbs.).

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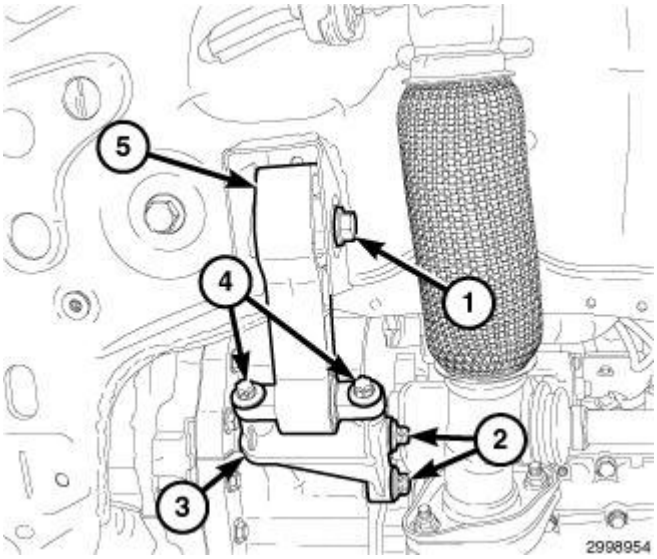


Fig. 770: Two Bolts Of Lower Transmission Mount
Courtesy of CHRYSLER GROUP, LLC

23. If equipped with an automatic transmission, install the rear engine mount isolator (5) in the bracket (3) with two bolts (4) tighten to 60 N.m (44 ft. lbs.). Install the isolator bolt (1) and tighten to 130 N.m (96 ft. lbs.).

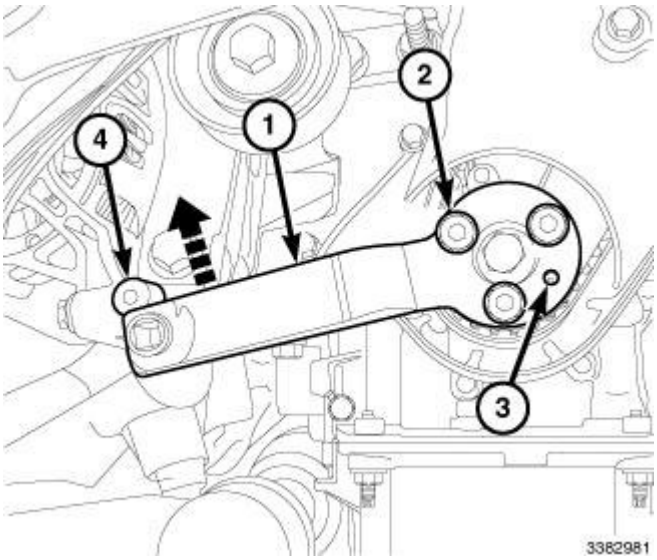


Fig. 771: Crankshaft Sprocket Holder, Clearance Hole & Bolts
Courtesy of CHRYSLER GROUP, LLC

24. Position the (special tool #10307, Holder, Crankshaft Sprocket) (1) against the accessory bracket boss (4) as shown in illustration.
25. Rotate the crankshaft until the vibration damper locating pin is centered in the clearance hole (3).
26. Install the (special tool #10307, Holder, Crankshaft Sprocket) (1) with three bolts (2) tightened to 25 N.m (15 ft. lbs.).

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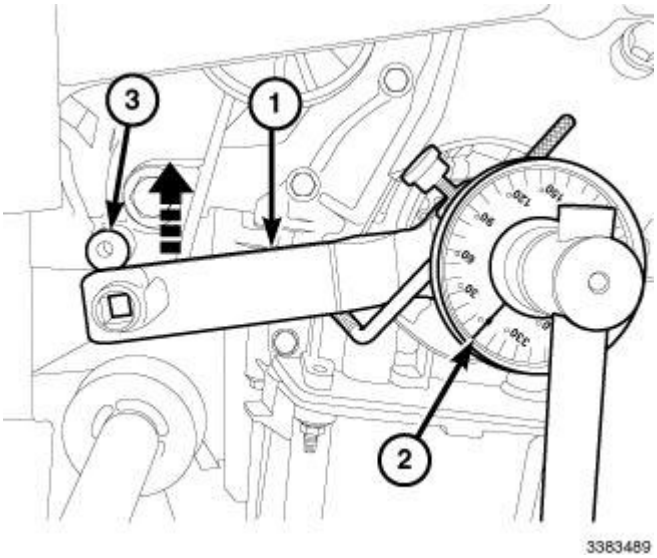


Fig. 772: Tightening Crankshaft Bolt An Additional 110 Degrees
Courtesy of CHRYSLER GROUP, LLC

27. With the (special tool #10307, Holder, Crankshaft Sprocket) (1) resting against the accessory bracket boss (3), initially tighten the crankshaft bolt to 20 N.m (15 ft. lbs.).
28. Using a torque angle measuring device, such as OTC Torque Angle Gauge 4554 (2), tighten the crankshaft bolt an additional 110°.

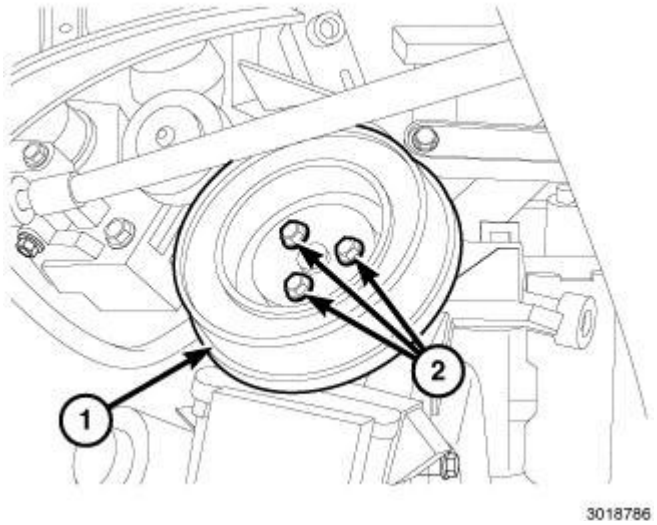


Fig. 773: Vibration Damper & Bolts
Courtesy of CHRYSLER GROUP, LLC

29. Install the vibration damper (1). Refer to **DAMPER, VIBRATION, INSTALLATION**.

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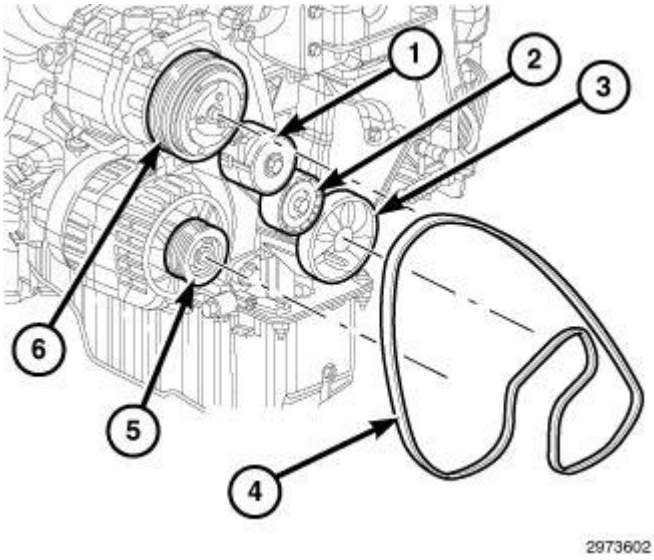


Fig. 774: Drive Belt Tensioners & Assembly With Drive Belt Routing
Courtesy of CHRYSLER GROUP, LLC

30. Install the accessory drive belt (4). Refer to **BELT, SERPENTINE, INSTALLATION** .

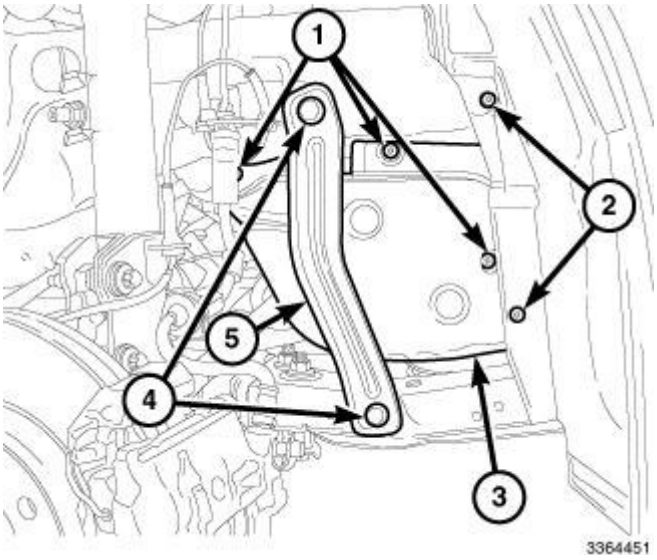


Fig. 775: Right Vertical Brace, Frame Splash Shield & Fasteners
Courtesy of CHRYSLER GROUP, LLC

31. Install the frame splash shield (3) with three screws (1).
32. Install two screws (2) to the front wheelhouse splash shield.
33. Install the right vertical brace (5) with two bolts (4) tightened to 45 N.m (33 ft. lbs.).

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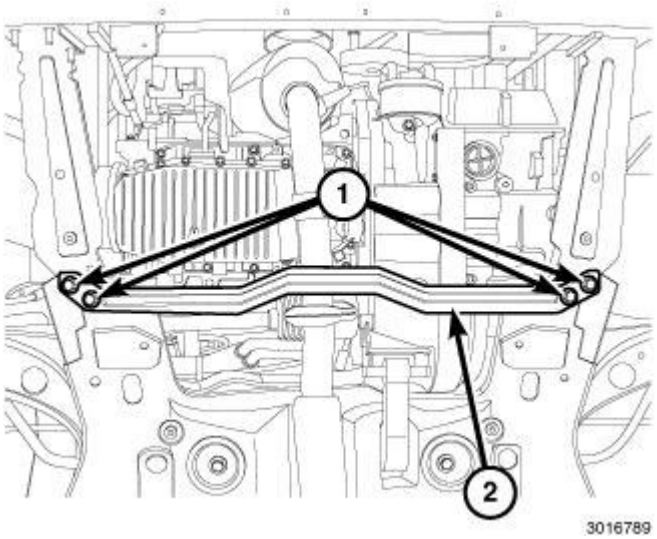


Fig. 776: Tunnel Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

34. Install the tunnel support brace (2) with four bolts (1) tightened to 90 N.m (60 ft. lb.).

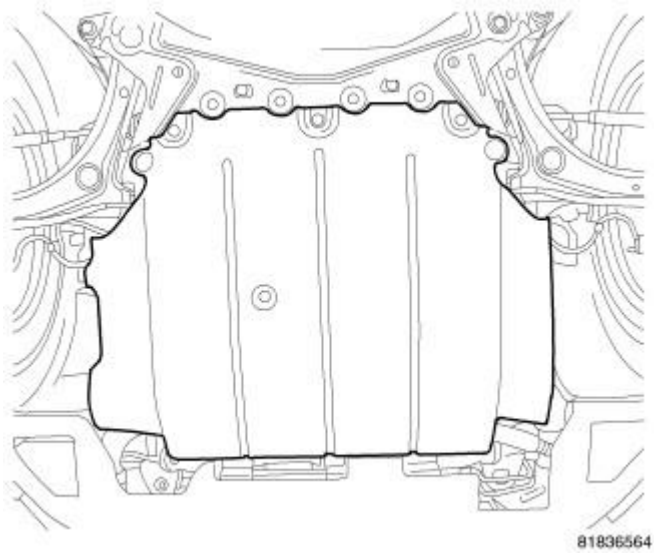


Fig. 777: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

35. Install the belly pan. Refer to **BELLY PAN, INSTALLATION** .

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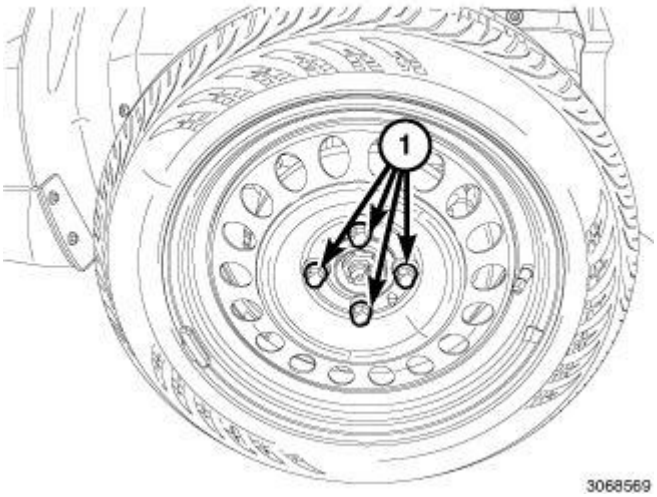


Fig. 778: Wheel Lug Bolts
Courtesy of CHRYSLER GROUP, LLC

36. Install the right front wheel and tire assembly. Refer to **INSTALLATION** .

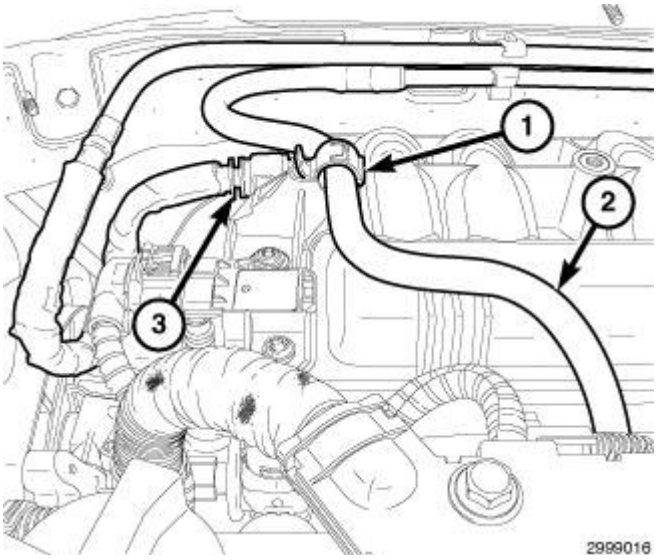


Fig. 779: Fuel Line, Hose Retainer & Fuel Vapor Purge Hose
Courtesy of CHRYSLER GROUP, LLC

37. Lower the vehicle.
38. Connect the fuel vapor purge hose (3) to the intake manifold.
39. Connect the fuel line (2) to the fuel rail and close the hose retainer (1). Refer to **FITTING, QUICK CONNECT, STANDARD PROCEDURE** .

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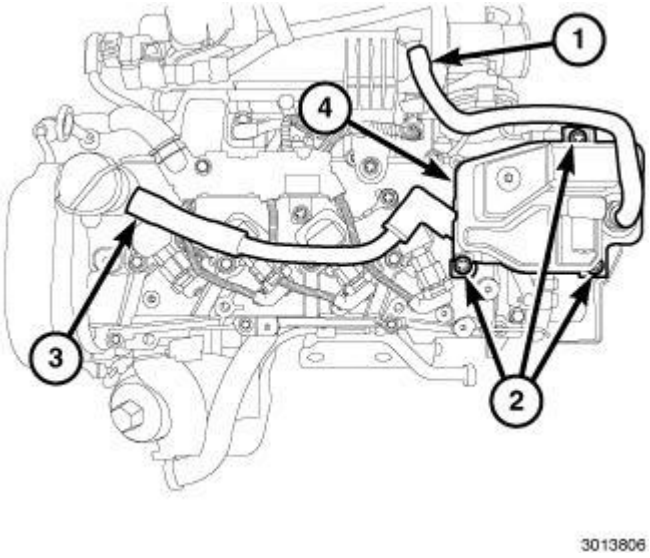


Fig. 780: PCV Hose, Bolts, Vent Hose & Oil Separator Housing
Courtesy of CHRYSLER GROUP, LLC

40. Install the oil separator housing (4) to the cylinder head cover with three bolts (2) tightened to 13 N.m (115 in. lbs.).
41. Connect the vent hose (3) to the oil filler neck.
42. Connect the PCV hose (1) to the intake manifold.

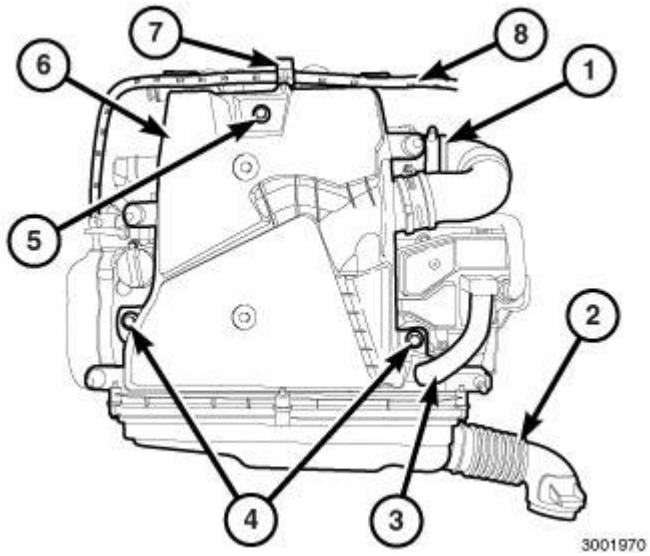


Fig. 781: Air Cleaner Body Assembly
Courtesy of CHRYSLER GROUP, LLC

43. Install the air cleaner body (6). Refer to **BODY, AIR CLEANER, INSTALLATION**.

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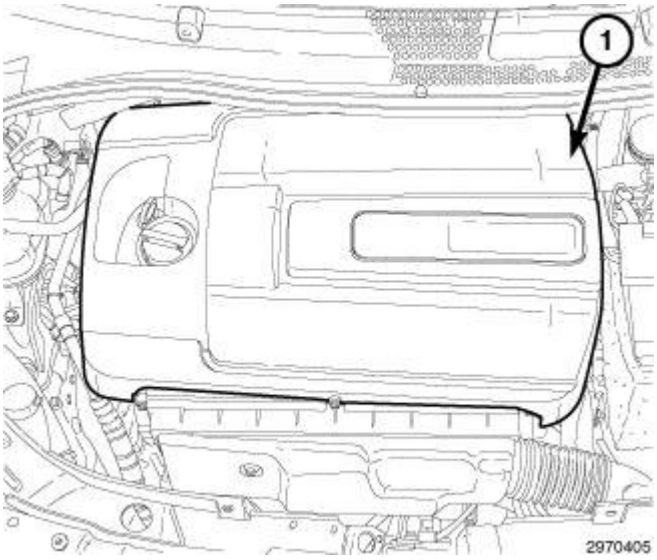


Fig. 782: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

44. Connect the negative battery cable. Tighten nut to 5 N.m (45 in. lb.).
45. Install the engine cover (1).
46. Start and run the engine until it reaches normal operating temperature. Check cooling system for correct fluid level. Refer to **STANDARD PROCEDURE** .

NOTE: The Cam/Crank Variation Relearn procedure must be performed using the scan tool anytime there has been a repair/replacement made to a powertrain system, for example: flywheel, valvetrain, camshaft and/or crankshaft sensors or components. Refer to the appropriate Diagnostic Information .

TENSIONER, ENGINE TIMING

DESCRIPTION

DESCRIPTION

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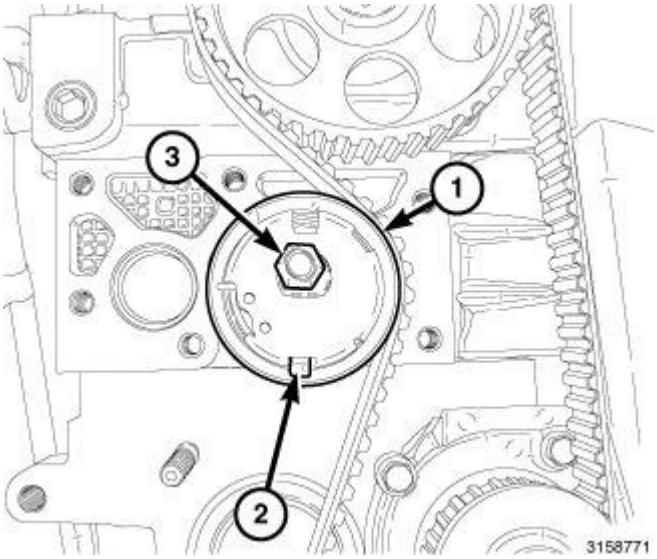


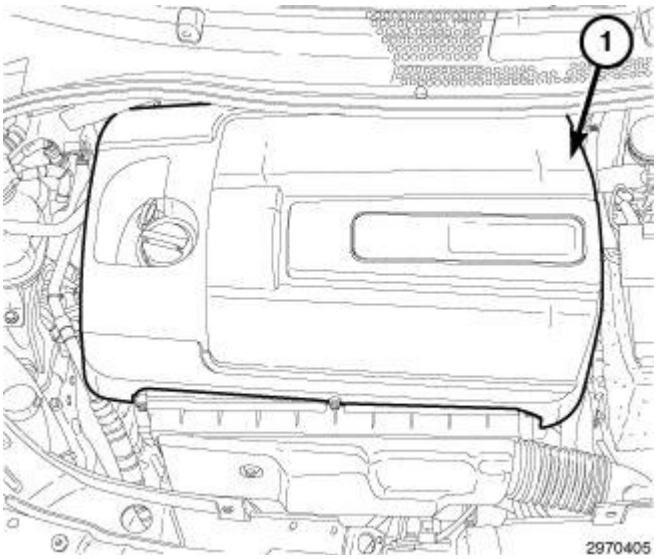
Fig. 783: Timing Belt Tensioner, Silver Tab & Lock Nut
Courtesy of CHRYSLER GROUP, LLC

The timing belt tensioner (1) is mounted to the cylinder head. It has a spring loaded offset hub and a tension indicator (2). Rotating the tensioner hub counterclockwise against internal spring pressure applies tension to the timing belt. When the silver tab is centered in the window the timing belt tension is correct. Lock the tensioner in this position by tightening the nut (3).

NOTE: If the silver tab is to the right side of the window, timing belt tension is insufficient. If the silver tab is left of the window, timing belt tension is excessive.

REMOVAL

REMOVAL



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Fig. 784: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

1. Perform the fuel pressure release procedure. Refer to **FUEL DELIVERY, GAS, STANDARD PROCEDURE** .
2. Disconnect and isolate the negative battery cable.
3. Remove the engine cover (1).

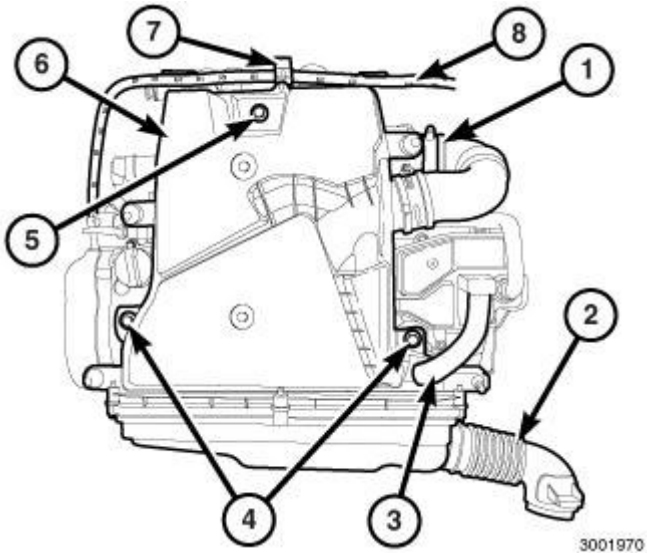


Fig. 785: Air Cleaner Body Assembly
Courtesy of CHRYSLER GROUP, LLC

4. Remove the air cleaner body (6). Refer to **BODY, AIR CLEANER, REMOVAL**.

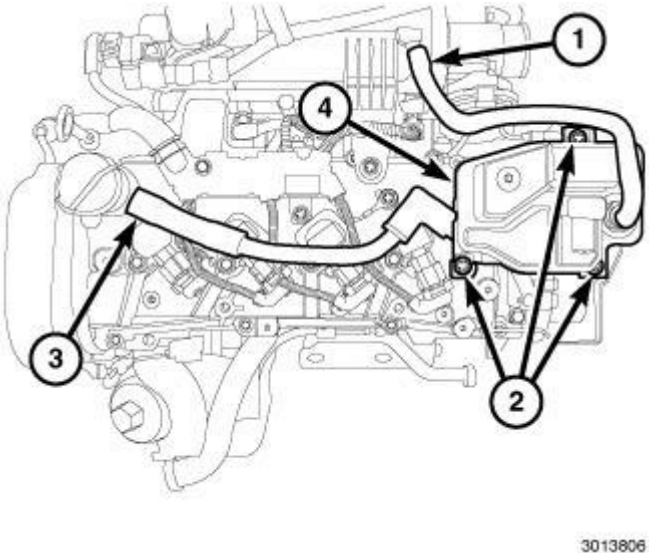


Fig. 786: PCV Hose, Bolts, Vent Hose & Oil Separator Housing
Courtesy of CHRYSLER GROUP, LLC

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5. Disconnect the PCV hose (1) from the intake manifold.
6. Disconnect the vent hose (3) from the oil filler neck.
7. Remove three bolts (2) and remove the oil separator housing (4) from the cylinder head cover.

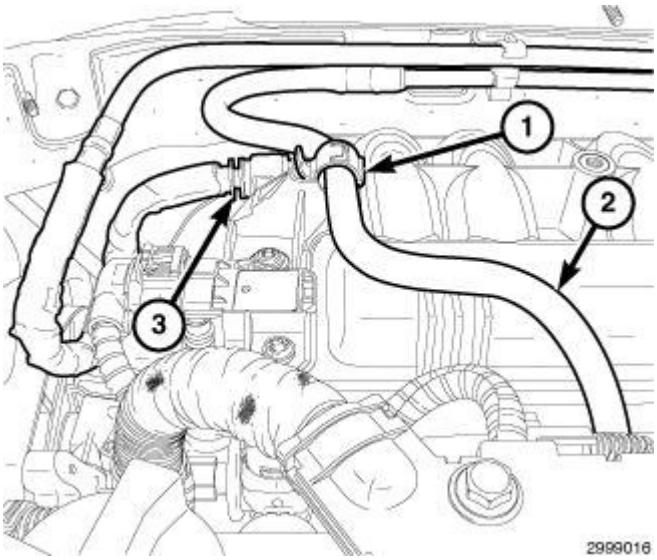


Fig. 787: Fuel Line, Hose Retainer & Fuel Vapor Purge Hose
Courtesy of CHRYSLER GROUP, LLC

8. Disconnect the fuel vapor hose (3) from the intake manifold.
9. Open the hose retainer (1) and disconnect the fuel line (2) from the fuel rail. Refer to **FITTING, QUICK CONNECT, STANDARD PROCEDURE** .

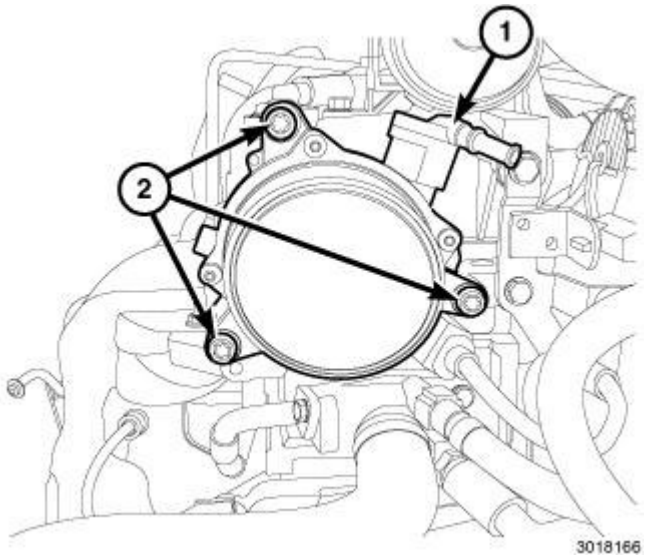


Fig. 788: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

CAUTION: When servicing components near the vacuum pump, avoid contact

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with the plastic nipple that connects the vacuum pump to the brake booster hose. It is possible to crack the plastic nipple resulting in a brake booster vacuum leak.

10. Remove the vacuum pump (1). Refer to **PUMP, VACUUM, REMOVAL**.

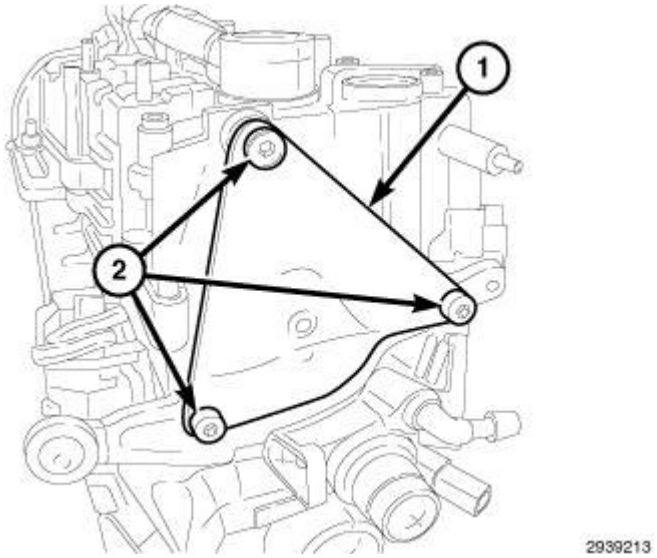


Fig. 789: Camshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

11. Install the (special tool #10277, Tool, Camshaft Timing Locking) (1) to the rear of the camshaft. Rotate the crankshaft vibration damper clockwise to align the tool with the vacuum pump mounting. Install three bolts (2) and tighten to 20 N.m (15 ft. lbs.).

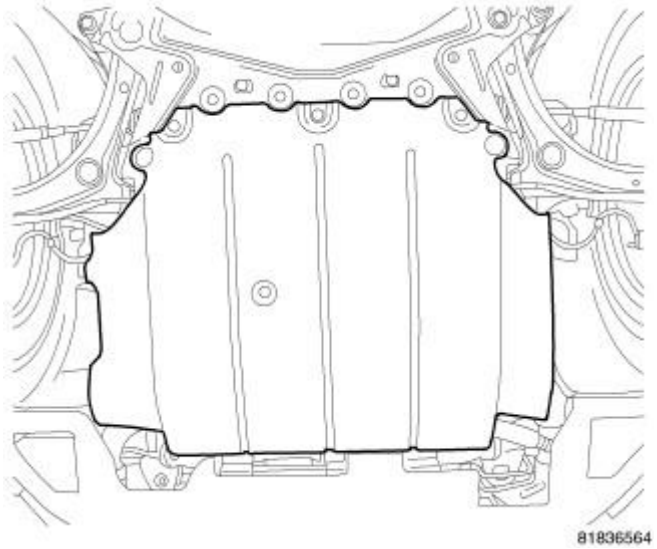


Fig. 790: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

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12. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
13. Remove the belly pan. Refer to **BELLY PAN, REMOVAL** .

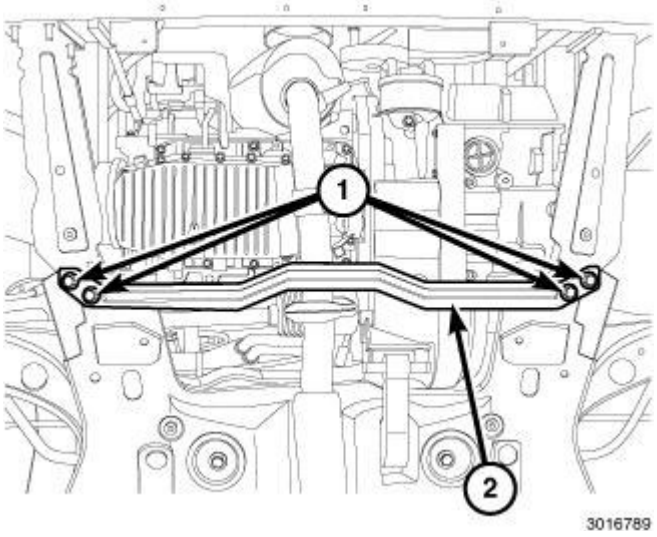


Fig. 791: Tunnel Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

14. Remove four bolts (1) and the tunnel support brace (2).

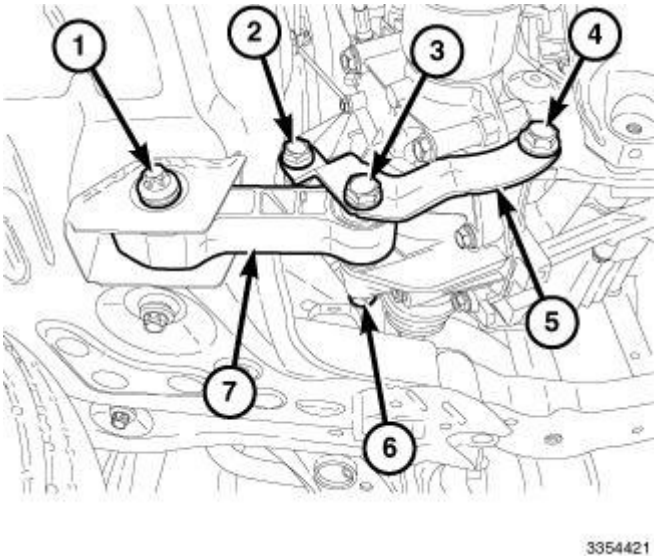


Fig. 792: Rear Engine Mount Bracket, Isolator & Fasteners
Courtesy of CHRYSLER GROUP, LLC

15. If equipped with a manual transmission, remove the rear engine mount bracket bolt (3) and nut (6), loosen the isolator bolt (1) and reposition the rear engine mount isolator (7) away from the bracket (5).

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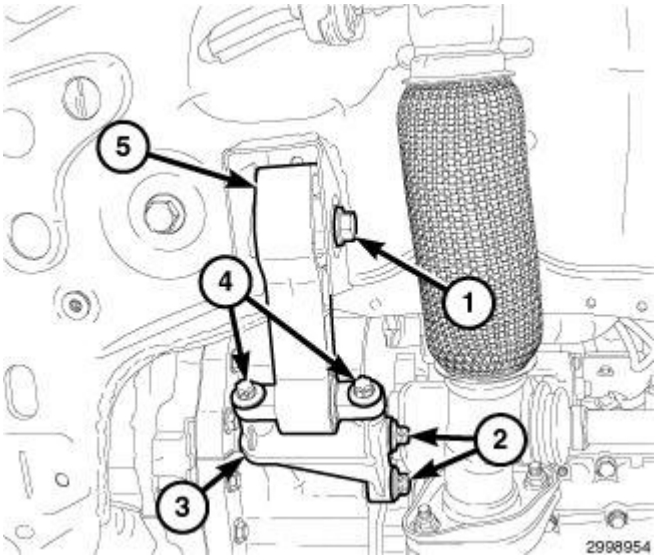


Fig. 793: Two Bolts Of Lower Transmission Mount
Courtesy of CHRYSLER GROUP, LLC

16. If equipped with an automatic transmission, remove two bolts (4) from the rear engine mount bracket (3), loosen the bolt (1) and reposition the rear engine mount link (5) away from the bracket (3).

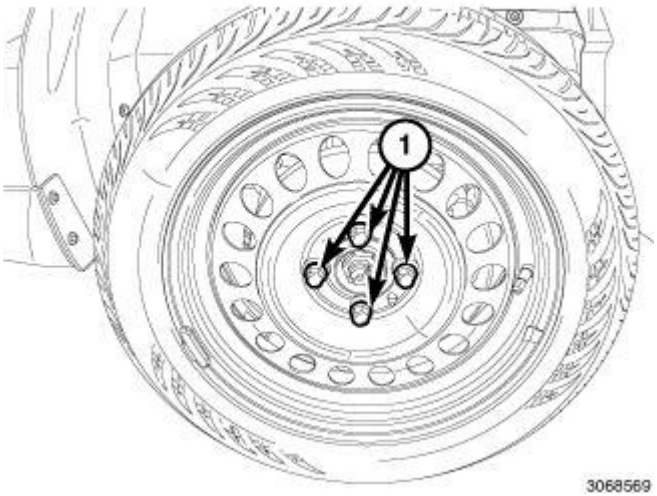


Fig. 794: Wheel Lug Bolts
Courtesy of CHRYSLER GROUP, LLC

17. Remove the right front wheel and tire assembly. Refer to **REMOVAL** .

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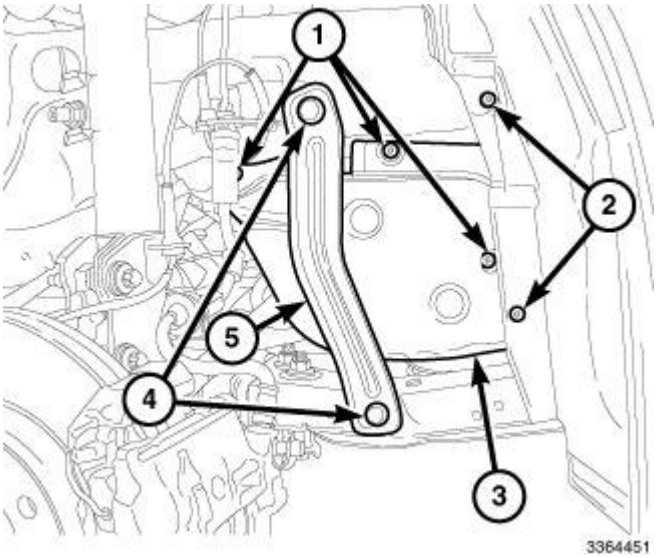


Fig. 795: Right Vertical Brace, Frame Splash Shield & Fasteners
Courtesy of CHRYSLER GROUP, LLC

18. Remove two bolts (4) and the right vertical brace (5).
19. Remove two screws (2) from the front wheelhouse splash shield.
20. Remove three screws (1) and the frame splash shield (3).

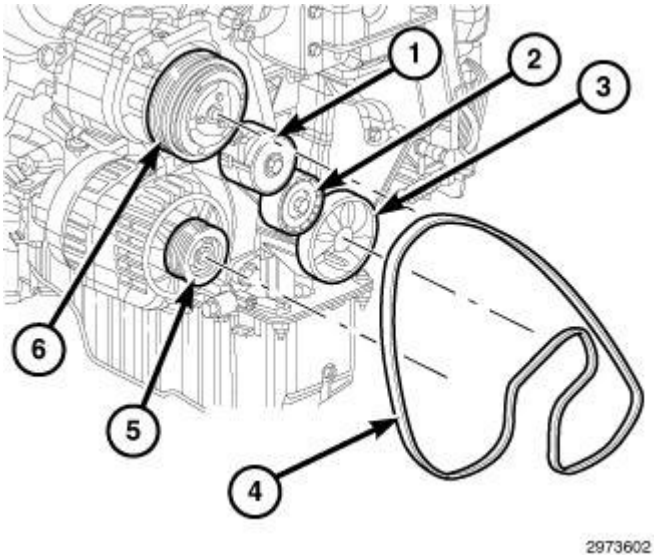


Fig. 796: Drive Belt Tensioners & Assembly With Drive Belt Routing
Courtesy of CHRYSLER GROUP, LLC

21. Remove the accessory drive belt (4). Refer to **BELT, SERPENTINE, REMOVAL** .

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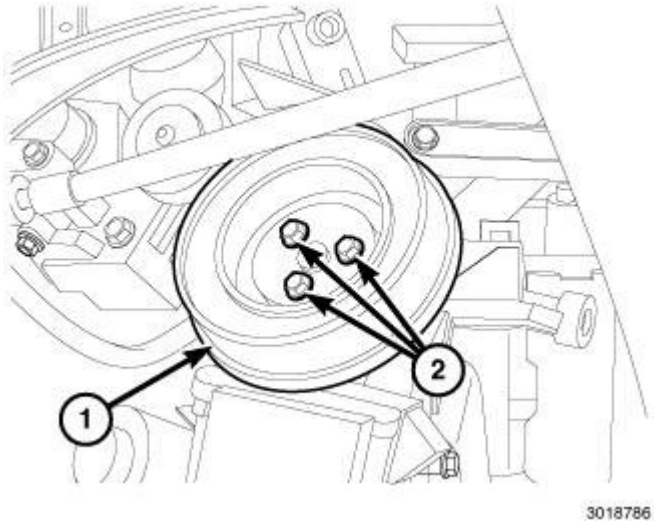


Fig. 797: Vibration Damper & Bolts
Courtesy of CHRYSLER GROUP, LLC

22. Remove the vibration damper (1). Refer to **DAMPER, VIBRATION, REMOVAL**.

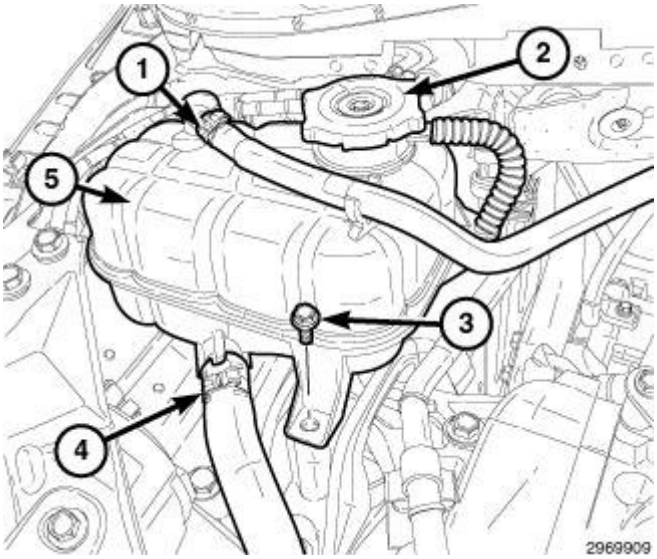


Fig. 798: Return Hose, Lower Supply Hose, Mounting Screw & Coolant Recovery Bottle
Courtesy of CHRYSLER GROUP, LLC

23. Lower the vehicle.
24. Reposition the coolant recovery bottle (5). Refer to **BOTTLE, PRESSURIZED COOLANT, REMOVAL** .

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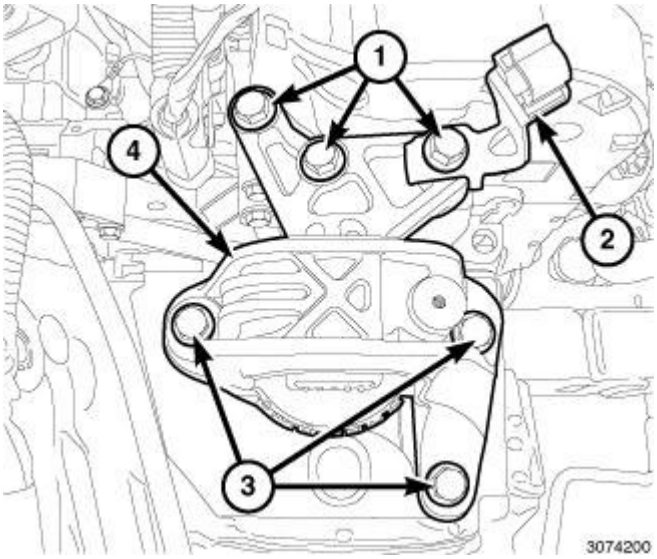


Fig. 799: Three Right Side Engine Mount Support Bolts
Courtesy of CHRYSLER GROUP, LLC

25. Support the engine with a floor jack positioned under the oil pan.
26. Remove six bolts (1 and 3) and the RH engine mount isolator (4).

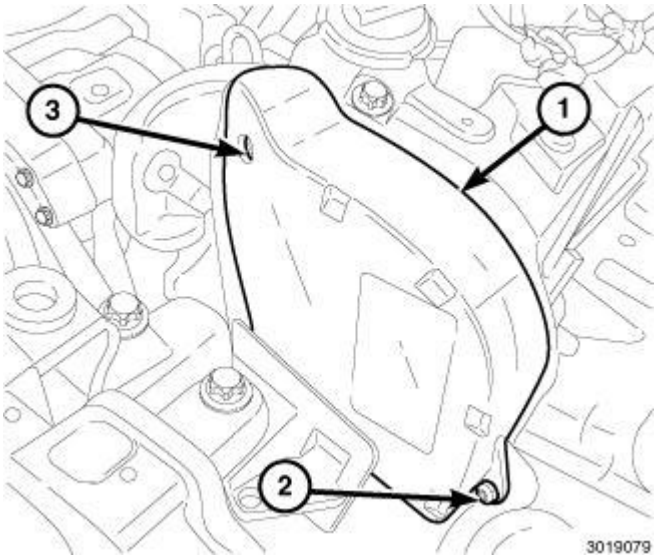


Fig. 800: Upper Timing Belt Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

27. Remove the bolts (2 and 3) and the upper timing belt cover (1).

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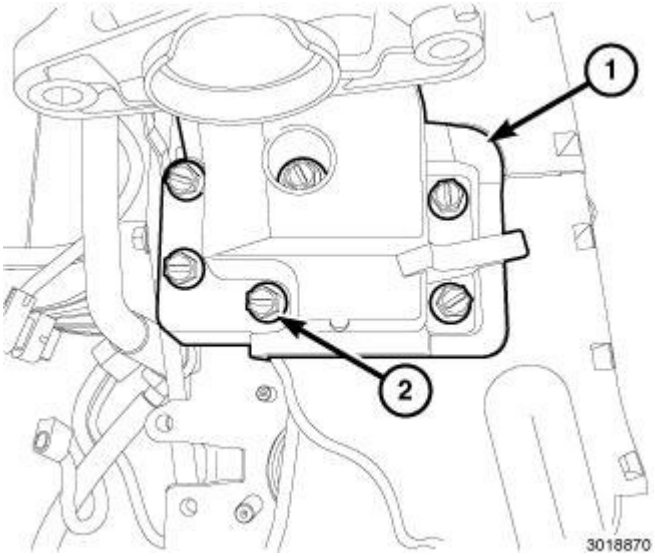


Fig. 801: RH Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

28. Carefully raise the front of the engine and remove the six bolts (2) and the RH engine mount bracket (1).

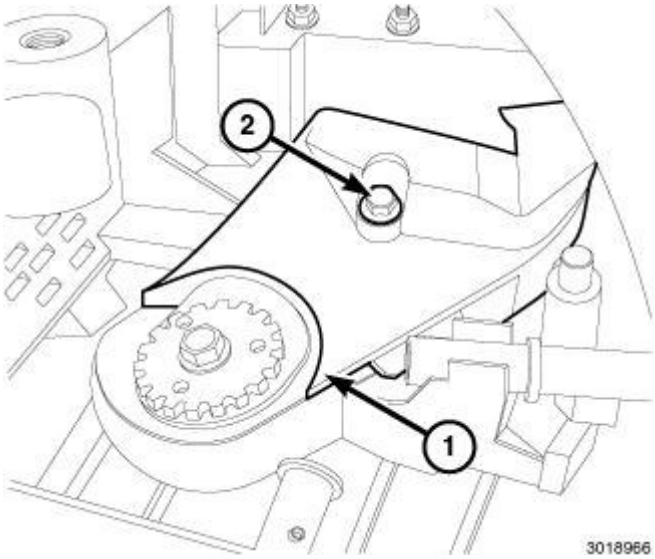


Fig. 802: Lower Timing Belt Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

29. Remove the bolt (2) and the lower timing belt cover (1).

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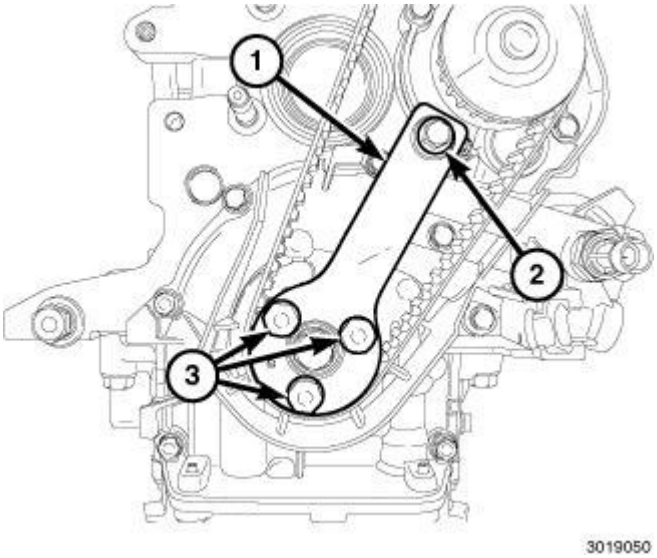


Fig. 803: Crankshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

30. Install the (special tool #10276, Tool, Crankshaft Timing Locking) (1) with three bolts (3) tightened to 25 N.m (18 ft. lbs.) and one bolt (2) tightened to 9 N.m (80 ft. lbs.).

NOTE: If the bolt (2) does not align with the lower timing belt cover mounting boss, the camshaft timing is not correct. Proceed to Timing Belt Installation for service procedures. Refer to BELT, TIMING, INSTALLATION.

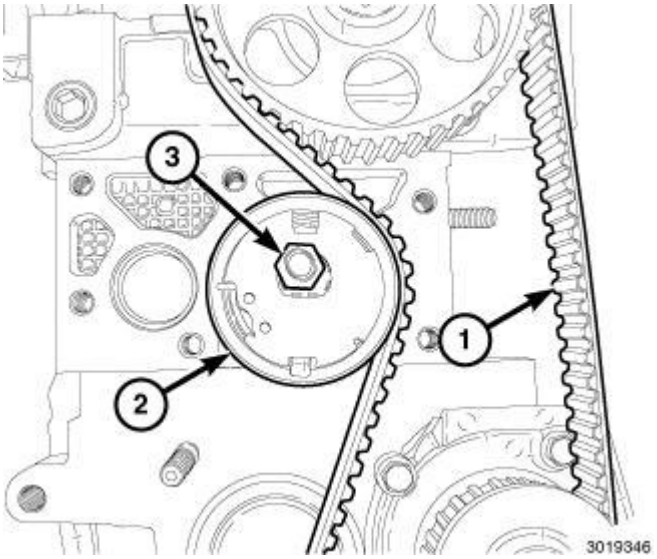


Fig. 804: Timing Belt, Tensioner & Lock Nut
Courtesy of CHRYSLER GROUP, LLC

NOTE: If the timing belt is to be reused, mark the direction of rotation using a paint pen or equivalent to aid in reassembly.

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31. Remove the tensioner lock nut (3) and the tensioner (2).

INSTALLATION

INSTALLATION

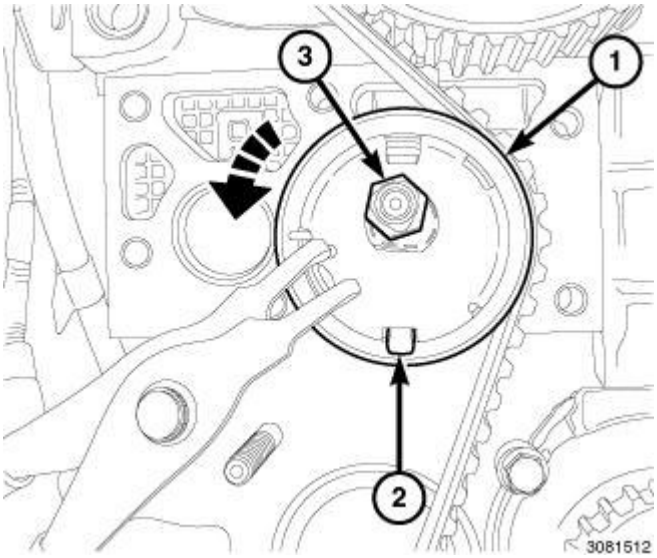


Fig. 805: Timing Belt Tensioner, Silver Tab & Lock Nut
Courtesy of CHRYSLER GROUP, LLC

NOTE: If the original timing belt (1) is being reused, install the belt so that it maintains the same direction of rotation as when it was removed.

1. If removed, install the timing belt starting with the crankshaft sprocket, then the water pump sprocket, finishing with the camshaft sprocket.
2. Install the timing belt tensioner (1) and adjust the tensioner so that the silver tab (2) is centered in the middle of the window. Tighten the lock nut (3) to 28 N.m (21 ft. lbs.).
3. Remove the (special tool #10277, Tool, Camshaft Timing Locking) and the (special tool #10276, Tool, Crankshaft Timing Locking).
4. Rotate the crankshaft clockwise at least two complete revolutions to center the timing belt on the sprockets.
5. Verify that the silver tab (2) is still centered in the middle of the window. If required, loosen the tensioner lock nut (3), readjust the timing belt tensioner (2) and tighten the lock nut (3) to 28 N.m (21 ft. lbs.).

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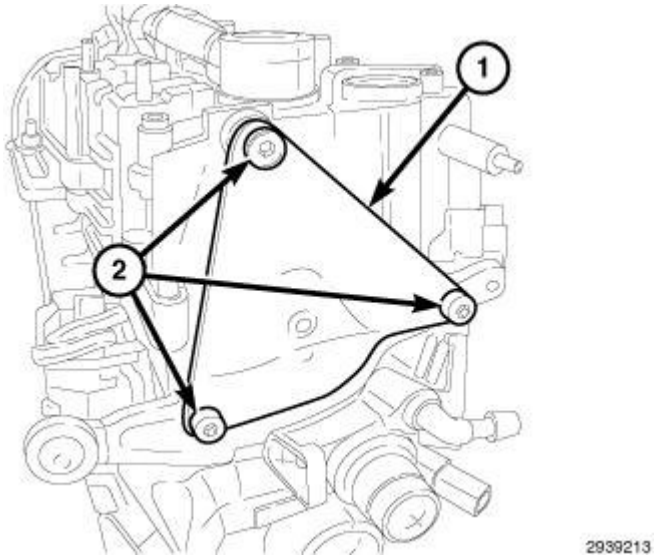


Fig. 806: Camshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

NOTE: Reinstall the timing locking tools to verify correct camshaft timing.

6. Install the (special tool #10277, Tool, Camshaft Timing Locking) (1) to the rear of the camshaft. Install three bolts (2) and tighten to 20 N.m (15 ft. lbs.).

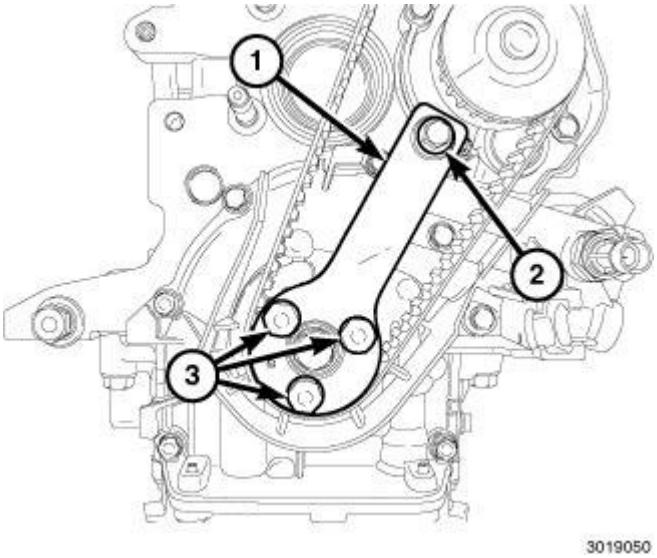


Fig. 807: Crankshaft Timing Locking Tool & Bolts
Courtesy of CHRYSLER GROUP, LLC

7. Install the (special tool #10276, Tool, Crankshaft Timing Locking) (1) with three bolts (3) tightened to 25 N.m (18 ft. lbs.) and one bolt (2) tightened to 9 N.m (80 in. lbs.).

NOTE: If the bolt (2) does not align with the lower timing belt cover mounting boss, the camshaft timing is not correct. Proceed to Timing Belt

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Installation for service procedures. Refer to BELT, TIMING, INSTALLATION.

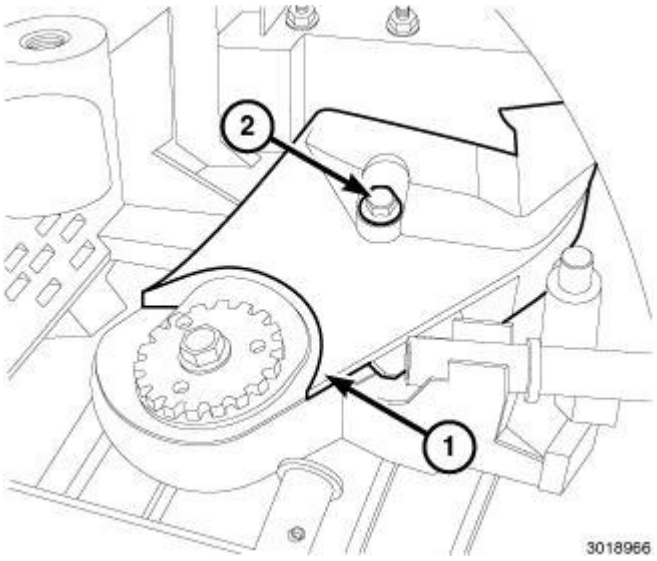


Fig. 808: Lower Timing Belt Cover & Bolt
Courtesy of CHRYSLER GROUP, LLC

8. Remove the (special tool #10277, Tool, Camshaft Timing Locking) and the (special tool #10276, Tool, Crankshaft Timing Locking).
9. Install the lower timing belt cover (1) with bolt (2) tightened to 9 N.m (80 in. lbs.).

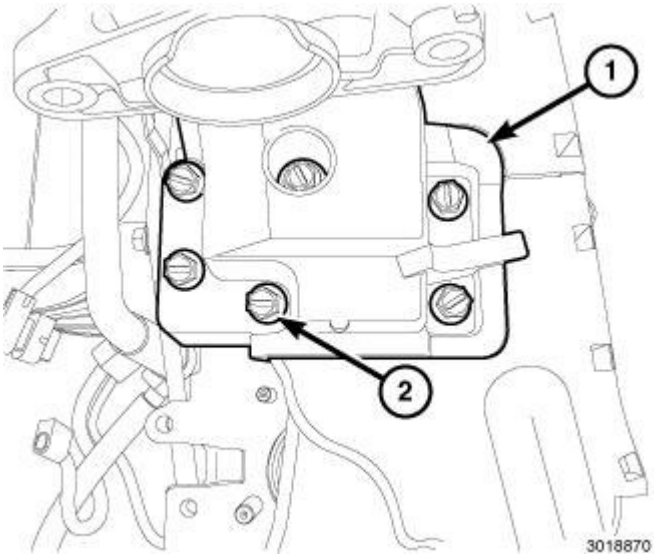


Fig. 809: RH Engine Mount Bracket & Bolts
Courtesy of CHRYSLER GROUP, LLC

10. Install the RH engine mount bracket (1) with six bolts (2) tightened to 25 N.m (18 ft. lbs.).

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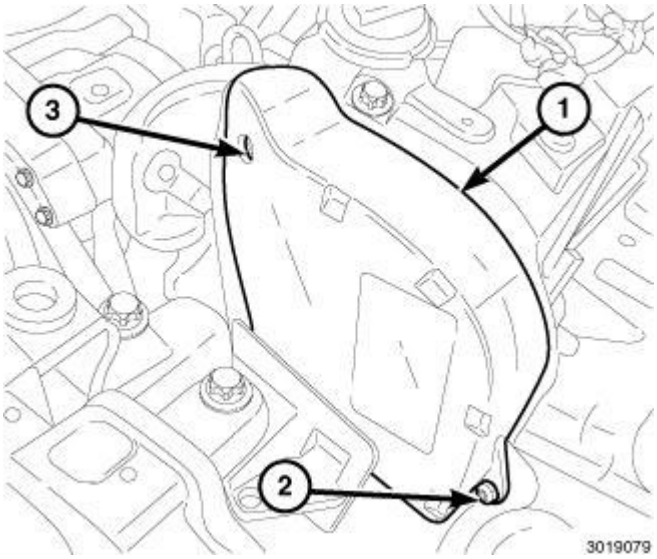


Fig. 810: Upper Timing Belt Cover & Bolts
Courtesy of CHRYSLER GROUP, LLC

11. Install the upper timing belt cover (1) with two bolts (2 and 3) tightened to 9 N.m (80 in. lbs.).

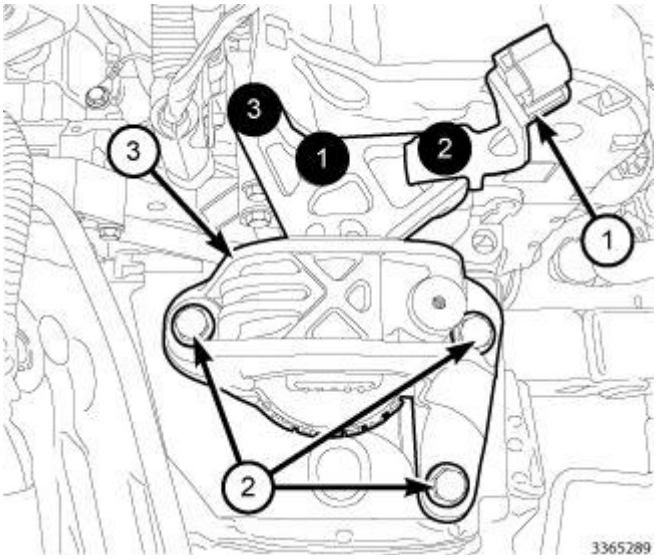


Fig. 811: RH Engine Mount Isolator, Support Bracket & Bolts With Tightening Sequence
Courtesy of CHRYSLER GROUP, LLC

12. Install the RH engine mount isolator (3) and support bracket (1) to the engine mount bracket with three bolts. Tighten the isolator to engine bracket bolts in the sequence shown in illustration to 60 N.m (44 ft. lbs.).
13. Install the RH engine mount isolator (3) to the body with three bolts (2). Tighten the isolator to body bolts (2) to 60 N.m (44 ft. lbs.).

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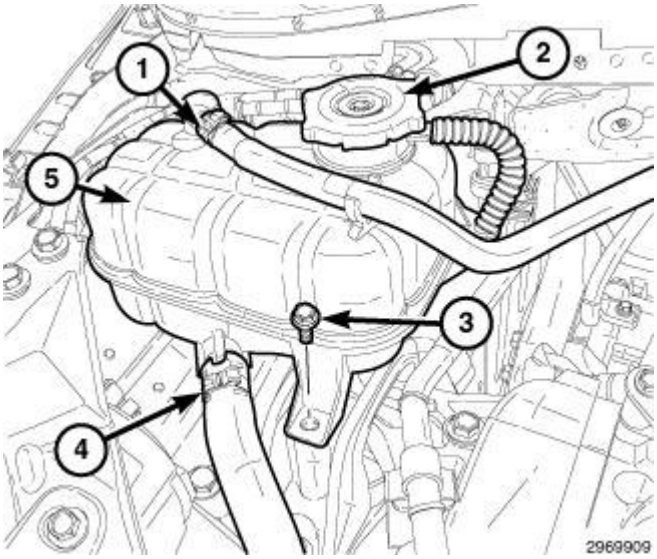


Fig. 812: Return Hose, Lower Supply Hose, Mounting Screw & Coolant Recovery Bottle
Courtesy of CHRYSLER GROUP, LLC

14. Install the pressurized coolant bottle (5). Refer to **BOTTLE, PRESSURIZED COOLANT, INSTALLATION** .

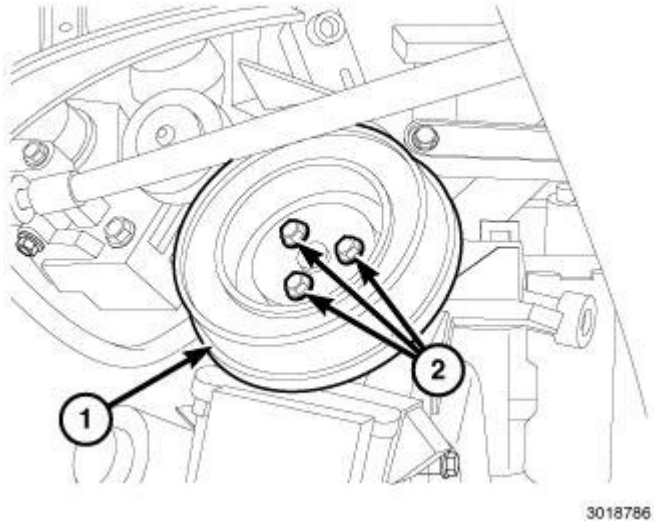


Fig. 813: Vibration Damper & Bolts
Courtesy of CHRYSLER GROUP, LLC

15. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
16. Install the vibration damper (1). Refer to **DAMPER, VIBRATION, INSTALLATION**.

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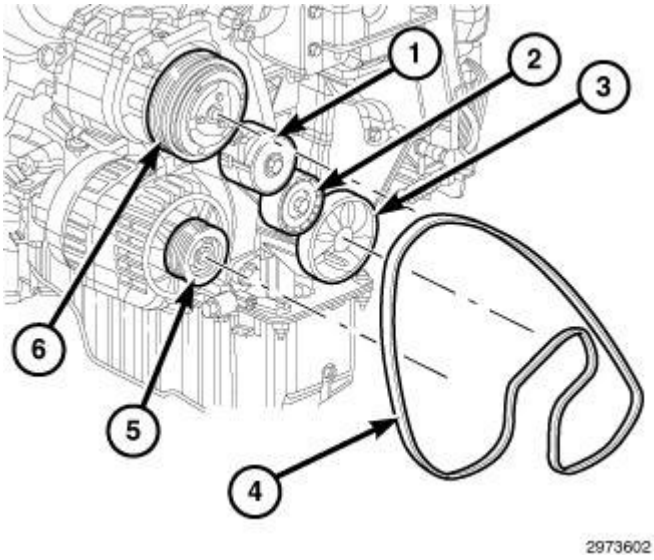


Fig. 814: Drive Belt Tensioners & Assembly With Drive Belt Routing
Courtesy of CHRYSLER GROUP, LLC

17. Install the accessory drive belt (4). Refer to **BELT, SERPENTINE, INSTALLATION** .

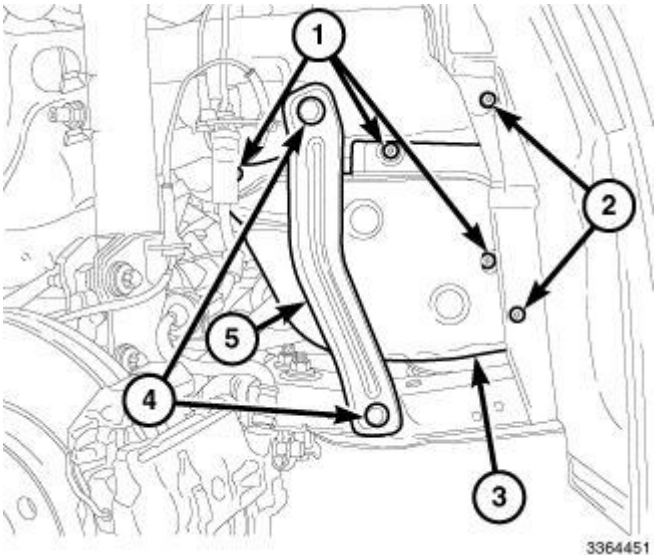


Fig. 815: Right Vertical Brace, Frame Splash Shield & Fasteners
Courtesy of CHRYSLER GROUP, LLC

18. Install the frame splash shield (3) with three screws (1).
19. Install two screws (2) to the front wheelhouse splash shield.
20. Install the right vertical brace (5) with two bolts (4) tightened to 45 N.m (33 ft. lbs.).

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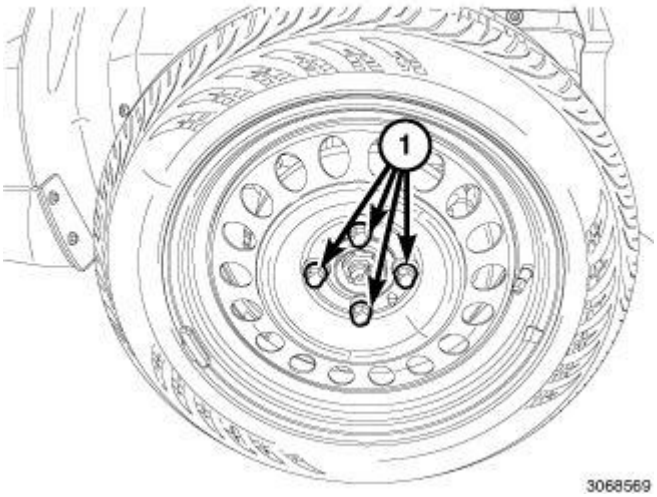


Fig. 816: Wheel Lug Bolts
Courtesy of CHRYSLER GROUP, LLC

21. Install the right front wheel and tire assembly. Refer to **INSTALLATION** .

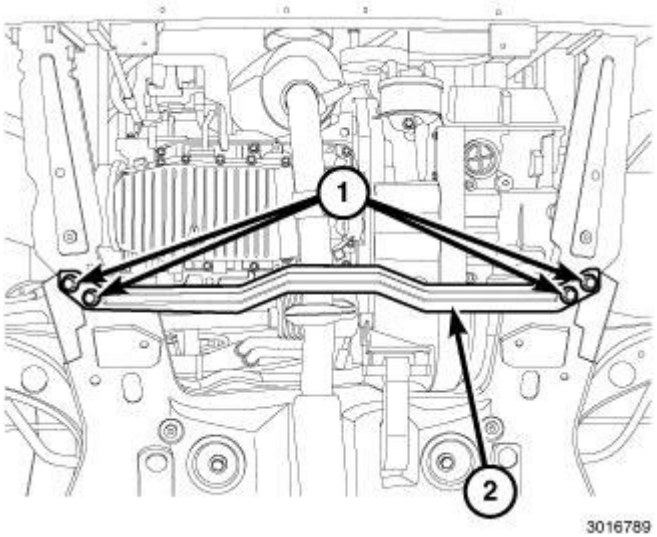


Fig. 817: Tunnel Support Brace & Bolts
Courtesy of CHRYSLER GROUP, LLC

22. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
23. Install the tunnel support brace (2) with four bolts (1) tightened to 90 N.m (60 ft. lb.).

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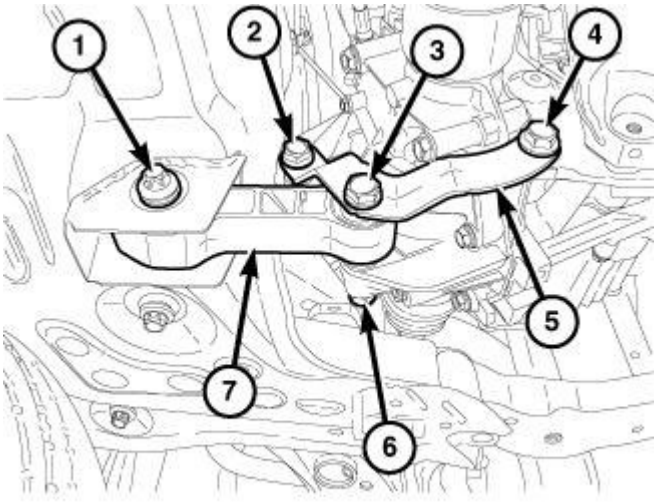


Fig. 818: Rear Engine Mount Bracket, Isolator & Fasteners
Courtesy of CHRYSLER GROUP, LLC

24. If equipped with a manual transmission, install the rear engine mount isolator (7) to the transmission with the rear engine mount bracket bolt (3) and nut (6) tightened to 80 N.m (59 ft. lbs.) and tighten the isolator bolt (1) to 130 N.m (96 ft. lbs.).

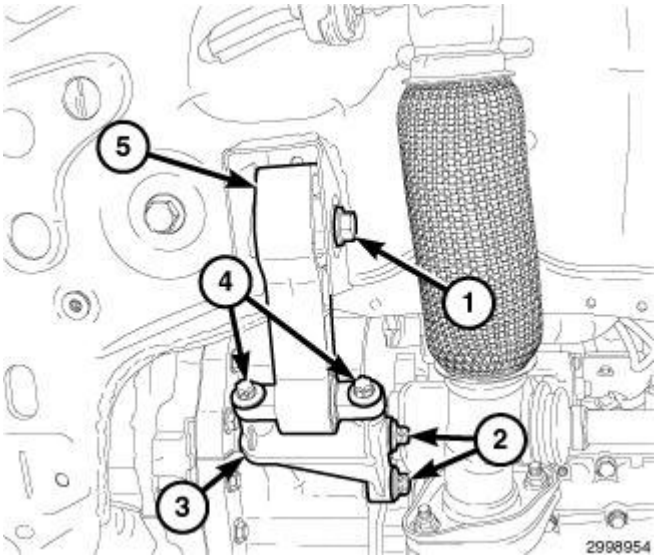


Fig. 819: Two Bolts Of Lower Transmission Mount
Courtesy of CHRYSLER GROUP, LLC

25. If equipped with an automatic transmission, install the rear engine mount isolator (5) in the bracket (3) with two bolts (4) tighten to 60 N.m (44 ft. lbs.). Install the isolator bolt (1) and tighten to 130 N.m (96 ft. lbs.).

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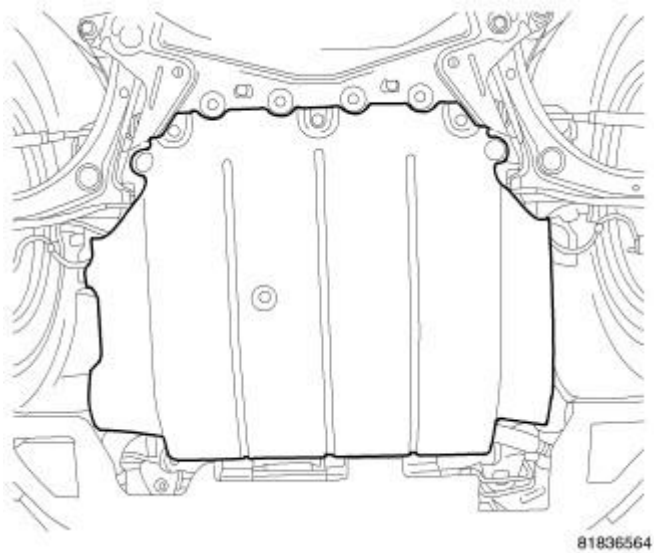


Fig. 820: Lower Air Dam/Belly Pan
Courtesy of CHRYSLER GROUP, LLC

26. Install the belly pan. Refer to **BELLY PAN, INSTALLATION** .

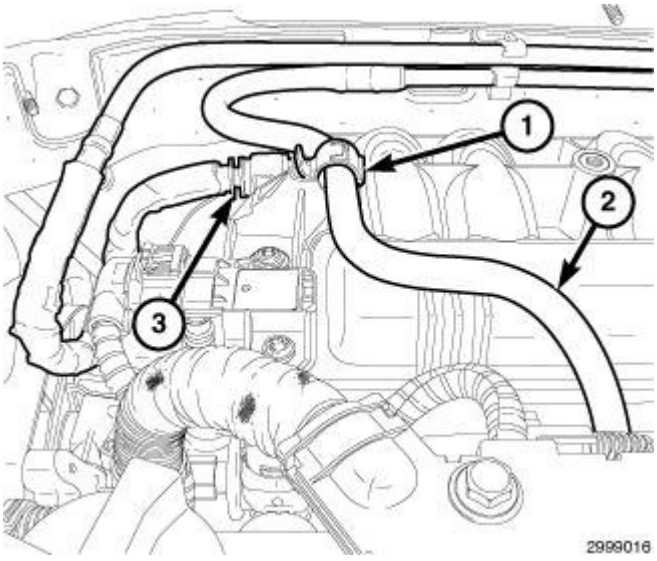


Fig. 821: Fuel Line, Hose Retainer & Fuel Vapor Purge Hose
Courtesy of CHRYSLER GROUP, LLC

27. Lower the vehicle.
28. Connect the fuel vapor purge hose (3) to the intake manifold.
29. Connect the fuel line (2) to the fuel rail and close the hose retainer (1). Refer to **FITTING, QUICK CONNECT, STANDARD PROCEDURE** .

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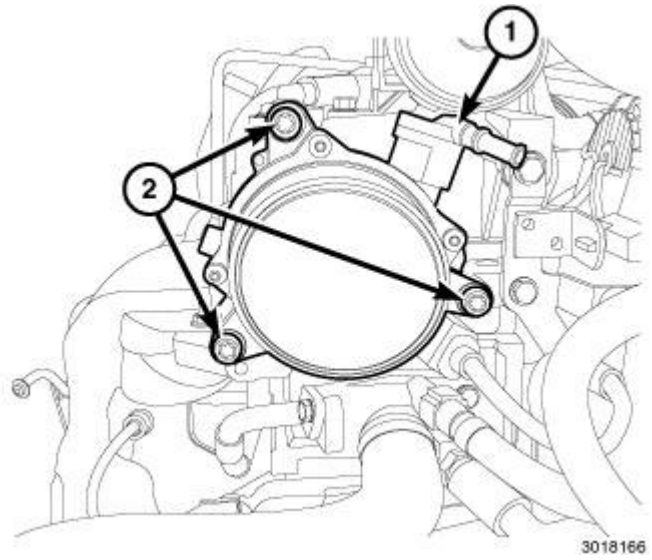


Fig. 822: Vacuum Pump & Bolts
Courtesy of CHRYSLER GROUP, LLC

30. Install the vacuum pump (1). Refer to **PUMP, VACUUM, REMOVAL**.

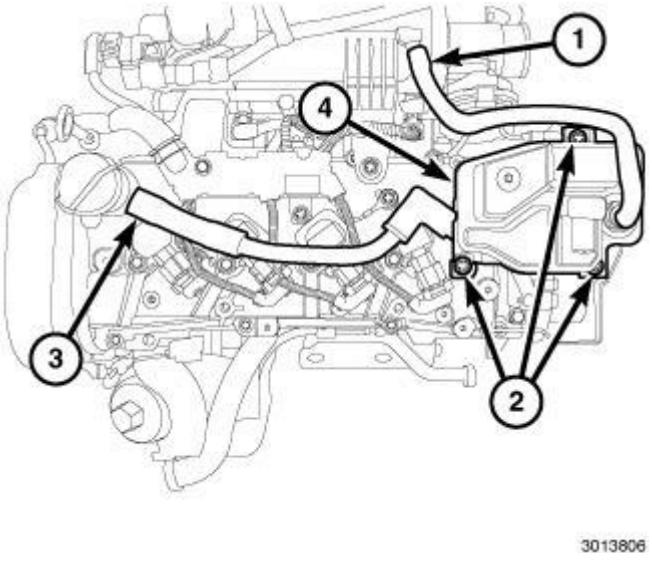


Fig. 823: PCV Hose, Bolts, Vent Hose & Oil Separator Housing
Courtesy of CHRYSLER GROUP, LLC

31. Install the oil separator housing (4) to the cylinder head cover with three bolts (2) tightened to 13 N.m (115 in. lbs.).
32. Connect the vent hose (3) to the oil filler neck.
33. Connect the PCV hose (1) to the intake manifold.

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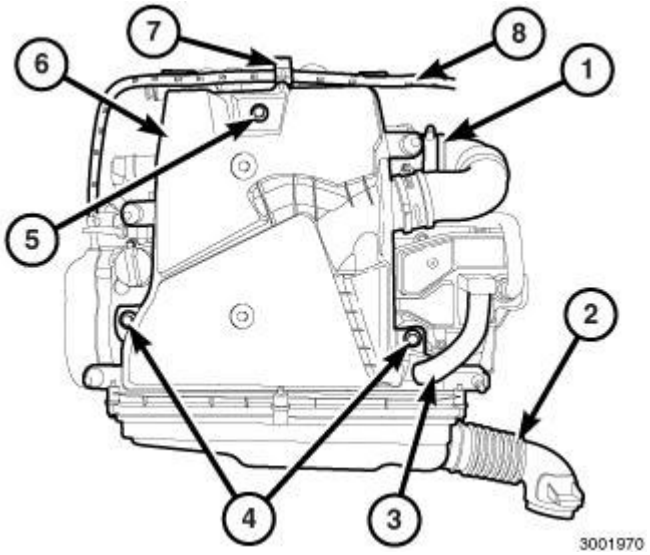


Fig. 824: Air Cleaner Body Assembly
Courtesy of CHRYSLER GROUP, LLC

34. Install the air cleaner body (6). Refer to **BODY, AIR CLEANER, INSTALLATION**.

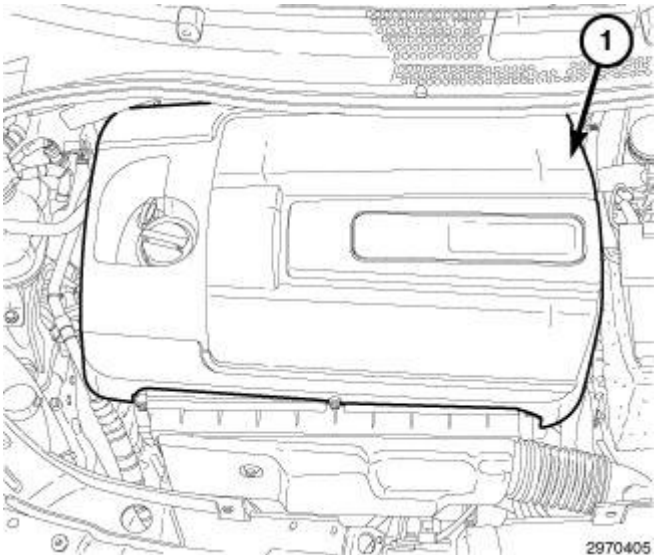


Fig. 825: Engine Cover
Courtesy of CHRYSLER GROUP, LLC

35. Connect the negative battery cable and tighten nut to 5 N.m (45 in. lbs.).
36. Install the engine cover (1).
37. Run the engine until it reaches normal operating temperature. Check cooling system for correct fluid level. Refer to **STANDARD PROCEDURE** .

NOTE: The Cam/Crank Variation Relearn procedure must be performed using the scan tool anytime there has been a repair/replacement made to a powertrain system, for example: flywheel, valvetrain, camshaft and/or crankshaft sensors or

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components. Refer to the appropriate Diagnostic Information .

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