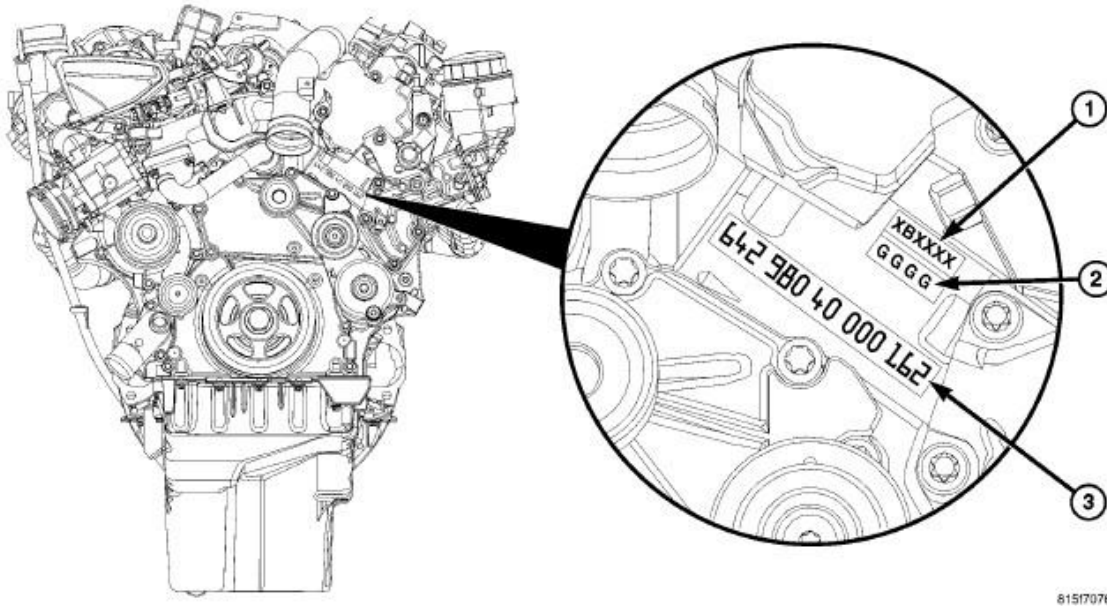


2009 ENGINE

3.0L Turbo Diesel - Service Information - Sprinter

DESCRIPTION

3.0L COMMON RAIL DIESEL ENGINE

**Fig. 1: 3.0L V-6 DIESEL ENGINE**

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - CYLINDER BORE TOLERANCE IDENTIFICATION
2 - MAIN BEARING TOLERANCE IDENTIFICATION
3 - ENGINE IDENTIFICATION AND SERIAL NUMBER |
|--|

The 3.0L (183 C.I.D.) six - cylinder "common rail" direct injection engine is a 72°, overhead valve design. The engine utilize a cast aluminum cylinder block molded around cast iron piston sleeves. The engine has aluminum cross flow cylinder heads, four valves per cylinder, central injectors and dual overhead camshafts. The 3.0L is turbocharged, intercooled, and also equipped with a EGR cooler.

Additional features are:

- Finger Follower Actuated Valves with Hydraulic Adjusters
- Counter Rotating Balance Shaft
- Oil Jet Cooled Pistons
- Swirl Intake Ports
- Chain driven D.O.H.C. per bank of cylinders, with 4 valves per cylinder

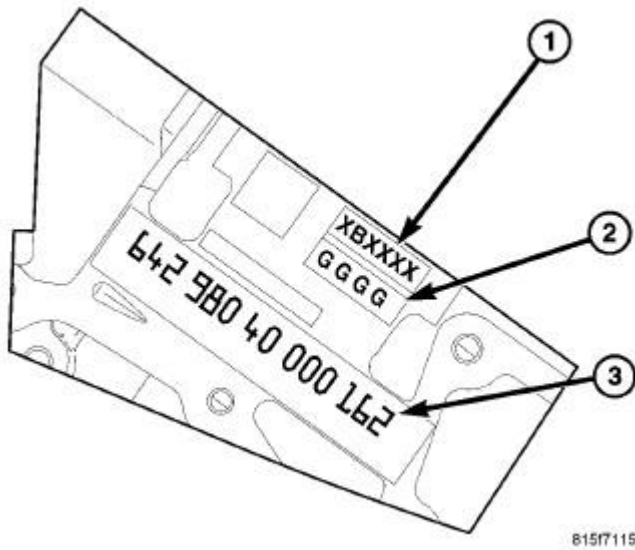


Fig. 2: ENGINE IDENTIFICATION MARKINGS
Courtesy of CHRYSLER LLC

- 1 - CYLINDER BORE IDENTIFICATION
- 2 - MAIN BEARING IDENTIFICATION
- 3 - ENGINE IDENTIFICATION AND SERIAL NUMBER

The engine identification stamp (3) for the 3.0L is located on the left side of the engine block, below the high pressure pump along with the 4 digit main bearing identifying stamp (2) and the 6 digit cylinder bore identifying stamp (1).

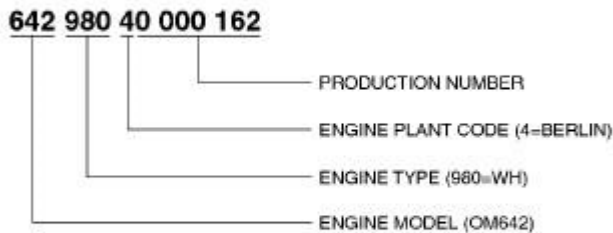


Fig. 3: ENGINE NUMBER CODE
Courtesy of CHRYSLER LLC

The engine identification number encompasses the production number, engine plant code, engine type and engine model.

DESCRIPTION

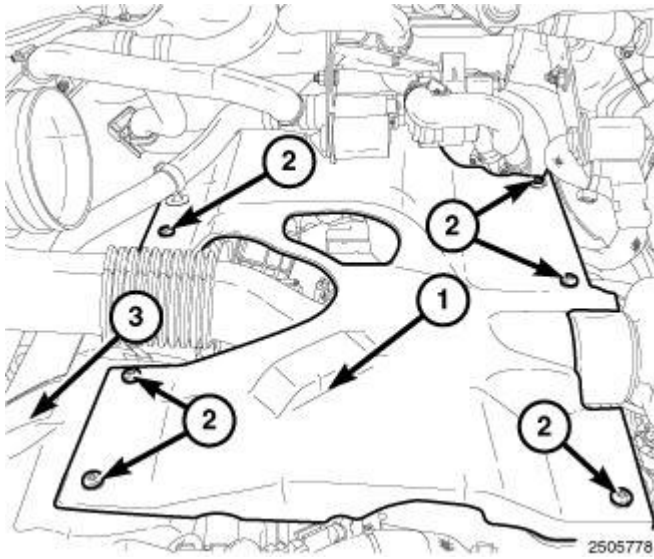


Fig. 4: ENGINE COVER

Courtesy of CHRYSLER LLC

The insulated engine cover (1) is made of composite material and used cosmetically to cover the top of the engine and greatly reduce engine noise.

DIAGNOSIS AND TESTING

ENGINE DIAGNOSIS - MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTION
LUBRICATING OIL PRESSURE LOW	1. Low oil level.	1. (a) Check and fill with clean engine oil. (b) Check for a severe oil leak, worn rings (burning oil), oil leaking from the turbocharger to the intake, or other root causes for low oil level.
	2. Oil viscosity thin, diluted or wrong specification.	2. (a) Verify the correct engine oil is being used. (b) Look for reduced viscosity from fuel dilution.
	3. Improperly operating pressure switch/gauge.	3. Verify the pressure switch is functioning correctly. If not, replace switch/gauge.
	4. Relief valve stuck open.	4. Check/replace valve.

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	5. If cooler was replaced, shipping plugs may have been left in cooler	5. Check/remove shipping plugs.
	6. Worn oil pump.	6. Check and replace oil pump.
	7. Suction tube loose or seal leaking.	7. Check and replace seal.
	8. Loose main bearing cap.	8. Check and install new bearing. Tighten cap to proper torque.
	9. Worn bearings or wrong bearings installed.	9. Inspect and replace connecting rod or main bearings. Check and replace directed piston cooling nozzles.
	10. Directed piston cooling nozzles under piston, bad fit into main carrier.	10. Check directed piston cooling nozzles position.
	12. Loose directed piston cooling nozzle.	12. Tighten directed piston cooling nozzle.
LUBRICATING OIL PRESSURE TOO HIGH	1. Pressure switch/gauge not operating properly.	1. Verify pressure switch is functioning correctly. If not, replace switch/gauge.
	2. Engine running too cold.	2. Coolant Temperature Below Normal
	3. Oil viscosity too thick.	3. Make sure the correct oil is being used.
	4. Oil pressure relief valve stuck closed or binding	4. Check and replace valve.
LUBRICATING OIL LOSS	1. External leaks.	1. Visually inspect for oil leaks. Repair as required.
	2. Crankcase overfilled.	2. Verify that the correct dipstick is being used.
	3. Incorrect oil specification or viscosity.	3. (a) Make sure the correct oil is being used.
		(b) Look for reduced viscosity from dilution with fuel.
		(c) Review/reduce oil change intervals.
	4. Oil cooler leak	4. Check and replace the oil cooler.
	5. High blow-by forcing oil out the breather.	5. Check the breather tube area for signs of oil loss. Perform the required repairs.
COMPRESSION KNOCKS	6. Turbocharger leaking oil to the air intake.	6. Inspect the air ducts for evidence of oil transfer. Repair as required (slight oil residue is normal).
	1. Air in the fuel system.	1. Identify location of air leak and repair. Do not bleed high pressure fuel system.
	2. Poor quality fuel or water/gasoline contaminated fuel.	2. Verify by operating from a temporary tank with good fuel. Clean and flush the fuel tank. Replace fuel/water separator filter.

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EXCESSIVE VIBRATION	3. Engine overloaded.	3. Verify the engine load rating is not being exceeded.
	4. Improperly operating injectors.	4. Check and replace misfiring/inoperative injectors.
	1. Loose or broken engine mounts.	1. Replace engine mounts.
	2. Damaged fan or improperly operating accessories.	2. Check and replace the vibrating components.
	3. Improperly operating vibration damper	3. Inspect/replace vibration damper.
	4. Improperly operating balance shaft	4. Inspect/replace balance shaft.
	5. Improperly operating electronically controlled viscous fan drive.	5. Inspect/replace fan drive.
	6. Worn or damaged generator bearing.	6. Check/replace generator.
	7. Flywheel housing misaligned.	7. Check/correct flywheel alignment.
EXCESSIVE ENGINE NOISES	8. Loose or broken power component.	8. Inspect the crankshaft and rods for damage that causes an unbalance condition. Repair/replace as required.
	9. Worn or unbalanced driveline components.	9. Check/repair driveline components.
	1. Drive belt squeal, insufficient tension or abnormally high loading.	1. Check the automatic tensioner and inspect the drive belt. Make sure water pump, tensioner pulley, fan hub, generator and power steering pump turn freely.
	2. Intake air or exhaust leaks.	2. Refer to Excessive Exhaust Smoke. See Diagnosis and Testing .
	3. Excessive valve lash.	3. Adjust valves. Make sure the rocker arms are not bent. Replace bent or severely worn components.
	4. Turbocharger noise.	4. Check turbocharger impeller and turbine wheel for housing contact. Repair/replace as required.
	5. Gear train noise.	5. Visually inspect and measure gear backlash. Replace gears as required.
	6. Power function knock.	6. Check/replace rod and main bearings.

SMOKE DIAGNOSIS CHARTS

Small amounts of exhaust smoke (at certain times) are to be considered normal for a diesel powered engine. The

following charts include possible causes and corrections for **excess or abnormal** exhaust smoke.

EXCESSIVE BLACK SMOKE	
POSSIBLE CAUSE	CORRECTION
Air filter dirty or plugged.	Check and replace the filter if necessary.
Air intake system restricted.	Check entire air intake system including all hoses and tubes for restrictions, collapsed parts or damage. Repair/replace as necessary.
Air Leak in Intake System.	Check entire air intake system including all hoses and tubes for collapse, cracks, loose clamps, or holes in rubber ducts. Also check intake manifold for loose mounting hardware.
Diagnostic Trouble Codes (DTC's) active or multiple, intermittent DTC's.	Refer to <u>DTC-Based Diagnostics/MODULE, Engine Control (ECM) - Diagnosis and Testing</u> .
Engine Control Module (ECM) has incorrect calibration.	Refer to <u>DTC-Based Diagnostics/MODULE, Engine Control (ECM) - Diagnosis and Testing</u> .
Exhaust system restriction is above specifications.	Check exhaust pipes for damage/restrictions. Repair as necessary.
Fuel grade is not correct or fuel quality is poor.	Temporarily change fuel brands and note condition. Change brand if necessary.
Fuel injection pump malfunctioning.	A DTC may have been set. If so. Refer to <u>DTC-Based Diagnostics/MODULE, Engine Control (ECM) - Diagnosis and Testing</u> .
Fuel injector malfunctioning.	A DTC may have been set. Perform "Injector Classification Programming" using scan tool. Also, refer to <u>DTC-Based Diagnostics/MODULE, Engine Control (ECM) - Diagnosis and Testing</u> and Return Fuel Quantity Test.
Fuel injector lower washer doubled or missing.	Remove and inspect injector washer.
Fuel return system restricted.	Check fuel return lines for restriction.
Intake manifold restricted.	Remove restriction.
Manifold Air Pressure (Boost) Sensor or sensor circuit malfunctioning.	A DTC should have been set. Refer to <u>DTC-Based Diagnostics/MODULE, Engine Control (ECM) - Diagnosis and Testing</u> .
Turbocharger air intake restriction.	Remove restriction.
Turbocharger damaged.	See <u>Diagnosis and Testing</u> .
Turbocharger has excess build up on compressor wheel or diffuser vanes.	See <u>Diagnosis and Testing</u> .
Turbocharger wheel clearance out of specification.	See <u>Diagnosis and Testing</u> .

EXCESSIVE WHITE SMOKE	
POSSIBLE CAUSE	CORRECTION
Air in fuel supply: Possible leak in fuel supply side.	Inspect fuel system
Coolant leaking into combustion chamber.	Perform pressure test of cooling system.

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Diagnostic Trouble Codes (DTC's) active or multiple, intermittent DTC's.	Refer to <u>DTC-Based Diagnostics/MODULE, Engine Control (ECM) - Diagnosis and Testing</u> .
In very cold ambient temperatures, engine block heater is malfunctioning (if equipped). Refer to <u>HEATER, ENGINE BLOCK</u> .	
Engine coolant temperature sensor malfunctioning.	A DTC should have been set. Refer to <u>DTC-Based Diagnostics/MODULE, Engine Control (ECM) - Diagnosis and Testing</u> . Also check thermostat operation.
Engine Control Module (ECM) has incorrect calibration.	A DTC should have been set. Refer to <u>DTC-Based Diagnostics/MODULE, Engine Control (ECM) - Diagnosis and Testing</u> .
Fuel filter plugged.	Refer to <u>Non-DTC Diagnostics/Driveability - Diesel - Diagnosis and Testing</u> .
Fuel grade not correct or fuel quality is poor.	Temporarily change fuel brands and note condition. Change brand if necessary.
Fuel injector malfunctioning.	A DTC should have been set. Perform "Injector Identification Programming" or "Cylinder Cutout Test" using scan tool to isolate individual cylinders. Also, refer to <u>DTC-Based Diagnostics/MODULE, Engine Control (ECM) - Diagnosis and Testing</u> .
Fuel injector hold-down(s) loose.	Replace the copper washer(s) (shim) and tighten to specifications.
Fuel injector protrusion not correct.	Check washer (shim) at bottom of fuel injector for correct thickness.
Fuel injection pump malfunctioning.	A DTC should have been set. Refer to <u>DTC-Based Diagnostics/MODULE, Engine Control (ECM) - Diagnosis and Testing</u> .
Fuel supply side restriction.	Refer to <u>Non-DTC Diagnostics/Driveability - Diesel - Diagnosis and Testing</u> for fuel system testing.
Intake manifold air temperature sensor malfunctioning.	A DTC should have been set. Refer to <u>DTC-Based Diagnostics/MODULE, Engine Control (ECM) - Diagnosis and Testing</u> .
Intake manifold heater circuit not functioning correctly in cold weather.	A DTC should have been set. Refer to <u>DTC-Based Diagnostics/MODULE, Engine Control (ECM) - Diagnosis and Testing</u> . Also check heater elements for correct operation.
Intake manifold heater elements not functioning correctly in cold weather.	A DTC should have been set if heater elements are malfunctioning. Refer to <u>DTC-Based Diagnostics/MODULE, Engine Control (ECM) - Diagnosis and Testing</u> .
Internal engine damage (scuffed cylinder).	Analyze engine oil and inspect oil filter to locate area of probable damage.
Restriction in fuel supply side of fuel system.	Refer to <u>Non-DTC Diagnostics/Driveability -</u>

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Diesel - Diagnosis and Testing for fuel system testing.

EXCESSIVE BLUE SMOKE

POSSIBLE CAUSE	CORRECTION
Dirty air cleaner or restricted turbocharger intake duct.	Check Air Cleaner Housing for debris and replace filter as necessary
Air leak in boost system between turbocharger compressor outlet and intake manifold.	Service charge air system.
Obstruction in exhaust manifold.	Remove exhaust manifold and inspect for blockage.
Restricted turbocharger drain tube.	Remove turbocharger drain tube and remove obstruction.
Crankcase ventilation system plugged.	Inspect oil separator system for function and clear drain back hole in cylinder head cover/intake manifold
Valve seals are worn, brittle, or improperly installed.	Replace valve stem oil seals
Valve stems or guides are worn.	Remove valves and inspect valves and guides.
Broken or Improperly installed piston rings.	Tear down engine and inspect piston rings.
Excessive piston ring end gap.	Remove pistons and measure piston ring end gap.
Excessive cylinder liner wear and taper.	Remove pistons and measure cylinder liner wear and taper.
Cylinder damage.	Remove pistons and inspect cylinder liner for cracks or porosity. Repair with new cylinder liner if necessary.
Piston damage.	Remove pistons and inspect for cracks, holes. Measure piston for out-of-round and taper.
Turbocharger failure.	See Diagnosis and Testing .

ENGINE OIL LEAK INSPECTION

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

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

DETECTION TEST METHOD as follows:

- Remove the CCV hose from the Oil separator. Cap or plug the oil separator nipple.
- Attach an air hose with pressure gauge and regulator to the dipstick tube.

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

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

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

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

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

INSPECTION FOR REAR SEAL AREA LEAKS

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

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

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak. If a leak is present in this area, remove transmission for further inspection.
 - a. Circular spray pattern generally indicates seal leakage or crankshaft damage.

- b. Where leakage tends to run straight down, possible causes are a porous block, oil gallery cup plug, bedplate to cylinder block mating surfaces and seal bore. See appropriate component repair procedures for these items.
4. If no leaks are detected, pressurize the crankcase as previously described in step 5 under ENGINE OIL LEAK INSPECTION.

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

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

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.
7. After the oil leak root cause and appropriate corrective action have been identified, replace component(s) as necessary.

STANDARD PROCEDURE

ENGINE GASKET SURFACE PREPARATION

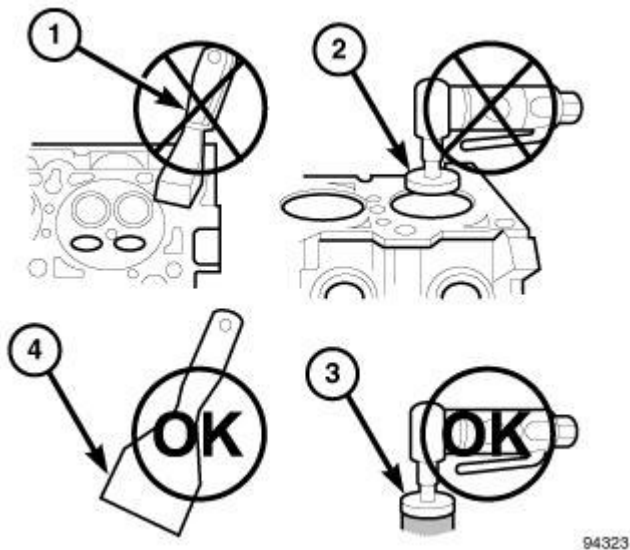


Fig. 5: PROPER TOOL USAGE FOR SURFACE PREPARATION
Courtesy of CHRYSLER LLC

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of

aluminum engine components and multi-layer steel cylinder head gaskets.

Never use the following to clean gasket surfaces:

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

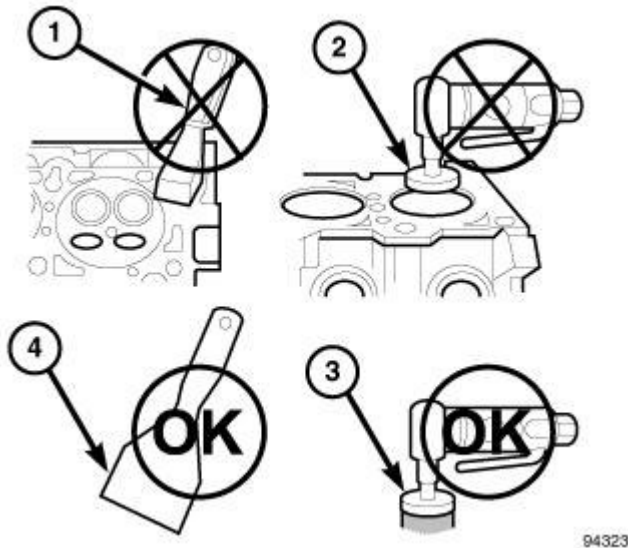


Fig. 6: PROPER TOOL USAGE FOR SURFACE PREPARATION

Courtesy of CHRYSLER LLC

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

Only use the following for cleaning gasket surfaces:

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

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

FORM-IN-PLACE GASKETS AND SEALERS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket.

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

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

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

Mopar® Gasket Maker is an anaerobic type gasket material. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR® GASKET SEALANT

Mopar® Gasket Sealant is a slow drying, permanently soft sealer. This material is recommended for sealing threaded fittings and gaskets against leakage of oil and coolant. Can be used on threaded and machined parts under all temperatures. This material is used on engines with multi-layer steel (MLS) cylinder head gaskets. This material also will prevent corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or 4oz./16 oz. can w/applicator.

FORM-IN-PLACE GASKET AND SEALER APPLICATION

Assembling parts using a form-in-place gasket requires care but it's easier than using precut gaskets.

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

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

Mopar® Gasket Sealant in an aerosol can should be applied using a thin, even coat sprayed completely over

both surfaces to be joined, and both sides of a gasket. Then proceed with assembly. Material in a can w/applicator can be brushed on evenly over the sealing surfaces. Material in an aerosol can should be used on engines with multi-layer steel gaskets.

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.

HYDROSTATIC LOCK

CAUTION: DO NOT use the starter motor to rotate the crankshaft. Severe damage could occur.

When an engine is suspected of hydrostatic lock (regardless of what caused the problem), follow the steps below.

1. Disconnect the negative cable(s) from the battery.
2. Inspect air cleaner, induction system, and intake manifold to ensure system is dry and clear of foreign material.
3. Place a shop towel around the fuel injectors to catch any fluid that may possibly be under pressure in the cylinder head. Remove the fuel injectors. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Removal** .

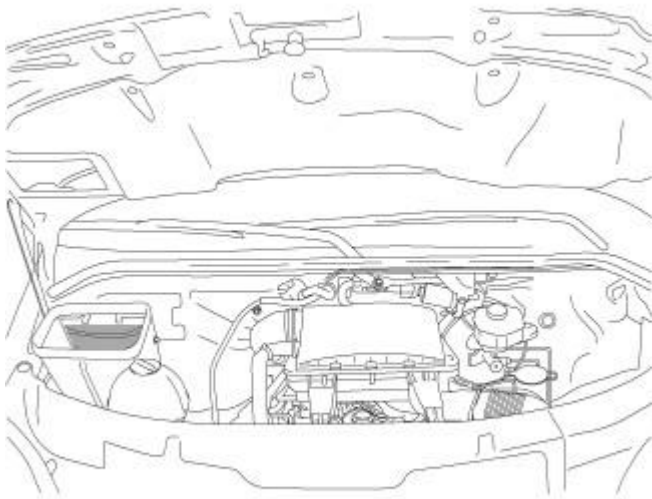
CAUTION: DO NOT use the starter motor to rotate the crankshaft. Severe damage could occur.

4. With all injectors removed, rotate the crankshaft using the crankshaft.
5. Identify the fluid in the cylinders (coolant, fuel, oil, etc.).
6. Be sure all fluid has been removed from the cylinders.
7. Repair engine or components as necessary to prevent this problem from occurring again.
8. Squirt a small amount of engine oil into the cylinders to lubricate the walls. This will prevent damage on restart.
9. Install fuel injectors. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Installation** .
10. Drain engine oil. Remove and discard the oil filter.
11. Install the drain plug. Tighten the plug to 50 N.m (37 ft. lbs.).

12. Install a new oil filter and tighten to 10 N.m 88 in. lbs.).
13. Fill engine crankcase with the specified amount and grade of oil. Refer to **Vehicle Quick Reference/Capacities and Recommended Fluids - Specifications** .
14. Connect the negative cable(s) to the battery.
15. Start the engine, allow to warm, turn engine off and check for any leaks.

REMOVAL

REMOVAL - ENGINE ASSEMBLY



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Fig. 7: OPEN HOOD

Courtesy of CHRYSLER LLC

1. Open the hood.
2. Remove engine hood. Refer to **Body/Hood - Removal**
3. Remove the auxiliary battery. Refer to **Electrical/Battery System/CABLES, Battery - Removal** .
4. Remove the auxiliary battery tray. Refer to **Electrical/Battery System/TRAY, Battery - Removal** .

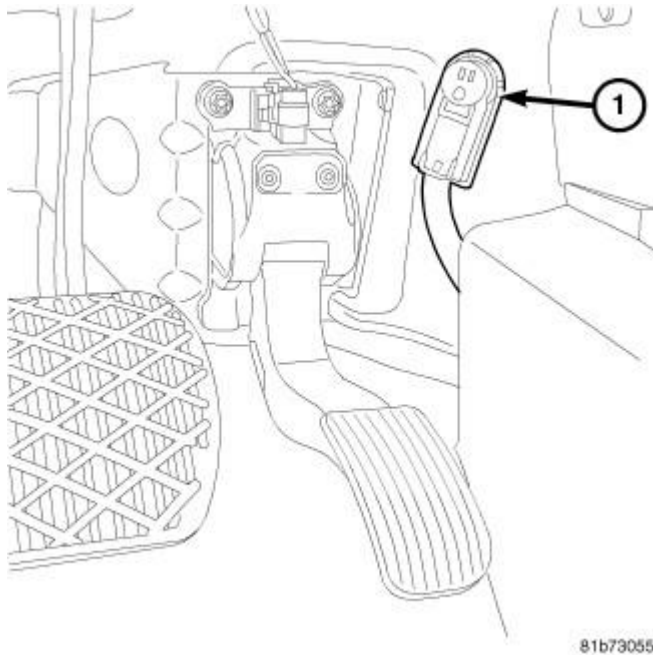


Fig. 8: BATTERY GROUND
Courtesy of CHRYSLER LLC

5. Disconnect the remote battery ground.

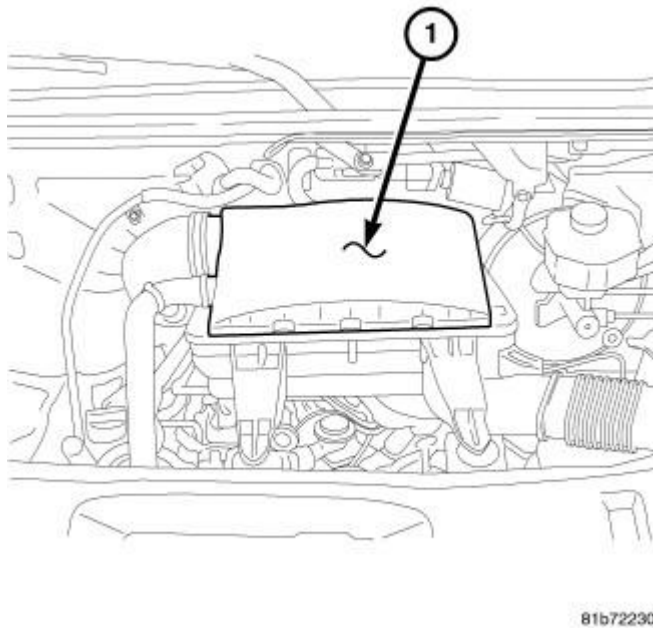
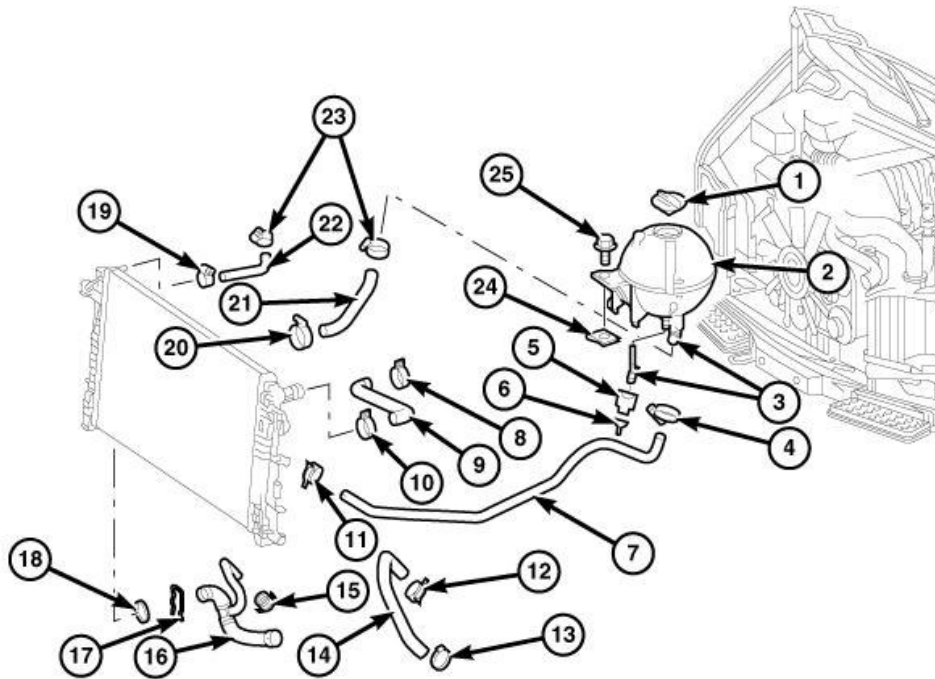


Fig. 9: INTAKE AIR HOUSING
Courtesy of CHRYSLER LLC

6. Remove air cleaner body. See **Removal**.
7. Disconnect electrical connector at intake manifold pressure sensor.

8. Raise and support the vehicle.
9. Drain the coolant. Refer to **Cooling - Standard Procedure**.
10. Remove the A/C condenser. Refer to **Heating and Air Conditioning/Plumbing/CONDENSER, A/C - Removal**.
11. Remove the hood latch. Refer to **Body/Hood/LATCH, Hood - Removal**.
12. Remove the radiator core support.



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Fig. 10: RADIATOR ASSEMBLY
Courtesy of CHRYSLER LLC

1 - COOLANT HOSE	8 - ATF LINE
2 - SENSOR HARNESS CONNECTOR	9 - LEFT RADIATOR TRIM PANEL
3 - HYDRAULIC HOSE	10 - RIGHT RADIATOR TRIM PANEL
4 - CHARGE AIR HOSE	11 - RADIATOR
5 - HYDRAULIC HOSE	12 - ATF LINE
6 - RUBBER GROMMET	13 - COOLANT HOSE
7 - COOLANT HOSE	14 - COOLANT RESERVOIR

13. Remove the coolant lines from the heater core.
14. Disconnect the EGR coolant hoses.

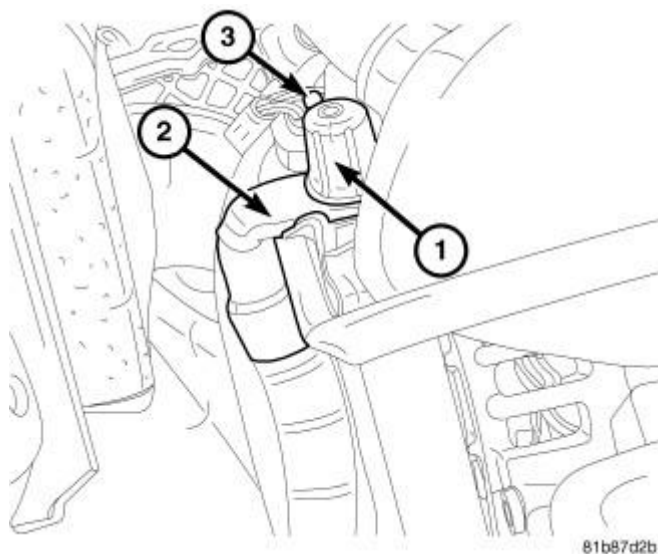


Fig. 11: Protective Plastic Cover, Nut Securing Battery Output Cable & Field Terminal Harness Connector

Courtesy of CHRYSLER LLC

15. Remove protective plastic cover (1) from B+ stud at top of generator.
16. Remove nut securing battery output cable (2) to B+ terminal at top of generator.
17. Disconnect the field terminal harness connector (3) at rear of generator.
18. Remove the A/C compressor. Refer to **Heating and Air Conditioning/Plumbing/COMPRESSOR, A/C - Removal** .

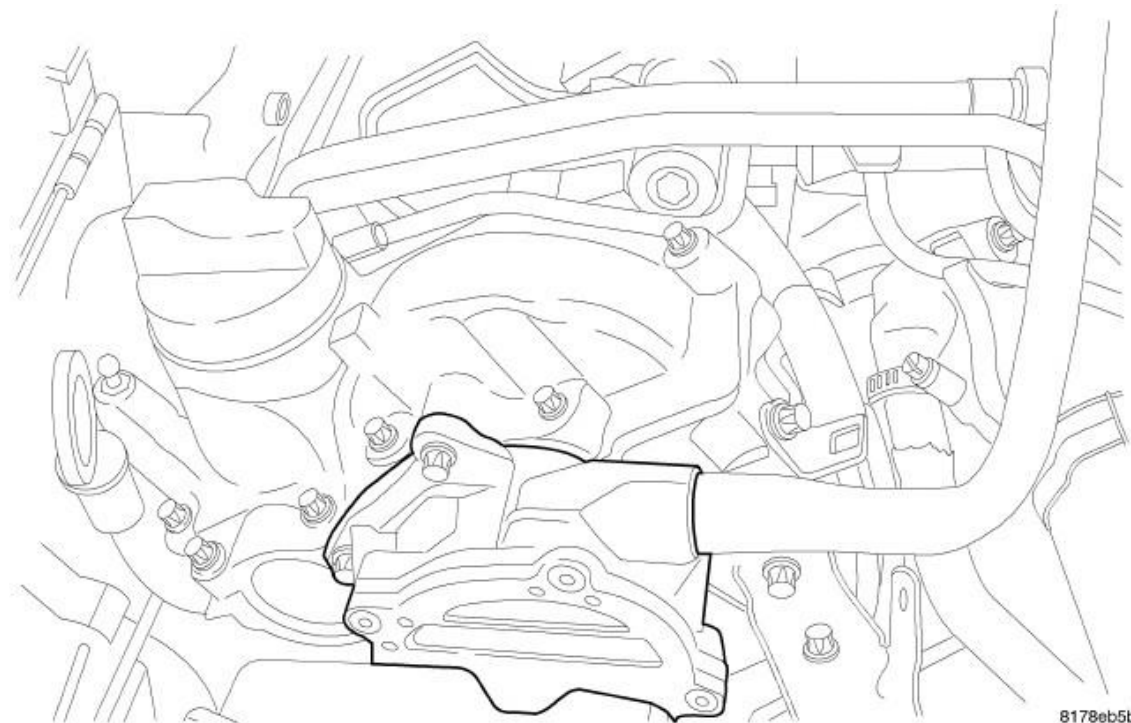
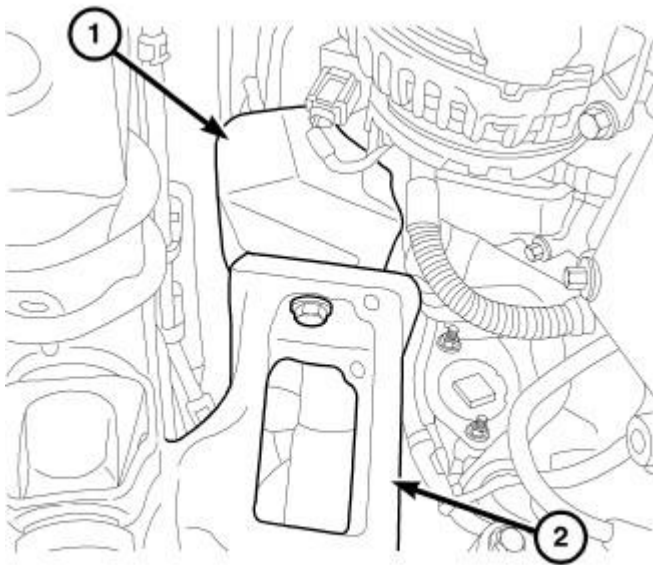


Fig. 12: VACUUM PUMP

Courtesy of CHRYSLER LLC

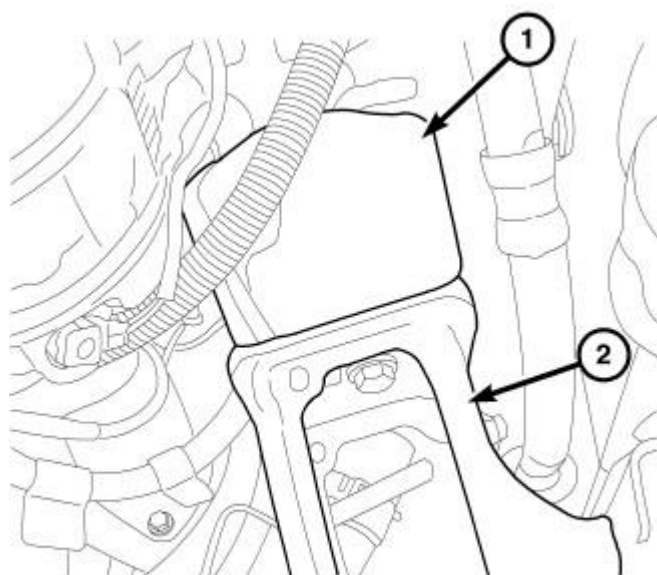
19. Remove the vacuum line at the vacuum pump.
20. Disconnect the engine ground.
21. Disconnect the ECM harness connectors.
22. Remove the transmission fill tube.
23. Disconnect the fuel lines.
24. Remove the power steering pump. Refer to **Steering/Pump - Removal** .
25. Remove the power steering reservoir.
26. Remove the catalytic converter. Refer to **Exhaust System/CONVERTER, Catalytic - Removal** .
27. Remove the starter. Refer to **Electrical/Starting/STARTER - Removal** .
28. Position aside the starter wire harness.
29. Remove the flex plate to torque converter bolts.
30. Remove the ground strap from left engine mount.
31. Remove the transmission to engine bolts.



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Fig. 13: MOTOR MOUNT LOWER RIGHT
Courtesy of CHRYSLER LLC

32. Remove bolts on right engine mount at the front.

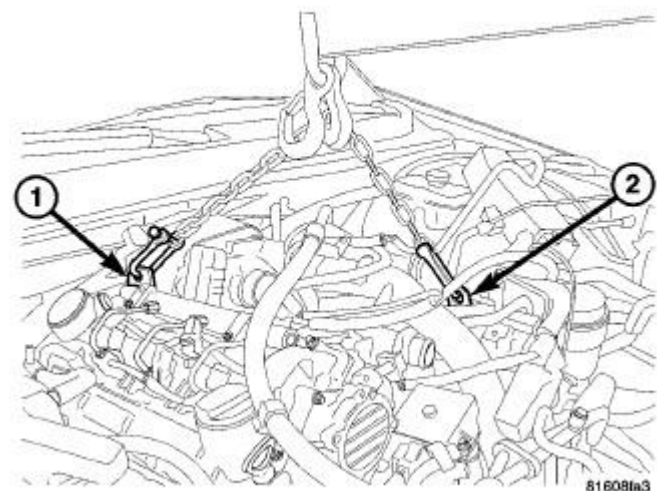


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Fig. 14: MOTOR MOUNT LEFT

Courtesy of CHRYSLER LLC

- 33. Remove bolts on left engine mount at the front.
- 34. Support the transmission with a jack.



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Fig. 15: ENGINE LIFTING POINTS

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - REAR ENGINE LIFT WITH CLEVIS CONNECTOR |
| 2 - FRONT ENGINE LIFT WITH CLEVIS CONNECTOR |

35. Attach engine removal chains to the lift points.
36. Use appropriate engine hoist to lift and remove the engine from the vehicle.

INSTALLATION

INSTALLATION - ENGINE ASSEMBLY

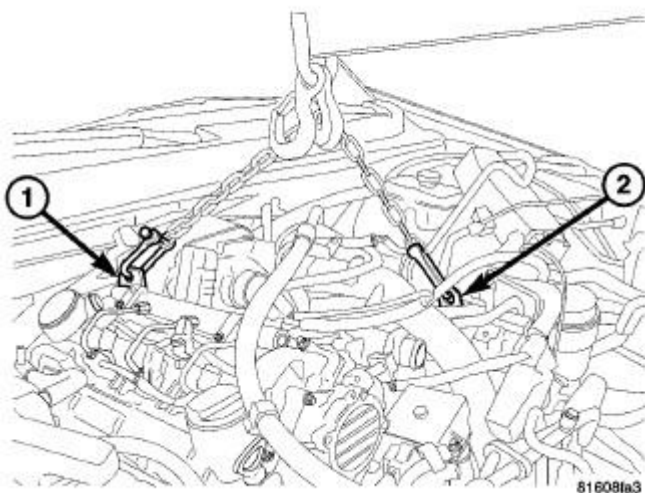
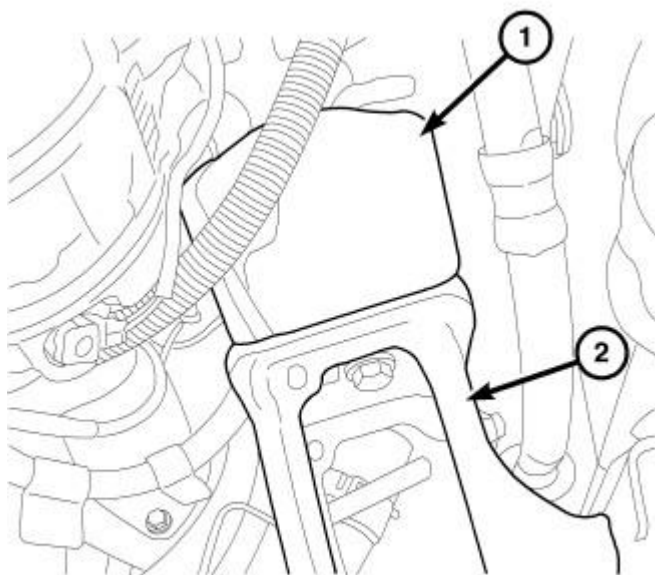


Fig. 16: ENGINE LIFTING POINTS

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - REAR ENGINE LIFT WITH CLEVIS CONNECTOR
2 - FRONT ENGINE LIFT WITH CLEVIS CONNECTOR |
|---|

1. Lower the engine and transmission into the vehicle.
2. Remove the jack supporting the transmission.
3. Remove the engine removal chains.

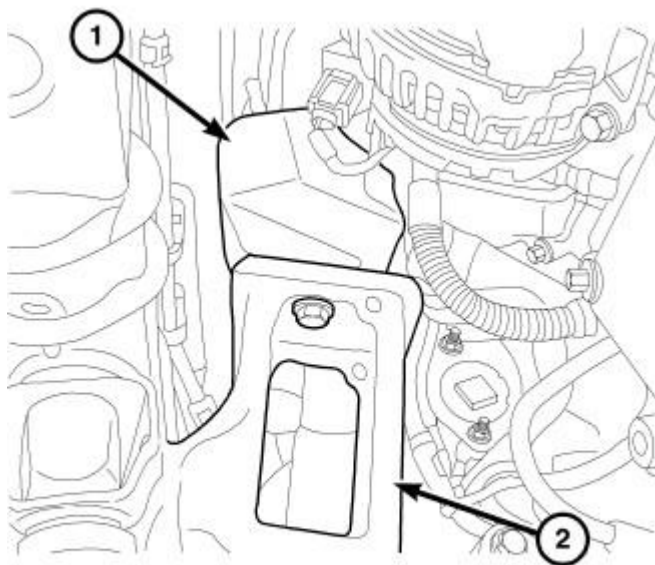


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Fig. 17: MOTOR MOUNT LEFT

Courtesy of CHRYSLER LLC

4. Install the left front engine mount bolts and tighten to 58 N.m 43 ft. lbs.).



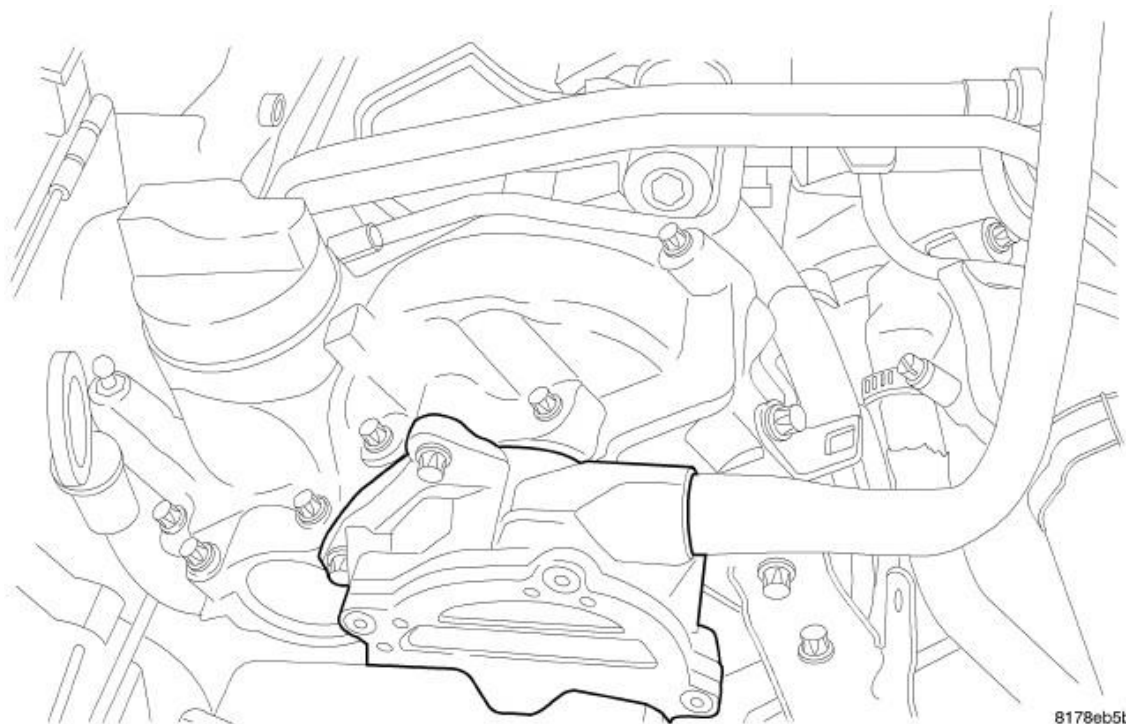
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Fig. 18: MOTOR MOUNT LOWER RIGHT

Courtesy of CHRYSLER LLC

5. Install the front right engine mount bolts and tighten to 58 N.m 43 ft. lbs.).
6. Install the transmission to engine bolts and tighten to 38 N.m (28 ft. lbs.).

7. Install the ground strap to left engine mount.
8. Install the flex plate to torque converter bolts. Tighten bolts to 50 N.m (37 ft. lbs.).
9. Position the starter wire harness.
10. Install the starter. Refer to **Electrical/Starting/STARTER - Installation** .
11. Install the catalytic converter. Refer to **Exhaust System/CONVERTER, Catalytic - Installation** .
12. Lower the vehicle.
13. Install the power steering reservoir.
14. Install the power steering pump. Refer to **Steering/Pump - Installation** .
15. Connect the fuel lines.
16. Install the transmission fill tube.
17. Connect the ECM harness connectors.
18. Connect the engine ground.



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Fig. 19: VACUUM PUMP
Courtesy of CHRYSLER LLC

19. Install the vacuum line at the vacuum pump.

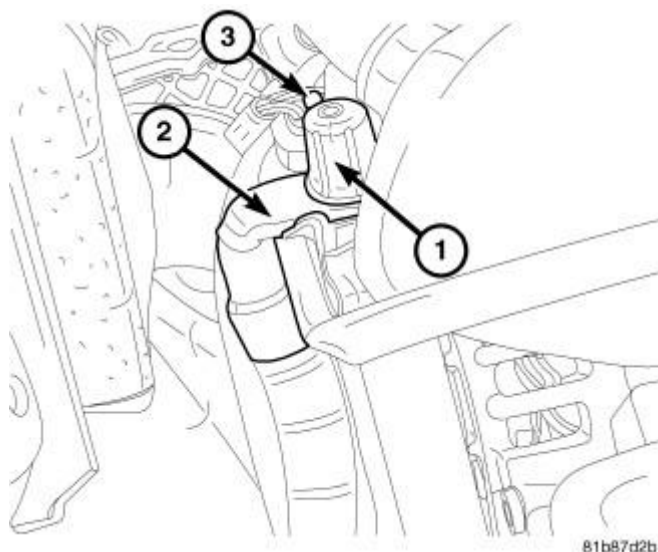


Fig. 20: Protective Plastic Cover, Nut Securing Battery Output Cable & Field Terminal Harness Connector

Courtesy of CHRYSLER LLC

20. Install the A/C compressor. Refer to **Heating and Air Conditioning/Plumbing/COMPRESSOR, A/C - Installation**.
21. Connect the field terminal connector (3) at rear of generator.
22. Install battery output cable (2) and nut to B+ terminal at top of generator. Tighten nut to 15 N.m (133 in. lbs).
23. Install protective plastic cover (1) to B+ stud at top of generator.

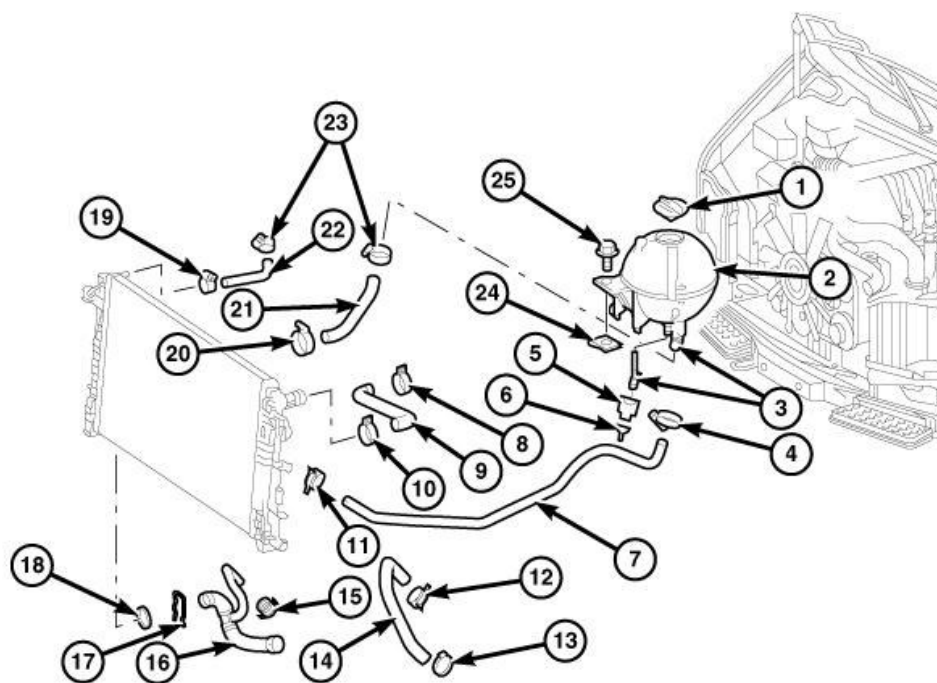


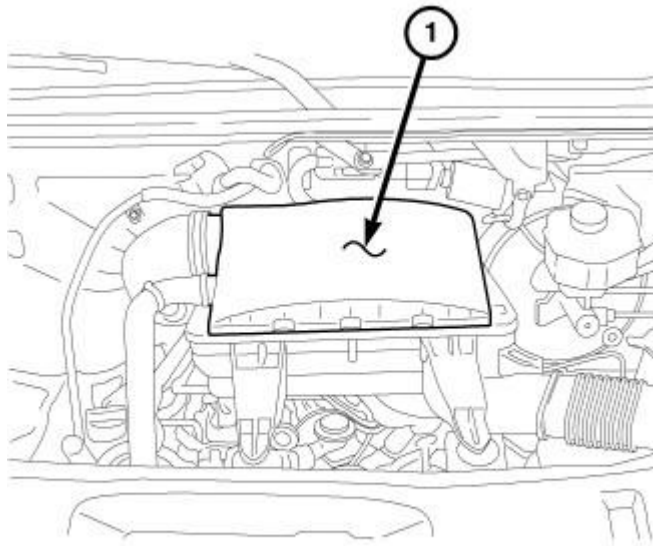
Fig. 21: RADIATOR ASSEMBLY

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Courtesy of CHRYSLER LLC

1 - COOLANT HOSE	8 - ATF LINE
2 - SENSOR HARNESS CONNECTOR	9 - LEFT RADIATOR TRIM PANEL
3 - HYDRAULIC HOSE	10 - RIGHT RADIATOR TRIM PANEL
4 - CHARGE AIR HOSE	11 - RADIATOR
5 - HYDRAULIC HOSE	12 - ATF LINE
6 - RUBBER GROMMET	13 - COOLANT HOSE
7 - COOLANT HOSE	14 - COOLANT RESERVOIR

24. Connect the EGR coolant hoses.
25. Install the coolant lines to the heater core.
26. Install the radiator core support.
27. Install the hood latch. Refer to **Body/Hood/LATCH, Hood - Installation** .
28. Install the A/C condenser. Refer to **Heating and Air Conditioning/Plumbing/CONDENSER, A/C - Installation** .
29. Fill the coolant. Refer to **Cooling - Standard Procedure** .



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Fig. 22: INTAKE AIR HOUSING
Courtesy of CHRYSLER LLC

30. Connect electrical connector at intake manifold pressure sensor.
31. Install the air cleaner body. See **Installation** .

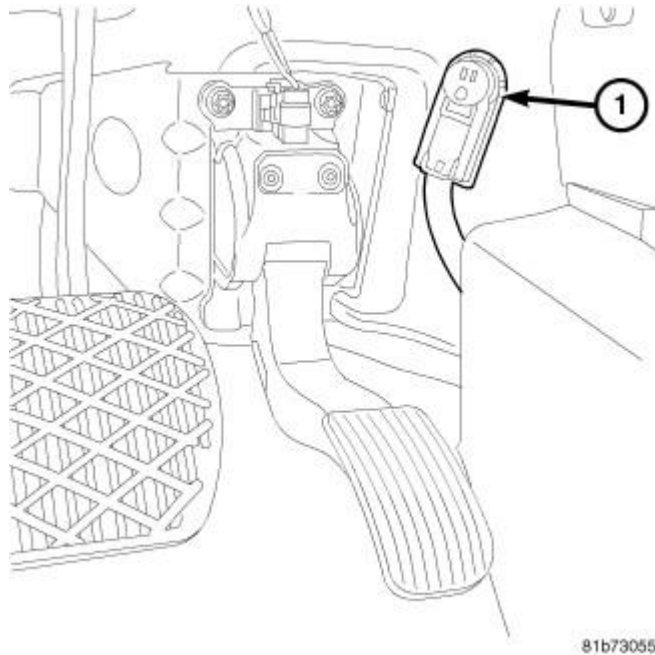


Fig. 23: BATTERY GROUND
Courtesy of CHRYSLER LLC

32. Connect the remote battery ground.

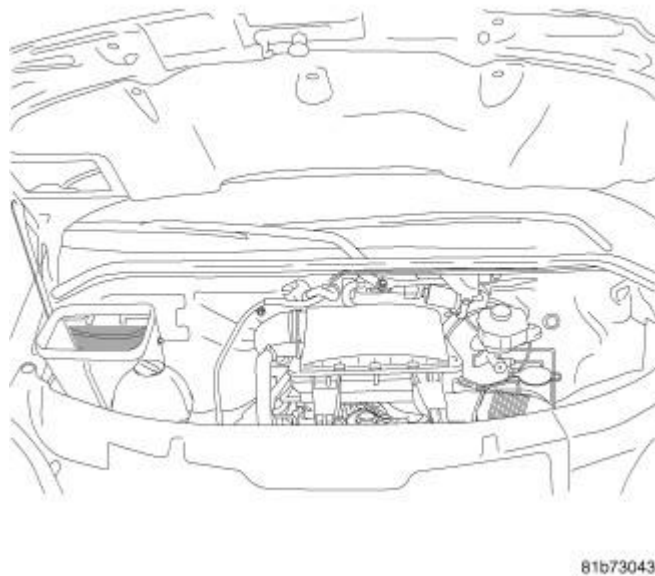


Fig. 24: OPEN HOOD
Courtesy of CHRYSLER LLC

33. Install the auxiliary battery tray. Refer to **Electrical/Battery System/TRAY, Battery - Installation** .
34. Install the auxiliary battery. Refer to **Electrical/Battery System/BATTERY - Installation** .

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35. Install engine hood. Refer to **Body/Hood - Installation** .

36. Close the hood.

SPECIFICATIONS

ENGINE SPECIFICATIONS

GENERAL DESCRIPTION

DESCRIPTION	SPECIFICATION
Displacement 3.0L	3.0L (2985 cc) (182 CID)
Bore	83 mm (3.26 in.)
Stroke	92 mm (3.62)
Compression Ratio	18 :1
Weight	215Kg (474 Lbs.)
Power	160Kw (215 HP) @ 4200 RPM
Torque	510 N.m (376 Ft. Lbs.) @ 1800 RPM
Idle Speed - Warm	620 RPM
Belt Tension	Automatic Belt Tensioner
Thermostat Opening	80°C ± 2°C (176°F ± 36°F)
Cooling System Capacity	13.3 Liters (14 qts.)
Engine Oil Capacity	12.5L (13.21 Qt.) W/Filter Change
Timing System	Chain Driven Dual Overhead Camshafts
Air Intake	Dry Filter With Turbocharger and Charge Air Cooler
Fuel Supply	Electric Pump In The Fuel Tank
Fuel System	Direct Fuel Injection Common Rail System
Combustion Cycle	4 Stroke
Compression Tolerance Or New Value	27 - 32 bar (392 - 464 psi)
Cylinder Compression Difference Between Cylinders	3 Bar (43.5 psi.)
Cylinder Leak Tightness Permissible Total Loss	not =25%
Cylinder Leak Tightness Permissible Loss At Valves And Cylinder Head Gasket	not =10%
Cylinder Leak Tightness Permissible Loss At Pistons And Piston Rings	not =20%
Cooling System	Water Cooling
Injection Pump	CP3 2nd. Generation Common Rail System
Injection Order	1-4-2-5-3-6
Lubrication	Pressure Lubricated By Rotary Pump
Oil Pressure 80°C (176°F)	1.1 Bar (16 psi.) at Idle 3.6 Bar (52 psi) at 3200 RPM
Engine Rotation	Clockwise Viewed From Front Cover

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CRANKSHAFT**CRANKSHAFT**

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Crankshaft Main Bearing Cap Bolts	-	
Thread Diameter	11 mm	0.43 in.
Length When New	66 mm	2.5985 in.
Maximum Length	67.8 mm	2.6693 in.
Crankshaft Journal Diameter	-	
Nominal Diameter	75.940 - 75.965 mm	2.98 -2.99 in.
First Repair Size	75.960 - 75.965 mm	2.9906 -2.9908 in.
Second Repair Size	75.955 - 75.960 mm	2.9904 -2.9906 in.
Third Repair Size	75.950 - 75.955 mm	2.9902 -2.9904 in.
Fourth Repair Size	75.945 - 75.950 mm	2.99 -2.9902 in.
Fifth Repair Size	75.940 - 75.945 mm	2.9898 -2.99 in.
Crankshaft Journal Width At Fit Bearing	-	
Identification Colorless/0	29.500 - 29.533 mm	1.16 -1.163 in.
Red/1	29.600 - 29.633 mm	1.164 -1.166 in.
Standard Dimension For Main Bearing Shells In Crankcase Upper And Lower Sections - Diameter 70.00 Mm (2.755 in.)	-	
Bearing shell thickness (Replacement part additional number (color coding blue) - 52)	2.250 - 2.255 mm	0.0886 -0.0876 in.
Bearing shell thickness (Replacement part additional number (color coding yellow) - 54)	2.255 - 2.260 mm	0.0876 -0.089 in.
Bearing shell thickness (Replacement part additional number (color coding red) - 56)	2.260 - 2.265 mm	0.089 -0.0892 in.
Bearing shell thickness (Replacement part additional number (color coding white) - 57)	2.265 - 2.270 mm	0.089 -0.0894 in.
Bearing shell thickness (Replacement part additional number (color coding purple) - 58)	2.270 - 2.275 mm	0.0894 -0.0896 in.
Crankshaft Bearing Clearance (When New)	0.029 - 0.056 mm	0.0012 -0.0023 in.
Axial play of crankshaft	0.100 - 0.254 mm	0.004 -0.01 in.

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CYLINDER HEAD**CYLINDER HEAD**

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Height Of Cylinder Head Without Camshaft Housing	-	
When new	128.35 - 128.65 mm	5.0532 -5.065 in.
Wear limit after machining	NA	NA
Valve Setback With New Valves And New Valve Seat Rings	-	
Exhaust valve	0.7 - 1.1 mm	0.0276 -0.0434 in.
Intake valve	1.0 - 1.4 mm	0.0394 -0.0552 in.
Flatness Of The Separating Surface Of The Cylinder Head	0.05 mm	0.002 in.
Cylinder Head Bolts	-	
Thread Diameter	12 mm	NA
Length When New	205 mm	8.0709 in.
Maximum Length	207 mm	8.1496 in.

VIBRATION DAMPER**VIBRATION DAMPER**

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Permissible Difference At Vibration Damper	-	
Radial runout	0.4 mm	0.158 in.
Axial runout	0.4 mm	0.158 in.

CYLINDER BORE**CYLINDER BORE**

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Cylinder Liner Diameter	-	
Standard dimensions	83.009 mm	3.268 in
Group code letter A	83.000 - 83.006 mm	3.2678 -3.268 in.
Group code letter X	83.006 - 83.012 mm	3.268 -3.2682 in.
Group code letter B	83.012 - 83.018 mm	3.2682 -3.2685 in.
1st repair size	83.050 mm	3.2697 in.
2nd repair size	83.100 mm	3.272 in.
Cylinder Liner	-	
Wear limit in longitudinal and transverse direction	0.20 mm	0.0079 in.

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Permissible difference for cylinder shape (when new)	0.000 - 0.007 mm	0.000 -0.0003 in.
Wear limit	0.05 mm	0.0002 in.
Permissible difference for rectangularity related to cylinder height	0.05 mm	0.0002 in.
Basic peak-to-valley height (R3Z)	0.002 - 0.005 mm	0.0001 -0.0002 in.
Maximum peak-to-valley height (Rmax)	0.011 mm	0.0005 in.
Honing angle	40 - 60°	40 - 60°

CRANKCASE**CRANKCASE**

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Crankshaft Bearing	-	
Basic bore diameter	80.000 - 80.522 mm	3.1496 -3.1702 in.
1st stage blue (Code number 52)	80.500 - 80.507 mm	3.1693 -3.1696 in.
2nd stage yellow (Code number 54)	80.507 - 80.514 mm	3.1696 -3.1699 in.
3rd stage red (Code number 56)	80.514 - 80.522 mm	3.1699 -3.1702 in.
Basic Bore Width At Fit Bearing	24.979 - 25.000 mm	0.9835 -0.9843 in.
Permissible Out-Of-Roundness And Conicity Of Basic Bore	0.02 mm	0.0008 in.
Crankcase	-	
Peak-to-valley height (Rz) top contact surface	0.015 - 0.025 mm	0.0006 -0.001 in.
Waviness (Wt) of top contact surface	0.001 - 0.007 mm	0.0001 -0.0003 in.
Unevenness of contact surface in longitudinal direction	0.03 mm	0.0012 in.
Unevenness of contact surface in transverse direction	0.03 mm	0.0012 in.
Variation of parallelism of top contact surface to bottom in longitudinal direction	NA	NA

CAMSHAFT**CAMSHAFT**

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Cylinder Head On Right Valve Timing At 2 mm Valve Lift And A New Timing Chain	-	
Inlet valve opens after TDC	19.6°	19.6°

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Inlet valve closes after BDC	5.6°	5.6°
Outlet valve opens after TDC	17.9°	17.9°
Outlet valve closes after BDC	27.9°	27.9°
Cylinder Head On Right Valve Timing At 2 mm Valve Lift And Used Timing Chain	-	
Inlet valve opens after TDC	21.5°	21.5°
Inlet valve closes after BDC	3.7°	3.7°
Outlet valve opens after TDC	16.0°	16.0°
Outlet valve closes after BDC	26.0°	26.0°
Cylinder Head On Left Valve Timing At 2 mm Valve Lift And A New Timing Chain	-	
Inlet valve opens after TDC	20.7°	20.7°
Inlet valve closes after BDC	4.5°	4.5°
Outlet valve opens after TDC	16.8°	16.8°
Outlet valve closes after BDC	26.8°	26.8°
Cylinder Head On Left Valve Timing At 2 mm Valve Lift And Used Timing Chain	-	
Inlet valve opens after TDC	21.5°	21.5°
Inlet valve closes after BDC	3.7°	3.7°
Outlet valve opens after TDC	16.0°	16.0°
Outlet valve closes after BDC	26.0°	26.0°

ENGINE VALVES

VALVES

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Valve Disk Diameter	-	
Exhaust	25.3 - 25.5 mm	0.9961 -1.004 in.
Intake	28.4 - 28.6 mm	1.1182 -1.126 in.
Height Of Valve Disk	-	
Exhaust	1.4 - 1.6 mm	0.0552 -0.063 in.
Intake	1.3 - 1.5 mm	0.0512 -0.0591
Valve Seat Face Angle	-	
Exhaust	45° (+ 0.5°)	45° (+ 0.5°)
Intake	45° (+ 0.5°)	45° (+ 0.5°)
Valve Seat Back-cut Angle	-	
Exhaust	30° (±15')	30° (±15')
Intake	30° (±15')	30° (±15')

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Valve Stem Diameter	-	
Exhaust	5.945 - 5.975 mm	0.2341 -0.2353 in.
Intake	5.960 - 5.975 mm	0.2347 -0.2353 in.
Length Of Valve	-	
Exhaust	102.1 - 102.5 mm	4.0197 -4.0355 in.
Intake	102.1 - 102.5 mm	4.0197 -4.0355 in.

ENGINE PISTONS AND ENGINE PISTON RINGS**ENGINE PISTONS**

DESCRIPTION	SPECIFICATION	
	Metric	Standard
-		
Piston Projection With New Crankcase	0.53 - 0.77 mm	0.0209 - 0.0304
Piston projection (a) with machined crankcase	NA	NA
Piston Diameter	-	
Piston group A	82.833 - 82.839 mm	3.2612 -3.2614 in.
Piston group X	82.838 - 82.846 mm	3.2614 -3.2617 in.
Piston group B	82.845 - 82.851 mm	3.2617 -3.2619 in.
1st repair size (Piston group +5)	82.876 - 82.890 mm	3.2629 -3.2634 in.
2nd repair size (Piston group +10)	82.926 - 82.940 mm	3.2648 -3.2654 in.

ENGINE PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Piston Ring End Clearance	-	
Groove 1	0.12 - 0.16 mm	0.0048 -0.0063 in.
Groove 2	0.065 - 0.110 mm	0.0026 -0.0044 in.
Groove 3	0.03 - 0.07 mm	0.0012 -0.0028 in.
Piston Ring End Gap	-	
Groove 1	0.12 - 0.16 mm	0.0048 -0.0063
Groove 2	0.065 - 0.110 mm	0.0026 -0.0044
Groove 3	0.03 - 0.07 mm	0.0012 -0.0028
Dimensions Of The Piston Rings	-	
Keystone ring	NA	NA
Taper-faced ring	NA	NA
Bevel-edged ring	NA	NA
Piston Ring Height	-	
Bevel-edged ring (DSF-ring)	83 X 2.0 X 3.4 mm	3.2678 X 0.0788 X 0.1339 in.
Taper-faced ring (M-ring)	83 X 2.0 X 3.45 mm	3.2678 x 0.0788 x 0.1359 in.
Double sided half-keystone ring		

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(DT-ring)

83 X 2.0 X 3.4 mm

3.2678 X 0.0788 X 0.1339 in.

ENGINE CONNECTING RODS**CONNECTING RODS**

DESCRIPTION	SPECIFICATION	
	Metric	Standard
-	-	-
Connecting Rod Bolt	-	-
Thread diameter	8 mm	0.315 in.
Shank length when new	47 mm	1.8504 in.
Maximum shank length	48 mm	1.8898 in.
Distance From Center Of Connecting Rod Bearing Bore To Connecting Rod Bushing Bore	167.97 - 168.03 mm	6.613 -6.6154 in.
Width Of Connecting Rod At Connecting Rod Bearing Bore	17.90 - 18.10 mm	0.7048 -0.7126 in.
Width Of Connecting Rod At Connecting Rod Bushing Bore	21.94 - 22.00 mm	0.8638 -0.8662 in.
Connecting Rod Bushing Inner	30.038 - 30.044 mm	1.1826 -1.1829 in.
Connecting Rod Bushing Outer Diameter	32.500 - 32.525 mm	1.2796 -1.2806 in.
Piston Pin Play In Connecting Rod Bushing	0.028 - 0.034 mm	0.0012 -0.0014 in.
Peak-To-Valley Height (Rz) Of Connecting Rod Bushing On Inside	5 mm	0.1969 in.
Connecting Rod Bearing Shell Basic Bore	67.600 - 67.614 mm	2.6615 -2.662 in.
Permissible Out-Of-Roundness And Concentricity Of Basic Bore	0.020 mm	0.0008 in.
Permissible Twist Of Connecting Rod Bearing Bore To Connecting Rod Bush Bore Over A Length Of 100 mm	0.1 mm	0.004 in.
Permissible Variation Of Axial Parallelism Of Connecting rod Bearing Bore To Connecting rod Bushing Bore Over A Length Of 100 mm	0.045 mm	0.0018 in.
Permissible Difference In Weight Of Complete Connecting Rod Of An Engine	2 grams	0.07 oz.

TORQUE SPECIFICATIONS

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ENGINE BLOCK

ENGINE BLOCK

DESCRIPTIONS	N.m	In. Lbs.	Ft. Lbs.
Balance Shaft Retaining Bracket Bolt	9	80	-
Balance Shaft Correctional Weight Bolt	20	177	-
Balance Shaft Correctional Weight Cover Bolt	8	71	-
Connecting Rod	Stage 1 Short Arm - 15	Stage 1 Short Arm -132	-
	Stage 2 Long Arm - 20	2nd Stage Long Arm - 177	-
	Stage 3 Short Arm - 30	-	Stage 3 Short Arm - 22
	Stage 4 Long Arm - 40	-	Stage 4 Long Arm - 30
	Stage 5 Short Arm - 40	-	Stage 5 Short Arm - 30
	Stage 6 Long Arm - 90 Degrees	Stage 6 Long Arm - 90 Degrees	Stage 6 Long Arm - 90 Degrees
	Stage 7 Short Arm - 90 Degrees	Stage 7 Short Arm - 90 Degrees	Stage 7 Short Arm - 90 Degrees
	Stage 8 Long Arm - 90 Degrees	Stage 8 Long Arm - 90 Degrees	Stage 8 Long Arm - 90 Degrees
Crankshaft Bearing Cap to Crankshaft Bearing Body Bolt	Stage 1 - 35	-	25
	Stage 2 - 95 Degrees	Stage 2- 95 Degrees	Stage 2- 95 Degrees
	Stage 3 - 95 Degrees	Stage 3 - 95 Degrees	Stage 3 - 95 Degrees

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Crankcase to Crankcase Bearing Cap Lateral Bolt	Stage 1 - 53	-	39
	Stage 2 - 95 Degrees	Stage 2 - 95 Degrees	Stage 2 - 95 Degrees
Dual Mass Flywheel	Stage 1 - 45	-	33
	Stage 2 - 90 Degrees	-	Stage 2 - 90 Degrees
Lower Oil Pan	12	160	-
Oil Drain Plug	30	-	22
Oil Jet	8	70	-
Oil Level Sensor Bracket	M6 x 8.8 - 8	70	-
	M6 x 10.9 - 12	106	-
Oil Pan To Timing Cover	14	124	-
Oil Pump	19	168	-
Oil Pump Cap With Oil Pipe to Oil Pump Bolt	12	106	-
Rear cover	Stage 1 - 8	70	-
	Stage 2 - 10	88	-
Timing Chain Tensioning Rail Guide Pin	17	150	-
Timing Chain Slide Rail Guide Pin	17	150	-
Timing Chain Tensioner	80	-	59
Torque Converter Bolts	50	-	37
Transmission to Engine Bolts	38	-	28
Upper Oil Pan (M6)	14	124	-
Upper Oil Pan (M8)	20	177	-
Upper Oil Pan to Crankcase On Transmission Side	20	177	-

CYLINDER HEAD

CYLINDER HEAD

DESCRIPTION	N.m	In. Lbs.	Ft. Lbs.
Camshaft Drive Gear Bolts	18	159	-
Camshaft Retainer On Cylinder Head	8	71	-
Cylinder Head Bolts (M8)	20	177	-
Cylinder Head Bolts (M10)	Stage 1 - 10	88	-
	Stage 2 - 60	-	44
	Stage 3 - 90 Degrees	Stage 3 - 90 Degrees	Stage 3 - 90 Degrees
	Stage 4 - 90 Degrees	Stage 4 - 90 Degrees	Stage 4 - 90 Degrees
	Stage 5 - 90	Stage 5 - 90	Stage 5 - 90

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	Degrees	Degrees	Degrees
Cylinder Head Bolt Length When New	205 mm		
Cylinder Head Bolt Max. length	207 mm		
Cylinder Head Cover	Stage 1 - 4	35	-
	Stage 2 - 6	53	-
	Stage 3 - 8	70	-
EGR Cooler	12	106	-
Exhaust Line to Exhaust Collector Pipe/Turbocharger Bolt	20	177	-
Exhaust Manifold to Cylinder Head Nut	25	-	18
Exhaust Manifold to Cylinder Head Stud Bolt	20	177	-
Flange connection, exhaust manifold or front exhaust pipes to exhaust collector	Stage 1 - 20	177	-
	Stage 2 - 90 Degrees	Stage 2 - 90 Degrees	-
Fuel Filter Bracket	6	53	-
Intake Manifold	16	141	-
Oil Separator Cover	14	123	10
Rail pressure sensor on rail	14	123	-
Swirl Valve Actuator	8	70	-
Tensioning claw to injector Bolt	Stage 1 - 7	62	-
	Stage 2 - 180 Degrees	Stage 2 - 180 Degrees	Stage 2 - 180 Degrees

FRONT OF ENGINE

FRONT OF ENGINE

DESCRIPTION	N.m	In. Lbs.	Ft. Lbs.
Crankshaft Damper	Stage 1 - 210	-	154
	Stage 2 - 180 degrees	-	Stage 2 - 180 degrees
Coolant Pump Housing to Crankcase Bolt	10	89	-
EGR Throttle Valve	9	80	-
Fuel Line Between Left and Right Fuel Rail	27	-	20
Fuel Line on Cylinder Head Cover/Lifting Eye/Charge Air Manifold	M6 x 12 - 9	80	-
	M6 x 15 - 14	124	-
Fuel Rail to Cylinder Head Bolt	14	124	-
High Pressure Fitting on High Pressure Pump	55	-	41
High Pressure Line to Cylinder Head Cover Retaining Clamp Bolt	14	124	-
High Pressure Line on High Pressure Pump	33	-	24
High Pressure Line from Pump to Rail	27	-	20

2009 Dodge Sprinter 2500

2009 ENGINE 3.0L Turbo Diesel - Service Information - Sprinter

High Pressure Pump to Cylinder Head Bolt	14	124	-
High Pressure Pump Drive Gear Nut	70	-	52
Oil Cooler	12	106	-
Oil Filter Cap	25	-	18
Oil Filter Housing	14	124	-
Oil Filter Housing to Cylinder Head Cover Bracket Bolt	14	124	-
Power Steering Oil Reservoir to Cylinder Head Cover and Oil Filter Bolt	14	124	-
Poly V-belt Tensioning Device to Crankcase Bolt	58	-	43
Pressure Line Union Nut on Rail	27	-	20
Pressure Line Union Nut on Injector	33	-	24
Quantity Control Valve to High Pressure Pump Housing Flange Bolt	7	62	-
Thermostat Housing to Charge Air Manifold Bolt	9	80	-
Timing Case Cover To Crankcase	10	88	-
Upper Idler Pulley	28	-	20
Vacuum Pump	9	80	-

TURBOCHARGER AND EXHAUST

TURBOCHARGER AND EXHAUST

DESCRIPTION	N.m	In. Lbs.	Ft. Lbs.
Charge Air Manifold to Radiator Support Bolt	20	177	-
Clamping Plates of Pressure Lines Bolt	10	88	-
Diesel Particulate Filter to Catalytic Converter Clamp	35	-	26
Diesel Particulate Filter to Front Muffler Clamp	45	-	33
Diesel Particulate Filter to Rear Muffler Clamp	45	-	33
Engine Charge Air Channel of Turbocharger to Charge Air Distribution Pipe Bolt	8	71	-
Engine Charge Air Duct Bracket to Cylinder Head Bolt	8	71	-
Engine Charge Air Duct Upstream of Charge Air Cooler on Bracket	8	71	-
Exhaust Gas Recirculation Pipe to Charge Air Distribution line	13	115	-
Exhaust Gas Recirculation Pipe to Exhaust Collector	Stage 1 - 10	Stage 1 - 89	-
	Stage 2 - 90 Degrees	Stage 2 - 90 Degrees	-
Exhaust Pipe Support	30	-	22
Muffler to Mixing Chamber Bolt	8	71	-
Turbocharger to Intake Manifold	10	88	-
	Stage 1 - 20	177	15
			Stage 2

2009 Dodge Sprinter 2500

2009 ENGINE 3.0L Turbo Diesel - Service Information - Sprinter

Exhausts Tube at Turbocharger	Stage 2 - 90 Degrees	Stage 2 - 90 Degrees	- 90 Degrees
Throttle Valve Actuator Bracket	10	89	-
Throttle Valve Actuator Coupling Flange	10	89	-
Throttle Valve Actuator to Cylinder Head Bracket	9	80	-
Throttle Valve Actuator on Mixing Chamber	5	44	-
Turbocharger Oil Feed Line At Crankcase	12	106	-
Turbocharger Oil Feed at Turbocharger	Stage 1 - 10	88	-
	Stage 2 - 30	265	22
Turbocharger Heat Shield to Bracket	8	70	-
Turbocharger Shield to Exhaust Collector	10	88	-
Union Nut Connecting Pressure Line to Diesel Particulate Filter	45	-	33

ENGINE MOUNTING**ENGINE MOUNTING**

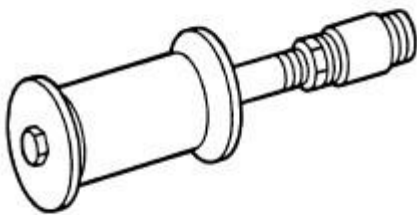
DESCRIPTION	N.m	In. Lbs.	Ft. Lbs.
Connecting Engine Support to Left Crankcase Bolt	20	177	-
Connecting Engine Support to Right Crankcase Bolt	20	177	-
Rear Engine Mount to Transmission Bolt	40	-	29
Rear Engine Mount to Transmission Carrier Bolt M8	30	-	22
Rear Engine Mount to Transmission Carrier Bolt M10	58	-	42

SPECIAL TOOLS**SPECIAL TOOLS**



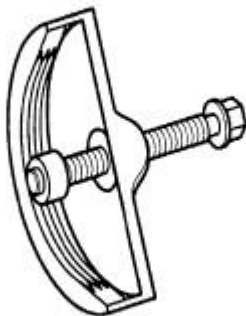
80e49185

Fig. 25: INSTALLER, FRONT CRANKSHAFT SEAL - 8936A
Courtesy of CHRYSLER LLC



80e492f2

Fig. 26: HAMMER, SLIDE - 8937
Courtesy of CHRYSLER LLC



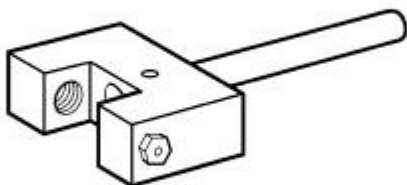
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Fig. 27: REMOVER, VIBRATION DAMPER - 8940
Courtesy of CHRYSLER LLC



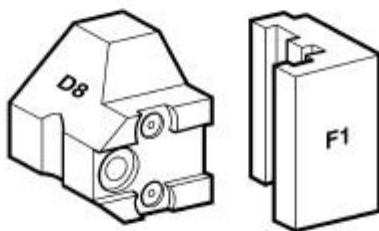
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Fig. 28: INSTALLER, REAR MAIN SEAL - 8944
Courtesy of CHRYSLER LLC



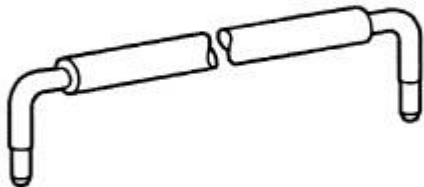
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Fig. 29: TOOL, CHAIN SEPARATOR - 8948
Courtesy of CHRYSLER LLC



80e492bd

Fig. 30: PIECE, THRUST - 8949A
Courtesy of CHRYSLER LLC



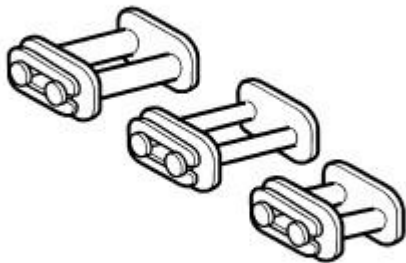
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Fig. 31: LOCKING PINS - 8929
Courtesy of CHRYSLER LLC



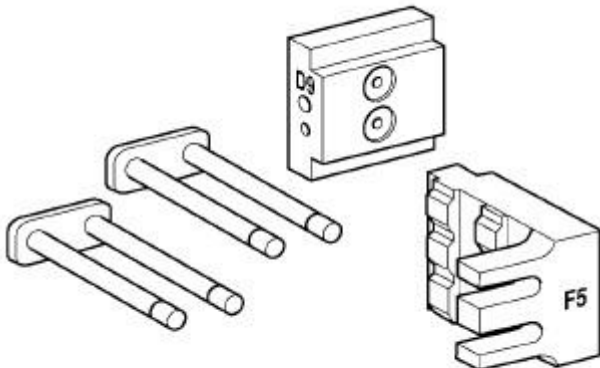
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Fig. 32: SCREW, PRESSING - 8950
Courtesy of CHRYSLER LLC



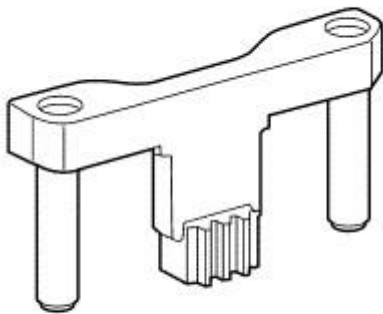
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Fig. 33: LINKS, ASSEMBLY - 8951
Courtesy of CHRYSLER LLC



811aa8d1

Fig. 34: INSERTS, ASSEMBLY - 8952A
Courtesy of CHRYSLER LLC



810db0a2

Fig. 35: TOOL, FLYWHEEL LOCKING - 9102
Courtesy of CHRYSLER LLC

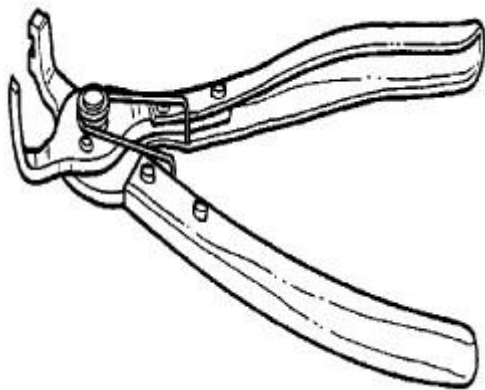


Fig. 36: PLIERS, FUEL LINE - 9539
Courtesy of CHRYSLER LLC

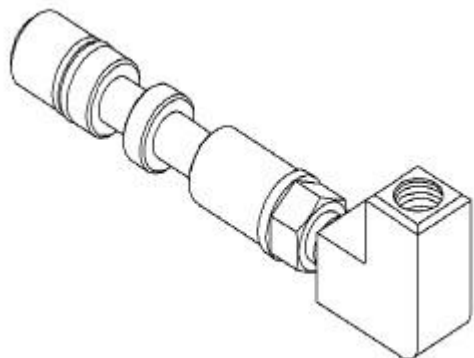


Fig. 37: ADAPTOR - 9543

Courtesy of CHRYSLER LLC

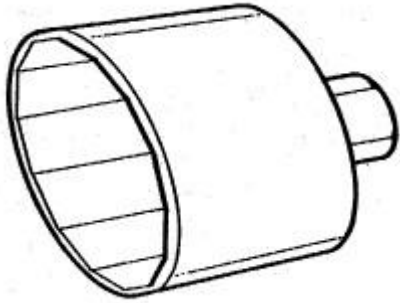


Fig. 38: WRENCH, OIL FILTER CAP - 9551

Courtesy of CHRYSLER LLC

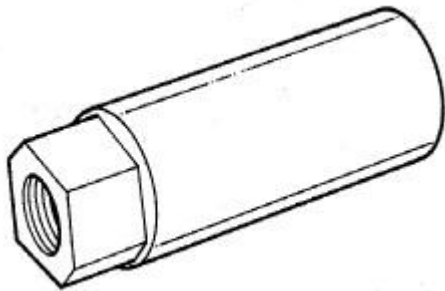
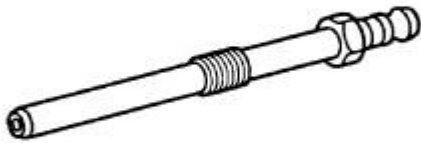


Fig. 39: REMOVER, FUEL INJECTOR - 9552

Courtesy of CHRYSLER LLC



80e492e9

Fig. 40: ADAPTER, COMPRESSION TESTER - 9553
Courtesy of CHRYSLER LLC

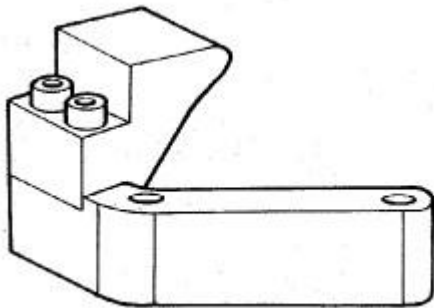


Fig. 41: GUIDE, TIMING CHAIN - 9554
Courtesy of CHRYSLER LLC

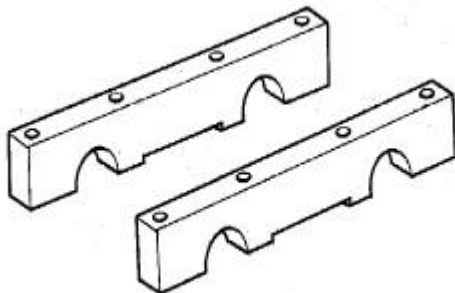


Fig. 42: RETAINER, CAMSHAFTS - 9555
Courtesy of CHRYSLER LLC

COVER, ENGINE

REMOVAL

REMOVAL

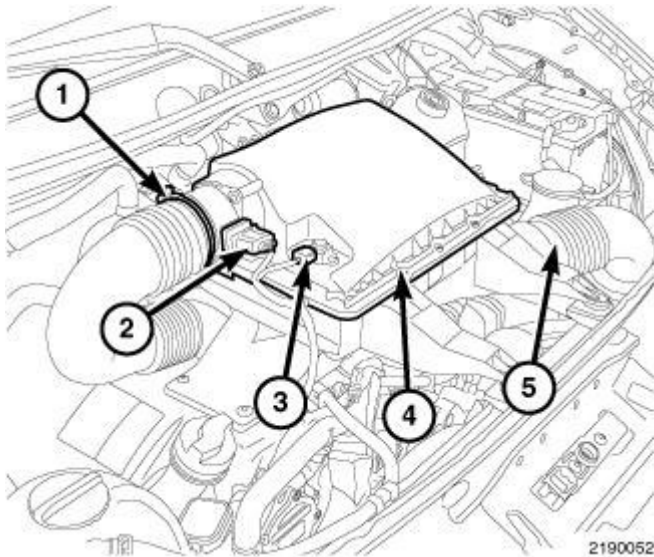


Fig. 43: MAF HARNESS CONNECTOR & INTAKE AIR PRESSURE SENSOR
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Disconnect the Mass Air Flow sensor (MAF) (2) harness connectors.
3. Disconnect the intake air pressure sensor (3) harness connectors.
4. Loosen the clamp (1) and disconnect the air cleaner outlet tube from the air cleaner housing (4).
5. Disconnect the air cleaner inlet tube (5).

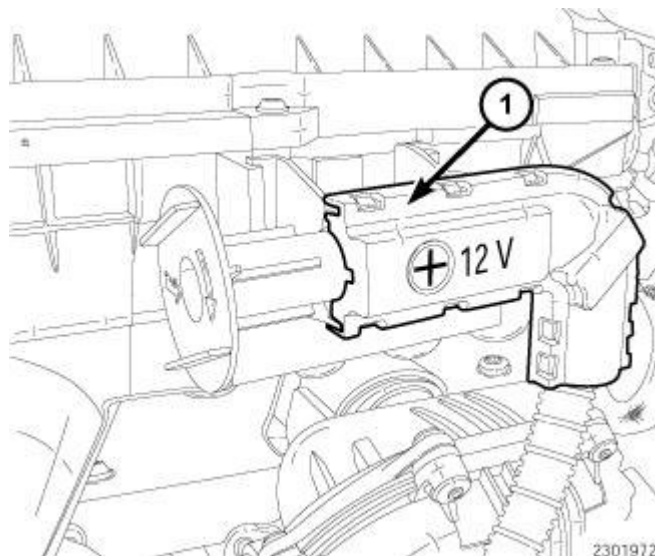
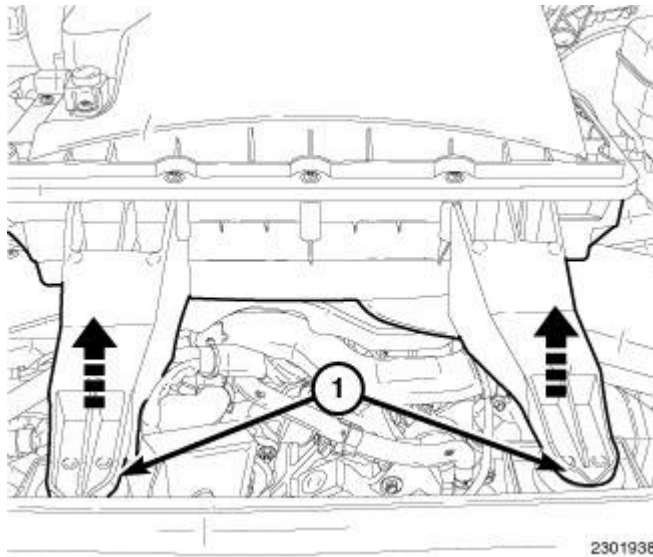


Fig. 44: POSITIVE BATTERY TERMINAL LEAD

Courtesy of CHRYSLER LLC

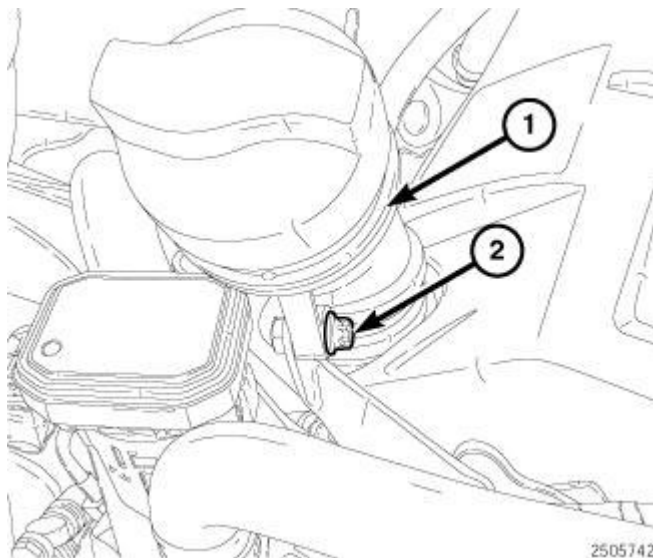
NOTE: The lock tab is located on the bottom of the terminal.

6. If equipped, release the lock tab and pull up to remove the positive battery terminal lead (1) from the air cleaner housing.

**Fig. 45: AIR CLEANER ASSEMBLY**

Courtesy of CHRYSLER LLC

7. Pulling upward to release the front tabs (1) and remove the air cleaner assembly.

**Fig. 46: OIL FILL TUBE & BOLT**

Courtesy of CHRYSLER LLC

8. Remove the bolt (2) and the oil fill tube (1).

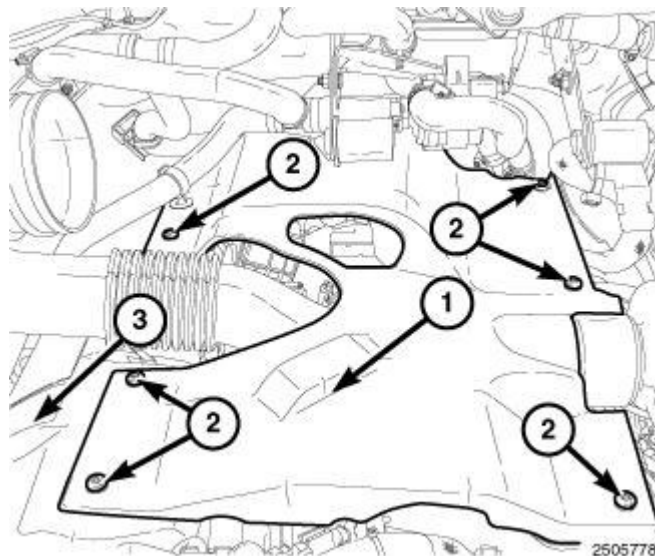


Fig. 47: ENGINE COVER
Courtesy of CHRYSLER LLC

9. Remove bolts (2) and the engine cover (1).

INSTALLATION

INSTALLATION

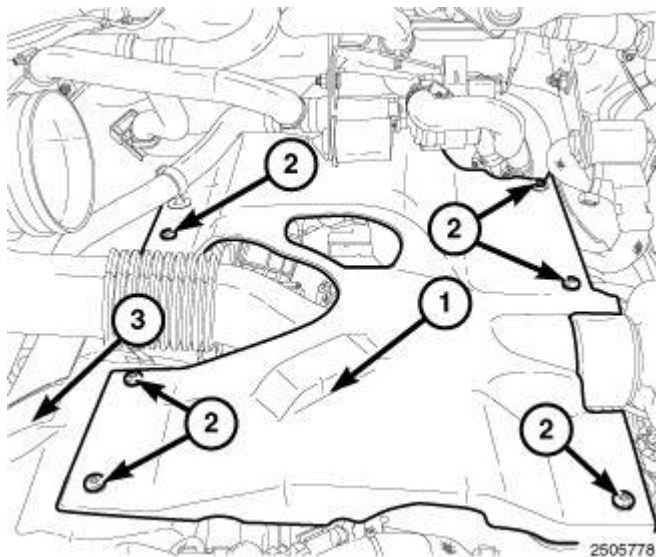


Fig. 48: ENGINE COVER
Courtesy of CHRYSLER LLC

1. Install the engine cover (1) and tighten retaining bolts (2).

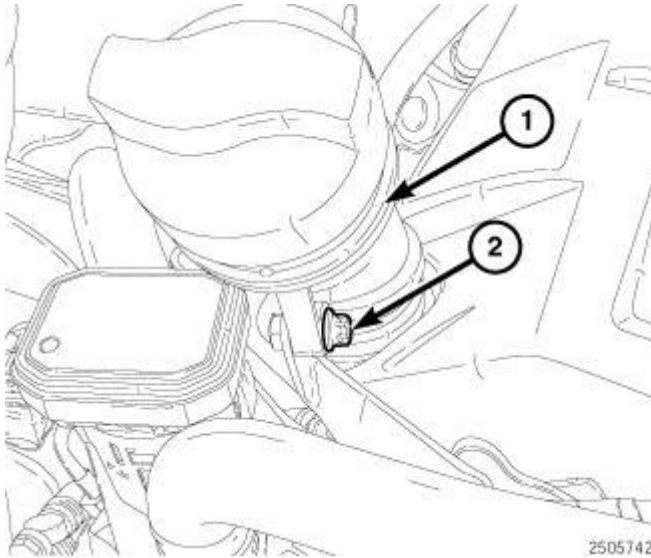


Fig. 49: OIL FILL TUBE & BOLT
Courtesy of CHRYSLER LLC

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

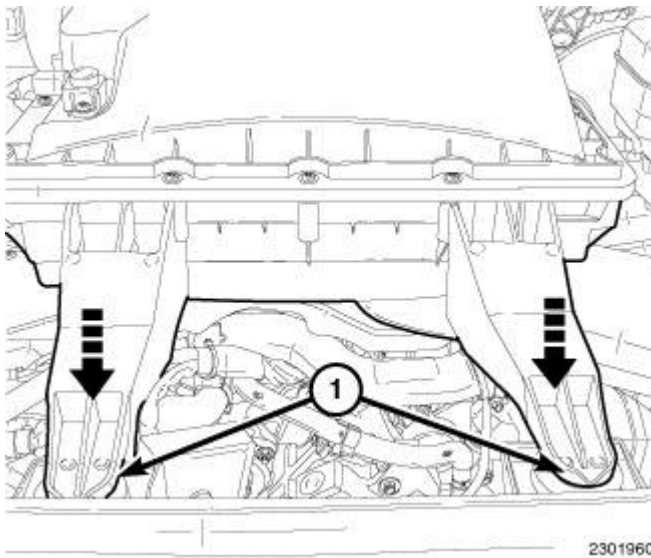


Fig. 50: AIR CLEANER ASSEMBLY
Courtesy of CHRYSLER LLC

3. Position the air cleaner assembly and push down on the front tabs (1) to lock in place.

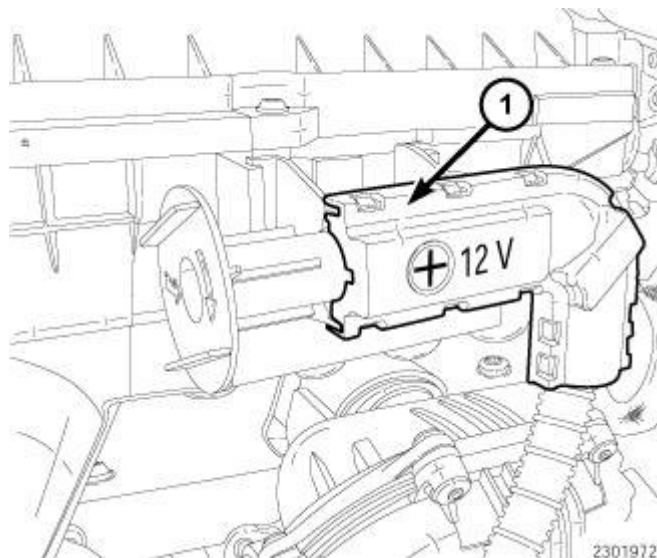


Fig. 51: POSITIVE BATTERY TERMINAL LEAD
Courtesy of CHRYSLER LLC

4. If equipped, install the positive battery terminal lead (1) to the air cleaner housing.

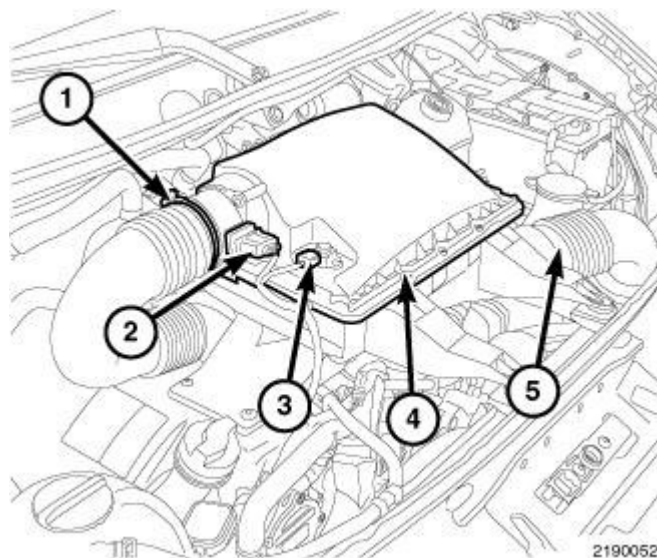


Fig. 52: MAF HARNESS CONNECTOR & INTAKE AIR PRESSURE SENSOR
Courtesy of CHRYSLER LLC

5. Connect the air cleaner inlet tube (5).
6. Loosen Connect the air cleaner outlet tube to the air cleaner housing (4) and tighten the clamp (1).
7. Connect the air intake air pressure sensor (3) harness connectors.
8. Disconnect the Mass Air Flow sensor (MAF) (2) harness connectors.
9. Connect the negative battery cable.

AIR INTAKE SYSTEM

AIR CLEANER

Removal

REMOVAL

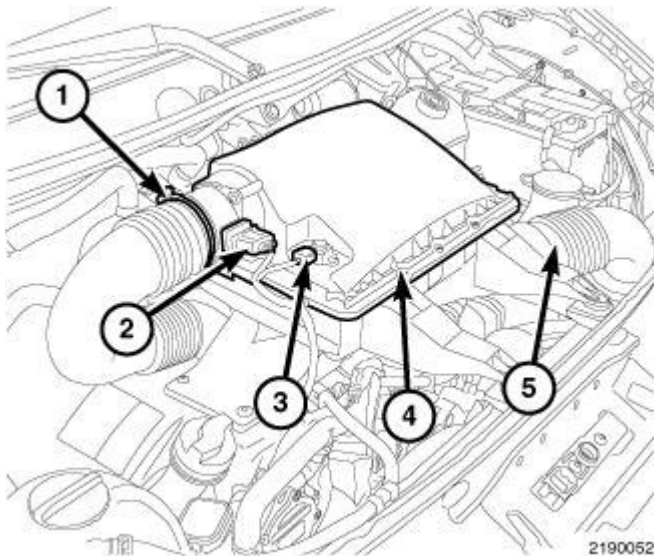


Fig. 53: MAF HARNESS CONNECTOR & INTAKE AIR PRESSURE SENSOR

Courtesy of CHRYSLER LLC

NOTE: Housing removal is not necessary for element (filter) replacement.

1. Disconnect the negative battery cable.
2. Loosen the clamp (1) and disconnect the air cleaner outlet tube from the air cleaner housing (4).
3. Disconnect the Mass Air Flow sensor (MAF) (2) harness connectors.
4. Disconnect the air intake air pressure sensor (3) harness connectors.

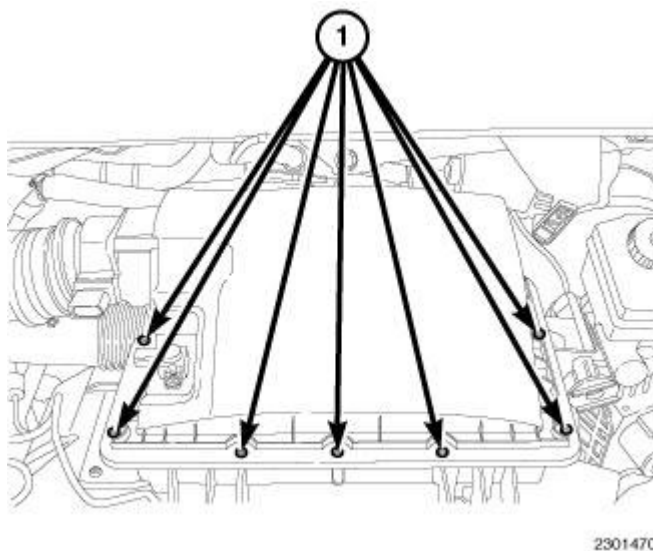
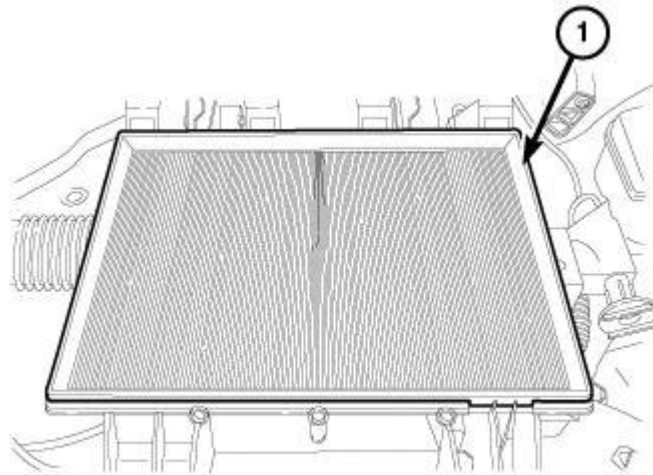


Fig. 54: FASTENERS

Courtesy of CHRYSLER LLC

5. Remove the 7 fasteners (1) and lift up on the cover.

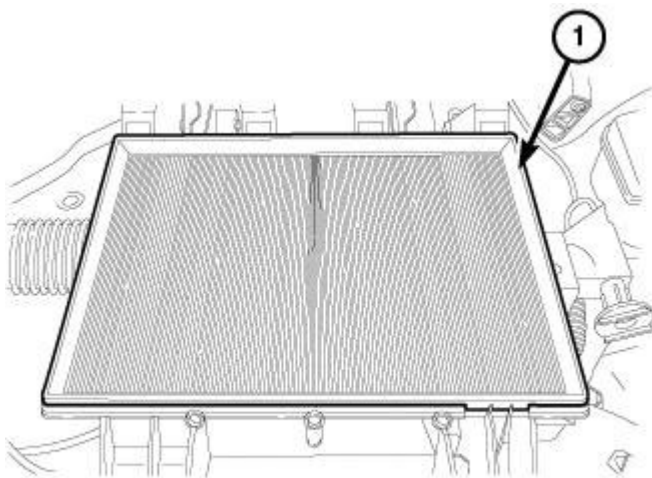


2301496

Fig. 55: AIR CLEANER ELEMENT

Courtesy of CHRYSLER LLC

6. Remove air cleaner element (2) from housing.

Installation**INSTALLATION**

2301496

Fig. 56: AIR CLEANER ELEMENT

Courtesy of CHRYSLER LLC

NOTE: Clean and inspect the air cleaner housing.

1. Install the air filter element into housing (1).

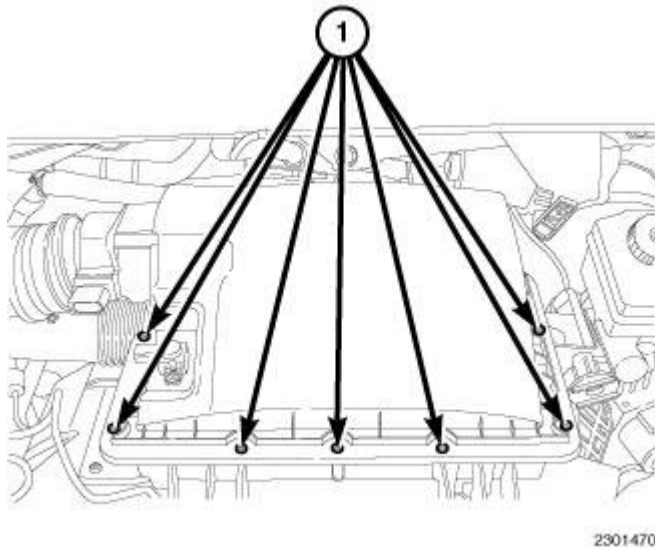


Fig. 57: FASTENERS
Courtesy of CHRYSLER LLC

2. Position housing cover into rear housing locating tabs and seat the cover onto housing. Securely tighten the fasteners (1).

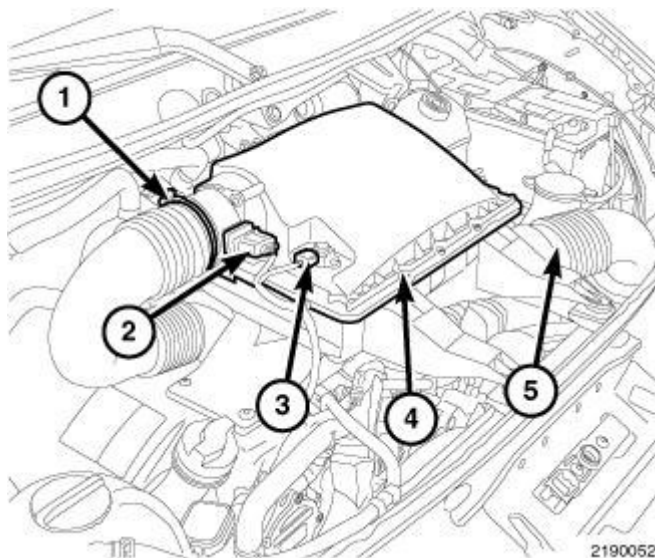


Fig. 58: MAF HARNESS CONNECTOR & INTAKE AIR PRESSURE SENSOR
Courtesy of CHRYSLER LLC

3. Connect air intake outlet tube to air cleaner housing. Tighten clamp (1) to 5 N.m (44 in. lbs.).
4. Connect the Mass Air Flow sensor (MAF) (2) harness connectors.

5. Connect the air intake air pressure sensor (3) harness connectors.
6. Connect the negative battery cable.

BODY, AIR CLEANER

Removal

REMOVAL

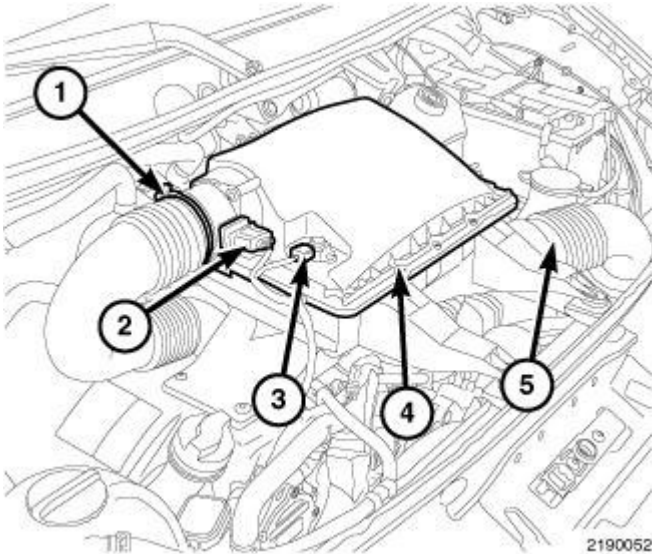


Fig. 59: MAF HARNESS CONNECTOR & INTAKE AIR PRESSURE SENSOR
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Disconnect the Mass Air Flow sensor (MAF) (2) harness connectors.
3. Disconnect the air intake air pressure sensor (3) harness connectors.
4. Loosen the clamp (1) and disconnect the air cleaner outlet tube from the air cleaner housing (4).
5. Disconnect the air cleaner inlet tube (5).

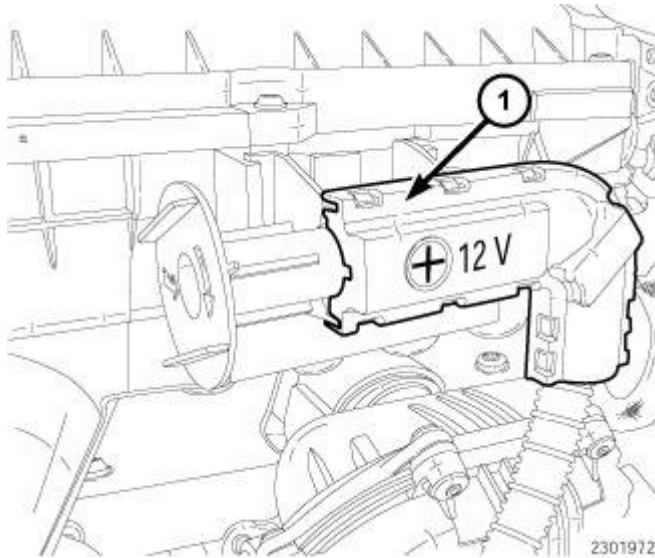


Fig. 60: POSITIVE BATTERY TERMINAL LEAD

Courtesy of CHRYSLER LLC

NOTE: The lock tab is located on the bottom of the terminal.

6. If equipped, release the lock tab and pull up to remove the positive battery terminal lead (1) from the air cleaner housing.

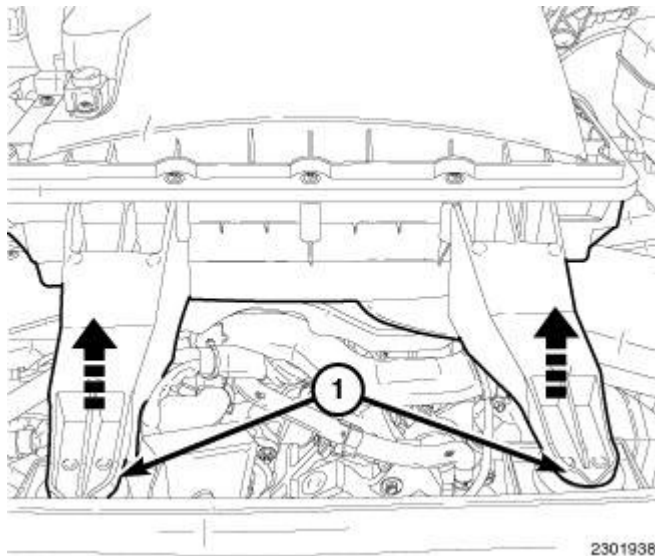


Fig. 61: AIR CLEANER ASSEMBLY

Courtesy of CHRYSLER LLC

7. Pulling upward to release the front tabs (1) and remove the air cleaner assembly.

Intake Air Tube

NOTE: The air cleaner assembly should already be removed.

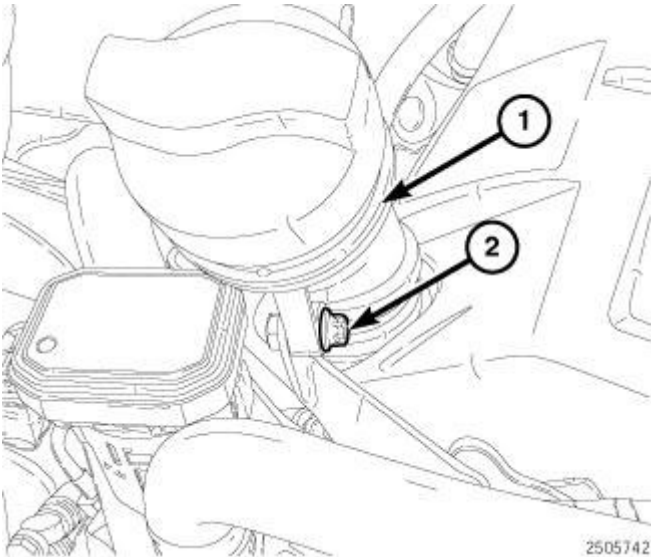


Fig. 62: OIL FILL TUBE & BOLT
Courtesy of CHRYSLER LLC

1. Remove the bolt (2) and the oil fill tube (1).

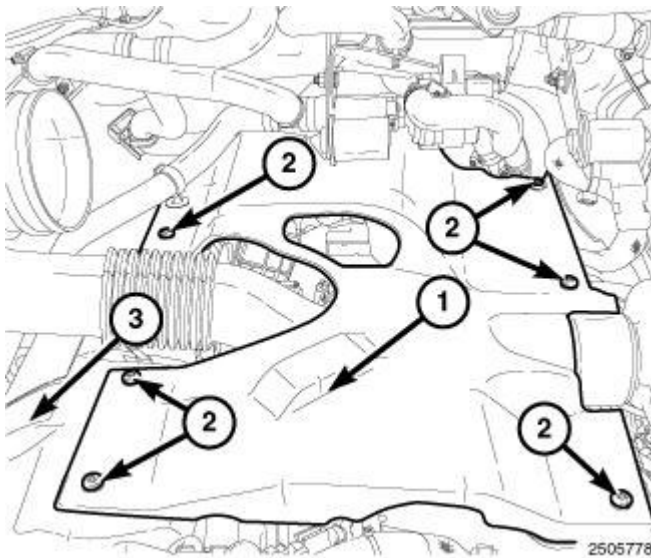


Fig. 63: ENGINE COVER
Courtesy of CHRYSLER LLC

2. Remove bolts (2) and the engine cover (1).
3. Remove the insulating cover (3) from the cylinder head cover.

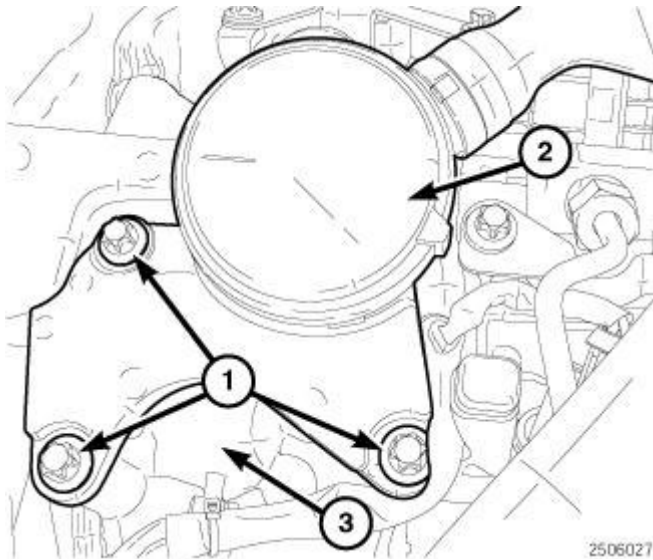


Fig. 64: CCV & CYLINDER HEAD COVER

Courtesy of CHRYSLER LLC

NOTE: During removal of the CCV, DO NOT disconnect CCV hose at the Air Tube.

4. Remove bolts (1) and the CCV (2) from cylinder head cover (3).

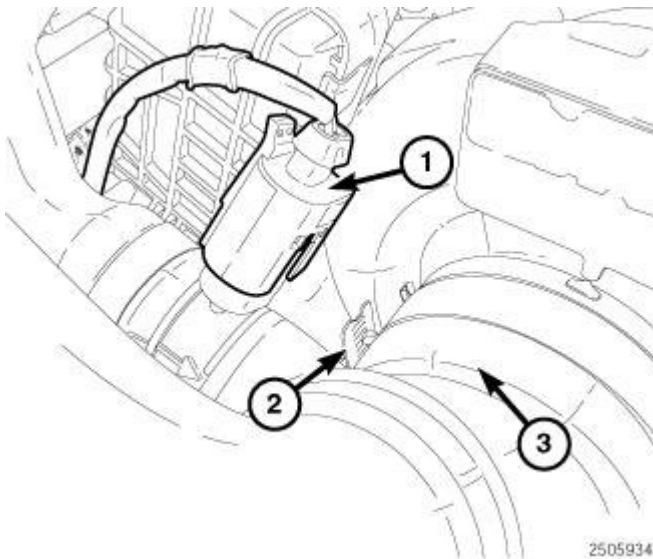


Fig. 65: CCV HEATER HARNESS CONNECTOR

Courtesy of CHRYSLER LLC

5. Disconnect the CCV heater harness connector (1).
6. Loosen the clamp (2) on the turbocharger inlet end.
7. Remove the intake air tube (3) from turbocharger and ensure that orange seal is not rolled or damaged.

Installation

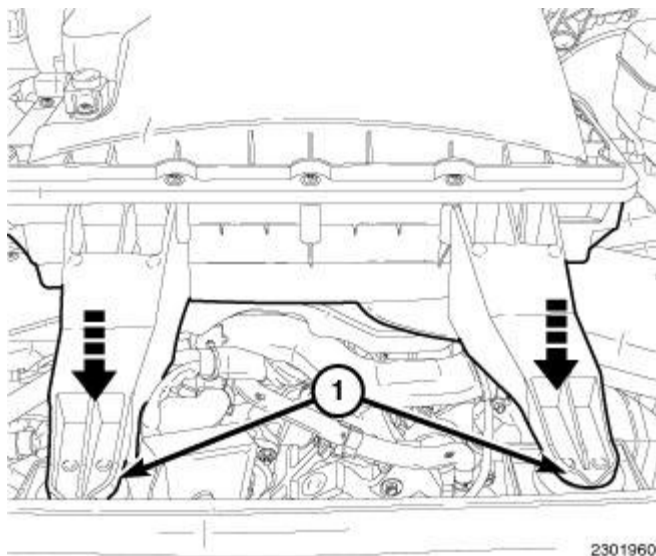
INSTALLATION

Fig. 66: AIR CLEANER ASSEMBLY
Courtesy of CHRYSLER LLC

1. Position the air cleaner assembly and push down on the front tabs (1) to lock in place.

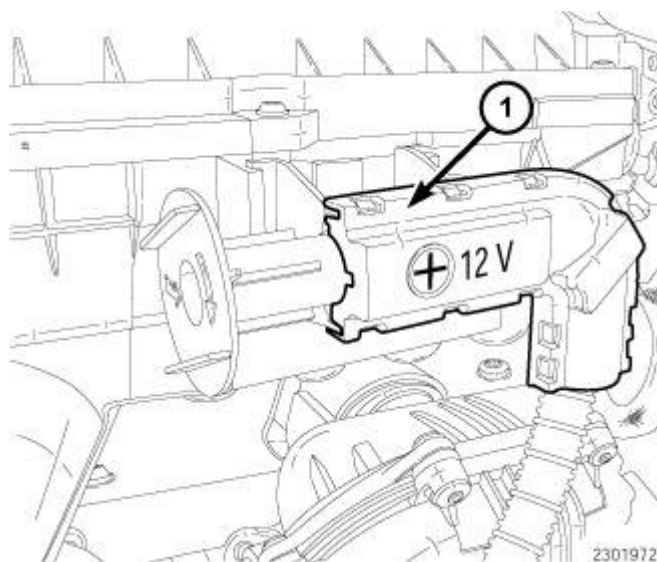


Fig. 67: POSITIVE BATTERY TERMINAL LEAD
Courtesy of CHRYSLER LLC

2. Install the positive battery terminal lead (1) to the air cleaner housing.

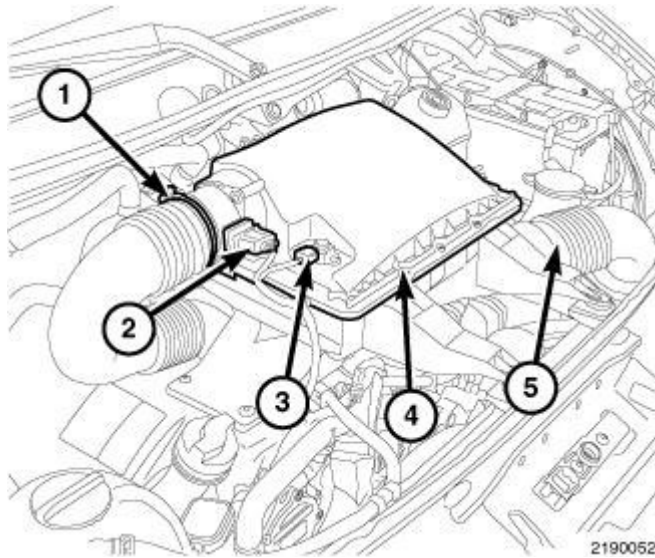


Fig. 68: MAF HARNESS CONNECTOR & INTAKE AIR PRESSURE SENSOR
Courtesy of CHRYSLER LLC

3. Connect the air cleaner inlet tube (5).
4. Loosen Connect the air cleaner outlet tube to the air cleaner housing (4) and tighten the clamp (1).
5. Connect the air intake air pressure sensor (3) harness connectors.
6. Disconnect the Mass Air Flow sensor (MAF) (2) harness connectors.
7. Connect the negative battery cable.

Intake Air Tube

NOTE: The air cleaner assembly should already be removed.

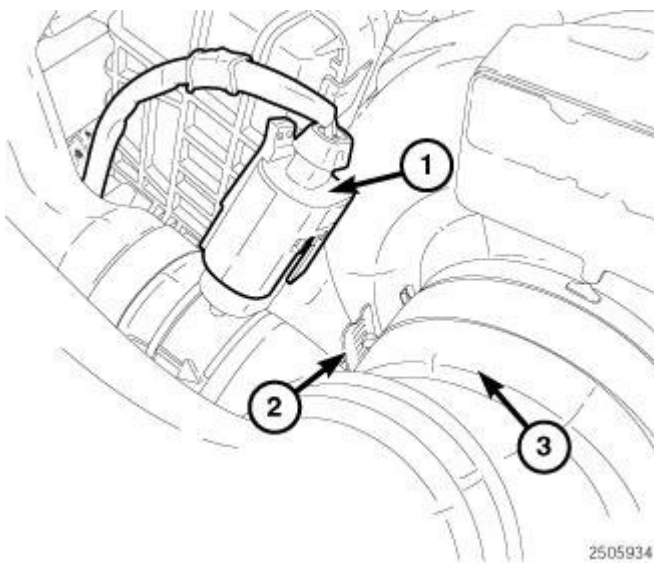


Fig. 69: CCV HEATER HARNESS CONNECTOR
Courtesy of CHRYSLER LLC

NOTE: Incorrect installation or miss alignment of the air tube or the CCV can result in leaks.

1. Install air Inlet tube (3) onto turbocharger inlet and ensure that orange seal is not rolled and is proper positioned.
2. Securely tighten the clamp (2) on the turbocharger inlet.
3. Connect the CCV heater harness connector (1).

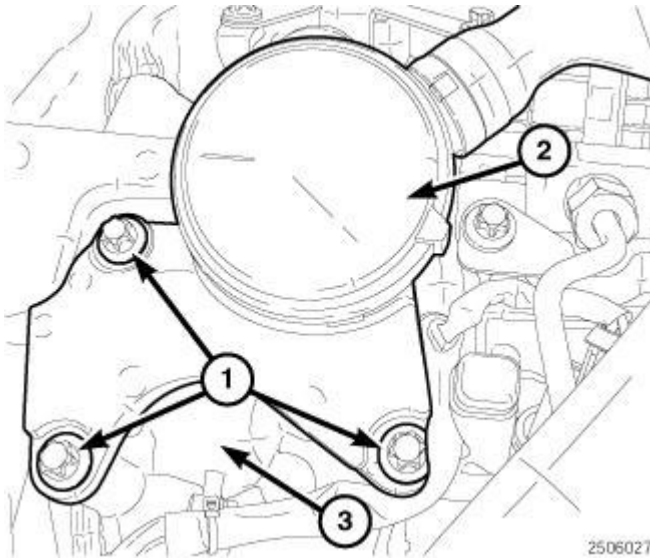


Fig. 70: CCV & CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

NOTE: During installation of the CCV, DO NOT disconnect CCV hose at the Air Tube.

4. Install the CCV (2) onto the cylinder head cover (3). Tighten bolts (1) to 10 N.m (89 in. lbs.).

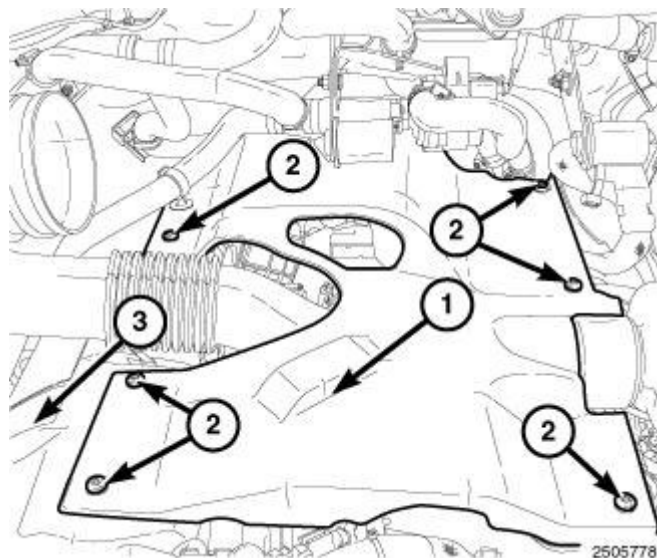


Fig. 71: ENGINE COVER
Courtesy of CHRYSLER LLC

5. Install the insulating cover (3) unto the cylinder head cover.
6. Install the engine cover (1) and tighten retaining bolts (2).

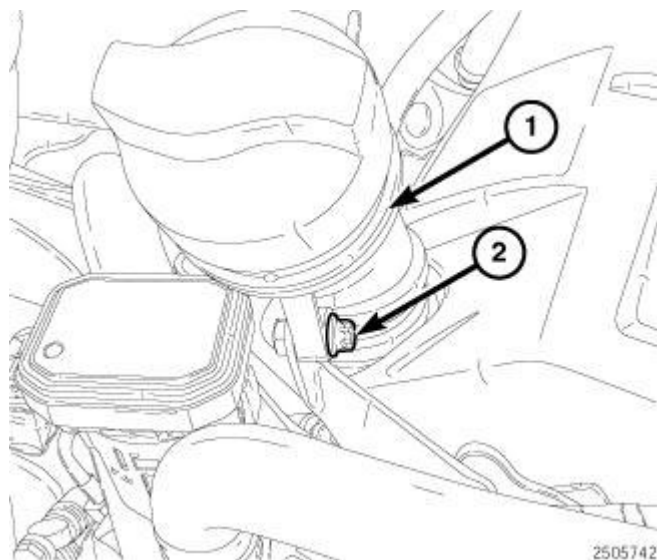


Fig. 72: OIL FILL TUBE & BOLT
Courtesy of CHRYSLER LLC

7. Install the oil fill tube (1). Tighten bolt (2) to 9 N.m (80 in. lbs.).

CYLINDER HEAD

DESCRIPTION

DESCRIPTION

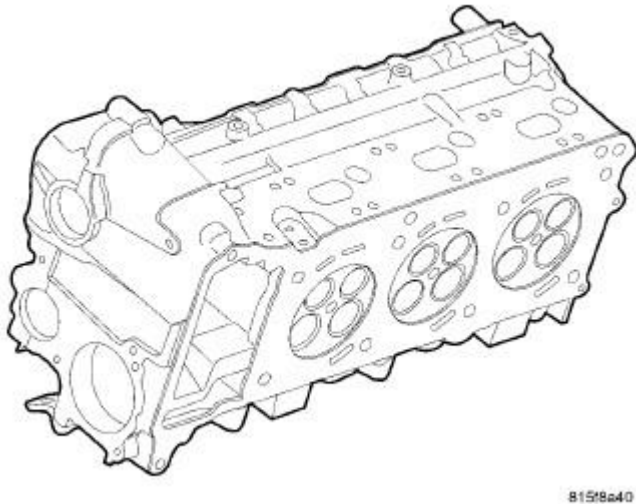


Fig. 73: CYLINDER HEAD
Courtesy of CHRYSLER LLC

The cylinder heads on the 3.0L V-6 Diesel Engine must withstand high thermal and mechanical loads due to the high specific output and combustion peak pressures of up to 175 bar (2,540 psi). The cylinder heads are of a cross-flow design and have the following features:

- High-Strength Cast Aluminum Alloy Construction.
- Four Valves per Cylinder.
- Roller Finger Followers/Lifter Assemblies.
- Pressed-in Valve Guides and Valve Seats.

The 3.0L aluminum, overhead valve cylinder heads are made of high strength aluminum alloy and are each equipped with two camshafts, roller finger followers/lifter assemblies and four valve technology. The cylinder head itself is not resurfacing. The cylinder head uses a Multi-layered Steel gasket for sealing.

The valve seats and valve guides are not serviceable. The position of the valves in relation to the cylinder head surface is measured to determine if excessive wear exists. This dimension is referred to as valve setback. See [Standard Procedure](#) for the proper procedure. If the setback dimension is less than what is specified, replace the cylinder head.

STANDARD PROCEDURE

CYLINDER HEAD BOLT INSPECTION

1. Measure cylinder head bolts between points shown.

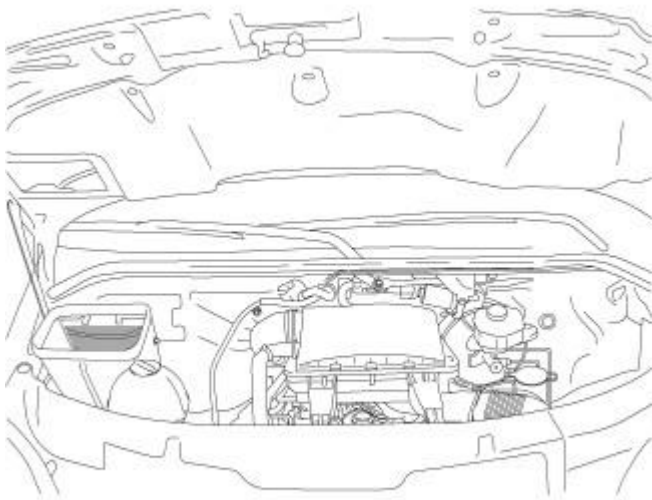
Cylinder Head Bolts	Thread Diameter	12 mm
-	Length When New	205 mm

Maximum Length	207 mm
----------------	--------

2. If the cylinder head bolt length is greater than the maximum allowable measurement, replace the cylinder head bolts.

REMOVAL

LEFT



81b73043

Fig. 74: OPEN HOOD

Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove engine cover (3) and brackets.

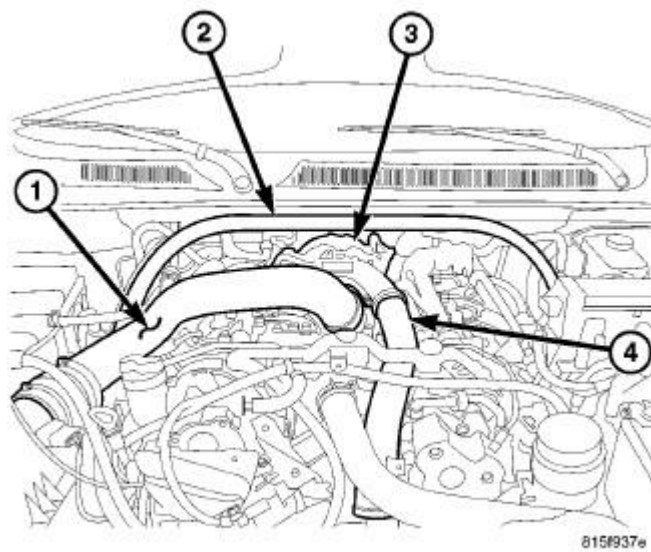


Fig. 75: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - AIR CLEANER OUTLET TUBE
2 - STRUT TOWER SUPPORT
3 - TURBOCHARGER
4 - CHARGE AIR INLET TUBE |
|---|

3. Remove the strut tower support (2).
4. Remove the air cleaner outlet tube (1).
5. Remove the charge air inlet tube (4).
6. Drain cooling system.
7. Disconnect the vacuum hose at the vacuum pump and set aside.
8. Remove upper radiator hose.
9. Disconnect the coolant reservoir hose at thermostat housing and set aside.

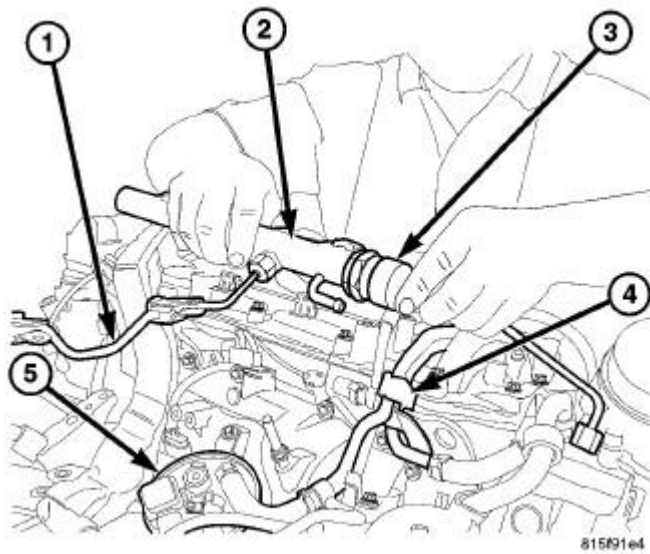


Fig. 76: LEFT FUEL RAIL REMOVAL
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - FUEL RAIL TRANSFER LINE
 2 - LEFT FUEL RAIL
 3 - FUEL RAIL SOLENOID
 4 - LOW FUEL PRESSURE SUPPLY AND RETURN LINE JUNCTION
 5 - FUEL FILTER</p> |
|--|

10. Disconnect the fuel supply and return hose quick connects at the left cylinder head cover.
11. Loosen the high pressure fuel pipes at the fuel rail (2) and disconnect the high pressure fuel pipes at the left injectors.
12. Disconnect the high pressure fuel line at the high pressure pump.
13. Disconnect the fuel rail solenoid (3) wiring harness connector and remove the left fuel rail (2) along with the fuel rail transfer pipe (1).
14. Remove the low pressure fuel supply and return pipe bundle (4) fasteners.

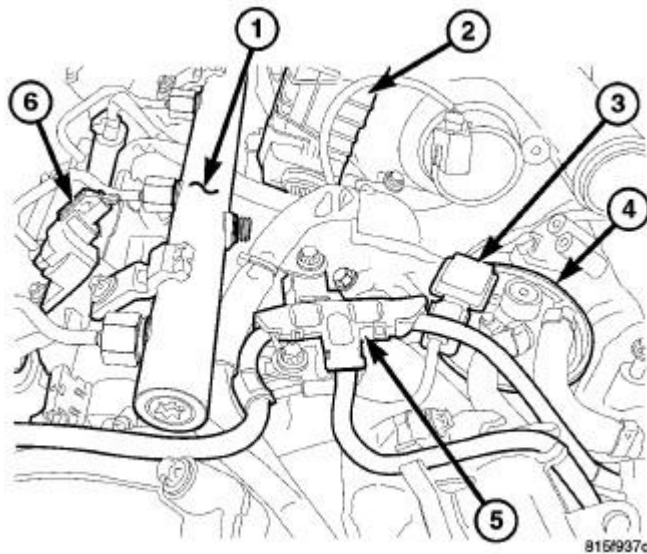
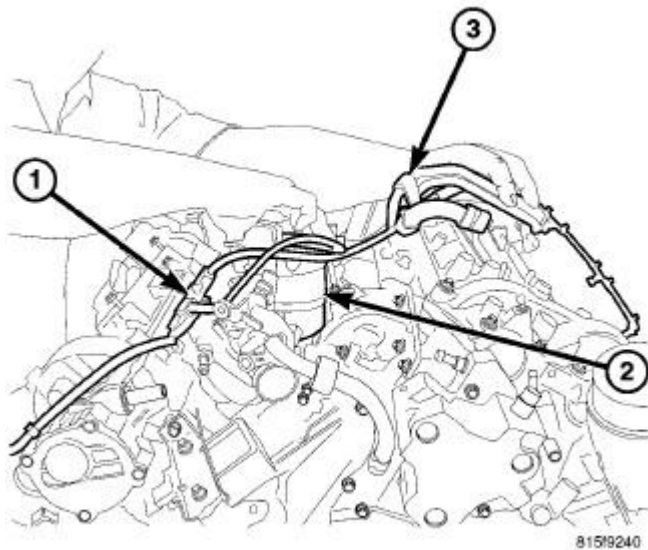


Fig. 77: RETURN FUEL HOSE BUNDLE
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - RIGHT FUEL RAIL
2 - TURBOCHARGER SERVO MOTOR
3 - WATER IN FUEL SENSOR
4 - FUEL FILTER
5 - RETURN FUEL HOSE BUNDLE
6 - CAMSHAFT POSITION SENSOR</p> |
|---|

15. Disconnect the right fuel rail pressure sensor and remove the fuel rail.
16. Disconnect the camshaft position sensor (CMP) (6), the right fuel injector wiring harness connectors, the right return fuel hoses from the injectors.
17. Remove the return fuel bundle fasteners (5).
18. Disconnect the water in fuel sensor (3) (if equipped) and the turbocharger servo motor (2) harness connectors.
19. Remove the fuel filter (4) bracket fasteners.
20. Disconnect the fuel return hose bundle (5), engine ground strap, at the right front of the intake manifold.

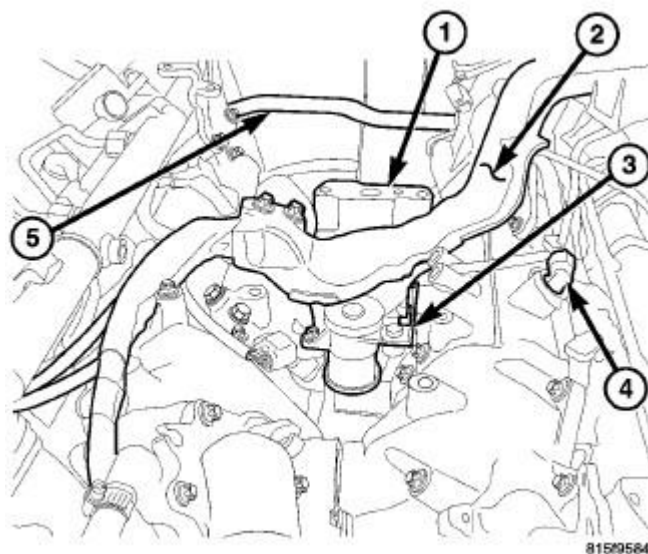
**Fig. 78: FUEL FILTER, LINES AND HOSES**

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - RETURN FUEL HOSE BUNDLE |
| 2 - FUEL FILTER |
| 3 - LOW PRESSURE FUEL SUPPLY AND RETURN PIPE |

NOTE: Fuel filter assembly, hoses and lines may seep fuel. Capture any fuel spillage and store in appropriately marked containers.

21. Remove the fuel filter (2), hose (1) and pipe (3) assemblies and position aside.

**Fig. 79: MAIN ENGINE WIRING HARNESS**

Courtesy of CHRYSLER LLC

- 1 - TURBOCHARGER OIL HOUSING ADAPTOR
- 2 - MAIN ENGINE WIRING HARNESS
- 3 - SWIRL VALVE ACTUATOR
- 4 - COOLANT TEMPERATURE SENSOR

22. Remove the turbocharger. See **Removal** .

NOTE: Observe the way the engine oil supply and return ports in the turbocharger adaptor housing align to the engine block for oil flow through the turbocharger. Failure to do so will result in immediate turbocharger failure.

23. Remove turbocharger oil housing adaptor (1).
24. Disconnect the swirl valve actuator (3), glow plugs, EGR pressure sensor and coolant temperature sensor (4) wiring harness connector.
25. Remove the main engine wiring harness (2) fasteners and position the harness aside.

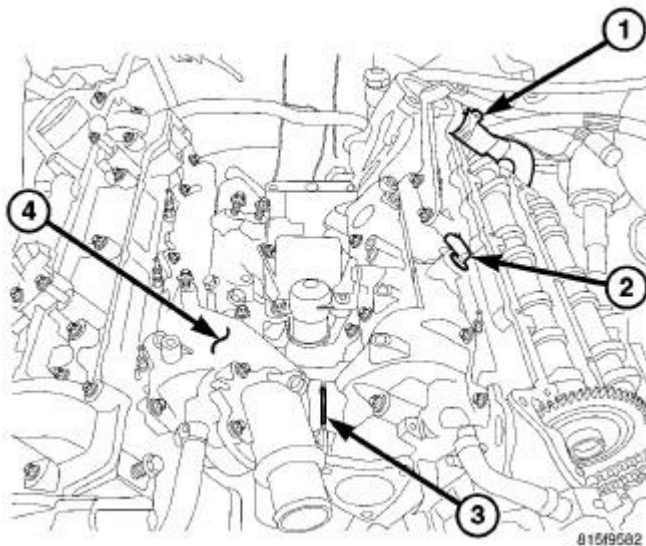


Fig. 80: INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

- 1 - EGR COOLANT PIPE
- 2 - COOLANT TEMPERATURE SENSOR
- 3 - INTAKE COOLANT PASSAGE
- 4 - INTAKE MANIFOLD

26. Disconnect the EGR coolant pipe (1) from the rear of the EGR housing.
27. Remove the EGR valve.

NOTE: The intake manifold is of the split design meaning that there are two halves. Whenever the intake manifold is removed, inspect the shared coolant passage (3) in the front of the intake manifold for leaks, repair as necessary.

28. Remove the intake manifold.

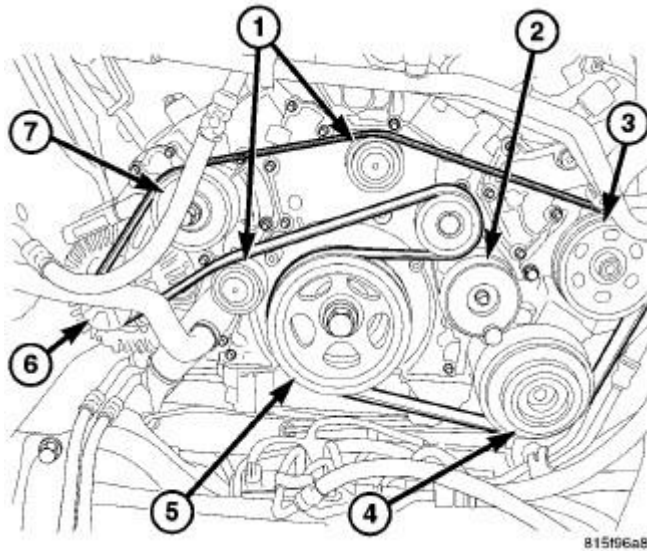


Fig. 81: ACCESSORY DRIVE BELT
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - IDLER PULLEYS
2 - DRIVE BELT TENSIONER
3 - POWER STEERING PUMP
4 - AIR CONDITIONING COMPRESSOR
5 - VIBRATION DAMPER
6 - GENERATOR
7 - WATER PUMP |
|--|

29. Remove the accessory drive belt.
30. Remove the two idler pulleys (1).
31. Remove the belt tensioner (2).

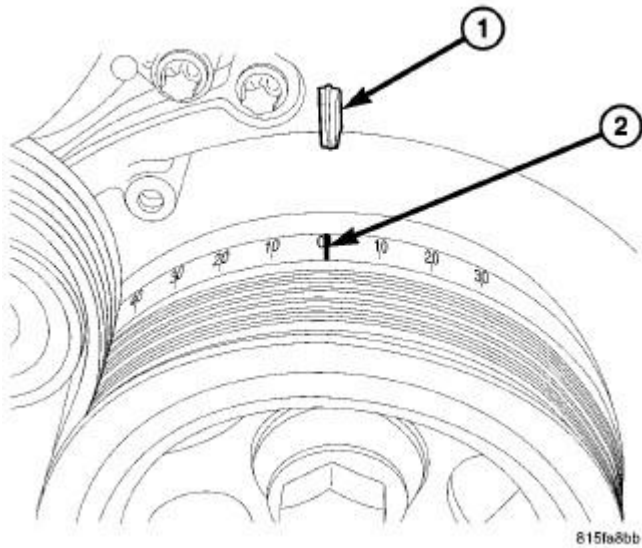


Fig. 82: VIBRATION DAMPER
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - TDC MARK ON TIMING COVER
2 - VIBRATION DAMPER TDC MARK</p> |
|---|

32. Rotate the engine by the vibration damper bolt, to TDC.
33. Raise and support the vehicle.
34. Remove right side starter blank.
35. Disconnect the hydraulic cooling fan lines and capture the fluid in a approved and clearly marked container.

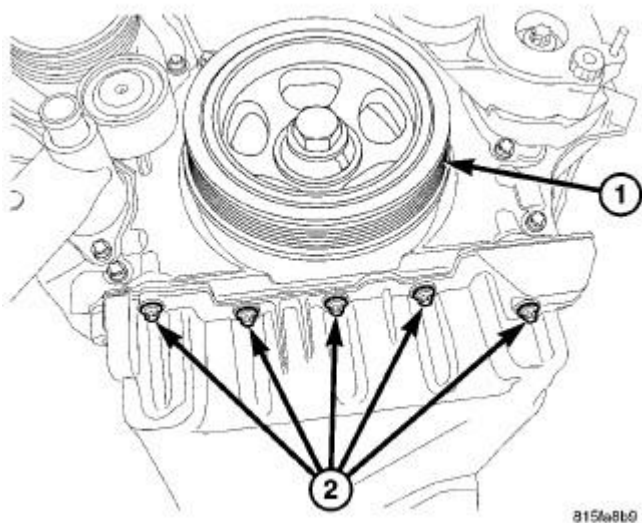


Fig. 83: VIBRATION DAMPER & FRONT OIL PAN BOLTS

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - VIBRATION DAMPER
2 - OIL PAN BOLTS |
|---|

- 36. Remove the front oil pan retaining bolts (2).
- 37. Lower the vehicle.

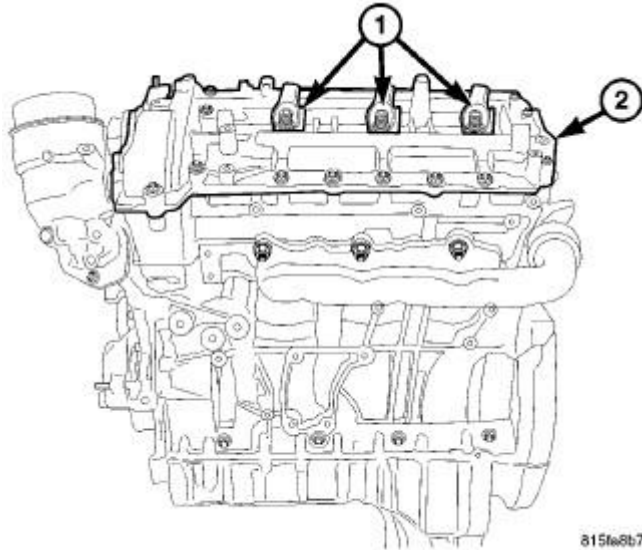
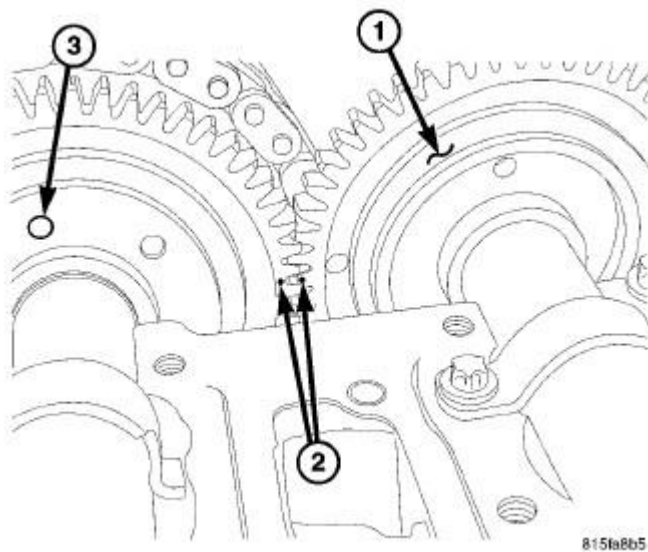


Fig. 84: LEFT CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

- 38. Remove the left rear heater hose retainer.
- 39. Remove the left fuel injectors (1).
- 40. Disconnect the vacuum supply hose.
- 41. Remove the oil filter housing bracket.

CAUTION: The timing cover is sealed with Mopar® sealant that may be difficult when separating components. If the component are difficult to separate heat the sealed edges or area with a heat gun. DO NOT use any heat source that works with flame.

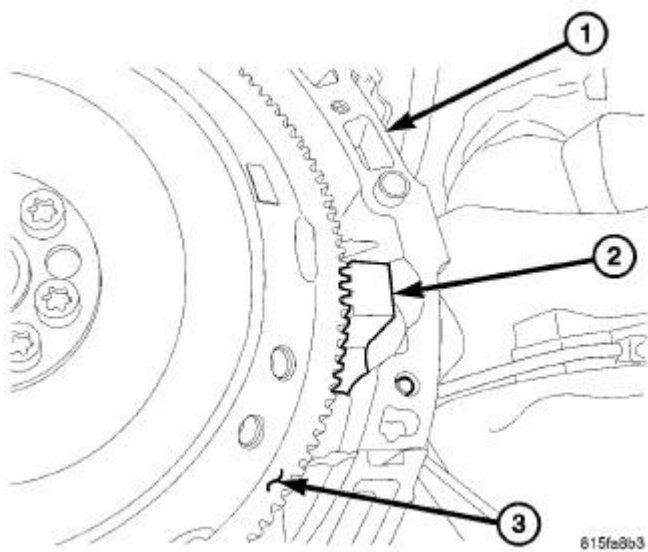
- 42. Remove the left cylinder head cover.

**Fig. 85: CAMSHAFT GEAR ALIGNMENT**

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - CAMSHAFT GEAR
2 - CAMSHAFT GEAR ALIGNMENT MARKS
3 - CAMSHAFT DRIVE GEAR DOWEL POSITION |
|--|

43. Observe the left camshaft gear alignment marks (2) on the rear of the camshaft gears (1,3). If they are together, continue with the next step. If the left camshaft alignment marks (2) are separated, rotate the engine by the vibration damper another 360 degrees, until camshaft marks (2) align together and the vibration damper reaches TDC.

**Fig. 86: SPECIAL TOOL # 9102**

Courtesy of CHRYSLER LLC

- 1 - ENGINE BLOCK
- 2 - SPECIAL TOOL #9102
- 3 - FLEX PLATE

- 44. Raise and support the vehicle.
- 45. Install the Flywheel Locking tool 9102 crankshaft lock into the starter access blank.
- 46. Lower the vehicle.

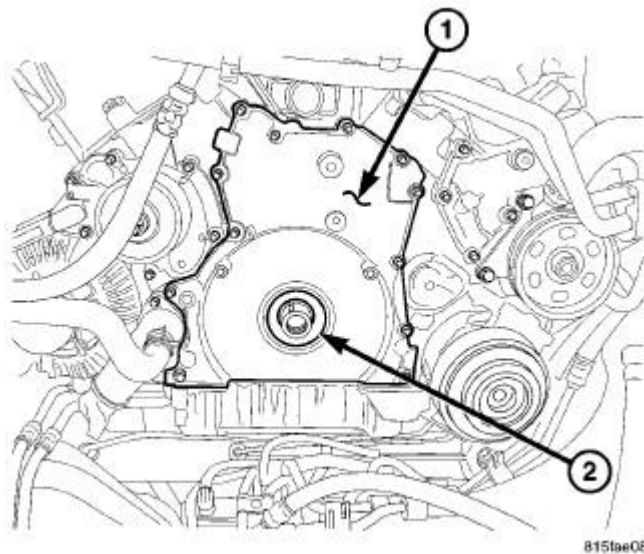


Fig. 87: FRONT TIMING COVER
Courtesy of CHRYSLER LLC

- 1 - TIMING CHAIN COVER
- 2 - FRONT CRANKSHAFT SEAL

- 47. Remove the cooling fan module.
- 48. Remove the vibration damper.

CAUTION: The timing cover is sealed with Mopar® sealant that may be difficult when separating components. If the component are difficult to separate heat the sealed edges or area with a heat gun. DO NOT use any heat source that works with flame.

- 49. Remove front timing chain cover.

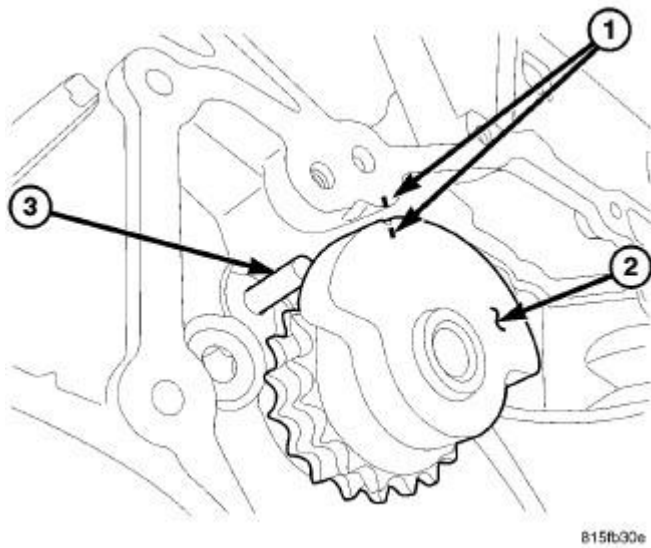


Fig. 88: BALANCE SHAFT INDEXING
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - PAINT MARK OR SCRIBE
2 - BALANCE SHAFT
3 - TIMING CHAIN OILING JET |
|--|

50. Paint mark or scribe the balance shaft (2) position to the engine block (1) and timing chain.
51. Paint mark or scribe the timing chain to crankshaft gear and camshaft drive gear relation.
52. Raise and support the vehicle.
53. Remove special tool #9102 crankshaft locking tool.
54. Lower the vehicle.

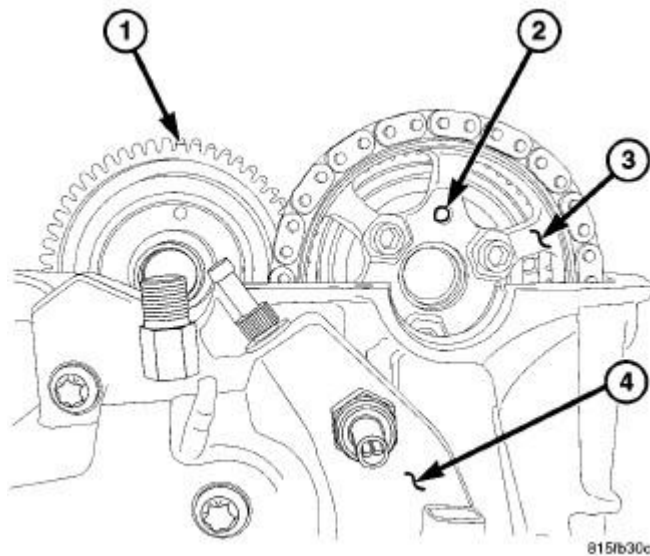


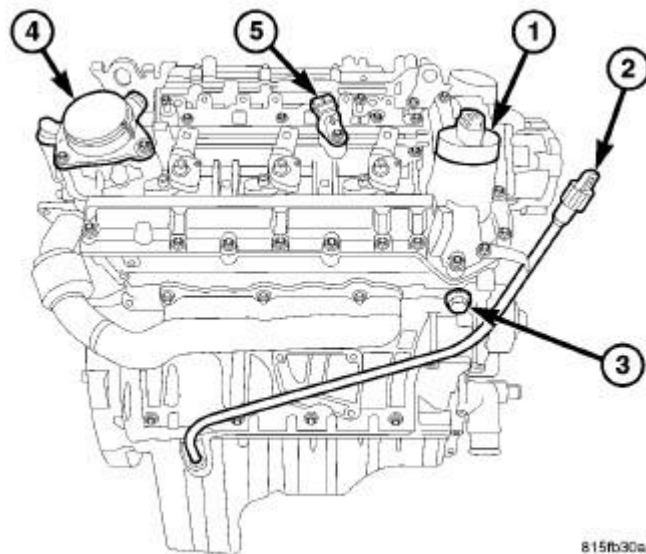
Fig. 89: LEFT EXHAUST CAMSHAFT DRIVE GEAR ALIGNMENT DOWEL
Courtesy of CHRYSLER LLC

- 1 - LEFT INTAKE CAMSHAFT
- 2 - LEFT EXHAUST CAMSHAFT DRIVE GEAR ALIGNMENT DOWEL
- 3 - LEFT EXHAUST CAMSHAFT DRIVE GEAR
- 4 - HIGH PRESSURE FUEL INJECTION PUMP

55. Remove the high pressure fuel pump (4). Refer to **Fuel System/Fuel Delivery/PUMP, Fuel - Removal**.
56. Rotate the engine and remove the left camshaft drive gear (3) lower bolt.

NOTE: The left exhaust camshaft drive gear (3) dowel pin should align at approximately the 12 O'clock position when viewing through the camshaft seal access hole.

57. Rotate the engine back to TDC and check the alignment marks at the balance shaft, camshaft gear and crankshaft gear.

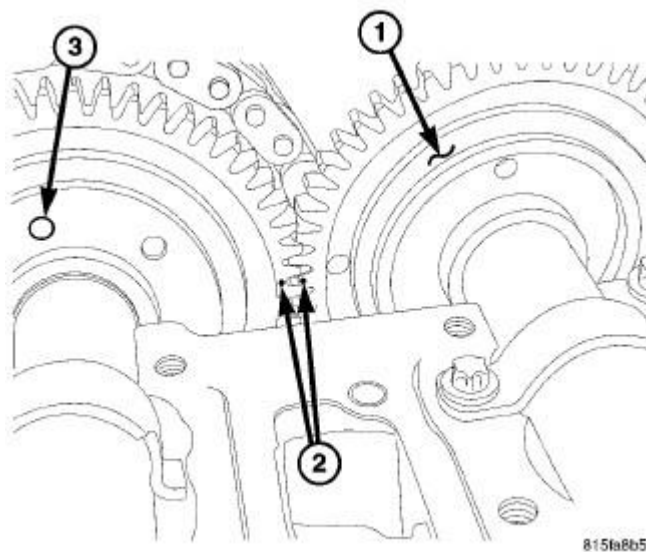


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Fig. 90: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- 1 - ENGINE OIL CAP
- 2 - OIL LEVEL INDICATOR
- 3 - TIMING CHAIN TENSIONER
- 4 - OIL SEPARATOR ASSEMBLY
- 5 - CAMSHAFT POSITION SENSOR

58. Remove the timing chain tensioner (3) .



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Fig. 91: CAMSHAFT GEAR ALIGNMENT
Courtesy of CHRYSLER LLC

- 1 - CAMSHAFT GEAR
- 2 - CAMSHAFT GEAR ALIGNMENT MARKS
- 3 - CAMSHAFT DRIVE GEAR DOWEL POSITION

59. Remove the remaining left camshaft drive gear (3) retaining bolts.
60. Separate the left camshaft drive gear (3) and chain from camshaft.

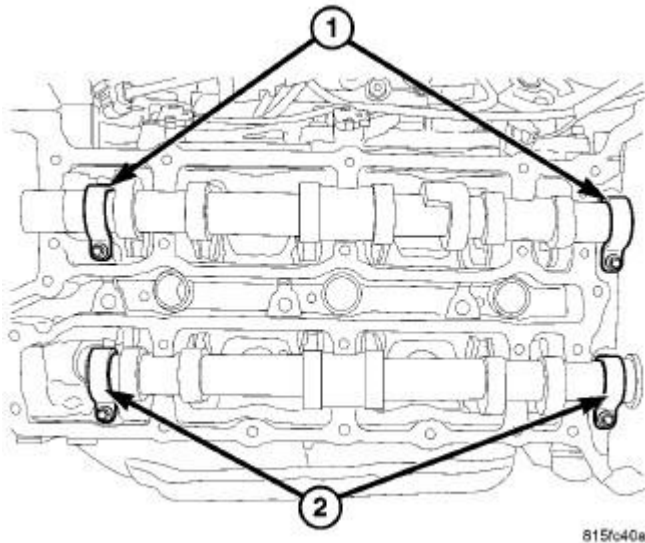


Fig. 92: CAMSHAFT RETAINERS
Courtesy of CHRYSLER LLC

- 1 - INTAKE CAMSHAFT RETAINERS
- 2 - EXHAUST CAMSHAFT RETAINERS

NOTE: Followers and tappets assemblies must be installed in same location as removed.

61. Remove the left camshaft retainers (1 and 2) and camshafts.
62. Remove the left camshaft drive gear.

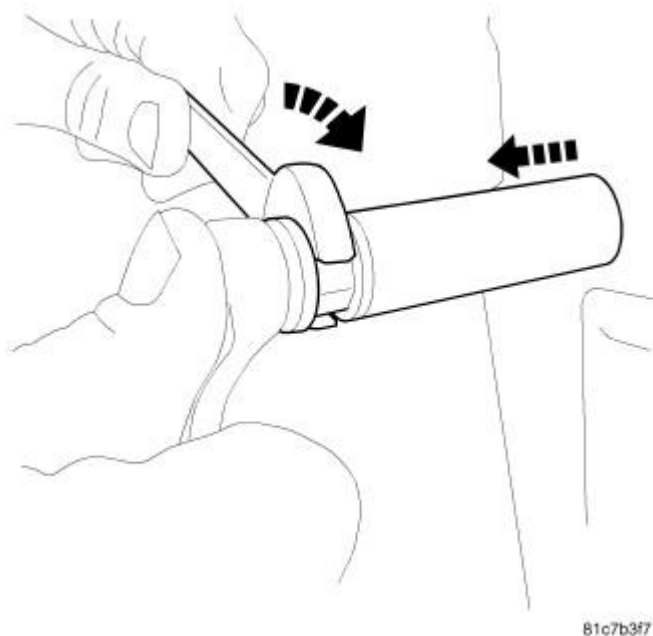


Fig. 93: ROLL PIN REMOVAL
Courtesy of CHRYSLER LLC

63. Make a roll pin tool by using a tube, nut, bolt and washer. Place the nut on the bolt and the bolt through the tube. Thread the bolt into the roll pin and turn the nut to remove the roll pin (as illustrated).

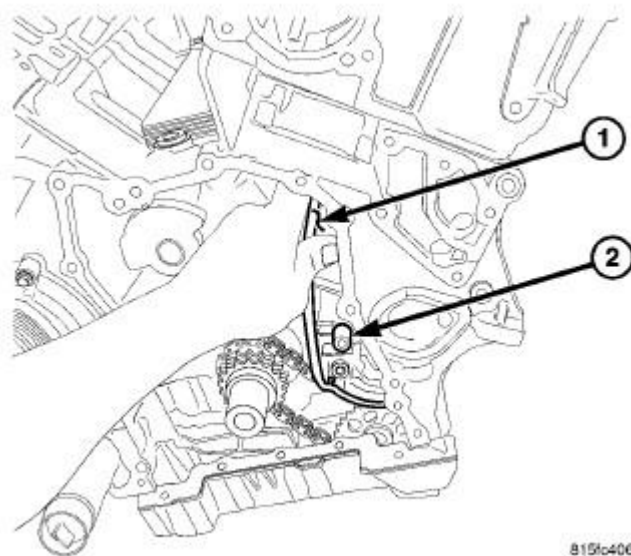


Fig. 94: LEFT LOWER TIMING CHAIN GUIDE AND FASTENER
Courtesy of CHRYSLER LLC

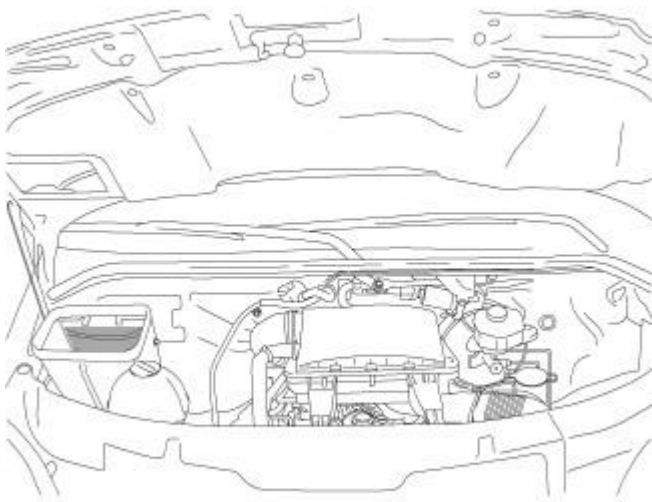
- | |
|---|
| <p>1 - LEFT LOWER TIMING CHAIN GUIDE
2 - FASTENER</p> |
|---|

64. Remove the left lower timing chain guide fastener (2) and guide (1).

NOTE: **Do Not store the cylinder head on the sealing surface. The glow plugs protrude into the cylinder surface area and may be damaged.**

65. Remove the left cylinder head glow plugs.
66. Remove cylinder head and gasket from engine block.

RIGHT



81b73043

Fig. 95: OPEN HOOD

Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove engine cover (3) and brackets.
3. Remove the strut tower support (2).
4. Drain cooling system.

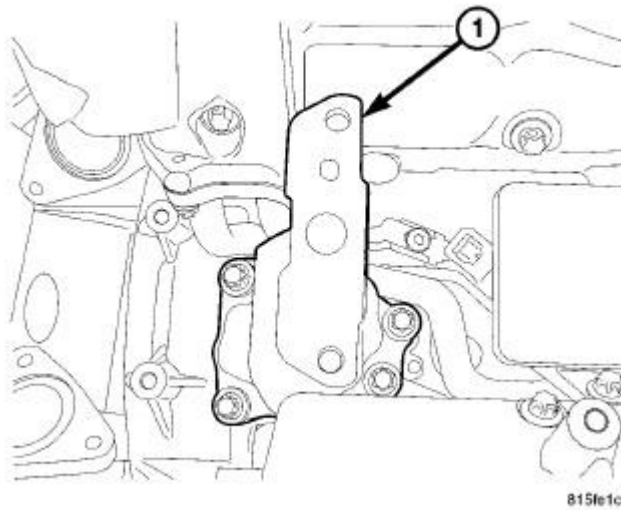


Fig. 96: TURBOCHARGER ADAPTOR
Courtesy of CHRYSLER LLC

1 - TURBOCHARGER ADAPTOR 2 - SWIRL VALVE ACTUATOR
--

5. Remove the turbocharger. See **Removal** .

NOTE: **Observe the way the engine oil supply and return ports in the turbocharger adaptor align to the engine block for oil flow through the turbocharger. Failure to do so will result in immediate turbocharger failure.**

6. Remove turbocharger oil housing adaptor (1).

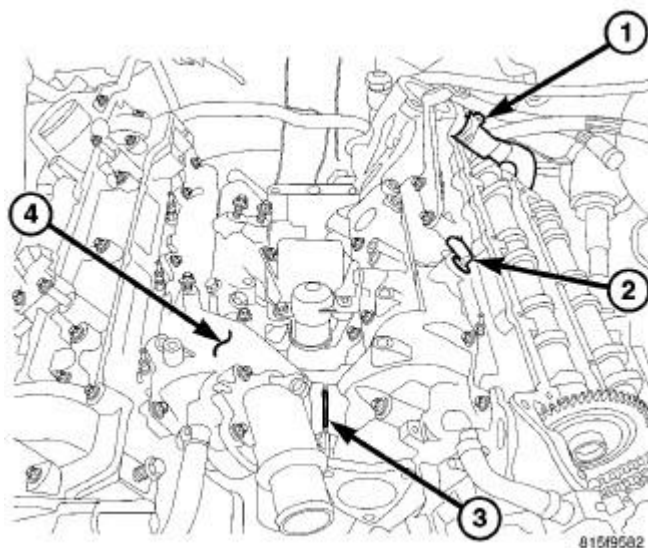


Fig. 97: INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - EGR COOLANT PIPE
2 - COOLANT TEMPERATURE SENSOR
3 - INTAKE COOLANT PASSAGE
4 - INTAKE MANIFOLD</p> |
|---|

7. Remove the intake manifold.

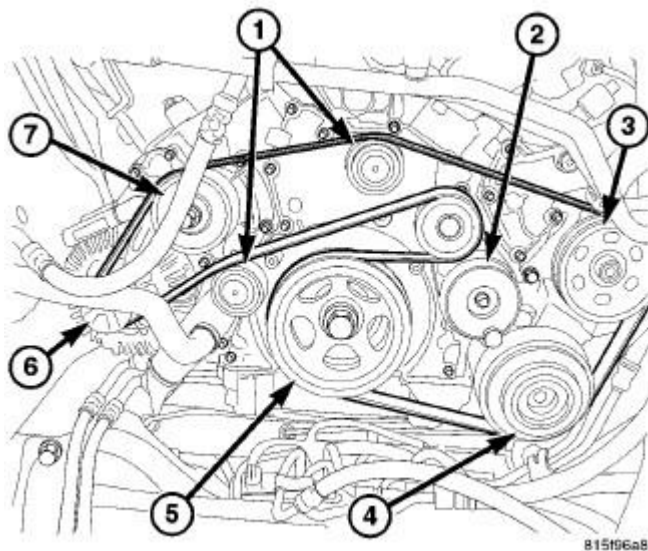


Fig. 98: ACCESSORY DRIVE BELT
Courtesy of CHRYSLER LLC

- 1 - IDLER PULLEYS
- 2 - DRIVE BELT TENSIONER
- 3 - POWER STEERING PUMP
- 4 - AIR CONDITIONING COMPRESSOR
- 5 - VIBRATION DAMPER
- 6 - GENERATOR
- 7 - WATER PUMP

- 8. Remove the accessory drive belt.
- 9. Remove the two idler pulleys (1).
- 10. Remove the belt tensioner (2).

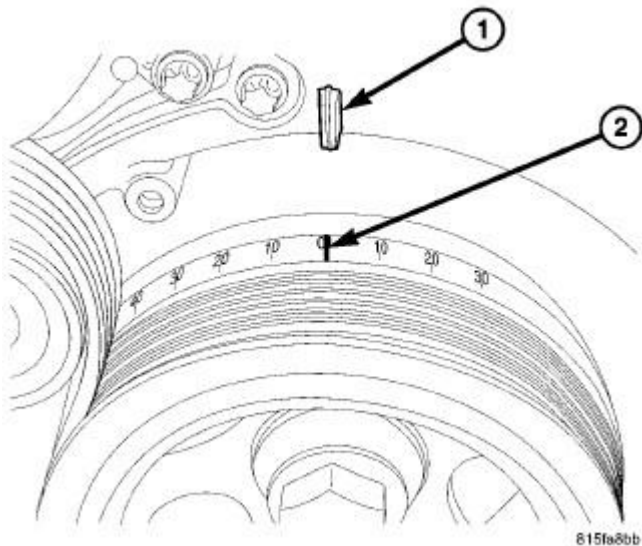


Fig. 99: VIBRATION DAMPER
Courtesy of CHRYSLER LLC

- 1 - TDC MARK ON TIMING COVER
- 2 - VIBRATION DAMPER TDC MARK

- 11. Rotate the engine by the vibration damper bolt, to TDC.
- 12. Raise and support the vehicle.
- 13. Remove right side starter blank.
- 14. Disconnect the hydraulic cooling fan lines and capture the fluid in a approved and clearly marked container.

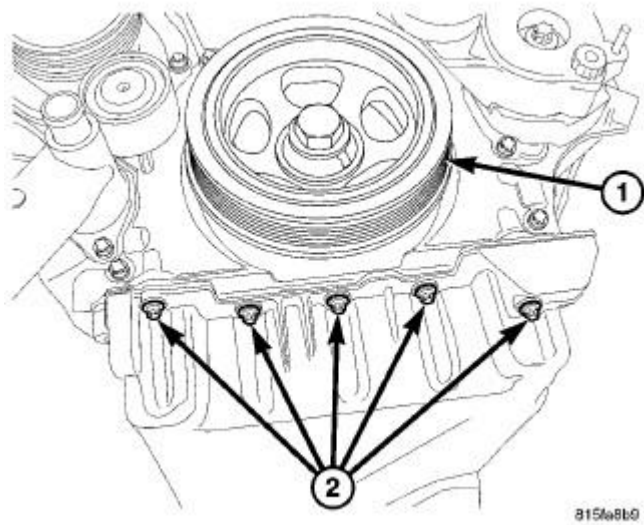


Fig. 100: VIBRATION DAMPER & FRONT OIL PAN BOLTS
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - VIBRATION DAMPER
2 - OIL PAN BOLTS</p> |
|---|

15. Remove the front oil pan retaining bolts.
16. Lower the vehicle.

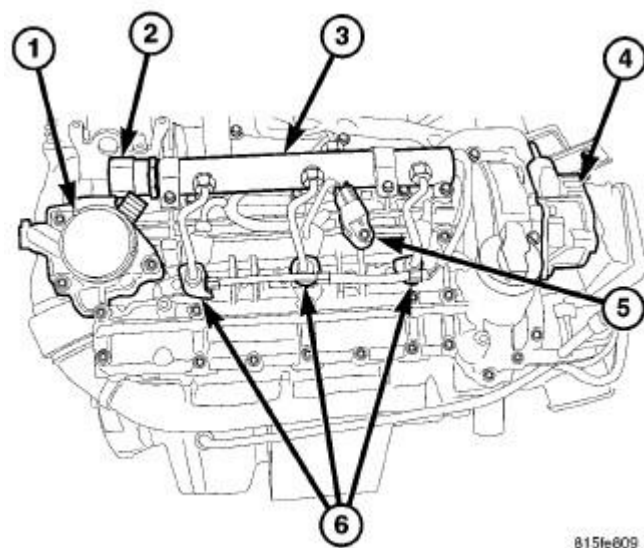


Fig. 101: RIGHT CYLINDER HEAD
Courtesy of CHRYSLER LLC

- | |
|-----------------------------------|
| <p>1 - BREATHER/OIL SEPARATOR</p> |
|-----------------------------------|

- 2 - FUEL RAIL PRESSURE SENSOR
- 3 - FUEL RAIL
- 4 - VACUUM PUMP
- 5 - CAMSHAFT POSITION SENSOR
- 6 - FUEL INJECTORS

17. Remove the breather/oil separator (1) assembly from the right cylinder head cover.
18. Remove the right fuel injectors (6).
19. Remove the fuel rail (3).
20. Disconnect the vacuum supply hose from the vacuum pump (4).
21. Remove the vacuum pump (4).

NOTE: If the cylinder head cover is difficult to remove, DO NOT PRY or damage the cover. Use a heat gun to warm the sealing surface until the cover can be removed.

22. Remove the right cylinder head cover.

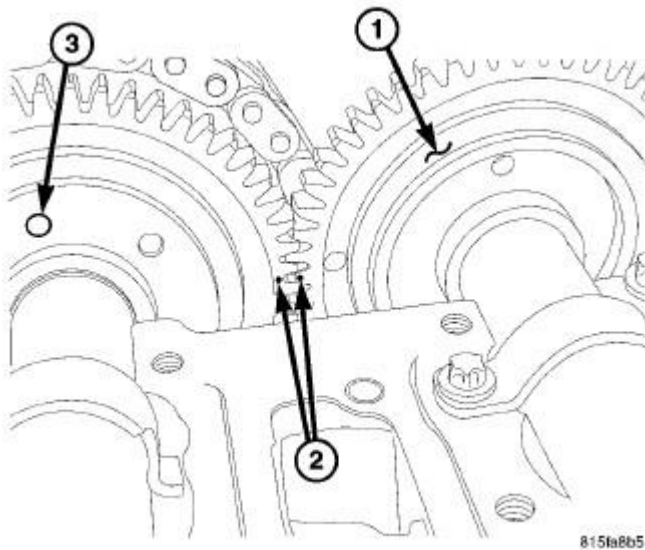


Fig. 102: CAMSHAFT GEAR ALIGNMENT

Courtesy of CHRYSLER LLC

- 1 - CAMSHAFT GEAR
- 2 - CAMSHAFT GEAR ALIGNMENT MARKS
- 3 - CAMSHAFT DRIVE GEAR DOWEL POSITION

23. Observe the right camshaft gear alignment marks (2). If they are together, continue with the next step. If the right camshaft alignment marks are separated, rotate the engine by the vibration damper until camshaft marks align together and the vibration damper reaches TDC.

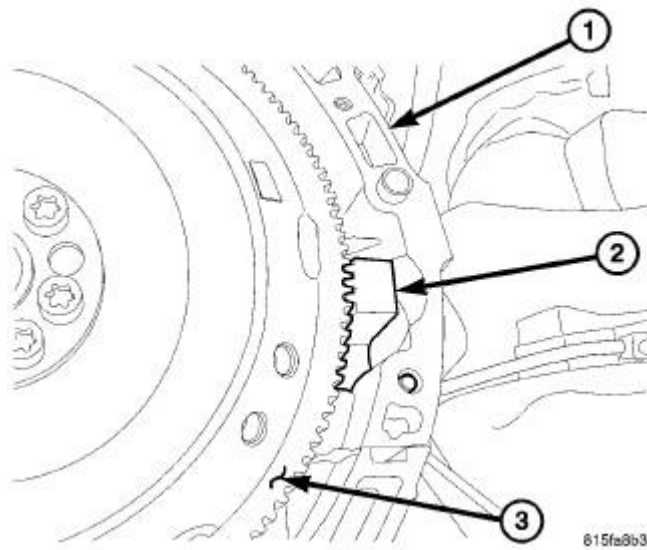


Fig. 103: SPECIAL TOOL # 9102
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - ENGINE BLOCK
2 - SPECIAL TOOL #9102
3 - FLEX PLATE |
|--|

24. Raise and support the vehicle.
25. Install the Flywheel Locking tool (2) 9102.

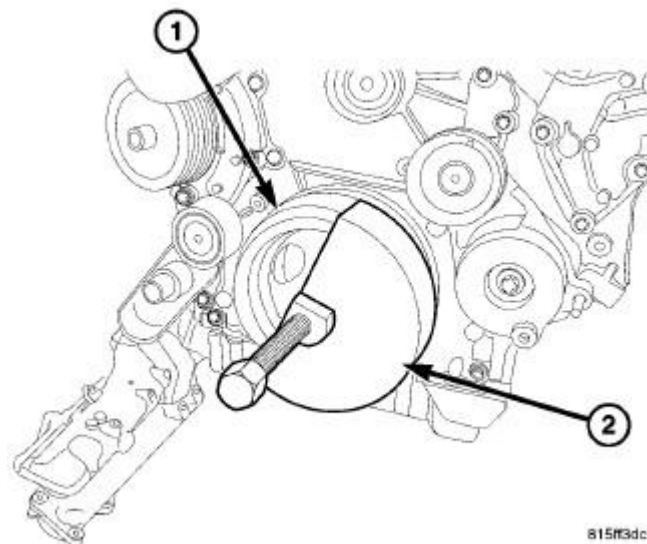


Fig. 104: VIBRATION DAMPER AND SPECIAL TOOL # 9944
Courtesy of CHRYSLER LLC

1 - VIBRATION DAMPER

2 - SPECIAL TOOL #9944

26. Lower the vehicle.
27. Remove the cooling fan module.
28. Remove the vibration damper (1) using the Crankshaft Damper Remover (2) 9544.

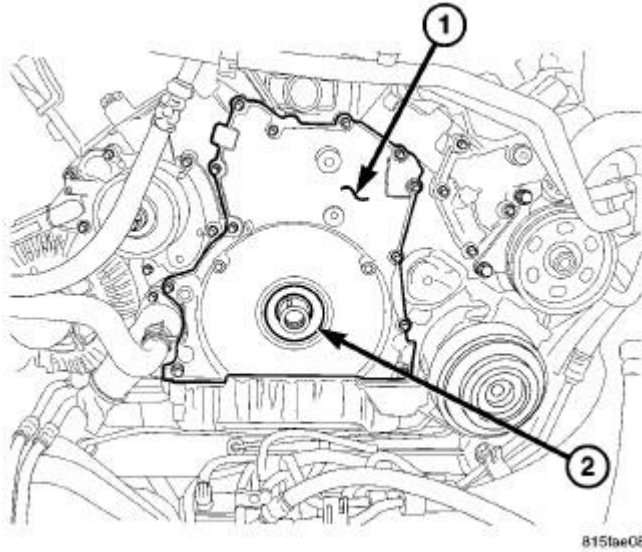


Fig. 105: FRONT TIMING COVER

Courtesy of CHRYSLER LLC

1 - TIMING CHAIN COVER

2 - FRONT CRANKSHAFT SEAL

29. Remove front timing chain cover (1).

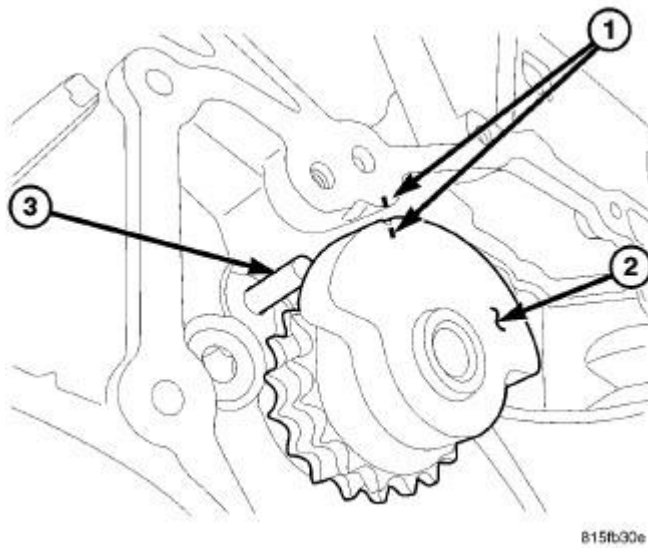


Fig. 106: BALANCE SHAFT INDEXING
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - PAINT MARK OR SCRIBE
2 - BALANCE SHAFT
3 - TIMING CHAIN OILING JET</p> |
|---|

30. Paint mark or scribe the balance shaft (2) position to the engine block and timing chain.
31. Paint mark or scribe the timing chain to crankshaft gear and camshaft drive gear relation.

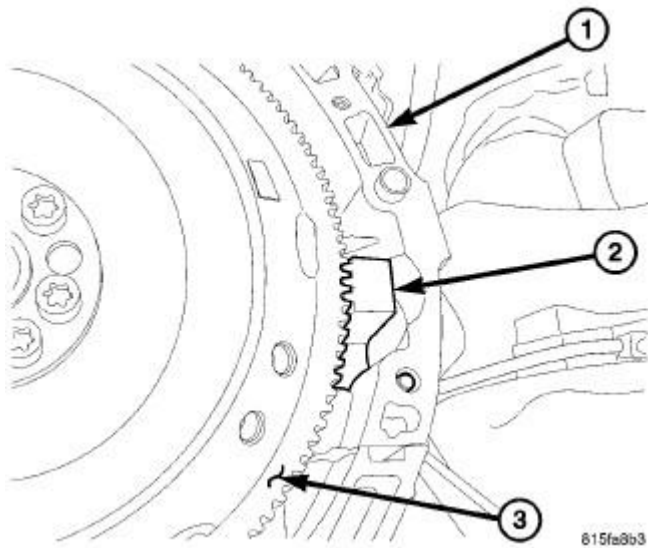


Fig. 107: SPECIAL TOOL # 9102
Courtesy of CHRYSLER LLC

- 1 - ENGINE BLOCK
- 2 - SPECIAL TOOL #9102
- 3 - FLEX PLATE

- 32. Raise and support the vehicle.
- 33. Remove the Flywheel Locking tool (2) 9102.
- 34. Lower the vehicle.

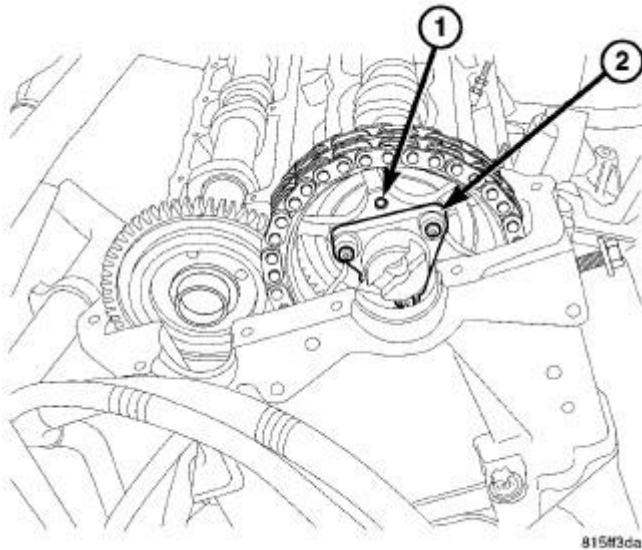
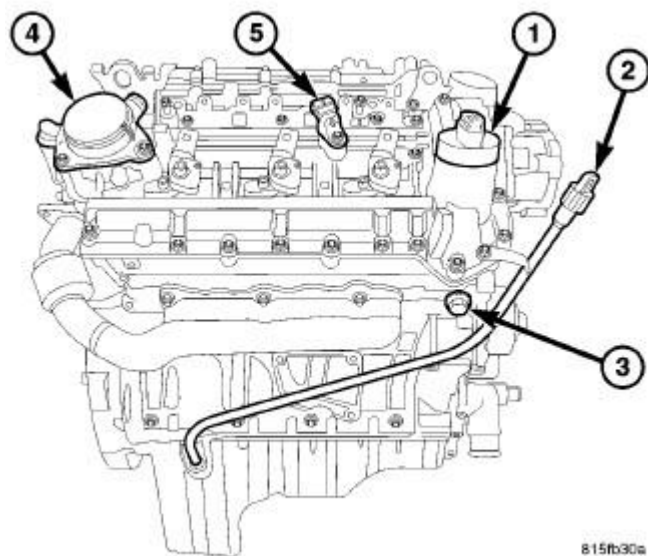


Fig. 108: RIGHT INTAKE CAMSHAFT DRIVE GEAR
Courtesy of CHRYSLER LLC

- 1 - RIGHT CAMSHAFT DRIVE GEAR ALIGNMENT DOWEL
- 2 - VACUUM PUMP DRIVE

- 35. Rotate the engine and remove the right camshaft drive gear (1) lower bolt.
- 36. Rotate the engine back to TDC and check the alignment marks at the balance shaft, camshaft gear and crankshaft gear.



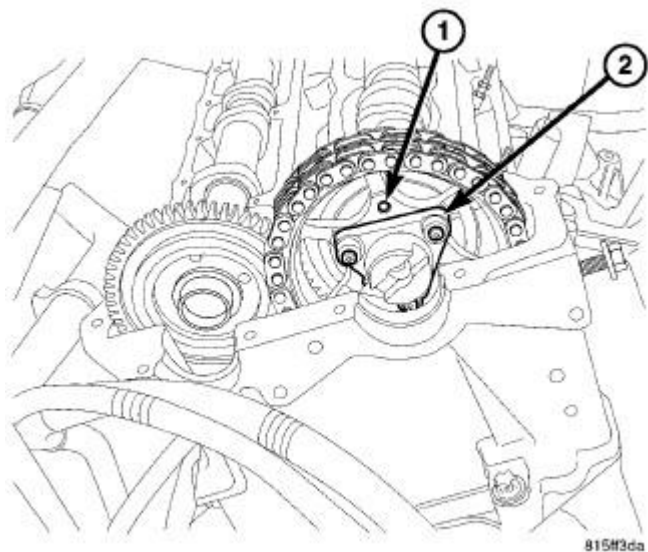
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Fig. 109: TIMING CHAIN TENSIONER

Courtesy of CHRYSLER LLC

- 1 - ENGINE OIL CAP
- 2 - OIL LEVEL INDICATOR
- 3 - TIMING CHAIN TENSIONER
- 4 - OIL SEPARATOR ASSEMBLY
- 5 - CAMSHAFT POSITION SENSOR

37. Remove the timing chain tensioner (3).



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Fig. 110: RIGHT INTAKE CAMSHAFT DRIVE GEAR

Courtesy of CHRYSLER LLC

- 1 - RIGHT CAMSHAFT DRIVE GEAR ALIGNMENT DOWEL
- 2 - VACUUM PUMP DRIVE

38. Remove the remaining right camshaft drive gear (1) retaining bolts.
39. Separate the right camshaft drive gear (1) and chain from camshaft.
40. Remove the right camshaft drive gear (1).

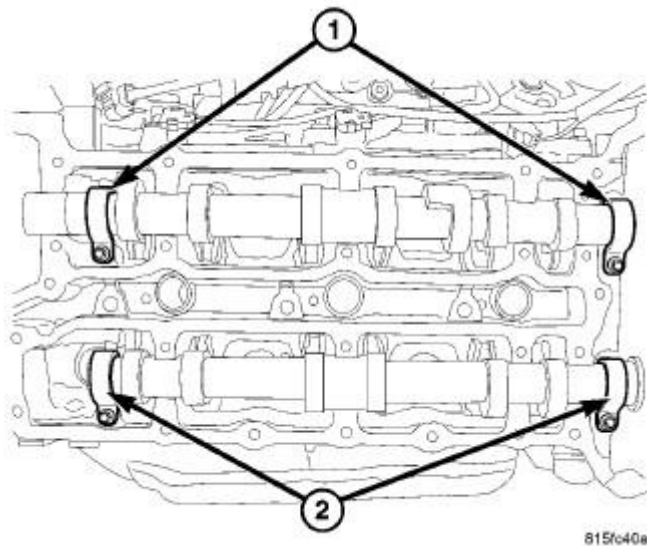
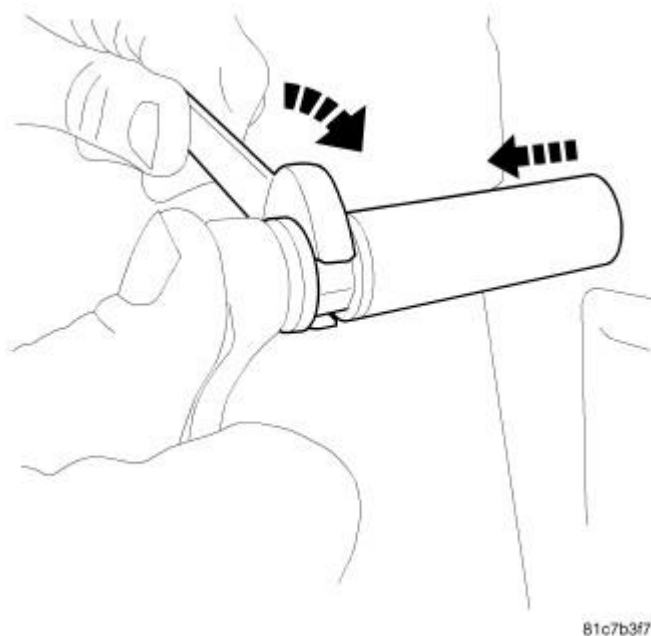


Fig. 111: CAMSHAFT RETAINERS
Courtesy of CHRYSLER LLC

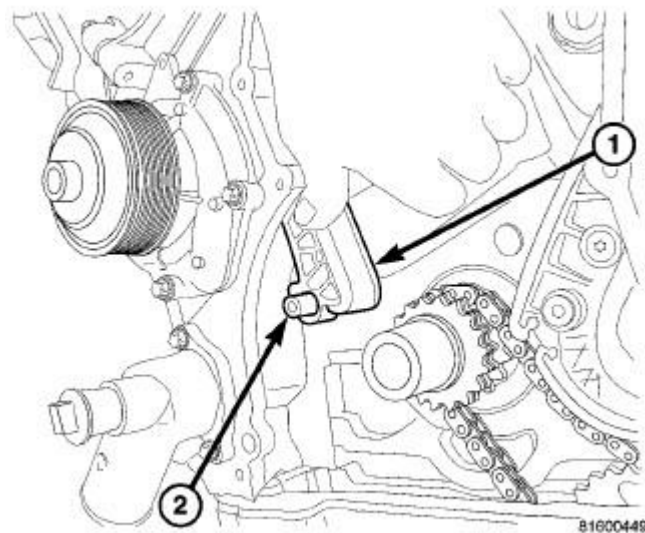
- 1 - INTAKE CAMSHAFT RETAINERS
- 2 - EXHAUST CAMSHAFT RETAINERS

41. Remove the right camshafts retainers (1,2) and camshafts.

**Fig. 112: ROLL PIN REMOVAL**

Courtesy of CHRYSLER LLC

42. Make a roll pin tool by using a tube, nut, bolt and washer. Place the nut on the bolt and the bolt through the tube. Thread the bolt into the roll pin and turn the nut to remove the roll pin (as illustrated).
43. Remove the right upper timing chain upper guide (3).

**Fig. 113: RIGHT LOWER TIMING CHAIN GUIDE**

Courtesy of CHRYSLER LLC

- | |
|------------------------------------|
| 1 - RIGHT LOWER TIMING CHAIN GUIDE |
| 2 - RETAINING BOLT |

44. Remove the right lower timing chain guide (1).

NOTE: **Followers and tappets assemblies must be installed in same location as removed.**

NOTE: **Do Not store the cylinder head on the sealing surface. The glow plugs protrude into the cylinder surface area and may be damaged.**

45. Remove the right cylinder head glow plugs.
46. Remove cylinder head and gasket from engine block.

CLEANING

CLEANING

Thoroughly clean the engine cylinder head and cylinder block mating surfaces. Clean the intake and exhaust manifold and engine cylinder head mating surfaces. Clean the injector bores. Remove all gasket material and carbon. See [Standard Procedure](#).

Check to ensure that no fuel injector washer seals are left in the injector bores.

Check to ensure that no coolant or foreign material has fallen into the tappet bore area.

Remove the carbon deposits from the combustion chambers and top of the pistons.

INSPECTION

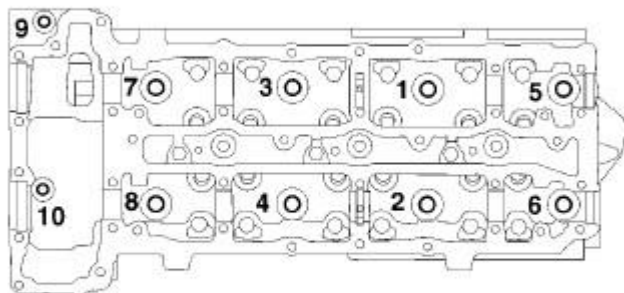
INSPECTION

Use a straightedge and feeler gauge to check the flatness of the engine cylinder head and engine block mating surfaces.

The minimum cylinder head thickness is 128.35 mm (5.0532 in.).

INSTALLATION

LEFT



B15kd376

Fig. 114: CYLINDER HEAD TIGHTENING SEQUENCE

Courtesy of CHRYSLER LLC

CAUTION: Inspect and measure all cylinder head bolt lengths. If out of specification, replace as necessary. See Standard Procedure .

1. Clean and inspect gasket mating surfaces. See Cleaning .
2. Position correct head gasket on engine block.
3. Place cylinder head on engine block.

CAUTION: If new cylinder head bolts are used, do not lubricate the new cylinder head bolts. They already are coated with an anti scuff treatment.

4. Tighten cylinder head bolts following procedure below.

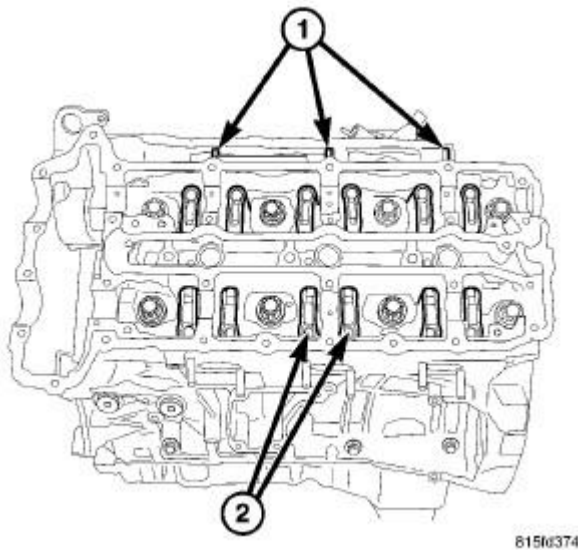


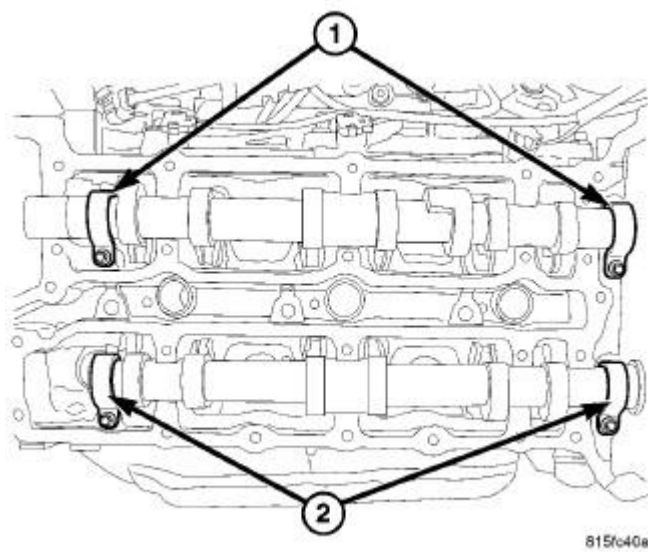
Fig. 115: TAPPET/CAMSHAFT FOLLOWER POSITION
Courtesy of CHRYSLER LLC

1 - GLOW PLUGS

2 - TAPPET/CAMSHAFT FOLLOWER ASSEMBLY

NOTE: Followers and tappets assemblies must be installed in same location as removed.

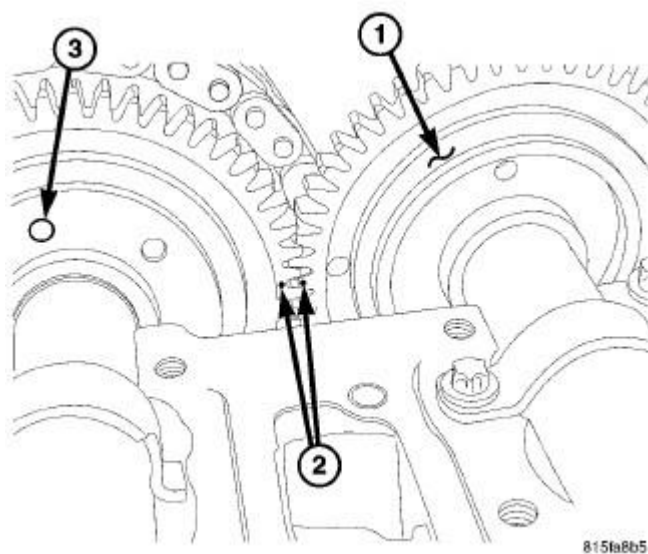
- a. Tighten M12 cylinder head bolts 1 through 8, in the sequence shown in illustration to 60 N.m (44 ft. lbs.).
 - b. Tighten M8 bolts 9 and 10 to 20 N.m (177 in. lbs.).
 - c. Tighten M12 cylinder head bolts 1 through 8, in the sequence shown in illustration an additional 90 degrees.
 - d. Recheck and tighten M8 bolts 9 and 10 to 20 N.m (177 in. lbs.).
 - e. And then again, Tighten M12 cylinder head bolts 1 through 8, in the sequence shown in illustration an additional 90 degrees.
5. Install the followers (2) and tappets (2) into their original positions.
 6. Install the glow plugs (1). Tighten glow plugs (1) to 15 N.m (133 in. lbs.).

**Fig. 116: CAMSHAFT RETAINERS**

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - INTAKE CAMSHAFT RETAINERS
2 - EXHAUST CAMSHAFT RETAINERS |
|---|

7. Install the left exhaust camshaft. Tighten the retaining (2) fasteners to 8 N.m (71 in. lbs.).
8. Install the left intake camshaft. Tighten the retaining (1) fasteners to 8 N.m (71 in. lbs.).

**Fig. 117: CAMSHAFT GEAR ALIGNMENT**

Courtesy of CHRYSLER LLC

- | |
|-------------------|
| 1 - CAMSHAFT GEAR |
|-------------------|

2 - CAMSHAFT GEAR ALIGNMENT MARKS

3 - CAMSHAFT DRIVE GEAR DOWEL POSITION

NOTE: Care must be taken to assure the proper exhaust camshaft to intake camshaft alignment is maintained. Before mating the drive gear to the camshaft gear a quick check will find the exhaust camshaft drive gear dowel (3) in the 12 O'clock position when viewed through the camshaft seal access hole.

9. Align the camshaft marks (2) so the alignment marks are facing each other.
10. Insert the timing chain, through the cylinder head, and on to the camshaft drive gear.

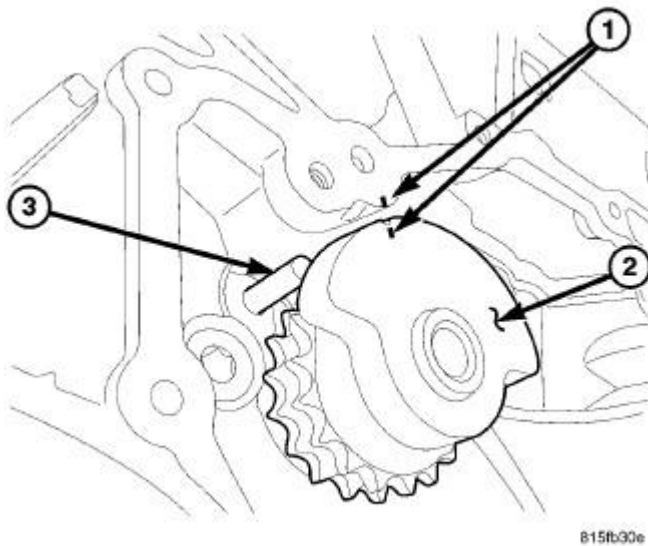


Fig. 118: BALANCE SHAFT INDEXING
Courtesy of CHRYSLER LLC

1 - PAINT MARK OR SCRIBE

2 - BALANCE SHAFT

3 - TIMING CHAIN OILING JET

11. Align the balance shaft (2) with the scribe or paint mark.
12. Once the camshaft drive gear is mated with the timing chain, install the camshaft drive gear on to the camshaft and assure the balance shaft is aligned properly.

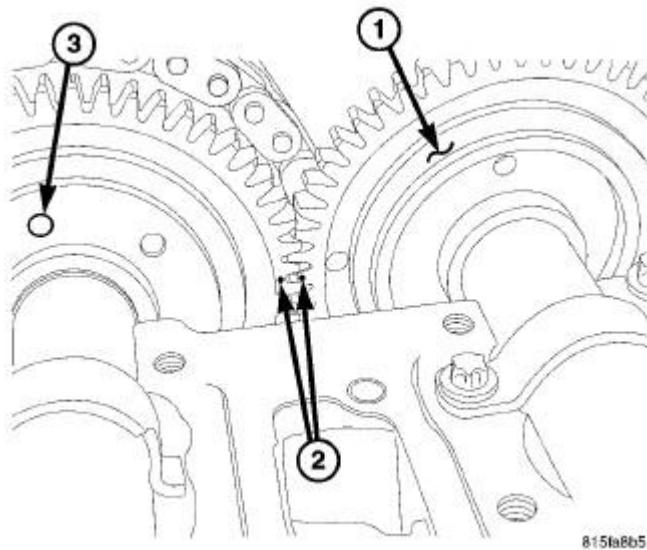


Fig. 119: CAMSHAFT GEAR ALIGNMENT
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - CAMSHAFT GEAR
2 - CAMSHAFT GEAR ALIGNMENT MARKS
3 - CAMSHAFT DRIVE GEAR DOWEL POSITION</p> |
|---|

13. Install the upper two of the three camshaft drive gear bolts.

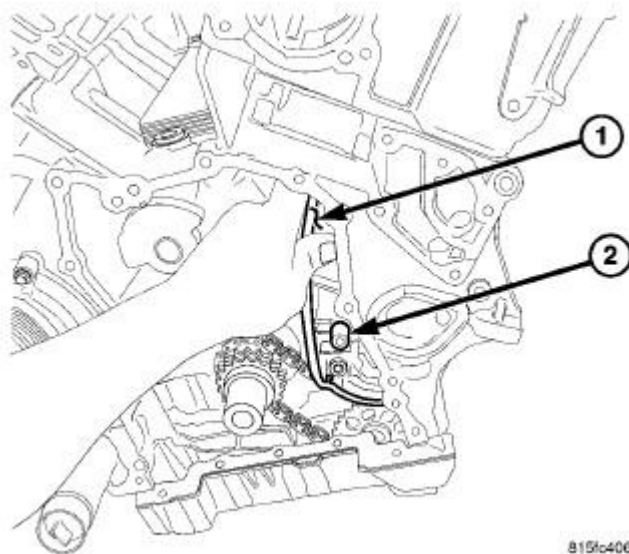


Fig. 120: LEFT LOWER TIMING CHAIN GUIDE AND FASTENER
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - LEFT LOWER TIMING CHAIN GUIDE</p> |
|--|

2 - FASTENER

14. Install the left lower timing chain guide (1).

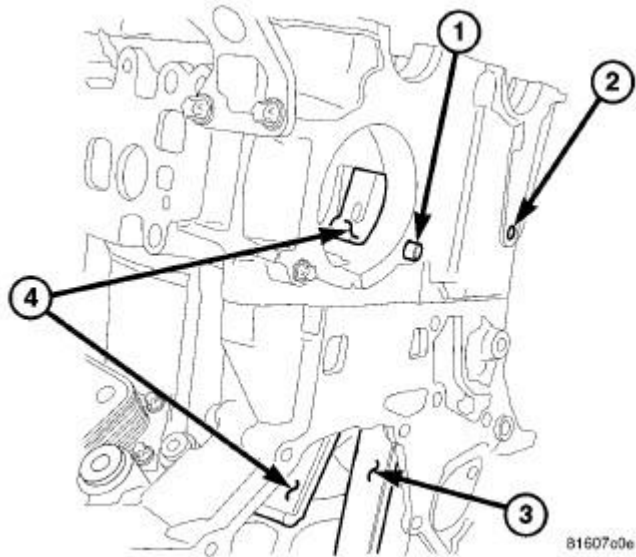
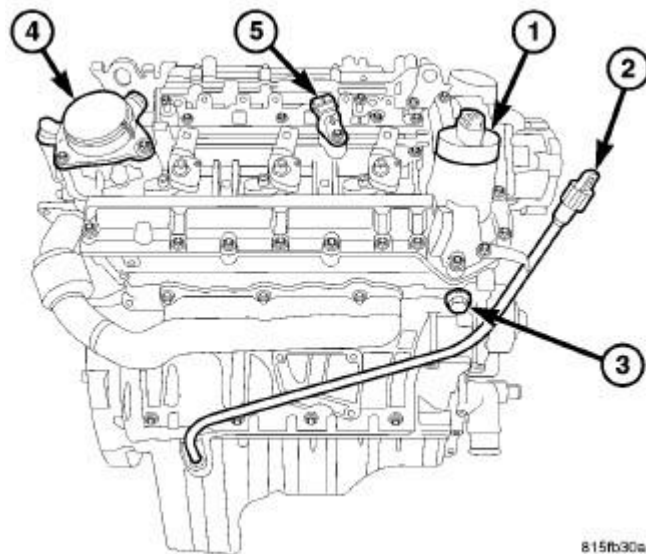


Fig. 121: LEFT TIMING CHAIN GUIDE PINS

Courtesy of CHRYSLER LLC

- 1 - UPPER TIMING CHAIN GUIDE PIN
- 2 - LOWER TIMING CHAIN GUIDE PIN
- 3 - LOWER TIMING CHAIN GUIDE
- 4 - UPPER TIMING CHAIN GUIDE

15. Install the left upper timing chain guide (4).

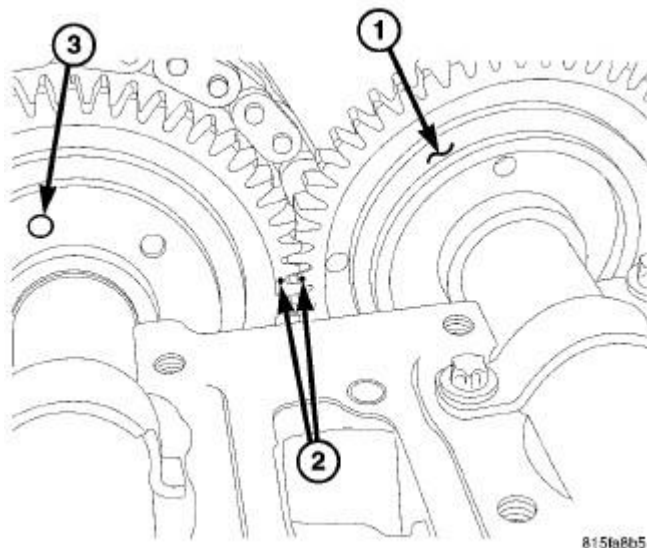


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Fig. 122: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- 1 - ENGINE OIL CAP
- 2 - OIL LEVEL INDICATOR
- 3 - TIMING CHAIN TENSIONER
- 4 - OIL SEPARATOR ASSEMBLY
- 5 - CAMSHAFT POSITION SENSOR

16. Install the timing chain tensioner (3).



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Fig. 123: CAMSHAFT GEAR ALIGNMENT
Courtesy of CHRYSLER LLC

- 1 - CAMSHAFT GEAR
- 2 - CAMSHAFT GEAR ALIGNMENT MARKS
- 3 - CAMSHAFT DRIVE GEAR DOWEL POSITION

17. Rotate the engine by the vibration damper bolt enough to gain access to the third camshaft drive gear bolt hole.
18. Install the third camshaft drive gear retaining bolt and tighten the bolt to 18 N.m (13 ft. lbs.).

WARNING: If the camshaft, balance shaft and or crankshaft alignment marks are not aligned properly immediate damage to the engine will occur. If the camshafts, balance shaft and or crankshaft do not align properly after rotating the engine to the original starting point, STOP and begin the alignment procedure again.

19. Rotate the engine back to TDC by the vibration damper bolt until the crankshaft, camshaft and balance shaft align TDC again.

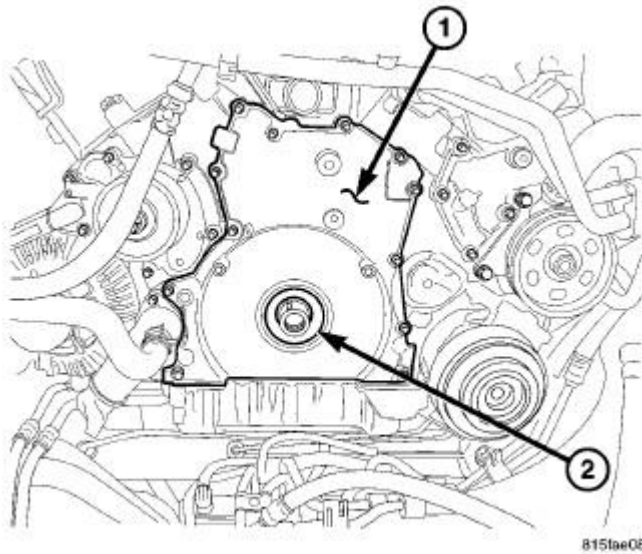


Fig. 124: FRONT TIMING COVER
Courtesy of CHRYSLER LLC

- 1 - TIMING CHAIN COVER
- 2 - FRONT CRANKSHAFT SEAL

WARNING: Check that all the timing chain fits properly on all the timing gears. Failure to do so will result in immediate engine damage.

20. Apply a 1.5 mm continuous bead of Mopar Engine Sealant RTV around the diameter of the timing chain cover (1) and Install the cover (1). Tighten the bolts to 8.4 N.m (74 in. lbs.).

21. Raise and support the vehicle.

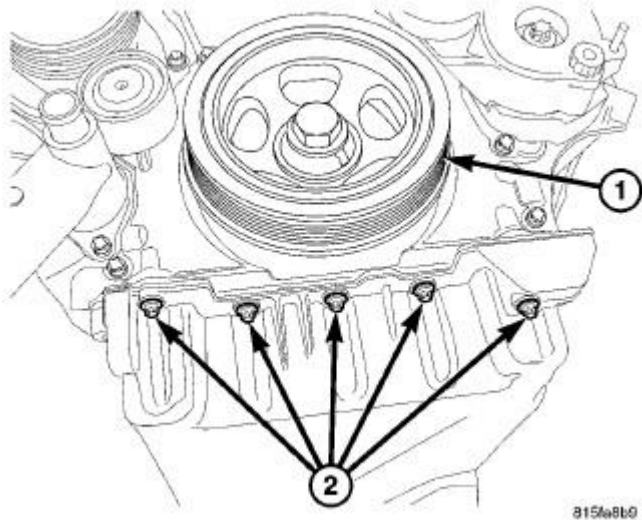


Fig. 125: VIBRATION DAMPER & FRONT OIL PAN BOLTS
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - VIBRATION DAMPER
2 - OIL PAN BOLTS</p> |
|---|

22. Install the 5 front oil pan to timing cover bolts. Tighten the bolts to 20 N.m (177 in. lbs.).

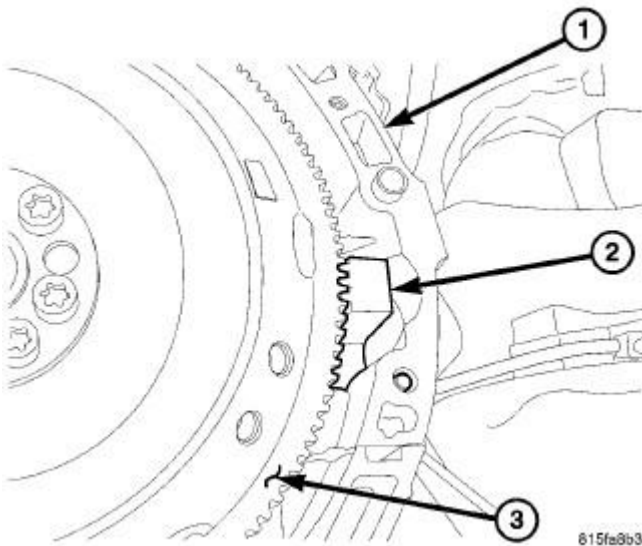


Fig. 126: SPECIAL TOOL # 9102
Courtesy of CHRYSLER LLC

- 1 - ENGINE BLOCK
- 2 - SPECIAL TOOL #9102
- 3 - FLEX PLATE

23. Install special tool #9102 crankshaft lock (2) into the starter access blank.
24. Lower the vehicle.

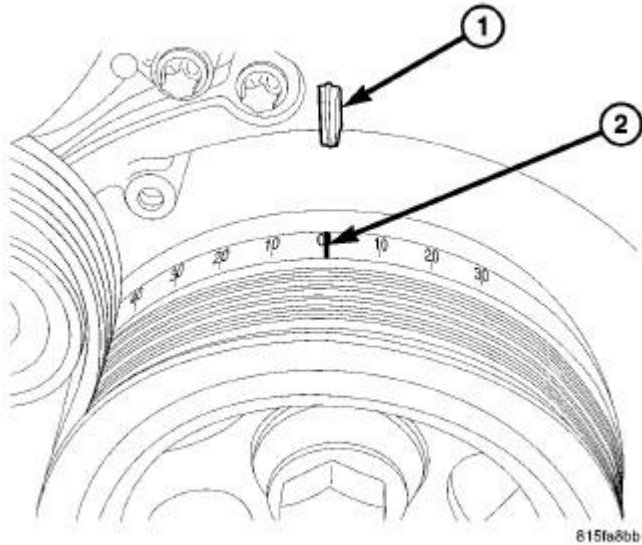


Fig. 127: VIBRATION DAMPER
Courtesy of CHRYSLER LLC

- 1 - TDC MARK ON TIMING COVER
- 2 - VIBRATION DAMPER TDC MARK

25. Install the vibration damper. Tighten the bolts to 200 N.m (148 ft. lbs.) and then an additional 90°.

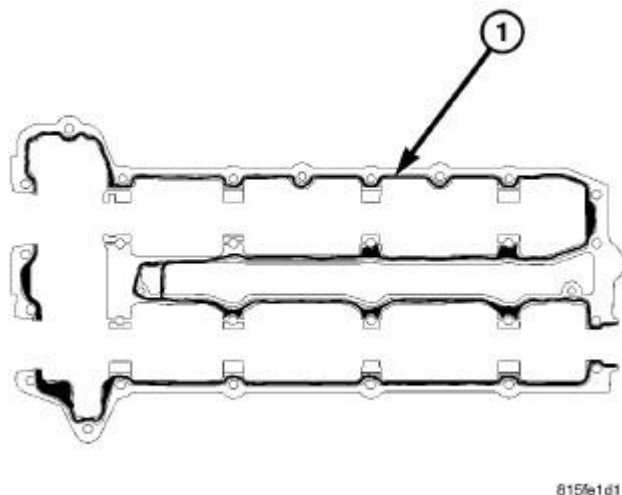


Fig. 128: SEALANT APPLICATION TO LEFT CYLINDER HEAD COVER
 Courtesy of CHRYSLER LLC

1 - 1.5 MM MOPAR ENGINE SEALANT RTV

NOTE: Care must be taken not to get any engine sealer on the camshaft journals.

26. Apply a 1.5 mm continuous bead of Mopar Engine Sealant RTV (1) around the diameter of the left cylinder head cover, and install the cover with new camshaft seals.

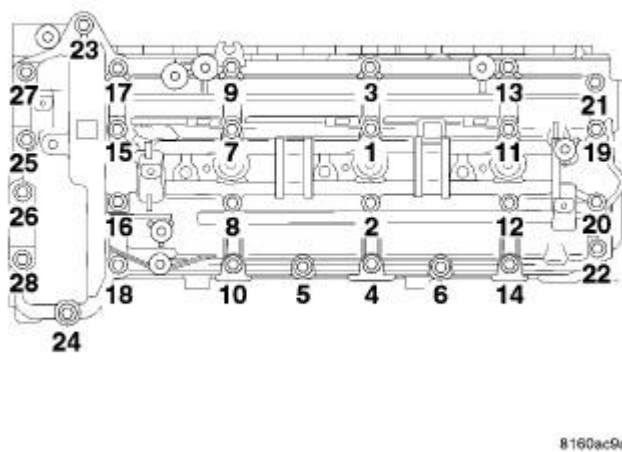


Fig. 129: LEFT CYLINDER HEAD COVER TIGHTENING SEQUENCE
 Courtesy of CHRYSLER LLC

27. Tighten the bolts in three stages following the sequence provided. First to 4 N.m (35 in. lbs.), then to 6 N.m (53 in. lbs.), and then to 8.4 N.m (75 in. lbs.).

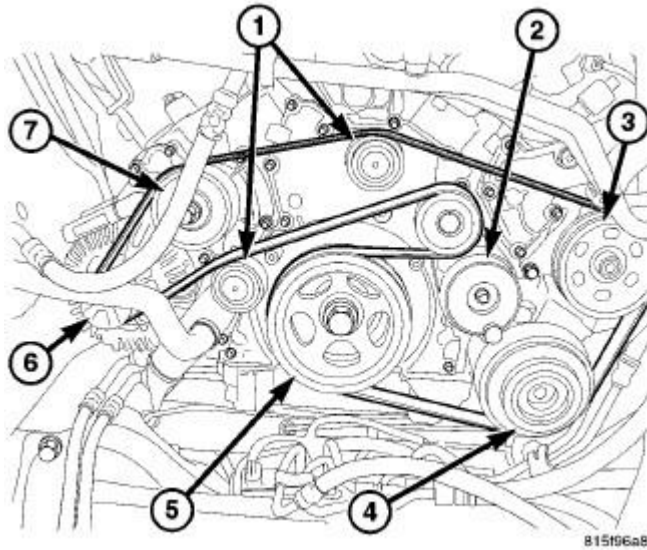


Fig. 130: ACCESSORY DRIVE BELT
Courtesy of CHRYSLER LLC

- 1 - IDLER PULLEYS
- 2 - DRIVE BELT TENSIONER
- 3 - POWER STEERING PUMP
- 4 - AIR CONDITIONING COMPRESSOR
- 5 - VIBRATION DAMPER
- 6 - GENERATOR
- 7 - WATER PUMP

28. Install the oil filter housing bracket. Tighten the bolts to 13.8 N.m (122 in. lbs.).
29. Install the high pressure pump. Tighten bolts to 13.5 N.m (120 in. lbs.).
30. Install the belt idler pulleys (1). Tighten the bolts to 58 N.m (43 ft. lbs.).
31. Install the drive belt tensioner (2). Tighten the bolts to 58 N.m (43 ft. lbs.).
32. Install the drive belt.

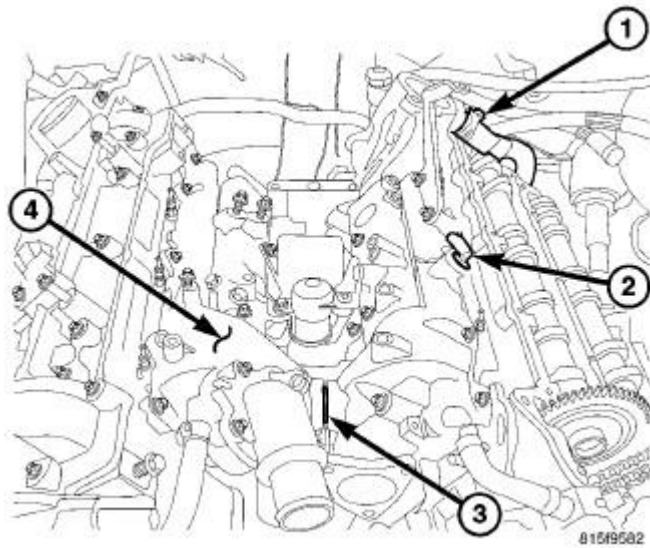


Fig. 131: INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - EGR COOLANT PIPE
2 - COOLANT TEMPERATURE SENSOR
3 - INTAKE COOLANT PASSAGE
4 - INTAKE MANIFOLD</p> |
|---|

CAUTION: The right intake manifold upper thermostat housing bolts should be tightened to 8.4 N.m (74 in. lbs.).

33. Install the intake manifold (4). Tighten bolts to 16 N.m (142 in. lbs.), starting in the middle and tightening in a cross pattern outward until reaching the upper thermostat bolts on the right front manifold.
34. Tighten the upper thermostat bolts on the right cylinder head to 8.4 N.m (74 in. lbs.).

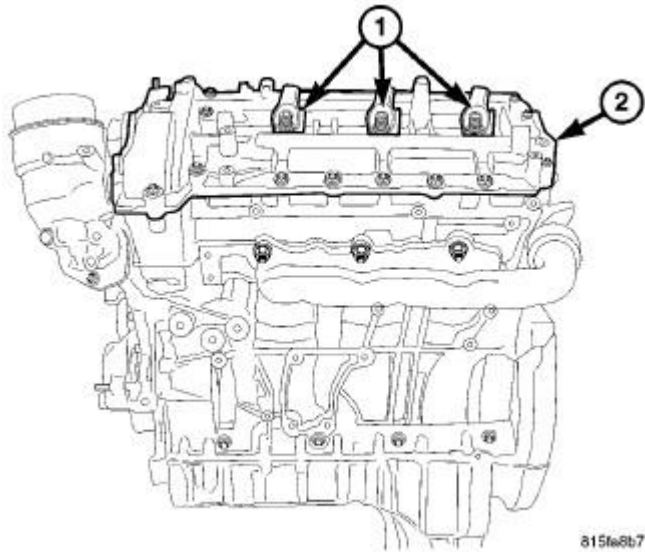


Fig. 132: LEFT CYLINDER HEAD COVER

Courtesy of CHRYSLER LLC

CAUTION: The fuel injector sealing washers **MUST** be replaced. **DO NOT** use the old sealing washers or double the sealing washers.

35. Lubricate the fuel injector body (1), install the left fuel injectors (1) and new lower sealing washers.

CAUTION: The injector retaining claw bolts are torque to yield and must always be replaced.

36. Install the injector retaining claws and tighten the bolts to 7 N.m plus 180 °(62 in. lbs. plus 180°).

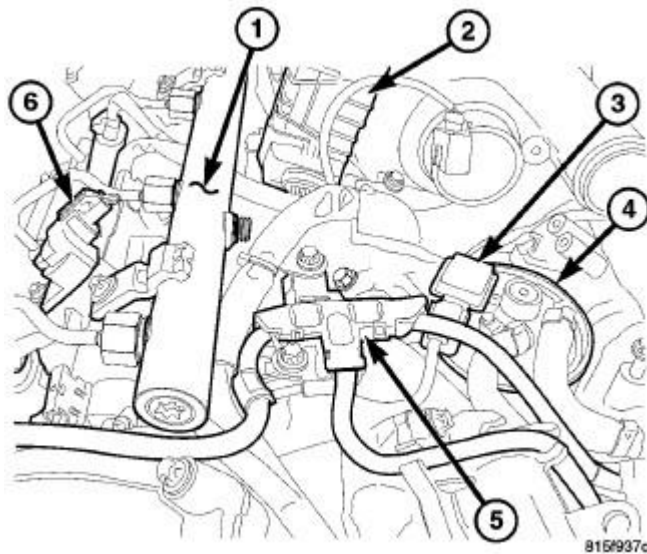


Fig. 133: RETURN FUEL HOSE BUNDLE
Courtesy of CHRYSLER LLC

- 1 - RIGHT FUEL RAIL
- 2 - TURBOCHARGER SERVO MOTOR
- 3 - WATER IN FUEL SENSOR
- 4 - FUEL FILTER
- 5 - RETURN FUEL HOSE BUNDLE
- 6 - CAMSHAFT POSITION SENSOR

37. Properly route and install the fuel return hoses (5) and connect them to the injectors.

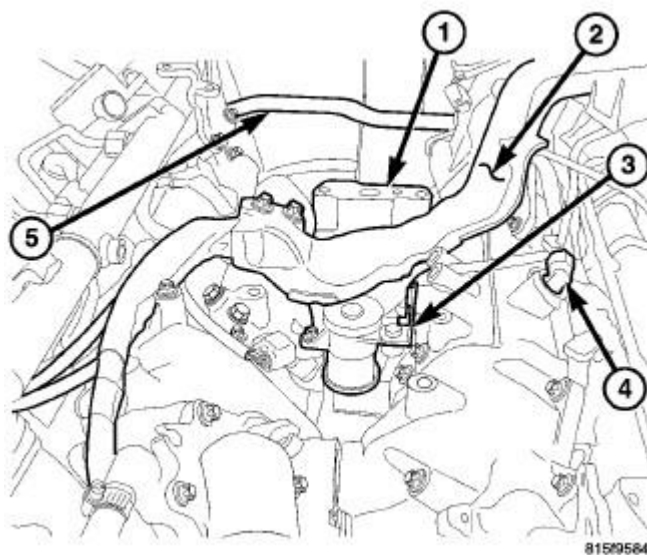


Fig. 134: MAIN ENGINE WIRING HARNESS

Courtesy of CHRYSLER LLC

- 1 - TURBOCHARGER OIL HOUSING ADAPTOR
- 2 - MAIN ENGINE WIRING HARNESS
- 3 - SWIRL VALVE ACTUATOR
- 4 - COOLANT TEMPERATURE SENSOR

38. Properly route and connect the engine harness.

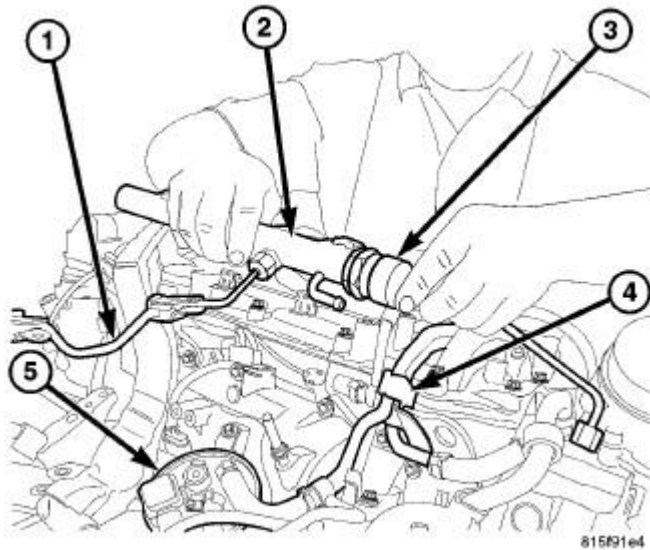


Fig. 135: LEFT FUEL RAIL
Courtesy of CHRYSLER LLC

- 1 - FUEL RAIL TRANSFER LINE
- 2 - LEFT FUEL RAIL
- 3 - FUEL RAIL SOLENOID
- 4 - LOW FUEL PRESSURE SUPPLY AND RETURN LINE JUNCTION
- 5 - FUEL FILTER

39. Install the fuel rail (2). Tighten the bolts to 14 N.m (10 ft. lbs.).

CAUTION: Inspect the fuel lines for wear or damage, look closely around the flange area. Replace as necessary. DO NOT over tighten.

40. Install the high pressure fuel lines, including the fuel rail equalizing line. Tighten the line nuts to 27 N.m (20 ft. lbs.).

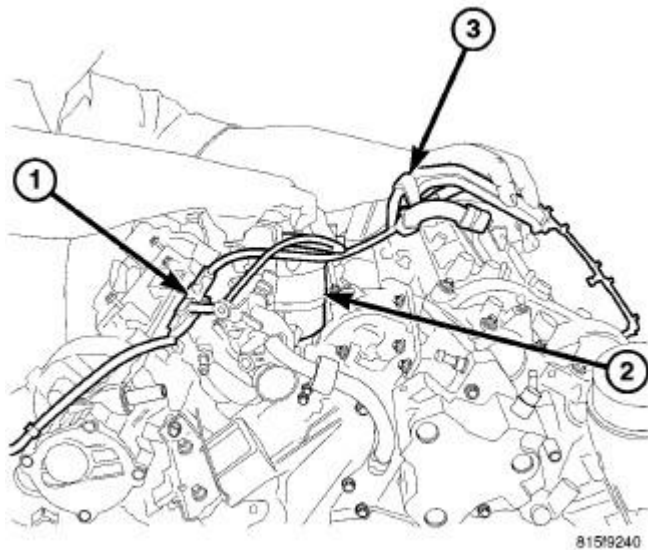


Fig. 136: FUEL FILTER, LINES AND HOSES
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - RETURN FUEL HOSE BUNDLE</p> <p>2 - FUEL FILTER</p> <p>3 - LOW PRESSURE FUEL SUPPLY AND RETURN PIPE</p> |
|---|

41. Install the fuel filter (2) and connect the harnesses (1) and hoses (3).

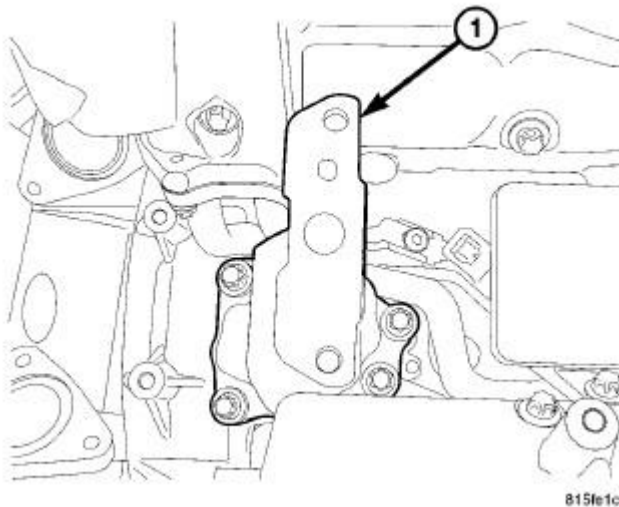


Fig. 137: TURBOCHARGER ADAPTOR
Courtesy of CHRYSLER LLC

- | |
|---------------------------------|
| <p>1 - TURBOCHARGER ADAPTOR</p> |
|---------------------------------|

2 - SWIRL VALVE ACTUATOR

CAUTION: Care must be taken when installing the turbocharger oil housing adaptor (1). The gasket **MUST** be aligned properly with the oil housing passages or immediate damage to the turbocharger will occur.

42. Install the turbocharger oil housing adaptor (1) with the gasket tabs secured to the adaptor (1) Tighten bolts to 12 N.m (9 ft. lbs.).
43. Install the turbocharger. See Installation .

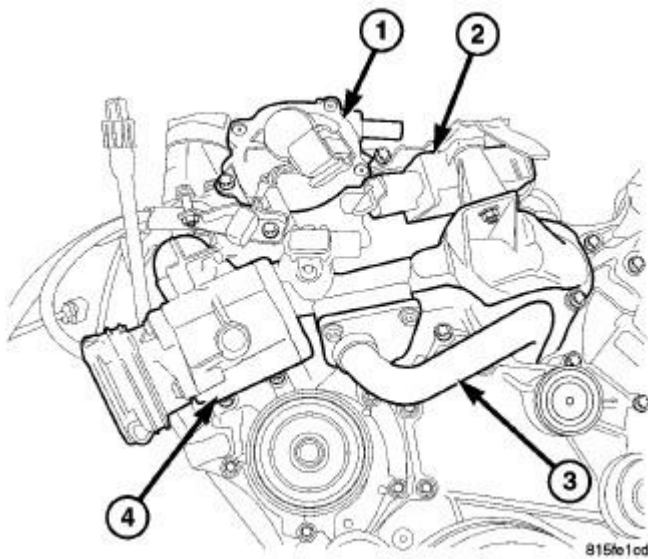


Fig. 138: AIR CONTROL VALVE
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - VACUUM PUMP
2 - GLOW PLUG RELAY
3 - EGR COOLER
4 - AIR CONTROL VALVE |
|---|

44. Install the air control valve and resonator.

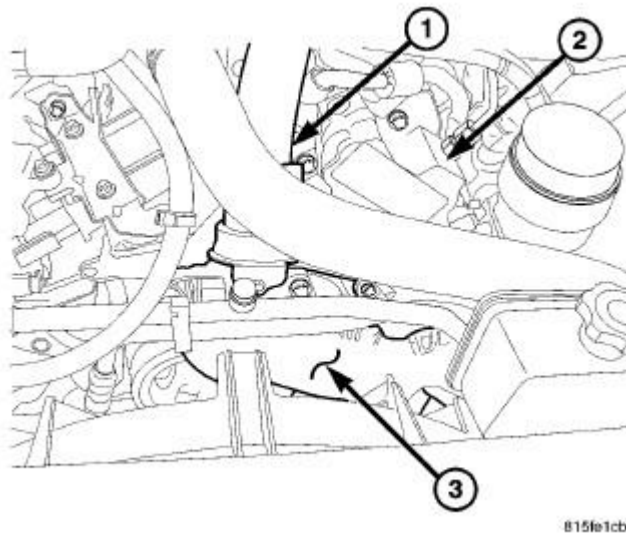


Fig. 139: CHARGE AIR COOLER INLET WITH RESONATOR
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - CHARGE AIR COOLER INLET PIPE
2 - HIGH PRESSURE INJECTION PUMP
3 - CHARGE AIR COOLER INLET RESONATOR</p> |
|--|

45. Install the charge air cooler inlet pipe and resonator.

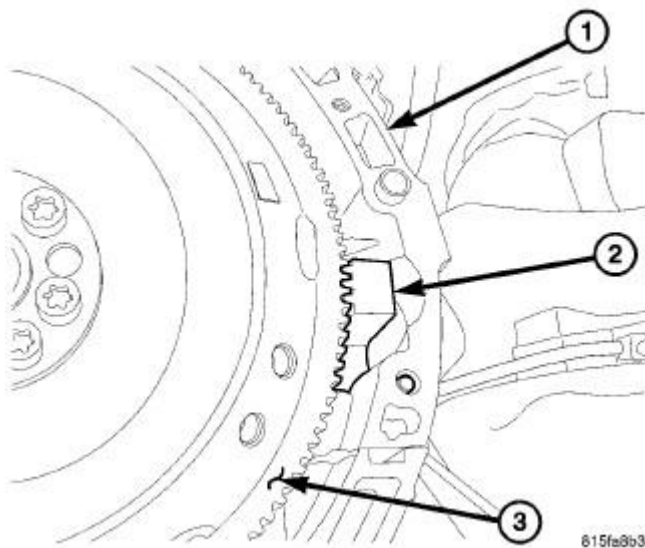


Fig. 140: SPECIAL TOOL # 9102
Courtesy of CHRYSLER LLC

- | |
|-------------------------|
| <p>1 - ENGINE BLOCK</p> |
|-------------------------|

- 2 - SPECIAL TOOL #9102
- 3 - FLEX PLATE

- 46. Install the cooling fan module.
- 47. Install the heater hose bracket and secure hoses.
- 48. Connect the vacuum pump supply hose.
- 49. Raise and support the vehicle.
- 50. Remove special tool #9102 crankshaft lock (2).
- 51. Install the starter blank.

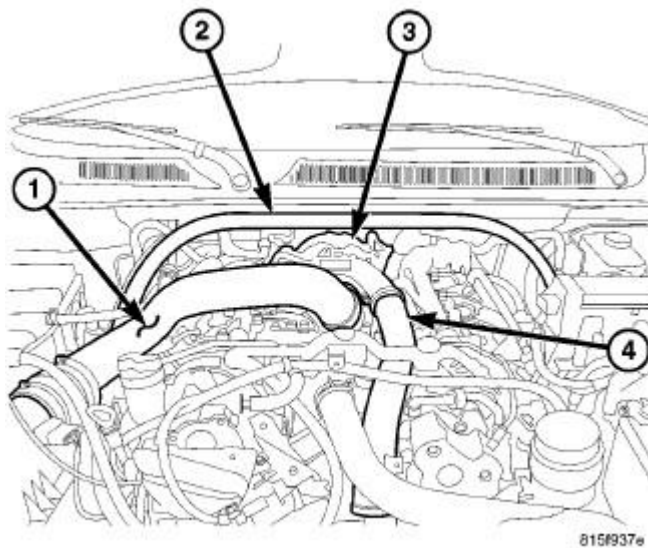
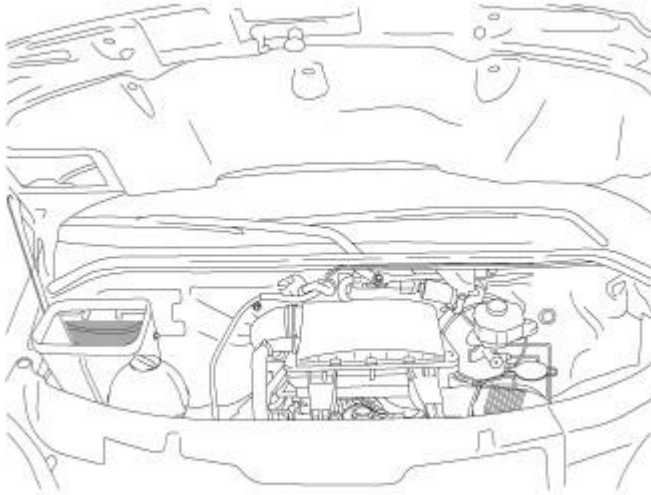


Fig. 141: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

- 1 - AIR CLEANER OUTLET TUBE
- 2 - STRUT TOWER SUPPORT
- 3 - TURBOCHARGER
- 4 - CHARGE AIR INLET TUBE

- 52. Connect the cooling fan hydraulic lines.
- 53. Lower the vehicle.
- 54. Fill the cooling system.
- 55. Fill power steering system.
- 56. Install the strut tower support (2).
- 57. Connect the negative battery cable.



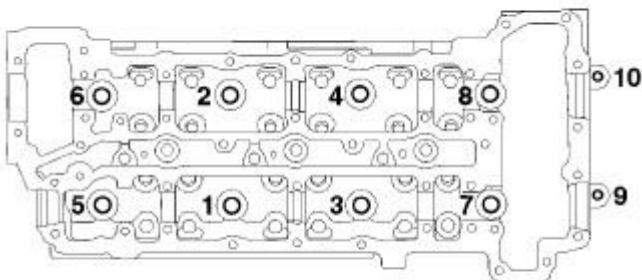
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Fig. 142: OPEN HOOD

Courtesy of CHRYSLER LLC

58. Start engine, allow to warm, turn engine off and inspect for leaks.
59. Purge the air from the power steering system using the scan tool.
60. Install the engine cover brackets and engine cover.

RIGHT



81600e2f

Fig. 143: RIGHT CYLINDER HEAD TIGHTENING SEQUENCE

Courtesy of CHRYSLER LLC

CAUTION: Inspect and measure all cylinder head bolt lengths. If out of specification, replace as necessary. See Standard Procedure .

1. Clean and inspect gasket mating surfaces.
2. Position head gasket on engine block. Be sure the coolant passages align (part number should be facing up).
3. Place cylinder head on engine block.

CAUTION: Inspect and measure all cylinder head bolt lengths. If out of specification, replace as necessary. See Standard Procedure . Do Not lubricate new cylinder head bolts. They already are coated with an anti scuff treatment.

4. Tighten cylinder head bolts following procedure below.

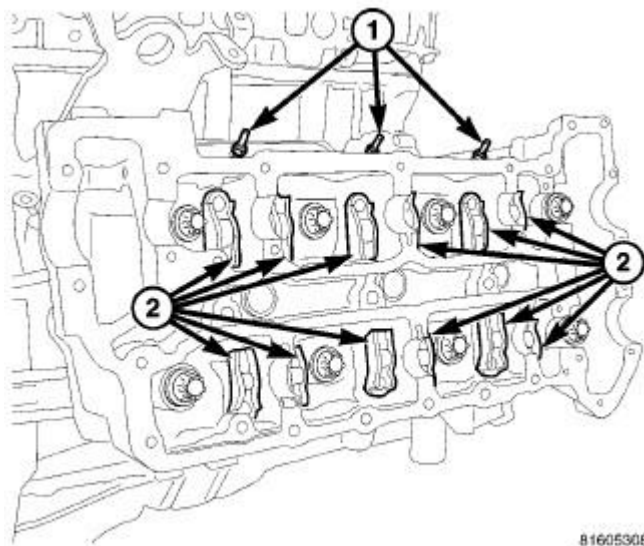


Fig. 144: RIGHT TAPPET/CAMSHAFT FOLLOWER POSITION

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - GLOW PLUGS
2 - TAPPET/CAMSHAFT FOLLOWER ASSEMBLY |
|---|

NOTE: Followers and tappets assemblies must be installed in same location as removed.

- a. Tighten M12 cylinder head bolts 1 through 8, in the sequence shown in illustration to 60 N.m (44 ft. lbs.).
- b. Tighten bolts 9 and 10 to 20 N.m (177 in. lbs.).
- c. Tighten 12 mm cylinder head bolts, 1 through 8, in sequence shown in illustration, an additional 90

degrees.

- d. Recheck and tighten M8 bolts 9 and 10 to 20 N.m (177 in. lbs.).
- e. And then again, tighten M12 cylinder head bolts, 1 through 8, in sequence an additional 90 degrees.
5. Install the followers (2) and tappets (2) into their original positions.
6. Install the glow plugs (1). Tighten glow plugs to 12.5 N.m (100 in. lbs.).

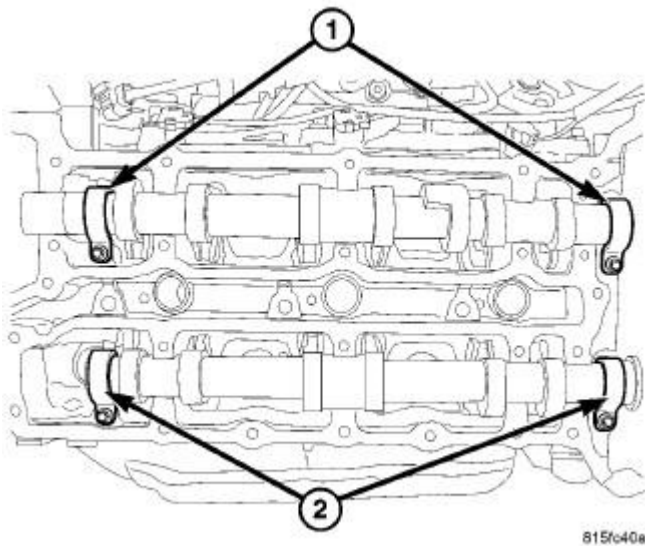


Fig. 145: CAMSHAFT RETAINERS
Courtesy of CHRYSLER LLC

1 - INTAKE CAMSHAFT RETAINERS
2 - EXHAUST CAMSHAFT RETAINERS

7. Install the right exhaust camshaft. Tighten the retaining fasteners to 8 N.m (71 in. lbs.).
8. Install the right intake camshaft. Tighten the retaining fasteners to 8 N.m (71 in. lbs.).

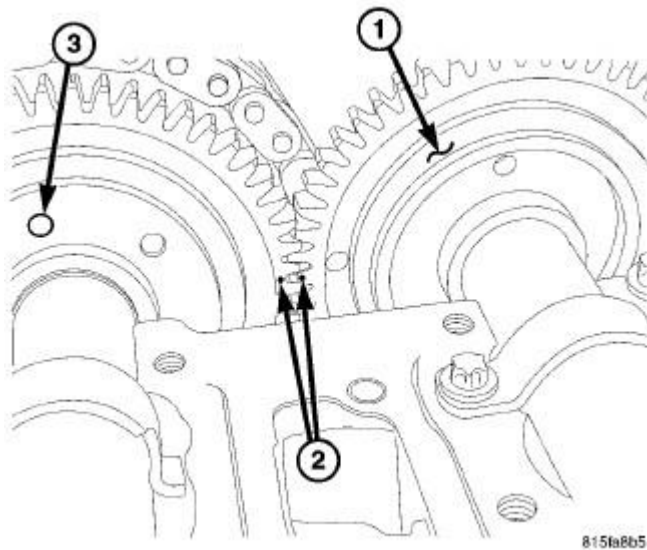


Fig. 146: CAMSHAFT GEAR ALIGNMENT
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - CAMSHAFT GEAR |
| 2 - CAMSHAFT GEAR ALIGNMENT MARKS |
| 3 - CAMSHAFT DRIVE GEAR DOWEL POSITION |

NOTE: Care must be taken to assure the proper exhaust camshaft to intake camshaft alignment.

9. Align the camshaft marks so the alignment marks are facing each other.
10. Insert the timing chain, through the cylinder head, and on to the camshaft drive gear.

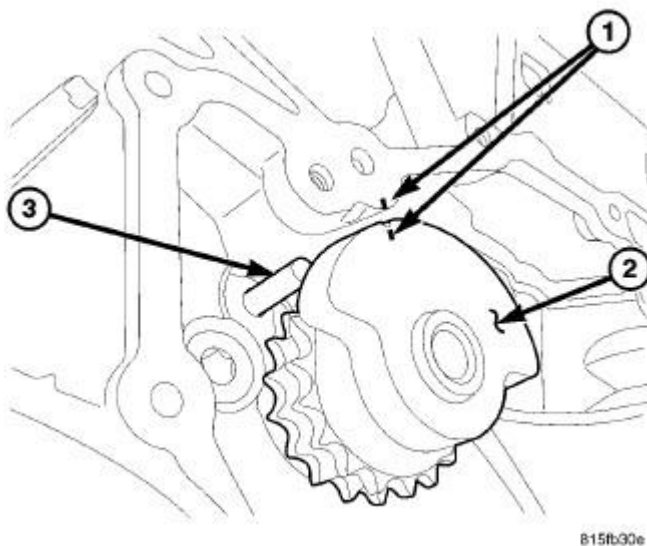
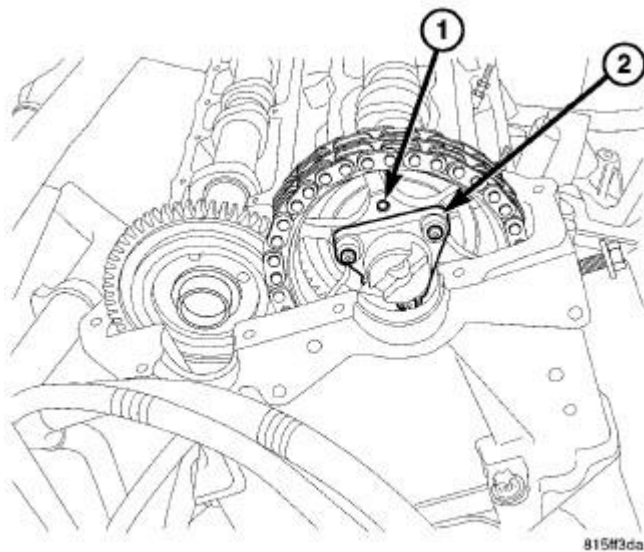


Fig. 147: BALANCE SHAFT INDEXING

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - PAINT MARK OR SCRIBE
2 - BALANCE SHAFT
3 - TIMING CHAIN OILING JET |
|--|

11. Align the balance shaft with the scribe or paint mark.
12. Once the camshaft drive gear is mated with the timing chain, install the camshaft drive gear on to the camshaft and assure the balance shaft is aligned properly.

**Fig. 148: RIGHT INTAKE CAMSHAFT DRIVE GEAR**

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - RIGHT CAMSHAFT DRIVE GEAR ALIGNMENT
DOWEL
2 - VACUUM PUMP DRIVE |
|---|

13. Install the upper two of the three camshaft drive gear bolts.

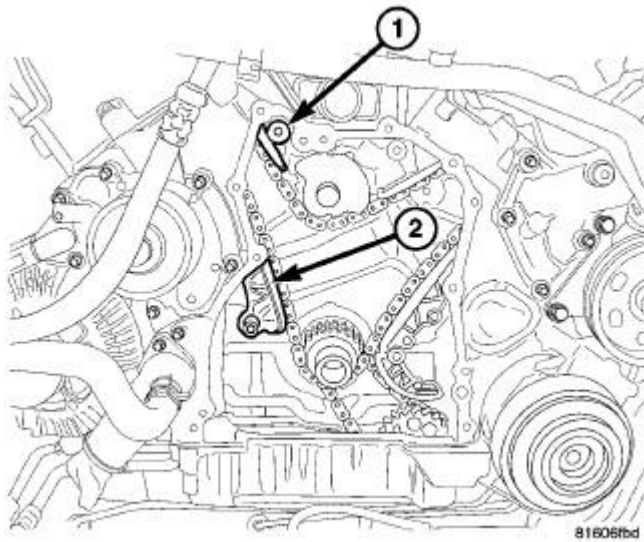


Fig. 149: RIGHT TIMING CHAIN GUIDES

Courtesy of CHRYSLER LLC

- | |
|------------------------------|
| 1 - UPPER TIMING CHAIN GUIDE |
| 2 - LOWER TIMING CHAIN GUIDE |

14. Install the right lower timing chain guide (2), seat the guide pin at the top, and tighten the guide bolt to 12 N.m (9 ft. lbs.).
15. Install the right upper timing chain guide (1), seat the guide pin at the top, and tighten the guide bolt to 12 N.m (9 ft. lbs.).

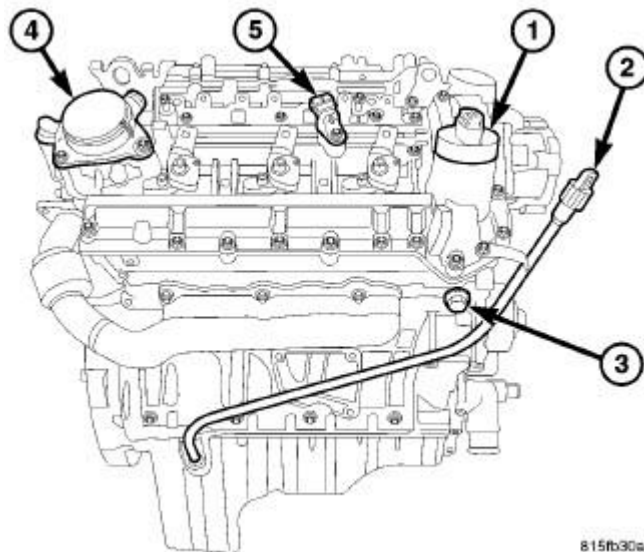


Fig. 150: TIMING CHAIN TENSIONER

Courtesy of CHRYSLER LLC

- 1 - ENGINE OIL CAP
- 2 - OIL LEVEL INDICATOR
- 3 - TIMING CHAIN TENSIONER
- 4 - OIL SEPARATOR ASSEMBLY
- 5 - CAMSHAFT POSITION SENSOR

16. Install the timing chain tensioner (3).

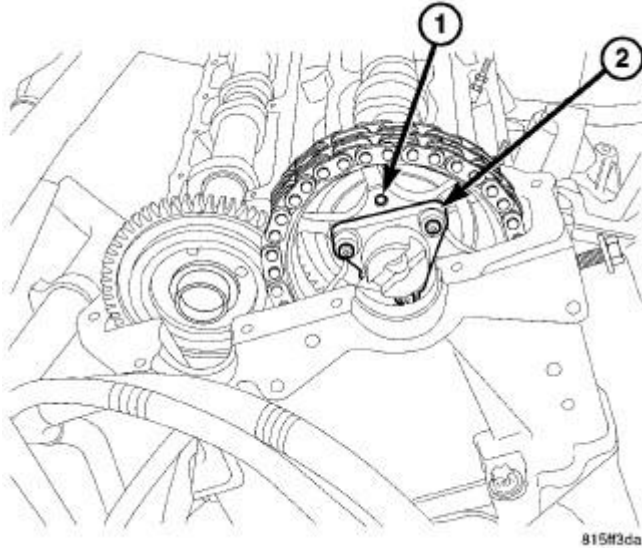


Fig. 151: RIGHT INTAKE CAMSHAFT DRIVE GEAR
Courtesy of CHRYSLER LLC

- 1 - RIGHT CAMSHAFT DRIVE GEAR ALIGNMENT DOWEL
- 2 - VACUUM PUMP DRIVE

17. Rotate the engine by the vibration damper bolt enough to gain access to the third camshaft bolt hole.
18. Install the third camshaft drive gear retaining bolt and tighten the bolt to 18 N.m (13 ft. lbs.).

WARNING: If the camshaft, balance shaft and or crankshaft alignment marks are not aligned properly, immediate damage to the engine will occur. If the camshafts, balance shaft and or crankshaft do not align properly after rotating the engine to the original starting point, STOP and begin the alignment procedure again.

19. Rotate the engine back to TDC by the vibration damper bolt until the crankshaft, camshaft and balance shaft align TDC again.
20. Tighten the two remaining camshaft drive gear bolts to 18 N.m (13 ft. lbs.).

WARNING: Check that all the timing chain fits properly on all the timing gears. Failure to do so will result in immediate engine damage.

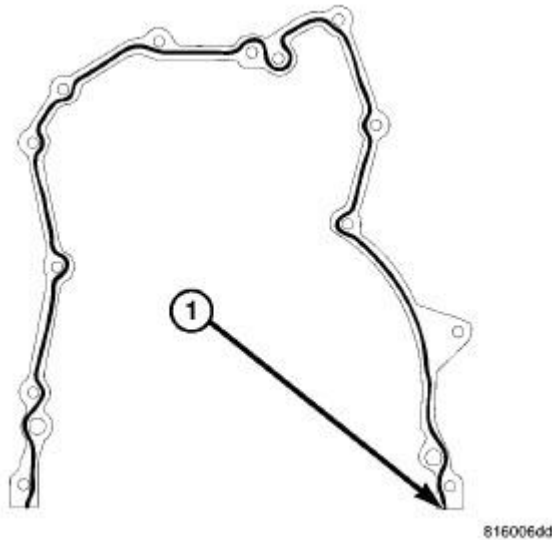


Fig. 152: TIMING COVER SEALING
Courtesy of CHRYSLER LLC

1 - 1.5 MM BEAD OF MOPAR ENGINE SEALANT RTV

21. Add a 1.5 mm continuous bead of Mopar Engine Sealant RTV (1) to the timing chain cover and the front portion of the oil pan, then install the timing chain cover. Tighten the bolts to 8.5 N.m (74 in. lbs.).
22. Raise and support the vehicle.

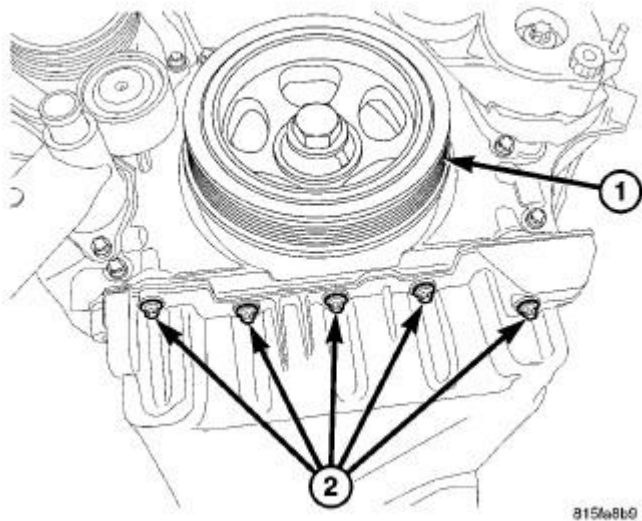


Fig. 153: VIBRATION DAMPER & FRONT OIL PAN BOLTS

Courtesy of CHRYSLER LLC

- 1 - VIBRATION DAMPER
- 2 - OIL PAN BOLTS

23. Install the 5 front oil pan (2) to timing cover bolts. Tighten the bolts to 20 N.m (177 in. lbs.).

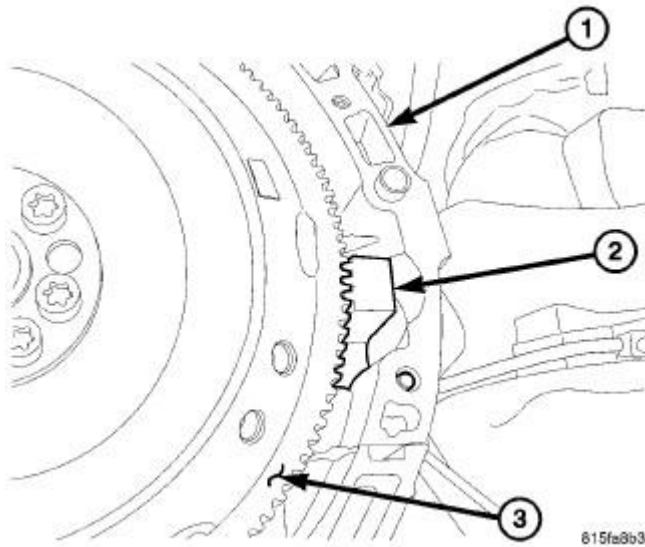
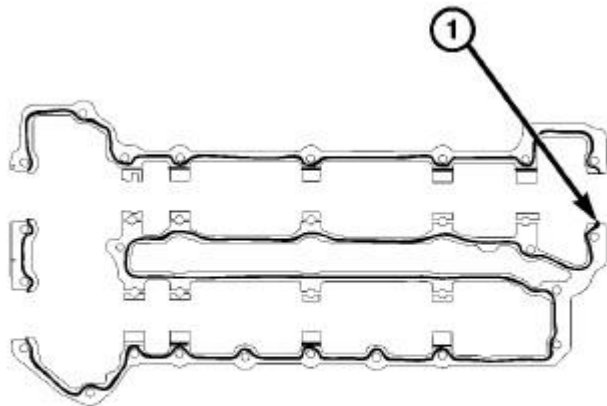


Fig. 154: SPECIAL TOOL # 9102
Courtesy of CHRYSLER LLC

- 1 - ENGINE BLOCK
- 2 - SPECIAL TOOL #9102
- 3 - FLEX PLATE

24. Install special tool # 9102 crankshaft lock (2).
25. Lower the vehicle.
26. Install the vibration damper. Tighten the bolts to 200 N.m (148 ft. lbs.). and then an additional 90°.



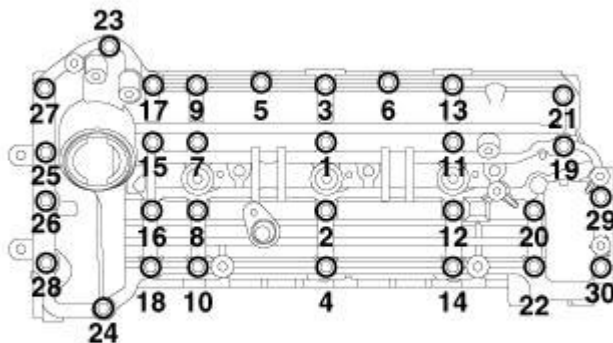
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Fig. 155: RIGHT CYLINDER HEAD COVER SEALANT
Courtesy of CHRYSLER LLC

1 - 1.5 MM MOPAR ENGINE SEALANT RTV

NOTE: Care must be taken not to get any engine sealer on the camshaft journals.

27. Add a 1.5 mm continuous bead of Mopar Engine Sealant RTV (1) to the cylinder head cover, then install the right cylinder head cover along with a new camshaft seal.



45631

Fig. 156: RIGHT CYLINDER HEAD COVER TIGHTENING SEQUENCE
Courtesy of CHRYSLER LLC

28. Tighten the bolts in three stages following the sequence provided. First to 4 N.m (35 in. lbs.), then to 6

N.m (53 in. lbs.) and then to 8.5 N.m (75 in. lbs.).

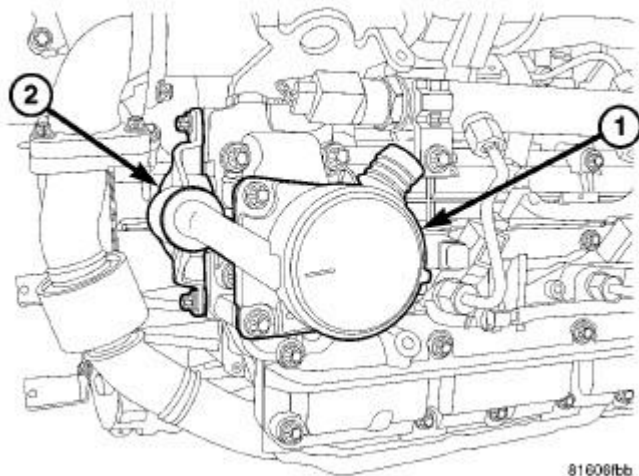


Fig. 157: OIL SEPARATOR
Courtesy of CHRYSLER LLC

- | |
|-----------------------------------|
| 1 - OIL SEPARATOR HOUSING |
| 2 - OIL SEPARATOR HOUSING ADAPTOR |

29. Install the oil separator (1) and housing adaptor (2) with new camshaft seal. Tighten the bolts to 11 N.m (97 in. lbs.).

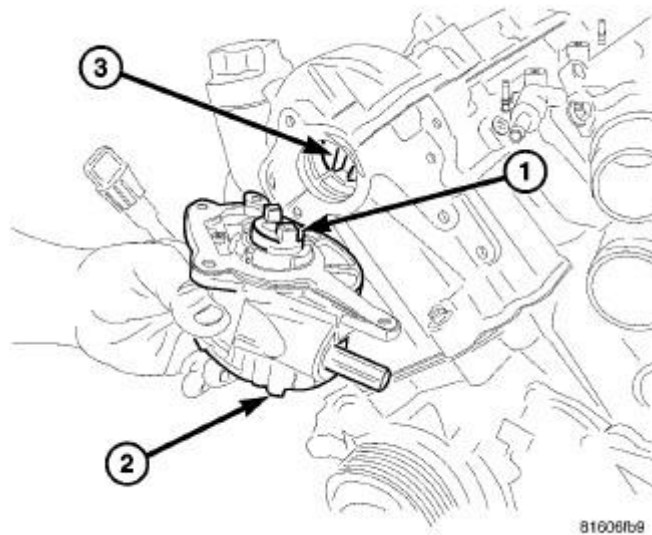


Fig. 158: VACUUM PUMP
Courtesy of CHRYSLER LLC

- 1 - VACUUM PUMP GEAR
- 2 - VACUUM PUMP
- 3 - RIGHT INTAKE CAMSHAFT DRIVE GEAR

30. Align the pump drive gear (1) with the camshaft drive gear (3) and install the vacuum pump (2) with new gasket. Tighten bolts to 9 N.m (7 ft. lbs.).

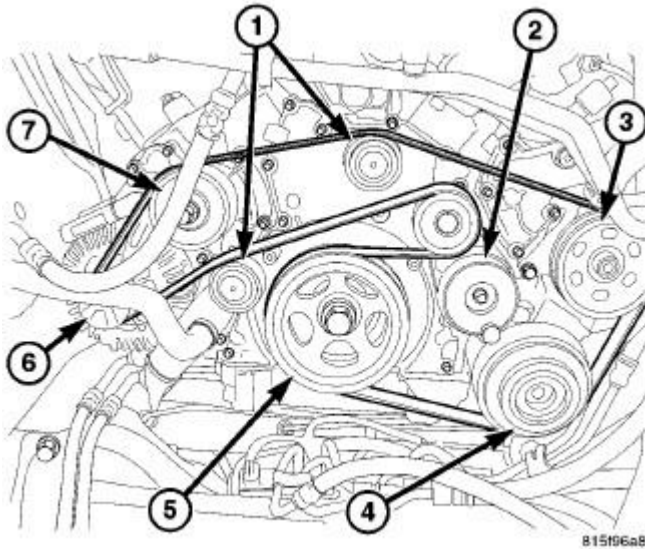


Fig. 159: ACCESSORY DRIVE BELT
Courtesy of CHRYSLER LLC

- 1 - IDLER PULLEYS
- 2 - DRIVE BELT TENSIONER
- 3 - POWER STEERING PUMP
- 4 - AIR CONDITIONING COMPRESSOR
- 5 - VIBRATION DAMPER
- 6 - GENERATOR
- 7 - WATER PUMP

31. Install the belt idler pulleys (1) Tighten the bolts to 58 N.m (43 ft. lbs.).
32. Install the accessory drive belt tensioner (2). Tighten the bolts to 58 N.m (43 ft. lbs.).
33. Install the accessory drive belt.

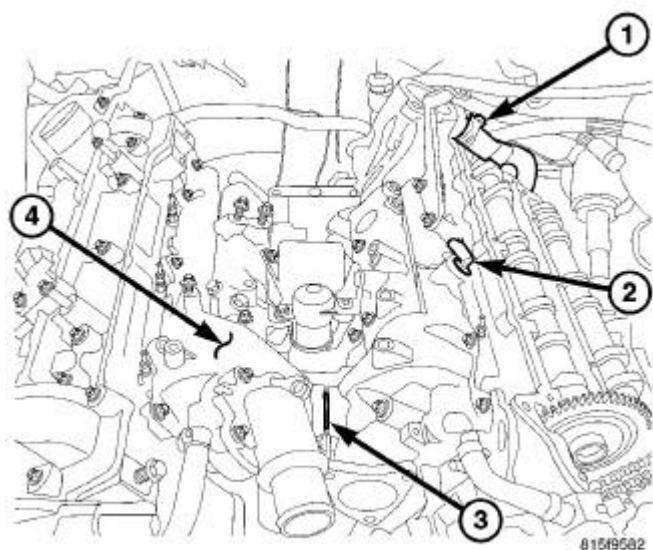


Fig. 160: INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - EGR COOLANT PIPE
2 - COOLANT TEMPERATURE SENSOR
3 - INTAKE COOLANT PASSAGE
4 - INTAKE MANIFOLD |
|---|

CAUTION: The right intake manifold upper thermostat housing bolts should be tightened to 8.5 N.m (74 in. lbs.).

34. Install the intake manifold (4). Tighten bolts to 16 N.m (142 in. lbs.), starting in the middle and tightening in a cross pattern outward until reaching the upper thermostat bolts on the right front manifold.
35. Tighten the upper thermostat bolts on the right cylinder head to 8.5 N.m (74 in. lbs.).

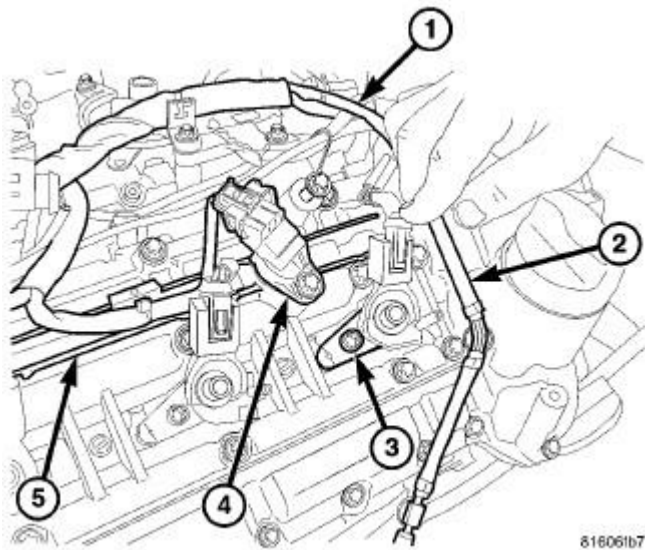


Fig. 161: RIGHT FUEL INJECTORS

Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - MAIN ENGINE WIRING HARNESS
2 - RIGHT FUEL INJECTOR FUEL RETURN HOSE
3 - FUEL INJECTOR RETAINING
4 - CAMSHAFT POSITION SENSOR
5 - ENGINE HARNESS ROUTING PATH</p> |
|---|

CAUTION: The fuel injector sealing washers **MUST** be replaced. **DO NOT** use the old sealing washers or double the sealing washers. **DO NOT** apply injector body lubricant near the injector nozzles.

36. Lubricate the fuel injector body, install the right fuel injectors and new sealing washers.

CAUTION: The fuel injector retaining claw bolts are torque to yield and must always be replaced.

37. Install the injector retaining claws (3) and tighten the bolts to 7 N.m, plus 180° (62 in. lbs., plus 180°).
38. Properly route and install the fuel return hoses (2) and connect them to the injectors.
39. Properly route and connect the engine harness (1).

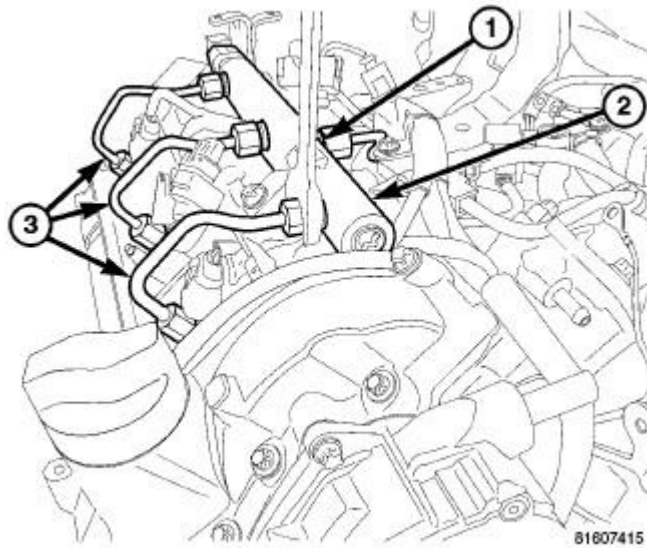


Fig. 162: RIGHT FUEL RAIL
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - FUEL RAIL TRANSFER LINE
2 - RIGHT FUEL RAIL
3 - HIGH PRESSURE FUEL LINES</p> |
|---|

40. Install the fuel rail (2). Tighten the bolts to 27 N.m (20 ft. lbs.).

CAUTION: Inspect the fuel lines for wear or damage, look closely around the flange area. Replace as necessary. DO NOT over tighten.

41. Install the high pressure fuel lines (3), including the fuel rail transfer line (1). Tighten the line nuts to 33 N.m (24 ft. lbs.).
42. Install the fuel filter and connect the harnesses and hoses using Fuel Line Pliers 9539 Hose Clamp pliers.

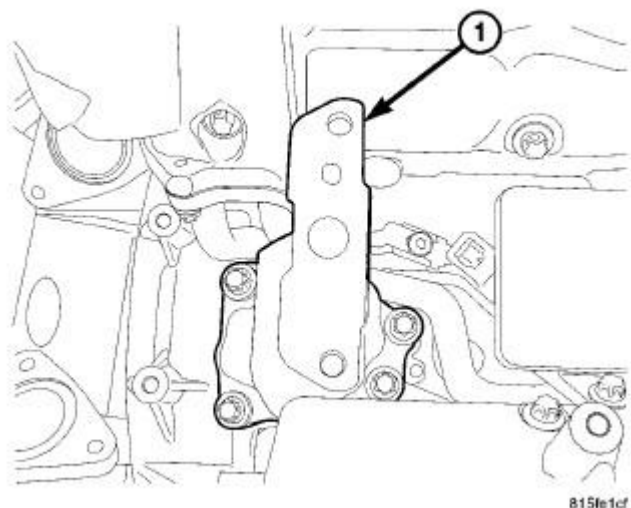


Fig. 163: TURBOCHARGER ADAPTOR

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - TURBOCHARGER ADAPTOR
2 - SWIRL VALVE ACTUATOR |
|--|

CAUTION: Care must be taken when installing the turbocharger oil housing adaptor. The gasket **MUST** be aligned properly with the oil housing passages or immediate damage to the turbocharger will occur.

43. Install the turbocharger oil housing adaptor with the gasket tabs secured to the adaptor. Tighten bolts to 12 N.m (9 ft. lbs.).
44. Install the turbocharger. See Installation .

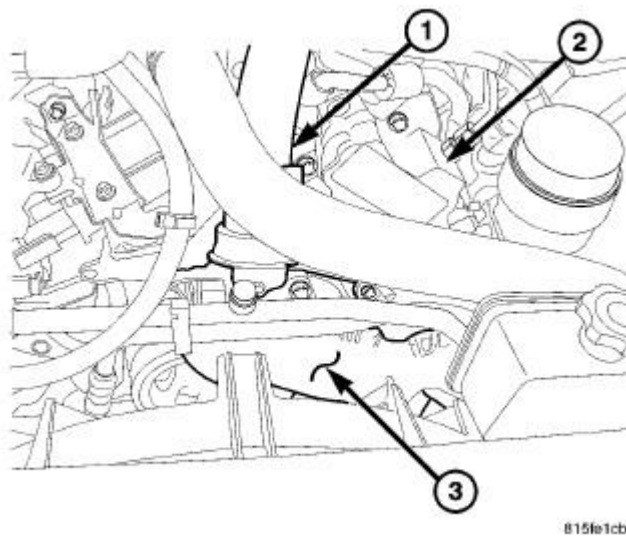


Fig. 164: CHARGE AIR COOLER INLET WITH RESONATOR
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - CHARGE AIR COOLER INLET PIPE
2 - HIGH PRESSURE INJECTION PUMP
3 - CHARGE AIR COOLER INLET RESONATOR</p> |
|--|

45. Install the charge air inlet pipe (1) and resonator (3).

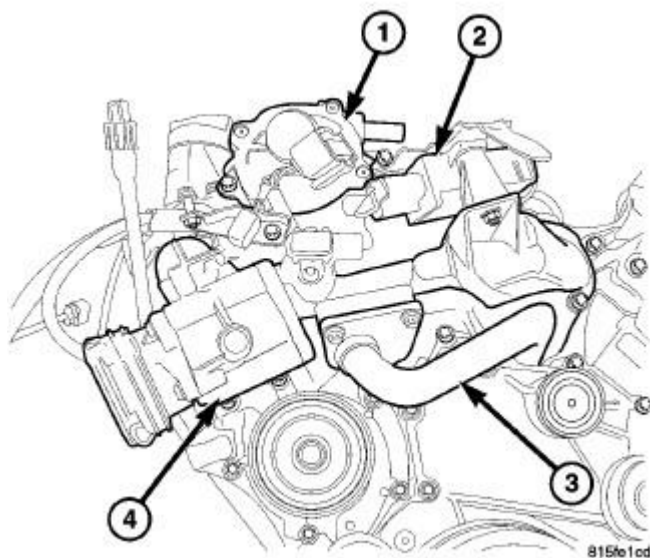


Fig. 165: AIR CONTROL VALVE
Courtesy of CHRYSLER LLC

- | |
|------------------------|
| <p>1 - VACUUM PUMP</p> |
|------------------------|

- 2 - GLOW PLUG RELAY
- 3 - EGR COOLER
- 4 - AIR CONTROL VALVE

46. Install the air control valve and resonator (4).

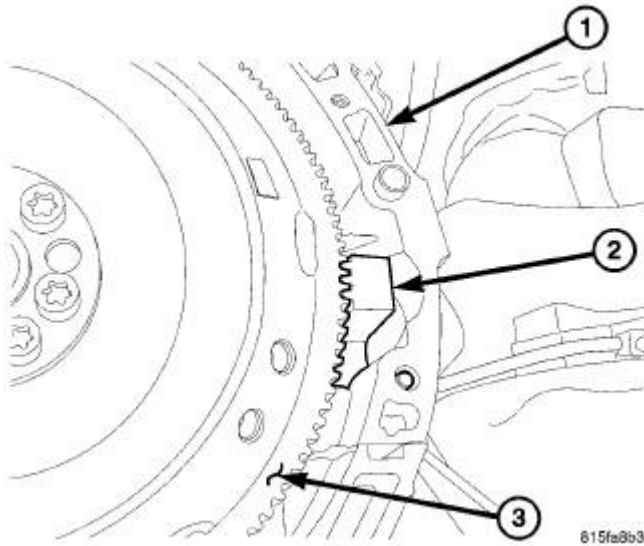
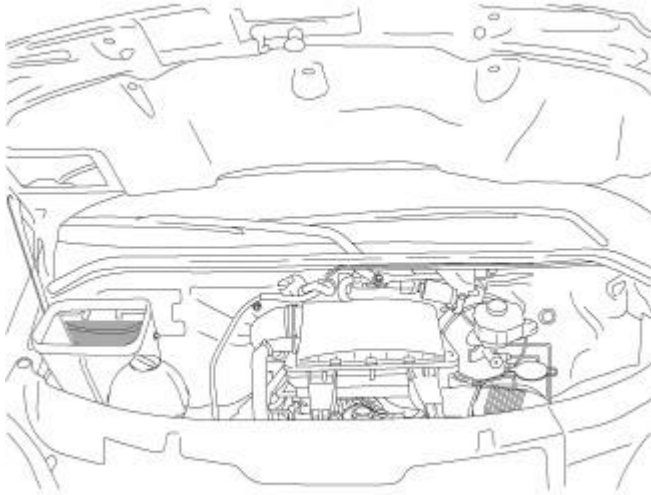


Fig. 166: SPECIAL TOOL # 9102
Courtesy of CHRYSLER LLC

- 1 - ENGINE BLOCK
- 2 - SPECIAL TOOL #9102
- 3 - FLEX PLATE

- 47. Install the cooling fan module.
- 48. Connect the vacuum pump supply hose.
- 49. Raise and support the vehicle.
- 50. Remove special tool #9102 crankshaft lock (2).
- 51. Install the starter blank.
- 52. Connect the cooling fan hydraulic lines.
- 53. Lower the vehicle.
- 54. Fill the cooling system.
- 55. Fill power steering system.
- 56. Install the strut tower support (2).
- 57. Connect the negative battery cable.
- 58. Start engine, allow to warm, turn engine off and inspect for leaks.
- 59. Purge the air from the power steering system using the scan tool.



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Fig. 167: OPEN HOOD

Courtesy of CHRYSLER LLC

60. Install the engine cover brackets and engine cover (3).

CAMSHAFT, ENGINE

Description

DESCRIPTION

The camshafts are multiple-piece components with six machined lobes that are mounted to a hollow shaft with an interference fit. The cam lobes are induction hardened. Each camshaft has four bearing journals except for the right-bank intake camshaft. Due to the longer length needed to accommodate the centrifugal oil separator, the right-bank intake camshaft has five bearing journals. The camshaft journals have the same diameter and are supplied with oil pressure through lubrication passages in the cylinder head journals. The cylinder head covers provide the upper bearing support for the camshafts. Each camshaft contains two retaining brackets, which prevent the camshafts from coming out of their journals when the cylinder head covers are removed. The retaining brackets are not designed to hold the camshafts if the engine is be rotated without the cylinder head covers. Special tool #9555 must be installed if the engine is rotated without the cylinder head covers.

Operation

OPERATION

Each cylinder has two intake and two exhaust valves, and one glow plug. Valve lash is controlled by hydraulic lifter/roller finger followers inside the cylinder head, in bores under the camshafts. The finger followers transfer the camshaft lobe movement into vertical valve movement. The valve moves by the lobe of the camshaft pressing down on the finger follower roller.

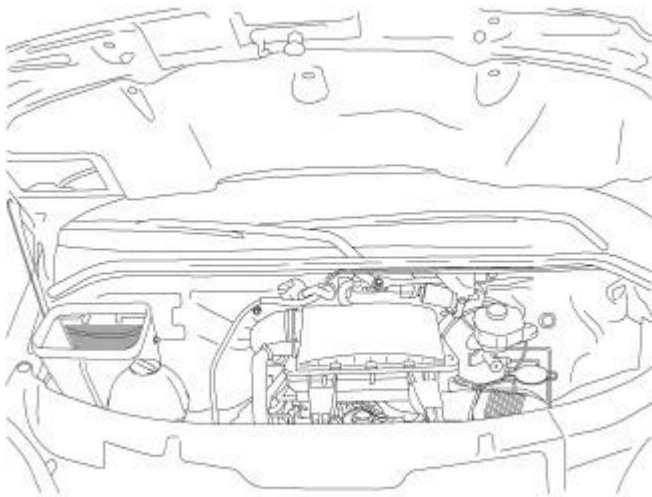
The finger followers are located on top of the hydraulic lifters and the valves. The finger followers are not held rigidly into position; instead, they are held in position by resting on top of the valve and the hydraulic lifter pivoting ball. A holding clip secures the finger follower to the hydraulic lifter.

WARNING: When the hydraulic lash adjusters are removed from the engine, they must be stored upright and in clean conditions. Install the finger followers and hydraulic lifters in the same location as removed.

WARNING: Replacement of the camshaft will also require replacement of the finger followers and hydraulic lifters.

Removal

LEFT



81b73043

Fig. 168: OPEN HOOD

Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable. Refer to **Electrical - Engine Systems/Battery System/CABLES, Battery - Removal**.
2. Remove engine cover.

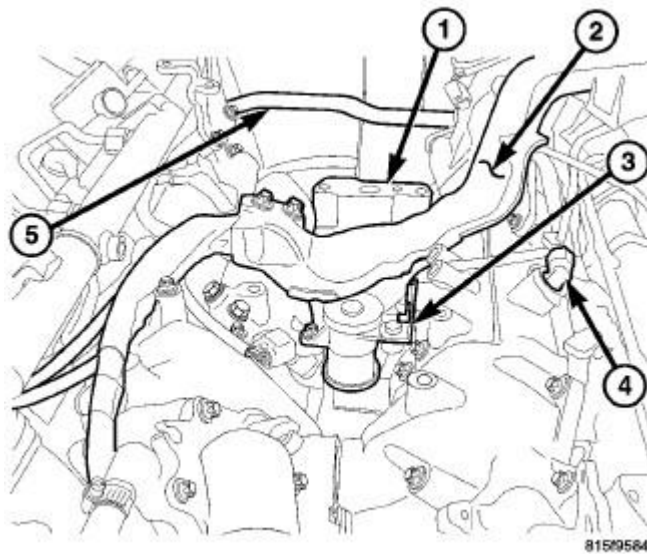


Fig. 169: MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - TURBOCHARGER OIL HOUSING ADAPTOR
2 - MAIN ENGINE WIRING HARNESS
3 - SWIRL VALVE ACTUATOR
4 - COOLANT TEMPERATURE SENSOR |
|--|

3. Rotate the engine to TDC using the vibration damper bolt.
4. Remove the main engine wiring harness retainers at the rear of the cylinder head cover.
5. Remove the EGR valve.
6. Remove the charge air inlet tube.
7. Disconnect the fuel line hoses at the fuel rail, high pressure pump using 9539 Pliers.
8. Disconnect the fuel lines at the left cylinder head.

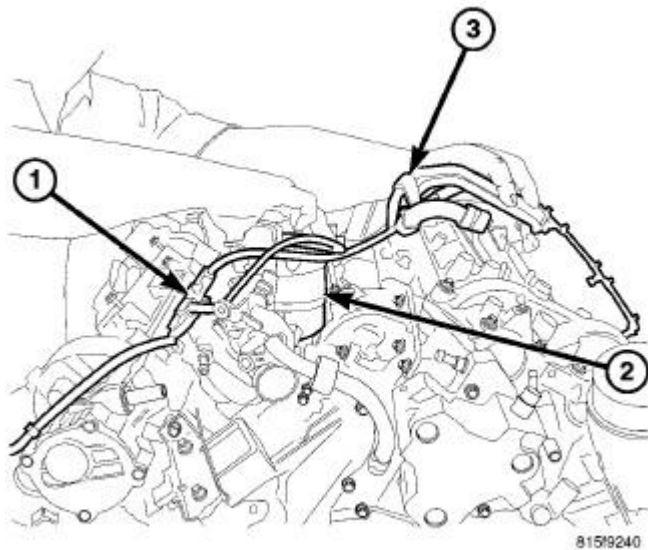


Fig. 170: FUEL FILTER, LINES AND HOSES
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - RETURN FUEL HOSE BUNDLE
2 - FUEL FILTER
3 - LOW PRESSURE FUEL SUPPLY AND RETURN PIPE</p> |
|---|

9. Remove the fuel pipe bundle and set aside.
10. Remove the oil filter housing support bracket.
11. Remove the cylinder head cover.

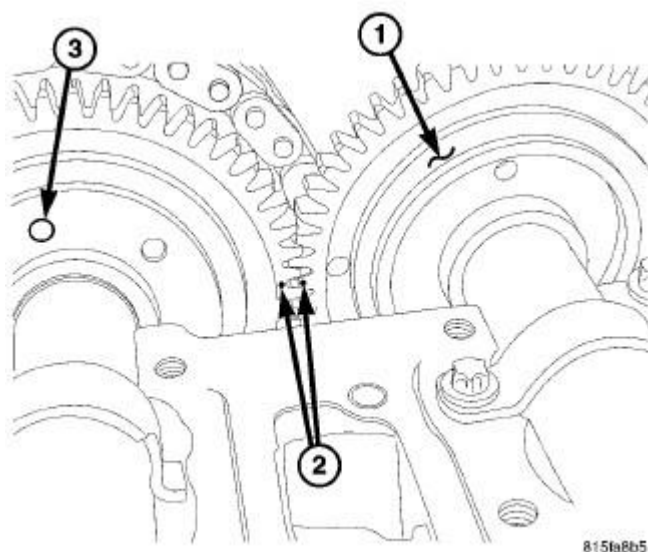


Fig. 171: CAMSHAFT GEAR ALIGNMENT
Courtesy of CHRYSLER LLC

- 1 - CAMSHAFT GEAR
- 2 - CAMSHAFT GEAR ALIGNMENT MARKS
- 3 - CAMSHAFT DRIVE GEAR DOWEL POSITION

NOTE: The left exhaust camshaft gear alignment mark is located in the gear tooth valley. The left intake camshaft gear mark is located on the outside of the tooth.

12. Check the camshaft timing gears for alignment. The alignment marks should be touching and the exhaust camshaft drive gear alignment pin should be located at approximately 12 o'clock, when viewed from the front camshaft seal.
13. Rotate the engine by the vibration damper bolt, past TDC to gain access to the lower camshaft drive gear bolt, and remove the bolt.
14. Rotate the engine back to TDC and check camshaft gear alignment.

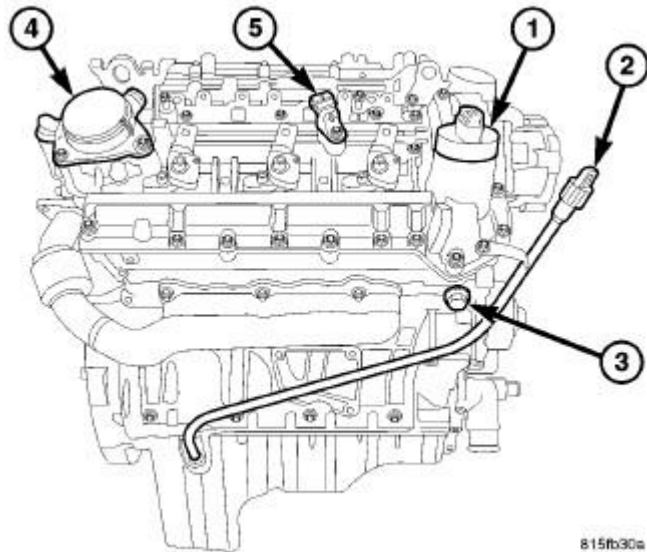
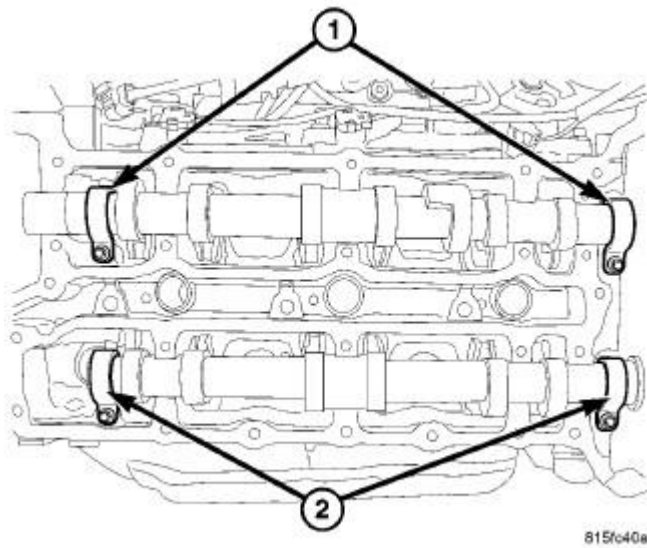


Fig. 172: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- 1 - ENGINE OIL CAP
- 2 - OIL LEVEL INDICATOR
- 3 - TIMING CHAIN TENSIONER
- 4 - OIL SEPARATOR ASSEMBLY
- 5 - CAMSHAFT POSITION SENSOR

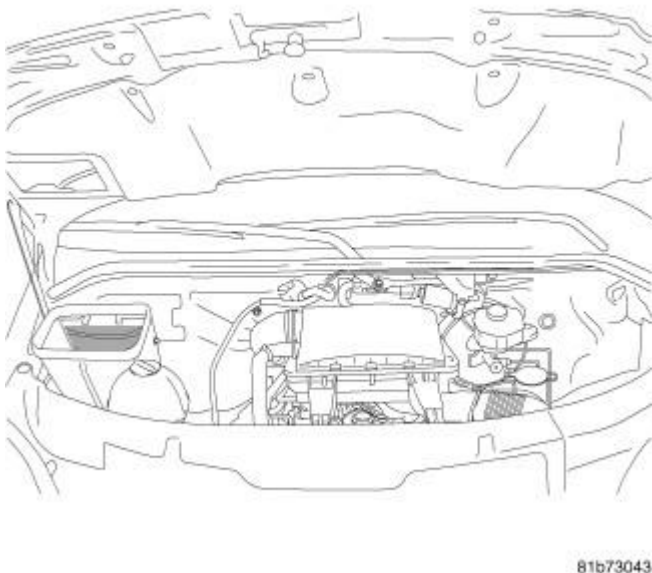
15. Remove the timing chain tensioner (3).
16. Paint mark or scribe the timing chain to drive gear relation.
17. Tie strap the timing chain to drive gear.
18. Remove the remaining camshaft drive gear bolts and separate the drive gear from camshaft gear.

**Fig. 173: CAMSHAFT RETAINERS**

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - INTAKE CAMSHAFT RETAINERS
2 - EXHAUST CAMSHAFT RETAINERS |
|---|

19. Remove the intake and exhaust camshaft retainers.
20. Remove the left cylinder head camshafts.

RIGHT**Fig. 174: OPEN HOOD**

Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable. Refer to Electrical - Engine Systems/Battery System/CABLES, Battery - Removal.
2. Remove engine cover.
3. Rotate the engine to TDC using the vibration damper bolt.

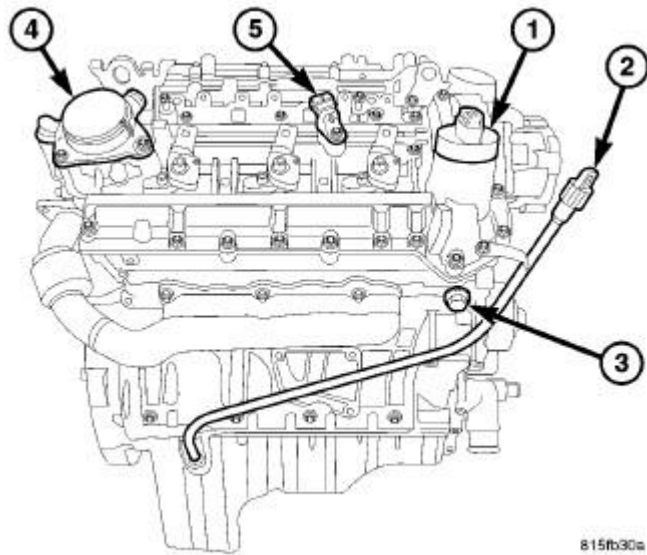


Fig. 175: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - ENGINE OIL CAP
2 - OIL LEVEL INDICATOR
3 - TIMING CHAIN TENSIONER
4 - OIL SEPARATOR ASSEMBLY
5 - CAMSHAFT POSITION SENSOR |
|---|

4. Remove the intake air resonator.
5. Remove the vacuum pump.
6. Remove the oil level indicator tube (2) retaining bolt at the right cylinder head cover.
7. Remove the crankcase breather assembly (4) from the right cylinder head cover.
8. Remove the cylinder head cover. See Removal.

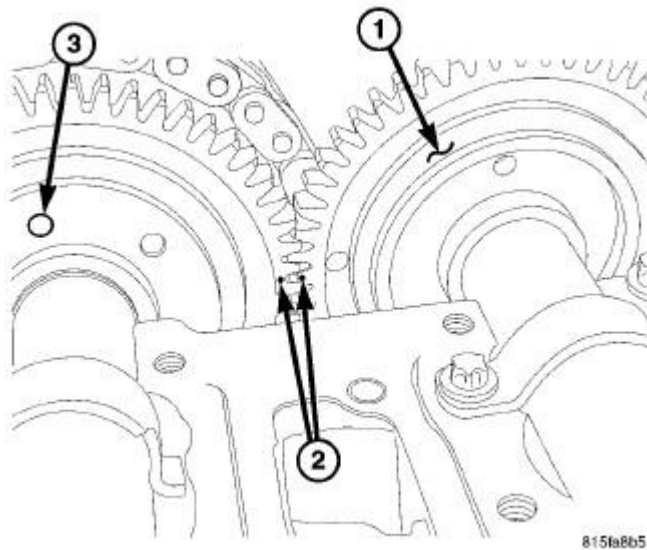
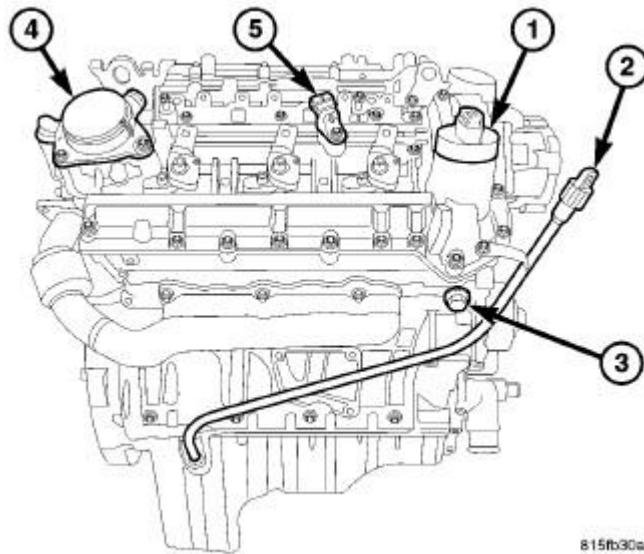


Fig. 176: CAMSHAFT GEAR ALIGNMENT
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - CAMSHAFT GEAR
2 - CAMSHAFT GEAR ALIGNMENT MARKS
3 - CAMSHAFT DRIVE GEAR DOWEL POSITION |
|--|

NOTE: The right exhaust camshaft gear alignment mark is located in the gear tooth valley. The left intake camshaft gear mark is located on the outside of the tooth.

9. Check the camshaft timing gears for alignment. The alignment marks should be touching and the exhaust camshaft drive gear alignment pin should be located at approximately 12 o'clock, when viewed from the front camshaft seal.
10. Rotate the engine by the vibration damper bolt, past TDC to gain access to the lower camshaft drive gear bolt, and remove the bolt.
11. Rotate the engine back to TDC and check camshaft gear alignment.

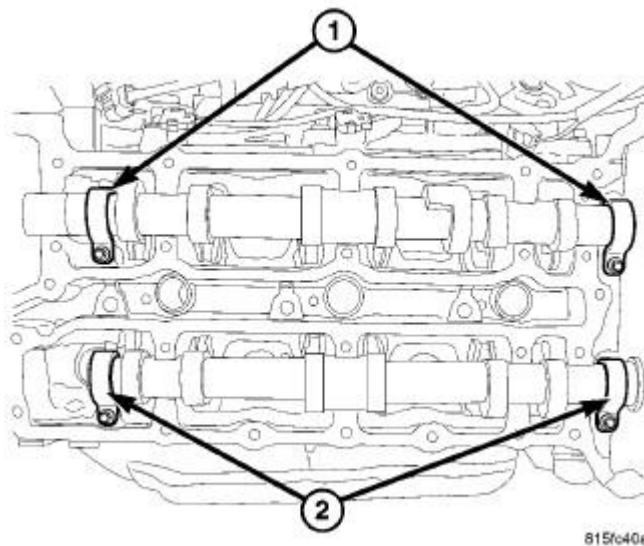


815fb30a

Fig. 177: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- 1 - ENGINE OIL CAP
- 2 - OIL LEVEL INDICATOR
- 3 - TIMING CHAIN TENSIONER
- 4 - OIL SEPARATOR ASSEMBLY
- 5 - CAMSHAFT POSITION SENSOR

12. Remove the timing chain tensioner (3).



815fc40a

Fig. 178: CAMSHAFT RETAINERS
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - INTAKE CAMSHAFT RETAINERS
2 - EXHAUST CAMSHAFT RETAINERS |
|---|

13. Paint mark or scribe the timing chain to drive gear relation.
14. Tie strap the timing chain to drive gear.
15. Remove the remaining camshaft drive gear bolts and separate the drive gear from camshaft gear.
16. Remove the intake and exhaust camshaft retainers.
17. Remove the left cylinder head camshafts.

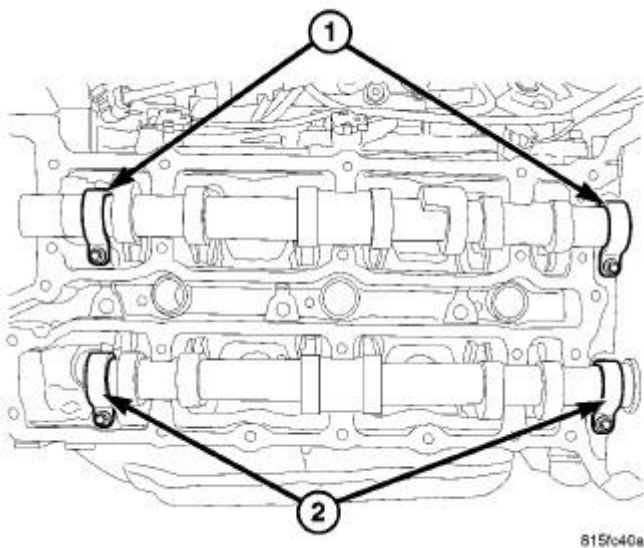
Installation**LEFT**

Fig. 179: CAMSHAFT RETAINERS
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - INTAKE CAMSHAFT RETAINERS
2 - EXHAUST CAMSHAFT RETAINERS |
|---|

1. Clean all mating surfaces.
2. Lubricate camshafts with Mopar® Engine Oil Supplement, or equivalent.
3. Carefully install camshafts onto cylinder head journals and align the camshaft gear timing marks.
4. Install the camshaft retainers and tighten each retaining bolt to 9 N.m (80 in. lbs.).

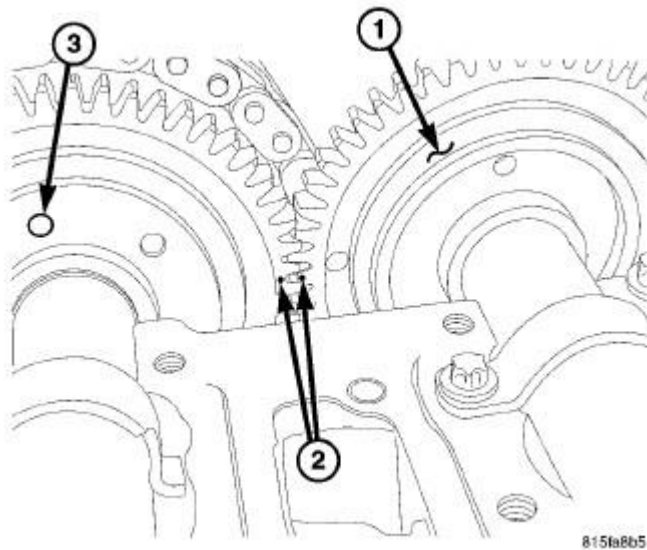


Fig. 180: CAMSHAFT GEAR ALIGNMENT

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - CAMSHAFT GEAR
2 - CAMSHAFT GEAR ALIGNMENT MARKS
3 - CAMSHAFT DRIVE GEAR DOWEL POSITION |
|--|

5. After camshafts are properly installed in cylinder head cover check end play of camshafts with a dial indicator.

NOTE: The left exhaust camshaft gear alignment mark is located in the gear tooth valley. The left intake camshaft gear mark is located on the outside of the tooth.

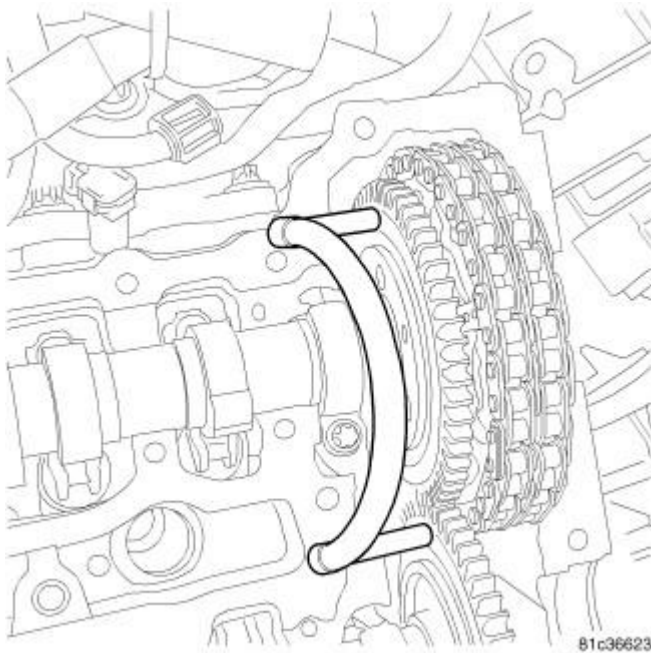
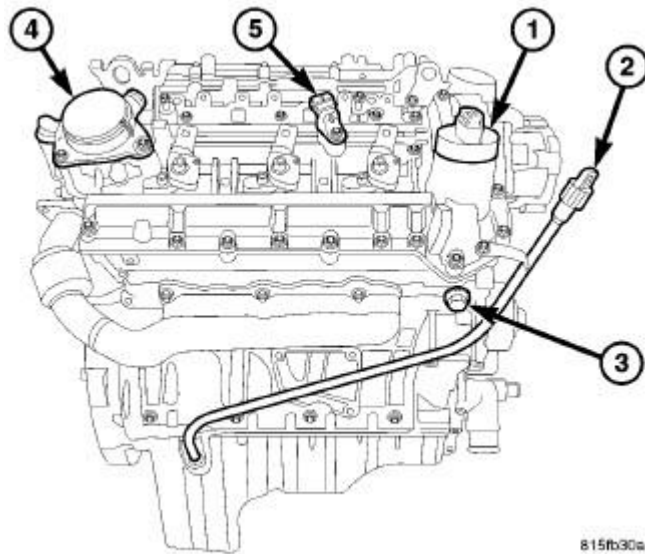


Fig. 181: CAMSHAFT PINS
Courtesy of CHRYSLER LLC

NOTE: The alignment marks should be touching and the exhaust camshaft drive gear alignment pin should be located at approximately 12 o'clock, when viewed from the front camshaft seal.

6. Assure the proper positioning of the camshaft gear alignment marks and install the camshaft driven gear onto the exhaust camshaft alignment dowel.
7. Install two of the drive gear bolts. Tighten the bolts to 18 N.m (13 ft. lbs.).
8. Assure proper positioning of the timing chain to drive gear paint or scribe marks and remove the tie strap.
9. Rotate the engine by the vibration damper bolt enough to install the third camshaft drive gear bolt. Tighten the bolt to 18 N.m (13 ft. lbs.).
10. Rotate the engine back to TDC and check camshaft gear alignment.

NOTE: If the camshaft endplay is not within specification, replace the cylinder head and cylinder head cover.

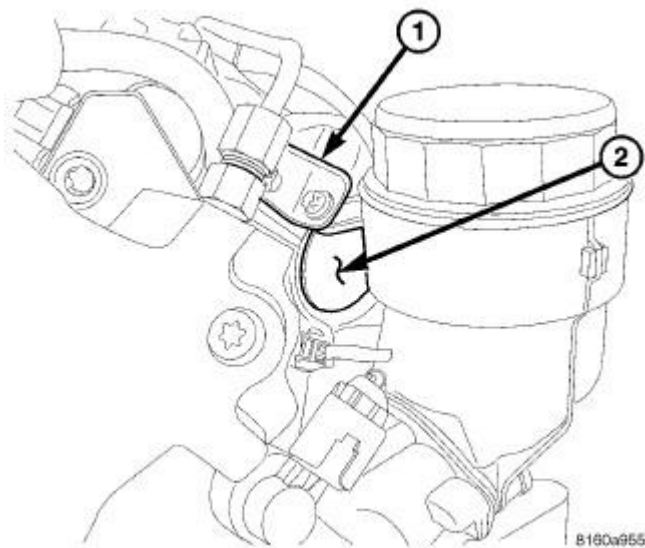


815fb30a

Fig. 182: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- 1 - ENGINE OIL CAP
- 2 - OIL LEVEL INDICATOR
- 3 - TIMING CHAIN TENSIONER
- 4 - OIL SEPARATOR ASSEMBLY
- 5 - CAMSHAFT POSITION SENSOR

11. Install the timing chain tensioner.



8160a955

Fig. 183: LEFT FRONT CAMSHAFT SEAL WITH OIL FILTER HOUSING BRACKET
Courtesy of CHRYSLER LLC

- 1 - OIL FILTER HOUSING BRACKET
- 2 - LEFT FRONT CAMSHAFT OIL SEAL

12. Install the left front camshaft oil seal (2).

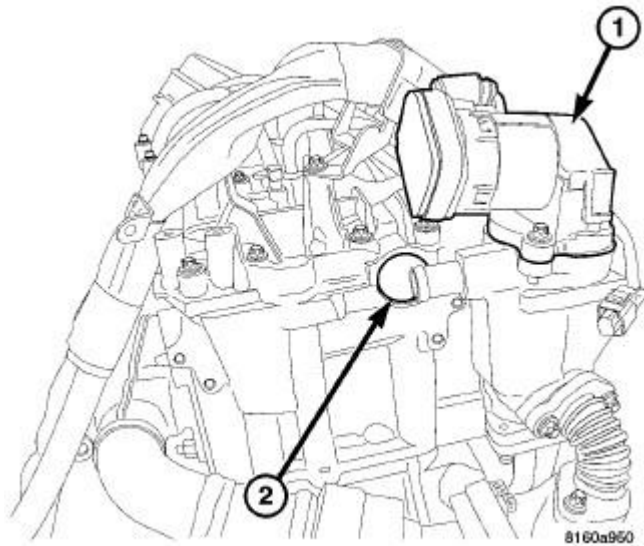


Fig. 184: LEFT REAR CAMSHAFT SEAL
Courtesy of CHRYSLER LLC

- 1 - EGR VALVE
- 2 - LEFT REAR CAMSHAFT OIL SEAL

13. Install the left rear camshaft oil seal (2).

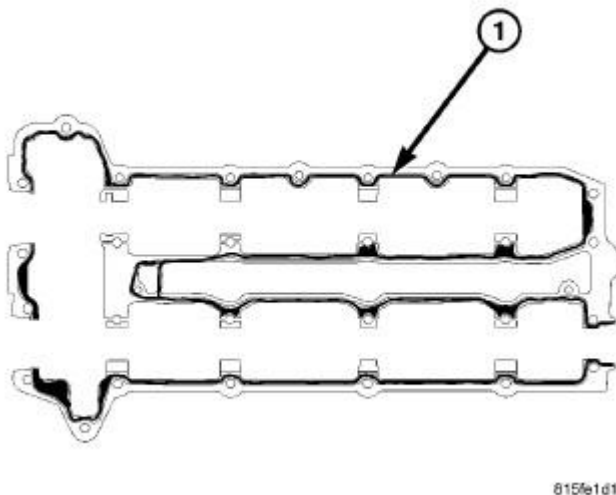


Fig. 185: SEALANT APPLICATION TO LEFT CYLINDER HEAD COVER

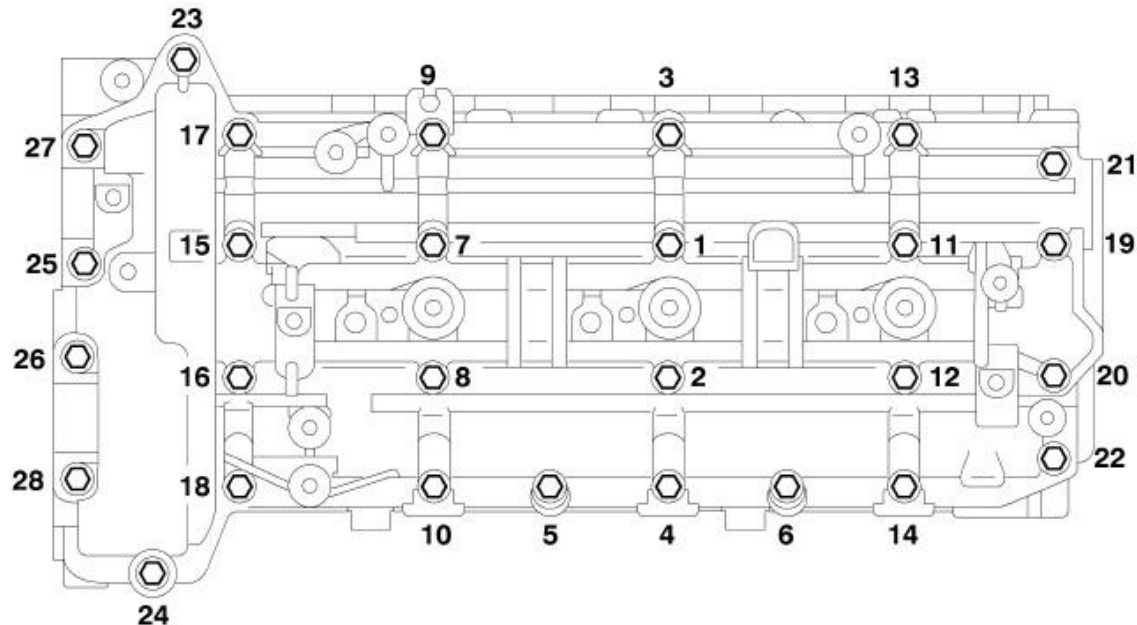
Courtesy of CHRYSLER LLC

1 - 1.5 MM MOPAR ENGINE SEALANT RTV

14. Clean and inspect all sealing surfaces.

NOTE: Care must be taken not to get any engine sealant on the camshaft journals of the cylinder head cover.

15. Install a 1/8 in bead of Mopar Engine RTV Gen II sealant to the underside of the cylinder head cover. See **Standard Procedure** .



8178df03

Fig. 186: CYLINDER HEAD COVER BOLTS TIGHTENING SEQUENCE

Courtesy of CHRYSLER LLC

16. Carefully position the cylinder head cover and install the bolts into their original position.

CAUTION: The cylinder head cover bolts are different lengths. Do not use the wrong length bolts or engine damage may result.

17. Tighten cylinder head cover bolts in sequence, first to 4 N.m (35 in. lbs.), and then repeat the sequence to 8.4 N.m (75 in. lbs.).

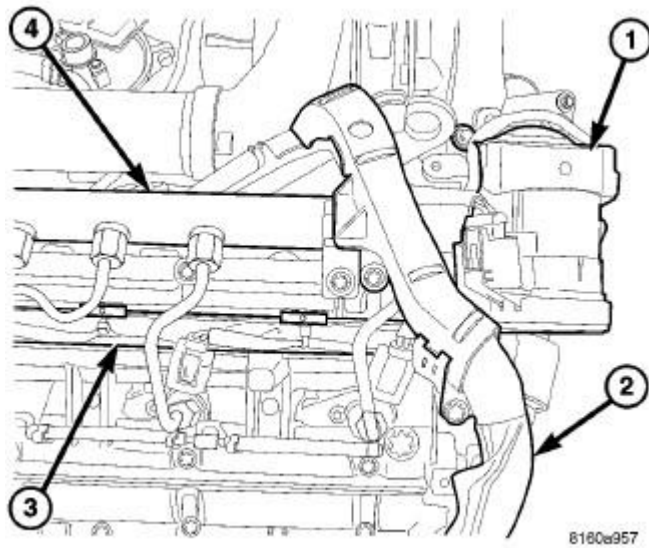


Fig. 187: EGR VALVE WITH MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - EXHAUST GAS RECIRCULATION (EGR) VALVE
2 - MAIN ENGINE WIRING HARNESS
3 - FUEL INJECTOR WIRING HARNESS
4 - LEFT FUEL RAIL |
|---|

18. Install the EGR valve.

CAUTION: The fuel injector sealing washers **MUST** be replaced. **DO NOT** use the old sealing washers or double the sealing washers.

NOTE: Care must be taken not to apply any lubricant to the fuel injector nozzles.

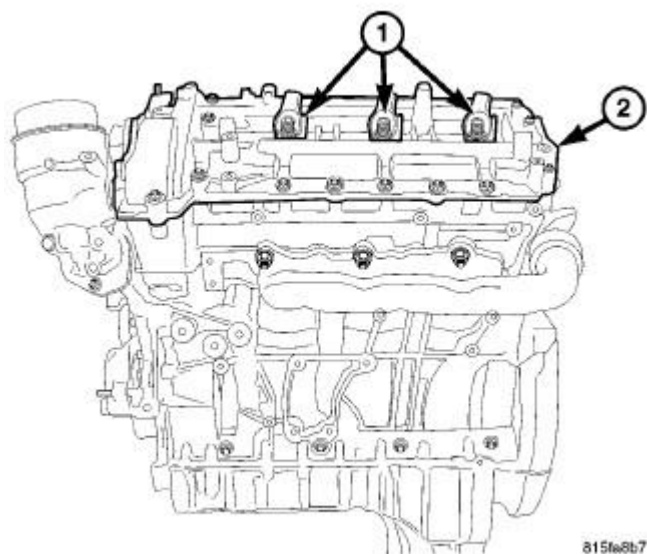


Fig. 188: LEFT CYLINDER HEAD COVER
 Courtesy of CHRYSLER LLC

19. Install the fuel injectors (1). Tighten the injector retaining claw bolt to 7 N.m (5 ft. lbs.) and then an additional 180°.
20. Reposition and secure the engine harness.
21. Install the left fuel rail. Tighten the fuel rail bolts to 11 N.m (8 in. lbs.).
22. Position the return fuel lines and secure to the injectors. Push down on the release lock tab to secure.
23. Connect the fuel injector electrical connectors.
24. Install the left rear engine cover bracket.

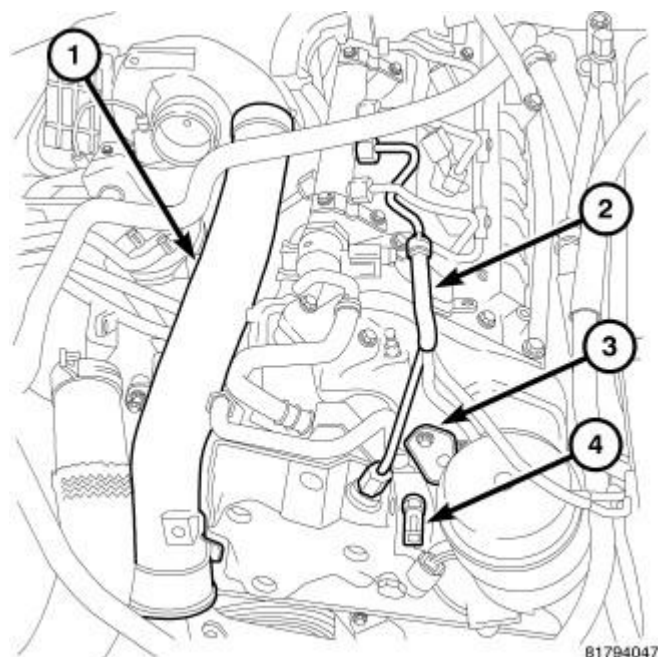
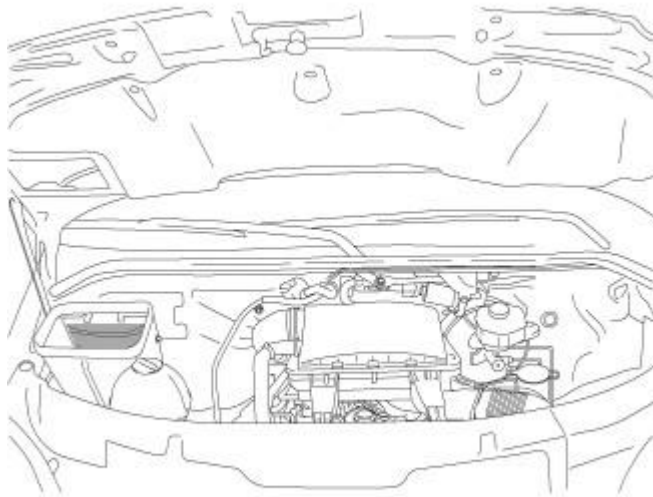


Fig. 189: SENSORS LINE AIRTUBE**Courtesy of CHRYSLER LLC**

25. Install the high pressure fuel lines from the fuel rail to injectors. Tighten the line connections to 27 N.m (20 ft. lbs.).
26. Install the fuel line from the high pressure pump to the left fuel rail. Tighten the retaining bolt to 30 N.m (22 ft. lbs.).
27. Install the fuel supply line to the fuel filter and high pressure pump.
28. Connect both fuel lines at the high pressure pump.
29. Install the air filter housing and tube.
30. Connect the negative battery cable.
31. Start the engine, run until warm, turn engine off and inspect for leaks.

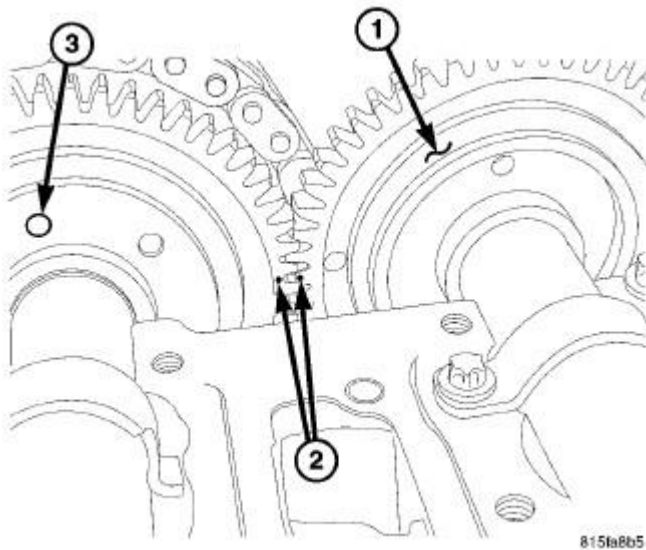


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Fig. 190: OPEN HOOD**Courtesy of CHRYSLER LLC**

32. Install the engine cover.
33. Connect negative battery cable.
34. Start engine, allow to warm, turn engine off and inspect for leaks.

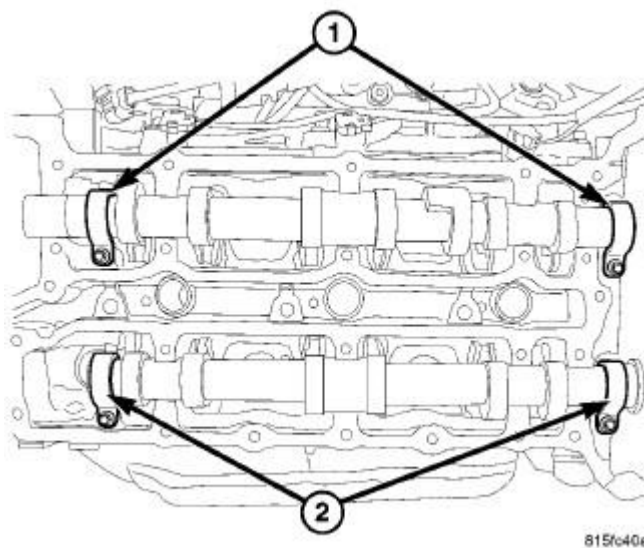
RIGHT

**Fig. 191: CAMSHAFT GEAR ALIGNMENT**

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - CAMSHAFT GEAR
2 - CAMSHAFT GEAR ALIGNMENT MARKS
3 - CAMSHAFT DRIVE GEAR DOWEL POSITION |
|--|

1. Clean all mating surfaces.
2. Lubricate camshafts with Mopar® Engine Oil Supplement, or equivalent.
3. Carefully install camshafts onto cylinder head journals and align the camshaft gear timing marks.

**Fig. 192: CAMSHAFT RETAINERS**

Courtesy of CHRYSLER LLC

- 1 - INTAKE CAMSHAFT RETAINERS
- 2 - EXHAUST CAMSHAFT RETAINERS

4. Install the camshaft retainers and tighten each retaining bolt to 9 N.m (80 in. lbs.).

NOTE: If the camshaft endplay is not within specification, replace the cylinder head and cylinder head cover.

5. After camshafts are properly installed in cylinder head cover check end play of camshafts with a dial indicator.

NOTE: The right exhaust camshaft gear alignment mark is located in the gear tooth valley. The right intake camshaft gear mark is located on the outside of the tooth. The alignment marks should be touching and the exhaust camshaft drive gear alignment pin should be located at approximately 12 o'clock, when viewed from the front camshaft seal.

6. Assure the proper positioning of the camshaft gear alignment marks and install the camshaft driven gear onto the exhaust camshaft alignment dowel.

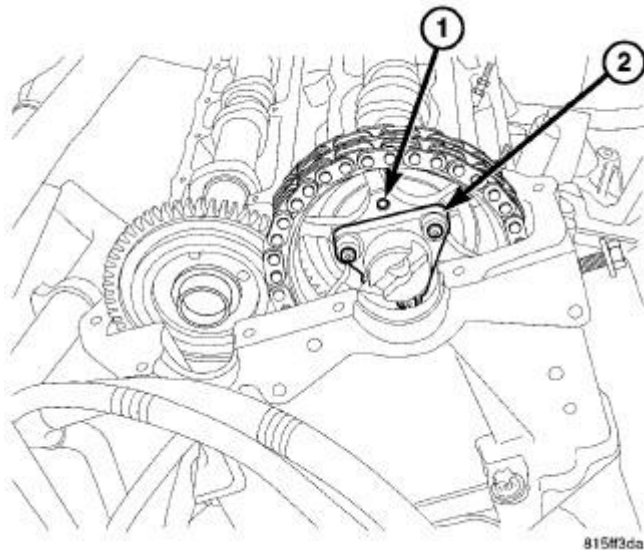


Fig. 193: RIGHT INTAKE CAMSHAFT DRIVE GEAR
Courtesy of CHRYSLER LLC

- 1 - RIGHT CAMSHAFT DRIVE GEAR ALIGNMENT DOWEL
- 2 - VACUUM PUMP DRIVE

7. Install two of the drive gear bolts. Tighten the bolts to 18 N.m (13 ft. lbs.).
8. Assure proper positioning of the timing chain to drive gear paint or scribe marks and remove the tie strap.

9. Rotate the engine by the vibration damper bolt enough to install the third camshaft drive gear bolt. Tighten the bolt to 18 N.m (13 ft. lbs.).
10. Rotate the engine back to TDC and check camshaft gear alignment.

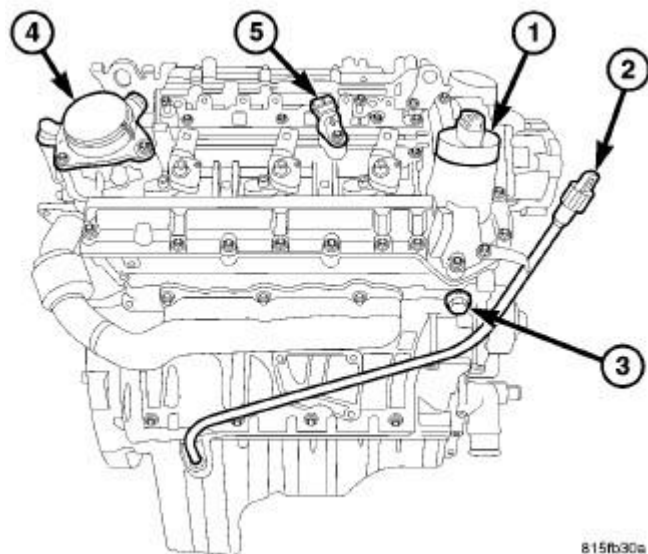
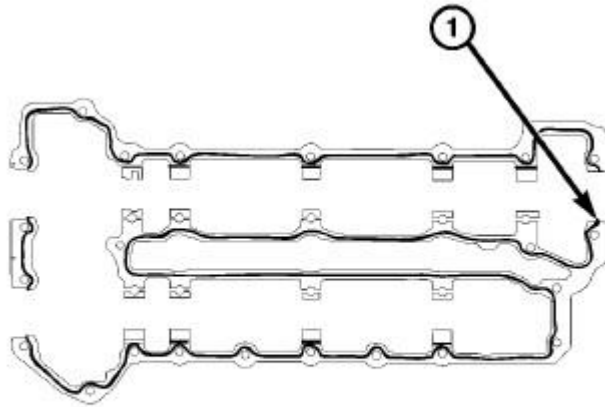


Fig. 194: TIMING CHAIN TENSIONER

Courtesy of CHRYSLER LLC

- | |
|---|
| <ul style="list-style-type: none">1 - ENGINE OIL CAP2 - OIL LEVEL INDICATOR3 - TIMING CHAIN TENSIONER4 - OIL SEPARATOR ASSEMBLY5 - CAMSHAFT POSITION SENSOR |
|---|

11. Install the timing chain tensioner (3).



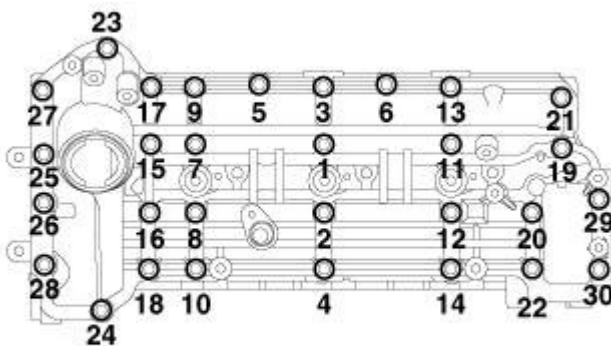
816006db

Fig. 195: RIGHT CYLINDER HEAD COVER SEALANT
Courtesy of CHRYSLER LLC

1 - 1.5 MM MOPAR ENGINE SEALANT RTV

NOTE: Care must be taken not to get any engine sealer on the camshaft journals.

12. Clean all mating surfaces.
13. Apply a 1.5 mm bead of Mopar® Engine RTV Sealant (1) to the cylinder head cover.



45631

Fig. 196: RIGHT CYLINDER HEAD COVER TIGHTENING SEQUENCE
Courtesy of CHRYSLER LLC

14. Place the camshaft seal into position.

15. Install the cylinder head cover. Tighten the bolts in three stages following the sequence provided. First to 4 N.m (35 in. lbs.), then to 6 N.m (53 in. lbs.), and then to 8.4 N.m (75 in. lbs.).

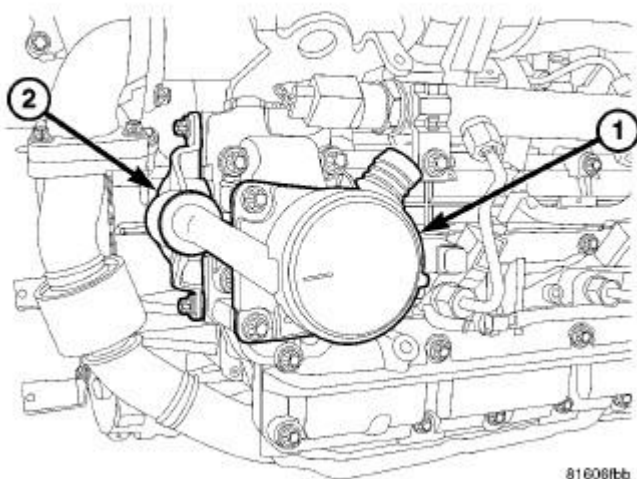


Fig. 197: OIL SEPARATOR
Courtesy of CHRYSLER LLC

- | |
|-----------------------------------|
| 1 - OIL SEPARATOR HOUSING |
| 2 - OIL SEPARATOR HOUSING ADAPTOR |

16. Install the oil separator housing adaptor (2) with new camshaft seal. Tighten fasteners to 9 N.m (7 ft. lbs.).
17. Install the oil separator (1). Tighten fasteners to 9 N.m (7 ft. lbs.).

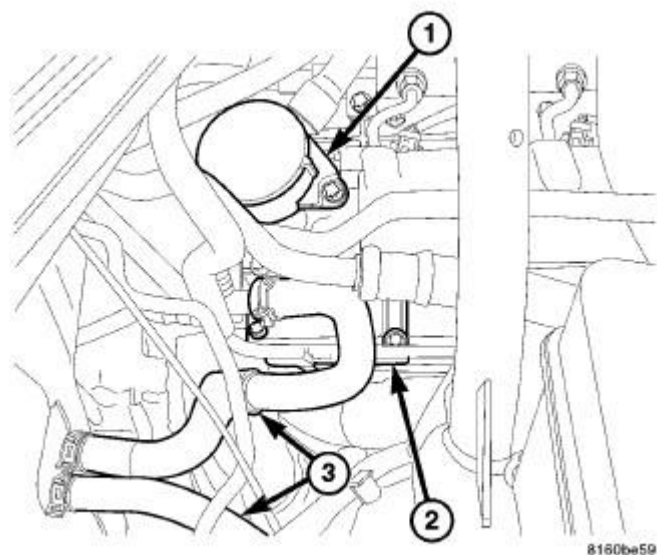
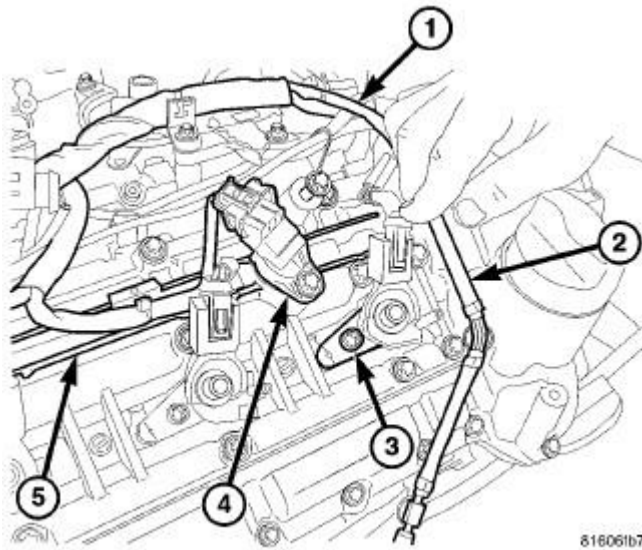


Fig. 198: HEATER HOSE WITH BRACKET

Courtesy of CHRYSLER LLC

- 1 - OIL SEPARATOR
- 2 - HEATER HOSE BRACKET
- 3 - HEATER HOSES

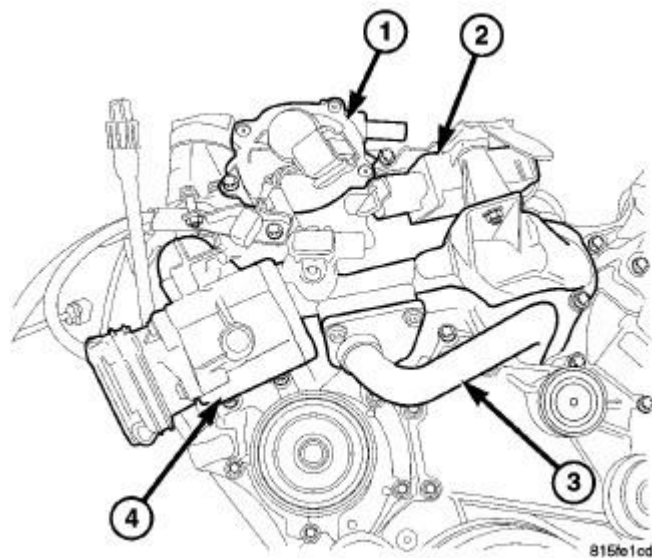
18. Secure the transmission tube fastener to the engine cover bracket.
19. Secure the heater hose bracket (2) to the cylinder head cover.

**Fig. 199: RIGHT FUEL INJECTORS**

Courtesy of CHRYSLER LLC

- 1 - MAIN ENGINE WIRING HARNESS
- 2 - RIGHT FUEL INJECTOR FUEL RETURN HOSE
- 3 - FUEL INJECTOR RETAINING
- 4 - CAMSHAFT POSITION SENSOR
- 5 - ENGINE HARNESS ROUTING PATH

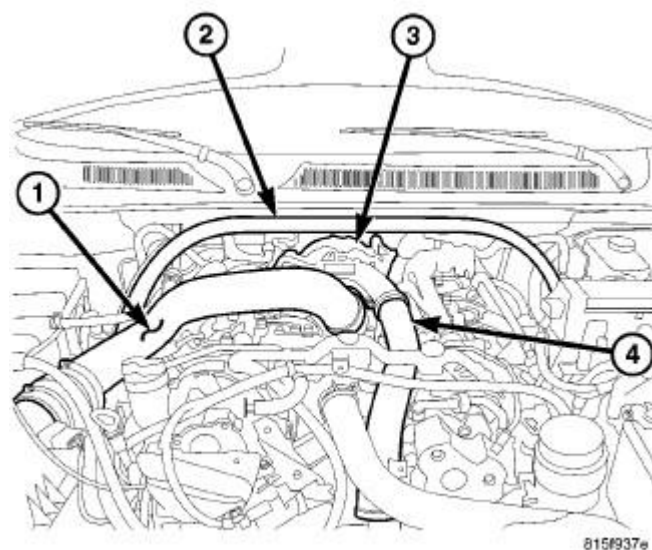
20. Secure the vacuum pump hose pipe to the cylinder head cover.
21. Install the fuel injectors. Tighten hold down fasteners (3) to 7 N.m, plus 180° (62 in. lbs., plus 180°).
22. Connect the camshaft position sensor (4) and fuel injector wiring harness connectors.
23. Connect the return fuel hose (2) to each injector.
24. Install the fuel rail, high pressure fuel lines and injector cover.

**Fig. 200: AIR CONTROL VALVE**

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - VACUUM PUMP
2 - GLOW PLUG RELAY
3 - EGR COOLER
4 - AIR CONTROL VALVE |
|---|

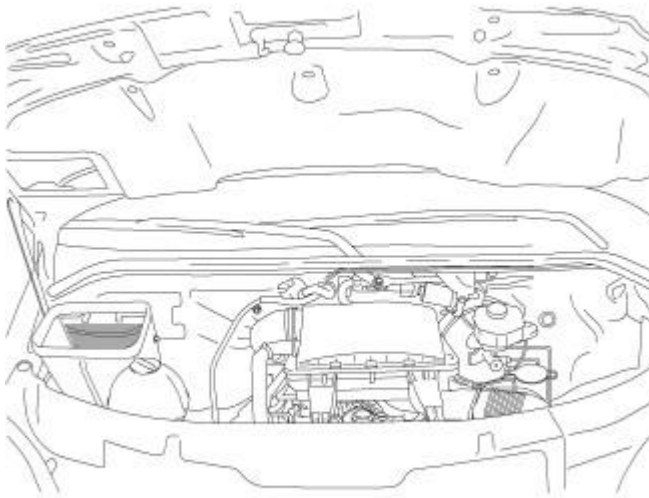
25. Secure the oil dipstick tube to the cylinder head. Tighten fastener to 11 N.m (8 in. lbs.).
26. Install the vacuum pump (1).
27. Install the air control valve resonator (2).

**Fig. 201: STRUT TOWER SUPPORT**

Courtesy of CHRYSLER LLC

- 1 - AIR CLEANER OUTLET TUBE
- 2 - STRUT TOWER SUPPORT
- 3 - TURBOCHARGER
- 4 - CHARGE AIR INLET TUBE

28. Install the air cleaner outlet tube to the turbocharger and secure the air cleaner housing cover.



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Fig. 202: OPEN HOOD

Courtesy of CHRYSLER LLC

29. Install the engine cover.
30. Connect negative battery cable. Refer to **Electrical - Engine Systems/Battery System/CABLES, Battery - Removal**.
31. Start engine, allow to warm, turn engine off and inspect for leaks.

COVER(S), CYLINDER HEAD

Description

DESCRIPTION

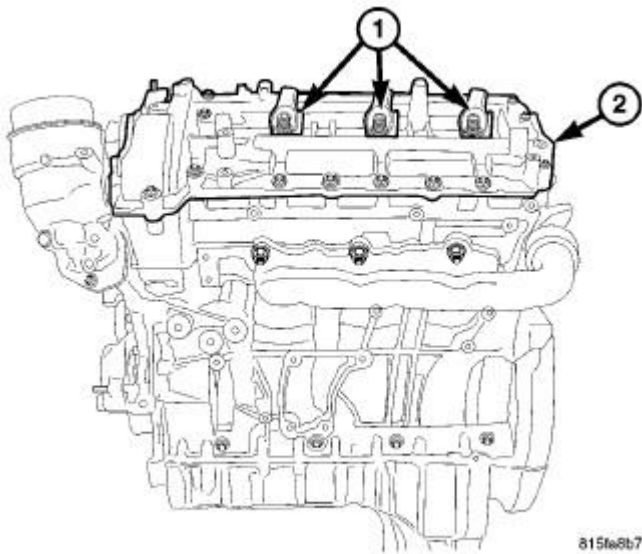


Fig. 203: LEFT CYLINDER HEAD COVER

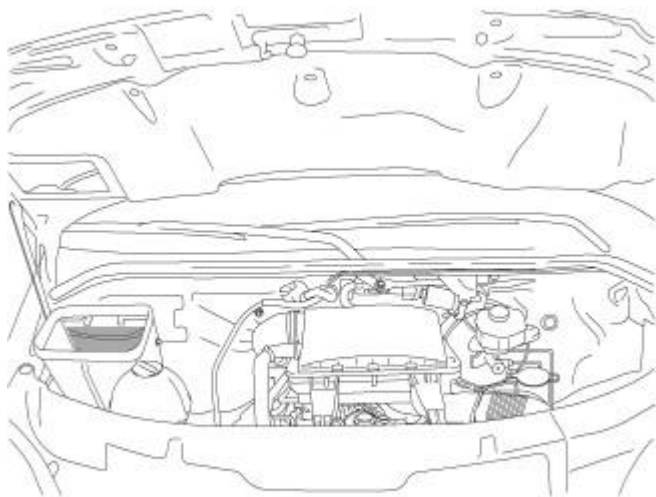
Courtesy of CHRYSLER LLC

CAUTION: Exercise caution when servicing the cylinder head covers. If a cylinder head cover is damaged, the cylinder head must also be replaced. Do not rotate the engine without cam holding tool 9555 if the cylinder head covers are removed.

The 3.0L cylinder head covers are made of cast aluminum and incorporate a oil drain back hole for the positive crankcase ventilation (PCV) system. The covers serve as engine noise inhibitors and are specifically designed to act as the camshaft main caps and thrust washers. Care must be taken when sealing the covers, too much sealant or sealant installed improperly may effect camshaft main cap clearances.

Removal

RIGHT



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Fig. 204: OPEN HOOD

Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable. Refer to **Electrical - Engine Systems/Battery System/CABLES, Battery - Removal** .
2. Position the coolant reservoir aside. Refer to **Cooling/Engine/BOTTLE, Coolant Recovery - Removal** .
3. Remove the strut tower support.
4. Remove engine cover.
5. Remove engine cover front bracket.
6. Remove air cleaner cover and inlet tube to turbocharger.
7. Remove engine cover right rear bracket.

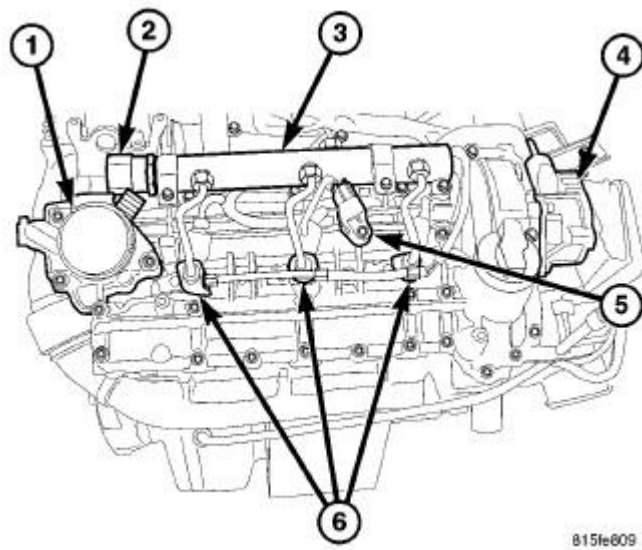


Fig. 205: RIGHT CYLINDER HEAD
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - BREATHER/OIL SEPARATOR
2 - FUEL RAIL PRESSURE SENSOR
3 - FUEL RAIL
4 - VACUUM PUMP
5 - CAMSHAFT POSITION SENSOR
6 - FUEL INJECTORS |
|---|

8. Remove the crankcase ventilation valve (CCV) and breather tube.
9. Disconnect the fuel return line.
10. Disconnect the fuel supply and return lines at the right cylinder head cover.
11. Disconnect the camshaft position sensor (CMP) and fuel injector wiring and position the right engine wiring harness aside.

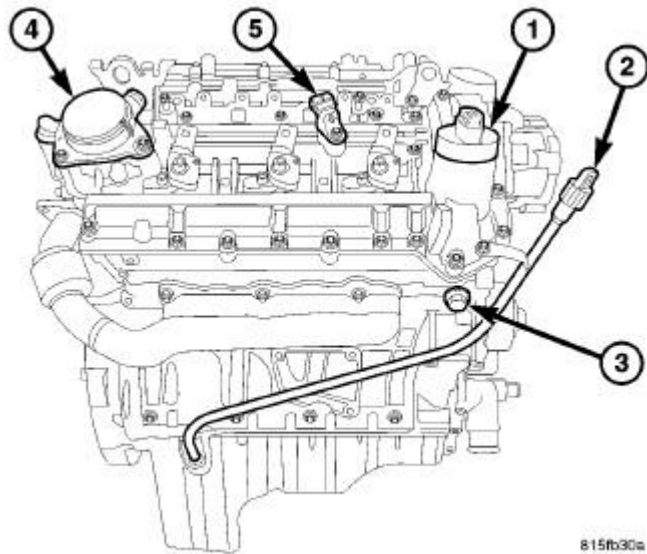


Fig. 206: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - ENGINE OIL CAP
 2 - OIL LEVEL INDICATOR
 3 - TIMING CHAIN TENSIONER
 4 - OIL SEPARATOR ASSEMBLY
 5 - CAMSHAFT POSITION SENSOR</p> |
|--|

12. Pull out on the fuel injector return fuel hose retainers, disconnect the hoses and position aside.
13. Remove the right fuel injectors. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Removal**.
14. Remove the air conditioning (A/C)/heater hose bracket.
15. Remove the oil level indicator tube retaining bolt.

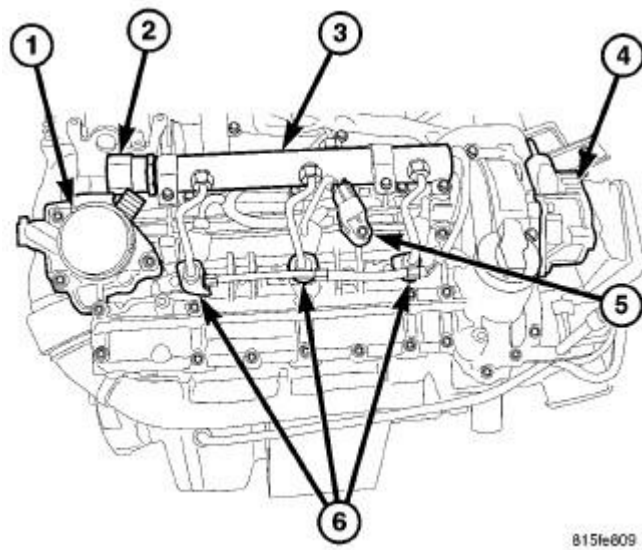
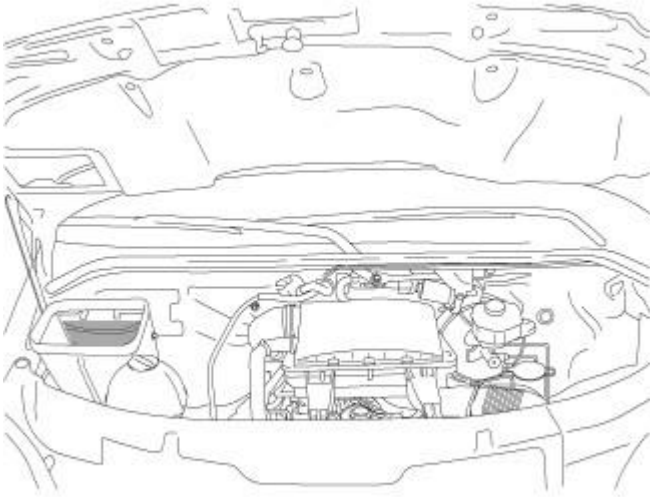


Fig. 207: RIGHT CYLINDER HEAD
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - BREATHER/OIL SEPARATOR
2 - FUEL RAIL PRESSURE SENSOR
3 - FUEL RAIL
4 - VACUUM PUMP
5 - CAMSHAFT POSITION SENSOR
6 - FUEL INJECTORS |
|---|

16. Remove the EGR air control valve assembly resonator.
17. Remove the vacuum pump (4).
18. Remove the cylinder head cover retaining bolts and remove cover.

LEFT

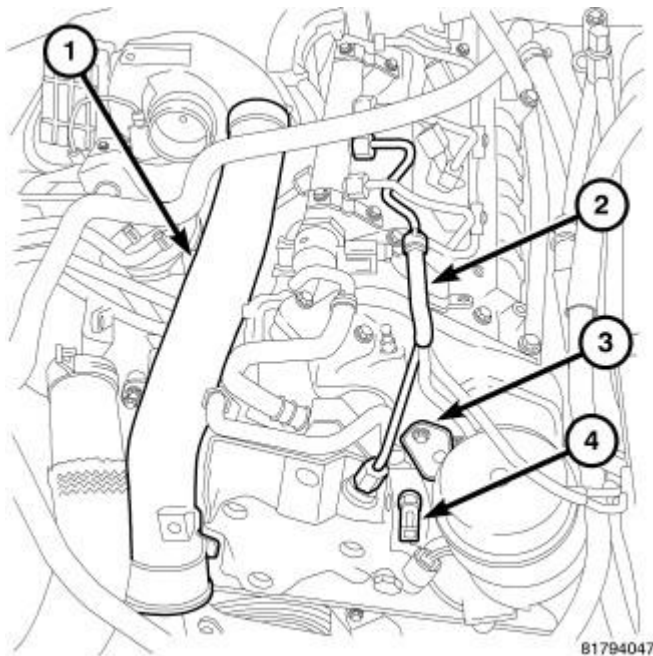


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Fig. 208: OPEN HOOD

Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable. Refer to **Electrical - Engine Systems/Battery System/CABLES, Battery - Removal**.
2. Remove engine cover (1) and bracket.
3. Remove air cleaner cover (2) and inlet tube to turbocharger.



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Fig. 209: SENSORS LINE AIRTUBE

Courtesy of CHRYSLER LLC

4. Remove the high pressure line (2) from the fuel pump and the fuel rail.
5. Remove the bracket (3) from the oil filter housing.
6. Disconnect the fuel temperature sensor connector (4).
7. Disconnect the fuel quantity solenoid connector.
8. Remove the wiring harness retaining bolts and position the engine harness aside.
9. Remove the bolts from the intercooler air chamber.
10. Remove the turbo outlet to intercooler inlet air tube (1).

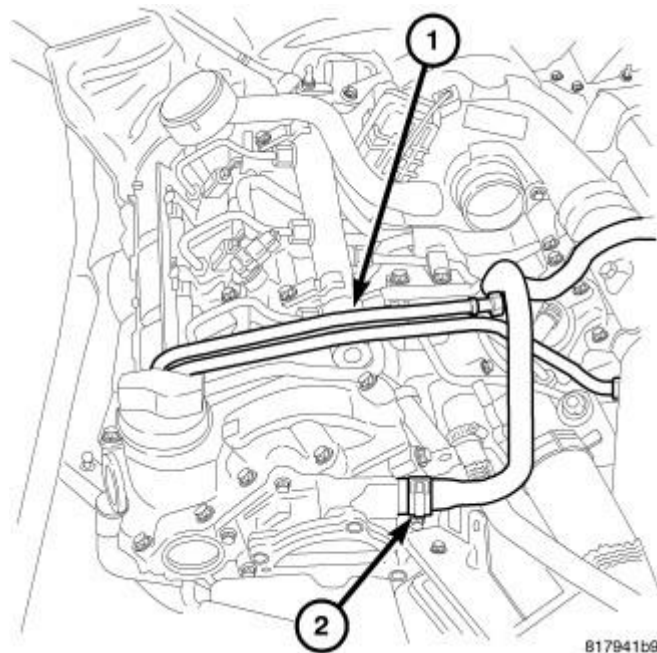
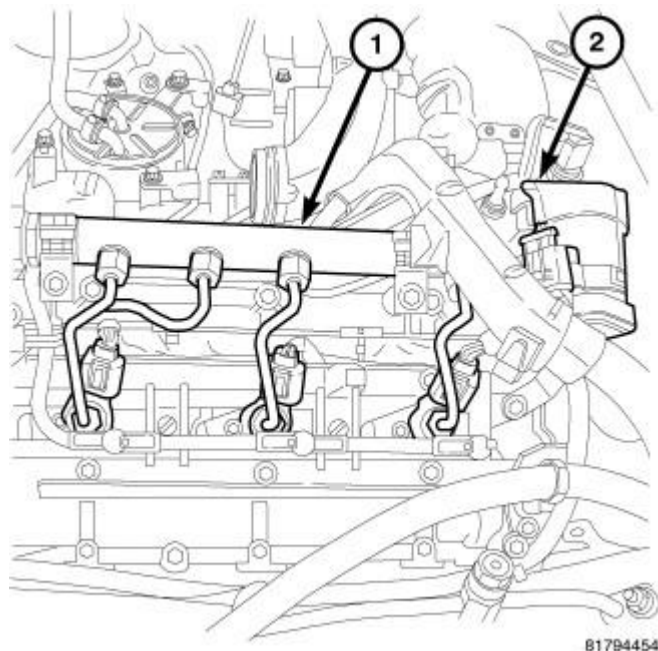


Fig. 210: POWER BRAKE BOOSTER VACUUM LINE
Courtesy of CHRYSLER LLC

11. Remove the power brake booster vacuum line (2) from the vacuum pump and position aside.
12. Disconnect the power feed line from the alternator and position aside.
13. Remove the supply and return fuel lines (1).

**Fig. 211: EGR VALVE****Courtesy of CHRYSLER LLC**

1 - EGR SOLENOID CONNECTOR 2 - EGR VALVE

14. Disconnect the EGR solenoid connector.
15. Remove the EGR valve (2).
16. Disconnect the fuel injector electrical connectors.
17. Remove the fuel injector wiring harness from the cylinder head cover and position aside.
18. Remove the left cylinder head fuel return line.
19. Remove the high pressure fuel lines from the fuel injectors.
20. Remove the fuel injectors (1).

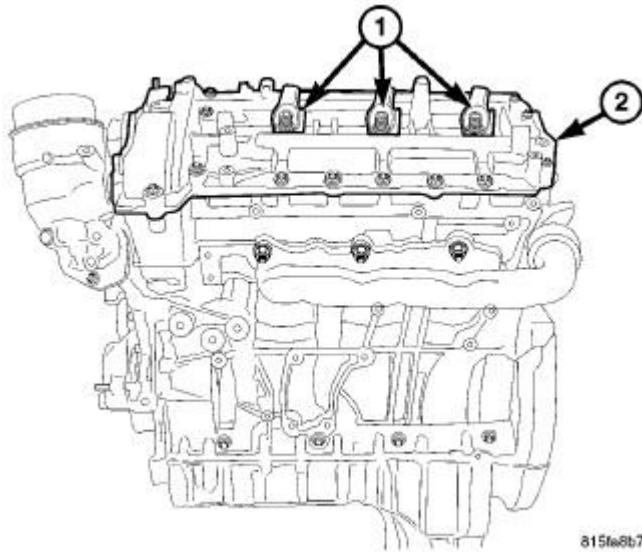


Fig. 212: LEFT CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

CAUTION: Care must be taken when removing the cylinder head cover. The cover is the camshaft retainer and end play interface. Do not pry on the cylinder head cover tabs.

CAUTION: The cylinder head cover is sealed with Mopar sealant that may be difficult when separating components. If the component are difficult to separate heat the sealed edges or area with a heat gun. **DO NOT** use any heat source that works with flame.

NOTE: Note the different length cylinder head cover bolts and their position for assembly purposes.

21. Remove the cylinder head cover (2) fasteners and cover.

Installation

RIGHT

1. Clean and inspect all sealing surfaces.

NOTE: Care must be taken not to get any engine sealant on the camshaft journals of the cylinder head cover.

2. Install a 1/8 in bead of Mopar Engine RTV Gen II sealant to the underside of the cylinder head cover. See Standard Procedure .

CAUTION: The cylinder head cover bolts are different lengths. Make sure to install the bolts into their original position.

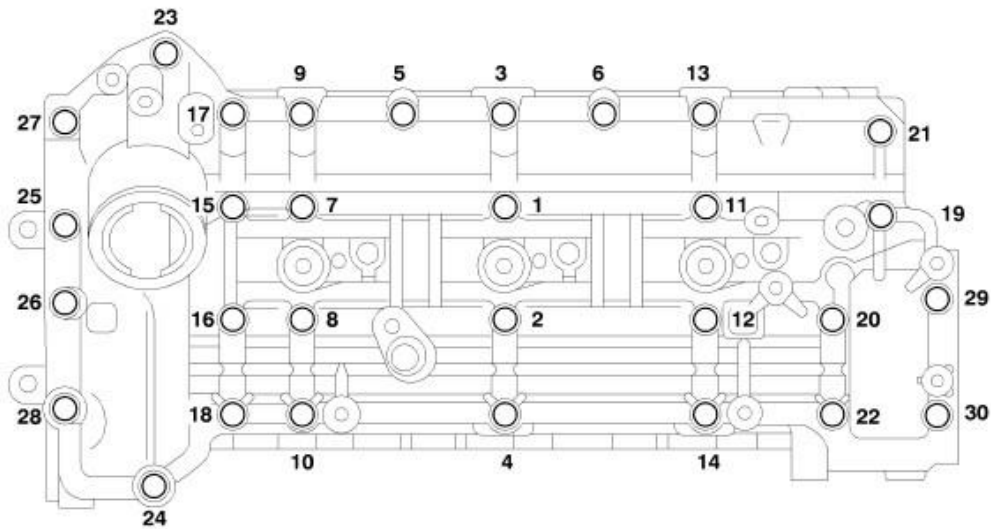


Fig. 213: RIGHT COVER TORQUE SEQUENCE

Courtesy of CHRYSLER LLC

3. Carefully position the cylinder head cover and install the bolts into their original position.
4. Tighten cylinder head cover bolts in sequence, first to 4 N.m (35 in. lbs.), and then repeat the sequence to 8.4 N.m (75 in. lbs.).

CAUTION: Make sure to replace the lower copper washer seal on the injector. Do not use the old seal and do not double the seals.

5. Install the fuel injectors. Tighten the retaining claw bolts to 7 N.m (5 ft. lbs.) and then an additional 180°.
6. Install the CCV housing. Tighten the fasteners to 9 N.m (80 in. lbs.).
7. Install the vacuum pump. Tighten the fasteners to 9 N.m (80 in. lbs.).
8. Install the EGR air control valve resonator. Tighten the fasteners to 9 N.m (80 in. lbs.).
9. Install the oil level indicator tube fastener. Tighten the bolt to 11 N.m (97 in. lbs.).
10. Install the AC/heater hose bracket. Tighten the bolts to 9 N.m (80 in. lbs.).
11. Install the fuel rail. Tighten bolts to 9 N.m (80 ft. lbs.).

NOTE: Inspect all fuel lines for damage or wear. Replace as necessary. DO NOT over tighten the fuel line nuts.

12. Install the fuel injector high pressure lines. Tighten line nuts to 33 N.m (24 ft. lbs.).
13. Position the engine wiring harness and connect the CMP, fuel rail pressure sensor and fuel injectors.
14. Connect the fuel return hoses to fuel injectors, pushing down on the hose retainers.
15. Install the air cleaner cover and inlet tube.

16. Install the rear engine cover bracket.
17. Connect the CCV hose to air inlet tube and connect the CCV heater wiring harness connector.
18. Install the engine cover.
19. Install the strut tower support.
20. Install the coolant reservoir.
21. Connect the negative battery cable.
22. Start engine, allow to warm, turn engine off and inspect for leaks.

LEFT

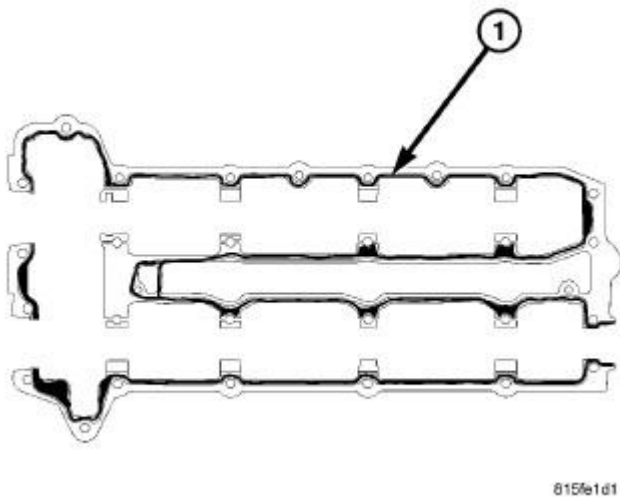


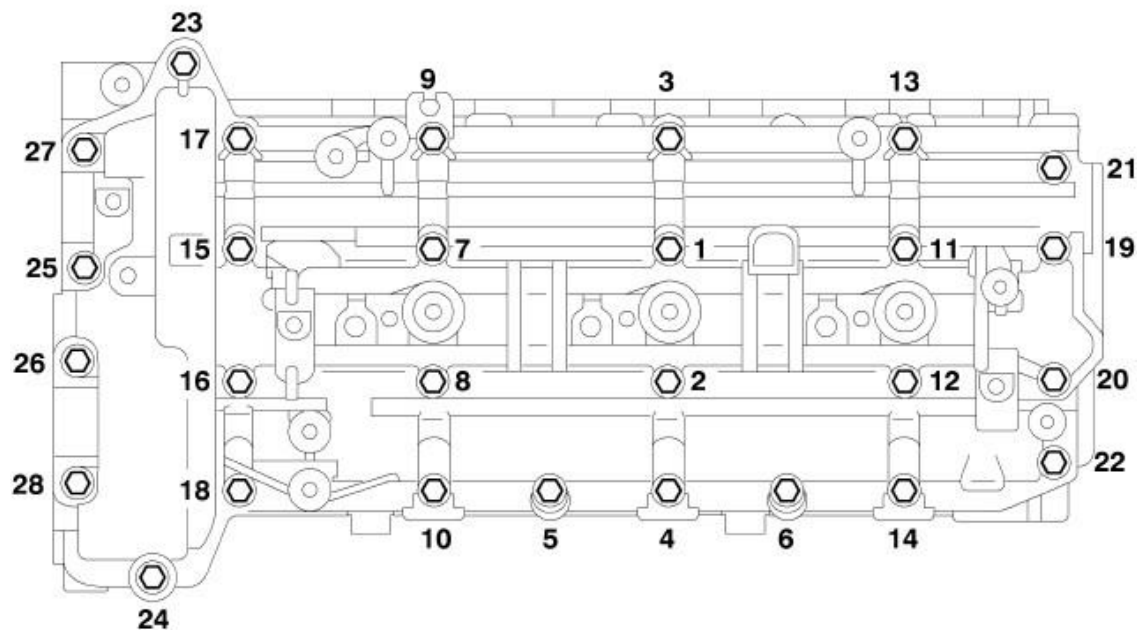
Fig. 214: SEALANT APPLICATION TO LEFT CYLINDER HEAD COVER
 Courtesy of CHRYSLER LLC

1 - 1.5 MM MOPAR ENGINE SEALANT RTV

1. Clean and inspect all sealing surfaces.

NOTE: Care must be taken not to get any engine sealant on the camshaft journals of the cylinder head cover.

2. Install a 1/8 in bead of Mopar® Engine RTV Gen II sealant to the underside of the cylinder head cover. See Standard Procedure .



8178df03

Fig. 215: CYLINDER HEAD COVER BOLTS TIGHTENING SEQUENCE

Courtesy of CHRYSLER LLC

3. Carefully position the cylinder head cover and install the bolts into their original position.

CAUTION: The cylinder head cover bolts are different lengths. Do not use the wrong length bolts or engine damage may result.

4. Tighten cylinder head cover bolts in sequence, first to 4 N.m (35 in. lbs.), and then repeat the sequence to 8.4 N.m (75 in. lbs).

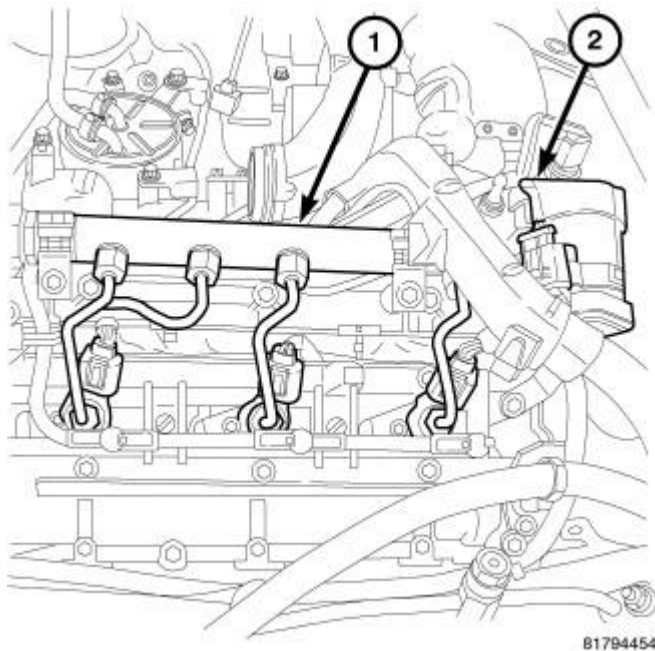


Fig. 216: EGR VALVE
Courtesy of CHRYSLER LLC

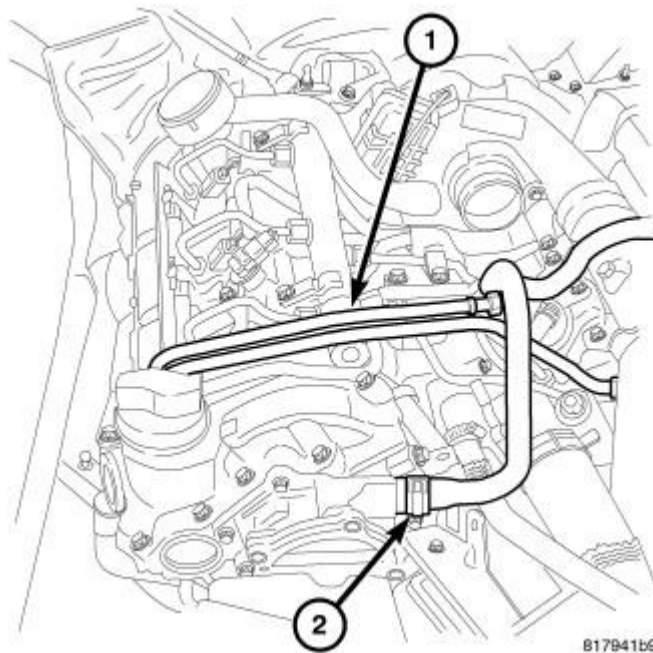
1 - EGR SOLENOID CONNECTOR 2 - EGR VALVE

5. Install the EGR valve.

CAUTION: The fuel injector sealing washers **MUST** be replaced. **DO NOT** use the old sealing washers or double the sealing washers.

NOTE: Care must be taken not to apply any lubricant to the fuel injector nozzles.

6. Install the fuel injectors. Tighten the injector retaining claw bolt to 7 N.m (5 ft. lbs.) and then an additional 180 degrees.
7. Reposition and secure the engine harness.
8. Install the left fuel rail. Tighten the fuel rail bolts to 11 N.m (8 in. lbs.).
9. Position the return fuel lines and secure to the injectors. Push down on the release lock tab to secure.
10. Connect the fuel injector electrical connectors.
11. Install the left rear engine cover bracket.



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Fig. 217: POWER BRAKE BOOSTER VACUUM LINE

Courtesy of CHRYSLER LLC

12. Install the high pressure fuel lines from the fuel rail to injectors. Tighten the line connections to 27 N.m (20 ft. lbs.).
13. Install the fuel line from the high pressure pump to the left fuel rail. Tighten the retaining bolt to 30 N.m (22 ft. lbs.).
14. Install the fuel supply line to the fuel filter and high pressure pump.
15. Connect both fuel lines at the high pressure pump.



81b73043

Fig. 218: OPEN HOOD

Courtesy of CHRYSLER LLC

16. Install the air filter housing and tube.
17. Connect the negative battery cable.
18. Start the engine, run until warm, turn engine off and inspect for leaks.

LIFTER(S), HYDRAULIC

Description

DESCRIPTION

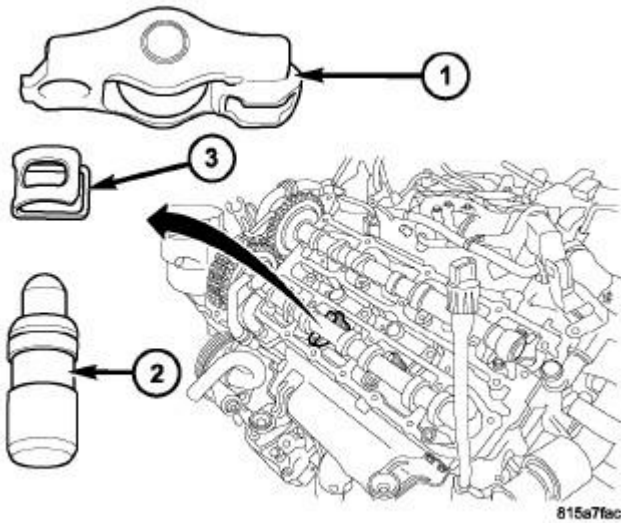


Fig. 219: ROCKER ARMS

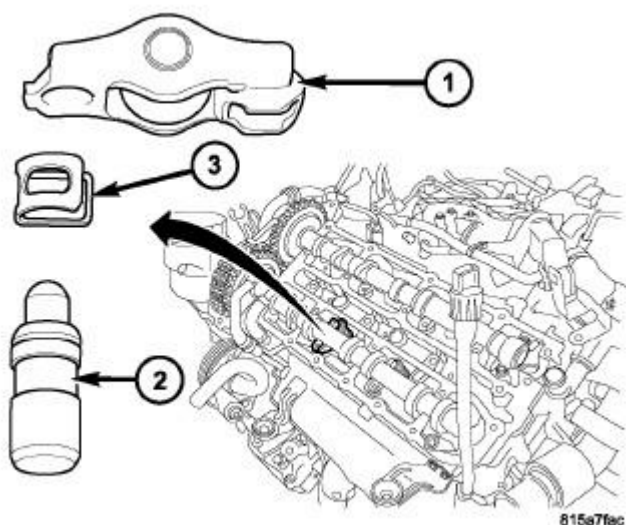
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - ROCKER ARM
2 - HYDRAULIC LIFTER
3 - RETAINING CLIP</p> |
|---|

Valve lash is controlled by hydraulic lifters (2) located inside the cylinder head, in tappet bores below the camshafts.

Removal

REMOVAL

**Fig. 220: ROCKER ARMS**

Courtesy of CHRYSLER LLC

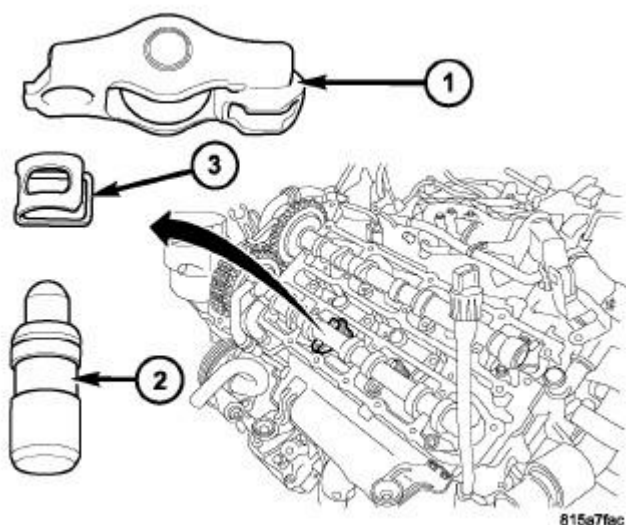
- | |
|--|
| 1 - ROCKER ARM
2 - HYDRAULIC LIFTER
3 - RETAINING CLIP |
|--|

1. Remove the appropriate camshafts. See **Removal** .
2. Remove the rocker arm (1) and lifter (2) assembly.

NOTE: When the lifters are removed from the engine, they must be stored upright and in clean conditions.

3. Separate the lifter from the rocker arm.

Inspection**INSPECTION**

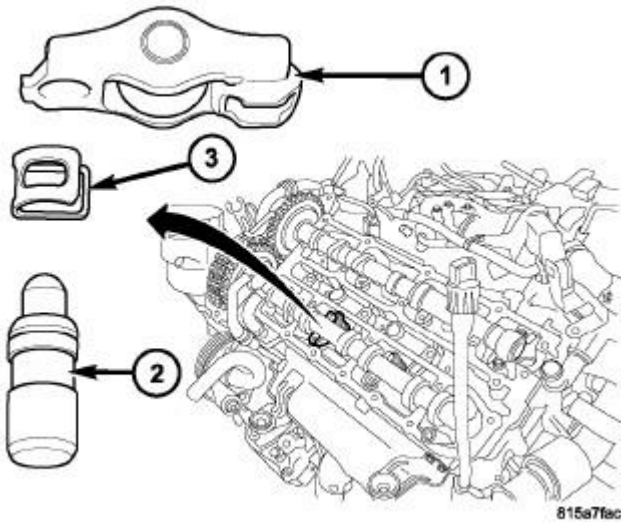
**Fig. 221: ROCKER ARMS**

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - ROCKER ARM
2 - HYDRAULIC LIFTER
3 - RETAINING CLIP |
|--|

1. Clean each lifter assembly in cleaning solvent to remove all varnish and sludge deposits. Inspect for indications of scuffing on the side and base of each lifter body (2).
2. Squeeze the lifter and be sure that the spring returns the lifter to its correct position.
3. Inspect the retaining clip (3) and rocker arm (1) roller for damage or excessive wear.
4. Replace any worn or damaged components.

Installation**INSTALLATION**

**Fig. 222: ROCKER ARMS**

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - ROCKER ARM
2 - HYDRAULIC LIFTER
3 - RETAINING CLIP |
|--|

CAUTION: When the lifters are removed from the engine, they must be stored upright and in clean conditions. Install the rocker arms and lifters in the same location as when removed.

CAUTION: Replacement of the camshaft will also require replacement of the rocker arms and lifters.

1. Assemble the lifter (2) to the rocker arm (1) with the retaining clip (3).

NOTE: Rocker arms and lifters must be installed in the same location as when removed.

2. Install the rocker arm and lifter assembly in the same location as noted during removal.
3. Install the camshaft(s). See **Installation** .

ROCKER ARM, VALVE

Description

DESCRIPTION

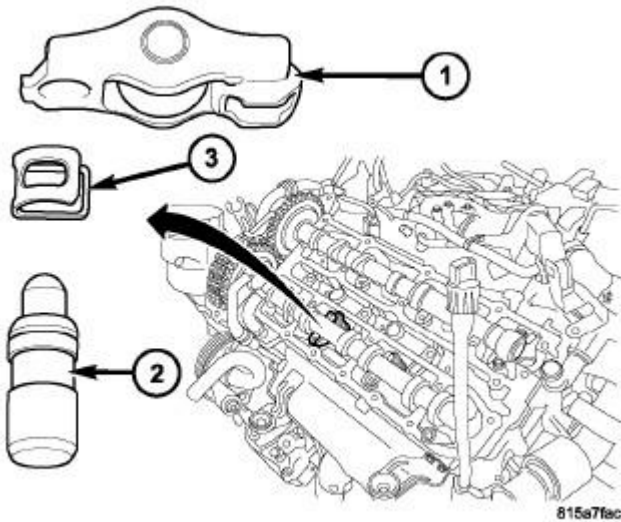


Fig. 223: ROCKER ARMS

Courtesy of CHRYSLER LLC

- 1 - ROCKER ARM
- 2 - HYDRAULIC LIFTER
- 3 - RETAINING CLIP

The rocker arms (1) are located on the top of the hydraulic lifters (2) and the valves. The rocker arms are not held rigidly into position; instead they are held in position by resting on top of the valve and the hydraulic lifter pivoting ball. A holding clip (3) secures the rocker arm to the hydraulic lifter.

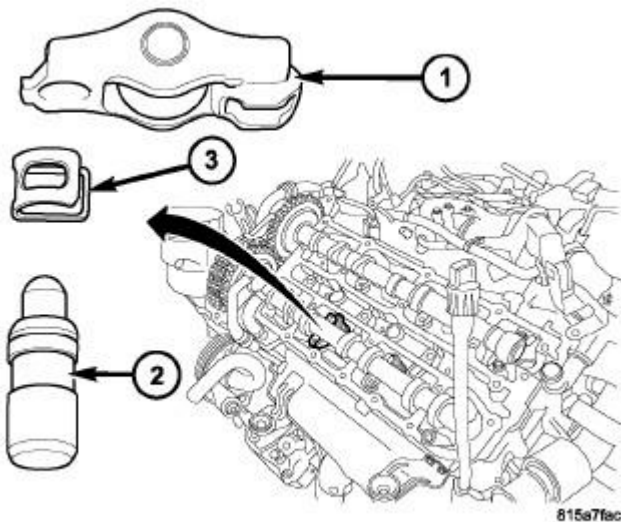
Operation

OPERATION

The rocker arms are used as a link between the camshaft and valves. As the camshaft rotates, the lobes of the camshafts apply downward pressure on the rocker arms. This pressure is then transmitted to the valves which causes the valves to open.

Removal

REMOVAL

**Fig. 224: ROCKER ARMS**

Courtesy of CHRYSLER LLC

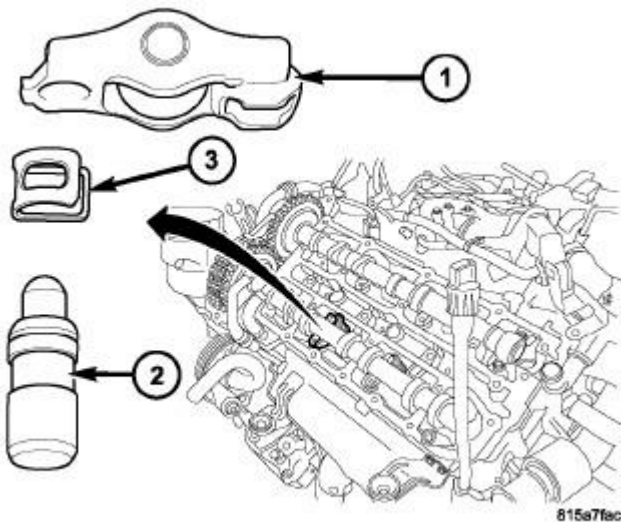
- | |
|--|
| 1 - ROCKER ARM
2 - HYDRAULIC LIFTER
3 - RETAINING CLIP |
|--|

1. Remove the appropriate camshafts. See **Removal** .

NOTE: **Rocker arms and lifters must be installed in the same location as when removed and stored in the up right position.**

2. Remove the rocker arm (1) and lifter (2) assembly.
3. Remove the retainer clip (3) and separate the rocker arm from the lifter.

Installation**INSTALLATION**

**Fig. 225: ROCKER ARMS**

Courtesy of CHRYSLER LLC

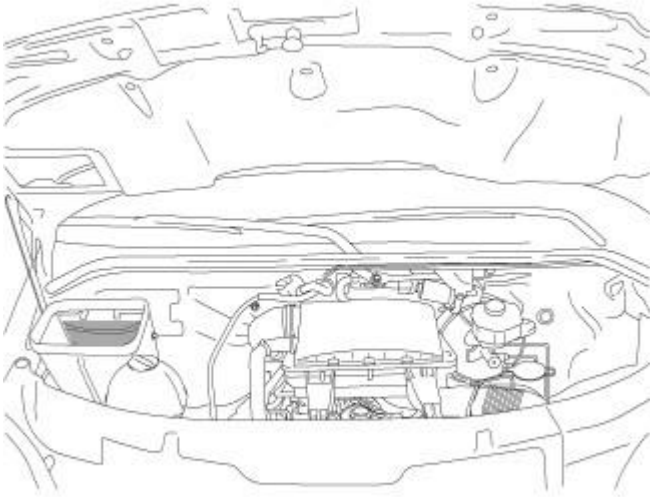
- | |
|--|
| 1 - ROCKER ARM
2 - HYDRAULIC LIFTER
3 - RETAINING CLIP |
|--|

1. Using the retaining clip (3), attach the rocker arm (1) to the lifter (2).

NOTE: **Rocker arms and lifters must be installed in the same location as when removed.**

2. Install the rocker arm and lifter assembly in the same location as noted during removal.
3. Install the camshaft. See **Installation** .

SEAL(S), CAMSHAFT**Removal****LEFT**

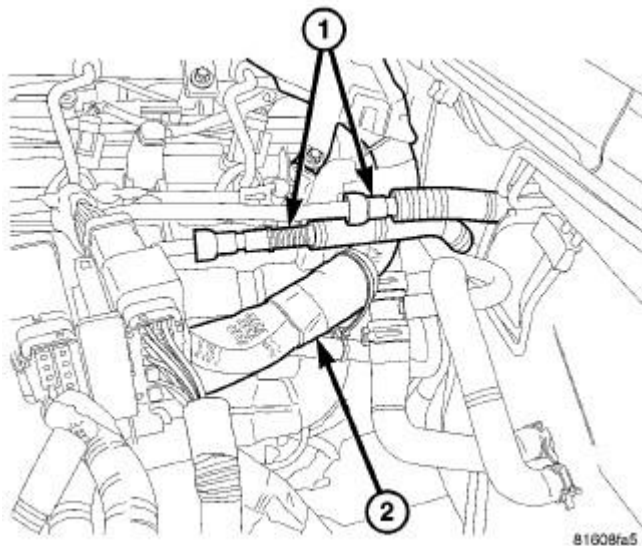


81b73043

Fig. 226: OPEN HOOD

Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove the engine cover (3) and bracket.
3. Remove the strut tower support (2) .



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Fig. 227: FUEL LINES

Courtesy of CHRYSLER LLC

1 - FUEL SUPPLY AND RETURN LINES FROM FUEL TANK

2 - MAIN ENGINE WIRING HARNESS

4. Disconnect the fuel tank supply (1) and return lines (1) from the fuel line bundle.
5. Separate the rear engine wiring harness (2) and hold downs at cylinder head cover.

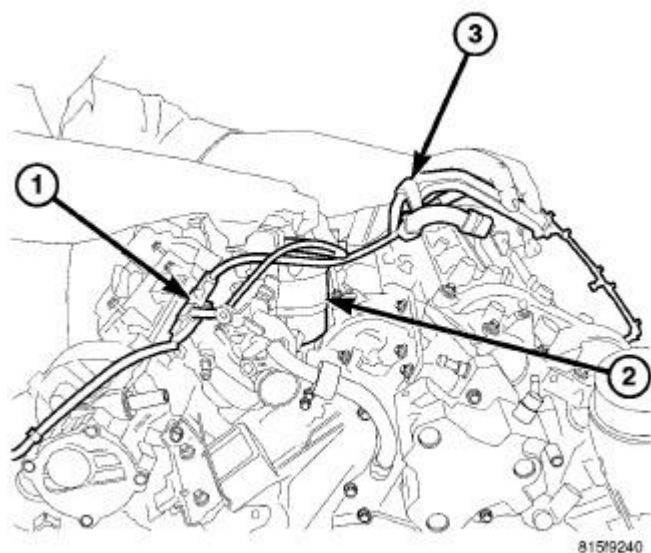


Fig. 228: FUEL FILTER, LINES AND HOSES
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - RETURN FUEL HOSE BUNDLE |
| 2 - FUEL FILTER |
| 3 - LOW PRESSURE FUEL SUPPLY AND RETURN PIPE |

6. Separate the fuel supply line at the high pressure pump and fuel filter.
7. Remove the high pressure fuel line from the high pressure pump to the fuel rail.

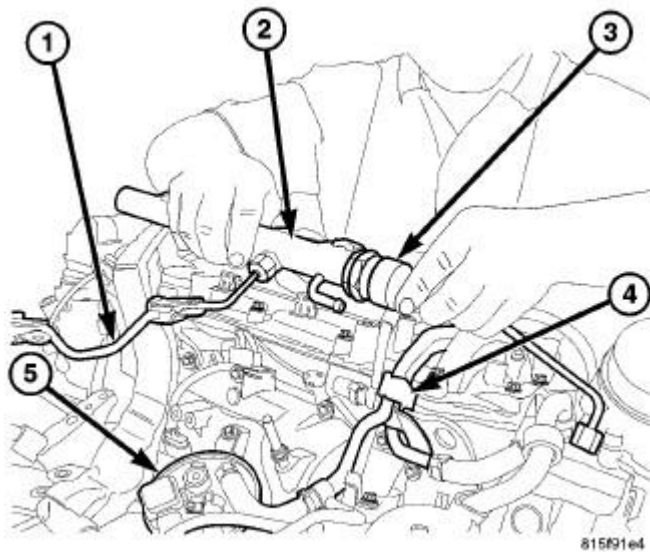


Fig. 229: LEFT FUEL RAIL
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - FUEL RAIL TRANSFER LINE |
| 2 - LEFT FUEL RAIL |
| 3 - FUEL RAIL SOLENOID |
| 4 - LOW FUEL PRESSURE SUPPLY AND RETURN LINE JUNCTION |
| 5 - FUEL FILTER |

8. Remove the high pressure lines from the fuel rail to fuel injectors.
9. Disconnect the fuel injector electrical connectors.
10. Remove the oil filter housing to engine cover bracket.
11. Lift up on the center of the return fuel line connector and separate the return fuel hose from fuel injectors.
12. Remove the fuel rail (2) .

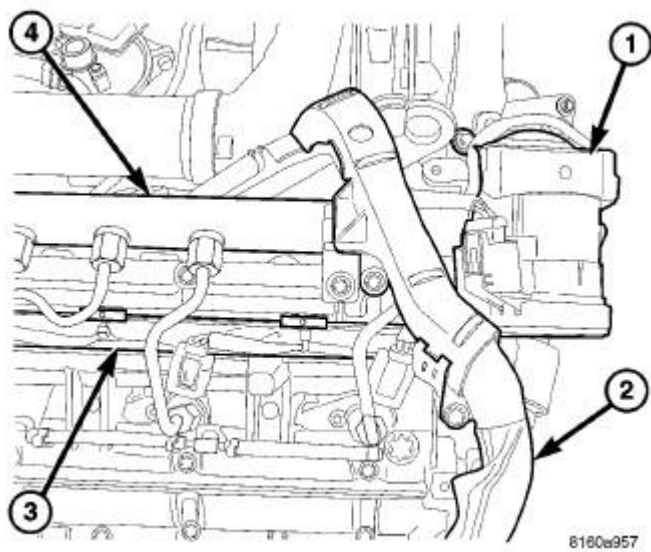


Fig. 230: EGR VALVE WITH MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - EXHAUST GAS RECIRCULATION (EGR) VALVE
 2 - MAIN ENGINE WIRING HARNESS
 3 - FUEL INJECTOR WIRING HARNESS
 4 - LEFT FUEL RAIL</p> |
|--|

13. Remove the engine harness retainers and fasteners (2) .
14. Remove the EGR valve (1).

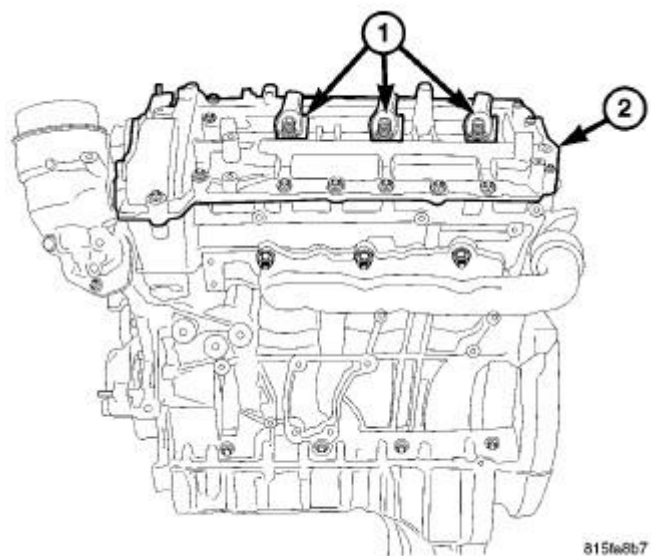


Fig. 231: LEFT CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

15. Remove the fuel injectors (1) .
16. Remove the power brake booster hose and set aside.
17. Remove the cylinder head cover (2) fasteners, note the different size fasteners for assembly.

CAUTION: Care must be taken not to damage the cylinder head cover. If the sealant is difficult to separate, use a hand held heat gun and warm the area thoroughly along the sealer bead.

18. Remove the cylinder head cover (2).

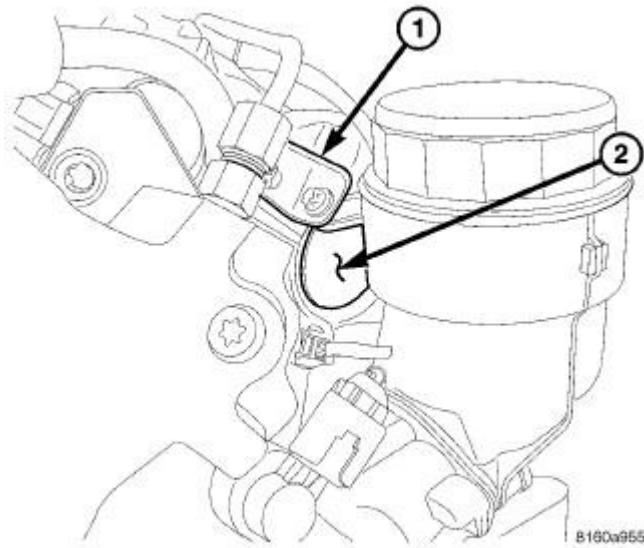


Fig. 232: LEFT FRONT CAMSHAFT SEAL WITH OIL FILTER HOUSING BRACKET
Courtesy of CHRYSLER LLC

1 - OIL FILTER HOUSING BRACKET 2 - LEFT FRONT CAMSHAFT OIL SEAL
--

19. Remove the front camshaft oil seal (2).

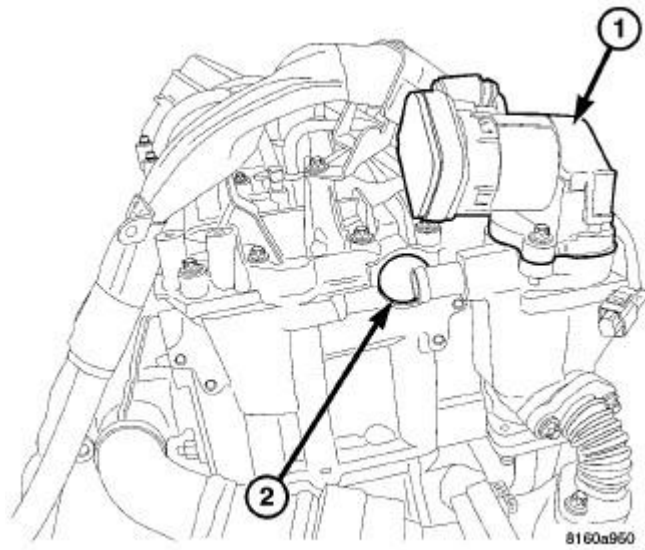


Fig. 233: LEFT REAR CAMSHAFT SEAL
Courtesy of CHRYSLER LLC

1 - EGR VALVE 2 - LEFT REAR CAMSHAFT OIL SEAL
--

20. Remove the left rear camshaft oil seal (2).

RIGHT

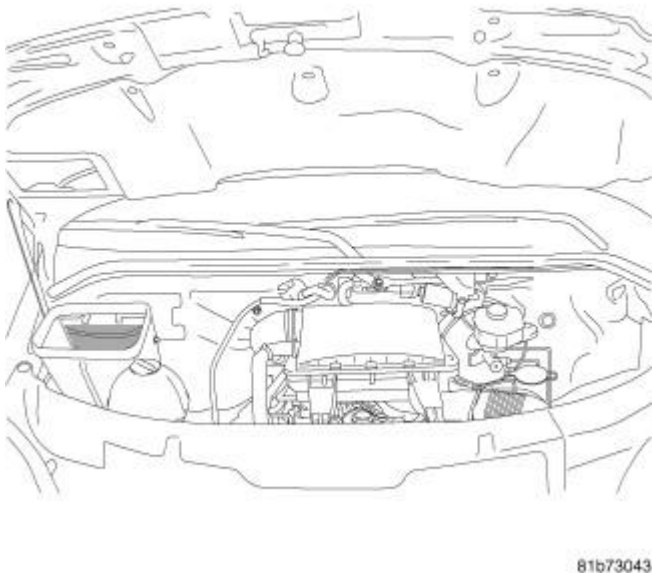


Fig. 234: OPEN HOOD
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the engine cover (3).
3. Remove the air inlet tube to the turbocharger along with the air cleaner cover (2).

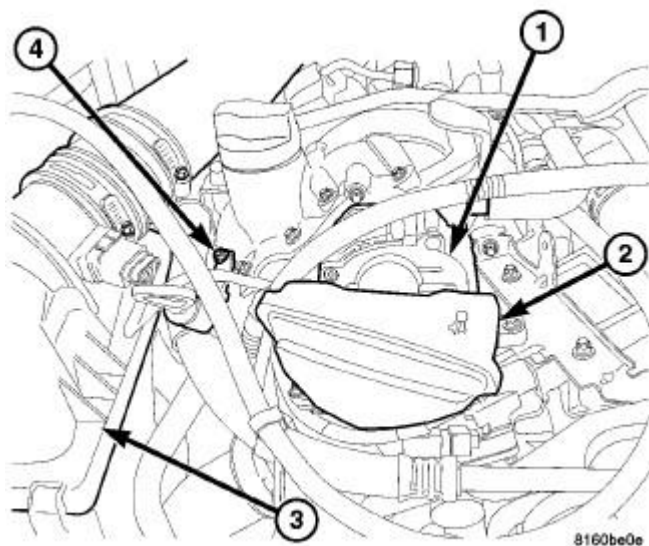
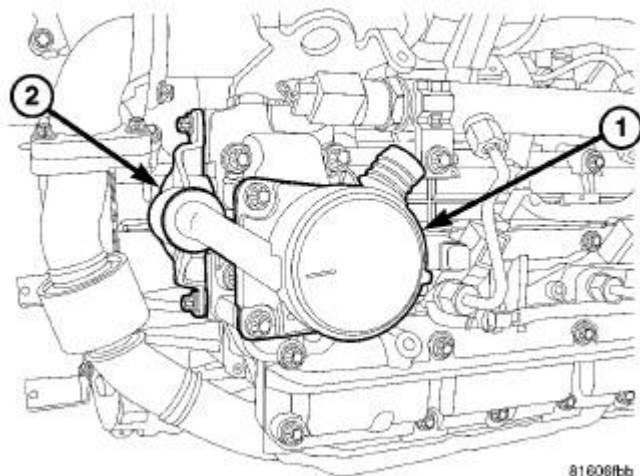


Fig. 235: AIR CONTROL VALVE RESONATOR
Courtesy of CHRYSLER LLC

- | |
|---------------------------------------|
| 1 - VACUUM PUMP |
| 2 - RESONATOR |
| 3 - AIR CLEANER COVER |
| 4 - OIL LEVEL INDICATOR TUBE FASTENER |

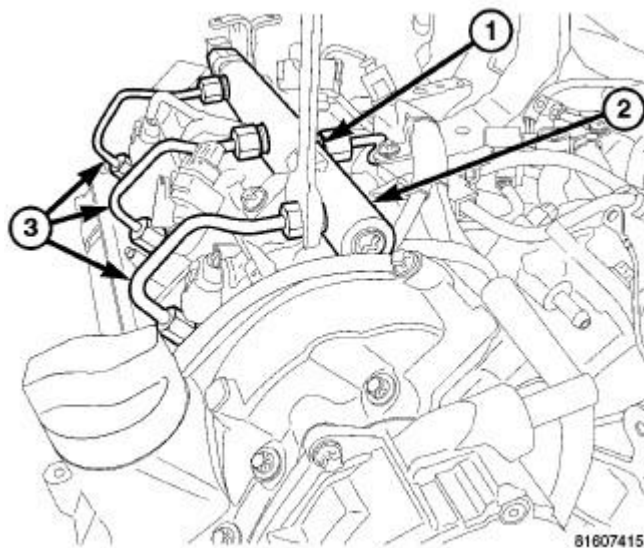
4. Remove the air control valve resonator (2).
5. Remove the vacuum pump (1).
6. Remove the oil level indicator fastener (4).

**Fig. 236: PCV**

Courtesy of CHRYSLER LLC

- | |
|-----------------------------------|
| 1 - OIL SEPARATOR HOUSING |
| 2 - OIL SEPARATOR HOUSING ADAPTOR |

7. Remove the oil separator (1) and rear housing adaptor (2).

**Fig. 237: RIGHT FUEL RAIL**

Courtesy of CHRYSLER LLC

- | |
|-----------------------------|
| 1 - FUEL RAIL TRANSFER LINE |
| 2 - RIGHT FUEL RAIL |

3 - HIGH PRESSURE FUEL LINES

8. Remove the injector cover.
9. Remove the fuel rail (2).
10. Remove the high pressure fuel lines at the injectors (3).
11. Disconnect the return fuel hose from the injectors.
12. Disconnect the fuel injector and camshaft position sensor wiring harness connectors and set aside.
13. Remove the injectors.

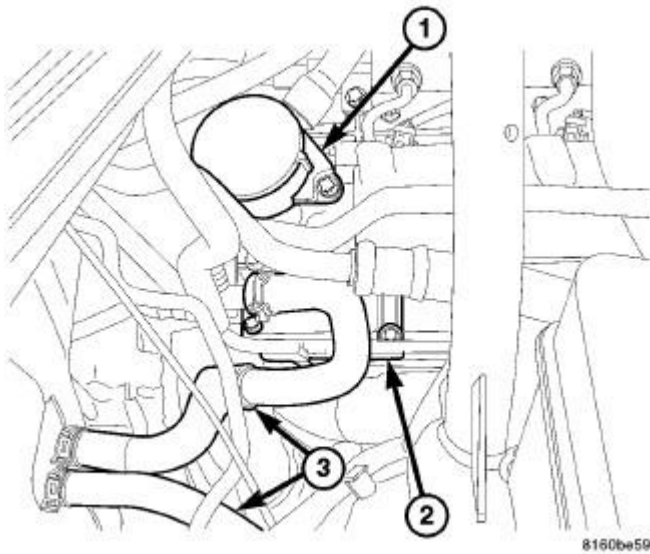


Fig. 238: HEATER HOSE WITH BRACKET
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - OIL SEPARATOR
2 - HEATER HOSE BRACKET
3 - HEATER HOSES</p> |
|---|

14. Disconnect the heater hose bracket from the cylinder head cover.

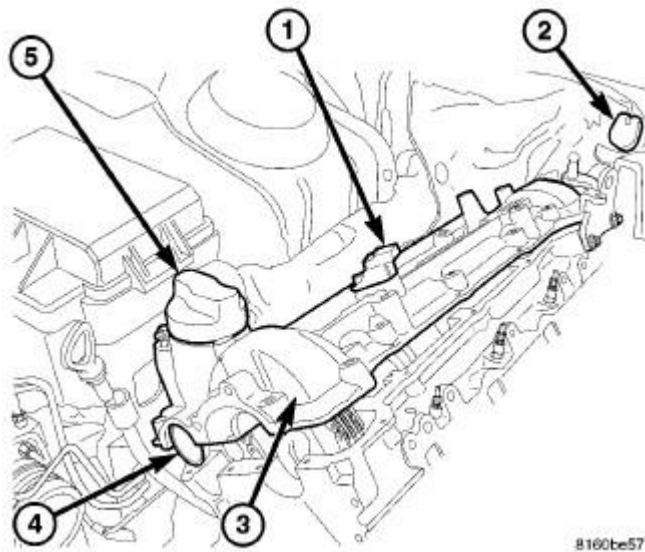


Fig. 239: RIGHT CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

- | |
|---------------------------------------|
| 1 - CAMSHAFT POSITION SENSOR |
| 2 - TRANSMISSION LEVEL INDICATOR TUBE |
| 3 - RIGHT CYLINDER HEAD COVER |
| 4 - RIGHT FRONT CAMSHAFT SEAL |
| 5 - ENGINE OIL CAP |

15. Disconnect the vacuum pump supply hose pipe at the front of the cylinder head cover.
16. Remove the transmission tube (2) fastener at the engine cover bracket.

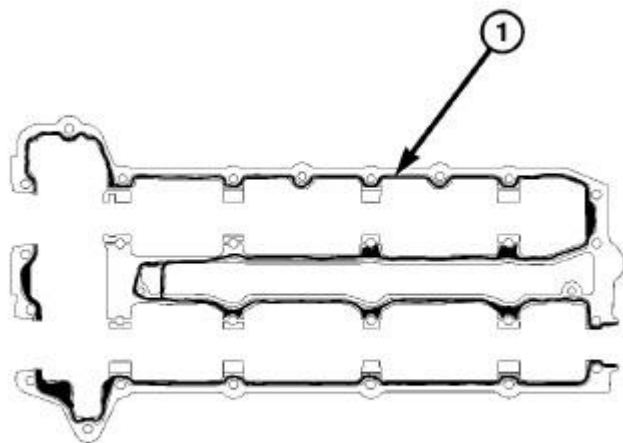
CAUTION: Care must be taken not to damage the cylinder head cover. If the sealant is difficult to separate, use a hand held heat gun and warm the area thoroughly along the sealer bead.

NOTE: The rear camshaft seal is located inside the oil separator housing adaptor assembly.

17. Remove the cylinder head cover (3) and front seal (4).

Installation

LEFT



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Fig. 240: SEALANT APPLICATION TO LEFT CYLINDER HEAD COVER

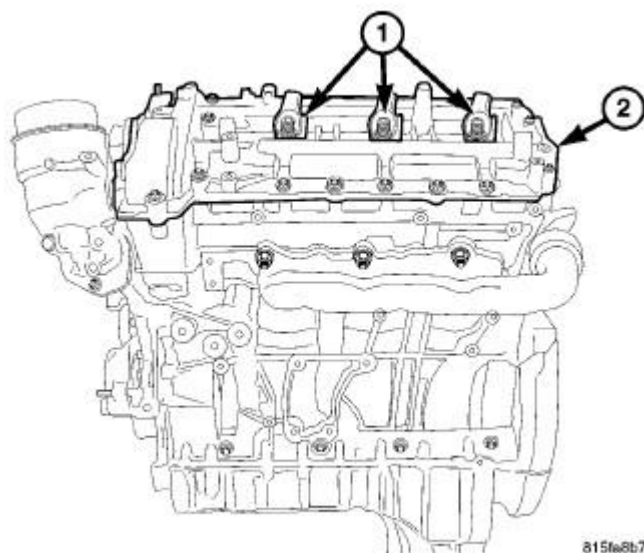
Courtesy of CHRYSLER LLC

1 - 1.5 MM MOPAR ENGINE SEALANT RTV

1. Clean all mating surfaces.

NOTE: Care must be taken not to get any engine sealer on the camshaft journals.

2. Add a 1.5 mm bead of Mopar® Sealant (1) to the cylinder head cover.

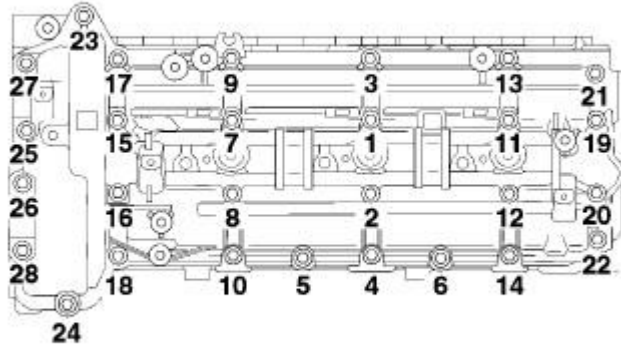


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Fig. 241: LEFT CYLINDER HEAD COVER

Courtesy of CHRYSLER LLC

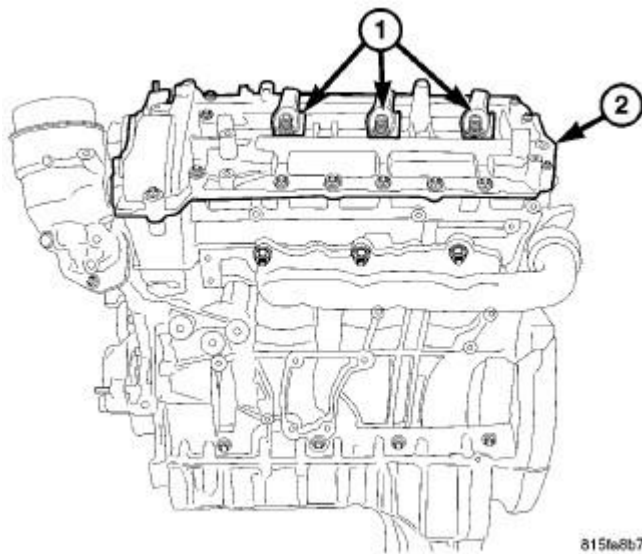
3. Place the camshaft seals into position within the cylinder head.
4. Install the cylinder head cover.



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Fig. 242: LEFT CYLINDER HEAD COVER TIGHTENING SEQUENCE
Courtesy of CHRYSLER LLC

5. Tighten the bolts in three stages following the sequence provided. First to 4 N.m (35 in. lbs.), then to 6 N.m (53 in. lbs.), and then to 8.4 N.m (75 in. lbs.).



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Fig. 243: LEFT CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

CAUTION: The fuel injector sealing washers **MUST** be replaced. **DO NOT** use the

old sealing washers or double the sealing washers.

NOTE: Care must be taken not to apply any lubricant to the fuel injector nozzles.

6. Lubricate the fuel injector bodies and install the fuel injectors (1). Install the injector retaining claws and tighten the bolts to 7 N.m plus 180 °(62 in. lbs. plus 180°).

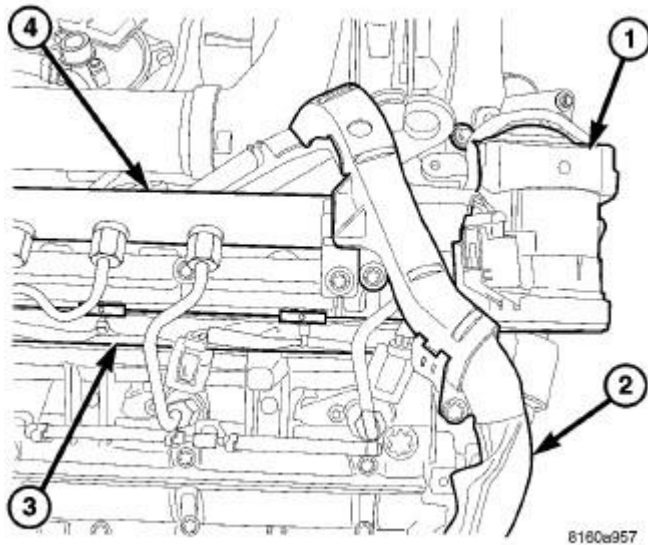
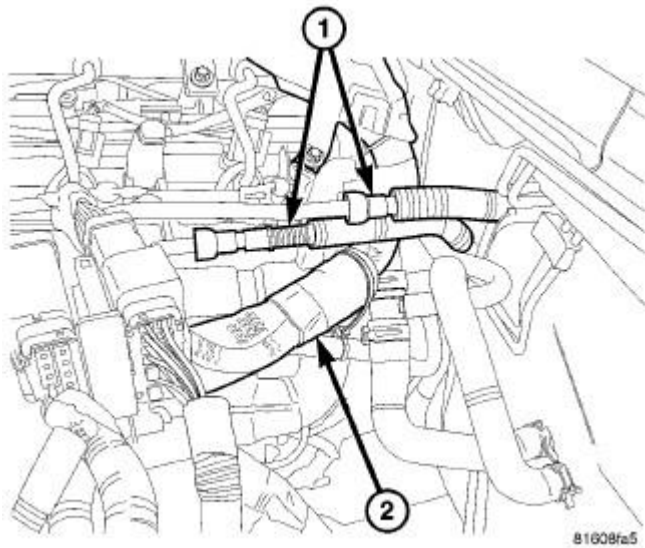


Fig. 244: EGR VALVE WITH MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - EXHAUST GAS RECIRCULATION (EGR) VALVE
2 - MAIN ENGINE WIRING HARNESS
3 - FUEL INJECTOR WIRING HARNESS
4 - LEFT FUEL RAIL |
|---|

7. Install the EGR valve (1).
8. Install the engine harness fasteners (2), route the return fuel hose, and injector harness.
9. Install the fuel rail (4) and high pressure lines.
10. Install the left rear engine cover bracket.
11. Connect the injector electrical connectors and return fuel hoses.

**Fig. 245: FUEL LINES**

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - FUEL SUPPLY AND RETURN LINES FROM FUEL TANK
2 - MAIN ENGINE WIRING HARNESS |
|---|

12. Install the high pressure fuel line from the high pressure pump to the fuel rail.
13. Install the fuel supply pipe bundle, reclamp at the high pressure pump and fuel filter.
14. Connect the fuel tank supply and return hoses (1) at fuel pipe bundle.

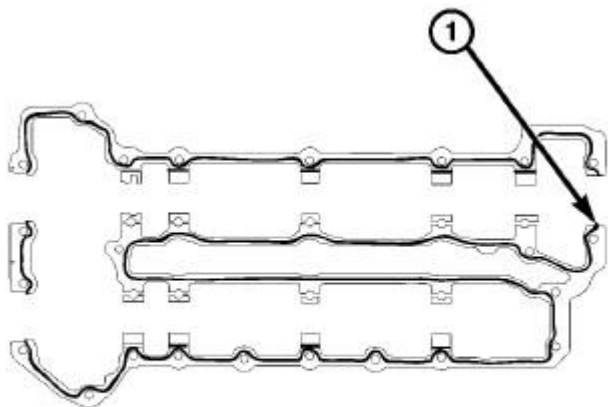


Fig. 246: OPEN HOOD

Courtesy of CHRYSLER LLC

15. Install the engine cover (3) and bracket.
16. Connect the negative battery cable.
17. Start engine, allow to warm, turn engine off and inspect for leaks.
18. Install the strut tower support (2).

RIGHT



816006db

Fig. 247: RIGHT CYLINDER HEAD COVER SEALANT

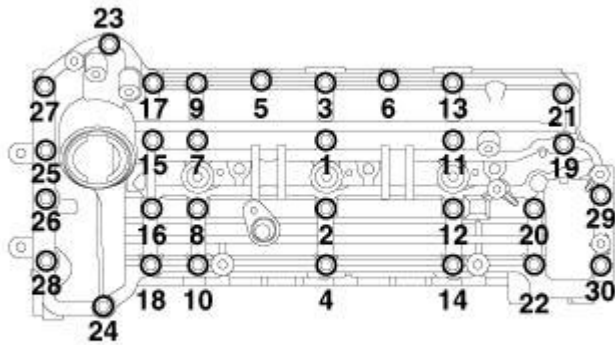
Courtesy of CHRYSLER LLC

1 - 1.5 MM MOPAR ENGINE SEALANT RTV

1. Clean all mating surfaces.

NOTE: Care must be taken not to get any engine sealer on the camshaft journals.

2. Apply a 1.5 mm bead of Mopar® Engine RTV Sealant (1) to the cylinder head cover.

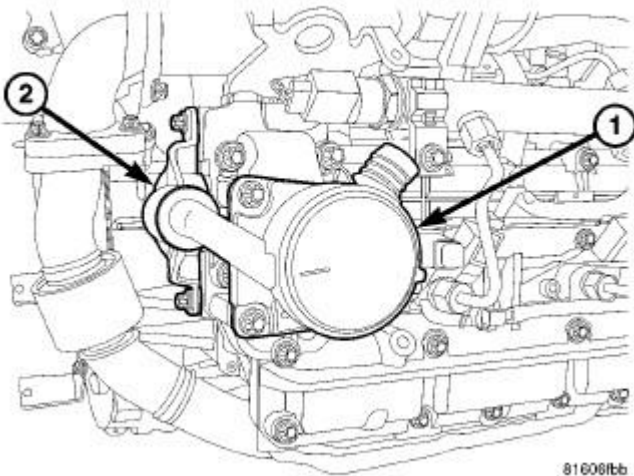


45631

Fig. 248: RIGHT CYLINDER HEAD COVER TIGHTENING SEQUENCE

Courtesy of CHRYSLER LLC

3. Place the camshaft seal into position.
4. Install the cylinder head cover. Tighten the bolts in three stages following the sequence provided. First to 4 N.m (35 in. lbs.), then to 6 N.m (53 in. lbs.), and then to 8.4 N.m (75 in. lbs.).



81606tbb

Fig. 249: OIL SEPARATOR

Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - OIL SEPARATOR HOUSING</p> <p>2 - OIL SEPARATOR HOUSING ADAPTOR</p> |
|---|

5. Install the oil separator housing adaptor (2) with new camshaft seal. Tighten fasteners to 9 N.m (7 ft.

lbs.).

6. Install the oil separator (1). Tighten fasteners to 9 N.m (7 ft. lbs.).

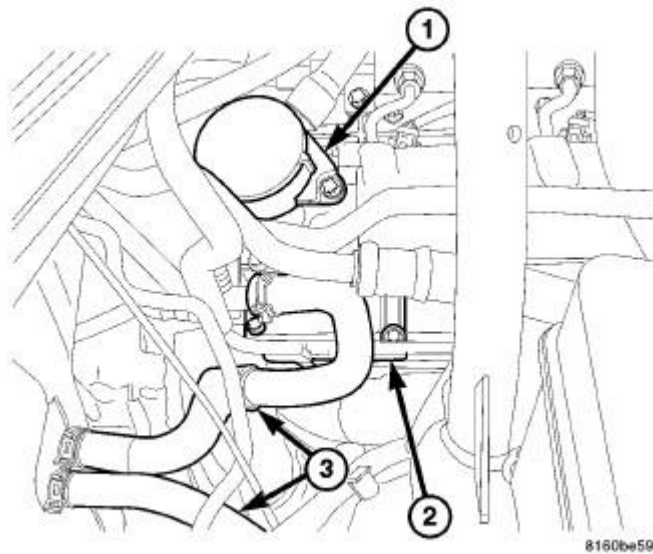


Fig. 250: HEATER HOSE WITH BRACKET

Courtesy of CHRYSLER LLC

- | |
|-------------------------|
| 1 - OIL SEPARATOR |
| 2 - HEATER HOSE BRACKET |
| 3 - HEATER HOSES |

7. Secure the transmission tube fastener to the engine cover bracket.
8. Secure the heater hose bracket (2) to the cylinder head cover.

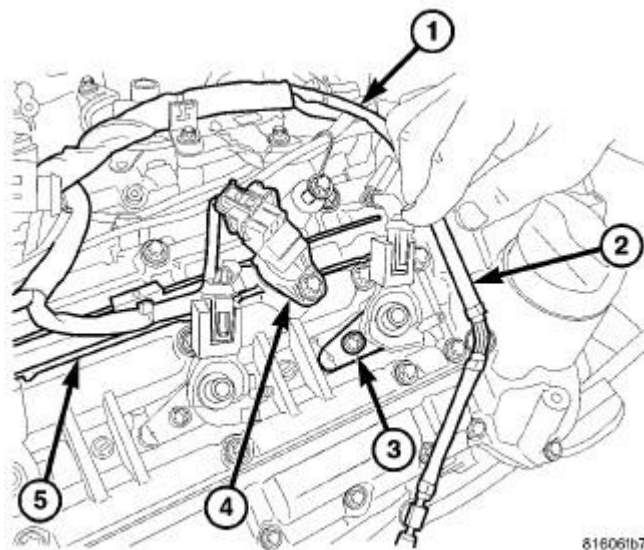
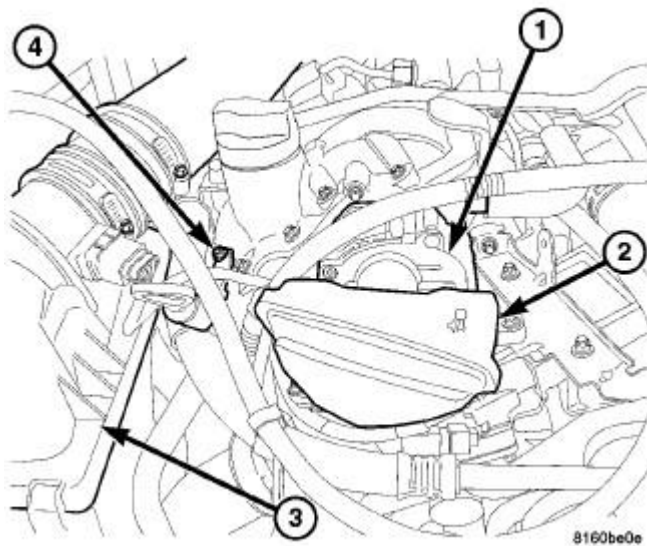


Fig. 251: RIGHT FUEL INJECTORS

Courtesy of CHRYSLER LLC

- 1 - MAIN ENGINE WIRING HARNESS
- 2 - RIGHT FUEL INJECTOR FUEL RETURN HOSE
- 3 - FUEL INJECTOR RETAINING
- 4 - CAMSHAFT POSITION SENSOR
- 5 - ENGINE HARNESS ROUTING PATH

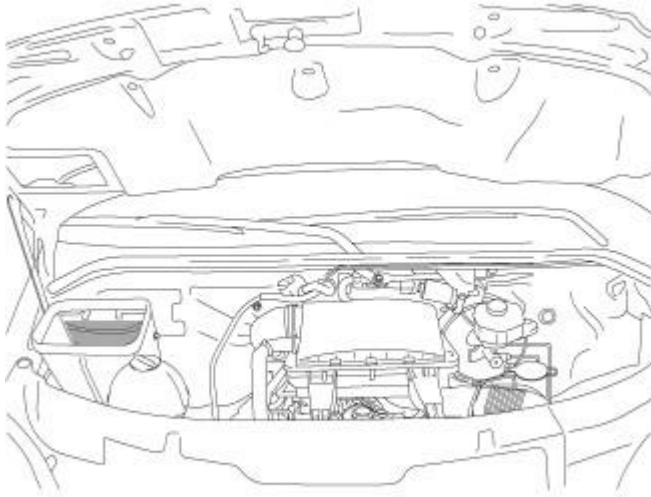
9. Secure the vacuum pump hose pipe to the cylinder head cover.
10. Install the fuel injectors. Tighten hold down fasteners (3) to 7 N.m, plus 180° (62 in. lbs., plus 180°).
11. Connect the camshaft position sensor (4) and fuel injector wiring harness connectors.
12. Connect the return fuel hose (2) to each injector.
13. Install the fuel rail, high pressure fuel lines and injector cover.

**Fig. 252: AIR CONTROL VALVE RESONATOR**

Courtesy of CHRYSLER LLC

- 1 - VACUUM PUMP
- 2 - RESONATOR
- 3 - AIR CLEANER COVER
- 4 - OIL LEVEL INDICATOR TUBE FASTENER

14. Secure the engine oil indicator tube (4) to the cylinder head. Tighten fastener to 11 N.m (8 ft. lbs.).
15. Install the vacuum pump (1).
16. Install the air control valve resonator (2).



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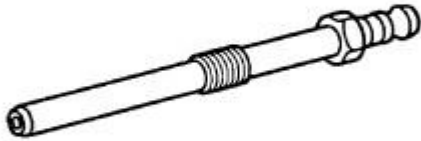
Fig. 253: OPEN HOOD**Courtesy of CHRYSLER LLC**

17. Install the air cleaner outlet tube to the turbocharger and secure the air cleaner housing cover (2).
18. Install the strut tower support (2).
19. Connect the negative battery cable.
20. Start engine, allow to warm, turn engine off and inspect for leaks.
21. Install the engine cover.

VALVES, INTAKE AND EXHAUST

Standard Procedure

VALVE SEALS - IN VEHICLE



80e492e9

Fig. 254: ADAPTER, COMPRESSION TESTER - 9553
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the intake manifold/cylinder head cover. See **Removal** .

NOTE: **Rocker arms and lifters must be kept in order of removal and stored in the up right position.**

3. Position the rocker arms aside. See **Removal** .
4. Install special tool 9553, compression tester adaptor, into the injector hole and retain with an injector hold down bolt.
5. Connect a regulated shop air supply to 9295 and pressurize the cylinder.
6. Place shop towels around the working area of the cylinder head to prevent valve locks from accidentally entering the engine.

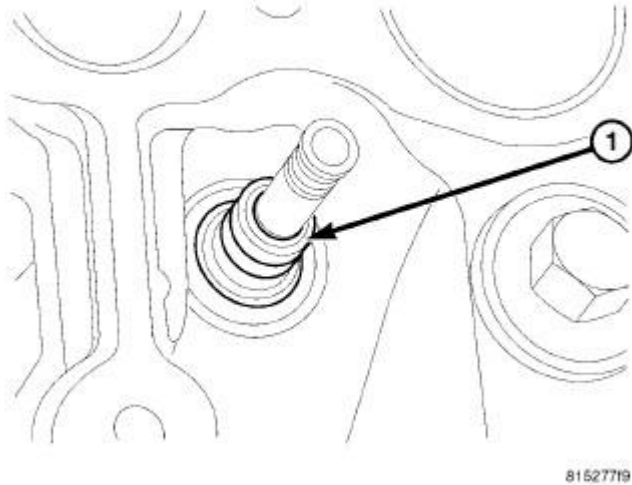


Fig. 255: VALVE SEAL
Courtesy of CHRYSLER LLC

7. Using adaptor MD998772A-15 adaptor, collapse the valve spring and remove the locks.
8. Remove the valve spring assembly.
9. Remove the valve seal.
10. Repeat this procedure for all cylinders.

VALVE SERVICE

This procedure is done with the engine cylinder head removed from the block.

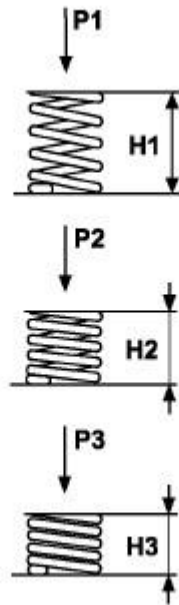
DISASSEMBLY

1. Remove the engine cylinder head from the cylinder block. See **Removal** .
2. Use Valve Spring Compressor Tool and compress each valve spring.
3. Remove the valve locks, retainers, and springs.
4. Use a smooth stone or a jewelers file to remove any burrs on the top of the valve stem, especially around the groove for the locks.
5. Remove the valves, and place them in a rack in the same order as removed.

VALVE CLEANING

1. Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and head.
2. Clean all residue and gasket material from the engine cylinder head machined gasket surface.

INSPECTION



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Fig. 256: VALVE SPRING CHART

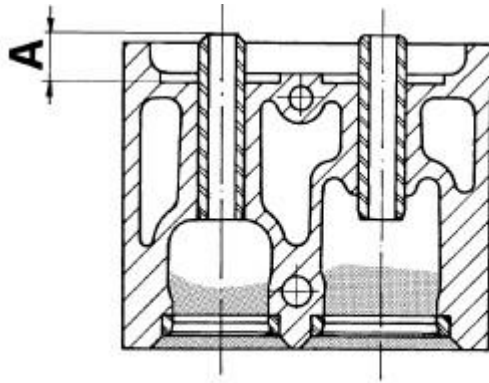
Courtesy of CHRYSLER LLC

1. Inspect for cracks in the combustion chambers and valve ports.
2. Inspect for cracks on the exhaust seat.
3. Inspect for cracks in the gasket surface at each coolant passage.
4. Inspect valves for burned, cracked or warped heads.
5. Inspect for scuffed or bent valve stems.
6. Replace valves displaying any damage.
7. Check valve spring height.

VALVE SEAT REFACING

1. Install a pilot of the correct size in the valve guide bore. Reface the valve seat to the specified angle with a good dressing stone. Remove only enough metal to provide a smooth finish.
2. Use tapered stones to obtain the specified seat width when required.

VALVE GUIDES



19509-36

Fig. 257: VALVE GUIDE HEIGHT
Courtesy of CHRYSLER LLC

1. Valve Guides height requirement.
2. Measurement A: 16.50 - 17.00 mm. Measurement B : 14.50 - 15.00 mm.

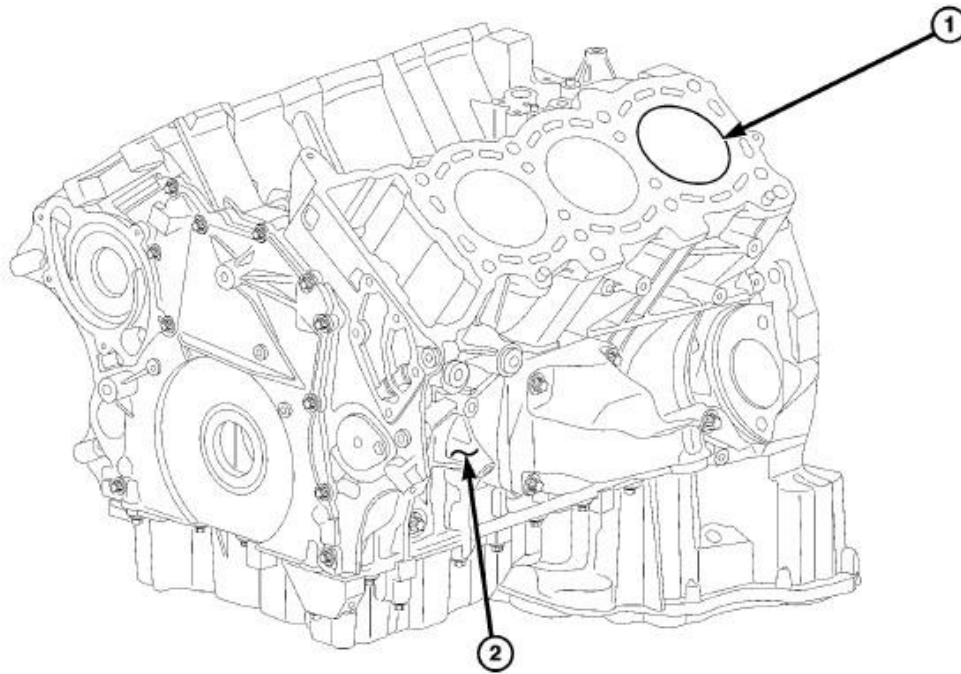
VALVE STEM-TO-GUIDE CLEARANCE MEASUREMENT

1. Measure and record internal diameter of valve guides. Valve guide internal diameter is 6.0 to 6.012 mm (0.2362 to 0.2366 in.).
2. Measure valve stems and record diameters. Intake valve stem diameter 5.952 to 5.97 mm (0.2343 to 0.2350 in). Exhaust valve stem diameter 5.942 to 5.96 mm (0.2339 to 0.2346 in).
3. Subtract diameter of valve stem from internal diameter of its respective valve guide to obtain valve stem clearance in valve guide. Clearance of inlet valve stem in valve guide is 0.03 to 0.06 mm (.0011 to .0023 in). Clearance of exhaust valve stem in valve guide is 0.04 to 0.07 mm (.0015 to .0027 in).
4. If valve stem clearance in valve guide exceeds tolerances, new valve guides must be installed.

ENGINE BLOCK

DESCRIPTION

DESCRIPTION

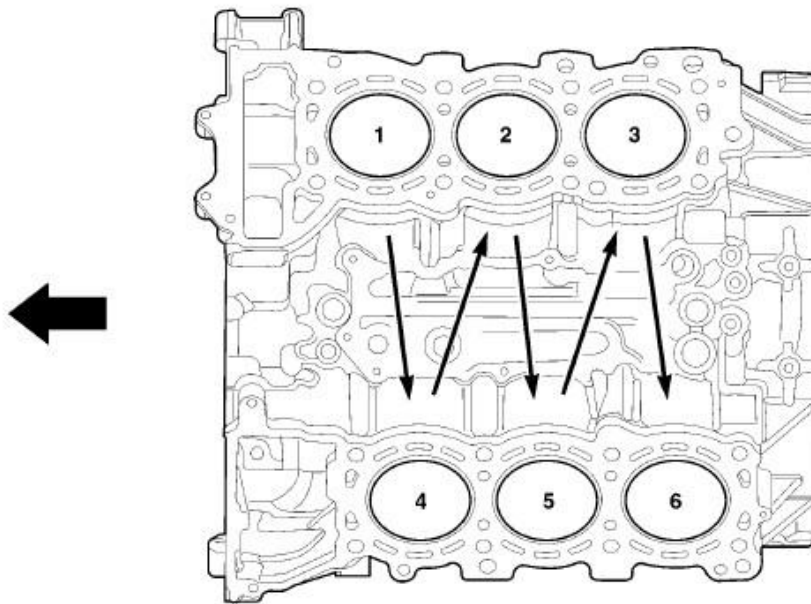


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Fig. 258: 3.0L ENGINE BLOCK
Courtesy of CHRYSLER LLC

The 3.0L engine utilizes a cast aluminum cylinder block (2) molded around cast iron piston sleeves (1). The cylinder angle is 72 degrees with cylinder spacing at 106 mm (4.173 in.). The cylinder block (2) has increased rigidity that reduces structural flexing, plus a fractured connecting rod cap design that can not distort connecting rod cap fit. The liner (1) surface is honed to a cross hatch angle between 40°-60°.

There is a stamped cylinder liner grading identification number located on the left front of the engine block, below the high pressure pump location. This identification mark (A, X, or B) is used for piston selection. For example, an "X" cylinder liner can use an "A", "X" or "B" piston. An "A" cylinder liner can only use an "A" or an "X" piston, and a "B" cylinder liner can only use a "X" or a "B" cylinder liner.



815R671

Fig. 259: INJECTION ORDER
Courtesy of CHRYSLER LLC

Cylinders are numbered front to back, beginning with the right bank. The right bank cylinders are numbered 1, 2, 3. The left bank cylinders 4, 5, 6. The injection order of the engine is 1-4-2-5-3-6.

BEARING(S), CRANKSHAFT, MAIN

Description

DESCRIPTION

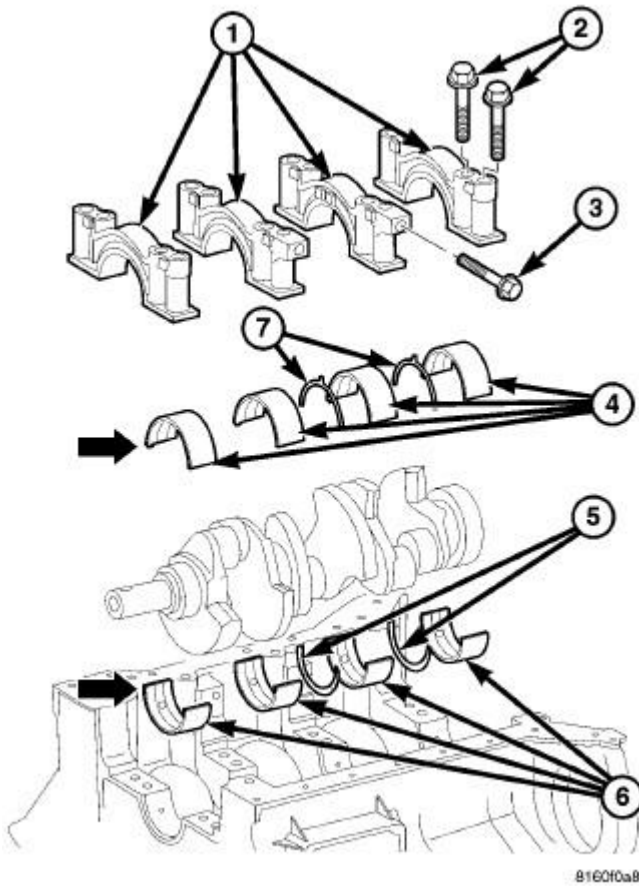


Fig. 260: CRANKSHAFT MAIN BEARINGS AND CAPS
Courtesy of CHRYSLER LLC

- 1 - MAIN CAP
- 2 - BOLTS
- 3 - BOLTS
- 4 - LOWER CRANKSHAFT MAIN BEARINGS
- 5 - THRUST WASHERS
- 6 - UPPER CRANKSHAFT MAIN BEARINGS
- 7 - THRUST WASHERS

The bottom of the cylinder block has provisions for mounting the main bearing caps and the oil jets. Four main bearing caps (1) made of gray cast iron are bolted to the cylinder block. Each main bearing cap has six mounting bolts, four vertical and two horizontal. The horizontal (cross) bolts add increased rigidity to the cylinder block.

The number three main bearing cap serves as the thrust washer (5) location .

The upper main bearings have a bi-metal construction and feature oil supply holes and center grooves for

lubrication of the main journals. The lower main bearings have tri-metal construction to provide strength where it is needed.

MAIN BEARING SELECTION

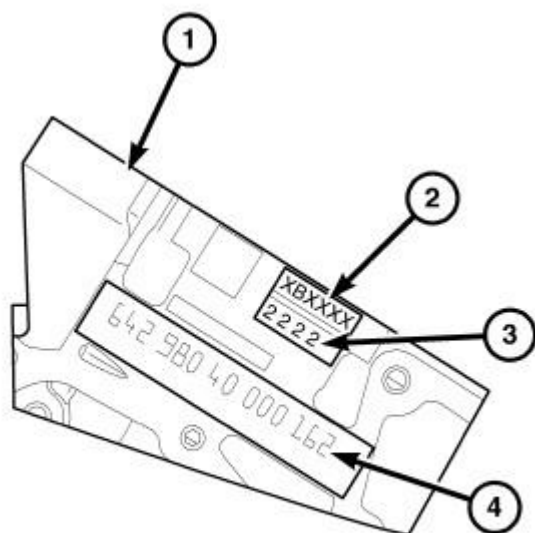
Stage	Color	Bearing Thickness	Applies To
1	Blue	2.250mm-2.255mm (0.0886-0.0888 in.)	Upper and Lower Bearings
2	Yellow	2.255mm-2.260mm (0.0888-0.0890 in.)	Upper and Lower Bearings
3	Red	2.260mm-2.265mm (0.0890-0.0892 in.)	Upper and Lower Bearings
4	White	2.265mm-2.270mm (0.0892-0.0894 in.)	Lower Bearings
5	Violet	2.270mm-2.275mm (0.0894-0.0896 in.)	Lower Bearings

The upper main bearings are available in three different thicknesses and the lower bearings in five. A color coded mark on the side of the bearing is used to identify it's thickness. Each color coded bearing is matched to it's respective journal. The select fit is obtained by matching the color coded bearings to grade identification marks on the cylinder block and crankshaft. Letters marked on the cylinder block identify the color of each upper-half main bearing, while letters marked on the front end of the crankshaft indicate the color of each lower half main bearing.

Installation

INSTALLATION

CRANKSHAFT MAIN BEARINGS



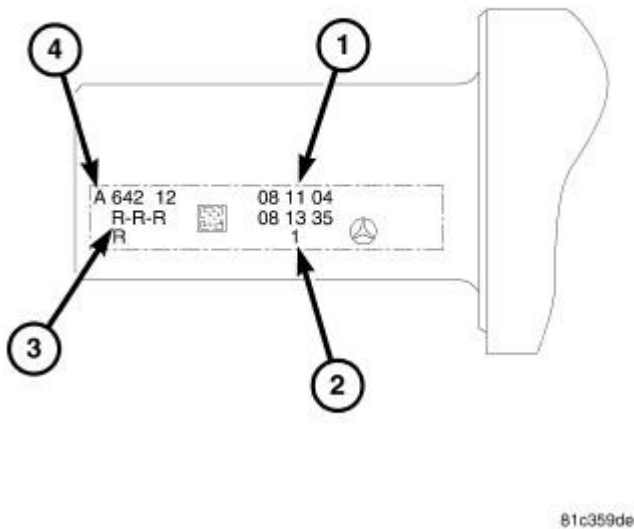
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Fig. 261: BLOCK MARKINGS

Courtesy of CHRYSLER LLC

Each color-coded bearing is matched to its respective journal for the best fit possible (select fit). In production, the select fit is obtained by matching the color-coded bearings to grade identification marks on the cylinder block and crankshaft. Letters marked on the cylinder block identify the color of each upper-half main bearing, while letters marked on the front end of the crankshaft indicate the color of each lower-half main bearing. A group of four letters located on the machined surface of the cylinder block, above the engine identification number, identifies the upper-half main bearings installed.

- The letter "B" indicates a blue bearing
- The letter "G" indicates a yellow bearing
- The letter "R" indicates a red bearing

**Fig. 262: CRANKSHAFT MARKINGS**

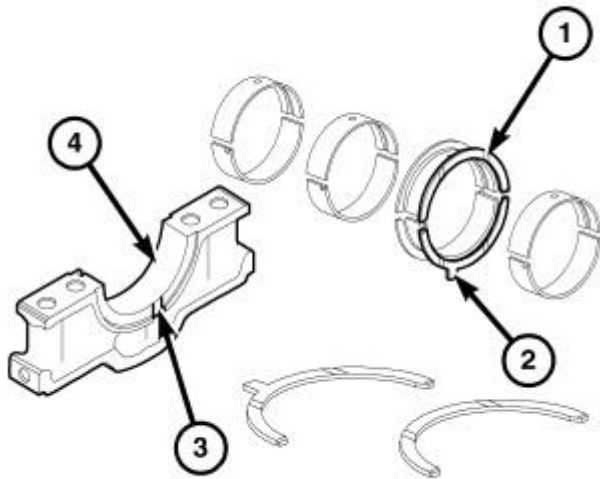
Courtesy of CHRYSLER LLC

The front end of the crankshaft is engraved using laser marking technology. A group of letters identifies the color of each lower-half main bearing.

- The letter "B" indicates a blue bearing
- The letter "G" indicates a yellow bearing
- The letter "R" indicates a red bearing
- The letter "W" indicates a white bearing
- The letter "V" indicates a violet bearing

Check the grade identification marks on the cylinder block and crankshaft to properly select the main bearings. For example, if the crankshaft has the letter "B" in position No. 2 and the cylinder block has the letter "R" in

position No. 2, the proper select bearing color code is red for the upper main bearing and blue for the lower main bearing.



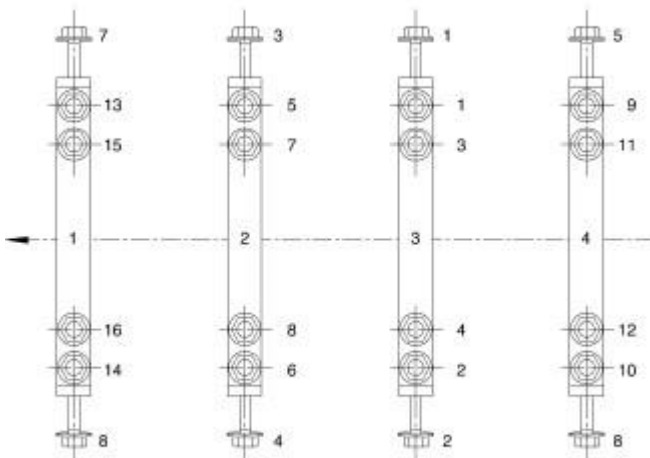
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Fig. 263: THRUST WASHERS

Courtesy of CHRYSLER LLC

The No. 3 main bearing cap includes provisions for the thrust washers. The thrust washers in the bearing cap have two locating tabs to prevent them from rotating and to avoid misassembly. During assembly, the oil grooves in the thrust washers must face the crankshaft thrust surfaces.

- The 0 digit represents a colorless thrust washer
- The 1 digit represents a thrust washer with a red color code



81c35318

Fig. 264: MAIN BEARING CAP SEQUENCE

Courtesy of CHRYSLER LLC

NOTE: Do not reuse the main bearing cap bolts. Always install new bolts.

NOTE: Add a light coating of oil to the crankshaft side of the bearing.

1. Lubricate bolts on the thread and bolt head contact surfaces with engine oil. Install all crankshaft bearing cap bolts finger tight.
2. Stage 1: In the sequence shown in illustration, tighten the crankshaft bearing cap bolts (1-13) to 35 Nm (26 ft lbs)
3. Stage 2: Turn crankshaft bearing cap bolts an additional 95 degrees.
4. Stage 3: Turn crankshaft bearing cap bolts an additional 95 degrees.
5. Stage 4: In the sequence shown in illustration, tighten the lateral (side of the block, 1- 8) crankshaft bearing cap bolts to 53 Nm (39 ft lbs).
6. Make sure that the crankshaft turns freely.

CRANKSHAFT

Description

DESCRIPTION

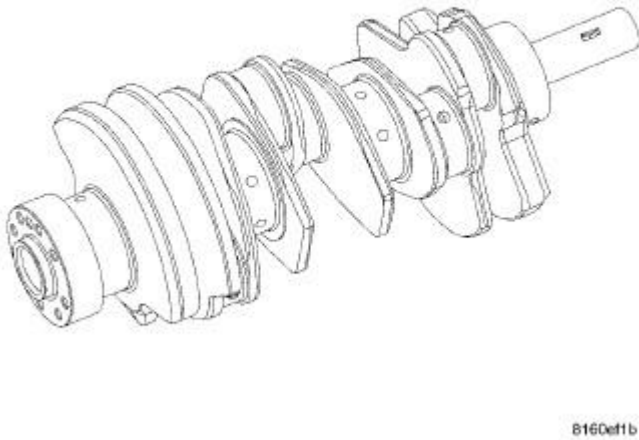


Fig. 265: CRANKSHAFT
 Courtesy of CHRYSLER LLC

1 - CRANKSHAFT

The crankshaft (1) for the 3.0L is a forged steel type design with four main bearing journals. The third crankshaft support controls crankshaft thrust. The bearing identification for the upper crankshaft main journals is etched into the engine block below the high pressure pump and the proper lower bearing selection can be found etched in the front of the crankshaft .

Operation

OPERATION

The crankshaft transfers force generated by combustion within the cylinder bores to the flexibility. The crankshaft has six separate throws arranged at different angles (splayed) to reduce second order free movements of inertia. Following the injection order 1-4-2-5-3-6, the crankshaft throw angles alternate between 48° and 192°.

In the injection order, together with the splayed throws and the 72° V-block, produce injection intervals of 120° (even fire). After ignition TDC of cylinder number 1, the crankshaft turns 120° to reach TDC of cylinder number 4. The 120° angle (even fire) is the result of the 48° throw angle plus the 72° cylinder block angle.

Standard Procedure

MEASURE CRANKSHAFT AND BLOCK JOURNALS

NOTE: After any bearing damage occurred, remove all debris which is present in the main oil gallery, connecting rod bores, and in the crankshaft and oil galleries. Include removal of the inserting steel ball of the main oil gallery before cleaning.

1. Remove crankshaft.
2. Clean all engine parts thoroughly.

CAUTION: Replace all of the connecting rods when ever any of the rod cap bolts are loosened or bearing caps are removed

3. Inspect crankshaft, replace as necessary.
4. Inspect crankcase for damage.
5. Inspect crankshaft main bearing caps for damage.
6. Install the crankshaft main bearing caps and check for out of round. Replace as necessary.
7. Remove the main bearing caps and install the crankshaft with the correct selected bearings.

NOTE: **Radial mounting of the main bearings of standard size crankshaft is possible by assigning the color-coded bearing shells. The upper main bearings can be identified by the four digit mark etched on the engine block below the high pressure pump. The lower main bearings can be identified by the code etched on the front of the crankshaft hub.**

ASSIGNING CRANKSHAFT MAIN BEARING SHELLS

The upper main bearings can be identified by the four digit mark etched in the block below the high pressure pump. The lower main bearings can be identified by the code etched on the front of the crankshaft hub. This color code indicates which bearing shell halves are to be used.

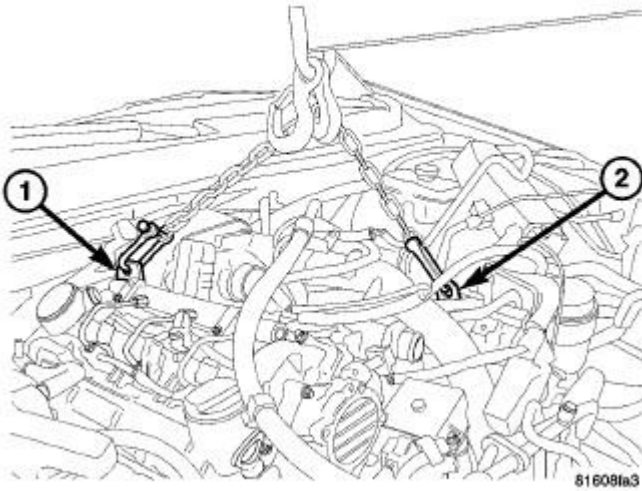
8. Select the correct bearing shells based upon the crankcase and crankshaft identification marks.
9. Mount crankshaft axially using the thinnest thrust washer.
10. Inspect crankshaft end play. If the crankshaft end play is out of specification, remove the crankshaft and install the larger thrust shim. repeat the procedure until crankshaft end play is within specification.
11. Mount the crankshaft axially again and check each main bearing oil clearance with plasti-gauge. For bearing clearance specifications, see **Specifications** .

CHECKING CRANKSHAFT END PLAY

1. Mount a dial indicator to a stationary point at rear of engine. Locate the probe perpendicular against the rear of the crankshaft.
2. Move the crankshaft all the way to the front of its travel.
3. Zero the dial indicator.
4. Move the crankshaft all the way to the rear of it's travel and record the reading on the dial indicator. For crankshaft end play clearances, refer to the engine specification chart. See **Specifications** .

Removal

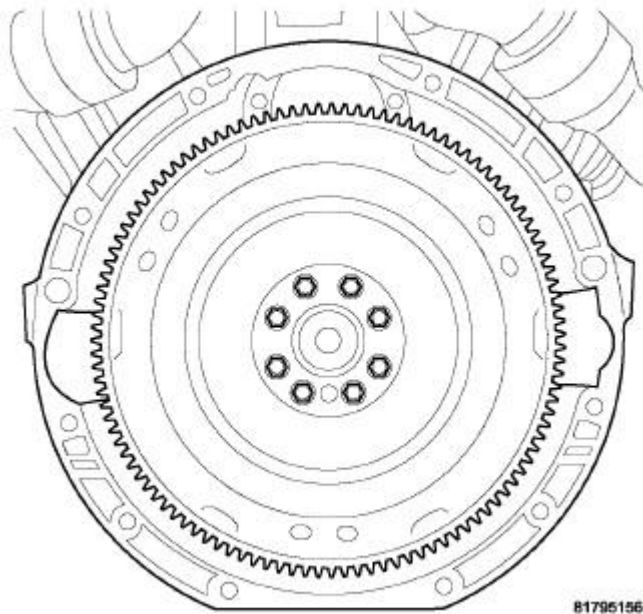
REMOVAL

**Fig. 266: ENGINE LIFTING POINTS**

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - REAR ENGINE LIFT WITH CLEVIS CONNECTOR
2 - FRONT ENGINE LIFT WITH CLEVIS CONNECTOR |
|---|

1. Remove the engine cover.
2. Remove the engine from the vehicle. See **Removal**

**Fig. 267: FLEX PLATE**

Courtesy of CHRYSLER LLC

3. Remove the flex plate.

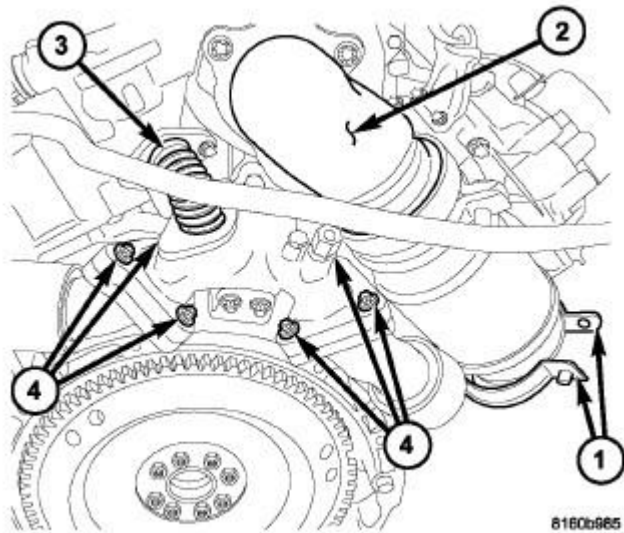


Fig. 268: REMOVING/INSTALLING AIR INTAKE, TURBO & EXHAUST SYSTEM COMPONENTS

Courtesy of CHRYSLER LLC

4. Remove the turbocharger.

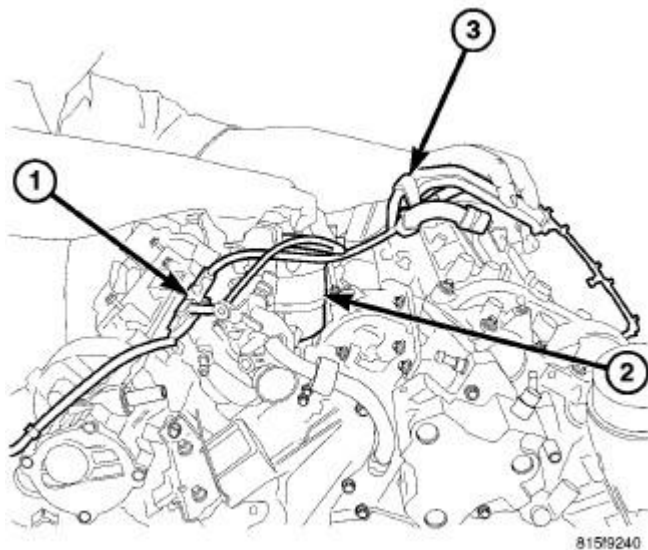


Fig. 269: FUEL FILTER, LINES AND HOSES

Courtesy of CHRYSLER LLC

1 - RETURN FUEL HOSE BUNDLE

2 - FUEL FILTER

3 - LOW PRESSURE FUEL SUPPLY AND RETURN PIPE

5. Remove the fuel filter.
6. Remove the fuel rails and lines.

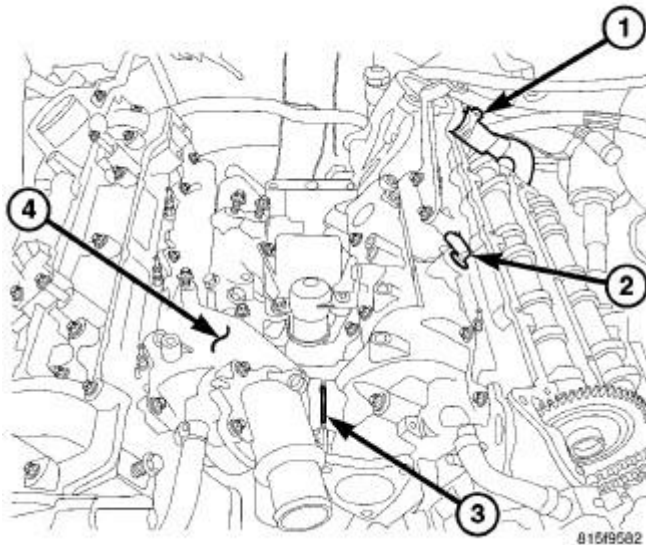


Fig. 270: INTAKE MANIFOLD

Courtesy of CHRYSLER LLC

1 - EGR COOLANT PIPE

2 - COOLANT TEMPERATURE SENSOR

3 - INTAKE COOLANT PASSAGE

4 - INTAKE MANIFOLD

7. Remove the intake manifold.

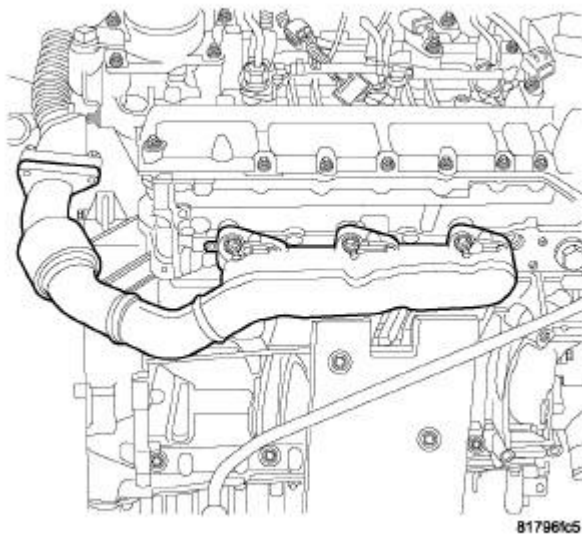


Fig. 271: RIGHT EXHAUST MANIFOLD
Courtesy of CHRYSLER LLC

8. Remove the exhaust manifolds.

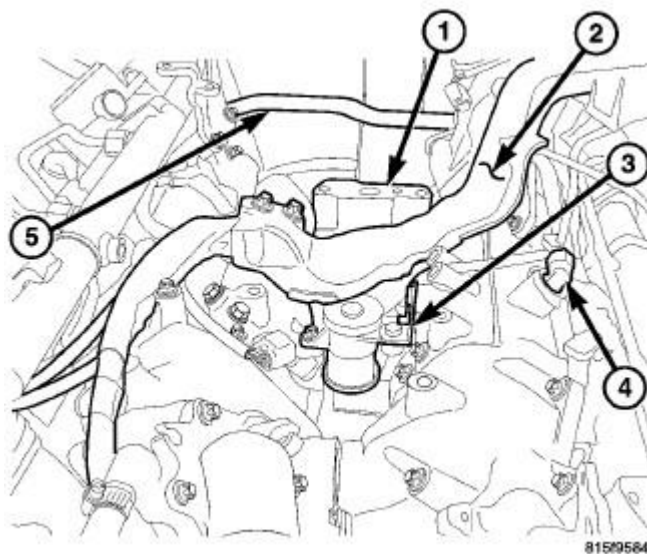
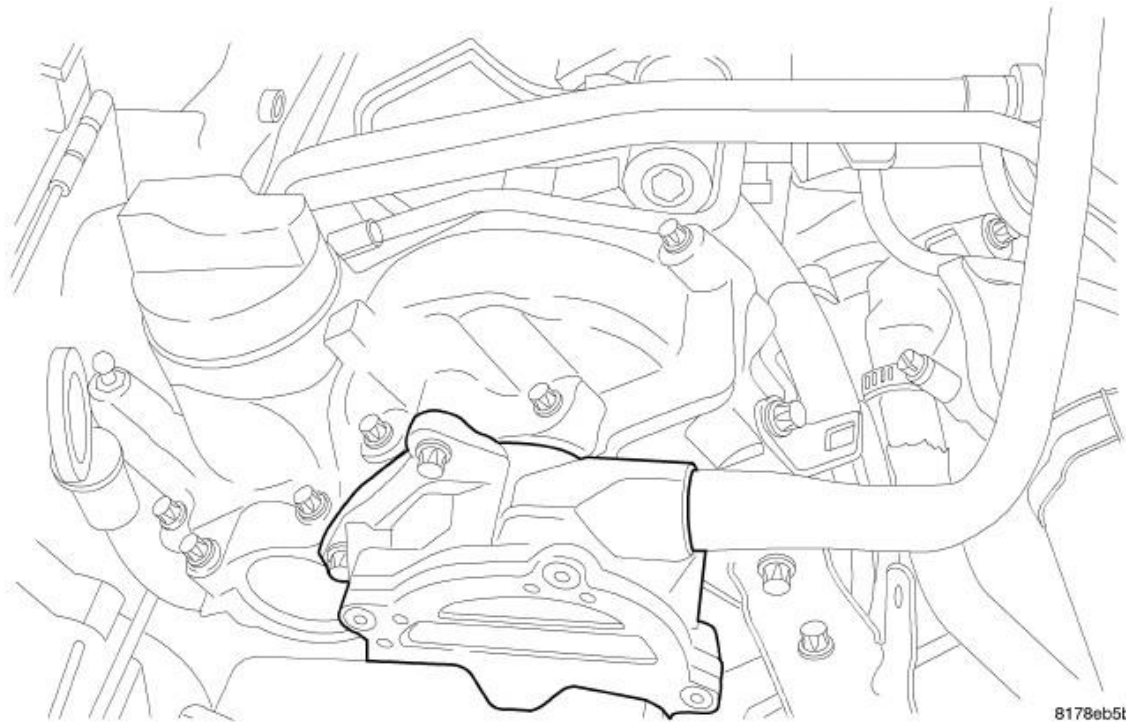


Fig. 272: MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - TURBOCHARGER OIL HOUSING ADAPTOR
2 - MAIN ENGINE WIRING HARNESS
3 - SWIRL VALVE ACTUATOR |
|--|

4 - COOLANT TEMPERATURE SENSOR

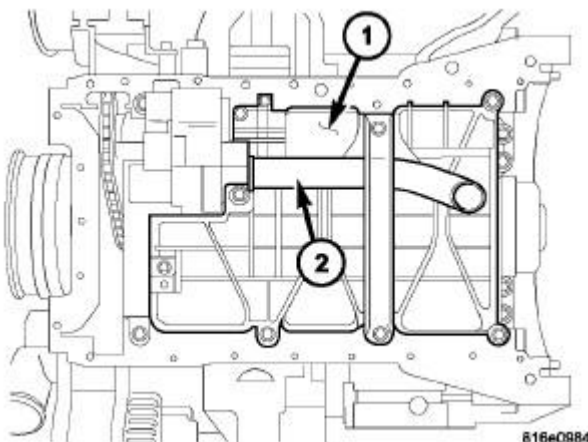
9. Remove the oil filter assembly.
10. Remove the water pump.
11. Remove the air flow control valve assembly.
12. Disconnect and remove the engine harness.



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Fig. 273: VACUUM PUMP
Courtesy of CHRYSLER LLC

13. Remove the vacuum pump.

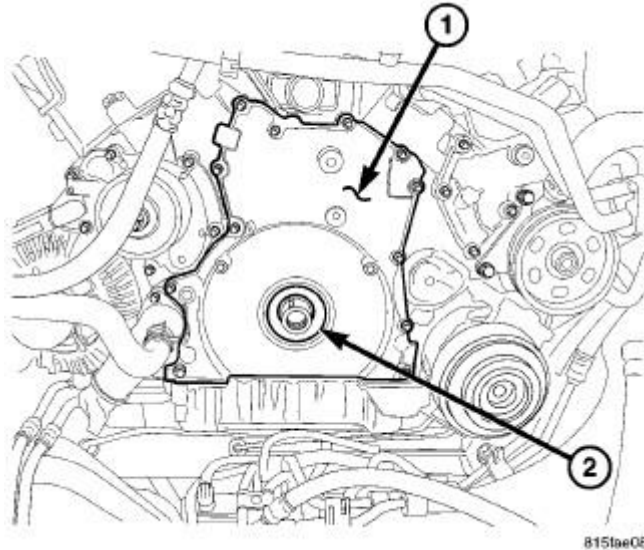


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Fig. 274: OIL PUMP COVER REMOVAL

Courtesy of CHRYSLER LLC

14. Remove the windage tray and lower oil pan. See **Removal**.
15. Remove the oil pump pickup tube. See **Removal**.
16. Remove the upper oil pan. See **Removal**.
17. Remove the oil pump. See **Removal**.

**Fig. 275: FRONT TIMING COVER**

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - TIMING CHAIN COVER
2 - FRONT CRANKSHAFT SEAL |
|---|

18. Remove the timing chain cover. See **Removal**.
19. Remove the timing chains.
20. Remove the timing chain tensioner. See **Removal**.
21. Remove the right cylinder head. See **Removal**.
22. Remove the left cylinder head. See **Removal**.

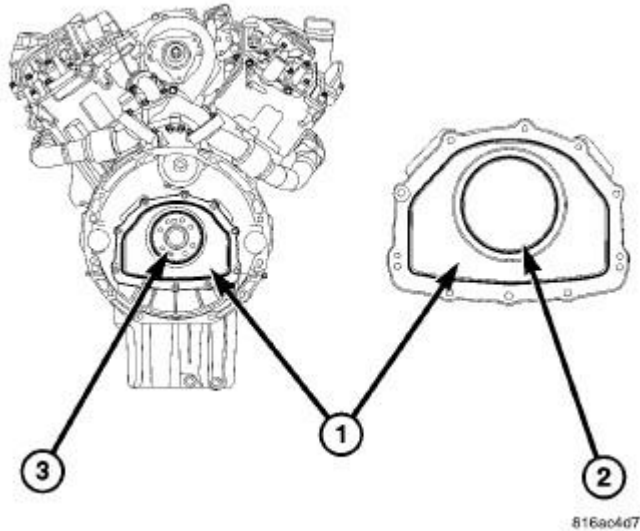


Fig. 276: REAR MAIN SEAL CARRIER
 Courtesy of CHRYSLER LLC

23. Remove the crankshaft oil seal.

CAUTION: Do not allow the connecting rods to nick or score the crankshaft during assembly or disassembly.

CAUTION: Do not allow the connecting rods to touch the oil jets. Serious engine damage can occur if the oil jets are bent or misaligned.

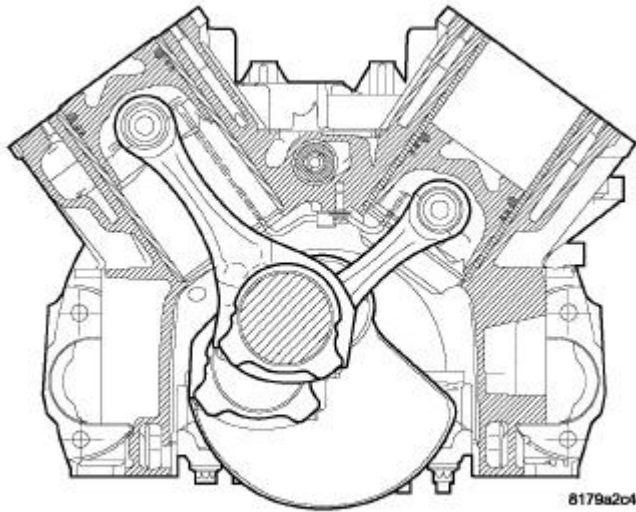


Fig. 277: BLOCK CUTAWAY
Courtesy of CHRYSLER LLC

24. Remove the pistons and connecting rods. See **Removal**.
25. Remove the oil jets. See **Removal**.

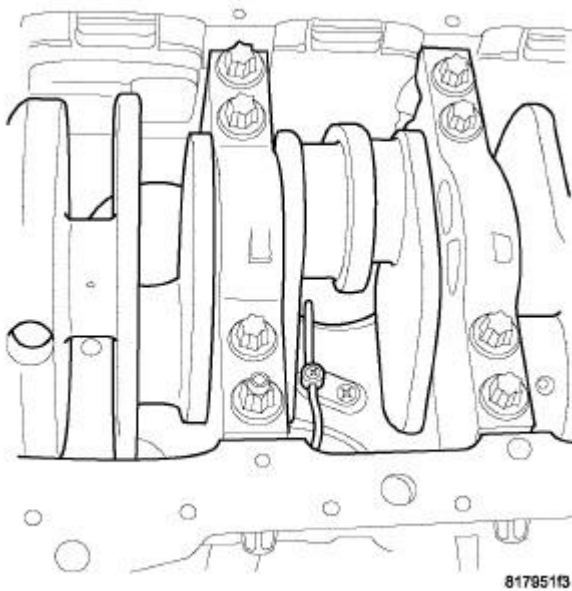


Fig. 278: OIL JET
Courtesy of CHRYSLER LLC

26. Remove the crankshaft main bearing caps.
27. Remove the crankshaft.
28. Remove the thrust washer.
29. Remove the crankshaft bearings.

Installation

INSTALLATION

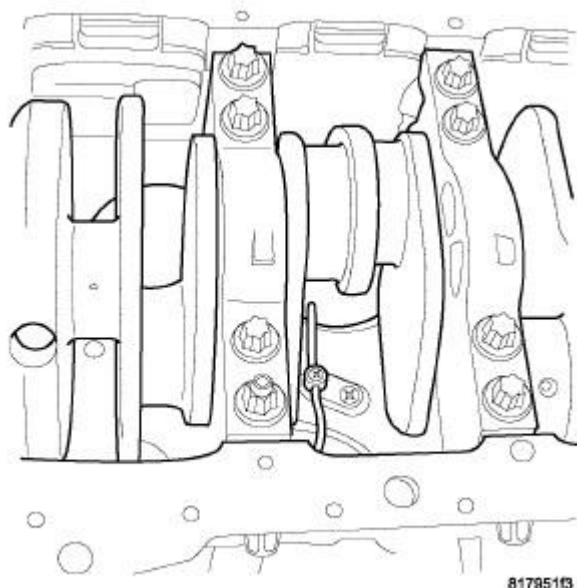


Fig. 279: OIL JET

Courtesy of CHRYSLER LLC

1. Clean all sealing and mating surfaces. Be sure that the sealing and mating surfaces are free of oil and debris.

NOTE: If any bearing damage has occurred, remove all debris from the connecting rod bores, crankshaft, and oil galleries. Remove the steel ball from the main oil gallery before cleaning.

2. Inspect the crankshaft and bearings. Replace as necessary. See Standard Procedure.
3. Install the crankshaft bearings and the top half of the crankshaft thrust bearing.
4. Position the crankshaft.
5. Position and install the main bearing caps.
6. Install the lower half of the crankshaft thrust bearing.
7. Measure the main bearing cap bolts. Replace any bolt that is not within specification.

8. Using the correct torque sequence, torque the main bearing caps to 44 N.m (33 lb. ft.).
9. Check the crankshaft end play. See **Standard Procedure**.
10. The crankshaft should turn freely. If the crankshaft does not turn freely loosen and re-torque the bearing caps.

CAUTION: Replace all of the connecting rods when ever any of the rod cap bolts are loosened or bearing caps are removed

CAUTION: When installing the pistons and connecting rods do not allow the connecting rod to score or mark the crankshaft.

CAUTION: Do not allow the connecting rod to bend or dent the oil jet. Serious engine damage may result from a misaligned oil jet.

11. Install the pistons and connecting rods.

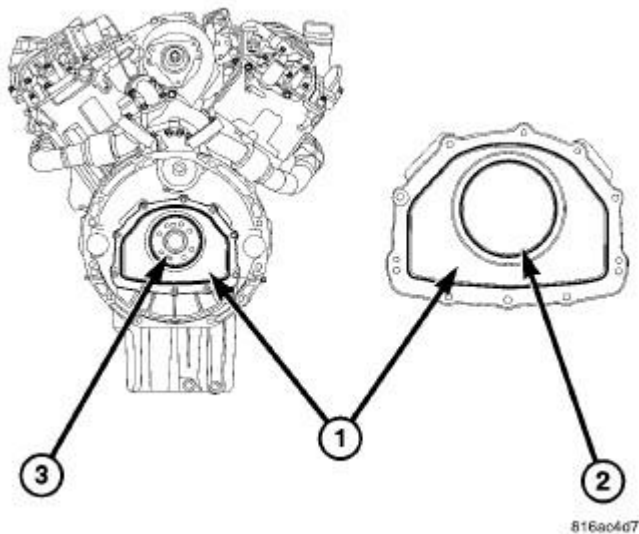


Fig. 280: REAR MAIN SEAL CARRIER
Courtesy of CHRYSLER LLC

12. Install the rear crankshaft oil seal.

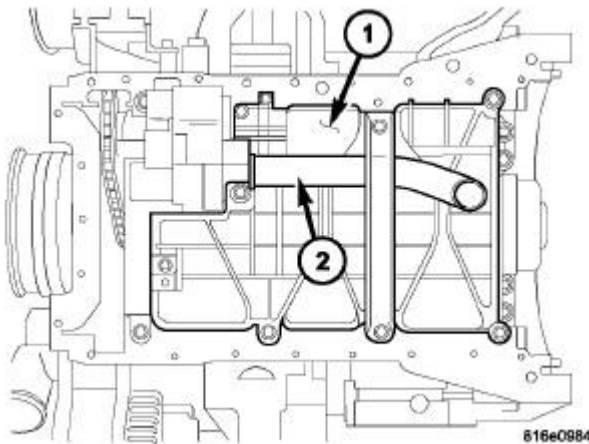


Fig. 281: OIL PUMP COVER REMOVAL
Courtesy of CHRYSLER LLC

13. Install the oil pump. See **Installation**.
14. Install the oil pump chain.
15. Position the timing chains on the crankshaft.
16. Install the windage tray.
17. Install the right cylinder head. See **Installation**.
18. Install the left cylinder head. See **Installation**.

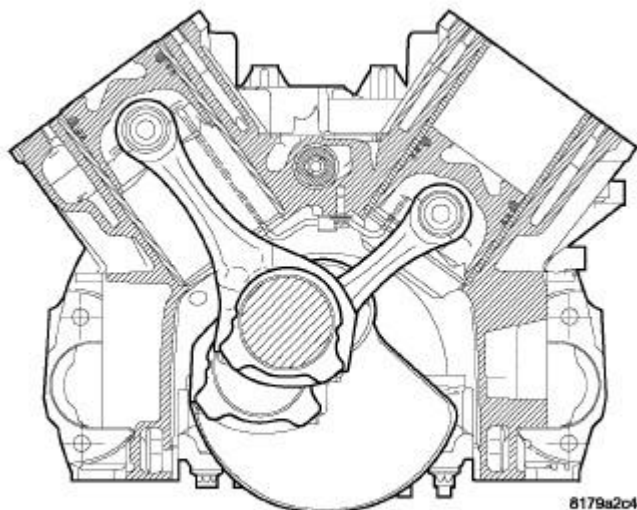


Fig. 282: BLOCK CUTAWAY
Courtesy of CHRYSLER LLC

19. Install the timing chain sprockets to the camshafts.
20. Set the engine timing.
21. Install the camshaft cover on the left cylinder head.
22. Install the camshaft cover on the right cylinder head.

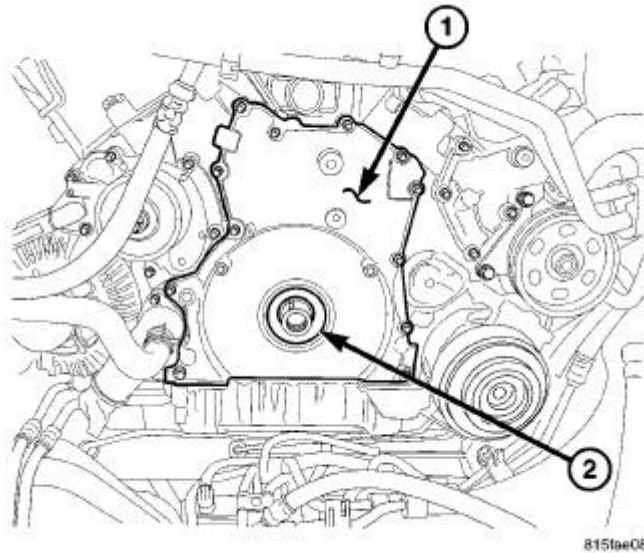


Fig. 283: FRONT TIMING COVER

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - TIMING CHAIN COVER
2 - FRONT CRANKSHAFT SEAL |
|---|

23. Install the upper oil pan.
24. Install the lower oil pan (if equipped).

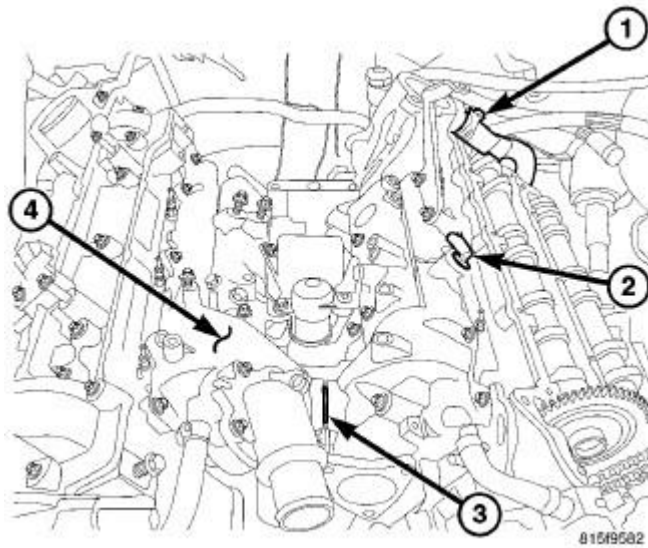


Fig. 284: INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

- 1 - EGR COOLANT PIPE
- 2 - COOLANT TEMPERATURE SENSOR
- 3 - INTAKE COOLANT PASSAGE
- 4 - INTAKE MANIFOLD

25. Install the intake manifold. See **Installation** .

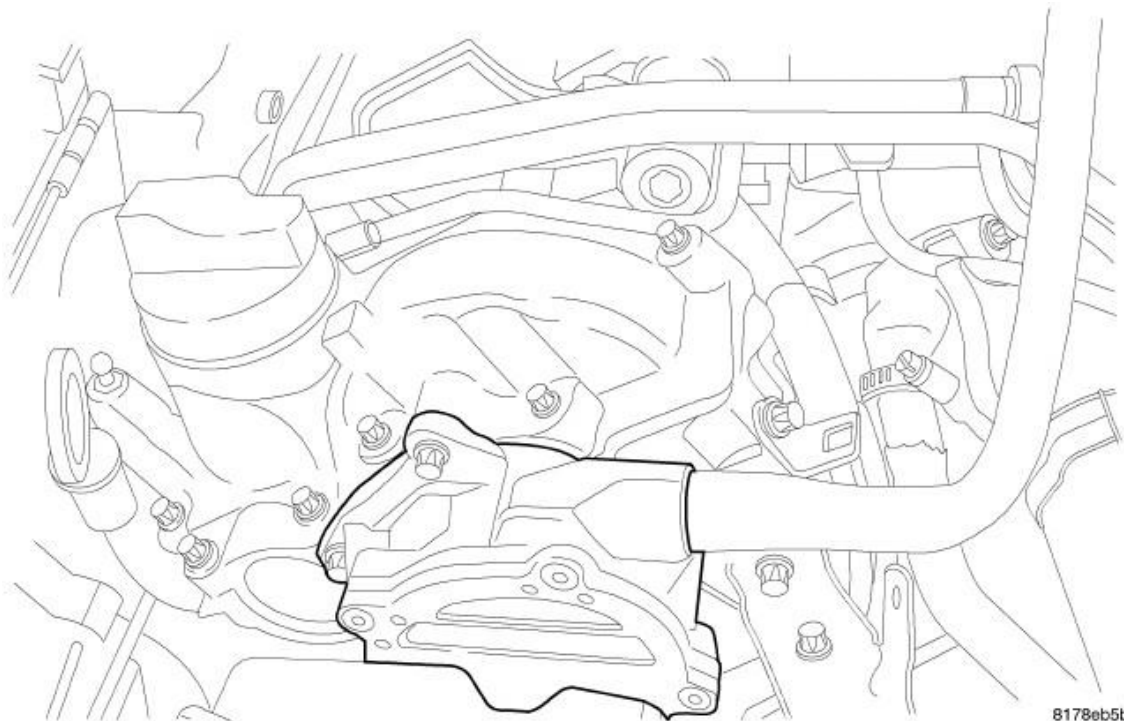
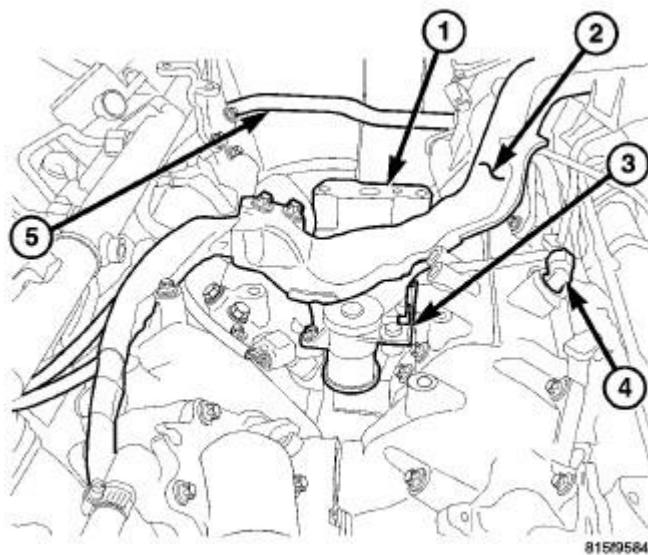


Fig. 285: VACUUM PUMP

Courtesy of CHRYSLER LLC

26. Install the vacuum pump.

**Fig. 286: MAIN ENGINE WIRING HARNESS**

Courtesy of CHRYSLER LLC

- | |
|--------------------------------------|
| 1 - TURBOCHARGER OIL HOUSING ADAPTOR |
| 2 - MAIN ENGINE WIRING HARNESS |
| 3 - SWIRL VALVE ACTUATOR |
| 4 - COOLANT TEMPERATURE SENSOR |

27. Install and connect the engine harness.

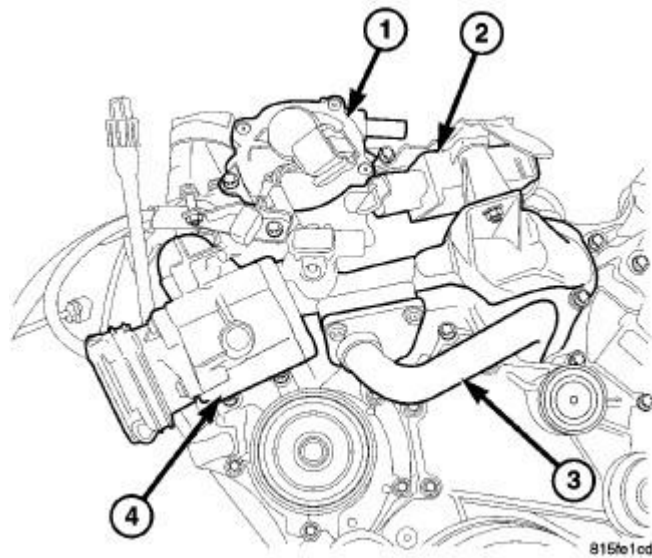


Fig. 287: AIR CONTROL VALVE
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - VACUUM PUMP
2 - GLOW PLUG RELAY
3 - EGR COOLER
4 - AIR CONTROL VALVE |
|---|

28. Install the air flow control valve assembly.
29. Install the water pump.

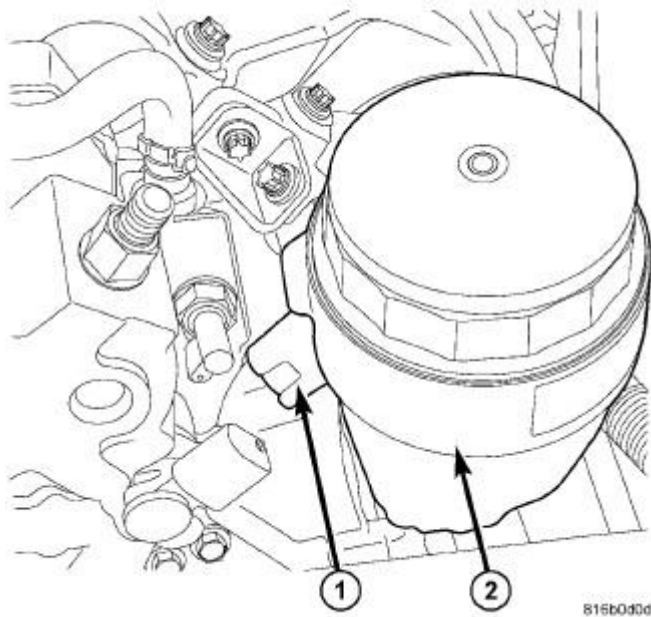


Fig. 288: OIL FILTER HOUSING
Courtesy of CHRYSLER LLC

30. Install the oil filter assembly.

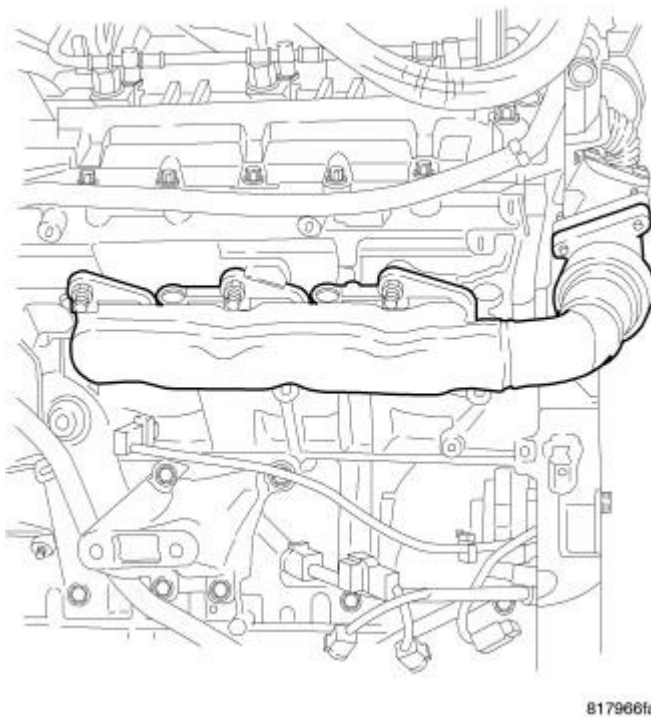


Fig. 289: EXHAUST MANIFOLD - LEFT
Courtesy of CHRYSLER LLC

31. Install the left exhaust manifold. See **Installation**.
32. Install the right exhaust manifold. See **Installation**.

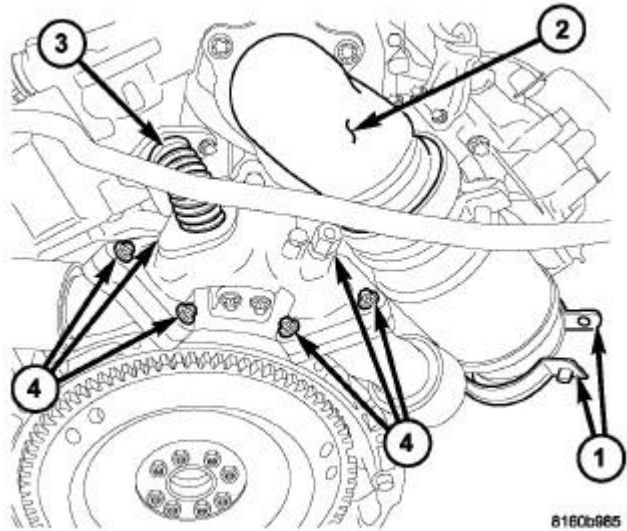


Fig. 290: REMOVING/INSTALLING AIR INTAKE, TURBO & EXHAUST SYSTEM COMPONENTS

Courtesy of CHRYSLER LLC

33. Install the turbocharger. See **Installation**.

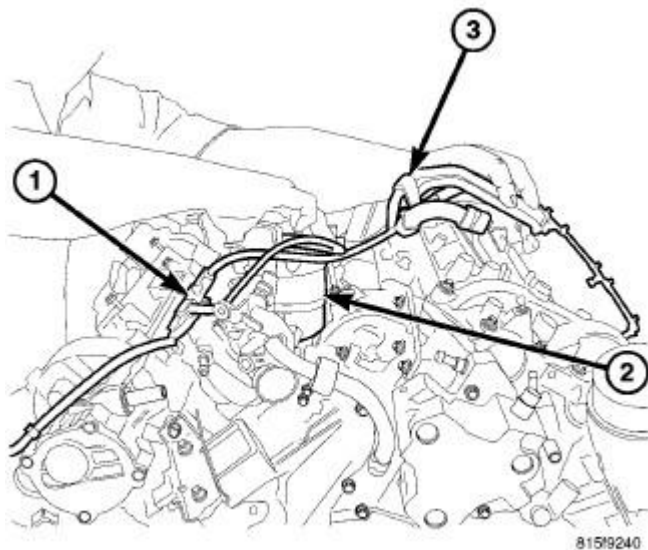


Fig. 291: FUEL FILTER, LINES AND HOSES

Courtesy of CHRYSLER LLC

1 - RETURN FUEL HOSE BUNDLE

2 - FUEL FILTER**3 - LOW PRESSURE FUEL SUPPLY AND RETURN PIPE**

34. Install the fuel rails and lines.

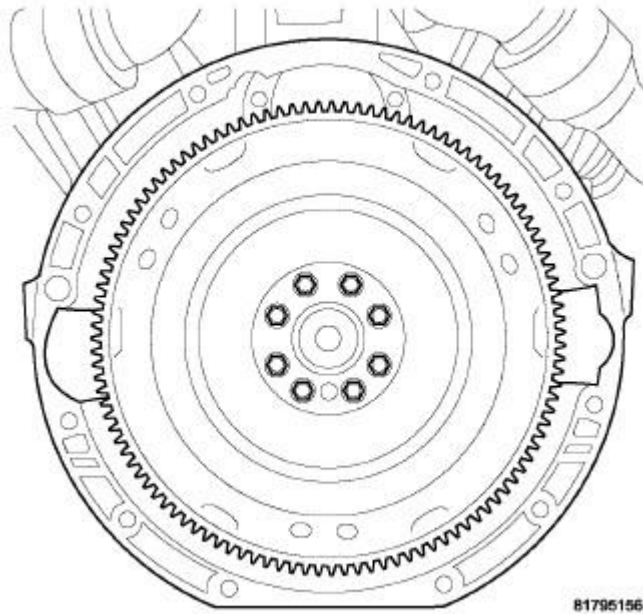


Fig. 292: FLEX PLATE
Courtesy of CHRYSLER LLC

35. Install the flex plate. See **Installation**.

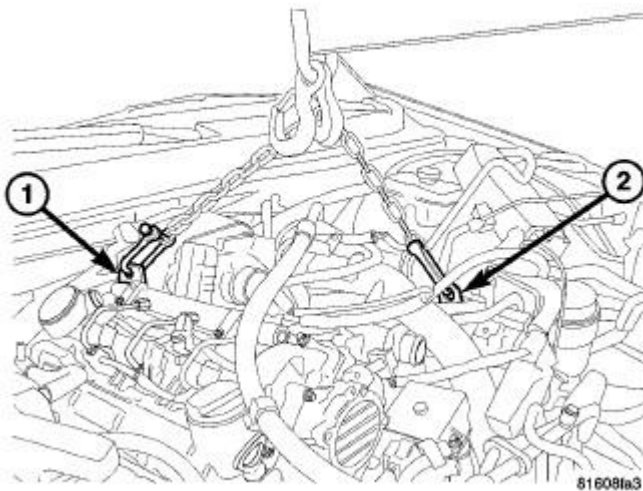


Fig. 293: ENGINE LIFTING POINTS

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - REAR ENGINE LIFT WITH CLEVIS CONNECTOR
2 - FRONT ENGINE LIFT WITH CLEVIS CONNECTOR |
|---|

36. Install engine in vehicle. See **Installation**.
37. Fill engine oil with proper oil to correct level. Refer to **Vehicle Quick Reference/Capacities and Recommended Fluids - Specifications**.
38. Start the engine and check for leaks.

DAMPER, VIBRATION

Removal

REMOVAL

1. Disconnect negative battery cable.
2. Remove the air cleaner assembly. See **Removal**.
3. Drain the cooling system. Refer to **Cooling - Standard Procedure**.
4. Remove the lower radiator hose.
5. Remove the serpentine belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal**.

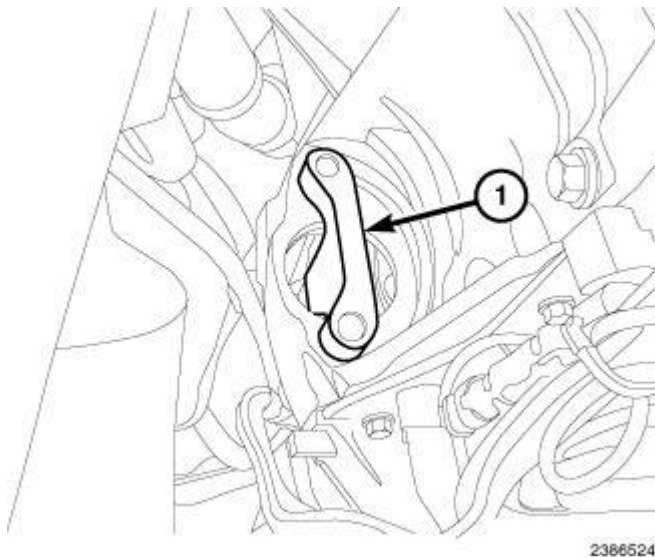


Fig. 294: FLYWHEEL LOCKING TOOL
Courtesy of CHRYSLER LLC

6. Remove the starter blank.
7. Install the Flywheel Locking Tool (1) 9102.

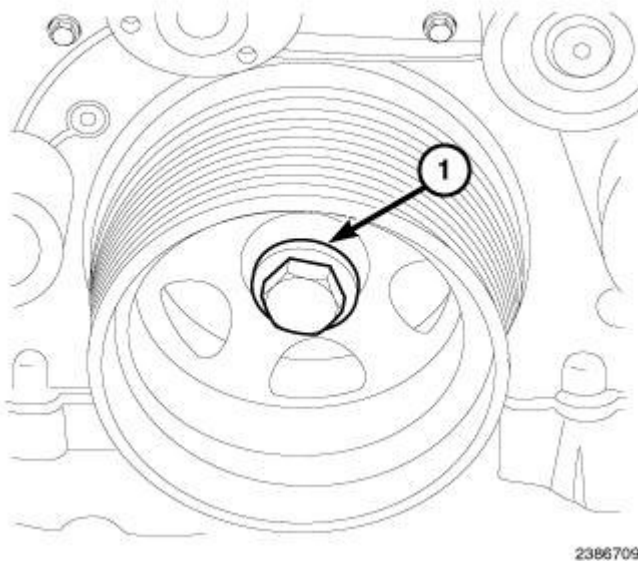


Fig. 295: VIBRATION DAMPER BOLT
Courtesy of CHRYSLER LLC

8. Remove the vibration damper bolt (1).

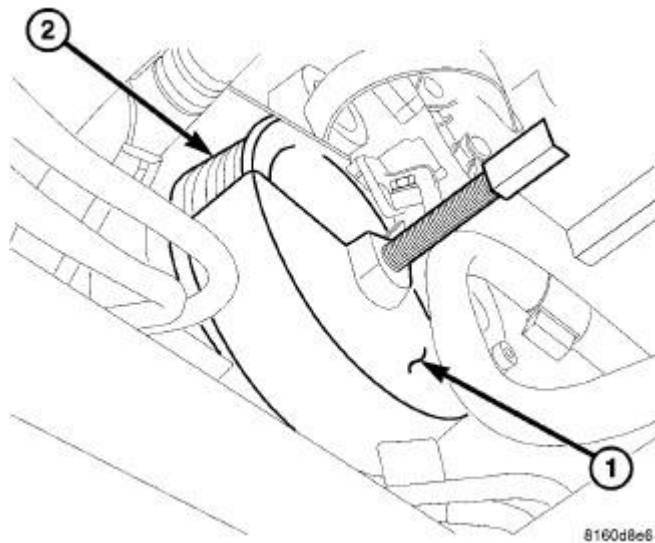


Fig. 296: SPECIAL TOOL #8940 VIBRATION DAMPER PULLER
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - SPECIAL TOOL #9544
2 - VIBRATION DAMPER</p> |
|--|

CAUTION: Care must be taken when removing the damper. DO NOT damage or gouge the front crankshaft seal

9. Using Vibration Damper Puller (1) 9544, remove the vibration damper (2).

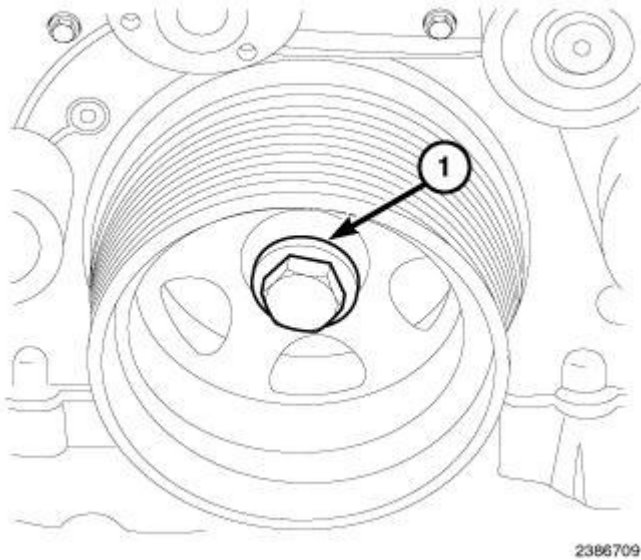
Installation**INSTALLATION**

Fig. 297: VIBRATION DAMPER BOLT

Courtesy of CHRYSLER LLC

CAUTION: Care must be taken when installing the damper. **DO NOT** damage or gouge the front crankshaft seal

NOTE: To prevent potential oil leaks, **DO NOT** touch the front crankshaft inner seal.

1. Align the alignment key in the crankshaft with the key way in the damper and install the vibration damper.
2. Install the vibration bolt (1). Tighten bolt to 210 N.m, plus 180 degrees (154 ft. lbs. plus 180 degrees).

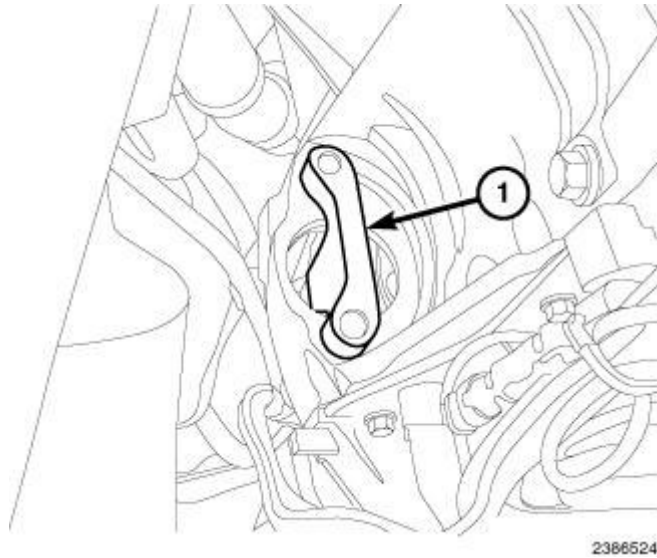


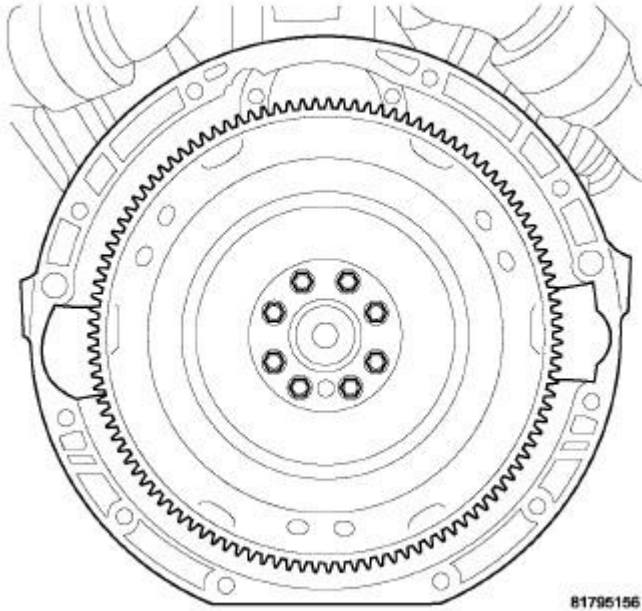
Fig. 298: FLYWHEEL LOCKING TOOL
Courtesy of CHRYSLER LLC

3. Remove Flywheel Locking Tool (1) 9102.
4. Install the starter blank.
5. Install the serpentine belt. Refer to Cooling/Accessory Drive/BELT, Serpentine - Installation .
6. Fill the cooling system. Refer to Cooling - Standard Procedure .
7. Install the lower radiator hose.
8. Install the cleaner assembly. See Installation.
9. Connect negative battery cable.

FLEXPLATE

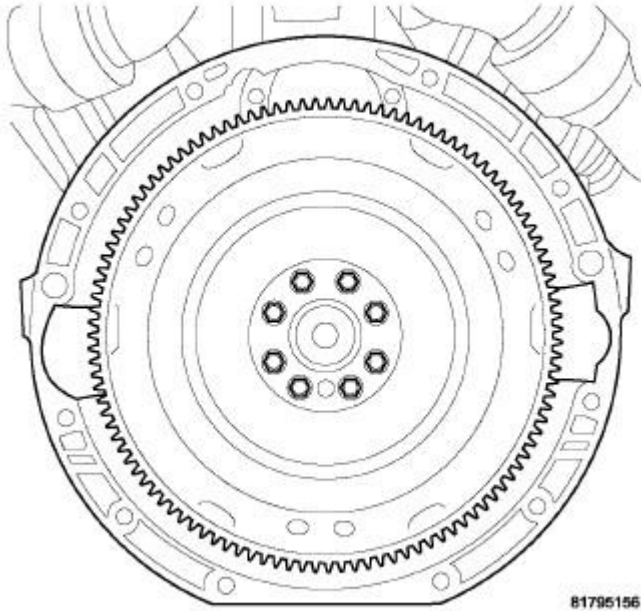
Description

DESCRIPTION

**Fig. 299: FLEX PLATE****Courtesy of CHRYSLER LLC**

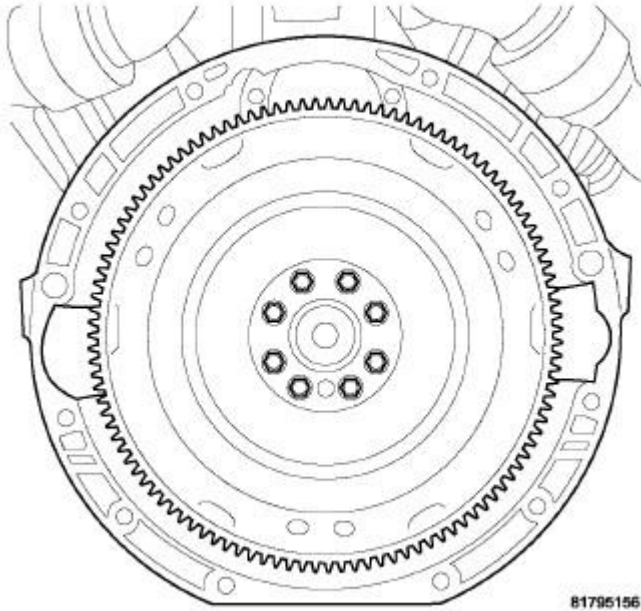
The flex plate is fastened to the crankshaft and can only be installed one way. The crankshaft has a dowel locating pin that is used to align the flex plate. The stamped-steel flex plate has a segment ring to provide engine speed and crankshaft position information to the Engine Control Module (ECM). The crankshaft position sensor is mounted next to the segment ring and sends electrical pulses to the ECM. The segment ring contains 58 segments and a gap with two missing segments (the 59th and 60th) for the detection of TDC of cylinder No. 1.

Removal**REMOVAL**

**Fig. 300: FLEX PLATE****Courtesy of CHRYSLER LLC**

1. Remove the transmission. Refer to **Transmission and Transfer Case/Automatic - NAG1 - Removal** .
2. Paint mark the flex plate hub to flex plate relation.
3. Remove the flex plate bolts and flex plate.
4. Inspect flex plate for damage.

Installation**INSTALLATION**

**Fig. 301: FLEX PLATE**

Courtesy of CHRYSLER LLC

NOTE: Do Not lubricate new bolts as they are already coated with an anti-scuff treatment.
Align the flex plate to hub paint marks, where applicable.

1. Install the flex plate locating pin.
2. Install the flex plate to the hub and install the fasteners. Tighten the flex plate fasteners in a cross sequence to 44 N.m (32.5 ft. lbs.).
3. Install the transmission. Refer to Transmission and Transfer Case/Automatic - NAG1 - Installation .

LINER, CYLINDER

Description

DESCRIPTION

The cylinder liners used in the 3.0L engine are made of cast iron and molded into the aluminum engine block. There are three size cylinder liners used and they are identified by the markings "A", "X", or "B" on the engine block below the high pressure pump. These markings are used to match piston size with cylinder bore size.

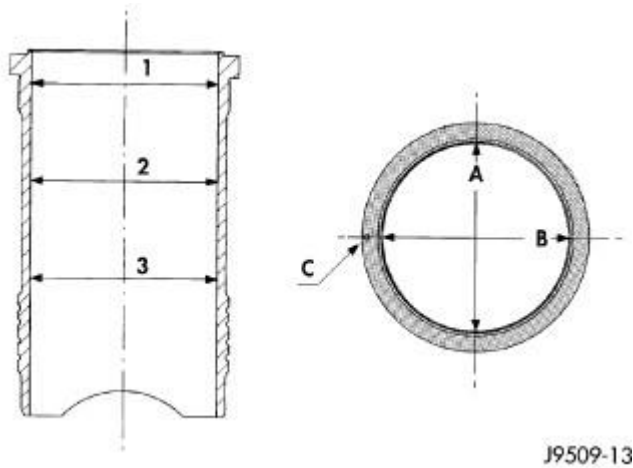
A group of letters located on the machined surface of the cylinder block, above the engine identification number, identifies the dimensional tolerance of each cylinder bore. The standard diameter of the cylinder bore is 83.009 mm (3.2681 in). The manufacturing tolerance is ± 0.009 mm (± 0.00035 in). Three cylinder bore groups are assigned within the 0.018 mm (0.0007 in) tolerance:

- Code letter A-includes cylinder bore sizes 83.000-83.006 mm (3.2677-3.2680 in)
- Code letter X-includes cylinder bore sizes 83.006-83.012 mm (3.2680-3.2682 in)
- Code letter B-includes cylinder bore sizes 83.012-83.018 mm (3.2682-3.2684 in)

WARNING: The cylinder liners are not serviceable and no repair stages are specified. Oversize pistons are not available. The cylinder block must be replaced if a cylinder liner is out of specifications.

Inspection

INSPECTION



J9509-13

Fig. 302: LINER INSPECTION
Courtesy of CHRYSLER LLC

The cylinder walls should be checked for out-of-round and taper with a dial bore gauge. If the cylinder walls are badly scuffed or scored, replace the engine block.

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

MODULE, BALANCE SHAFT

Removal

REMOVAL

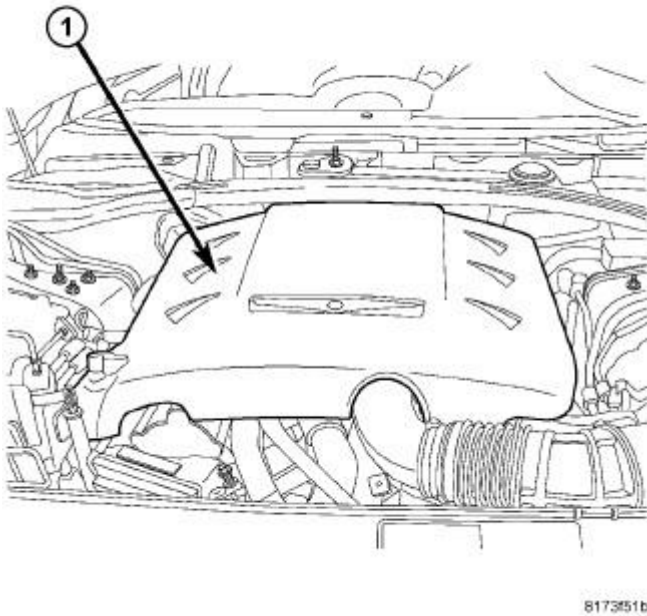


Fig. 303: ENGINE COVER
Courtesy of CHRYSLER LLC

1. Disconnect and isolate the negative battery cable.
2. Remove the engine cover (1) and brackets.

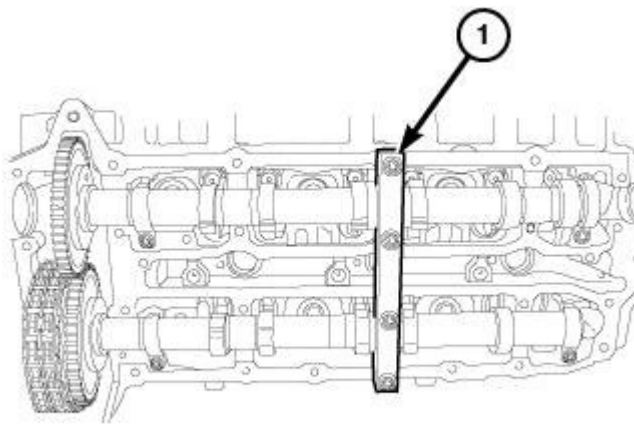


Fig. 304: CAMSHAFT HOLDING FIXTURE 9555
Courtesy of CHRYSLER LLC

3. Remove both cylinder head covers. See **Removal** .
4. Install the Camshaft Holding Fixture 9555 (1) on both cylinder heads.

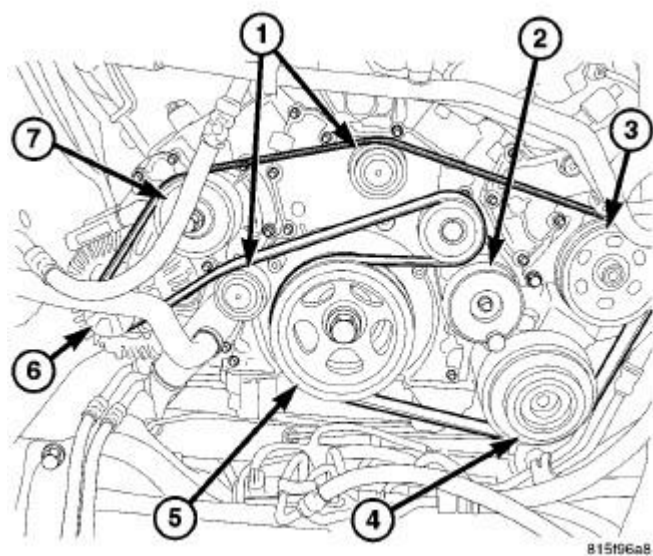


Fig. 305: ACCESSORY DRIVE BELT
Courtesy of CHRYSLER LLC

- 1 - IDLER PULLEYS
- 2 - DRIVE BELT TENSIONER
- 3 - POWER STEERING PUMP
- 4 - AIR CONDITIONING COMPRESSOR
- 5 - VIBRATION DAMPER
- 6 - GENERATOR
- 7 - WATER PUMP

5. Remove the radiator. Refer to Cooling/Engine/RADIATOR, Engine Cooling - Removal .
6. Remove the A/C condenser. Refer to Heating and Air Conditioning/Plumbing/CONDENSER, A/C - Removal .
7. Remove the accessory drive belt. Refer to Cooling/Accessory Drive/BELT, Serpentine - Removal .

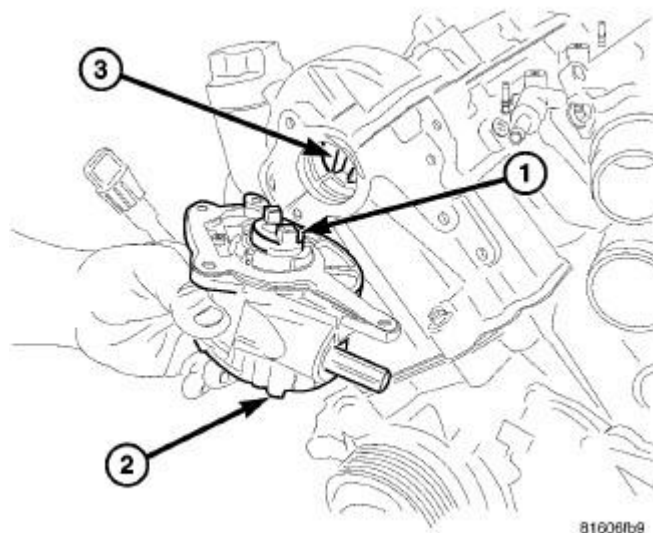


Fig. 306: VACUUM PUMP
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - VACUUM PUMP GEAR
2 - VACUUM PUMP
3 - RIGHT INTAKE CAMSHAFT DRIVE GEAR</p> |
|--|

8. Remove the vacuum pump (2) and discard gasket.

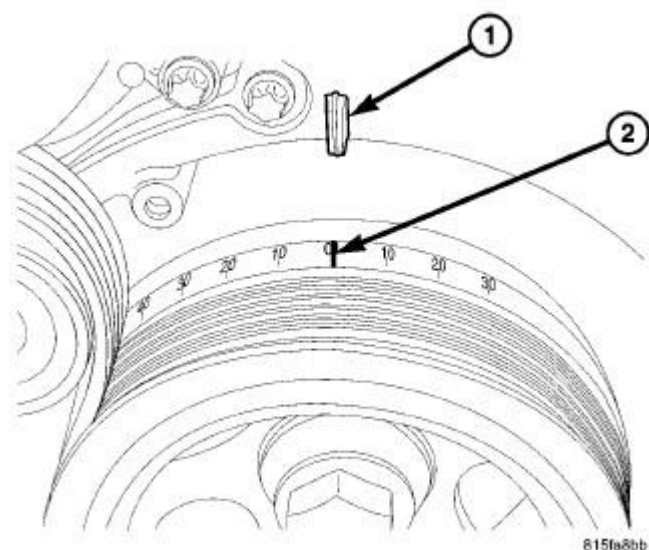


Fig. 307: VIBRATION DAMPER
Courtesy of CHRYSLER LLC

- | |
|-------------------------------------|
| <p>1 - TDC MARK ON TIMING COVER</p> |
|-------------------------------------|

2 - VIBRATION DAMPER TDC MARK

9. Rotate the engine by the crankshaft damper bolt to TDC.

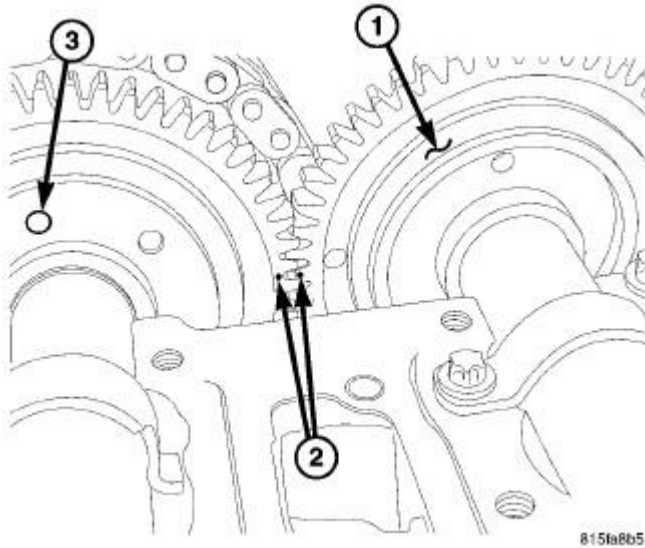


Fig. 308: CAMSHAFT GEAR ALIGNMENT

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - CAMSHAFT GEAR |
| 2 - CAMSHAFT GEAR ALIGNMENT MARKS |
| 3 - CAMSHAFT DRIVE GEAR DOWEL POSITION |

10. Observe the camshaft gear alignment marks (2) on the rear of the camshaft gears (1,3). If they are together, continue with the next step. If the camshaft alignment marks (2) are separated, rotate the engine by the vibration damper another 360° until the camshaft marks (2) align together and the vibration damper reaches TDC.

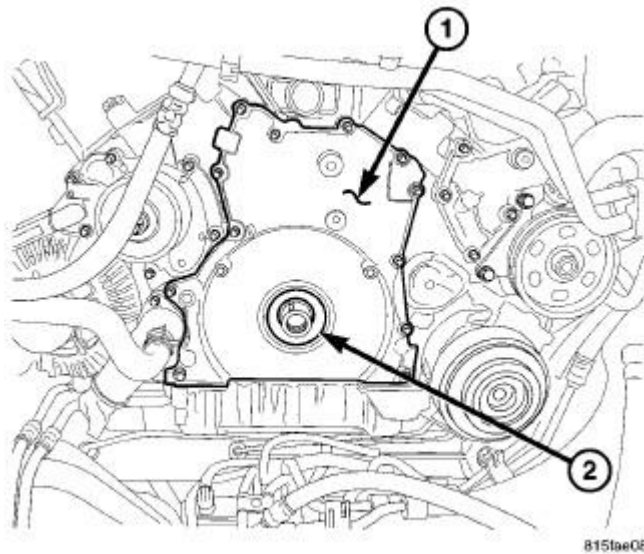


Fig. 309: FRONT TIMING COVER
Courtesy of CHRYSLER LLC

11. Remove the front timing chain cover (1). See **Removal** .

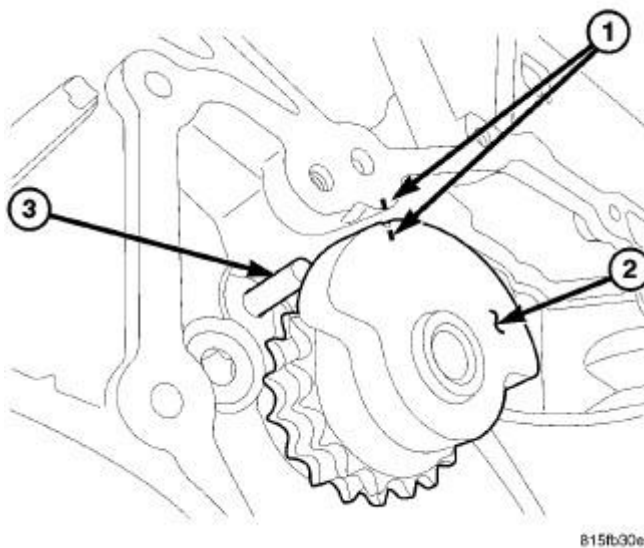


Fig. 310: BALANCE SHAFT INDEXING
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - PAINT MARK OR SCRIBE
2 - BALANCE SHAFT
3 - TIMING CHAIN OILING JET</p> |
|---|

12. Paint mark or scribe the balance shaft (2) position to the engine block (1) and timing chain.

13. Paint mark or scribe the timing chain to crankshaft gear and camshaft drive gear relation.

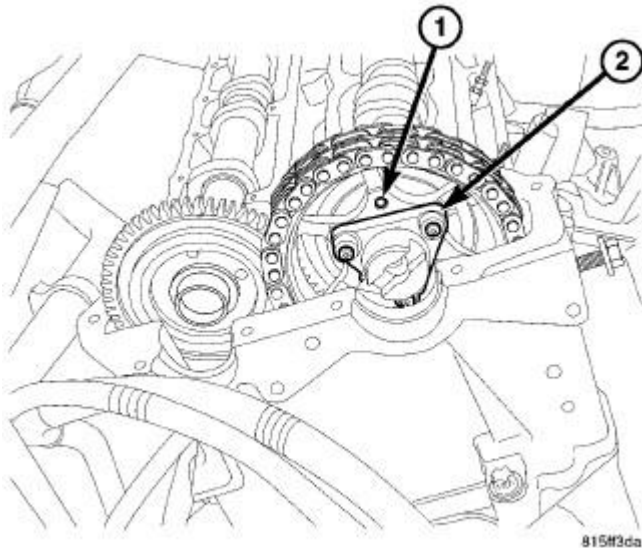


Fig. 311: RIGHT INTAKE CAMSHAFT DRIVE GEAR
Courtesy of CHRYSLER LLC

1 - RIGHT CAMSHAFT DRIVE GEAR ALIGNMENT DOWEL 2 - VACUUM PUMP DRIVE

14. Rotate the engine and remove the intake camshaft drive gear (1) lower bolt.

NOTE: **The intake camshaft drive gear (1) dowel pin should align at approximately the 12 O'clock position.**

15. Rotate the engine back to TDC and verify the alignment marks at the balance shaft, camshaft gear and crankshaft gear.

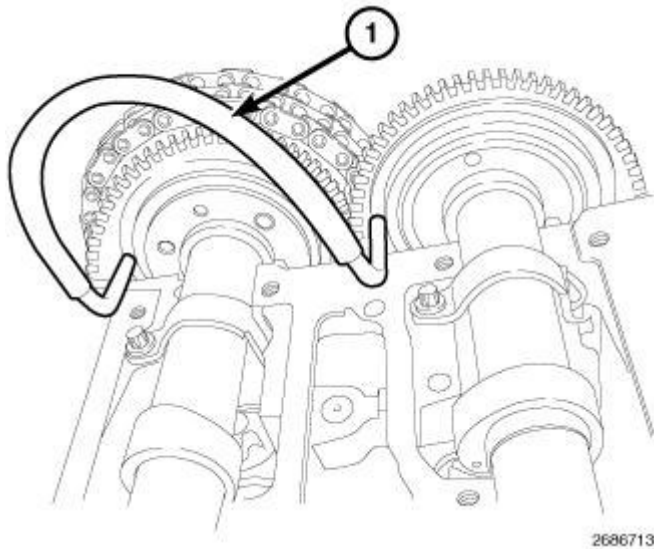


Fig. 312: CAMSHAFT LOCKING PINS 8929
Courtesy of CHRYSLER LLC

16. Using the camshaft Locking Pins 8929 (1), lock both left camshaft gears in place.

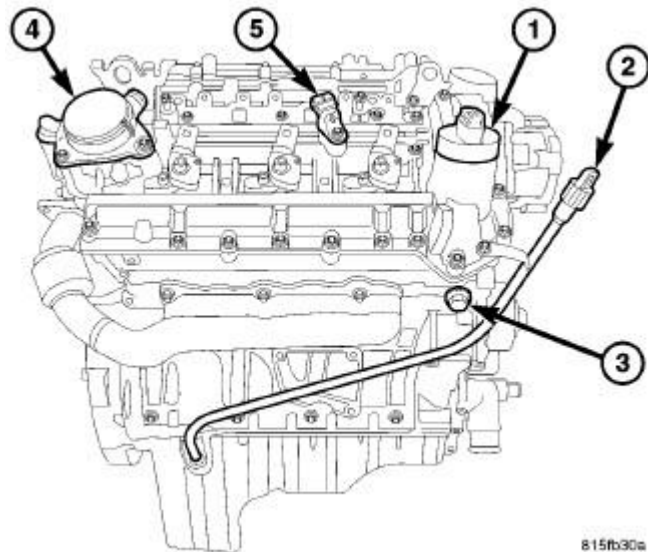


Fig. 313: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- | |
|------------------------------|
| 1 - ENGINE OIL CAP |
| 2 - OIL LEVEL INDICATOR |
| 3 - TIMING CHAIN TENSIONER |
| 4 - PCV ASSEMBLY |
| 5 - CAMSHAFT POSITION SENSOR |

17. Remove the timing chain tensioner (3).

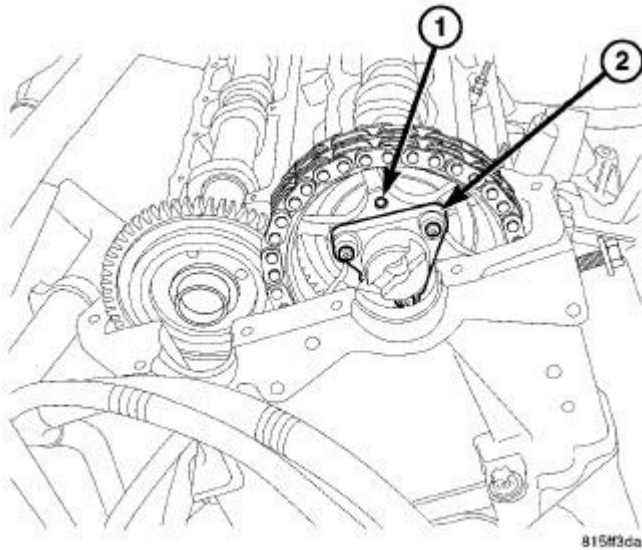


Fig. 314: RIGHT INTAKE CAMSHAFT DRIVE GEAR
Courtesy of CHRYSLER LLC

1 - RIGHT CAMSHAFT DRIVE GEAR ALIGNMENT DOWEL 2 - VACUUM PUMP DRIVE

18. Remove the intake camshaft drive gear (1) remaining 2 bolts (2).
19. Separate the intake camshaft drive gear (1) and chain from the camshaft.
20. Remove the intake camshaft drive gear.

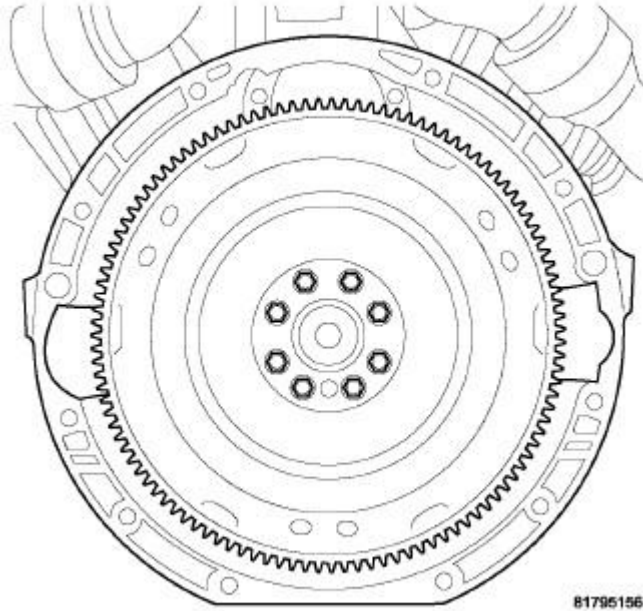


Fig. 315: FLEX PLATE
Courtesy of CHRYSLER LLC

21. Remove the flexplate. See **Removal** .

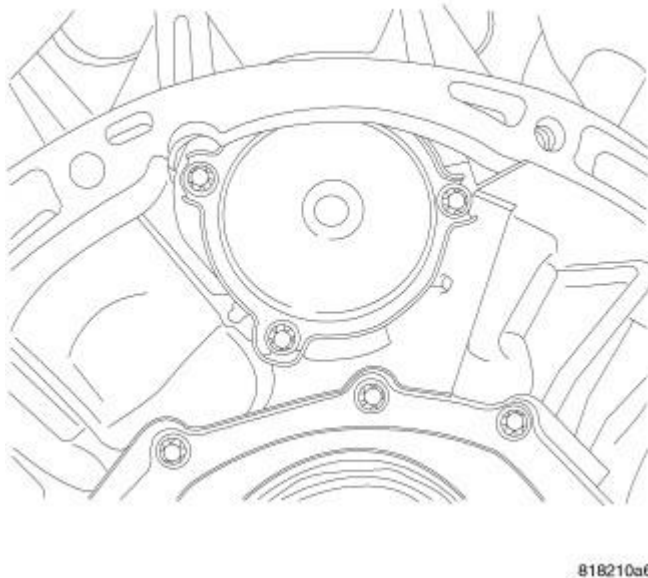
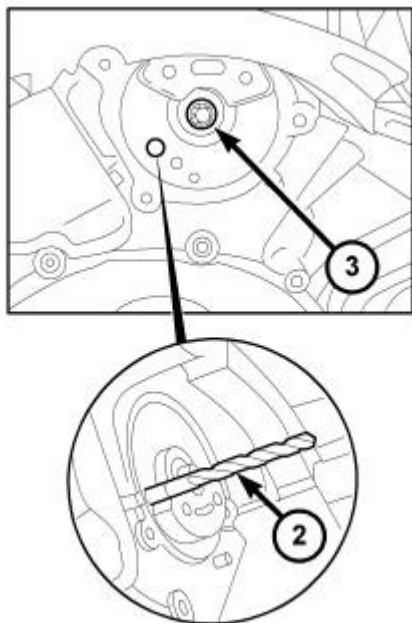


Fig. 316: BALANCE SHAFT REAR COVER
Courtesy of CHRYSLER LLC

NOTE: When servicing the balance shaft, the rear balance shaft cover must be

replaced.

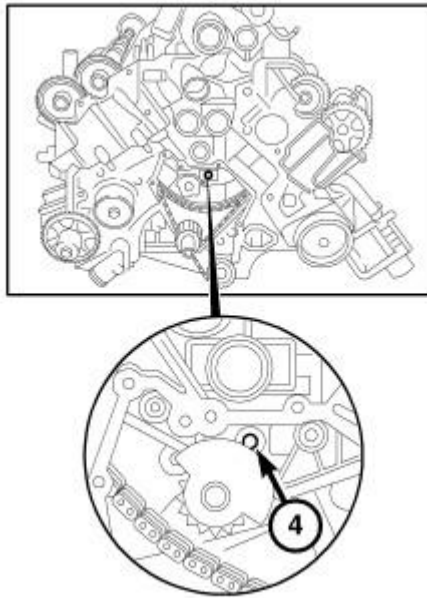
22. Remove the rear balance shaft cover retaining bolts, remove and discard the balance shaft cover.



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Fig. 317: BALANCE SHAFT ALIGNMENT REAR
Courtesy of CHRYSLER LLC

23. Install a 8.5 mm drift or an equivalent diameter drill bit (2) into the bore in crankcase.
24. Remove the balance shaft correctional weight retaining bolt (3) and weight.
25. Remove the 8.5 mm drift or equivalent diameter drill bit (2).



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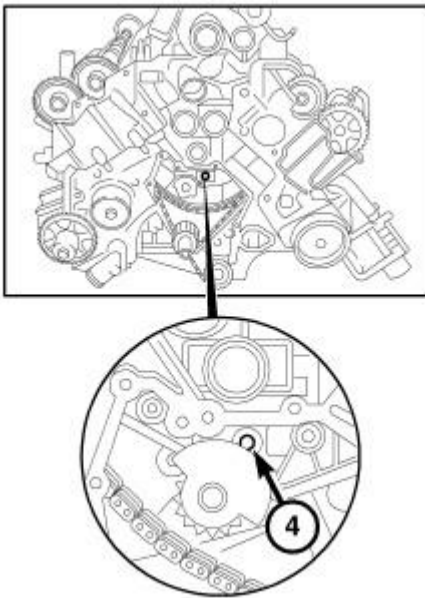
Fig. 318: BALANCE SHAFT ALIGNMENT FRONT

Courtesy of CHRYSLER LLC

26. Remove the balance shaft retaining bracket hold down bolt (4) and remove bracket.
27. Pull the balance shaft out through the front of the engine block and remove balance shaft.

Installation

INSTALLATION



8182089c

Fig. 319: BALANCE SHAFT ALIGNMENT FRONT

Courtesy of CHRYSLER LLC

1. Install the balance shaft.
2. Align the balance shaft so that the notch in the counterweight is facing directly up.

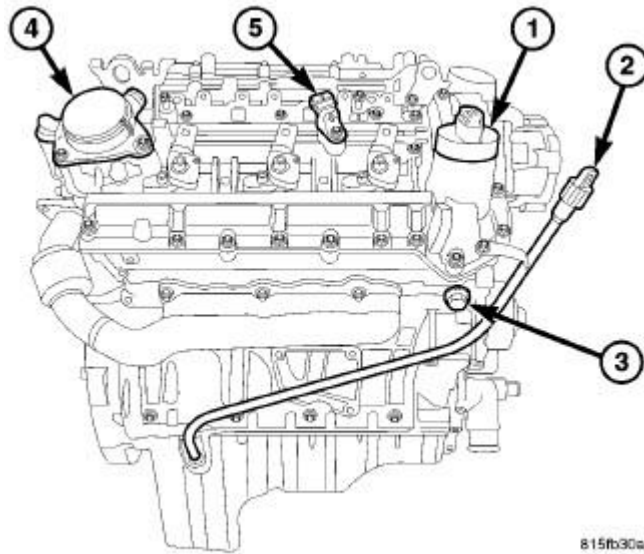
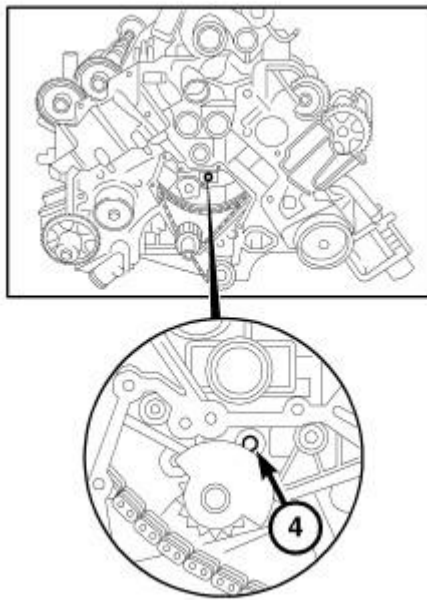


Fig. 320: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- | |
|------------------------------|
| 1 - ENGINE OIL CAP |
| 2 - OIL LEVEL INDICATOR |
| 3 - TIMING CHAIN TENSIONER |
| 4 - OIL SEPARATOR ASSEMBLY |
| 5 - CAMSHAFT POSITION SENSOR |

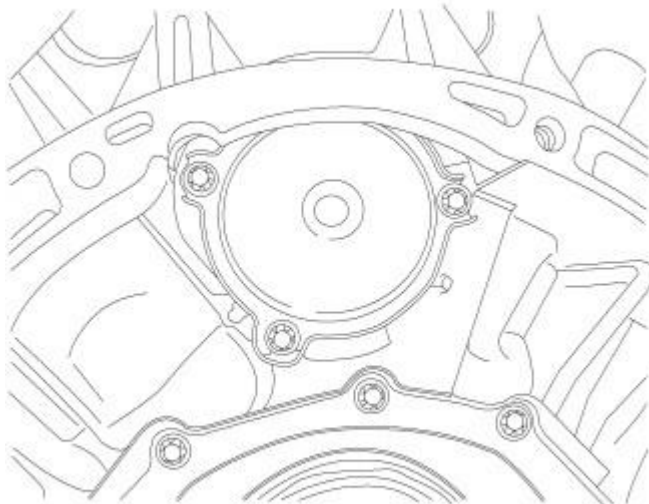
3. Install the timing chain tensioner. Tighten to 80 N.m (59 ft. lbs).
4. Be sure that the camshafts and crankshaft are all set to their correct timing positions.



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Fig. 321: BALANCE SHAFT ALIGNMENT FRONT
Courtesy of CHRYSLER LLC

5. Install the balance shaft bolt (4). Tighten bolt to 35 N.m (309 in. lbs.).



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Fig. 322: BALANCE SHAFT REAR COVER
Courtesy of CHRYSLER LLC

6. Install the bolt in the rear of the balance shaft 20 N.m (177 in. lbs) and then rotate an additional 90°.
7. Install the rear balance shaft cover. Tighten bolts to 8 N.m (71.8 in. lbs.).

8. Install the timing chain cover. See **Installation**.
9. Install the torque converter and transmission. Refer to **Transmission and Transfer Case/Automatic - NAG1 - Installation**.
10. Connect the battery. Refer to **Electrical/Battery System/CABLES, Battery - Installation**.

PUMP, VACUUM

Description

DESCRIPTION

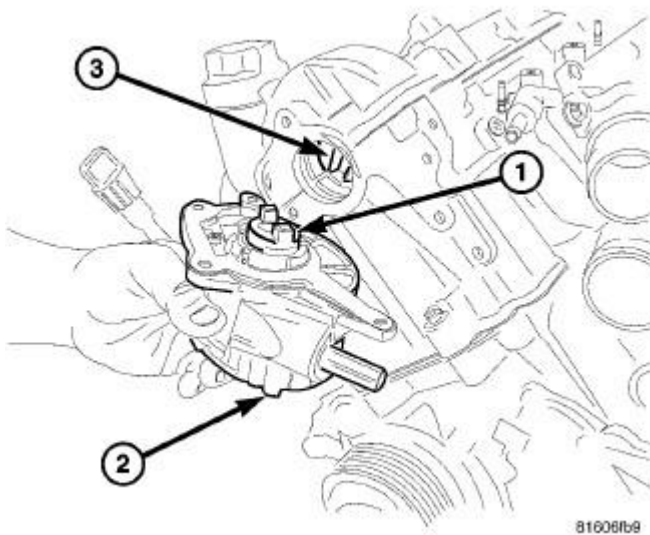


Fig. 323: VACUUM PUMP
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - VACUUM PUMP GEAR
2 - VACUUM PUMP
3 - RIGHT INTAKE CAMSHAFT DRIVE GEAR |
|---|

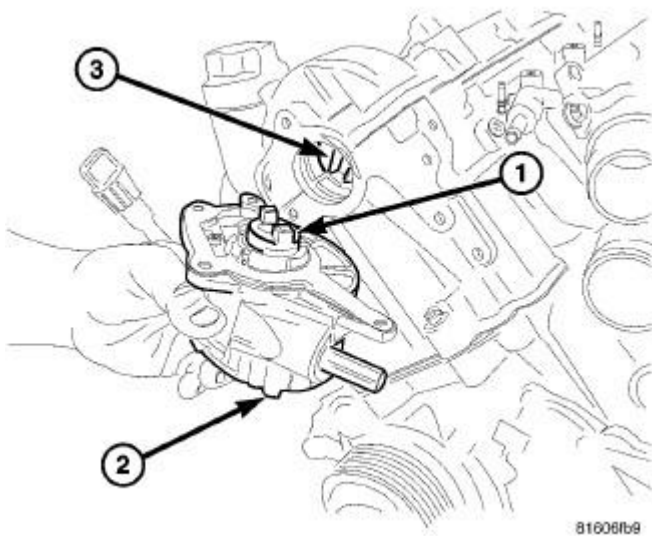
The vacuum pump is a constant displacement, vane-type pump. Vacuum is generated by vanes mounted in the pump rotor. The rotor is located in the pump housing and is pressed onto the pump shaft.

The vacuum pump operates by a slotted extension attached to the vacuum pump shaft. The vacuum pump shaft slotted extension fits into, and is driven by, the exhaust camshaft gear.

The vacuum pump rotating components are internally lubricated and the vacuum pump has no serviceable parts. Do not disassemble or attempt to repair the pump.

Operation

OPERATION

**Fig. 324: VACUUM PUMP**

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - VACUUM PUMP GEAR
2 - VACUUM PUMP
3 - RIGHT INTAKE CAMSHAFT DRIVE GEAR |
|---|

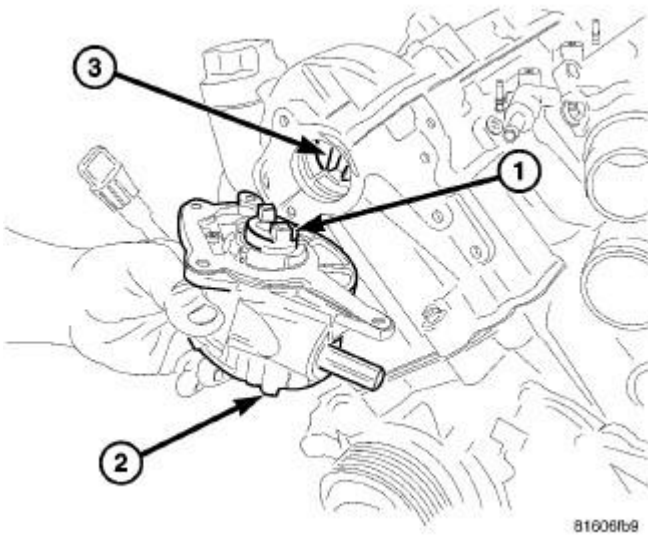
Vacuum pump output is transmitted to the Heater, Electronic, Vacuum, Air Conditioner (HEVAC) and brake vacuum booster, systems through a supply hose. The hose is connected to an outlet port on the pump housing and uses an in-line check valve to retain system vacuum when vehicle is not running.

Pump output ranges from a minimum of 8.5 to 25 inches vacuum.

The pump rotor and vanes are rotated by the slotted pump drive gear which fits into the camshaft drive gear.

Removal

REMOVAL

**Fig. 325: VACUUM PUMP**

Courtesy of CHRYSLER LLC

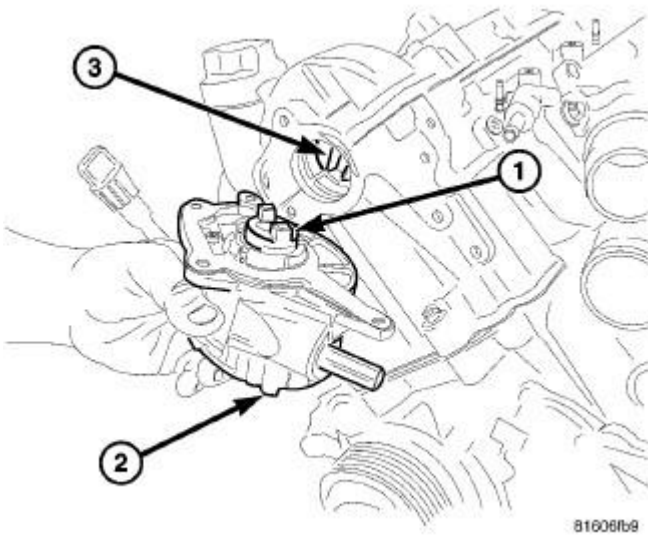
- | |
|---|
| 1 - VACUUM PUMP GEAR
2 - VACUUM PUMP
3 - RIGHT INTAKE CAMSHAFT DRIVE GEAR |
|---|

1. Disconnect negative battery cable.
2. Remove vacuum line at vacuum pump.

NOTE: **Observe position of driver on rear of pump.**

3. Remove vacuum pump and seals.
4. Clean all sealing surfaces.

Installation**INSTALLATION**

**Fig. 326: VACUUM PUMP**

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - VACUUM PUMP GEAR
2 - VACUUM PUMP
3 - RIGHT INTAKE CAMSHAFT DRIVE GEAR |
|---|

1. Clean all sealing surfaces.
2. Position driver on rear of pump and install vacuum pump with new seals. Tighten bolts to 14 N.m (124 in. lbs.).
3. Install vacuum line to vacuum pump.
4. Connect negative battery cable.

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 fan. Do not wear loose clothes.

5. Start the engine and inspect for leaks.

ROD, PISTON AND CONNECTING

Description

DESCRIPTION

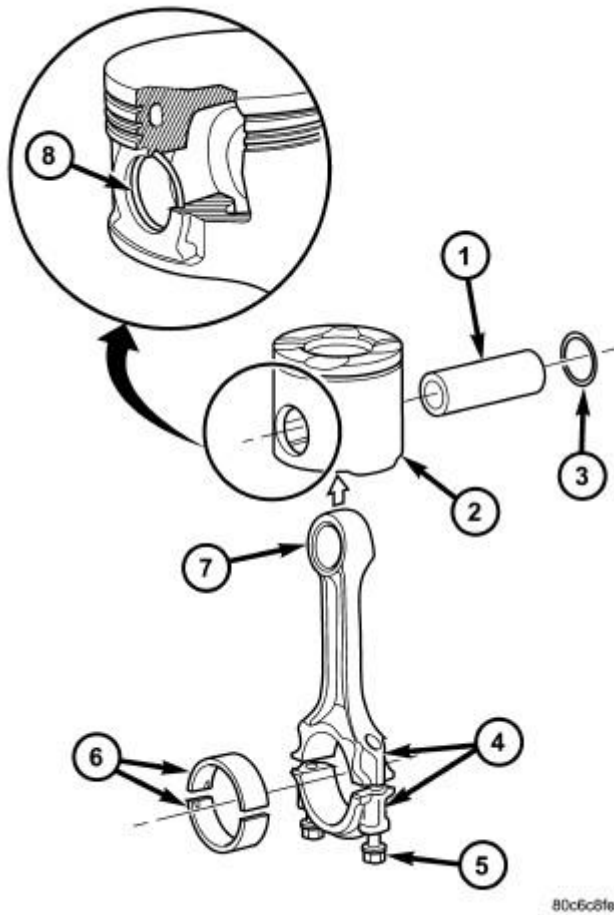


Fig. 327: PISTON AND CONNECTING ROD ASSEMBLY
Courtesy of CHRYSLER LLC

- 1 - PISTON PIN
- 2 - PISTON
- 3 - SNAP RING
- 4 - PAINTED CONNECTING ROD ALIGNMENT NUMBERS
- 5 - CONNECTING ROD BOLT
- 6 - CONNECTING ROD BEARING
- 7 - CONNECTING ROD
- 8 - SNAP RING

CAUTION: If the connecting rod bolts are ever loosened, replace all of the connecting rods.

The pistons are made of a high strength aluminum alloy and have an oval shape to reduce friction and noise. The piston crown consists of a combustion bowl and four recesses machined for the valves. Circlips secure a full floating piston pin. The piston pin is offset 0.4 mm (0.016 in) toward the piston's major thrust surface to

reduce slap. The pistons have a phosphated surface treatment and the piston skirts have a graphite treatment for scuff resistance. The piston skirts have notches to provide the necessary clearance for the oil jets when the pistons are at BDC.

Standard Procedure

PISTON RING FITTING

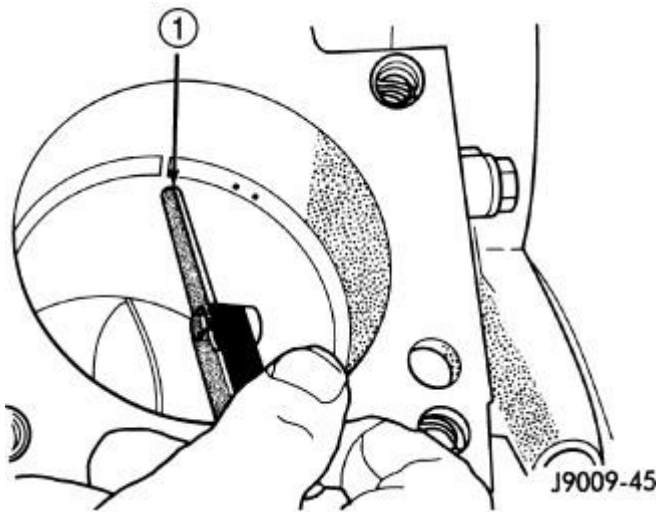
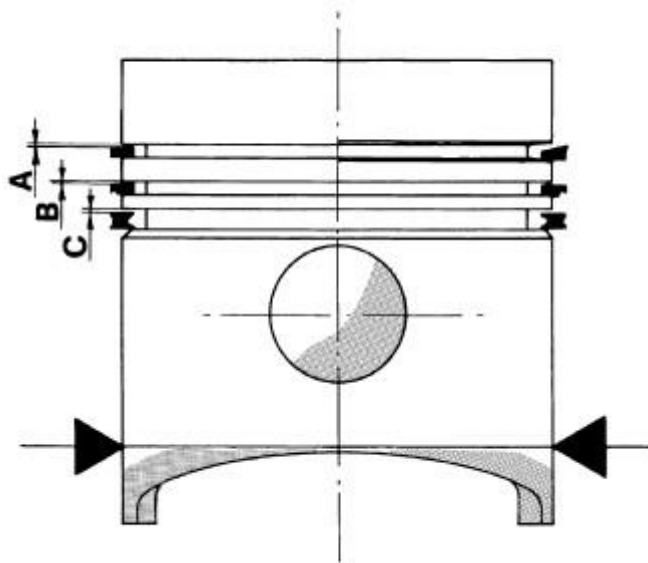


Fig. 328: RING END GAP MEASUREMENT
Courtesy of CHRYSLER LLC

1 - FEELER GAUGE

1. Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 12 mm (0.50 in.) from bottom of cylinder bore. Check gap with feeler gauge (1). Top compression ring gap .40 to .55 mm (.015 in. to .0217 in.). Second compression ring gap .25 mm to .50 mm (.0099 to .0197 in.). Oil control ring gap .20 to .40 mm (.0079 to .0158 in.).
2. If ring gaps exceed dimension given, new rings, piston and cylinder boring may be necessary. Keep piston rings in piston sets.



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Fig. 329: PISTON RING TO GROOVE CLEARANCE

Courtesy of CHRYSLER LLC

3. Check piston ring to groove clearance. Top compression ring gap 0.12 to 0.16 mm (.0048 to .0063 in.) (A). Second compression ring gap 0.065 to 0.110 mm (.0026 to .0044 in.) (B). Oil control ring gap 0.03 to 0.07 mm (.0012 to .0028 in.) (C).

Removal**REMOVAL**

WARNING: The connecting rods are not serviceable, and must be replaced every time the end caps bolts are loosened or removed. Otherwise, the precision fit is no longer achieved. All six must have the same weight and the same number. Replacement connecting rods will only be supplied in sets of six. When assembling the connecting rod, be sure to paint mark or scribe mark each of the connecting rods and caps before installation, for alignment purposes later.

1. Disconnect the negative battery cable.

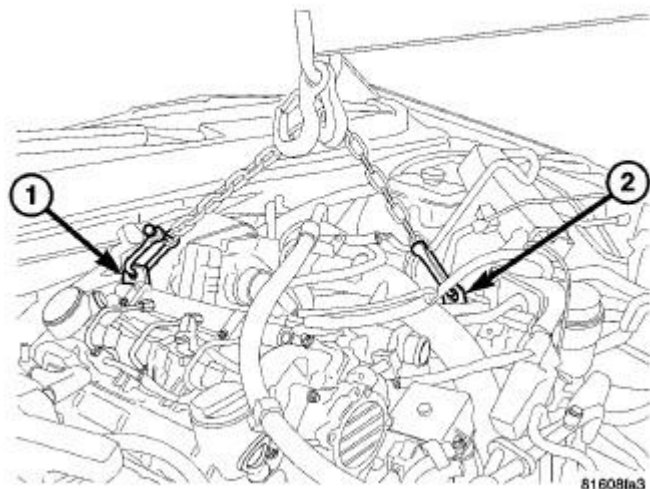


Fig. 330: ENGINE LIFTING POINTS
Courtesy of CHRYSLER LLC

2. Remove the engine from the vehicle. See **Removal** .
3. Remove the flexplate. See **Removal** .
4. Remove both cylinder heads. See **Removal** .

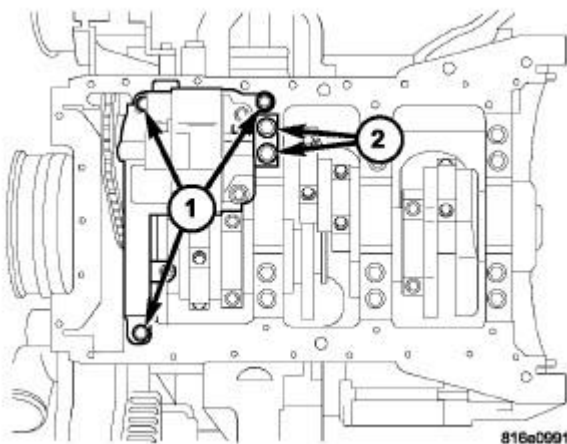


Fig. 331: OIL PUMP
Courtesy of CHRYSLER LLC

5. Remove the oil pump and pickup tube. See **Removal** .

CAUTION: To prevent damage to the oil jets, remove the oil jets before removing the pistons.

CAUTION: Use caution when removing and installing oil jets. Damage to oil jet nozzle could cause severe engine damage. Care must be taken not to damage the crankshaft tone ring when removing cylinder number four oil jet.

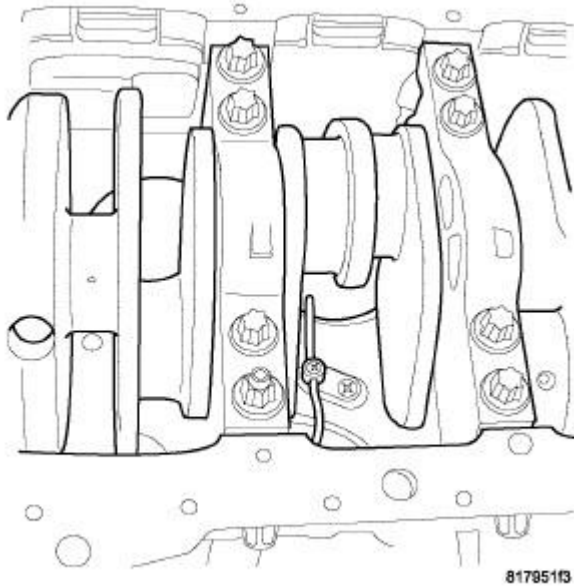


Fig. 332: Oil Jet

Courtesy of CHRYSLER LLC

6. Remove the appropriate oil jet retaining bolt and remove oil jet from the engine block.

NOTE: The piston and connecting rod assembly must be removed through the top of cylinder block.

7. Remove the ridge from the top of the cylinder bores with a ridge reamer before removing pistons from cylinder block. **Be sure to keep the top of pistons covered during this operation.**
8. Rotate the crankshaft so the connecting rod is centered in the cylinder bore.
9. Remove the connecting rod cap bolts and remove the fracture-split rod cap.

NOTE: Use care not to nick or scratch the crankshaft journal or cylinder bore during removal.

10. Carefully remove the piston and connecting rod assembly out through the top of the cylinder block.
11. Mark the pistons with the matching cylinder number after removal.
12. Repeat this procedure for the remaining pistons and connecting rod assemblies.

PISTON PIN - REMOVAL

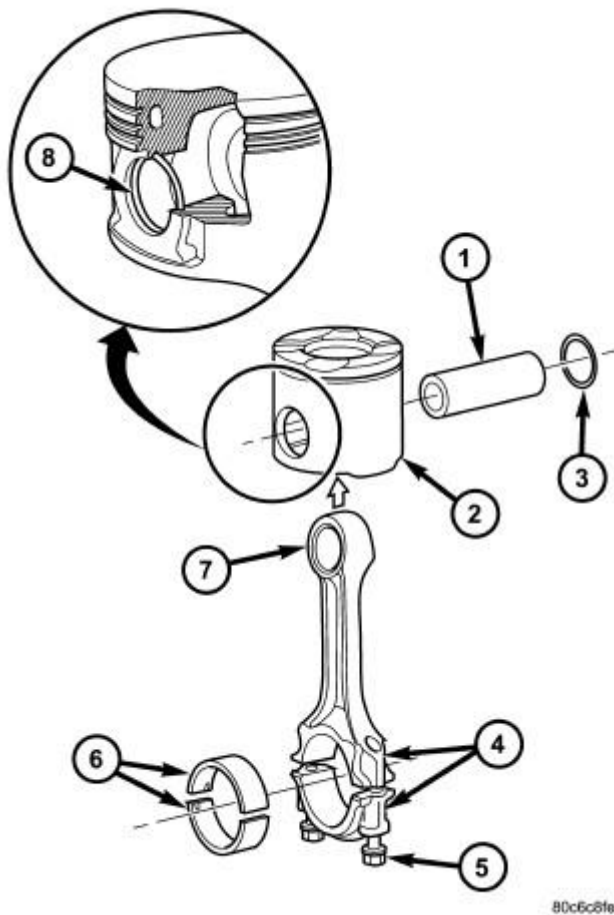


Fig. 333: PISTON AND CONNECTING ROD ASSEMBLY
Courtesy of CHRYSLER LLC

1. Secure the connecting rod (7) in a soft jawed vice.
2. Remove the 2 snap rings (3) securing the piston pin.
3. Push the piston pin (1) out of the piston (2) and the connecting rod.
4. Remove the piston from the connecting rod.
5. Measure the diameter of the piston pin in the center and on both ends. See **Specifications** .
6. Repeat this procedure for the remaining pistons and connecting rod assemblies.

PISTON RING - REMOVAL

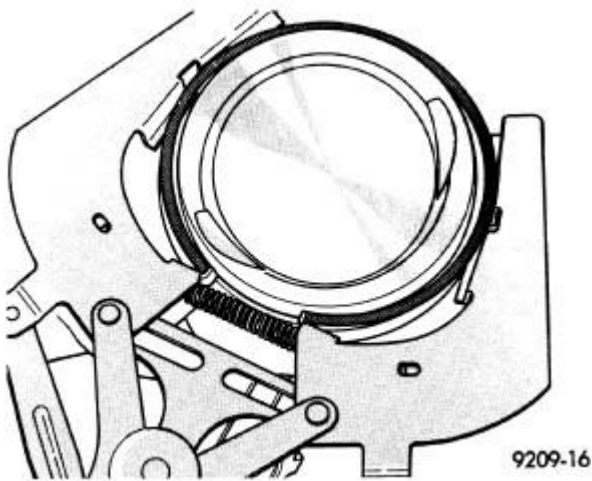


Fig. 334: PISTON RINGS - REMOVAL/INSTALLATION
Courtesy of CHRYSLER LLC

1. The ID mark on the face of the top and second piston rings must point toward the piston crown.
2. Using a suitable ring expander, remove the top and second piston rings.
3. Remove the upper oil ring side rail, lower oil ring side rail and then the oil expander from the piston.
4. Carefully clean carbon from the piston crowns, skirts and ring grooves ensuring the 4 oil holes in the oil control ring groove are clear.
5. Repeat this procedure for the remaining pistons and connecting rod assemblies.

Inspection

INSPECTION

PISTONS

1. Check piston pin bores in piston for roundness. Make 3 checks at 120° intervals. Maximum out of roundness .020 mm (.0008 in.).
2. The piston diameter should be measured approximately 10 mm (.394 in.) up from the base.
3. Skirt wear should not exceed 0.1 mm (.00039 in.).
4. The clearance between the cylinder liner and piston should not exceed 0.010-0.022 mm (.0003 -.0008 in.).

PISTON PINS

1. Measure the diameter of piston pin in the center and both ends. Refer to the engine specification chart. See **Specifications** .

CONNECTING RODS

CAUTION: Connecting rods must be replaced once the end caps are loosened. All six must have the same weight and the same number. Replacement

connecting rods will only be supplied in sets of six. When assembling the connecting rod, be sure to paint mark or scribe mark each of the connecting rods and caps before installation, for alignment purposes later.

NOTE: Do Not lubricate the new connecting rod bolts. They are already coated with a anti scuff treatment.

Connecting rods are supplied in sets of six since they all must be of the same weight category. Max allowable weight difference is 5 gr.

1. Assemble bearing shells and bearing caps to their respective connecting rods ensuring that the serrations on the cap and reference marks are aligned.
2. Tighten connecting cap bolts to 20 N.m (15 ft. lbs.).
3. Without loosening connecting rod bolts, tighten all bolts to 40 N.m (30 ft. lbs.).
4. Using a torque angle gauge, tighten each bolt an additional 90°.

SEAL, CRANKSHAFT OIL, FRONT

Removal

REMOVAL

1. Disconnect negative battery cable.
2. Remove the air cleaner assembly. See **Removal**.
3. Drain the cooling system. Refer to **Cooling - Standard Procedure**.
4. Remove the lower radiator hose.
5. Remove the serpentine belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal**.

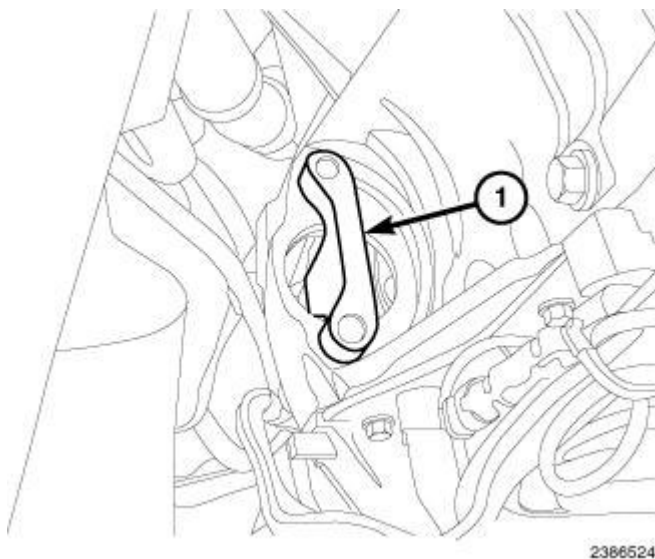


Fig. 335: FLYWHEEL LOCKING TOOL
Courtesy of CHRYSLER LLC

6. Remove the starter blank.
7. Install the Flywheel Locking Tool (1) 9102.

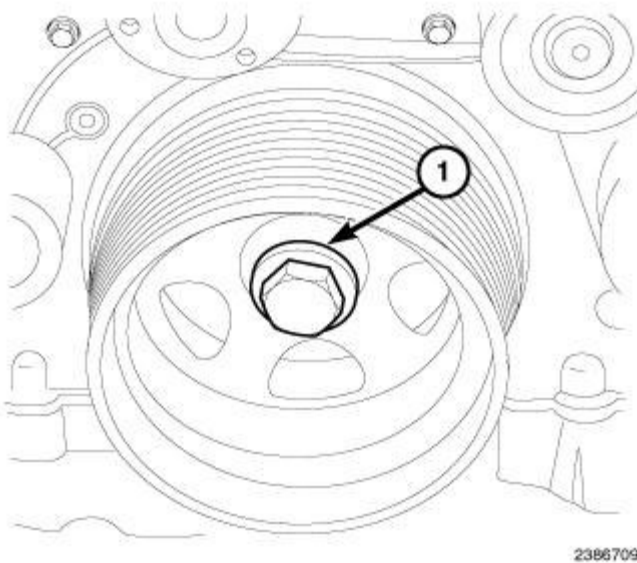


Fig. 336: VIBRATION DAMPER BOLT
Courtesy of CHRYSLER LLC

8. Remove the vibration damper bolt (1).

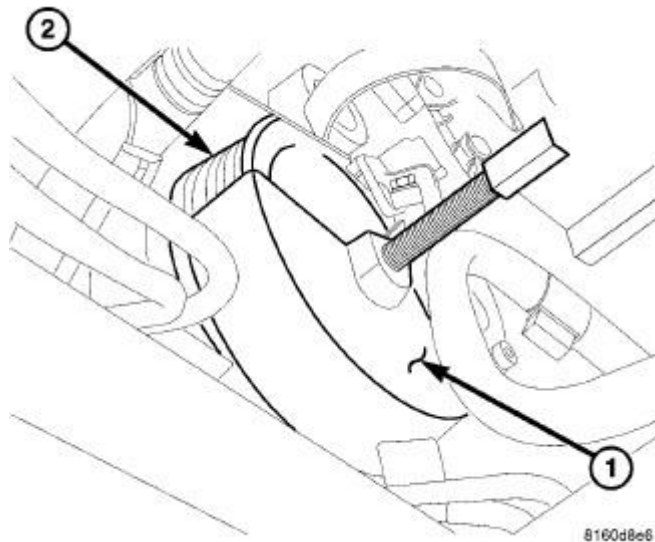


Fig. 337: SPECIAL TOOL #9544 VIBRATION DAMPER PULLER
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL #9544

2 - VIBRATION DAMPER

9. Using Vibration Damper Puller (1) 9544, remove the vibration damper (2).

CAUTION: Care must be taken when removing the crankshaft seal. **DO NOT** damage or gouge the timing chain cover.

10. Using suitable seal puller, remove the front crankshaft seal.

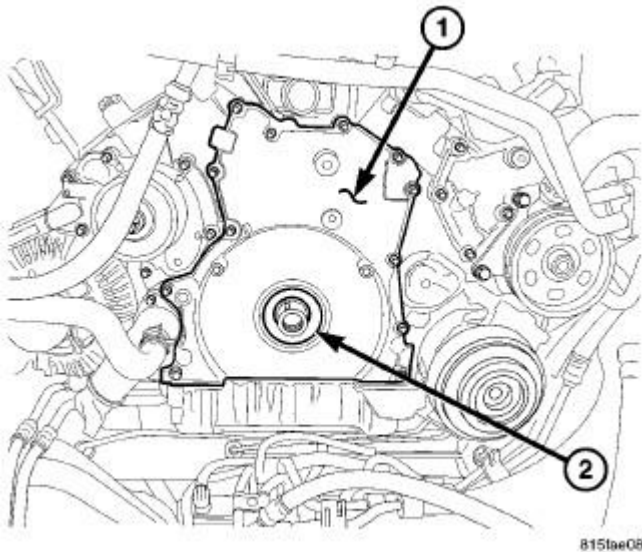
Installation**INSTALLATION**

Fig. 338: FRONT TIMING COVER

Courtesy of CHRYSLER LLC

1 - TIMING CHAIN COVER

2 - FRONT CRANKSHAFT SEAL

NOTE: To prevent potential oil leaks, **DO NOT** touch the front crankshaft inner seal. Always handle the seal from the outer diameter.

1. Clean timing chain cover (1) seal surface.

NOTE: Keep seal centered in the timing chain cover at all times.

2. Using Seal Installer 8936A, install crankshaft oil seal (2).

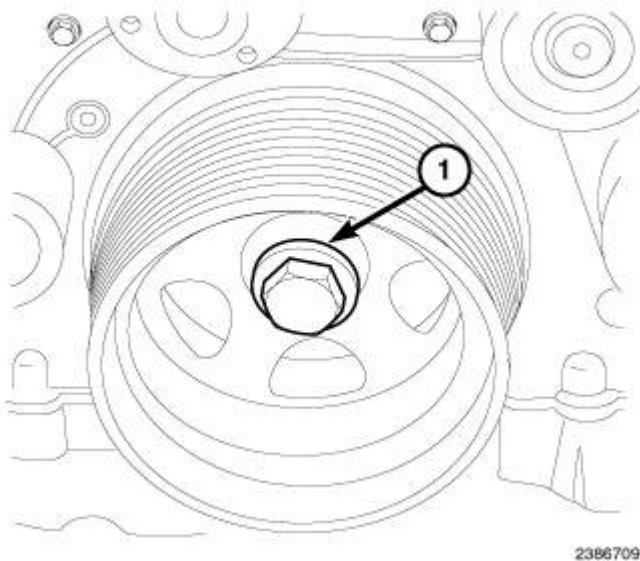


Fig. 339: VIBRATION DAMPER BOLT
Courtesy of CHRYSLER LLC

CAUTION: Care must be taken when installing the damper. **DO NOT** damage or gouge the front crankshaft seal

3. Align the alignment key in the crankshaft with the key way in the damper and install the vibration damper.
4. Install the vibration damper bolt (1). Tighten bolt (1) to 210 N.m, plus 180° (154 ft. lbs., plus 90°).

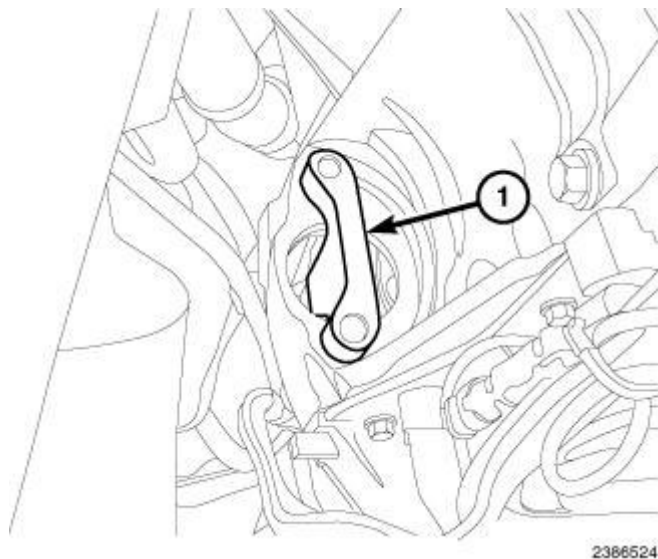


Fig. 340: FLYWHEEL LOCKING TOOL
Courtesy of CHRYSLER LLC

5. Remove Flywheel Locking Tool 9102.

6. Install the starter blank.
7. Install the serpentine belt. Refer to Cooling/Accessory Drive/BELT, Serpentine - Installation .
8. Install the lower radiator hose.
9. Fill the cooling system. Refer to Cooling - Standard Procedure .
10. Install the air cleaner assembly. See Installation.
11. Connect negative battery cable.

SEAL, CRANKSHAFT OIL, REAR

Description

DESCRIPTION

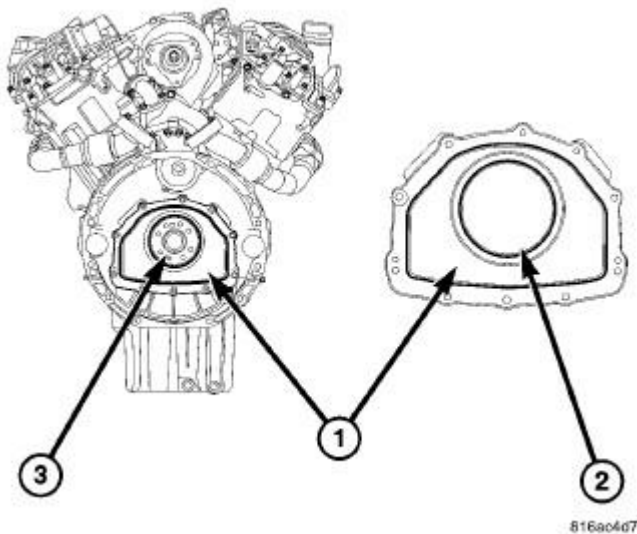


Fig. 341: REAR MAIN SEAL CARRIER

Courtesy of CHRYSLER LLC

WARNING: NOTE: When servicing the oil pan, the transmission and flex plate must be removed to access the rear main seal carrier fasteners.

The rear main seal carrier (1) is located behind the flex plate. The rear main seal carrier is bolted to the cylinder block and oil pan. The rear main seal carrier (2) is molded to the carrier and is not serviceable. The rear main seal carrier must be replaced if an oil leak or seepage occurs.

Removal

REMOVAL

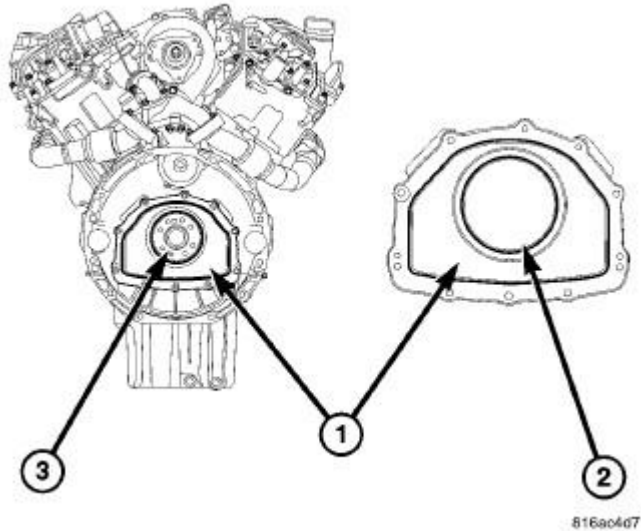


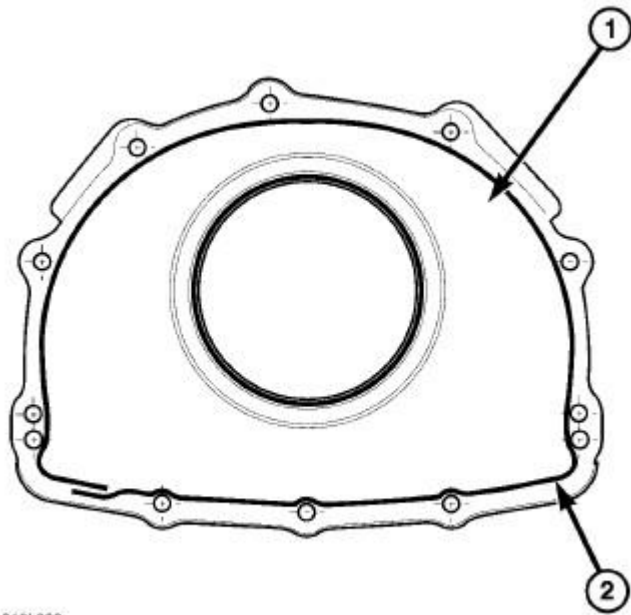
Fig. 342: REAR MAIN SEAL CARRIER

Courtesy of CHRYSLER LLC

1. Remove the transmission. Refer to **Transmission and Transfer Case/Automatic - NAG1 - Removal** .
2. Remove the bolts holding the flex plate to the crankshaft (3).
3. Remove the flex plate.
4. Remove the bolts holding the rear main seal carrier (1) to the engine block and oil pan.
5. Remove the rear main seal carrier (1) from the engine block and oil pan.
6. Clean sealant residue from the engine block and oil pan.

Installation

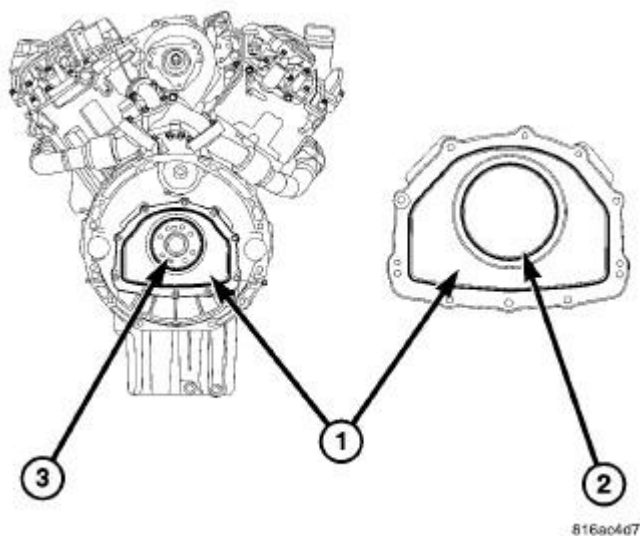
INSTALLATION



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Fig. 343: Sealant Application Pattern
Courtesy of CHRYSLER LLC

1. Apply sealant 1.5 mm (.059 in) wide, MOPAR Engine Sealant/RTV Silicone Rubber Adhesive (2) to the rear main seal carrier (1). Install the rear oil seal cover within 10 minutes after applying sealing compound. Do not spread the sealing bead. Only use the approved sealing compound in the Service Information. Clean sealing surfaces and apply sealing compound to the marked line with a bead thickness of 1.5 ± 0.5 mm (0.059 ± 0.020 in.).



816a0407

Fig. 344: REAR MAIN SEAL CARRIER
Courtesy of CHRYSLER LLC

2. Install the rear main seal carrier (1) to the engine block and oil pan.
3. Install the bolts holding the rear main seal carrier (1) to the engine block and oil pan. Torque the bolts to 8 N.m (70 in. lbs.) and then to 10 N.m (88 in. lbs.).
4. Install the flex plate. See **Installation**.
5. Install the transmission. Refer to **Transmission and Transfer Case/Automatic - NAG1 - Installation**.

ENGINE MOUNTING

INSULATOR, ENGINE MOUNT, LEFT

Removal

REMOVAL

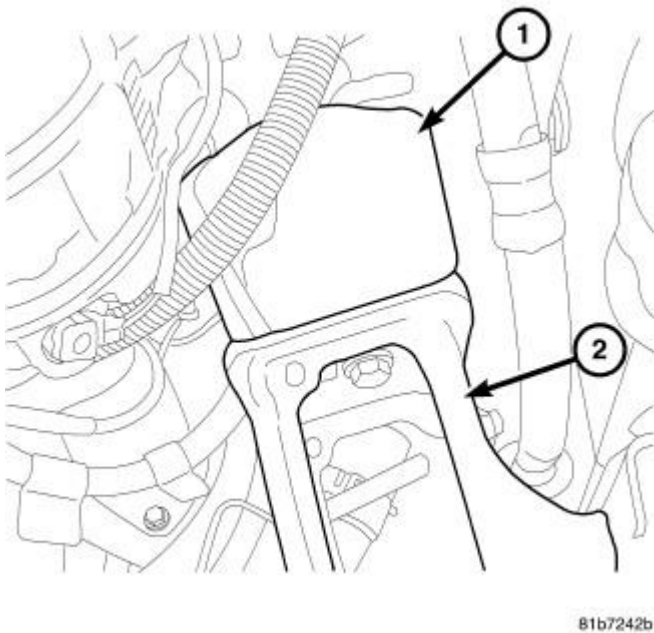


Fig. 345: MOTOR MOUNT LEFT
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable. Refer to **Electrical - Engine Systems/Battery System/CABLES, Battery - Removal**.
2. Remove the engine cover. See **Removal**.
3. Remove the engine cover brackets and transmission tube retainer.
4. Remove the battery and battery tray.
5. Remove power distribution center (PDC) from bracket and set aside.
6. Remove PDC bracket.
7. Reposition the engine wiring harness.
8. Raise and support the vehicle.

9. Loosen both right and left engine mount through bolts.
10. Lower the vehicle.
11. Install clevis brackets through engine lifting fixtures.
12. Install engine lifting chain to clevis brackets.
13. Install engine lift and hoist engine.
14. Remove the left engine mount retaining bolts
15. Remove the engine mount.

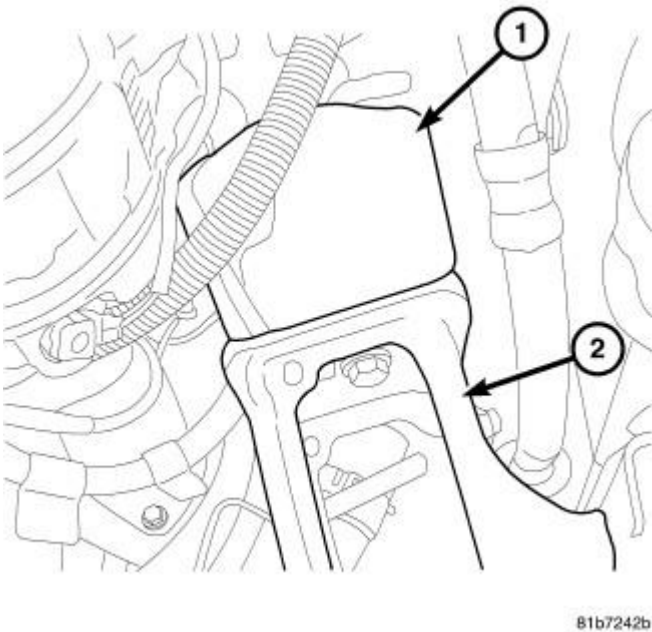
Installation**INSTALLATION**

Fig. 346: MOTOR MOUNT LEFT
Courtesy of CHRYSLER LLC

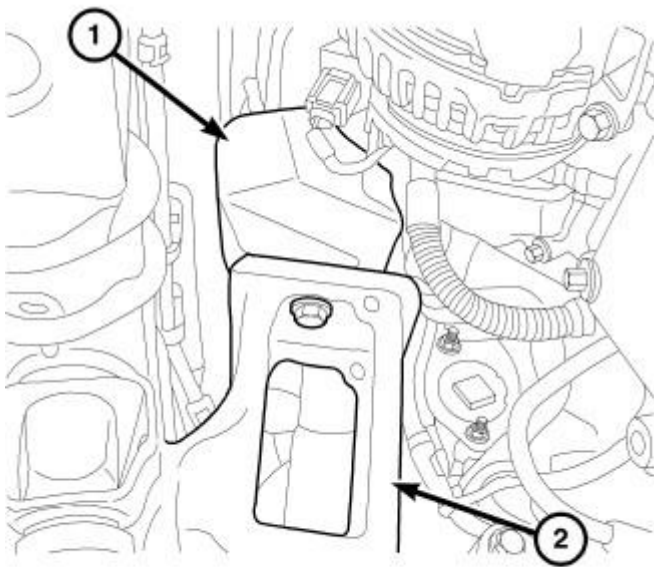
1. Position and install the engine mount to engine bolts. Tighten bolts to 45 N.m (33 lbs. ft.).
2. Lower the engine and remove the engine hoist with chain.
3. Raise and support the vehicle.
4. Install the engine mount through bolts. Tighten bolts to 110 N.m (82 lbs. ft.).
5. Install the splash shield.
6. Lower the vehicle.
7. Install the power distribution center (PDC) bracket and PDC.
8. Install the battery tray and battery.
9. Install the engine cover bracket and secure the transmission tube.
10. Install the engine cover front bracket.

11. Install the engine cover.
12. Install the front structural bracket.
13. Install the coolant recovery container.
14. Connect the negative battery cable.

INSULATOR, ENGINE MOUNT, RIGHT

Removal

REMOVAL



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Fig. 347: MOTOR MOUNT LOWER RIGHT
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the engine cover.
3. Remove the front engine cover bracket.
4. Separate the transmission level indicator tube from bracket and remove the rear engine cover bracket.
5. Install clevis bracket to engine lift brackets.
6. Install engine lifting chain through clevis brackets.
7. Raise and support the vehicle.
8. Remove the skid plate.
9. Drain engine oil.
10. Loosen both engine mount through bolts.
11. Lower the vehicle.

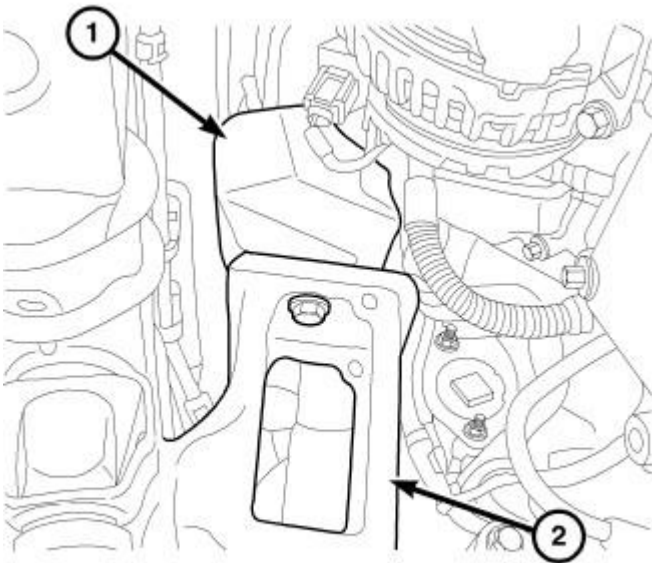
12. Remove the oil level indicator tube.

NOTE: Care must be taken not to crush the turbocharger against the windshield cowl when raising and supporting the engine.

13. Connect an engine lift and support the engine.
14. Remove the engine mount retaining bolts.
15. Remove the engine mount.

Installation

INSTALLATION



81b7242f

Fig. 348: MOTOR MOUNT LOWER RIGHT
Courtesy of CHRYSLER LLC

1. Position and install the engine mount to engine bolts. Tighten bolts to 45 N.m (33 lbs. ft.).
2. Lower the engine and remove the lifting fixtures.
3. Install the oil level indicator tube.
4. Raise and support the vehicle.
5. Tighten the engine mount through bolts to 110 N.m (81 ft. lbs.).
6. Install the skid plate.
7. Lower the vehicle.
8. Install the rear engine cover bracket and secure the transmission level indicator tube.
9. Install the front engine cover bracket.
10. Fill the engine with the correct viscosity oil to the proper level.

11. Connect the negative battery cable.
12. Install the engine cover.

LUBRICATION

DESCRIPTION

DESCRIPTION

An efficient and acoustically optimized chain drive external gear pump is used for supply.

Oil is circulated through a high volume primary oil filter on the engine to one of the oil/water coolers in the "V" of the engine. The oil cooler maintains a maximum oil temperature of 140° C (284°F).

After the oil cooler, the oil is directed into the balance shaft tunnel that at the same time is the primary oil duct of the crankcase. Short passages lead to the crankshaft main bearings. The inlet pressurized piston oil injectors are located directly on the main oil channel and are supplied there.

Front mounted passages supply the cylinder heads. The hydraulically loaded chain tensioner is supplied via the right cylinder head in the direction of travel.

The oil supply and return of the turbo charger is integrated in the cast steel turbo charger carrier.

WARNING: Any time the oil is drained and filled it is critical to wait 15 minutes before starting the engine.

WARNING: Before checking the engine oil level turn the engine off and wait 15 minutes for the oil to return to the oil pan.

COOLER, OIL

Description

DESCRIPTION

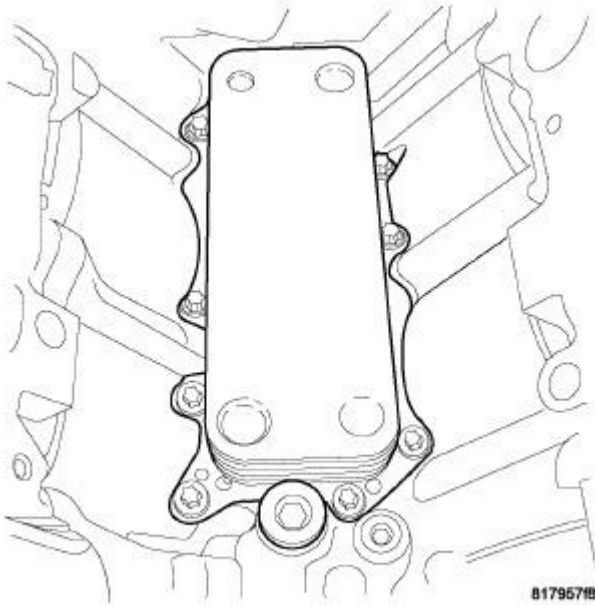


Fig. 349: HEAT EXCHANGER
Courtesy of CHRYSLER LLC

Engine coolant is used to cool the oil. A plate-style external heat exchanger is located in the valley of the cylinder block, below the EGR cooler. Two gaskets seal the oil cooler to the cylinder block. Replace the gaskets whenever the oil cooler is removed or replaced. The oil is fed to the oil cooler through the oil filter. With a maximum cooling power of 15 kW (51,200 BTU), the oil cooler ensures the maximum oil temperature does not exceed 135°C (275°F). After the oil cooler, the oil is fed to the balance shaft tunnel, which is simultaneously the main oil gallery of the cylinder block.

Removal

REMOVAL

1. Disconnect the negative battery cable.
2. Drain the cooling system.

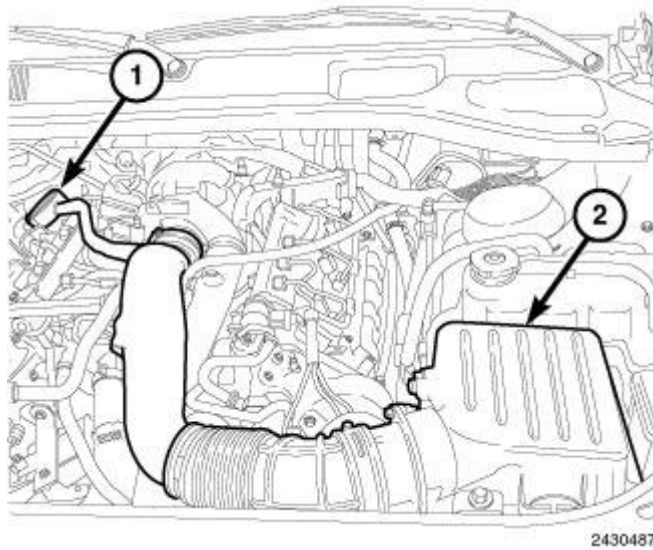


Fig. 350: AIR CLEANER ASSEMBLY
Courtesy of CHRYSLER LLC

3. Remove the air cleaner assembly (2). See **Removal** .
4. Remove the coolant reservoir and hoses.

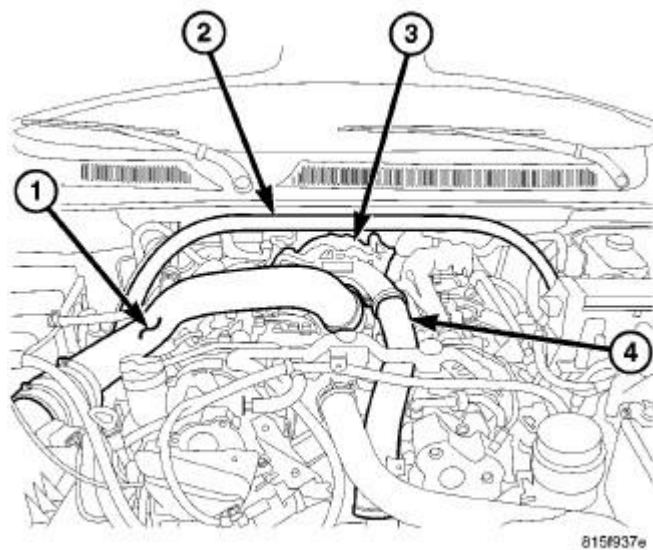


Fig. 351: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

5. Remove the charge air cooler hose between turbocharger and cooler (4).
6. Remove the turbocharger (3). See **Removal** .

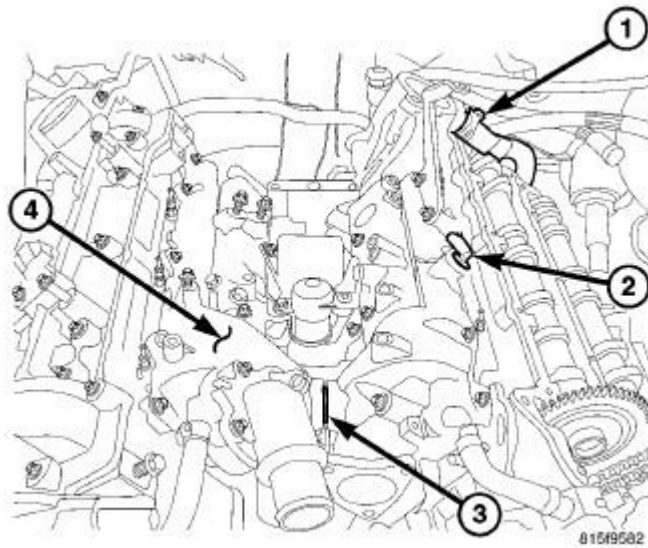


Fig. 352: INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

7. Remove the intake manifold (4). See **Removal**.

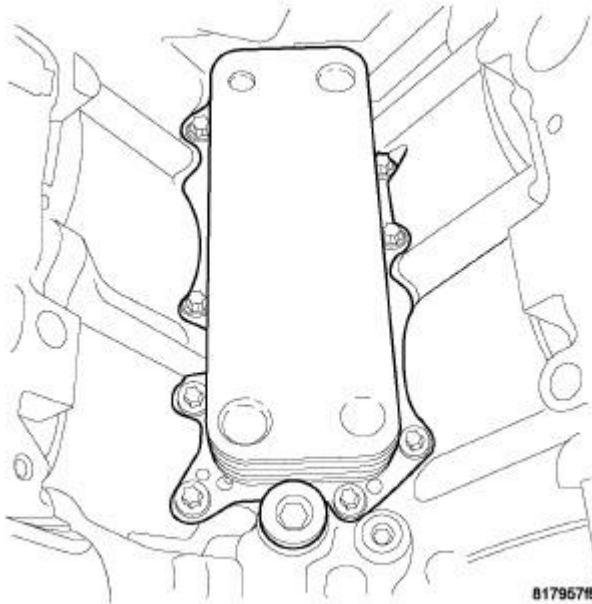


Fig. 353: HEAT EXCHANGER
Courtesy of CHRYSLER LLC

8. Remove the engine oil cooler.

Installation

INSTALLATION

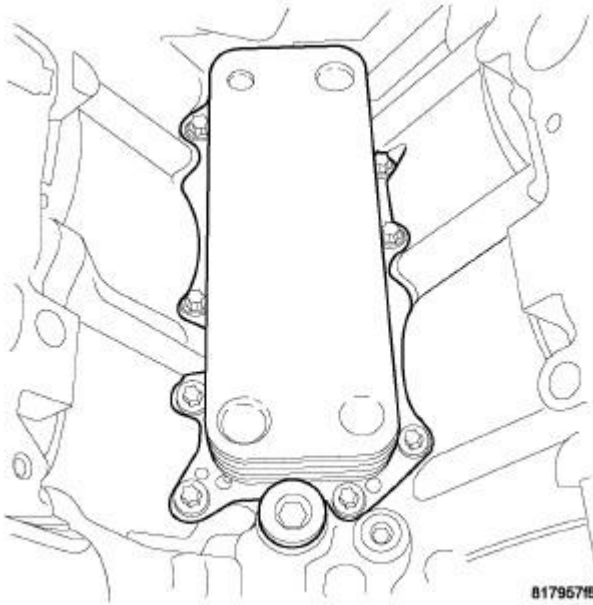


Fig. 354: HEAT EXCHANGER
Courtesy of CHRYSLER LLC

1. Clean all engine mating surfaces.
2. Position the oil cooler and gasket. Install the fasteners and tighten to 10.8 N.m (96 in. lbs.).

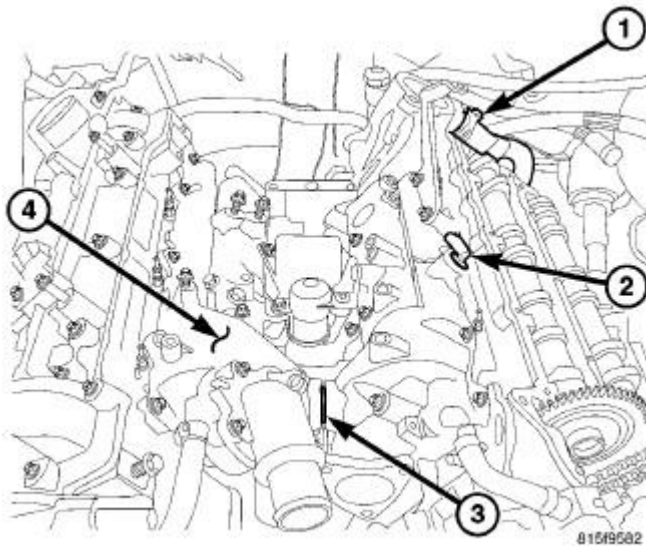


Fig. 355: INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

3. Install the intake manifold (4). See **Installation** .

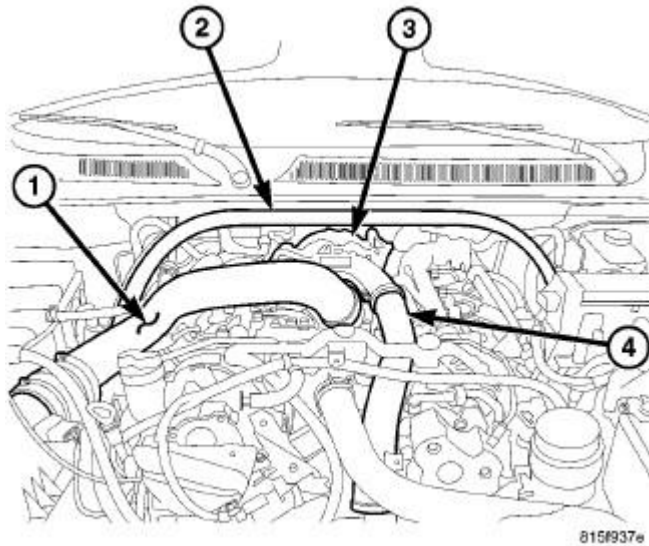


Fig. 356: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

4. Install the turbocharger (3). See **Installation** .
5. Install the charge air hose (4).
6. Install coolant reservoir and hoses.
7. Install air cleaner assembly. See **Installation** .
8. Fill the coolant system
9. Connect the negative battery cable
10. Start engine, run until warm, turn the engine off, and inspect for leaks.

FILTER, ENGINE OIL

Removal

REMOVAL

1. Using the Oil Filter Socket 9551, unscrew the oil filter cap.
2. Remove clean and inspect cap gasket, replace as necessary.
3. Remove and discard the oil filter.

Installation

INSTALLATION

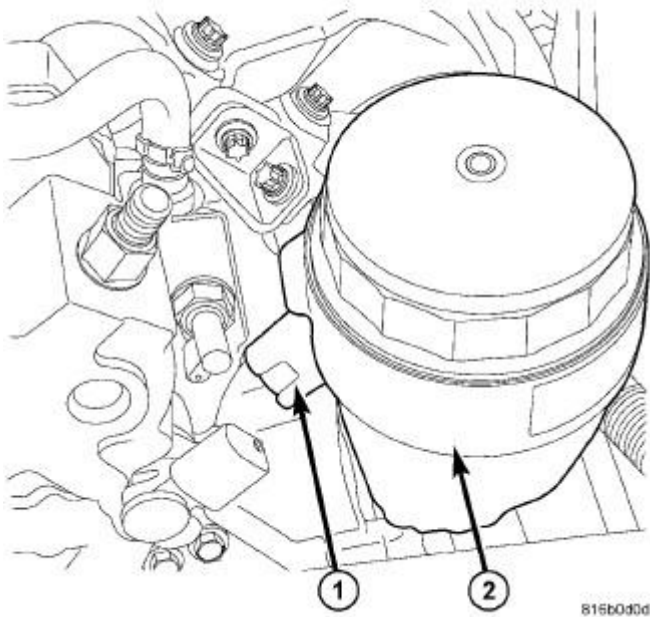


Fig. 357: OIL FILTER HOUSING

Courtesy of CHRYSLER LLC

WARNING: Any time the oil is drained and filled it is critical to wait 15 minutes before starting the engine.

WARNING: Before checking the engine oil level turn the engine off and wait 15 minutes for the oil to return to the oil pan.

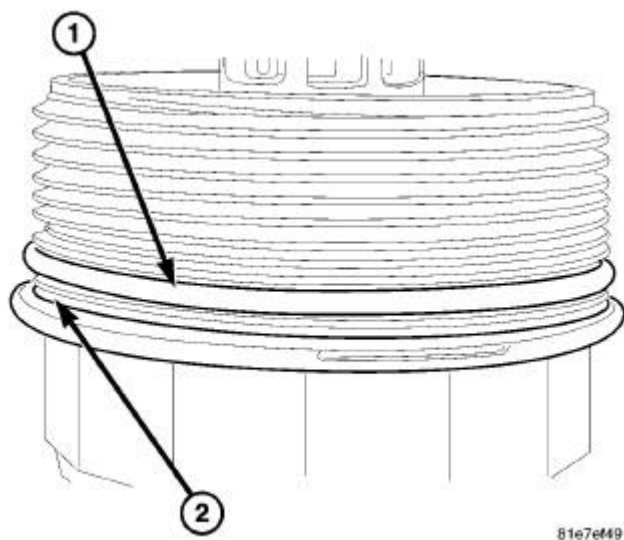
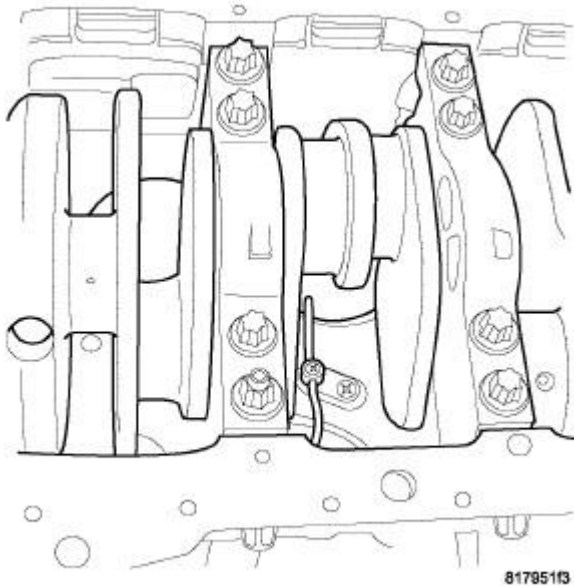


Fig. 358: O-RING LOCATION

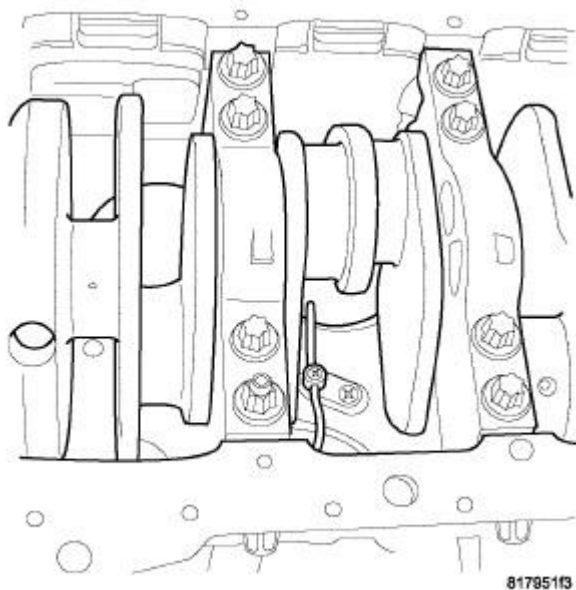
Courtesy of CHRYSLER LLC

1. Inspect oil filter cap gasket, lubricate with clean engine oil. Make sure the oil filter cap O-ring is in the correct location (1).
2. Install oil filter.
3. Screw oil filter cap to housing and tighten to 25 N.m (18 lbs. ft.) using 9551 Oil Filter Socket. Adjust oil level as necessary.

JET, PISTON OIL COOLER**Description****DESCRIPTION****Fig. 359: Oil Jet****Courtesy of CHRYSLER LLC**

Three dual-nozzle oil jets are bolted to the cylinder block underneath the main oil gallery. The jets connect with an oil-tight fit to the main gallery through lubrication passages. Each oil jet helps cool two opposite pistons. Proper oil jet alignment is important. Each nozzle is designed to alternatively spray oil through both cooling galleries within the piston. The oil spray is aimed at one of the cooling galleries as the piston approaches TDC. As the piston approaches BDC, the oil spray is aimed at the adjacent cooling gallery.

Removal**REMOVAL**

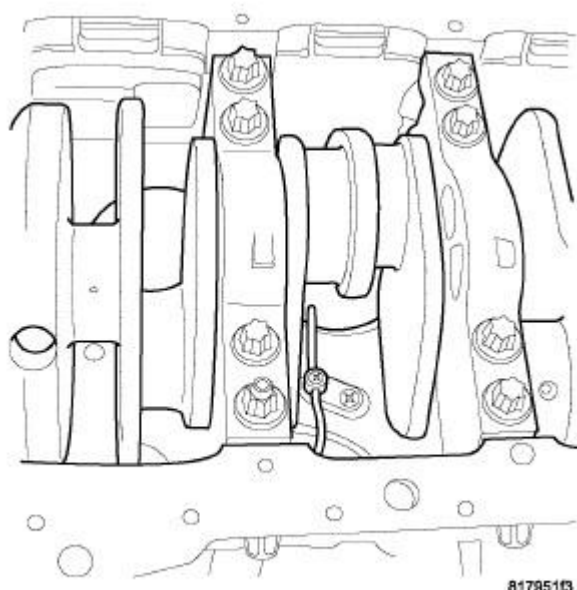
**Fig. 360: Oil Jet**

Courtesy of CHRYSLER LLC

CAUTION: Use caution when removing and installing oil jets. Damage to oil jet nozzle could cause severe engine damage. Care must be taken not to damage the crankshaft tone ring when removing cylinder number four oil jet.

1. Disconnect negative battery cable.
2. Raise vehicle on hoist.
3. Remove oil pan.
4. Remove oil jet retaining bolt and remove oil jet from engine block.

Installation**INSTALLATION**

**Fig. 361: Oil Jet**

Courtesy of CHRYSLER LLC

CAUTION: Use caution when removing and installing oil jets. Damage to oil jet nozzle could cause severe engine damage.

1. Install oil jet in engine block
2. Install oil jet retaining bolt. Tighten bolt to 11 N.m (96 in. lbs.).
3. Install oil pan.
4. Fill engine oil to proper level.
5. Connect negative battery cable.

OIL

Description

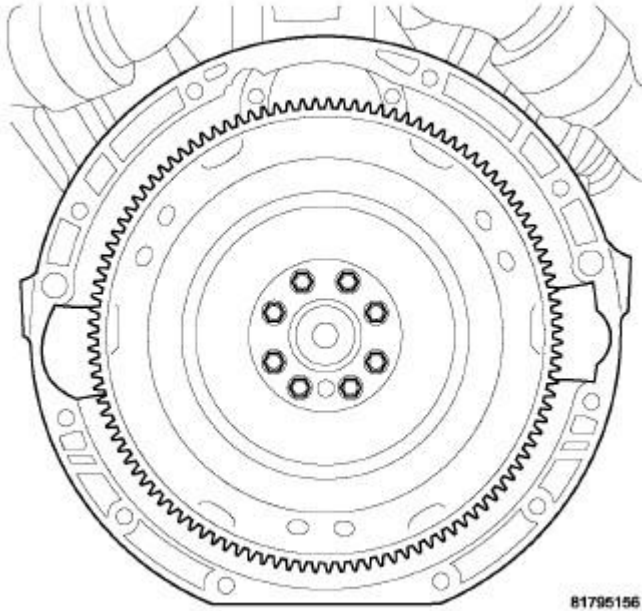
DESCRIPTION

Refer to the Lube and Maintenance information for oil specifications. Refer to **Vehicle Quick Reference/Capacities and Recommended Fluids - Description** .

PAN, OIL

Removal

REMOVAL

**Fig. 362: FLEX PLATE**

Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable. Refer to **Electrical - Engine Systems/Battery System/CABLES, Battery - Removal**.
2. Remove the oil level indicator tube.
3. Remove the skid plate.
4. Remove the lower bolt from the A/C compressor to oil pan.
5. Remove the transmission. Refer to **Transmission and Transfer Case/Automatic - NAG1 - Removal**.
6. Remove the flex plate. See **Removal**.

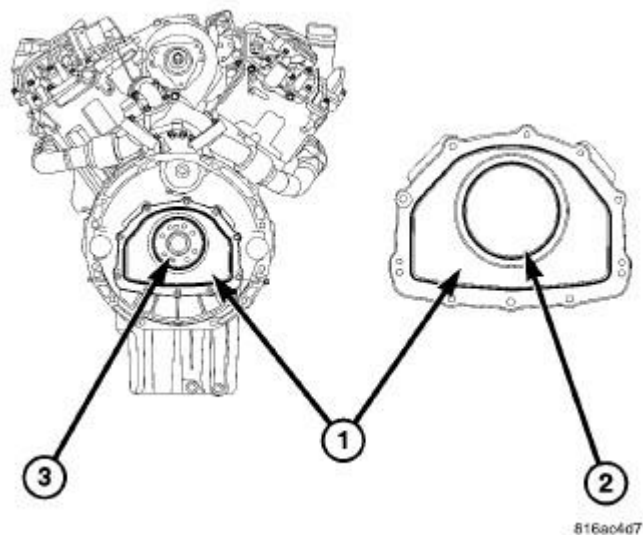


Fig. 363: REAR MAIN SEAL CARRIER
Courtesy of CHRYSLER LLC

7. Remove the 5 bolts on the bottom of the rear main seal carrier (1).
8. Remove oil pan bolts.
9. Remove the oil pan.

Installation

INSTALLATION

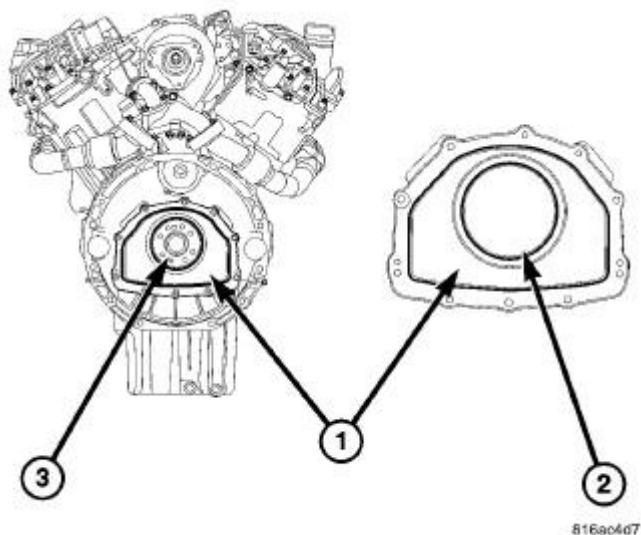


Fig. 364: REAR MAIN SEAL CARRIER
Courtesy of CHRYSLER LLC

NOTE: Sealing surfaces must be free of a gasket material and oil residue.

NOTE: If installing a new oil pan, exchange the oil temperature sensor and the oil level sensor.

1. Position the oil pan to engine block and install the oil pan bolts. Tighten the oil pan bolts to 12 Nm (106 in. lbs.).
2. Install the bolts holding the rear main seal carrier (1) to the oil pan. Tighten the bolts to 9 Nm (7 ft. lbs.).

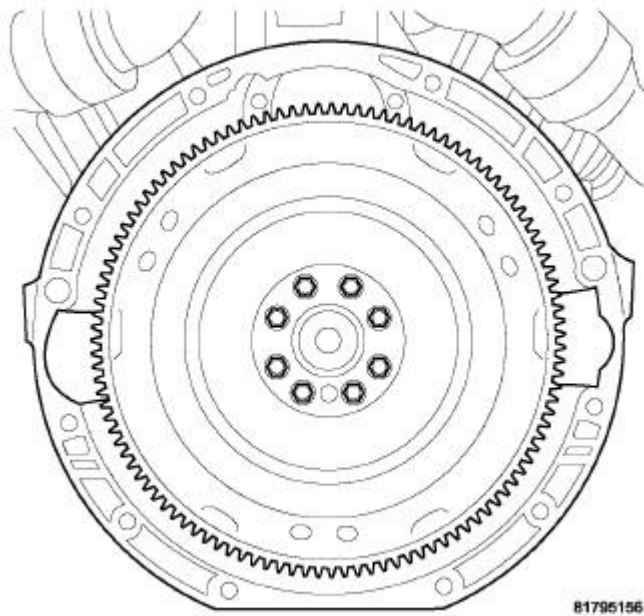


Fig. 365: FLEX PLATE
Courtesy of CHRYSLER LLC

3. Install the flex plate. See Installation.
4. Install the transmission. Refer to Transmission and Transfer Case/Automatic - NAG1 - Installation.
5. Install the lower A/C compressor bolt to oil pan. Tighten the bolt to 20 Nm (15 ft. lbs.).
6. Install the oil level indicator tube.
7. Fill the oil pan to the appropriate level with the correct viscosity engine oil.
8. Connect the negative battery cable.
9. Start the engine, allow to warm.

WARNING: Any time the oil is drained and filled it is very important to wait 15 minutes before starting the engine.

WARNING: Before checking the engine oil level turn the engine off and wait 15

minutes for the oil to return to the oil pan.

10. Turn engine off and inspect for leaks.
11. Install the skid plate.

PUMP, ENGINE OIL

Removal

OIL PUMP PICKUP TUBE

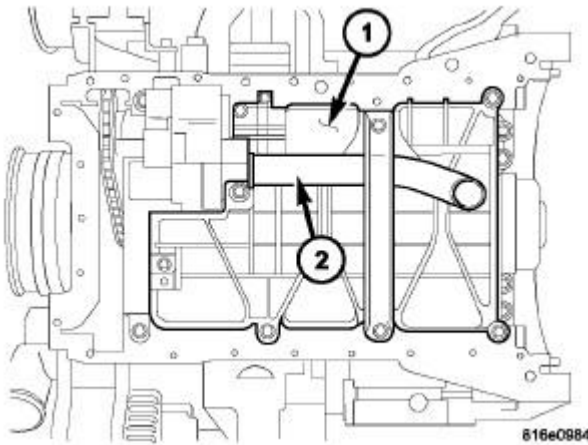


Fig. 366: OIL PUMP COVER REMOVAL
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Raise vehicle on hoist.
3. Remove oil pan. See **Removal** .
4. Remove oil pump pickup tube retaining bolt and pull pickup tube from engine block. Discard O-rings.

OIL PUMP

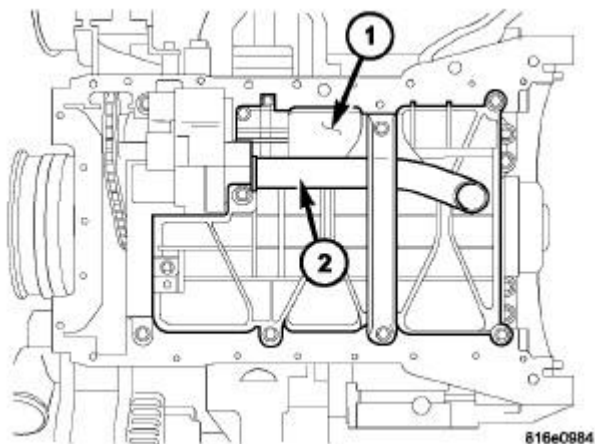


Fig. 367: OIL PUMP COVER REMOVAL
Courtesy of CHRYSLER LLC

1. Remove oil pan. See **Removal**.
2. Remove fasteners at the oil pump cover.

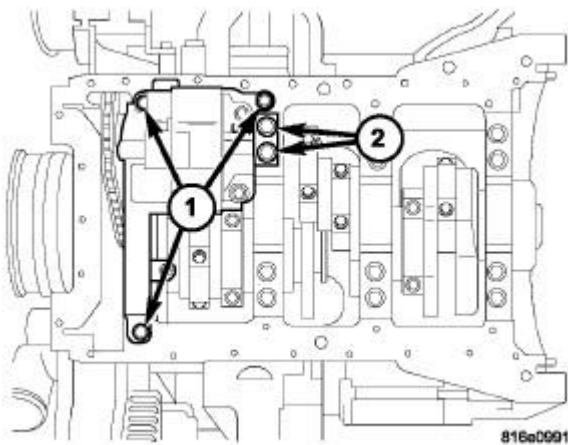


Fig. 368: OIL PUMP
Courtesy of CHRYSLER LLC

3. Remove oil pump fasteners (1).
4. Remove oil pump from the crankcase.

Installation

OIL PUMP PICKUP TUBE

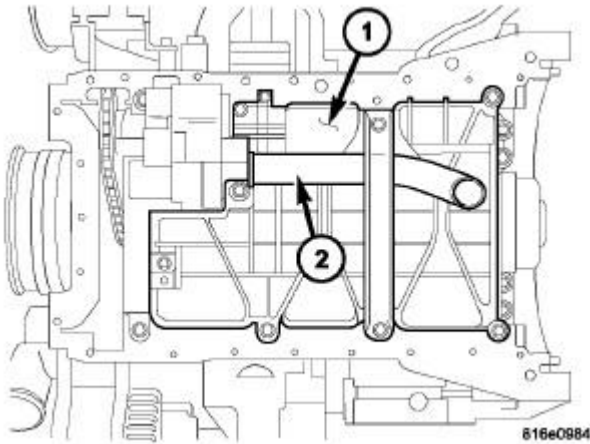


Fig. 369: OIL PUMP COVER REMOVAL

Courtesy of CHRYSLER LLC

1. Lubricate o-rings on oil pump pickup tube with engine oil.
2. Install pickup tube in engine block and install retaining bolt. Tighten bolt to 32.4 N.m (24 ft. lbs.).
3. Install oil pan. See **Installation** .
4. Refill engine oil to proper level.
5. Connect negative battery cable.

OIL PUMP

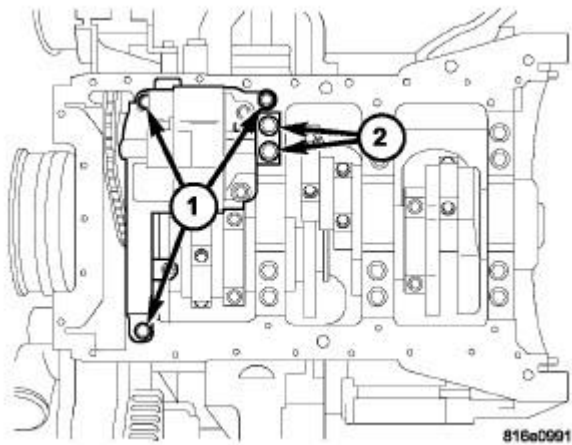


Fig. 370: OIL PUMP

Courtesy of CHRYSLER LLC

1. Clean the strainer of the oil pump and replace sealing ring. Fill oil pump with engine oil so that oil is delivered when first starting engine.
2. Install the oil pump.

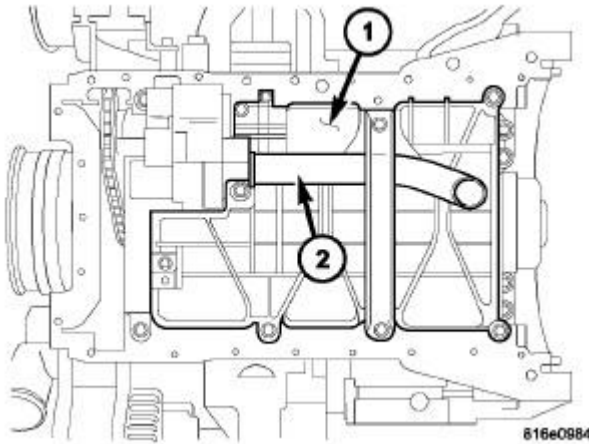


Fig. 371: OIL PUMP COVER REMOVAL

Courtesy of CHRYSLER LLC

3. Install fastener for oil pump. Tighten fastener to 19 N.m (14 ft. lbs.).
4. Install fastener for oil pump cover (1) with oil pipe (2) to oil pump. Tighten fastener to 12 N.m (9 ft. lbs.).
5. Install bracket to the oil pump. Tighten fastener to 9 N.m (7 ft. lbs.).

WARNING: Any time the oil is drained and filled it is critical to wait 15 minutes before starting the engine.

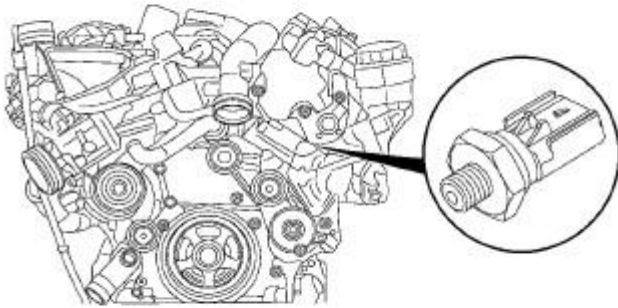
WARNING: Before checking the engine oil level turn the engine off and wait 15 minutes for the oil to return to the oil pan.

6. Install oil pan. See **Installation**.

SENSOR, OIL PRESSURE

Description

DESCRIPTION



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Fig. 372: OIL PRESSURE SENSOR**Courtesy of CHRYSLER LLC**

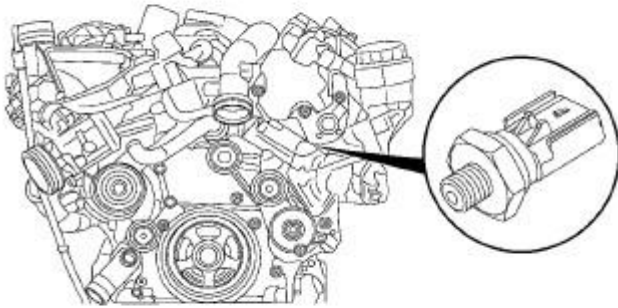
The engine oil pressure sensor is mounted on the front of the oil filter housing. The sensor provides an output voltage to the ECM that corresponds to the engine oil pressure. Under certain operating conditions, for example low oil pressure, it may be necessary for the ECM to increase the engine idle speed to ensure adequate engine lubrication.

The engine oil pressure sensor is a three wire sensor with a threaded pressure port. The pressure port is mounted to the oil filter housing through an access hole. An aluminum seal ring seals the engine oil pressure sensor to the oil filter housing.

Operation**OPERATION**

The engine oil pressure sensor receives a 5- volt reference from the ECM. The sensor ground is also provided by the ECM. The sensor output voltage varies from 0.5 to 4.5 volts depending on engine oil pressure.

Removal**REMOVAL**

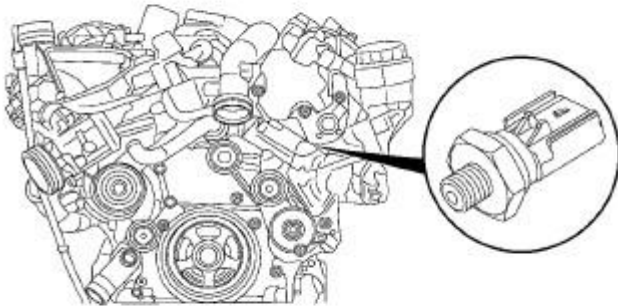


81a348b2

Fig. 373: OIL PRESSURE SENSOR**Courtesy of CHRYSLER LLC**

1. Open hood and disconnect negative battery cable.
2. Disconnect engine oil pressure sensor connector.
3. Remove engine oil pressure sensor from the engine.

Installation**INSTALLATION**



81a348b2

Fig. 374: OIL PRESSURE SENSOR

Courtesy of CHRYSLER LLC

1. Install the engine oil pressure sensor to the engine. Tighten sensor to 15 N.m (11 ft. lbs.).
2. Connect engine oil pressure sensor electrical connector to the sensor.
3. Add engine oil and check engine oil level as needed.
4. Connect the negative battery cable.
5. Start vehicle and inspect for leaks.

TUBE, OIL LEVEL INDICATOR**Removal****REMOVAL**

1. Remove the generator bolts and position the generator aside.
2. Remove the upper oil level indicator tube bolt.
3. Remove the lower oil level indicator tube bolt.
4. Remove the oil level indicator tube.

Installation**INSTALLATION**

1. Install the oil level indicator tube.
2. Install the lower oil level indicator tube bolt.

3. Install the upper oil level indicator tube bolt.
4. Position the generator and install the generator bolts.

VALVE, OIL PRESSURE RELIEF

Description

DESCRIPTION

The oil pressure relief valve is integral to the oil pump and is not serviceable.

MANIFOLDS

ACTUATOR, SWIRL VALVE

Description

DESCRIPTION

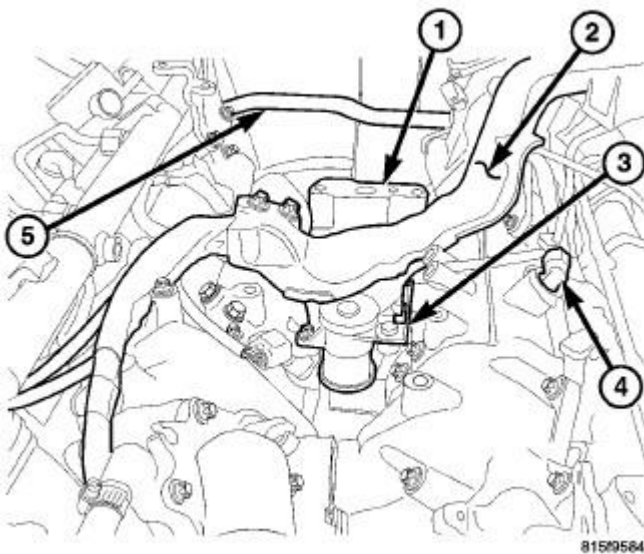


Fig. 375: MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - TURBOCHARGER OIL HOUSING ADAPTOR
2 - MAIN ENGINE WIRING HARNESS
3 - SWIRL VALVE ACTUATOR
4 - COOLANT TEMPERATURE SENSOR |
|--|

The intake manifolds feature swirl intake ports to reduce particulates at low engine speeds. Each cylinder incorporates one swirl port and one charge port. The swirl ports can be closed by the swirl valves. The valves are connected together via a linkage which is operated by the swirl valve actuator.

The swirl valves are normally open by spring tension. The spring is integral with the swirl valve actuator. In the lower engine speed and load range, the swirl valves are closed by the swirl valve actuator. The entire air mass flows through the charge ports only, which results in greater swirling. The increased swirling produces uniform combustion for better engine performance and reduction of particulates. As rotational speed and load increases, the swirl valves open, so that optimal swirling and the required air mass are provided for the current operating conditions.

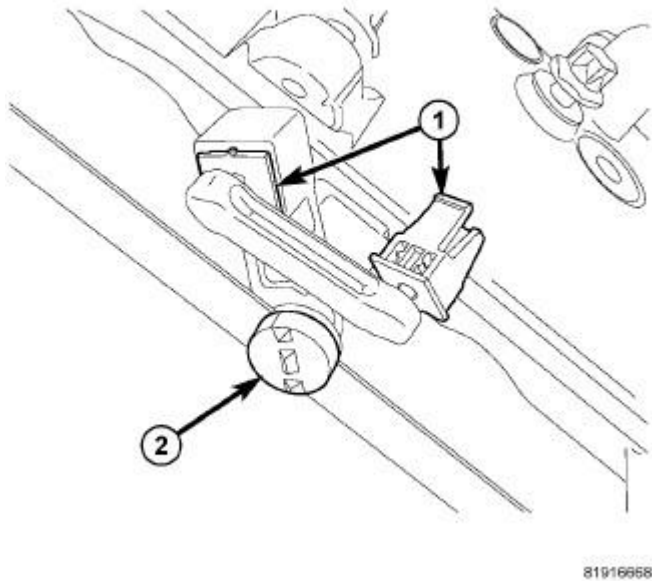


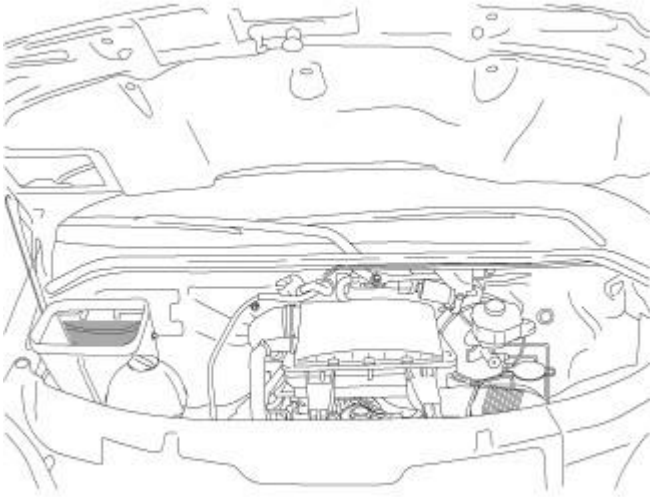
Fig. 376: SWIRL VALVE CLIPS

Courtesy of CHRYSLER LLC

The linkage between the swirl valve actuator and the intake manifold has two different style clips. The square clip (1) is a two piece design, and the round clip (2) is a one piece design.

Removal

REMOVAL



81b73043

Fig. 377: OPEN HOOD

Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable. Refer to **Electrical - Engine Systems/Battery System/CABLES, Battery - Removal** .
2. Remove the engine cover. See **Removal**.
3. Drain the coolant. Refer to **Cooling - Standard Procedure** .
4. Remove the strut tower support (2).
5. Remove the intake air housing and tube. See **Removal** .
6. Remove the charge air cooler tube (4).
7. Remove the resonator.
8. Remove the EGR tube.

CAUTION: Observe the position of the turbocharger oil passage housing and gasket. Failure to properly position the gasket during assembly will result in immediate turbocharger failure after assembly.

9. Remove the turbocharger (3). See **Removal**.

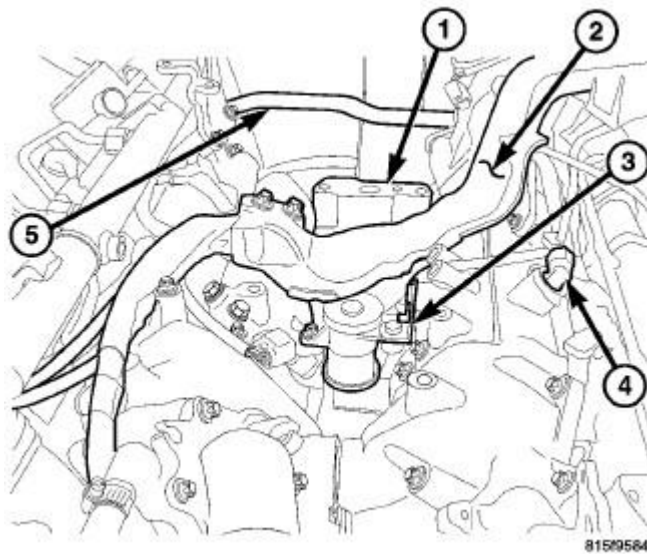


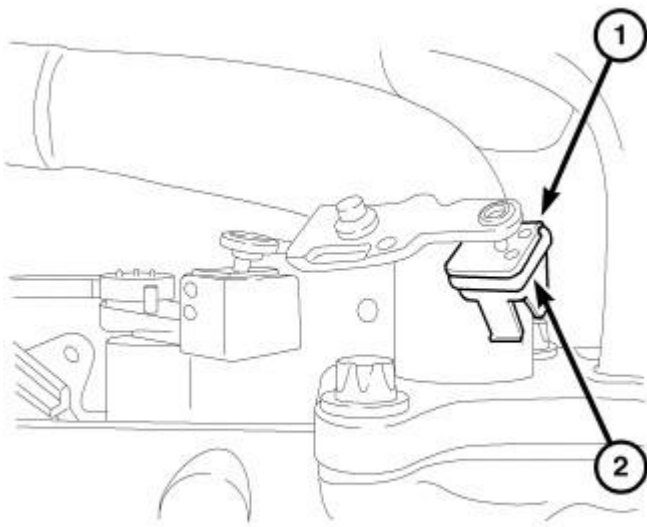
Fig. 378: MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - TURBOCHARGER OIL HOUSING ADAPTOR
2 - MAIN ENGINE WIRING HARNESS
3 - SWIRL VALVE ACTUATOR
4 - COOLANT TEMPERATURE SENSOR |
|--|

10. Disconnect the engine harness and position aside.
11. Disconnect the swirl valve actuator connector.
12. Remove the swirl valve actuator (3) clips.
13. Remove the swirl valve actuator.

Installation

INSTALLATION

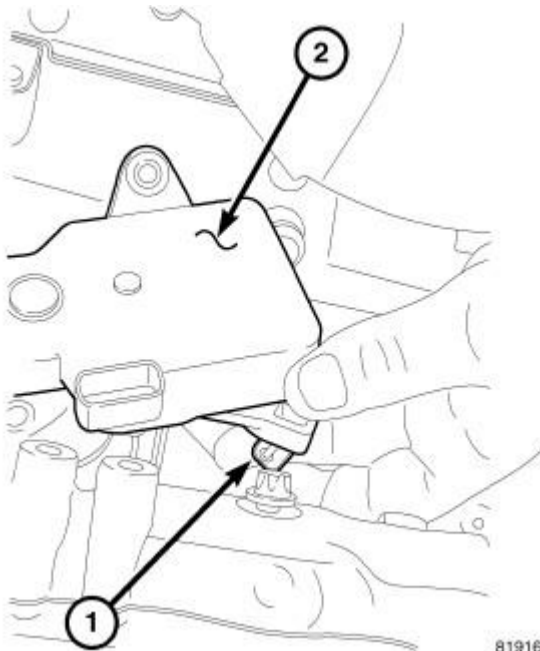


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Fig. 379: O-RING INSTALLED

Courtesy of CHRYSLER LLC

1. Assemble the two halves of the square clip around the actuator arm, and place a 5/16" O-ring (2) around the base of the clip (1) to hold it together.



81916654

Fig. 380: INSTALL CLIP

Courtesy of CHRYSLER LLC

2. Position the clip into the actuator arm and push the clip partially into the arm.

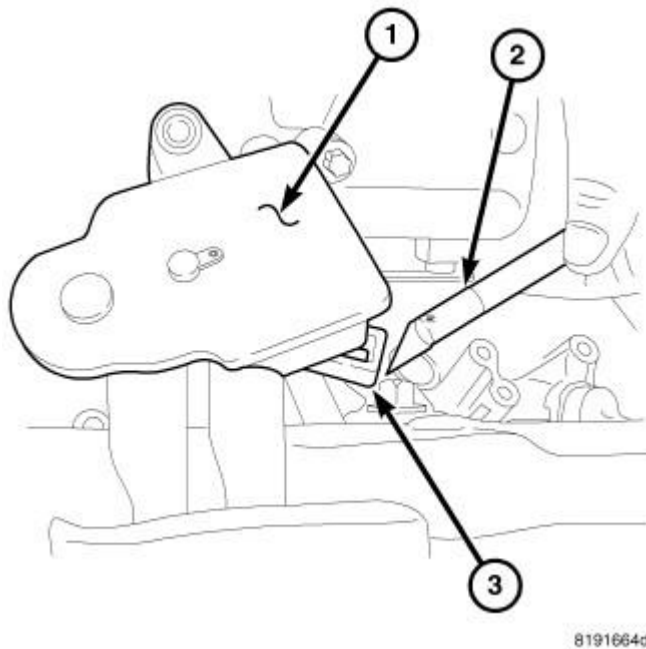


Fig. 381: REMOVE O-RINGS
Courtesy of CHRYSLER LLC

3. Cut the O-ring and press the clip the rest of the way into the actuator arm. Make sure the clip clicks into place.

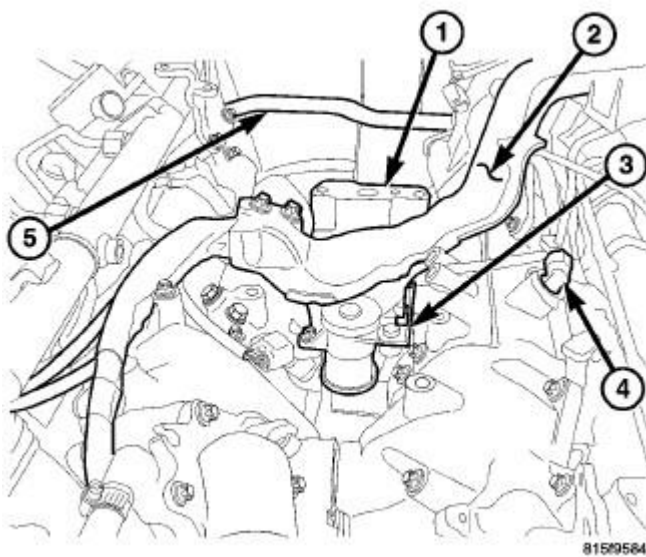


Fig. 382: MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

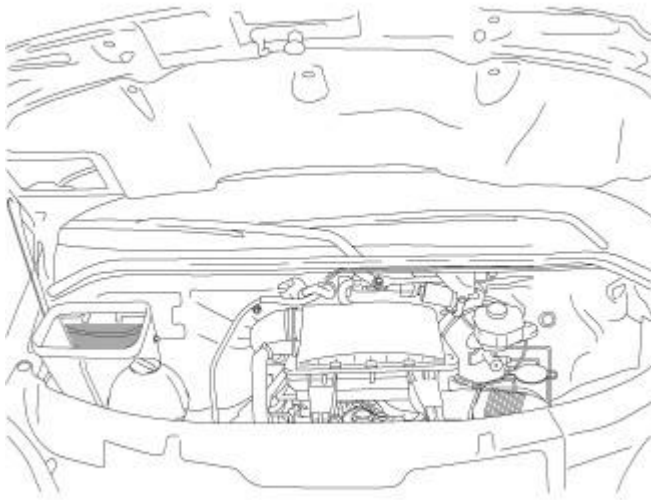
- | |
|---|
| <p>1 - TURBOCHARGER OIL HOUSING ADAPTOR
2 - MAIN ENGINE WIRING HARNESS
3 - SWIRL VALVE ACTUATOR</p> |
|---|

4 - COOLANT TEMPERATURE SENSOR

4. Install the swirl valve actuator. Tighten the bolts to 8 N.m (44 lbs. in.).
5. Connect the swirl valve connector.
6. Position and connect the engine harness.

CAUTION: Observe the position of the turbocharger oil passage housing and gasket. Failure to properly position the gasket during assembly will result in immediate turbocharger failure after assembly.

7. Install the turbocharger. See Installation.



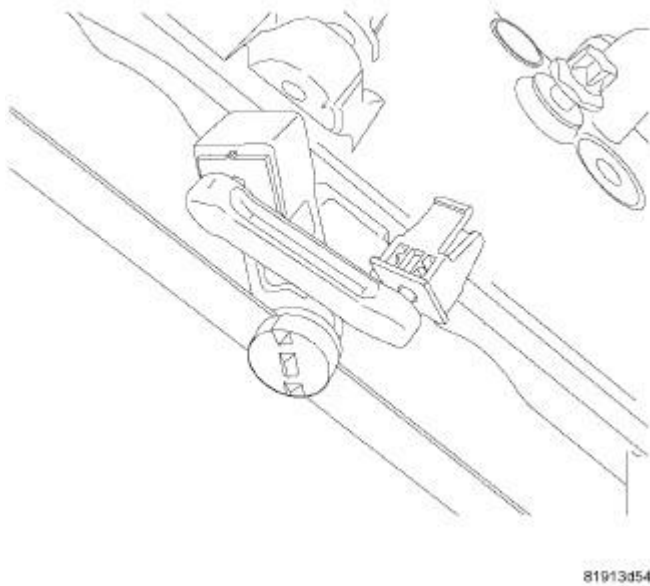
81b73043

Fig. 383: OPEN HOOD

Courtesy of CHRYSLER LLC

8. Install the EGR tube.
9. Install the resonator.
10. Install the charge air cooler tube (4).
11. Install the air cleaner housing and air tube. See Installation.
12. Install the strut tower support (2).
13. Fill the cooling system. Refer to Cooling - Standard Procedure.
14. Install the engine cover. See Installation.
15. Connect the battery. Refer to Electrical - Engine Systems/Battery System/CABLES, Battery - Installation.

LINKAGE, SWIRL VALVE

Description**DESCRIPTION****Fig. 384: SWIRL VALVE LINKAGE****Courtesy of CHRYSLER LLC**

The swirl valve linkage links the swirl valves in the intake manifold to the swirl valve actuator.

The swirl valve linkage has two different style clips. The square clip (1) is a two piece design, and the round clip (2) is a one piece design.

Removal**REMOVAL**

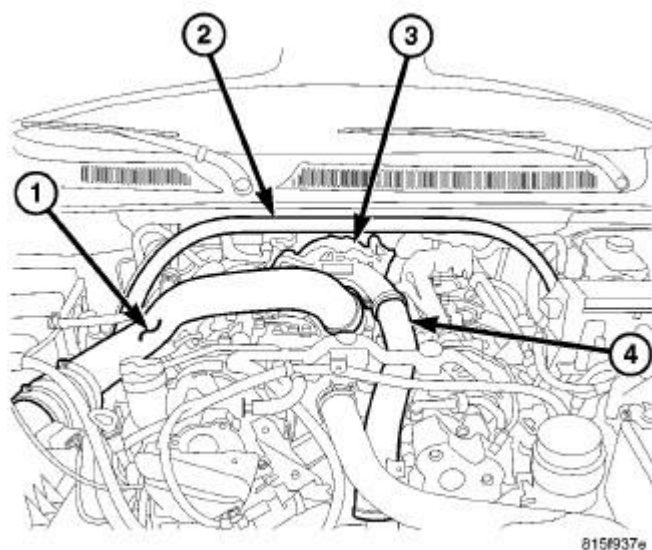


Fig. 385: STRUT TOWER SUPPORT

Courtesy of CHRYSLER LLC

- 1 - AIR CLEANER OUTLET TUBE
- 2 - STRUT TOWER SUPPORT
- 3 - TURBOCHARGER
- 4 - CHARGE AIR INLET TUBE

1. Disconnect the negative battery cable. Refer to **Electrical - Engine Systems/Battery System/CABLES, Battery - Removal** .
2. Remove the engine cover. See **Removal**.
3. Remove the air cleaner assembly. See **Removal** .
4. Remove the air charge resonator.
5. Remove the air charge outlet tube (4).
6. Remove the vapor control valve.
7. Drain the coolant. Refer to **Cooling - Standard Procedure** .
8. Remove the belly pan.

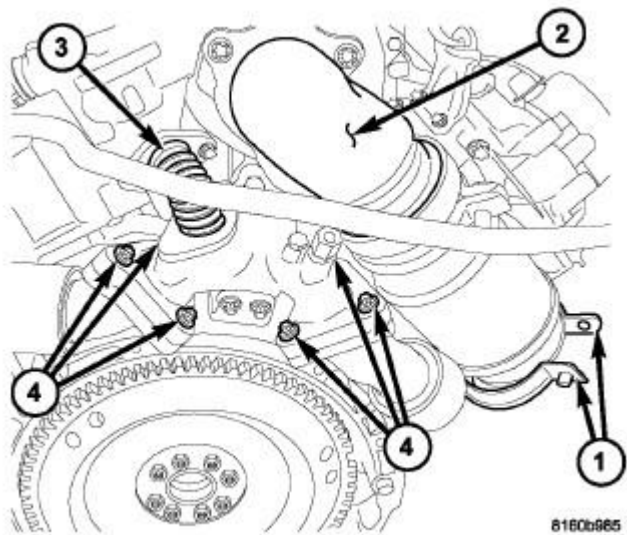


Fig. 386: REMOVING/INSTALLING AIR INTAKE, TURBO & EXHAUST SYSTEM COMPONENTS

Courtesy of CHRYSLER LLC

9. Remove the turbocharger. See **Removal**.
10. Remove the EGR tube (3).

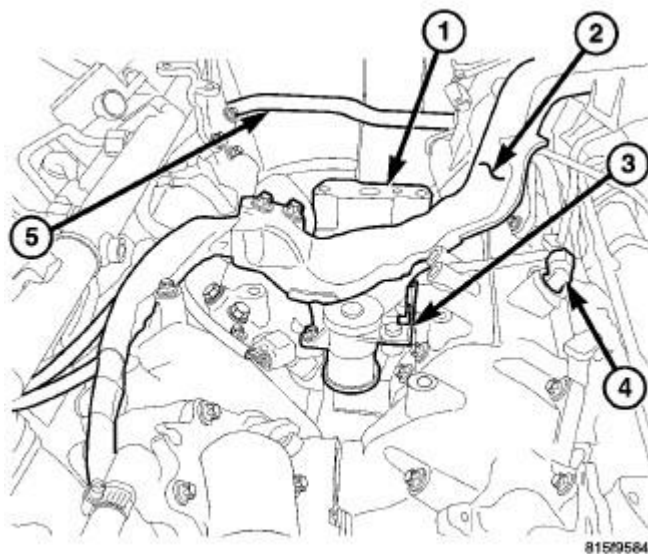


Fig. 387: MAIN ENGINE WIRING HARNESS

Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - TURBOCHARGER OIL HOUSING ADAPTOR
 2 - MAIN ENGINE WIRING HARNESS
 3 - SWIRL VALVE ACTUATOR</p> |
|---|

4 - COOLANT TEMPERATURE SENSOR

11. Remove the oil housing adapter (1).
12. Remove the rear engine lift bracket at the intake manifold.
13. Remove the front engine lift bracket at the cylinder heads.

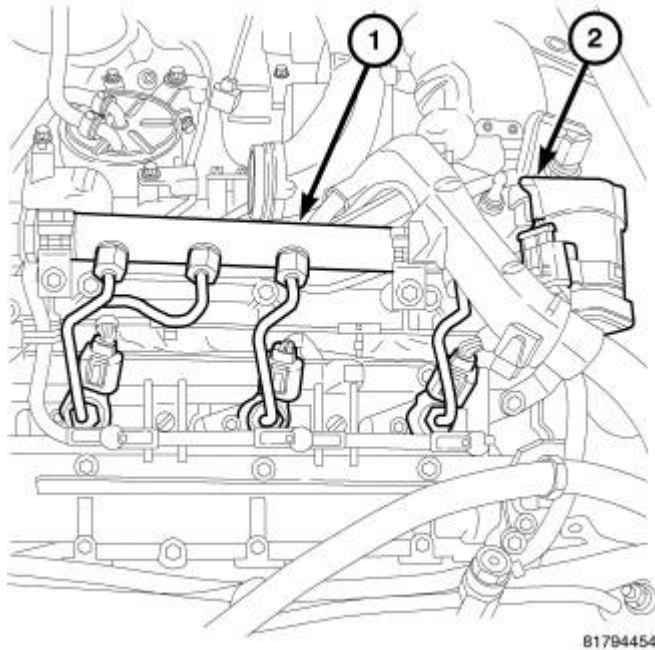


Fig. 388: EGR VALVE
Courtesy of CHRYSLER LLC

1 - FUEL RAIL AND LINES
2 - EGR VALVE

14. Remove the left fuel rail and lines. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Removal** .
15. Remove the right fuel rail and lines. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Removal** .

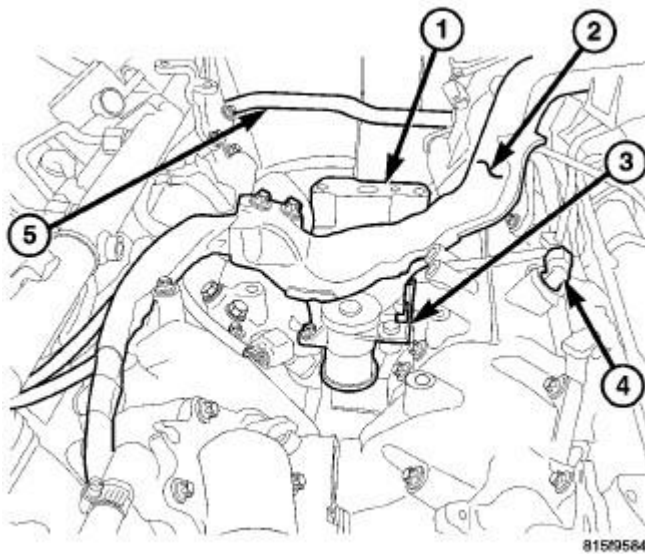
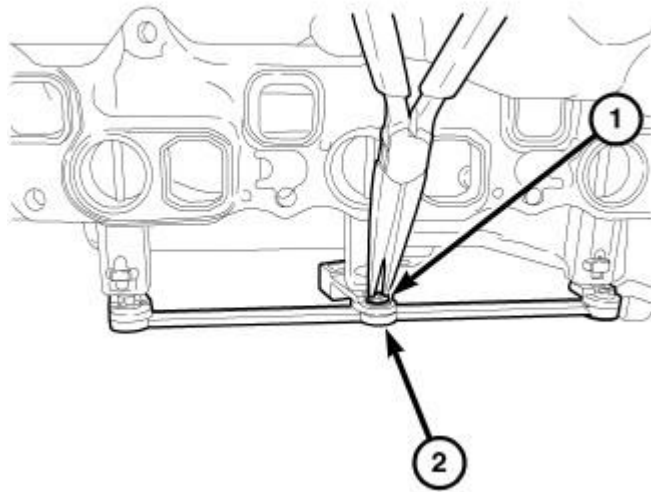


Fig. 389: MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - TURBOCHARGER OIL HOUSING ADAPTOR
2 - MAIN ENGINE WIRING HARNESS
3 - SWIRL VALVE ACTUATOR
4 - COOLANT TEMPERATURE SENSOR |
|--|

16. Disconnect the engine harness (2) and position aside.
17. Remove the swirl port actuator (3).
18. Remove the heater hose at the EGR valve.
19. Remove the EGR control assembly.



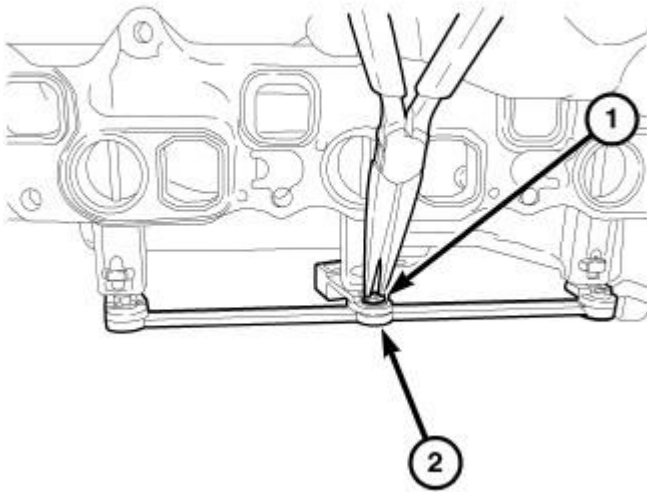
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Fig. 390: REMOVE/INSTALL ROUND CLIPS
Courtesy of CHRYSLER LLC

20. Remove the coolant hose at the thermostat housing.
21. Remove the glow plug module.
22. Remove the throttle control assembly.
23. Remove the intake manifold.
24. Loosen the EGR cooler bolts to gain access to the swirl valve linkage clips.
25. Remove the swirl valve linkage clips (2).

Installation

INSTALLATION

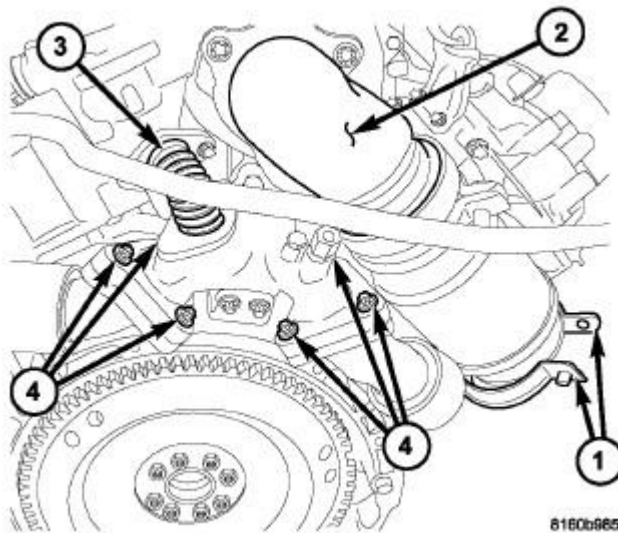


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Fig. 391: REMOVE/INSTALL ROUND CLIPS

Courtesy of CHRYSLER LLC

1. Install the round clips (2) into the swirl valve linkage.
2. Clean the intake manifold sealing surfaces.
3. Install new intake manifold gaskets.



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Fig. 392: REMOVING/INSTALLING AIR INTAKE, TURBO & EXHAUST SYSTEM COMPONENTS

Courtesy of CHRYSLER LLC

4. Install the EGR cooler.

5. Position the intake manifold and tighten to 20.34 N.m (180 lbs. in.)
6. Install the throttle control assembly.
7. Install the glow plug module.
8. Install the coolant hose at the thermostat housing.
9. Install the EGR control assembly.
10. Install the EGR control assembly chamber retaining bolts.
11. Install the EGR control assembly retaining bracket.

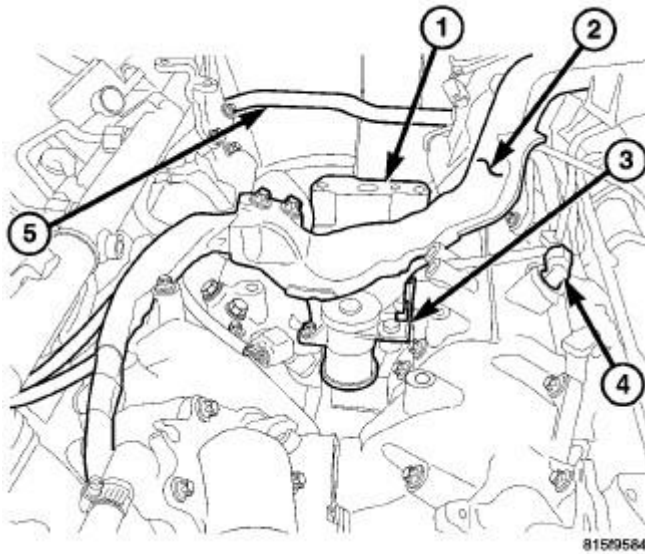


Fig. 393: MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - TURBOCHARGER OIL HOUSING ADAPTOR
 2 - MAIN ENGINE WIRING HARNESS
 3 - SWIRL VALVE ACTUATOR
 4 - COOLANT TEMPERATURE SENSOR</p> |
|---|

12. Install the swirl valve actuator. See **Installation** .
13. Install the fuel filter assembly. Refer to **Fuel System/Fuel Delivery/FILTER, Fuel - Installation** .
14. Install the fuel lines. Refer to **Fuel System/Fuel Delivery/TUBE(S), Fuel - Installation** .
15. Position and connect the engine harness.
16. Install the front lifting bracket.
17. Install rear lifting bracket.
18. Install the EGR tube.
19. Install the turbocharger. See **Installation**.
20. Install the engine compartment lower silencer.
21. Fill the cooling system. Refer to **Cooling - Standard Procedure** .

22. Install the vapor control valve.
23. Install the charge air outlet tube (4).
24. Install the charge air resonator.
25. Install the air cleaner assembly. See **Installation** .
26. Install the engine cover. See **Installation** .
27. Connect the batteries. Refer to **Electrical - Engine Systems/Battery System/CABLES, Battery - Installation** .

MANIFOLD, EXHAUST

Removal

RIGHT

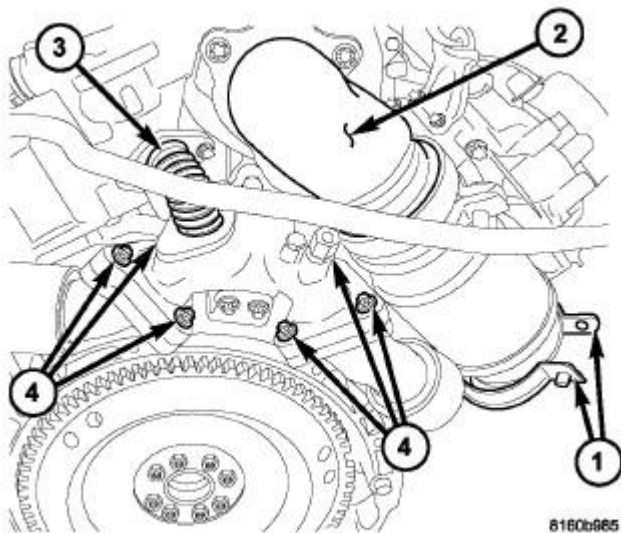


Fig. 394: REMOVING/INSTALLING AIR INTAKE, TURBO & EXHAUST SYSTEM COMPONENTS
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable. Refer to **Electrical - Engine Systems/Battery System/CABLES, Battery - Removal** .
2. Remove the engine cover. See **Removal**.
3. Remove the turbo heat shield.
4. Remove the exhaust elbow (4) at the turbo.

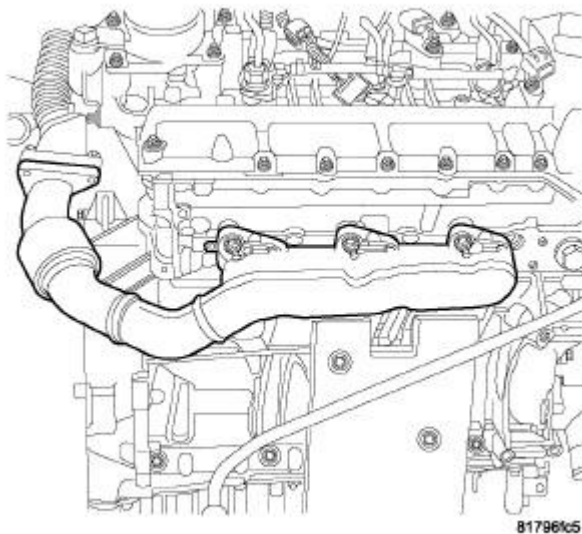


Fig. 395: RIGHT EXHAUST MANIFOLD
Courtesy of CHRYSLER LLC

5. Remove the right exhaust manifold.

LEFT

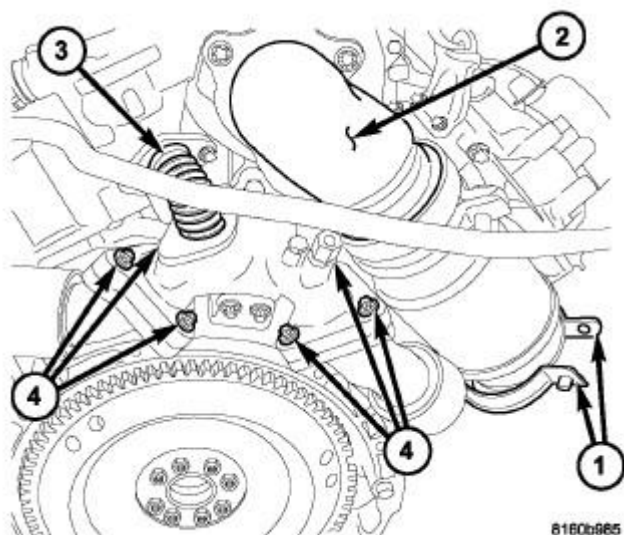


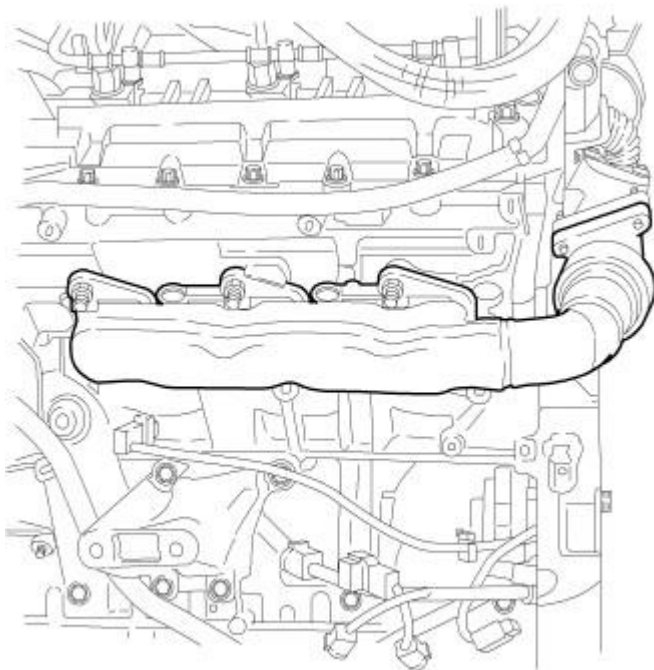
Fig. 396: REMOVING/INSTALLING AIR INTAKE, TURBO & EXHAUST SYSTEM COMPONENTS
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable. Refer to Electrical/Battery System/CABLES, Battery - Removal .

2. Remove the engine cover. See **Removal**.
3. Remove the turbo heat shield.
4. Remove the EGR tube (3).

NOTE: By loosening the clamp at the turbo (1). You can gain access to the crossover pipe to the Exhaust manifolds without removing exhaust system.

5. Remove the exhaust elbow (2) at the turbo.
6. Remove the 3 exhaust manifold bolts on the left side from the crossover pipe (4).



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Fig. 397: EXHAUST MANIFOLD - LEFT
Courtesy of CHRYSLER LLC

7. Remove the left exhaust manifold.

Installation

RIGHT

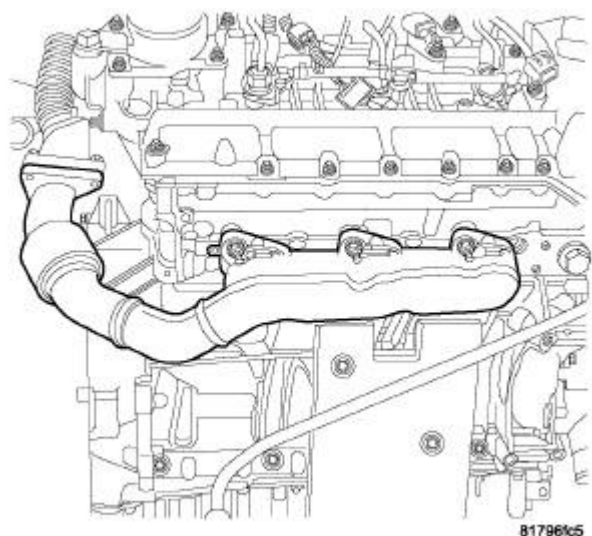


Fig. 398: RIGHT EXHAUST MANIFOLD

Courtesy of CHRYSLER LLC

1. Discard the old gasket and clean the cylinder head and manifold sealing surfaces.
2. Install a new exhaust manifold gasket.
3. Install the right exhaust manifold to cylinder head nuts. Tighten the nuts to 25 Nm (222 in. lbs.)

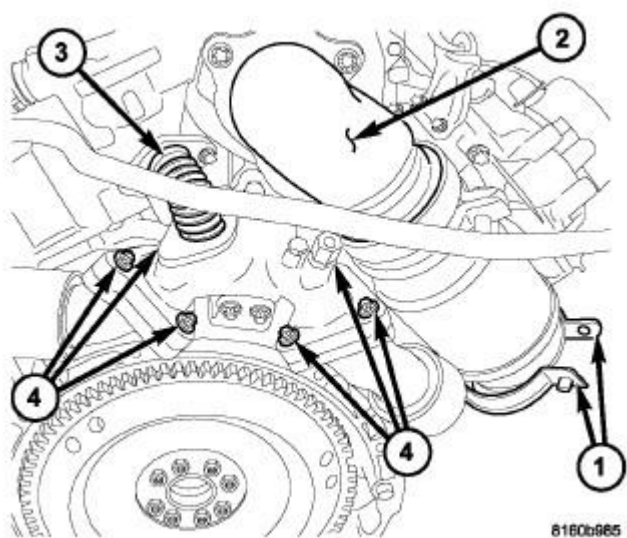


Fig. 399: REMOVING/INSTALLING AIR INTAKE, TURBO & EXHAUST SYSTEM COMPONENTS

Courtesy of CHRYSLER LLC

4. Install the exhaust elbow to turbocharger bolts. Tighten to 20 Nm (177 in. lbs.) and then add another 90° of rotation.
5. Install the strut tower brace.
6. Install the engine cover. See **Installation**.
7. Connect the negative battery cable. Refer to **Electrical - Engine Systems/Battery System/CABLES, Battery - Installation**.

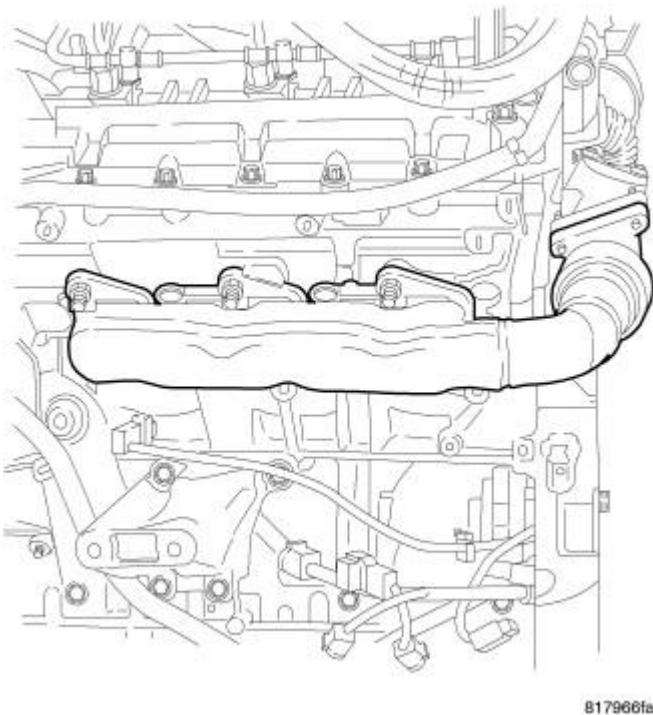
LEFT

Fig. 400: EXHAUST MANIFOLD - LEFT
Courtesy of CHRYSLER LLC

1. Discard the old gasket and clean the cylinder head and manifold sealing surfaces.
2. Install a new exhaust manifold gasket.
3. Install the left exhaust manifold to cylinder head nuts. Tighten the nuts to 25 Nm (222 in. lbs.)

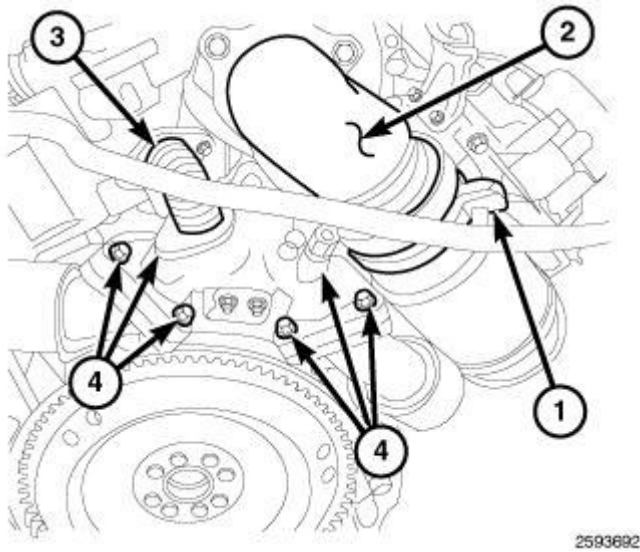


Fig. 401: EXHAUST MANIFOLD ASSEMBLY
Courtesy of CHRYSLER LLC

4. Install the three exhaust manifold bolts (4) on the left side from the crossover pipe to manifold flange. Tighten to 22 Nm (177 in. lbs.). and then add another 90° of rotation.
5. Install EGR tube (3). Tighten to 10 Nm (88 in. lbs.) And then add another 90° of rotation.
6. Install the exhaust elbow (2) to turbocharger bolts. Tighten to 20 Nm (177 in. lbs.). and then add another 90° of rotation.
7. Install the turbocharger heat shield. Tighten to 10 Nm (88 in. lbs.).
8. Install the engine cover. See **Installation**.
9. Connect the negative battery cable. Refer to **Electrical/Battery System/CABLES, Battery - Installation** .

MANIFOLD, INTAKE

Description

DESCRIPTION

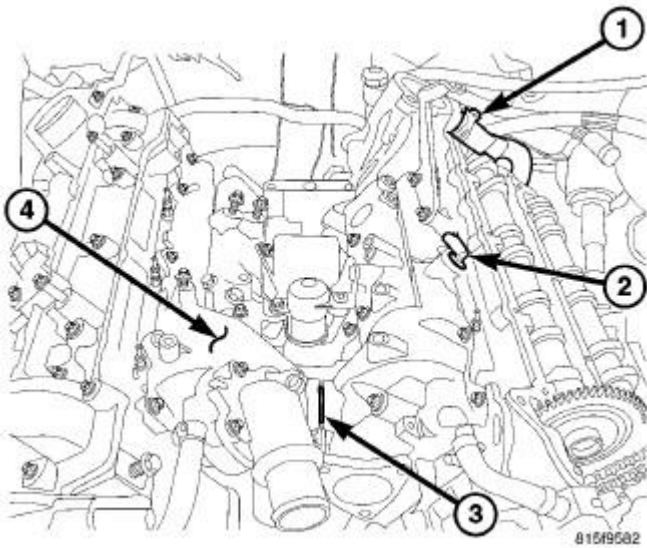


Fig. 402: INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

- 1 - EGR COOLANT PIPE
- 2 - COOLANT TEMPERATURE SENSOR
- 3 - INTAKE COOLANT PASSAGE
- 4 - INTAKE MANIFOLD

The aluminum intake manifold is a two piece design joined by a frontal cross coolant passage. Incorporated into the intake manifold assemblies are swirl and charge air channels. The swirl channels have blades that are electronically controlled by PWM signals from the ECM via a swirl valve actuator. In their normal resting position the swirl valves are open. Charge air and cooled EGR exhaust gasses are combined within the intake manifold. The swirl valve assembly assists in the mixing of these inlet airs within the cylinder. The swirl valves themselves are not serviceable separately, should a failure occur, the intake manifold must be replaced.

Removal

REMOVAL

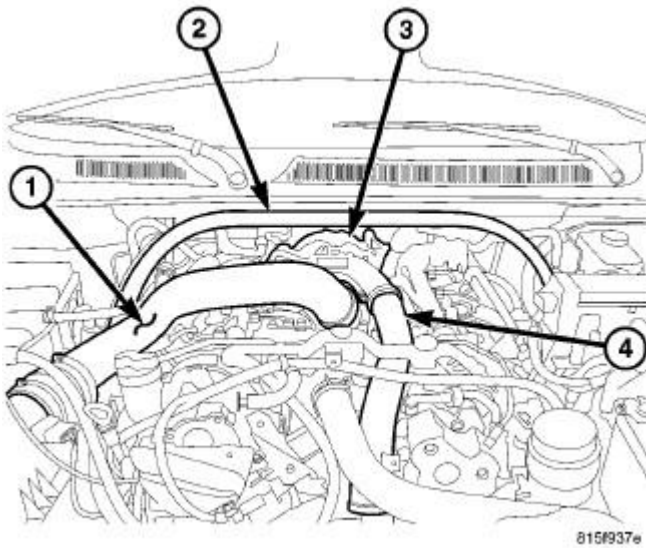


Fig. 403: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

- 1 - AIR CLEANER OUTLET TUBE
- 2 - STRUT TOWER SUPPORT
- 3 - TURBOCHARGER
- 4 - CHARGE AIR INLET TUBE

1. Disconnect negative battery cable. Refer to Electrical/Battery System/CABLES, Battery - Removal.
2. Remove the engine cover. See Removal.
3. Drain the cooling system.
4. Remove the coolant reservoir and position aside.
5. Remove the strut tower support.
6. Remove the air cleaner housing cover and air inlet tube (1).
7. Remove the charge air outlet tube (4).
8. Remove the right rear engine cover bracket and disconnect the transmission oil level indicator tube retaining bolt.

CAUTION: Observe the position of the turbocharger oil passage housing and gasket. Failure to properly position the gasket during assembly will result in immediate turbocharger failure after assembly.

9. Remove the turbo charger. See Removal.

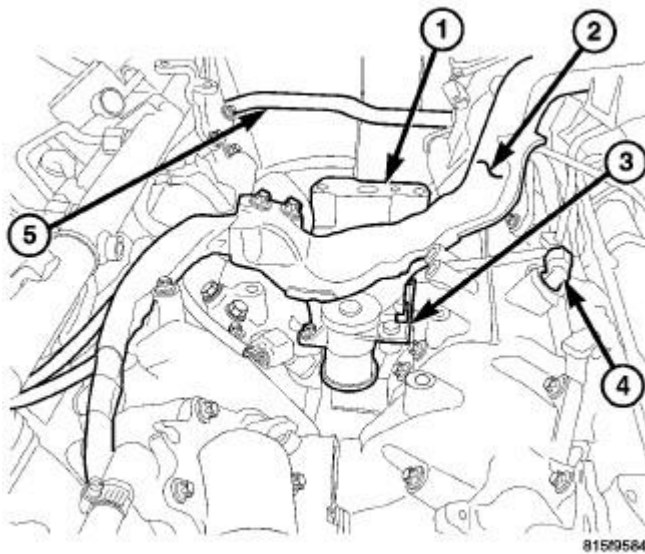


Fig. 404: MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - TURBOCHARGER OIL HOUSING ADAPTOR
2 - MAIN ENGINE WIRING HARNESS
3 - SWIRL VALVE ACTUATOR
4 - COOLANT TEMPERATURE SENSOR</p> |
|--|

10. Remove the turbocharger oil housing adaptor (1) and gasket.
11. Remove the EGR tube to the left cylinder head.
12. Disconnect the coolant hose at the EGR housing.
13. Disconnect the EGR and EGR temperature sensor wiring harness connectors.
14. Disconnect the swirl valve module wiring harness connector.
15. Remove the left fuel rail and high pressure lines.
16. Remove the right fuel rail and high pressure lines.
17. Disconnect the fuel return hoses at the injectors.
18. Disconnect the return fuel hose harness and position aside.
19. Remove fuel rail transfer line.
20. Remove the fuel filter assembly.
21. Remove the fuel filter supply and return pipe harness and position aside.
22. Remove the glow plug module.
23. Remove the EGR air control valve assembly.

CAUTION: Do Not rest the intake manifold on the swirl valve actuator. Care must be taken when handling the swirl valve assembly.

24. Remove the intake manifold and gasket.

Installation

INSTALLATION

NOTE: Before installation, clean cylinder heads and intake manifold surfaces.

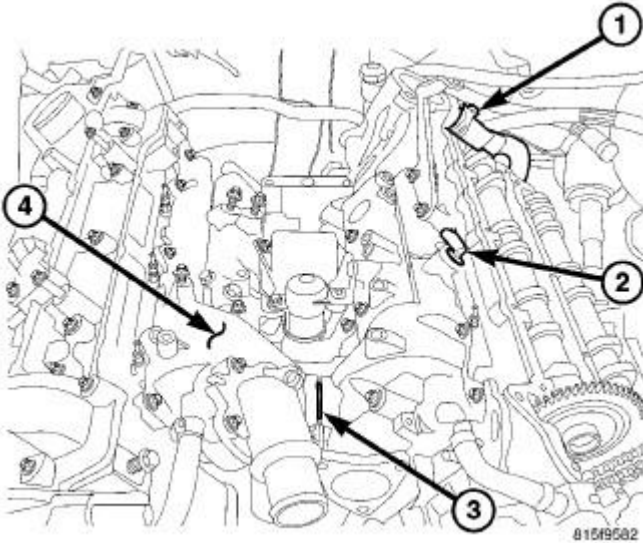


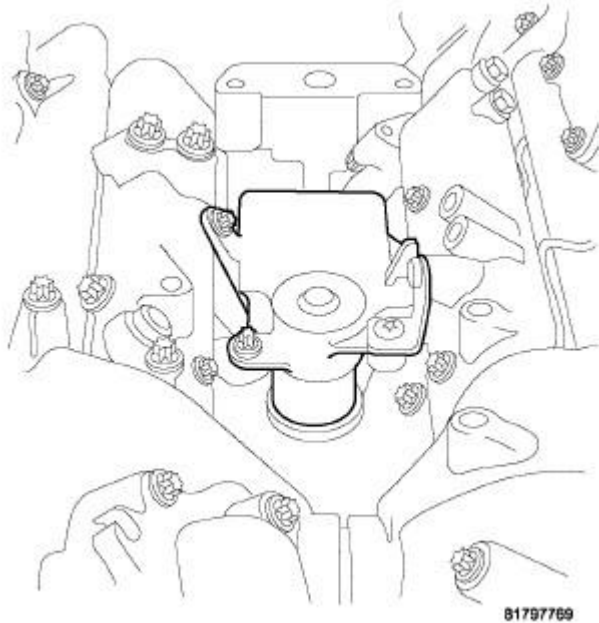
Fig. 405: INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - EGR COOLANT PIPE
2 - COOLANT TEMPERATURE SENSOR
3 - INTAKE COOLANT PASSAGE
4 - INTAKE MANIFOLD |
|---|

1. Properly position the intake manifold gasket and install the intake manifold.

CAUTION: The right intake manifold upper thermostat housing bolts should be tightened to 8.4 N.m (74 in. lbs.).

2. Tighten bolts to 16 N.m (142 in. lbs.), starting in the middle and tightening in a cross pattern outward until reaching the upper thermostat bolts on the right front manifold.
3. Tighten the upper thermostat bolts on the right cylinder head to 8.4 N.m (74 in. lbs.).



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Fig. 406: SWIRL VALVE ACTUATOR**Courtesy of CHRYSLER LLC**

4. Install the fuel filter.
5. Position and install the fuel filter supply and return pipe harness.
6. Position and install the fuel injector return fuel hose harness.
7. Position and properly route the engine wiring harness.
8. Install the left fuel rail. Tighten bolts to 27 N.m (20 ft. lbs.).

NOTE: **Inspect the fuel lines, especially around the barrel ends for damage.
Replace as necessary.**

9. Install the fuel rail transfer line along with the right fuel rail. Tighten fuel rail bolts to 27 N.m (20 ft. lbs.), and fuel pipe to 33 N.m (24 ft. lbs.).
10. Install the fuel injector high pressure lines. Tighten lines to 27 N.m (20 ft. lbs.).
11. Connect the swirl valve motor electrical connector.

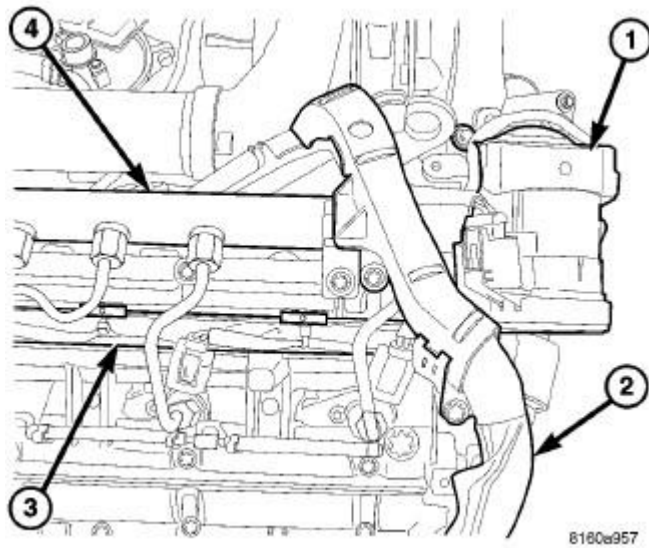


Fig. 407: EGR VALVE WITH MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - EXHAUST GAS RECIRCULATION (EGR) VALVE
2 - MAIN ENGINE WIRING HARNESS
3 - FUEL INJECTOR WIRING HARNESS
4 - LEFT FUEL RAIL |
|---|

12. Connect the EGR and EGR temperature sensor wiring harness connectors.
13. Connect the coolant hose at the EGR housing.
14. Install the EGR tube to the EGR housing.

CAUTION: Observe the positioning of the oil housing to block gasket. This gasket must be attached to the housing and both oil passages aligned properly. Failure to do so will result in immediate turbocharger damage upon start up.

15. Install the turbocharger oil housing adaptor.
16. Install the turbocharger. See **Installation**.
17. Install the right rear engine cover bracket and connect the transmission oil level indicator tube.
18. Install the charge air outlet tube.
19. Install the EGR air control valve assembly.
20. Install the glow plug module.

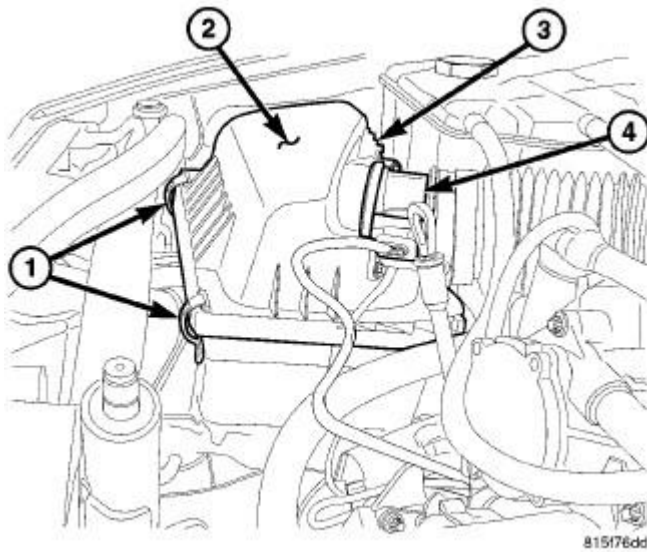


Fig. 408: AIR CLEANER COVER
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - SPRING CLIPS
2 - COVER
3 - AIR PRESSURE SENSOR
4 - MAF SENSOR |
|--|

21. Install the air cleaner cover and air inlet tube.
22. Install the engine cover.
23. Install the strut tower support.
24. Fill the engine with coolant.
25. Connect the negative battery cable.

WARNING: High-pressure fuel lines deliver fuel under extreme pressure from the injection pump to the injectors. This may be as high as 1600 bar (23,200 psi). Use extreme caution when inspecting for high-pressure fuel leaks. Inspect high-pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system. Fuel under this amount of pressure can penetrate skin causing serious or fatal injury.

26. Start the engine, allow to warm, turn the engine off and inspect for leaks.

TURBOCHARGER SYSTEM

COOLER AND HOSES, CHARGE AIR

Description

DESCRIPTION

The charge air system consists of the charge air cooler and charge air cooler piping.

The charge air cooler is a heat exchanger that uses air flow from vehicle motion to dissipate heat from the intake air. As the turbocharger increases air pressure, the air temperature increases. Lowering the intake air temperature increases engine efficiency and power.

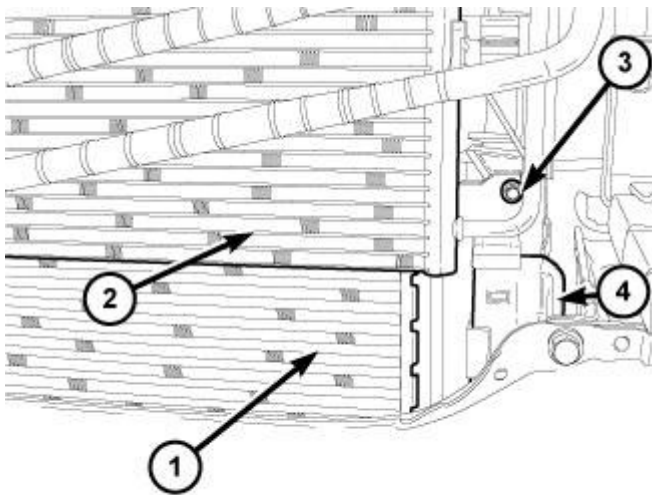
Operation

OPERATION

Intake air is drawn through the air cleaner and into the turbocharger compressor housing. Pressurized air from the turbocharger then flows forward through the charge air cooler located in front of the radiator. From the charge air cooler the air flows back into the intake manifold.

Removal

CHARGE AIR COOLER



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Fig. 409: CHARGE AIR COOLER & RADIATOR BOLT
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Disconnect the AGM starter negative battery cable located inside the vehicle under the instrument panel near the accelerator pedal. Refer to **Electrical - Engine Systems/Battery System - Standard Procedure**.
3. Drain the cooling system. Refer to **Cooling - Standard Procedure**.
4. Remove the air box assembly. See **Removal**.
5. Remove the front bumper. Refer to **Frame and Bumpers/Bumpers/BUMPER, Front - Removal**.

6. Remove the grille. Refer to **Body/Exterior/GRILLE - Removal** .
7. Remove the headlamp support panel located below the headlamps. Refer to **Body/Exterior/GRILLE - Removal** .
8. Remove the A/C condenser fan. Refer to **Heating and Air Conditioning/Plumbing/FAN, A/C Condenser - Removal** .
9. Remove the upper radiator air seal.
10. Remove the upper radiator hose at the radiator.
11. Remove the lower radiator air seals (4).
12. Remove the viscous fan assembly. Refer to **Cooling/Engine/FAN, Cooling - Removal** .
13. Disconnect the charge air hoses at charge air cooler (1).
14. Remove the charge air cooler (1) to radiator bolt (3) located on the driver side of the vehicle.

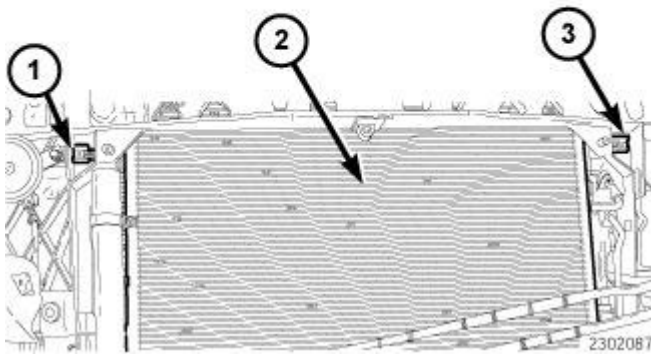
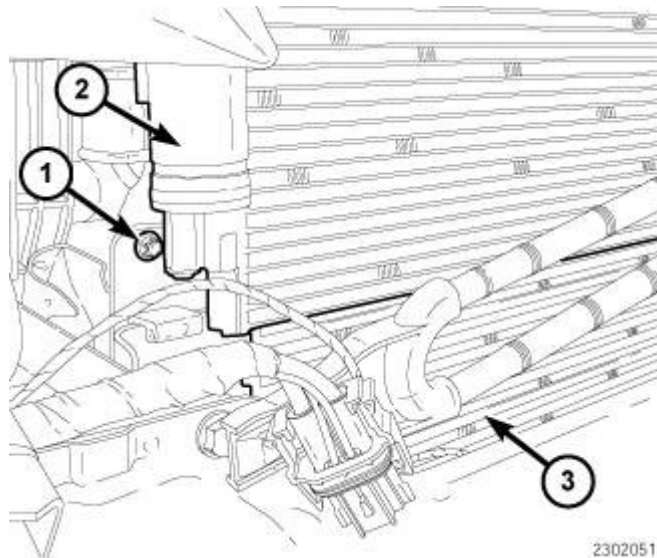


Fig. 410: UPPER RADIATOR RETAINING CLIPS
Courtesy of CHRYSLER LLC

15. Disengage the upper radiator retaining clips (1, 3).

**Fig. 411: RADIATOR/CONDENSER ASSEMBLY**

Courtesy of CHRYSLER LLC

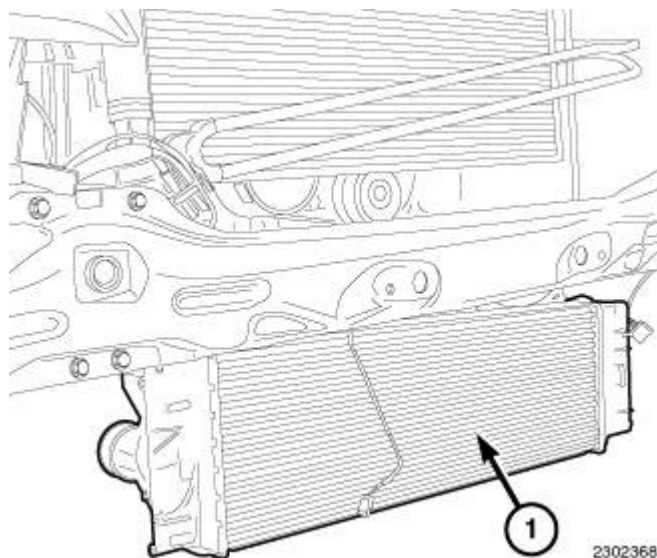
16. Slightly tilt the radiator/condenser assembly (2) back towards the rear of the vehicle.

CAUTION: DO NOT crimp or bend lines.

17. Partially separate the A/C condenser (2) from the radiator by pushing the A/C condenser up.

NOTE: DO NOT completely remove the A/C condenser.

18. Remove the charge air cooler to radiator bolt (1) located on the passenger side of the vehicle.

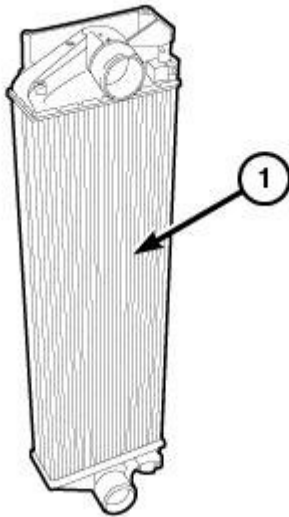
**Fig. 412: CHARGE AIR COOLER**

Courtesy of CHRYSLER LLC

19. Remove the charge air cooler (1) from the radiator assembly by pulling straight down.

Cleaning

CLEANING



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Fig. 413: CHARGE AIR COOLER
Courtesy of CHRYSLER LLC

CAUTION: Do not use caustic cleaners to clean the charge air cooler. Damage to the charge air cooler will result.

NOTE: If internal debris cannot be removed from the cooler, the charge air cooler **MUST** be replaced.

1. If the engine experiences a turbocharger failure or any other situation where oil or debris get into the charge air cooler, the charge air cooler (1) must be cleaned internally.
2. Position the charge air cooler (1) so the inlet and outlet tubes are vertical.
3. Flush the charge air cooler (1) internally with solvent in the direction opposite of normal air flow.
4. Shake the charge air cooler (1) and lightly tap on the end tanks with a rubber mallet to dislodge trapped debris.
5. Continue flushing until all debris or oil are removed.
6. Rinse the charge air cooler (1) with hot soapy water to remove any remaining solvent.
7. Rinse thoroughly with clean water and blow dry with compressed air.

Inspection

INSPECTION

Visually inspect the charge air cooler for cracks, holes, or damage. Inspect the tubes, fins, and welds for tears, breaks, or other damage. Replace the charge air cooler if damage is found.

Installation

CHARGE AIR COOLER

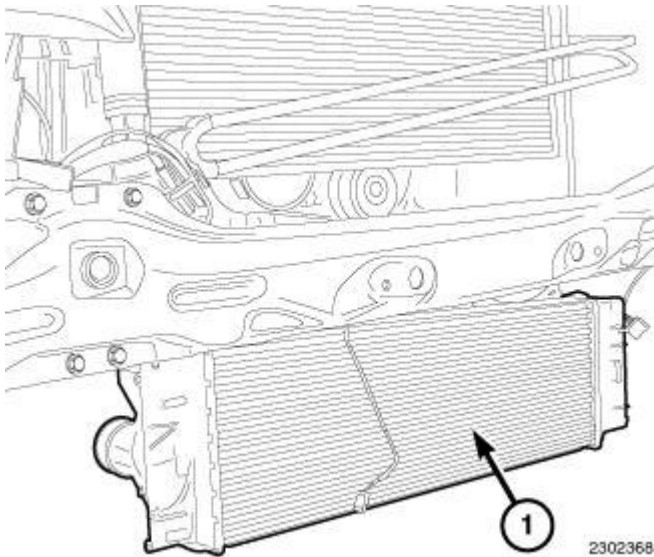


Fig. 414: CHARGE AIR COOLER

Courtesy of CHRYSLER LLC

1. Position the charge air cooler (1) to the radiator. Secure the charge air cooler (1) in place with a cord or strap.

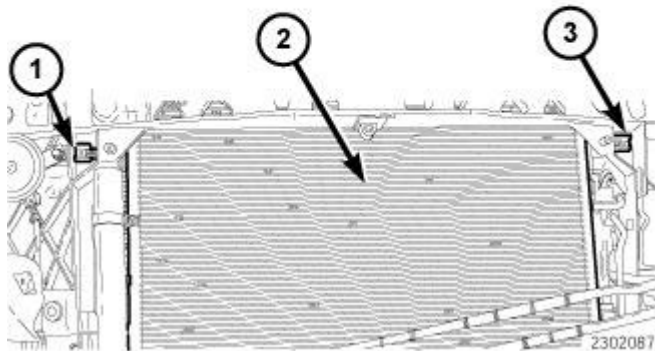


Fig. 415: UPPER RADIATOR RETAINING CLIPS

Courtesy of CHRYSLER LLC

2. Disengage the upper radiator retaining clips (1, 2).

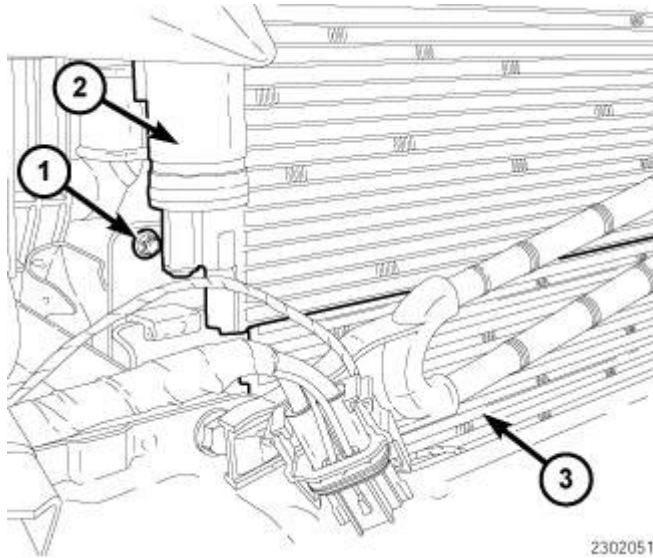


Fig. 416: RADIATOR/CONDENSER ASSEMBLY
Courtesy of CHRYSLER LLC

3. Slightly tilt the radiator/condenser assembly back towards the rear of the vehicle.

CAUTION: DO NOT crimp or bend lines.

4. Partially separate the A/C condenser (2) from the radiator by pushing the A/C condenser (2) up.
5. Install the charge air cooler to radiator bolt (1) located on the passenger side of the vehicle. Tighten the bolt to 8 N.m (71 in. lbs.).
6. Engage the upper radiator clips. **Ensure that both clips lock into place.**

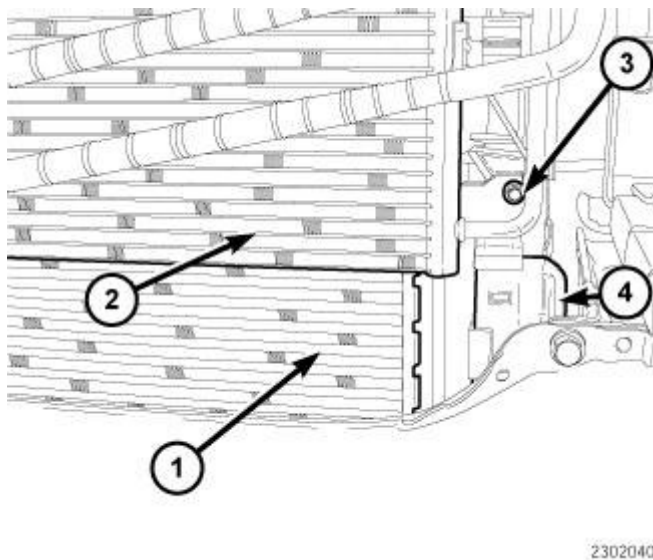


Fig. 417: CHARGE AIR COOLER & RADIATOR BOLT
Courtesy of CHRYSLER LLC

7. Install the charge air cooler (1) to radiator bolt (3) located on the driver side of the vehicle. Tighten the bolt to 8 N.m (71 in. lbs.).
8. Connect the charge air cooler (1) hoses.
9. Install the viscous fan assembly. Refer to **Cooling/Engine/FAN, Cooling - Installation** .
10. Install the lower radiator air seals (4).
11. Install the upper radiator hose at the radiator.
12. Install the upper radiator air seal.
13. Install the A/C condenser fan. Refer to **Heating and Air Conditioning/Plumbing/FAN, A/C Condenser - Installation** .
14. Install the headlamp support panel located below the headlamps. Refer to **Body/Exterior/GRILLE - Installation** .
15. Install the grille. Refer to **Body/Exterior/GRILLE - Installation** .
16. Install the front bumper. Refer to **Frame and Bumpers/Bumpers/BUMPER, Front - Installation** .
17. Install the air box assembly. See **Installation**.
18. Fill the cooling system. Refer to **Cooling - Standard Procedure** .
19. Connect the AGM starter negative battery cable located inside the vehicle under the instrument panel near the accelerator pedal. Refer to **Electrical - Engine Systems/Battery System/BATTERY - Standard Procedure** .
20. Connect the negative battery cable.
21. Start engine and check for leaks. Refer to **Cooling - Diagnosis and Testing** . See **Diagnosis and Testing**.

POSITIONER, BOOST PRESSURE

Description

DESCRIPTION

The turbocharger boost pressure positioner is located under the turbocharger housing and is responsible for controlling turbocharger boost pressure. It controls the boost pressure by varying the position of the guide vanes. The turbocharger boost pressure positioner operates in response to a PWM signal from the ECM.

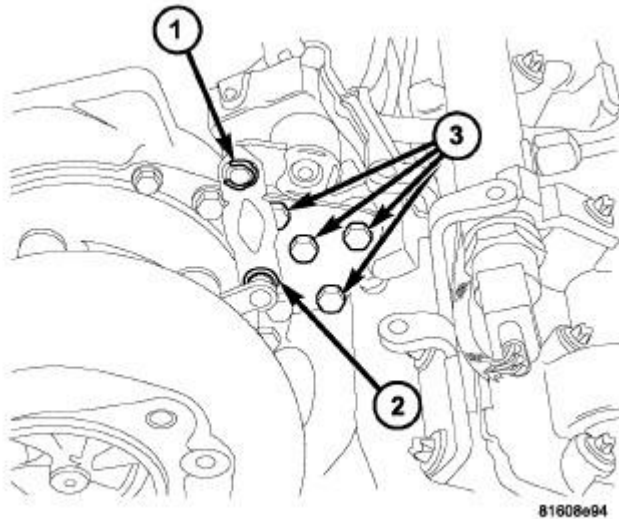
Operation

OPERATION

The boost pressure positioner receives a PWM signal from the ECM.

At low speed, the boost pressure regulator reduces the flow cross-section of the guide vanes. The speed at which the exhaust gas impacts on the turbine wheel is increased, as a result of which the speed of the turbocharger and thus the charge pressure rises.

At high engine, the boost pressure positioner increases the flow cross-section of the guide vanes. The speed at which the exhaust gas impacts on the turbine wheel is reduced, as a result of which the speed of the turbocharger reduces and the charge pressure drops.

Removal**REMOVAL****Fig. 418: BOOST PRESSURE POSITIONER AND ACTUATOR ROD****Courtesy of CHRYSLER LLC**

1. Disconnect the negative battery cable.
2. Remove the air cleaner housing.
3. Remove the turbo heat shield.
4. Remove circlip from actuator rod at turbocharger end (2).
5. Remove mounting bolts and remove boost pressure positioner and actuator rod (3).
6. Remove circlip and actuator rod from boost pressure positioner (1).

Installation**INSTALLATION**

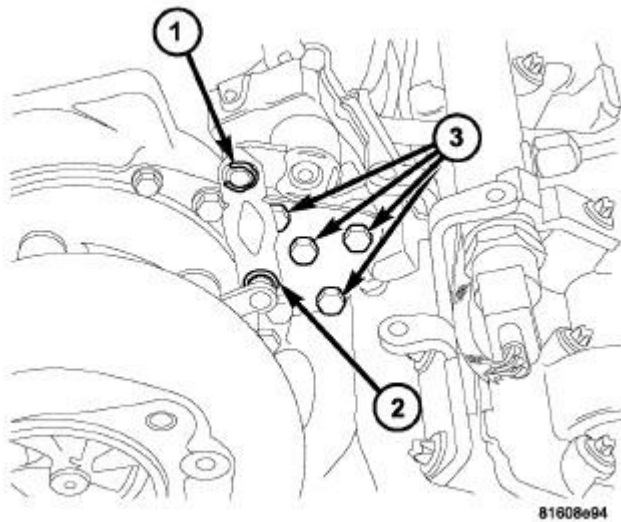


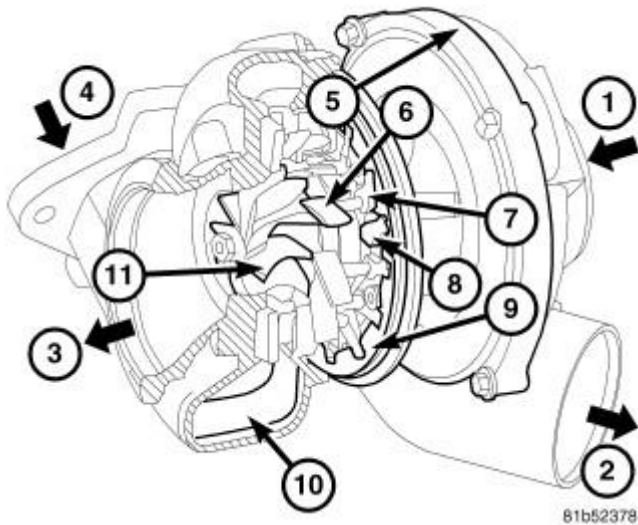
Fig. 419: REMOVING/INSTALLING SERVOMOTOR
 Courtesy of CHRYSLER LLC

1. Install actuator rod onto boost pressure positioner (4).
2. Install circlip (1).
3. Position boost pressure positioner and actuator rod onto turbocharger (5).
4. Install mounting bolts (3). Tighten bolts to 8 N.m (70 lbs. in).
5. Install circlip on the actuator rod at the turbocharger end (2).
6. Connect electrical connector (6).
7. Install the turbo heat shield.
8. Connect negative battery cable.
9. Install air cleaner housing.
10. Connect negative battery cable.

TURBOCHARGER

Description

DESCRIPTION

**Fig. 420: TURBOCHARGER - 3.0L DIESEL**

Courtesy of CHRYSLER LLC

1 - COMPRESSOR INLET (FRESH AIR)
2 - COMPRESSOR OUTLET
3 - EXHAUST OUTLET
4 - EXHAUST GAS TO TURBINE WHEEL
5 - COMPRESSOR HOUSING
6 - GUIDE VANE
7 - GUIDE VANE PILOT STUD
8 - CONTROL ROD PILOT STUD
9 - ADJUSTING RING
10 - TURBINE HOUSING
11 - TURBINE WHEEL

CAUTION: The turbocharger is a performance part and must not be tampered with. The boost pressure bracket is an integral part of the turbocharger. Tampering with the boost pressure components can reduce durability by increasing cylinder pressure and thermal loading due to incorrect inlet and exhaust manifold pressure. Poor fuel economy and failure to meet regulatory emissions laws may result. Increasing the turbocharger boost **WILL NOT** increase engine power.

The turbocharger is located between the cylinder heads at the rear of the engine.

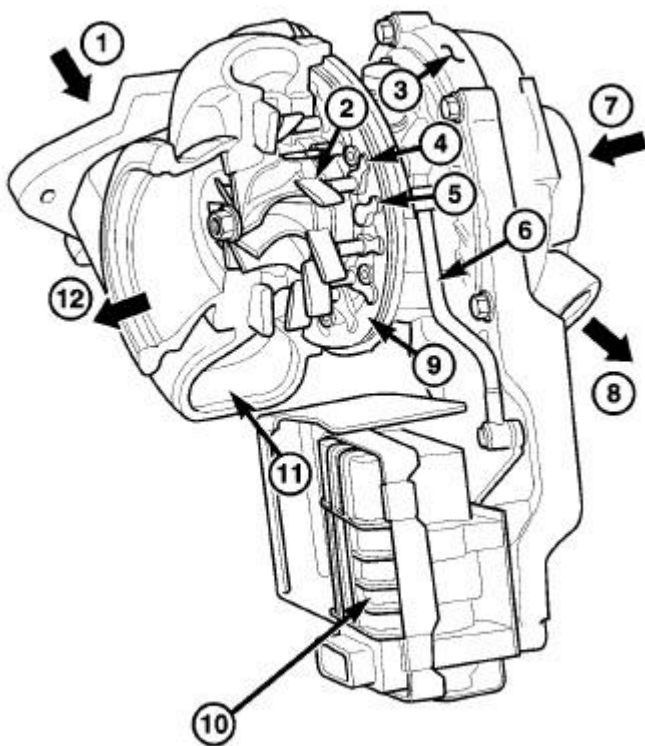
The turbocharger used on this vehicle is of the variable turbine type. These turbochargers use the entire exhaust energy to boost efficiency of the turbocharger and the engine.

The advantages of a turbocharger with variable turbine geometry are:

- Higher charge pressure already in the lower and in upper engine speed ranges.
- Higher torque as a result of improved cylinder charge.
- Reduction in exhaust emissions as a result of an improvement in the air supply of the engine.
- Increased power output as a result of the higher charge pressure combined with a reduced exhaust back pressure and thus improved charge cycle.

Operation

OPERATION



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Fig. 421: TURBOCHARGER COMPONENTS

Courtesy of CHRYSLER LLC

- 1 - EXHAUST GASES TO TURBINE WHEEL
- 2 - GUIDE VANE
- 3 - COMPRESSOR HOUSING
- 4 - GUIDE STUD OF GUIDE VANE
- 5 - GUIDE STUD OF CONTROL LINKAGE

- 6 - CONTROL LINKAGE
- 7 - TURBO INLET (FRESH AIR)
- 8 - TURBO OUTLET (COMPRESSED AIR)
- 9 - ADJUSTING RING
- 10 - BOOST PRESSURE CONTROL UNIT
- 11 - TURBINE HOUSING
- 12 - EXHAUST OUTLET

The exhaust gases of the engine are directed through the exhaust manifold into the turbine housing onto the turbine wheel. The flow energy of the exhaust gases cause the turbine wheel to rotate. As a result, the compressor wheel, which is connected through the turbine shaft with the turbine wheel, is driven at the same speed. The fresh air inducted by the compressor wheel is compressed and passed to the engine.

The charge pressure is controlled by varying the position of the guide vanes. The guide stud of the control linkage of the boost pressure actuator turns the adjusting ring in the turbine housing. As a result, all the guide vanes whose guide studs likewise mesh into the adjusting ring, are also turned.

At low speeds, the flow cross-section is reduced by closing the guide vanes. As a result, the speed at which the exhaust gas impacts on the turbine wheel is increased, as a result of which the speed of the turbocharger and thus the boost pressure rises.

At high engine speeds the guide vanes are increasingly opened and the flow cross-section is thus enlarged, as a result of which the speed of the turbocharger reduces and the boost pressure drops.

Diagnosis and Testing

TURBOCHARGER

The turbocharger, charge air cooler and exhaust gas recirculation systems operate with one another and must be tested as a complete system. It is important that all components of the air intake system be thoroughly tested any time a symptom is present for one of these components.

It is typical to notice a small amount of engine oil in the air intake system. This comes from the crankcase ventilation and may weep out of hose connections that are not clamped properly. This does not mean that the turbocharger requires replacement.

If DTC's or the performance of the vehicle lead to the determination that the boost pressure and/or mass air flow values are out of range, the systems listed should be inspected.

NOTE: **Also a continuous air leak may result in an intermittent symptom. The ECM monitors the sensor readings continuously but only sets a DTC or reduces the engine torque when these readings are outside of the tolerances, which may occur under certain driving conditions.**

Inspect the following:

- Air intake system plumbing: Loose or broken hoses or fittings may create an air leak resulting in a loss of

pressure and mass air flow. (A smoke machine does not create enough pressure to find a leak in the air intake system).

- Turbo Resonator: Inspect the resonator (muffler, connected to the turbocharger) for air leaks at the seam between the two shells.
- Charge Air Cooler: A charge air cooler damaged by tools or external debris may leak air.
- Exhaust Gas Recirculation (EGR) valve: A sticking EGR valve influences the mass air flow causing implausibility with MAF, which displays one or more DTC's. Don't replace the EGR valve if no DTC's are present. Use the actuator test in scan tool to move the EGR valve at idle speed. The MAF value should alternate between 500 to 600 mg/strk at 5% ratio (almost closed) and 200 to 300 mg/strk at 95% ratio (almost opened) when the "EGR Positioner" is being actuated by scan tool.
- Mass Air Flow Sensor (MAF): The mass air flow, measured and provided by the MAF is critical for calculations performed by the ECM and may result in several DTC's related to the air intake system if not accurate.
- Boost Pressure Sensor.
- Turbocharger: See **TURBOCHARGER DIAGNOSTIC PROCEDURE**. Consider that an operating turbocharger creates a flow sound, which is normal and does not require replacement. Other sounds like whistling are potentially caused by the resonator or improper line connections.

TURBOCHARGER DIAGNOSTIC PROCEDURE

1. Visually inspect all the blades of the turbocharger compressor and turbine wheel for damage which may have been caused by foreign particles. For example if the air filter was improperly installed or an incorrect air filter was installed.
2. Start the engine and let it run at idle speed. Perform the actuator test using the scan tool. The connecting rod of the actuator should move back and forth when the "Boost Pressure Sol" is being actuated by scan tool in short intervals. Also note that the values for both MAF and Boost Pressure should alternate slightly if both sensors work properly.

CAUTION: Do NOT try to move the actuator mechanism by pushing or pulling the connecting rod. There is a worm gear attached to the actuator mechanism, which doesn't allow any movement from its output side.

3. If the actuator mechanism doesn't move at all check power and ground supply of the actuator.
4. If the actuator mechanism doesn't move even though the electrical connection has been verified or moves erratically the turbocharger is defective and must be replaced as an entire assembly.

Removal

TURBOCHARGER

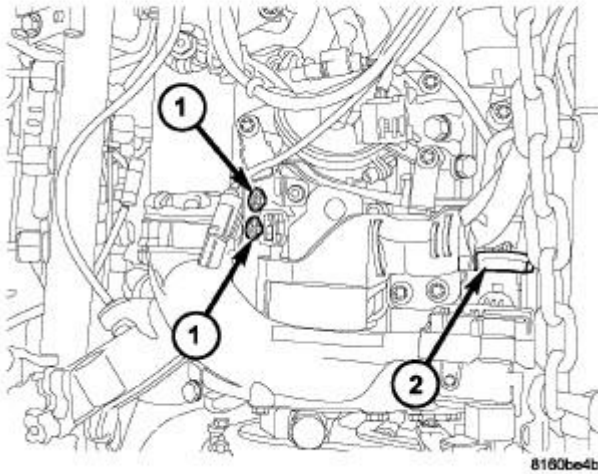


Fig. 422: TURBOCHARGER
Courtesy of CHRYSLER LLC

NOTE: When servicing the air charge cooler and/or the turbocharger, the air charge hose seal (orange seal) located between the air charge hose and the turbocharger must be replaced.

WARNING: The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it is cool. Care should be taken when working near the turbocharger. The temperature of the turbocharger rises to a high level after a short period of engine operation time.

NOTE: There is no procedure for repairing the turbocharger. If damage is found during inspection, the turbocharger must be replaced.

1. Disconnect the negative battery cable.
2. Disconnect the AGM starter negative battery cable located inside the vehicle under the instrument panel near the accelerator pedal. Refer to Electrical - Engine Systems/Battery System - Standard Procedure.
3. Remove the air box assembly. See Removal.
4. Remove the oil extension filler tube.
5. Remove the engine trim cover. See Removal.
6. Remove the air intake tube (turbocharger to resonator).
7. Remove the turbocharger heat shield.
8. Remove the turbocharger front bracket retaining bolts (1).

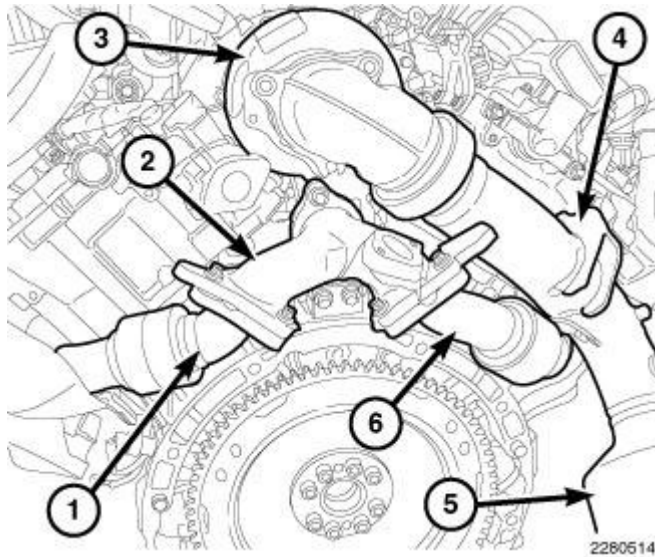


Fig. 423: EXHAUST MANIFOLD & TURBOCHARGER MANIFOLD
Courtesy of CHRYSLER LLC

9. Remove the EGR tube at manifold to cylinder head. Refer to **Emissions Control/Exhaust Gas Recirculation/TUBE, Exhaust Gas Recirculation (EGR) - Removal** .
10. Remove the catalytic converter (5). Refer to **Exhaust System/CONVERTER, Catalytic - Removal** .
11. Raise and secure the vehicle, remove the front splash shield.
12. Disconnect the transmission fill tube and trim cover bracket and set aside.
13. Remove the two turbocharger manifold to support brace bolts.
14. Remove the left and right exhaust manifold (1, 6) to turbocharger manifold (2) retaining bolts and gaskets.

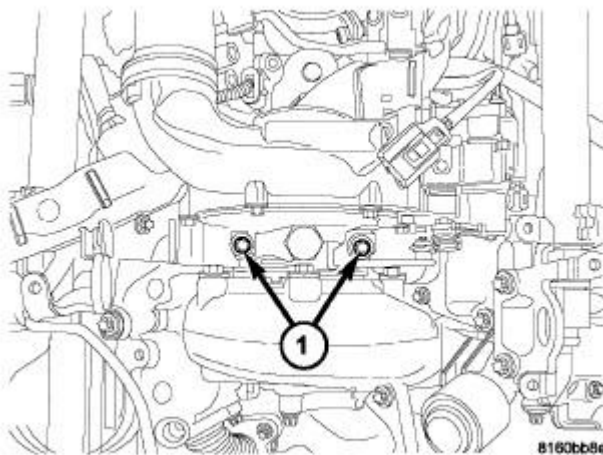


Fig. 424: TURBOCHARGER RETAINING BOLTS
Courtesy of CHRYSLER LLC

15. Lower the vehicle.
16. Disconnect the turbocharger boost pressure servo connector.
17. Remove the turbocharger retaining bolts (1).
18. Remove the turbocharger and gasket from the turbocharger oil housing adapter.

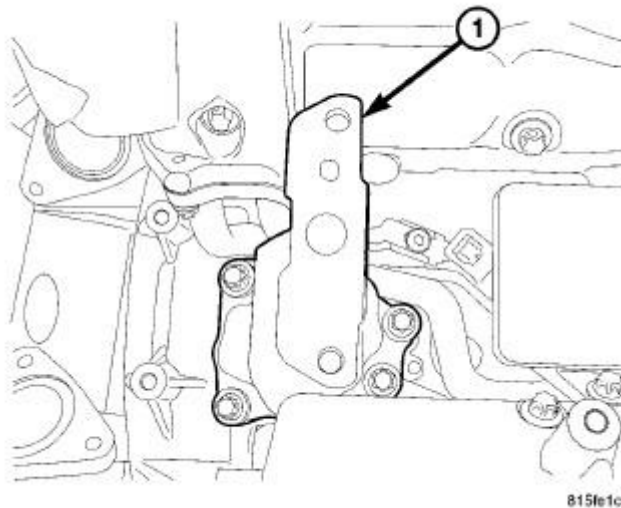


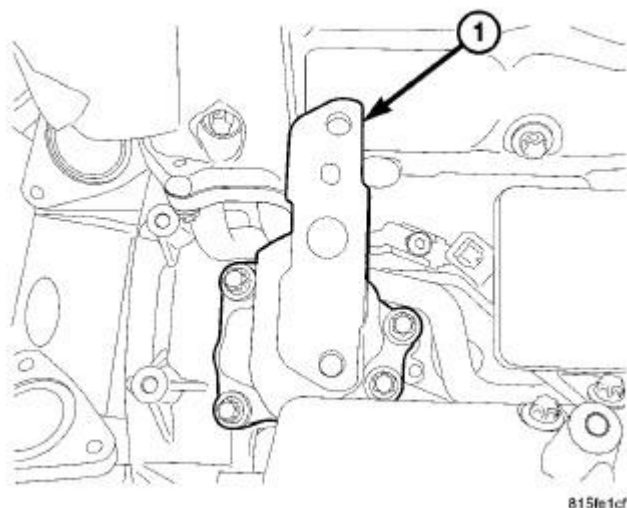
Fig. 425: TURBOCHARGER ADAPTOR

Courtesy of CHRYSLER LLC

19. Remove the turbocharger oil housing adapter (1) and gasket.
20. Remove the turbocharger from the exhaust crossover pipe.

Installation

INSTALLATION

**Fig. 426: TURBOCHARGER ADAPTOR**

Courtesy of CHRYSLER LLC

NOTE: When servicing the air charge cooler and/or the turbocharger, the air charge hose seal (orange seal) located between the air charge hose and the turbocharger must be replaced.

CAUTION: Make sure the gasket is installed properly or the turbo oil feed hole will be blocked.

1. If separated, install the turbo to the exhaust crossover pipe. Tighten the bolts to 20 N.m (15 ft. lbs.) then add another 90° of rotation.
2. Install the turbocharger oil housing gasket and adapter (1). Tighten the bolts to 10 N.m (89 in. lbs.).

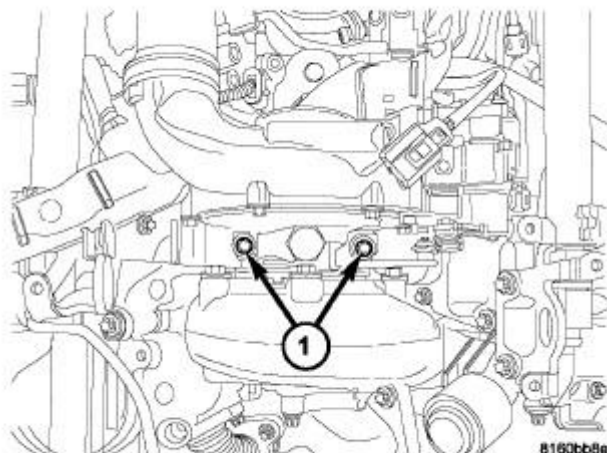


Fig. 427: TURBOCHARGER RETAINING BOLTS

Courtesy of CHRYSLER LLC

3. Position and install the front turbocharger retaining bolts (1) through the turbocharger oil housing gasket. Tighten the bolts to 10 N.m (89 in. lbs.).
4. Connect the turbocharger boost pressure servo connector.

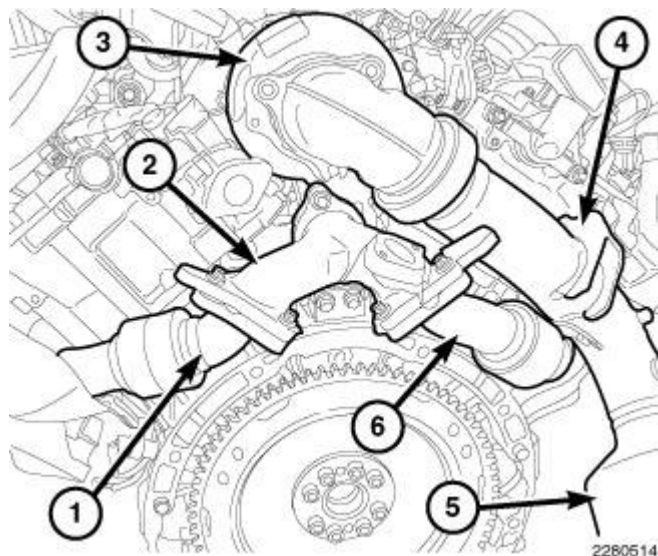


Fig. 428: EXHAUST MANIFOLD & TURBOCHARGER MANIFOLD

Courtesy of CHRYSLER LLC

5. Install the left and right exhaust manifold (1, 6) to turbocharger manifold (2) retaining bolts and gaskets. Tighten the bolts to 20 N.m (15 ft. lbs.) then add another 90° of rotation.
6. Install the two turbocharger manifold to support brace bolts. Tighten the bolts to 8 N.m (71 INCH lbs.).
7. Connect the transmission fill tube and trim cover bracket.

8. Raise and secure the vehicle.
9. Install the catalytic converter. Refer to **Exhaust System/CONVERTER, Catalytic - Installation** .

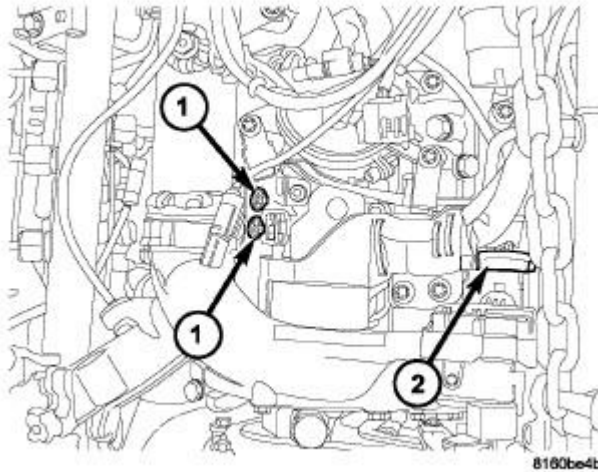


Fig. 429: TURBOCHARGER
Courtesy of CHRYSLER LLC

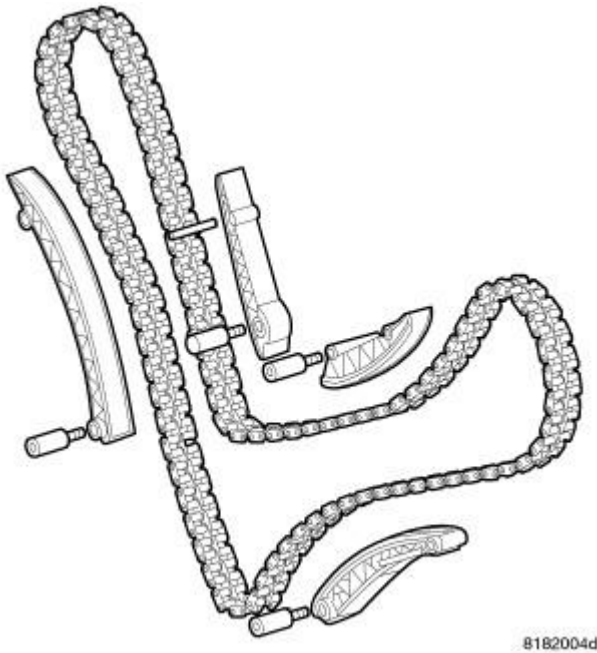
10. Install the rear EGR tube. Refer to **Emissions Control/Exhaust Gas Recirculation/TUBE, Exhaust Gas Recirculation (EGR) - Installation** .
11. Install the front splash shield.
12. Lower the vehicle and install the turbo front bracket retaining bolts (2). Tighten the bolts to 8 N.m (71 INCH lbs.).
13. Install the turbo heat shield (4). Tighten the bolts to 8 N.m (71 INCH lbs.).
14. Install air tube (turbocharger to resonator) (3). Tighten the bolt to 8 N.m (71 INCH lbs.).
15. Install the engine trim cover. See **Installation**.
16. Install the oil extension filler tube.
17. Install the air box assembly. See **Installation**.
18. Connect the AGM starter negative battery cable located inside the vehicle under the instrument panel near the accelerator pedal. Refer to **Electrical - Engine Systems/Battery System/BATTERY - Standard Procedure** .
19. Reconnect negative battery cable.

VALVE TIMING

CHAIN AND SPROCKETS, TIMING

Removal

TIMING CHAIN

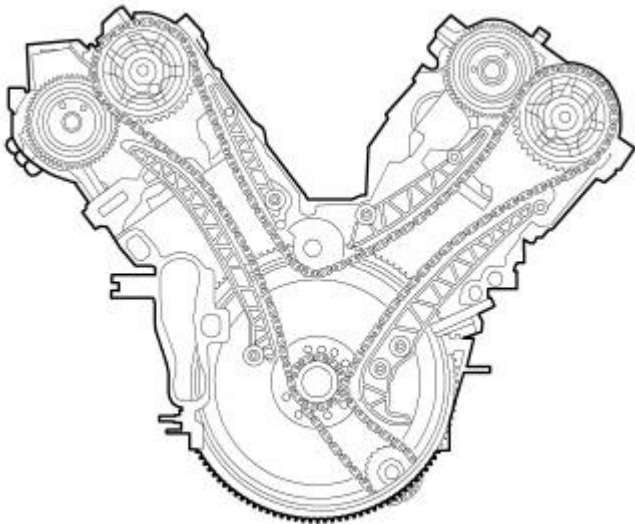


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Fig. 430: TIMING CHAIN AND GUIDES

Courtesy of CHRYSLER LLC

To check the timing chain for wear and stretch, remove the right-bank cylinder head cover and position the engine at TDC of cylinder number one. Lock the camshafts with the Locking Pins 8929. The timing marks on the camshaft gears must face each other. Rotate the engine in the direction of rotation only and do not turn back otherwise measurement errors can result. With the camshafts locked, check the position of the vibration damper. The chain stretch is measured by the number of crankshaft degrees past the TDC mark. The timing chain is OK when the belt pulley is at the marking at max. 11° after TDC with locked camshafts. Replace the timing chain has stretched beyond specifications.



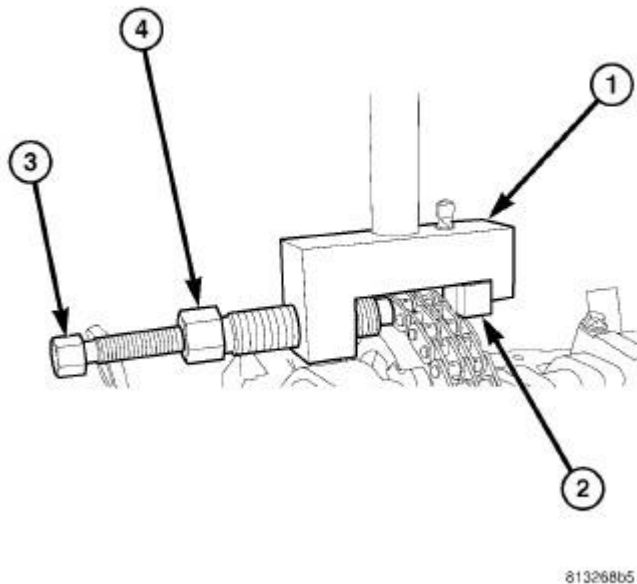
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Fig. 431: TIMING

Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable. Refer to Electrical/Battery System/CABLES, Battery - Removal.
2. Remove the right cylinder head cover. See Removal.
3. Make sure the crankshaft is turned to the TDC. Verify TDC of the crankshaft by lining up the mark on the front cover with the mark on the crankshaft damper.
4. Make sure that the timing marks on the back of the camshafts are horizontal and pointing at each other.
5. Remove the timing chain tensioner.

NOTE: Cover the timing chain area. Care must be taken not to drop any repair debris or pieces into the engine when separating the timing chain links.

**Fig. 432: SPECIAL TOOL X66 WITH INSERT**

Courtesy of CHRYSLER LLC

- | |
|---------------------------------------|
| 1 - SPECIAL TOOL #9312-1 |
| 2 - SPECIAL TOOL #9312-13 - INSERT |
| 3 - SPECIAL TOOL #9312-3 - THRUST PIN |
| 4 - SPECIAL TOOL #9312-4 - SPINDLE |

6. Install the Timing Chain Holder 9554 using two of the cylinder head cover bolts.
7. Assemble the Chain Link Remover/Installer (1) 9312A using the Thrust Pin (3) 9312-3 and Thrust Spindle (4) 9312-4. Install the Insert (2) 9312-13 and retain with screw provided.

CAUTION: Care must be taken not to drop the timing chain plates into the engine once the timing chain is separated.

NOTE: When installing the Chain Link Remover/Installer 9312A onto timing chain link, be sure to back off the smaller nut of the thrust pin 9312-3 until the pin is recessed inside of the Thrust Spindle, 9312-4. Screw the Thrust Spindle 9312-4 in until it is seated and aligned properly over the rivet of the timing chain.

NOTE: When fitting the thrust spindle, ensure that the thrust pin is positioned at the left timing chain pin of a chain link.

NOTE: Cover the timing chain area. Care must be taken not to drop any repair debris or pieces into the engine when separating the timing chain links.

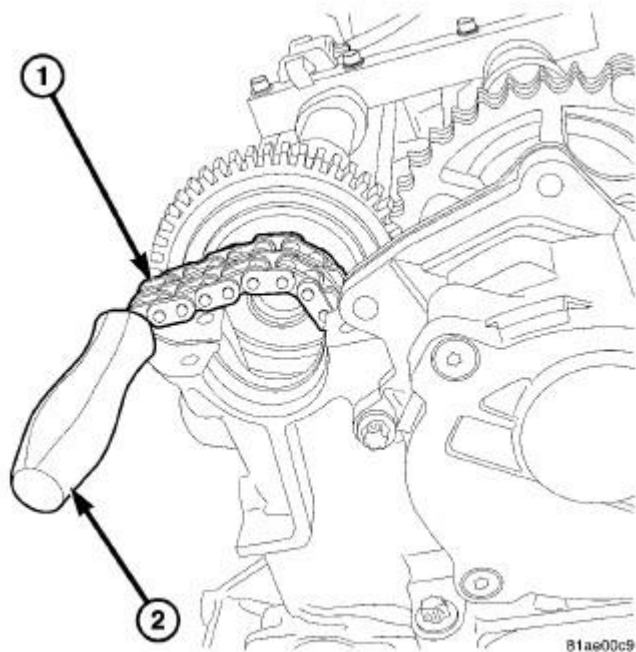


Fig. 433: PREVENT CHAIN FROM FALLING
Courtesy of CHRYSLER LLC

8. Carefully turn the thrust pin (2) 9312-13 of the Chain Link Remover/Installer (1) 9312A clockwise while holding the handle until the rivet is pressed out and the chain is separated. Discard the loose link and plates.
9. Use a small screwdriver to prevent the timing chain from slipping into the engine.

NOTE: One whole timing chain link must be removed.

CAUTION: IT IS ESSENTIAL that the installation procedure for the timing chain

is followed exactly. Failure to do so will result in severe engine damage.

TIMING CHAIN GUIDE

NOTE: When servicing the timing chain guides, both the upper and the lower guide should be replaced in pairs.

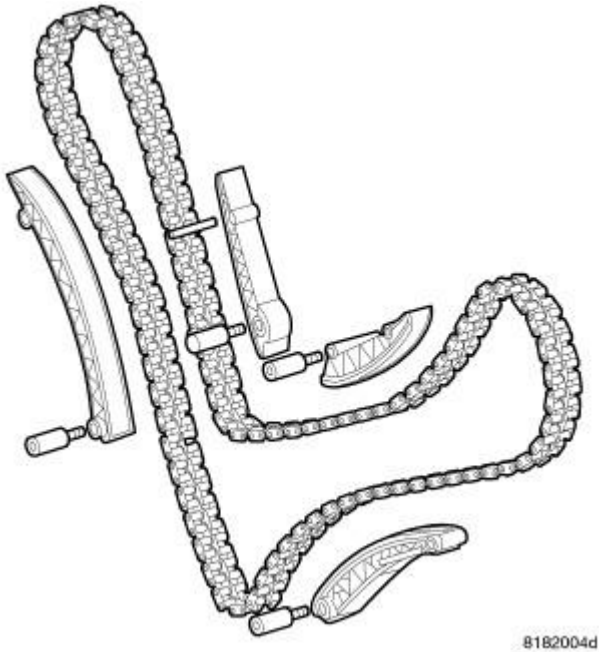
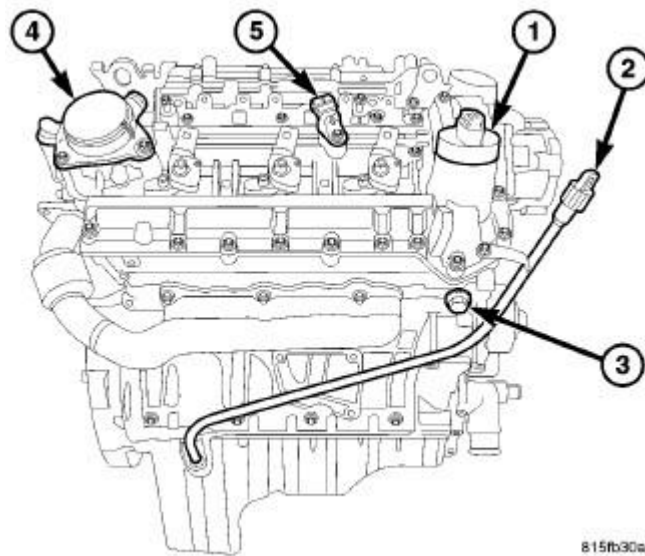


Fig. 434: TIMING CHAIN AND GUIDES
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable. Refer to Electrical/Battery System/CABLES, Battery - Removal .
2. Remove the left cylinder head cover. See Removal.
3. Remove the right cylinder head cover. See Removal.
4. Remove the timing chain cover. See Removal.

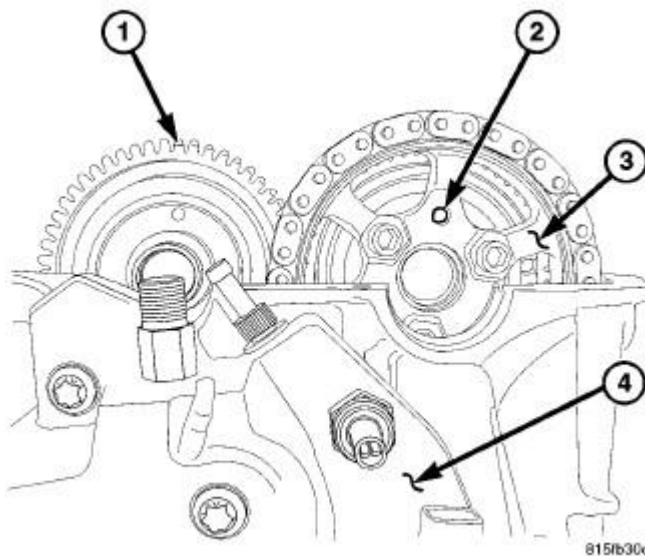


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Fig. 435: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- 1 - ENGINE OIL CAP
- 2 - OIL LEVEL INDICATOR
- 3 - TIMING CHAIN TENSIONER
- 4 - OIL SEPARATOR ASSEMBLY
- 5 - CAMSHAFT POSITION SENSOR

5. Remove the timing chain tensioner (3).



815fb30c

Fig. 436: LEFT EXHAUST CAMSHAFT DRIVE GEAR ALIGNMENT DOWEL
Courtesy of CHRYSLER LLC

- 1 - LEFT INTAKE CAMSHAFT
- 2 - LEFT EXHAUST CAMSHAFT DRIVE GEAR
ALIGNMENT DOWEL
- 3 - LEFT EXHAUST CAMSHAFT DRIVE GEAR
- 4 - HIGH PRESSURE FUEL INJECTION PUMP

6. Rotate the engine and remove the right camshaft drive gear lower bolt.
7. Rotate the engine back to TDC and check the alignment marks at the balance shaft, camshaft gear and crankshaft gear.
8. Remove the remaining right camshaft drive gear retaining bolts.
9. Separate the right camshaft drive gear and chain from camshaft.
10. Remove the right camshaft drive gear.
11. Secure the chain so that there is slack at the timing chain guides but the chain remains on the crankshaft gear.

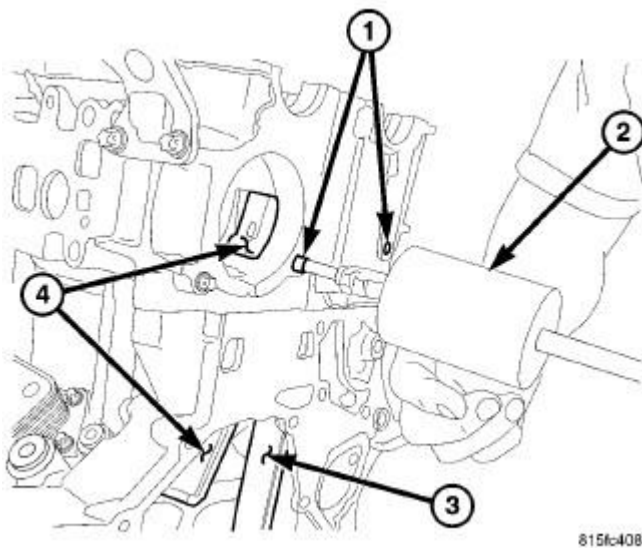


Fig. 437: LEFT UPPER TIMING CHAIN GUIDE PIN EXTRACTION
Courtesy of CHRYSLER LLC

- 1 - GUIDE PIN
- 2 - SLIDE HAMMER
- 3 - LOWER TIMING CHAIN GUIDE
- 4 - UPPER TIMING CHAIN GUIDE

12. Cut a small section of tubing, with an inner diameter of the tube that is larger than the outer diameter of the timing chain guide pin, 25 mm (1 inch) in length.
13. Place the tube over the timing chain guide pin and thread a bolt into the timing chain guide pin in the right cylinder head. Tighten the bolt until the guide pin is removed from the cylinder head.

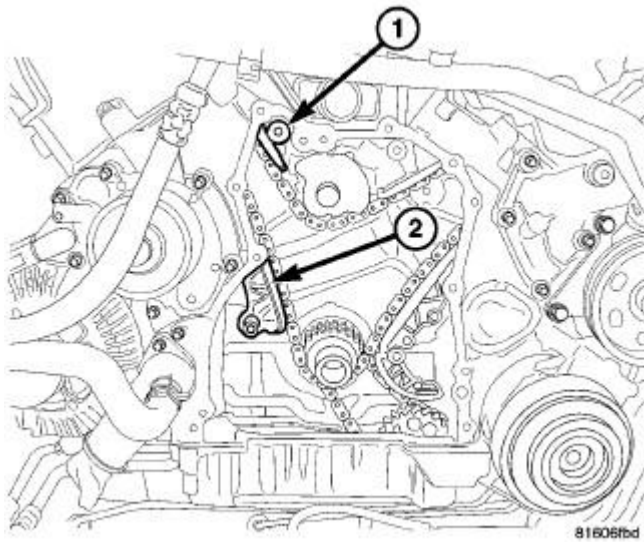


Fig. 438: RIGHT TIMING CHAIN GUIDES
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - UPPER TIMING CHAIN GUIDE
2 - LOWER TIMING CHAIN GUIDE</p> |
|--|

14. Remove the bolt for the left upper timing chain.
15. Remove the upper timing chain guide from the left cylinder head.
16. Remove the bolt for the right upper timing chain.
17. Remove the upper timing chain guide in the right cylinder head.

TIMING CHAIN TENSIONING RAIL

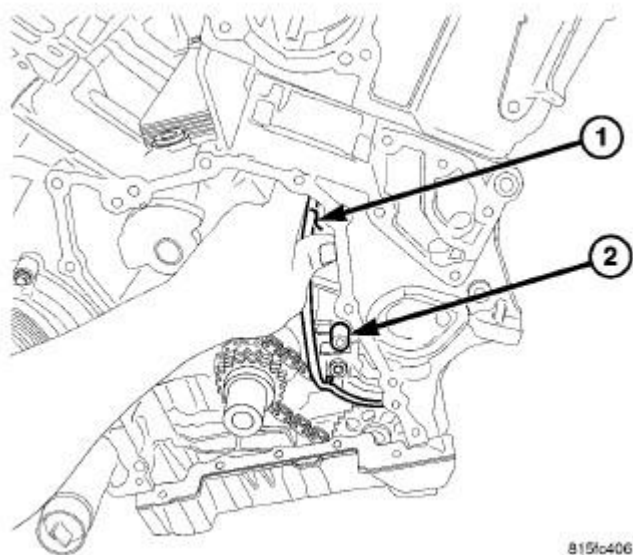


Fig. 439: LEFT LOWER TIMING CHAIN GUIDE AND FASTENER
Courtesy of CHRYSLER LLC

- 1 - LEFT LOWER TIMING CHAIN GUIDE
- 2 - FASTENER

1. Disconnect negative battery cable.
2. Remove cylinder head. See **Removal** .
3. Remove timing chain cover. See **Removal** .

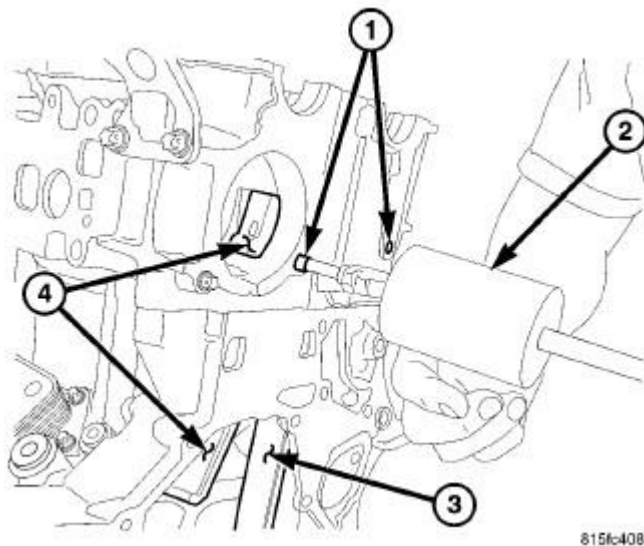


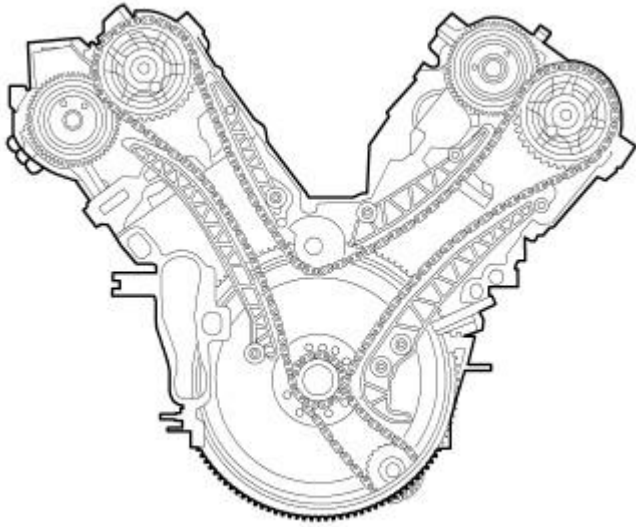
Fig. 440: LEFT UPPER TIMING CHAIN GUIDE PIN EXTRACTION
Courtesy of CHRYSLER LLC

- 1 - GUIDE PIN
- 2 - SLIDE HAMMER
- 3 - LOWER TIMING CHAIN GUIDE
- 4 - UPPER TIMING CHAIN GUIDE

4. Remove the timing chain guide pin.
5. Remove the timing chain retaining bolt.
6. Remove the timing chain tensioner.

Inspection

INSPECTION

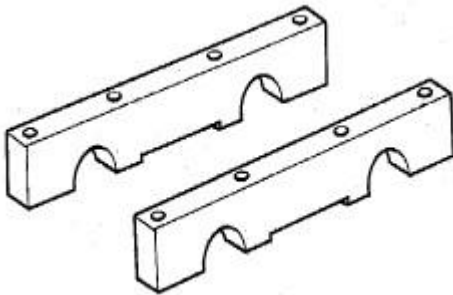


81820051

Fig. 441: TIMING

Courtesy of CHRYSLER LLC

1. Remove the left cylinder head cover. See **Removal**.
2. Remove the right cylinder head cover. See **Removal**.

**Fig. 442: RETAINER, CAMSHAFTS - 9555**

Courtesy of CHRYSLER LLC

3. Install the camshaft retainers.

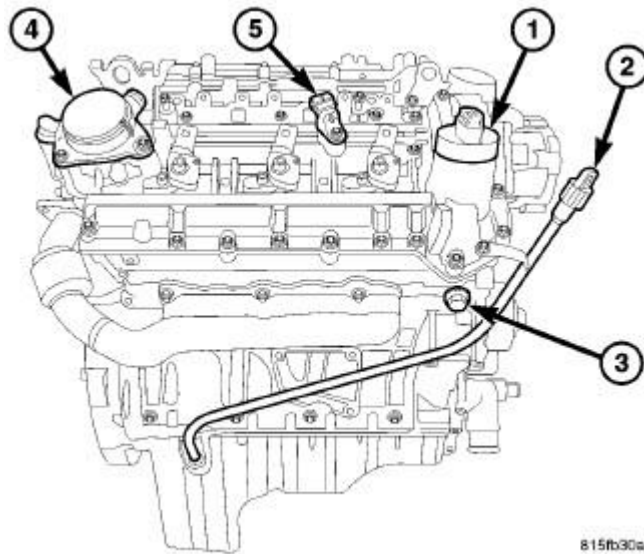
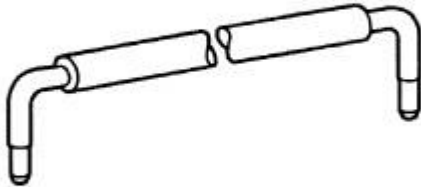


Fig. 443: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- | |
|---|
| <ul style="list-style-type: none">1 - ENGINE OIL CAP2 - OIL LEVEL INDICATOR3 - TIMING CHAIN TENSIONER4 - OIL SEPARATOR ASSEMBLY5 - CAMSHAFT POSITION SENSOR |
|---|

4. Make sure that the timing chain cover is fully seated.



80e492c7

Fig. 444: #8929 CAMSHAFT LOCKING PIN
Courtesy of CHRYSLER LLC

5. Rotate the crankshaft clockwise until the crankshaft is at TDC and the camshaft locking pins can be installed.
6. With the locking pins installed, turn the crankshaft clockwise until the timing chain is completely tight. If the marks on the crankshaft damper exceed 11 degrees, replace the timing chain.

Installation

TIMING CHAIN

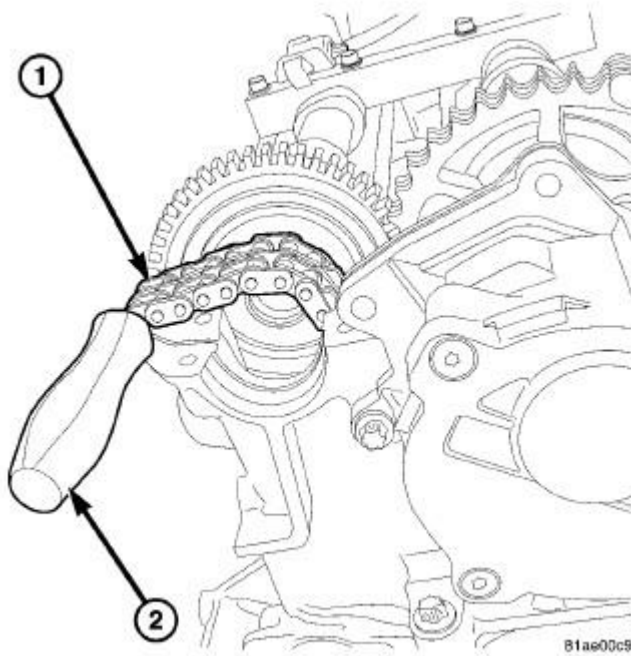


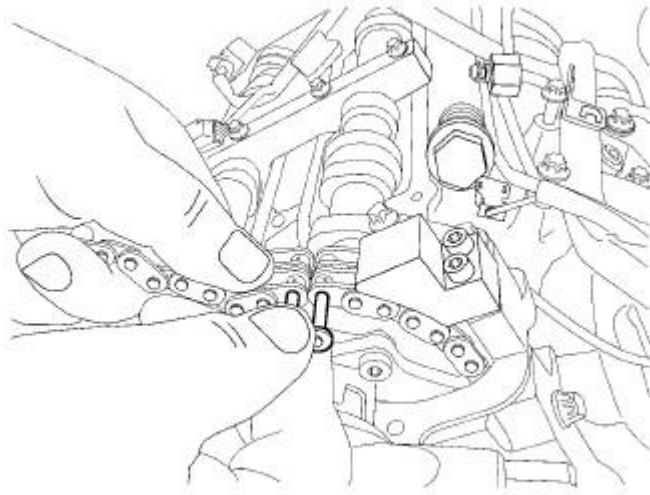
Fig. 445: PREVENT CHAIN FROM FALLING

Courtesy of CHRYSLER LLC

CAUTION: IT IS ESSENTIAL that the installation procedure is followed exactly. Failure to do so will result in severe engine damage.

CAUTION: Cover timing case recesses to prevent foreign material from entering engine.

1. Use a small screwdriver to prevent the timing chain from slipping down into the engine.

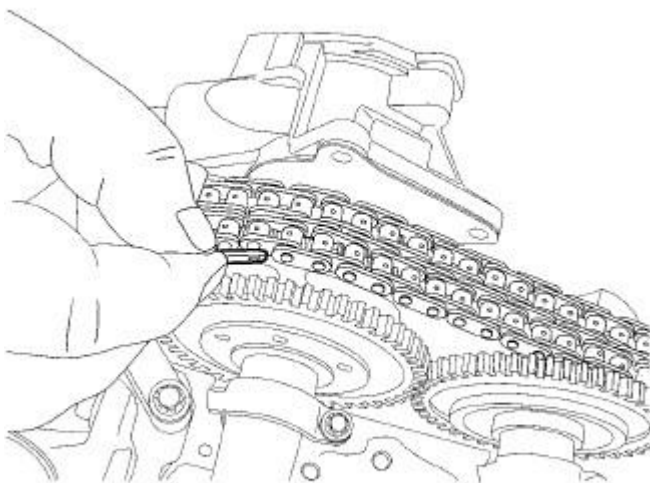


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Fig. 446: MASTER LINK
Courtesy of CHRYSLER LLC

CAUTION: Always install the new timing chain with the oil holes pointing up.
Failure to do so will result in severe engine damage.

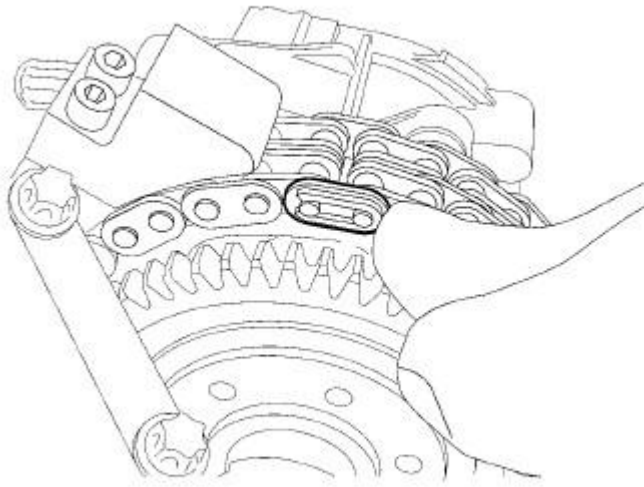
2. Connect new timing chain, oil hole side up and old timing chain with the assembly link.



81ae00bc

Fig. 447: MASTER LINK - REVERSE SIDE**Courtesy of CHRYSLER LLC**

3. Place the baking plate on the back side of the master link.



81ae00b8

Fig. 448: MASTER LINK CLIP**Courtesy of CHRYSLER LLC**

4. Place the master link clip on the master link.

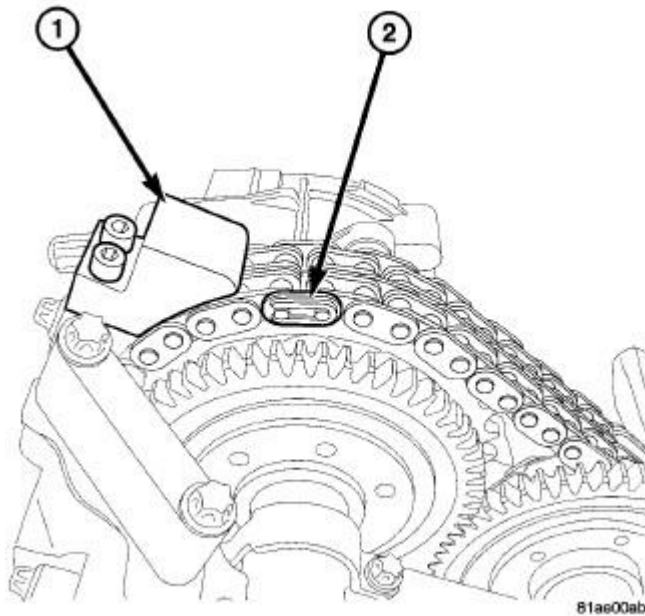


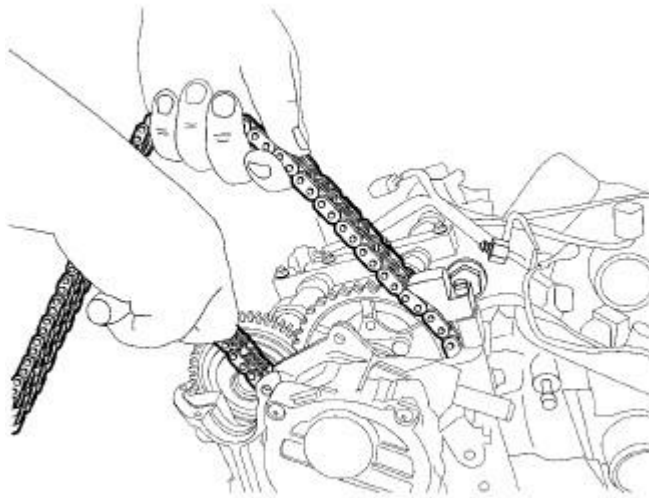
Fig. 449: MASTER LINK CLIP INSTALLED

Courtesy of CHRYSLER LLC

NOTE: Always keep new timing chain meshed with camshaft sprocket.

CAUTION: DO NOT CRANK ENGINE and DO NOT ROTATE ENGINE BACKWARD. Engine rotation is clockwise, as you are looking at the engine. Rotate engine at crankshaft only.

NOTE: With the timing cover and special tools in place, the timing chain can not jump time while being fed through the engine. As the engine is rotated the timing chain may appear to slip as the valve springs move the camshafts.



81ae00cd

Fig. 450: FEED THE CHAINS THROUGH

Courtesy of CHRYSLER LLC

NOTE: Draw out the end of old timing chain evenly as it becomes free, to the same extent that new timing chain is drawn in.

5. Draw in new timing chain with the oil holes facing up, by rotating the crankshaft slowly in direction of rotation of engine.
6. Rotate the engine until the ends of the new timing chain meet and can be connected.

NOTE: Assembly link is only an assembly aid and NOT designed for engine running.

7. Remove assembly locking element, assembly outer plate and assembly link.
8. Insert new riveted link with the oil hole up, and new middle plate into ends of timing chain using the guide link to hold the middle plate in position.

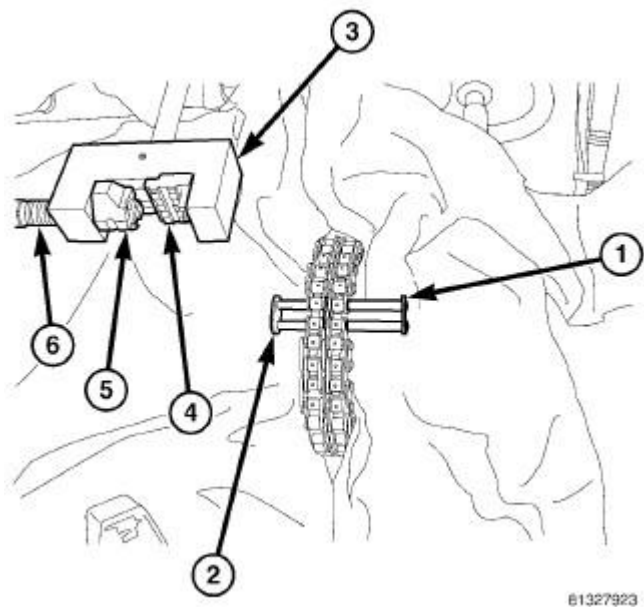
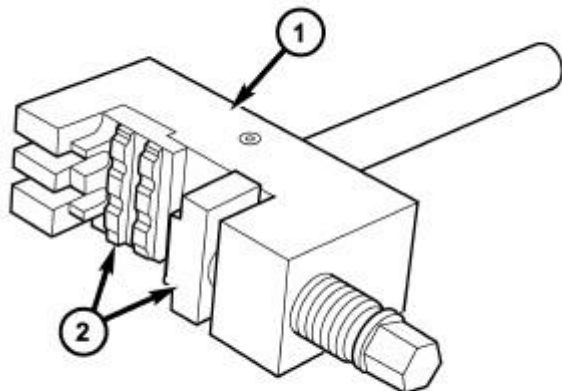


Fig. 451: INSERTING NEW TIMING CHAIN LINK
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - GUIDE LINK
2 - NEW LINK
3 - CHAIN LINK REMOVER/INSTALLER 9312A
4 - INSERT 9312-7
5 - INSERT 9312-10
6 - THRUST PIN 9312-4 |
|--|

NOTE: When assembling riveting tool, Tool Insert 9312-7 is secured by a screw and Tool Insert 9312-10 can move loosely on thrust spindle

9. Assemble riveting tool by inserting pieces 9312-7 and 931A2-10.



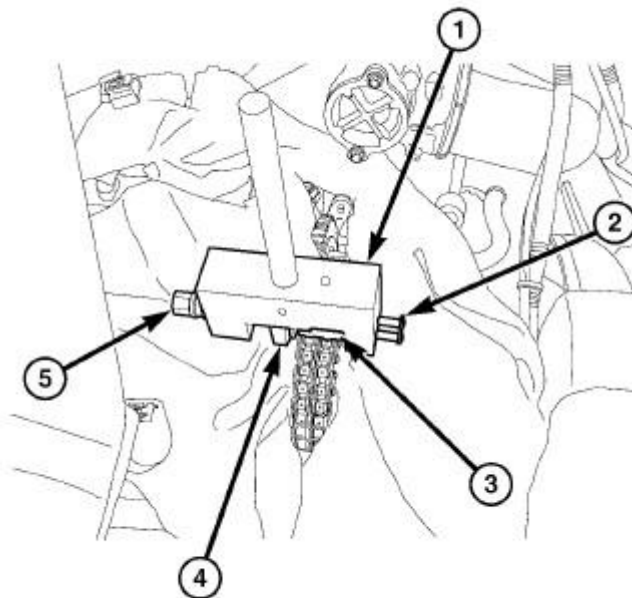
80e18a18

Fig. 452: INSTALLING ASSEMBLY INSERTS INTO RIVETING TOOL
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - CHAIN LINK REMOVER/INSTALLER 9312A
2 - INSERTS 9312-7 and 9312-10</p> |
|--|

NOTE: Make sure that the riveted link and riveting tool are aligned.

10. Press in new riveted link as far as the stop.



8132791c

Fig. 453: PRESSING THE NEW LINK

Courtesy of CHRYSLER LLC

- 1 - CHAIN LINK REMOVER/INSTALLER 9312A
- 2 - GUIDE LINK
- 3 - INSERT 9312-7
- 4 - INSERT 9312-10
- 5 - THRUST SPINDLE 9312-4

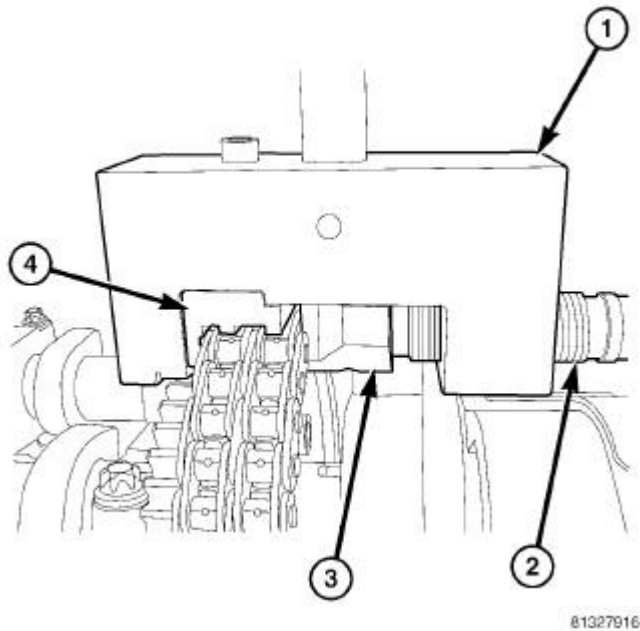
11. Remove guide link and riveting tool to change inserts.
12. Install Chain Link Remover/Installer 9312A on riveting tool.

NOTE: The outer plate is held magnetically by riveting tool.

13. Insert new outer plate into the moving assembly insert.
14. Position riveting tool so that spacer webs of the guide are side by side.
15. Ensure that riveted link and outer plate are aligned.

NOTE: When turning spindle of riveting tool, be sure that pins of riveted link are inserted into holes of outer plate

16. Screw in spindle of riveting tool until firm resistance is felt.

**Fig. 454: OUTER PLATE INSTALLATION**

Courtesy of CHRYSLER LLC

- 1 - CHAIN LINK REMOVER/INSTALLER 9312A
- 2 - THRUST SPINDLE 9312-4
- 3 - INSERT 9312-8
- 4 - INSERT 9312-6

17. Remove riveting tool.
18. Install moving assembly insert 9312-11A to 9312-1.
19. Position riveting tool exactly over middle of pin.
20. Tighten riveting tool spindle to end of travel.
21. Repeat procedure for both riveting pins.

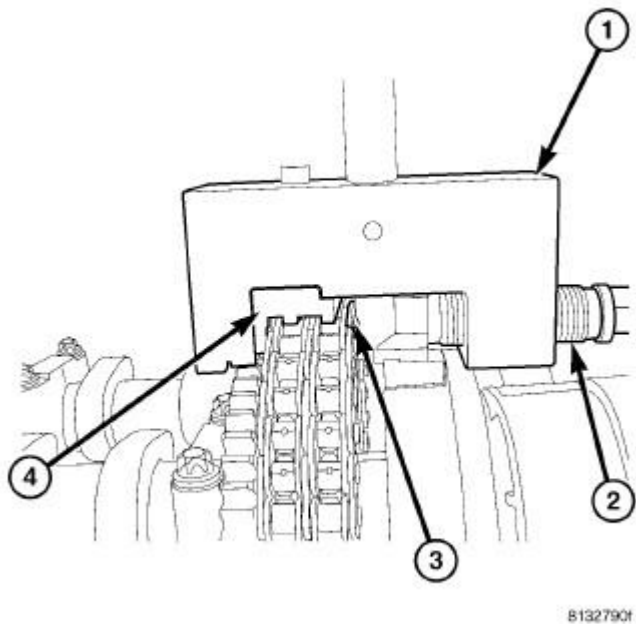
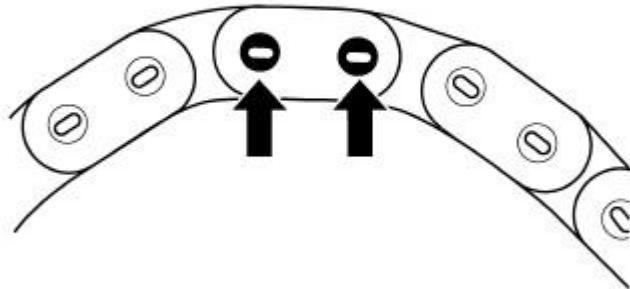


Fig. 455: RIVETING THE LINK PINS
Courtesy of CHRYSLER LLC

- 1 - CHAIN LINK REMOVER/INSTALLER 9312A
- 2 - THRUST SPINDLE
- 3 - RIVETING PROFILE
- 4 - INSERT 9312-6

22. Inspect riveting, re-rivet if required.

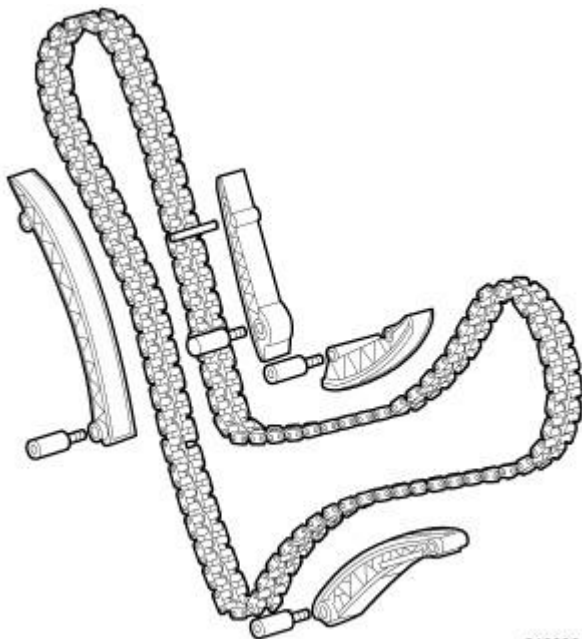


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Fig. 456: RIVET INSPECTION

Courtesy of CHRYSLER LLC

23. Install cylinder head cover. See **Installation** .
24. Install engine cover. See **Installation** .
25. Connect negative battery cable.
26. Start engine and inspect for leaks. Care must be taken to observe the fuel system warnings.

TIMING CHAIN GUIDE

8182004d

Fig. 457: TIMING CHAIN AND GUIDES

Courtesy of CHRYSLER LLC

NOTE: Carefully clean all mating surfaces with appropriate solvents to assure that no grease or oil is present during reassembly.

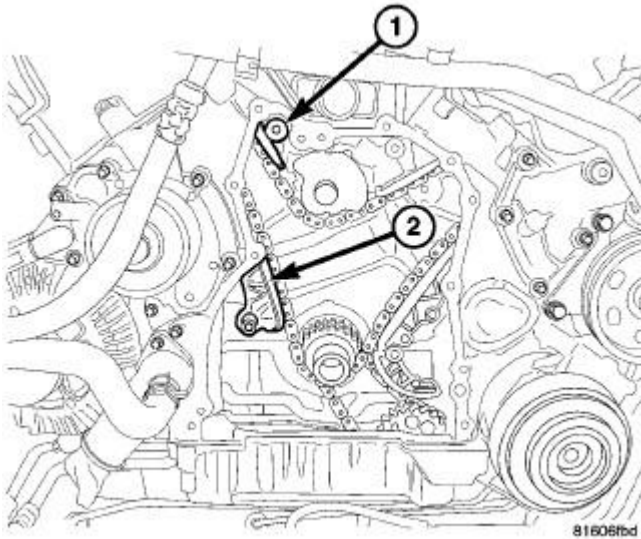


Fig. 458: RIGHT TIMING CHAIN GUIDES
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - UPPER TIMING CHAIN GUIDE
2 - LOWER TIMING CHAIN GUIDE |
|--|

1. Install the right side upper timing chain guide and bolt (1).
2. Install the upper timing chain guide pin in the right cylinder head.
3. Install the left side upper timing chain guide and bolt.
4. Install the upper timing chain guide pin in the left cylinder head.

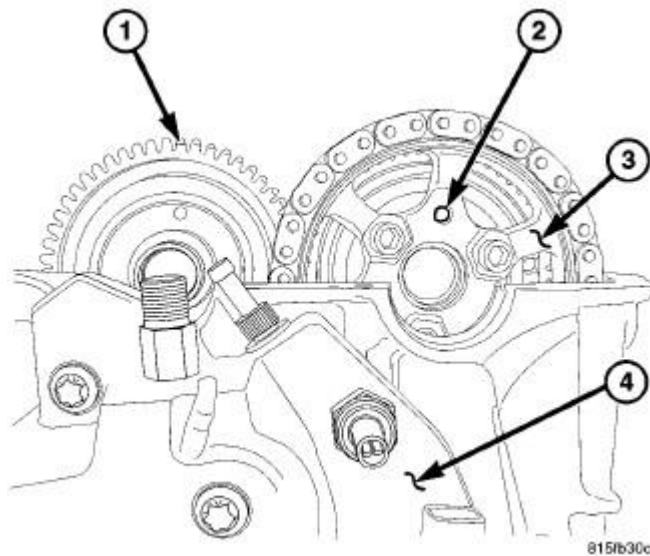


Fig. 459: LEFT EXHAUST CAMSHAFT DRIVE GEAR ALIGNMENT DOWEL
 Courtesy of CHRYSLER LLC

- 1 - LEFT INTAKE CAMSHAFT
- 2 - LEFT EXHAUST CAMSHAFT DRIVE GEAR ALIGNMENT DOWEL
- 3 - LEFT EXHAUST CAMSHAFT DRIVE GEAR
- 4 - HIGH PRESSURE FUEL INJECTION PUMP

5. Install the camshaft drive gear on the exhaust camshaft in the right cylinder head.
6. Install the upper two bolts into the camshaft drive gear and tighten to 18 N.m (159 lbs. in.).

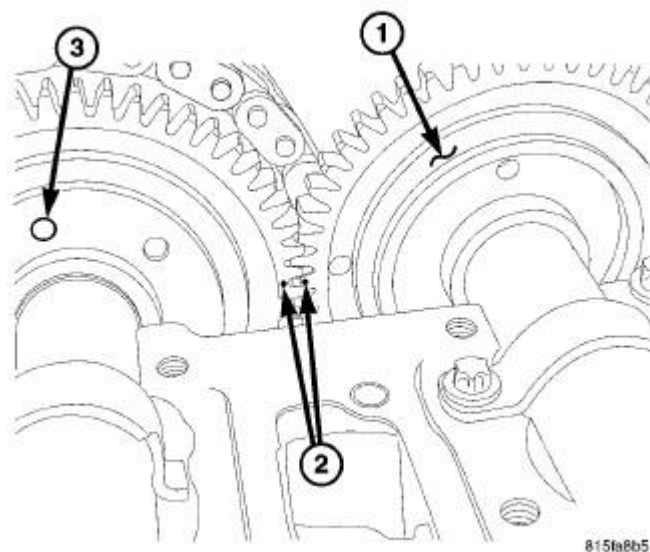


Fig. 460: CAMSHAFT GEAR ALIGNMENT

Courtesy of CHRYSLER LLC

- 1 - CAMSHAFT GEAR
- 2 - CAMSHAFT GEAR ALIGNMENT MARKS
- 3 - CAMSHAFT DRIVE GEAR DOWEL POSITION

7. Be sure that all of the timing marks are correctly aligned.
8. Rotate the engine and install the lower bolt into the camshaft drive gear. Tighten to 18 N.m (159 lbs. in.).

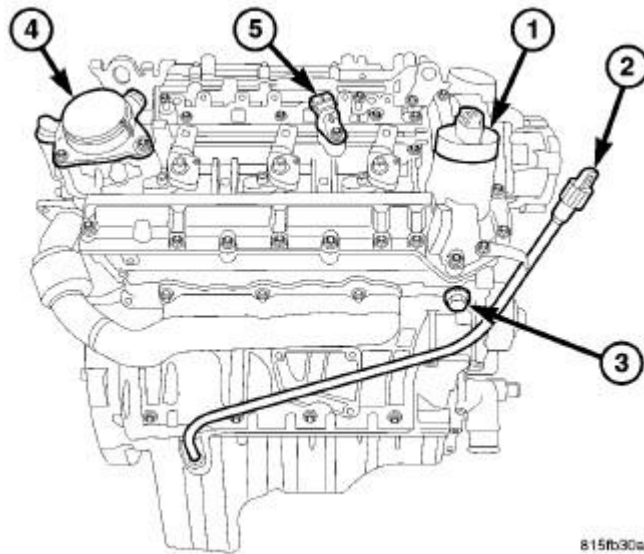


Fig. 461: TIMING CHAIN TENSIONER

Courtesy of CHRYSLER LLC

- 1 - ENGINE OIL CAP
- 2 - OIL LEVEL INDICATOR
- 3 - TIMING CHAIN TENSIONER
- 4 - OIL SEPARATOR ASSEMBLY
- 5 - CAMSHAFT POSITION SENSOR

9. Install the timing chain tensioner and tighten to 80 N.m (59 lbs. ft.).
10. Install the timing cover. See **Installation**.
11. Install oil pan bolts. Tighten M6 bolts to 9 N.m (80 lbs. in.) and M8 bolts to 20 N.m (15 lbs. ft.).
12. Reconnect negative battery cable. Refer to **Electrical/Battery System/CABLES, Battery - Installation**.

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 FAN. DO NOT WEAR LOOSE CLOTHES.

13. Start the engine, allow to warm, turn engine off and inspect for leaks. Care must be take to observe the fuel system warnings.

TIMING CHAIN TENSIONING RAIL

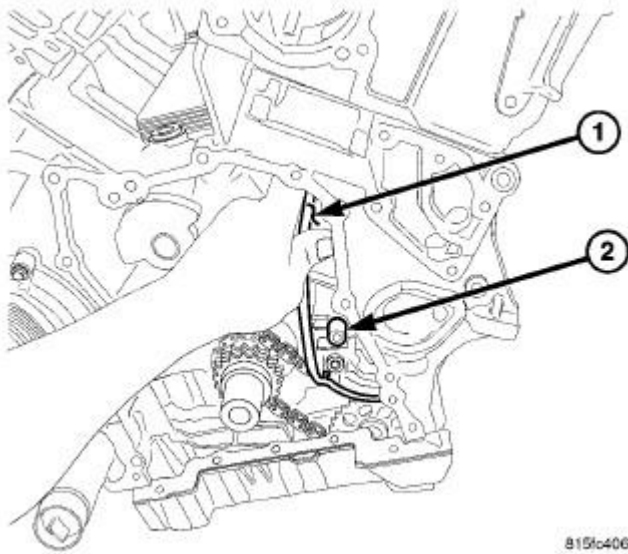


Fig. 462: LEFT LOWER TIMING CHAIN GUIDE AND FASTENER
Courtesy of CHRYSLER LLC

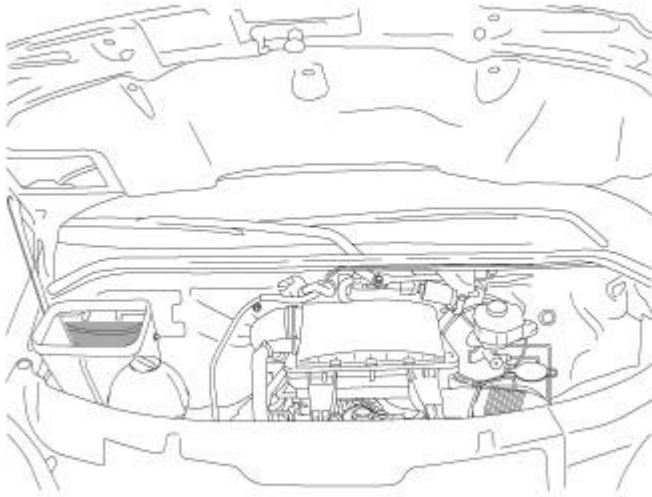
- | |
|---|
| 1 - LEFT LOWER TIMING CHAIN GUIDE
2 - FASTENER |
|---|

NOTE: Carefully clean all mating surfaces with appropriate solvents to assure that no grease or oil is present during reassembly.

1. Install tensioning rail on bearing pin
2. Install the timing chain tensioner retaining bolt. Tighten to 12 N.m (106 lbs. in.)
3. Install timing cover. See **Installation**.
4. Install oil pan and bolts. Tighten M6 bolts to 9 N.m (80 lbs. in.) and M8 bolts to 20 N.m (15 lbs. ft.).
5. Install cylinder head. See **Installation**.
6. Install the cylinder head covers. See **Installation**.
7. Reconnect negative battery cable.

WARNING: Use extreme caution when the engine is operating. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothes.

8. Start the engine and inspect for leaks. Care must be taken to observe the fuel system warnings.

COVER(S), ENGINE TIMING**Removal****REMOVAL**

81b73043

Fig. 463: OPEN HOOD**Courtesy of CHRYSLER LLC**

1. Disconnect negative battery cable. Refer to **Electrical - Engine Systems/Battery System/CABLES, Battery - Removal** .
2. Remove the engine cover.
3. Remove the front engine cover bracket.
4. Raise and support the vehicle.
5. Drain the power steering into a suitable and appropriately marked container.
6. Remove the power steering hose between the pump and cooling fan.
7. Remove the power steering hose between the cooling fan and suspension.
8. Remove the lower cooling fan module retaining bolts.
9. Disconnect the cooling fan wiring harness connector.
10. Remove the power steering line between the retainer and cooling fan module.
11. Remove the front splash shield.

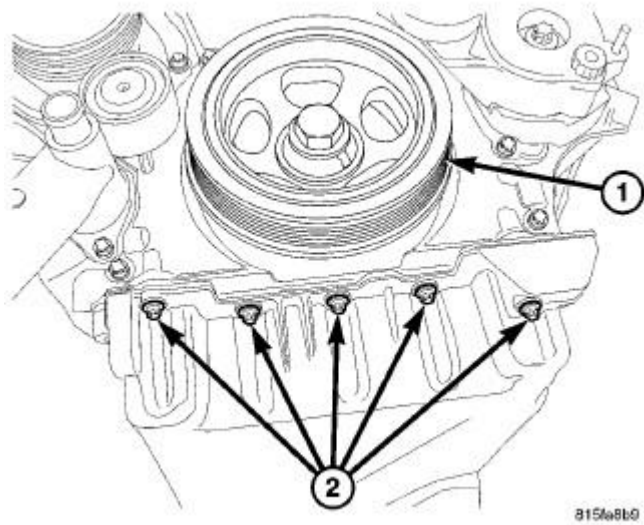


Fig. 464: VIBRATION DAMPER & FRONT OIL PAN BOLTS
 Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - VIBRATION DAMPER
2 - OIL PAN BOLTS |
|---|

12. Remove the front oil pan to timing cover bolts.
13. Lower the vehicle.
14. Remove the hoses at the power steering reservoir.
15. Remove the cooling fan module upper bolts and remove the fan assembly.
16. Remove the charge air outlet tube.

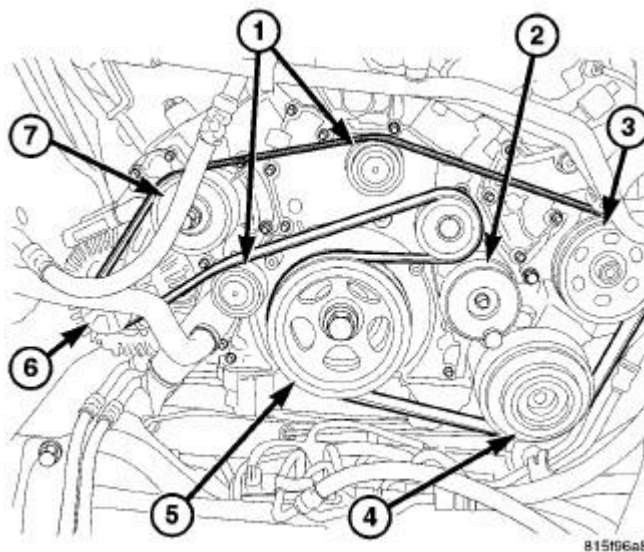
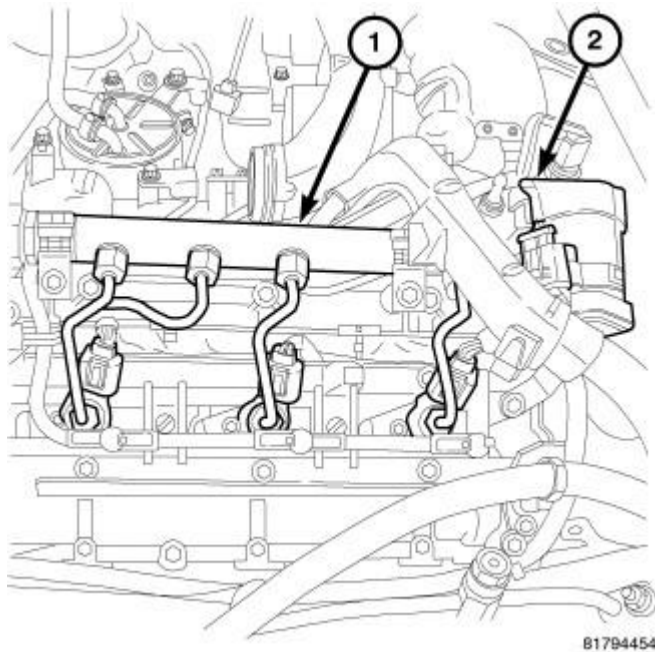


Fig. 465: ACCESSORY DRIVE BELT

Courtesy of CHRYSLER LLC

- 1 - IDLER PULLEYS
- 2 - DRIVE BELT TENSIONER
- 3 - POWER STEERING PUMP
- 4 - AIR CONDITIONING COMPRESSOR
- 5 - VIBRATION DAMPER
- 6 - GENERATOR
- 7 - WATER PUMP

- 17. Remove the accessory drive belt.
- 18. Disconnect the charge air inlet hose at the EGR air control valve.
- 19. Remove the glow plug module.

**Fig. 466: EGR VALVE**

Courtesy of CHRYSLER LLC

- 1 - EGR VALVE SOLENOID CONNECTOR
- 2 -EGR VALVE

- 20. Remove the EGR air control valve.
- 21. Remove both accessory drive belt idler pulleys.
- 22. Remove the accessory drive belt tensioner.
- 23. Rotate the engine to TDC by the crankshaft bolt.

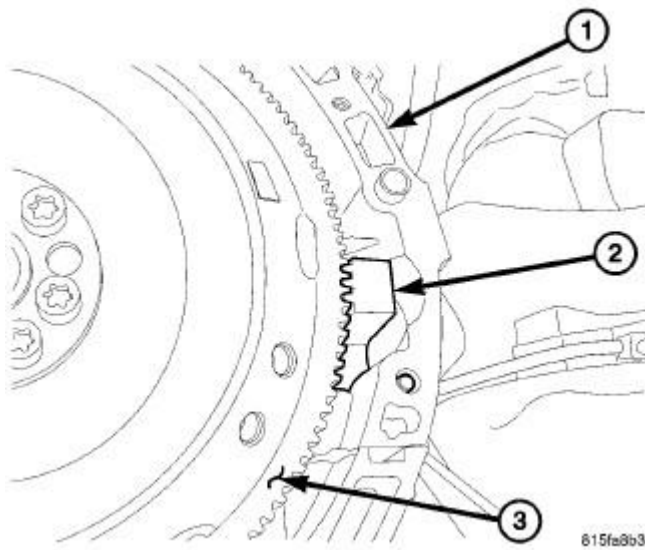


Fig. 467: Special Tool # 9102
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - ENGINE BLOCK
2 - SPECIAL TOOL #9102
3 - FLEX PLATE |
|--|

24. Raise and support the vehicle.
25. Remove the starter blank.
26. Install special tool 9102 crankshaft lock.
27. Lower the vehicle.

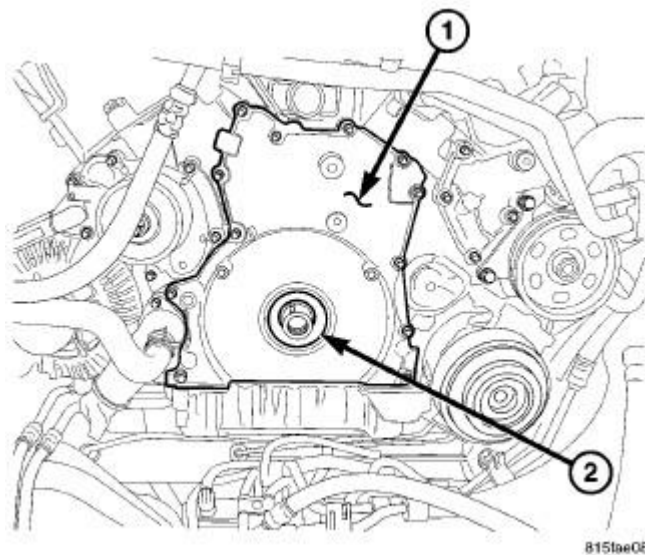


Fig. 468: FRONT TIMING COVER

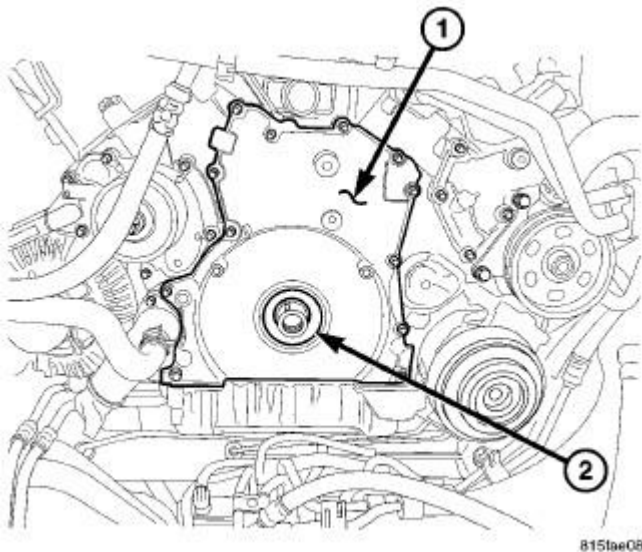
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - TIMING CHAIN COVER
2 - FRONT CRANKSHAFT SEAL |
|---|

28. Remove the vibration damper and pulley.
29. Remove the front timing cover seal.
30. Remove the front timing cover bolts and cover.

Installation**INSTALLATION**

NOTE: Component mating surfaces must be clean and free of all oil residue.

**Fig. 469: FRONT TIMING COVER**

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - TIMING CHAIN COVER
2 - FRONT CRANKSHAFT SEAL |
|---|

1. Install the front crankshaft seal in the timing cover (1).
2. Install the timing cover (1). Tighten bolts to 9 N.m (7 ft. lbs.).
3. Raise and support the vehicle.

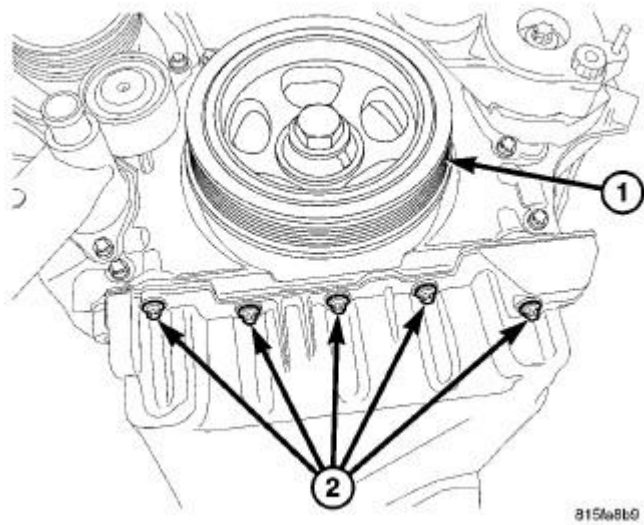


Fig. 470: VIBRATION DAMPER & FRONT OIL PAN BOLTS
Courtesy of CHRYSLER LLC

- 1 - VIBRATION DAMPER
2 - OIL PAN BOLTS

4. Install the front oil pan bolts. Tighten bolts to 10 N.m (88 in. lbs.).
5. Lower the vehicle.

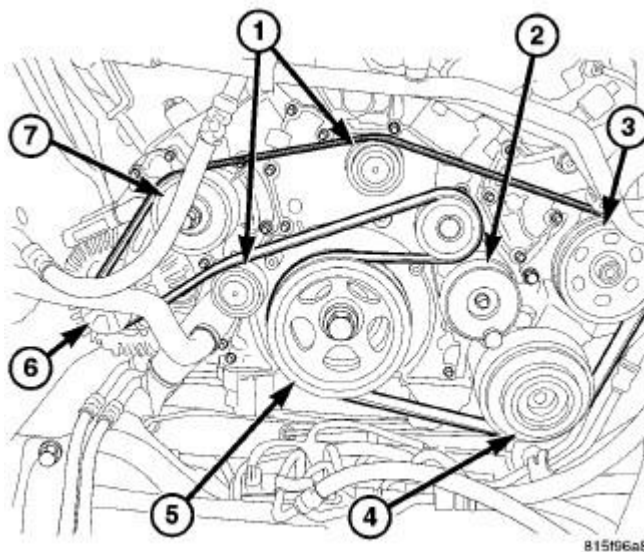


Fig. 471: ACCESSORY DRIVE BELT
Courtesy of CHRYSLER LLC

- 1 - IDLER PULLEYS

- 2 - DRIVE BELT TENSIONER
- 3 - POWER STEERING PUMP
- 4 - AIR CONDITIONING COMPRESSOR
- 5 - VIBRATION DAMPER
- 6 - GENERATOR
- 7 - WATER PUMP

6. Install the vibration damper and pulley. Tighten bolt to 210 N.m (154 ft. lbs.), and then an additional 180°
7. Install the accessory drive belt tensioner. Tighten bolt to 58 N.m (43 ft. lbs.).
8. Install the idler pulleys. Tighten bolts to 28 N.m (20 ft. lbs.).
9. Install the accessory drive belt.

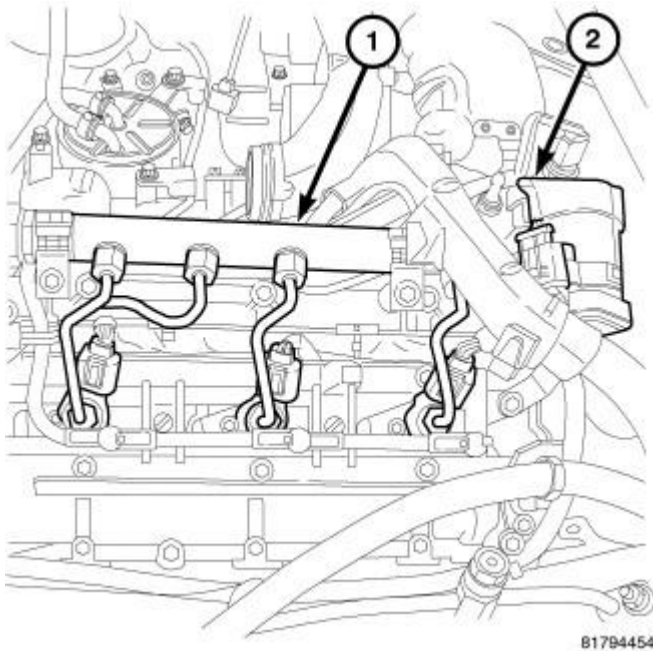


Fig. 472: EGR VALVE
Courtesy of CHRYSLER LLC

- 1 - EGR SOLENOID CONNECTOR
- 2 - EGR VALVE

10. Install the EGR air control valve assembly.
11. Install the glow plug module.
12. Install the charge air outlet tube.
13. Install the cooling fan module. Tighten upper bolts to 14 N.m (10 ft. lbs.).
14. Raise and support the vehicle.

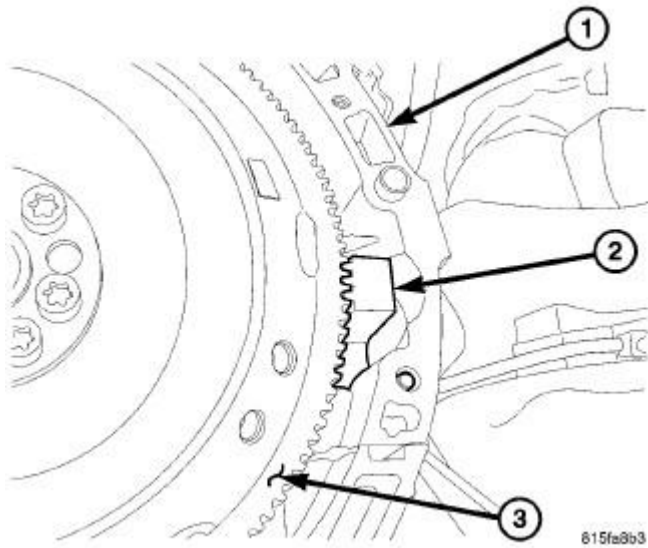
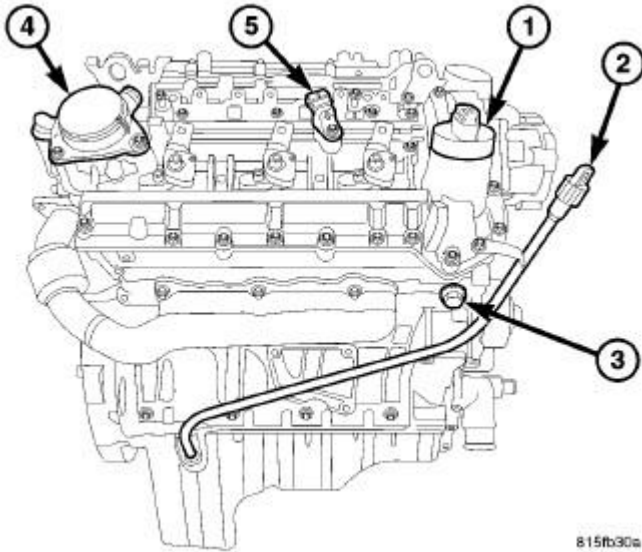


Fig. 473: SPECIAL TOOL # 9102
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - ENGINE BLOCK
 2 - SPECIAL TOOL #9102
 3 - FLEX PLATE</p> |
|---|

15. Remove special tool 9102 crankshaft lock.
16. Install the starter blank.
17. Install the lower cooling fan module bolts. Tighten lower bolts to 14 N.m (10 ft. lbs.).
18. Install the power steering line between the retainer and cooling fan module.
19. Connect the cooling fan wiring harness connector.
20. Install the power steering hose between the cooling fan and suspension.
21. Install the power steering hose between the pump and cooling fan.
22. Install the front skid plate.
23. Lower the vehicle.
24. Install the hoses at the power steering reservoir.
25. Fill the power steering reservoir.
26. Install the front engine cover bracket.
27. Install the engine cover.
28. Connect the negative battery cable.
29. Purge the air from the power steering system before starting by raising the vehicle and rotating the steering wheel back and forth 20 times.
30. Start the engine and follow the bleed procedure with the scan tool.
31. Turn engine off and inspect for leaks.

TENSIONER, ENGINE TIMING**Description****DESCRIPTION**

815fb30a

Fig. 474: TIMING CHAIN TENSIONER**Courtesy of CHRYSLER LLC**

- | |
|---|
| 1 - ENGINE OIL CAP
2 - OIL LEVEL INDICATOR
3 - TIMING CHAIN TENSIONER
4 - OIL SEPARATOR ASSEMBLY
5 - CAMSHAFT POSITION SENSOR |
|---|

The timing chain tensioner is located on the right cylinder head. The tensioner is hydraulically operated with the adjusting portion riding on the right timing chain guide. Hydraulic support for the tensioner is supplied by forward oil passages in the right cylinder head.

Removal**REMOVAL**

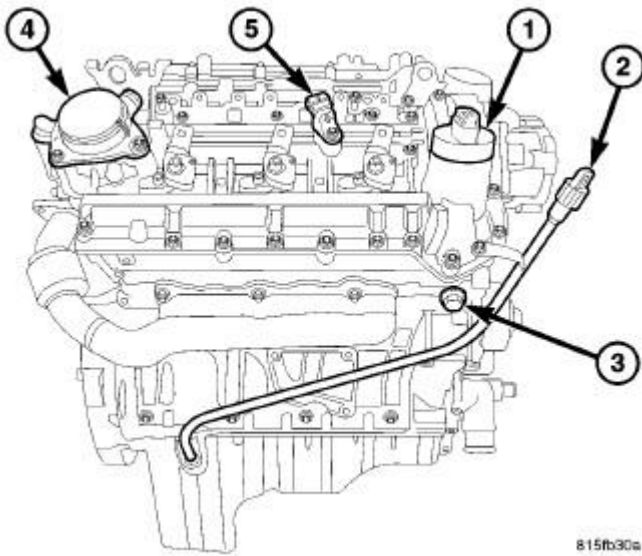


Fig. 475: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- 1 - ENGINE OIL CAP
- 2 - OIL LEVEL INDICATOR
- 3 - TIMING CHAIN TENSIONER
- 4 - OIL SEPARATOR ASSEMBLY
- 5 - CAMSHAFT POSITION SENSOR

1. Disconnect the negative battery cable. Refer to **Electrical/Battery System/CABLES, Battery - Removal**.
2. Remove the engine cover. See **Removal**.
3. Remove the engine intake air duct.
4. Remove air cleaner housing. See **Removal**.
5. Remove the cable strap from the engine wiring harness.
6. Remove the timing chain tensioner.

Installation

INSTALLATION

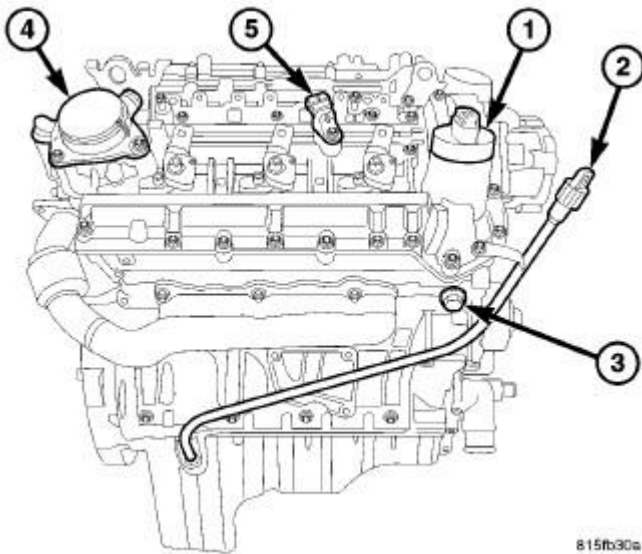


Fig. 476: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- 1 - ENGINE OIL CAP
- 2 - OIL LEVEL INDICATOR
- 3 - TIMING CHAIN TENSIONER
- 4 - OIL SEPARATOR ASSEMBLY
- 5 - CAMSHAFT POSITION SENSOR

NOTE: Carefully clean all mating surfaces with appropriate solvents to assure that no grease or oil is present during reassembly.

1. Install timing chain tensioner with new gasket. Tighten to 80 N.m (59 lbs. ft.).
2. Install cable strap on the engine wiring harness.
3. Install air cleaner housing.
4. Install intake air duct.
5. Reconnect negative battery cable.

WARNING: Use extreme caution when the engine is operating. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothes.

6. Start the engine and inspect for leaks.