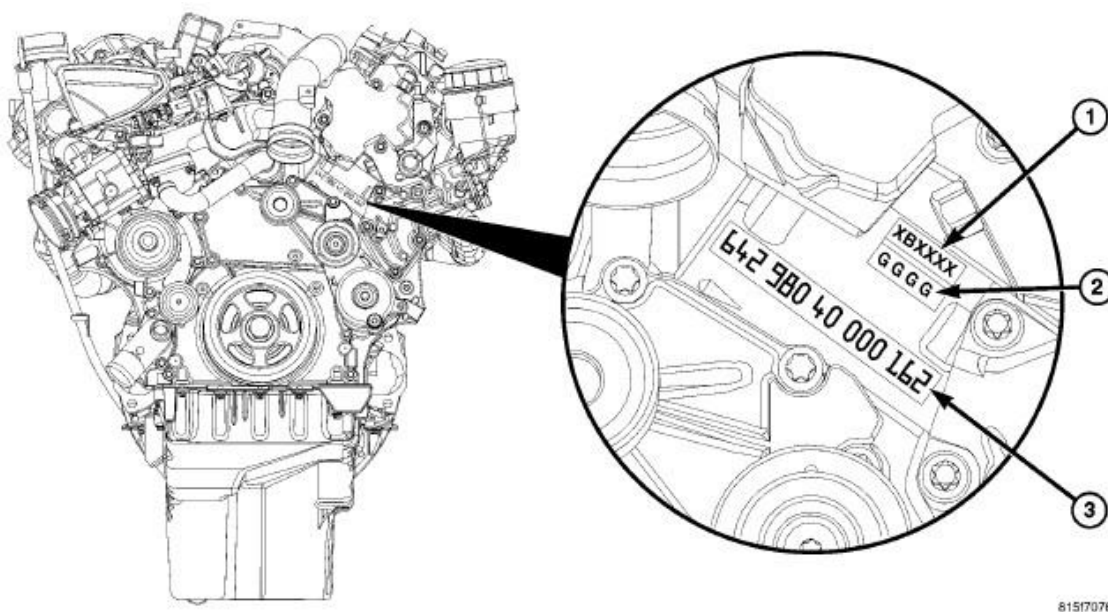


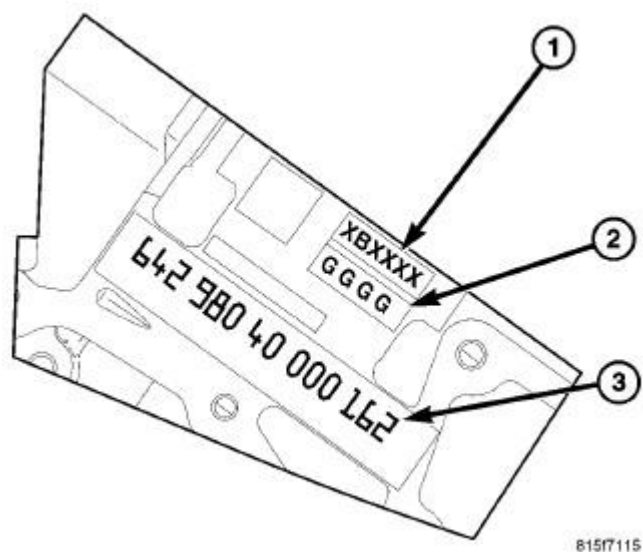
2010 ENGINE**3.0L Turbo Diesel - Service Information - Commander****DESCRIPTION****3.0L COMMON RAIL DIESEL ENGINE****Fig. 1: 3.0L V-6 DIESEL ENGINE****Courtesy of CHRYSLER LLC**

- | |
|--|
| 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:

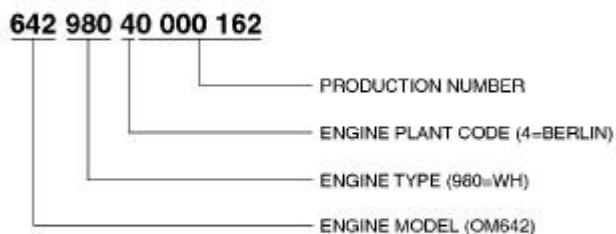
- Finger Follower Actuated Valves with Hydraulic Adjusters
- Counter Rotating Balance Shaft
- Oil Jet Cooled Pistons
- Swirl Intake Ports
- Chain driven D.O.H.C. per bank of cylinders, with 4 valves per cylinder

**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.

ENGINE COVER

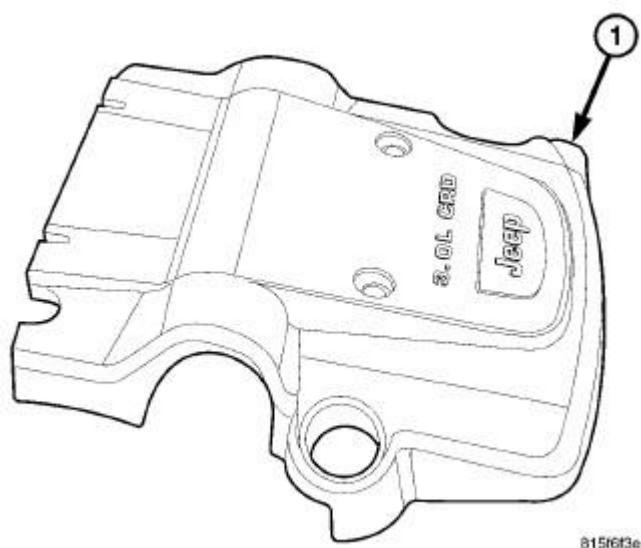


Fig. 4: ENGINE COVER
Courtesy of CHRYSLER LLC

1 - ENGINE COVER

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. Three brackets secure the cover to the engine.

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	3. Verify the pressure switch is

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2010 ENGINE 3.0L Turbo Diesel - Service Information - Commander

	pressure switch/gauge.	functioning correctly. If not, replace switch/gauge.
	4. Relief valve stuck open.	4. Check/replace valve.
	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	2. Verify by operating from a temporary

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	water/gasoline contaminated fuel.	tank with good fuel. Clean and flush the fuel tank. Replace fuel/water separator filter.
	3. Engine overloaded.	3. Verify the engine load rating is not being exceeded.
	4. Improperly operating injectors.	4. Check and replace misfiring/inoperative injectors.
EXCESSIVE VIBRATION	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.
	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.
EXCESSIVE ENGINE NOISES	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 SMOKE DIAGNOSIS CHARTS .
	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

The following charts include possible causes and corrections for **excess or abnormal** exhaust smoke. Small amounts of exhaust smoke (at certain times) are to be considered normal for a diesel powered engine.

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>Engine/Turbocharger System/TURBOCHARGER - Diagnosis and Testing</u> .
Turbocharger has excess build up on compressor wheel or diffuser vanes.	See <u>Engine/Turbocharger System/TURBOCHARGER - Diagnosis and Testing</u> .
Turbocharger wheel clearance out of specification.	See <u>Engine/Turbocharger</u>

System/TURBOCHARGER - Diagnosis and Testing.

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.
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>Cooling/Engine/HEATER, Engine Block - Diagnosis and Testing</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	A DTC should have been set if heater elements are

correctly in cold weather.	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 - Diesel - Diagnosis and Testing</u> 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 <u>Engine/Turbocharger System/TURBOCHARGER - Diagnosis and Testing</u> .

STANDARD PROCEDURE

ENGINE GASKET SURFACE PREPARATION

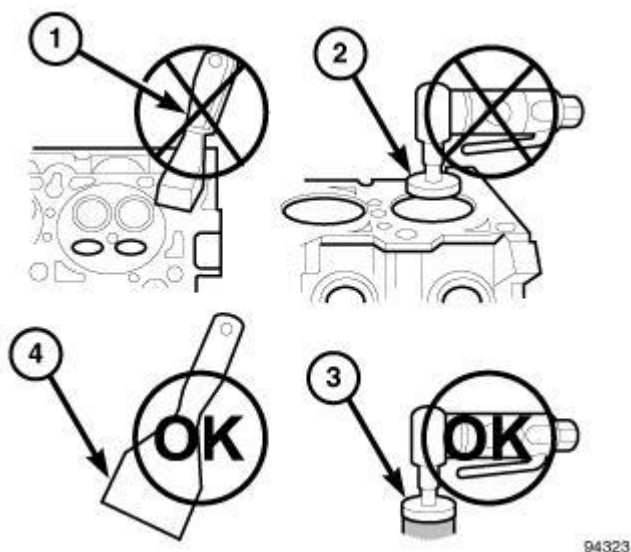


Fig. 5: PROPER TOOL USAGE FOR SURFACE PREPARATION

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

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).

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.

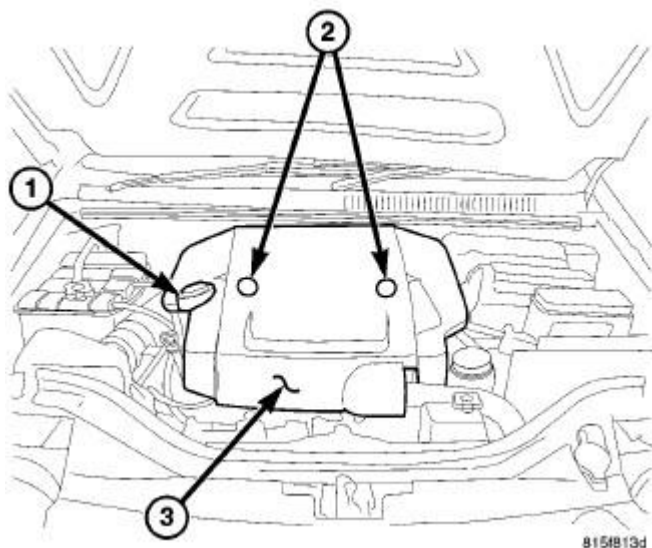
1. Disconnect the negative cable(s) from the battery.
2. Inspect air cleaner, induction system, and intake manifold to ensure system is dry and clear of foreign material.
3. Place a shop towel around the fuel injectors to catch any fluid that may possibly be under pressure in the cylinder head. Remove 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**ENGINE COVER****Fig. 6: ENGINE COVER****Courtesy of CHRYSLER LLC**

- | |
|---|
| 1 - OIL FILLER CAP
2 - COVER FASTENERS
3 - ENGINE COVER |
|---|

1. Remove the engine oil cap (1).
2. Remove the fasteners (2).
3. Pull the cover (1) forward and away from the rear mounting brackets.

REMOVAL

1. Disconnect negative battery cable.
2. Hoist vehicle.
3. Remove front tires.
4. Remove lower engine covers.
5. Drain cooling system. Refer to **Cooling - Standard Procedure** .
6. Lower vehicle.

7. Evacuate air conditioning. Refer to **Heating and Air Conditioning/Plumbing - Standard Procedure**.

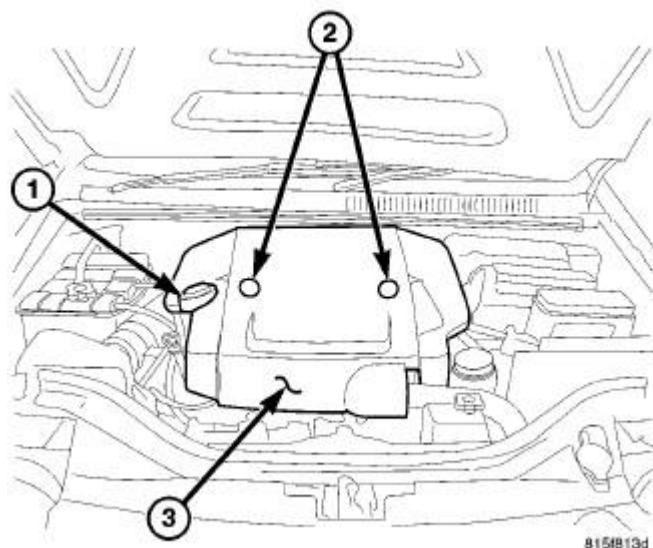


Fig. 7: ENGINE COVER
Courtesy of CHRYSLER LLC

- | |
|---------------------|
| 1 - OIL FILLER CAP |
| 2 - COVER FASTENERS |
| 3 - ENGINE COVER |

8. Remove engine cover (3). See **Engine - Removal**.
9. Remove air cleaner housing. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.
10. Remove coolant recovery bottle.

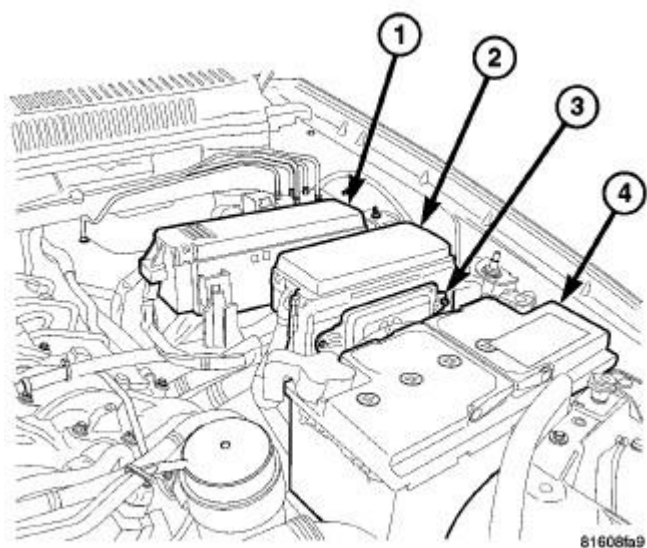


Fig. 8: POWER DISTRIBUTION CENTER AND FRONT CONTROL MODULE
Courtesy of CHRYSLER LLC

- 1 - POWER DISTRIBUTION CENTER (PDC)
- 2 - RELAY CENTER
- 3 - FRONT CONTROL MODULE (ECM)
- 4 - BATTERY

11. Remove the battery (4) and the battery tray.
12. Disconnect the wiring harness at the PDC (Power Distribution Center) (1) and the generator.

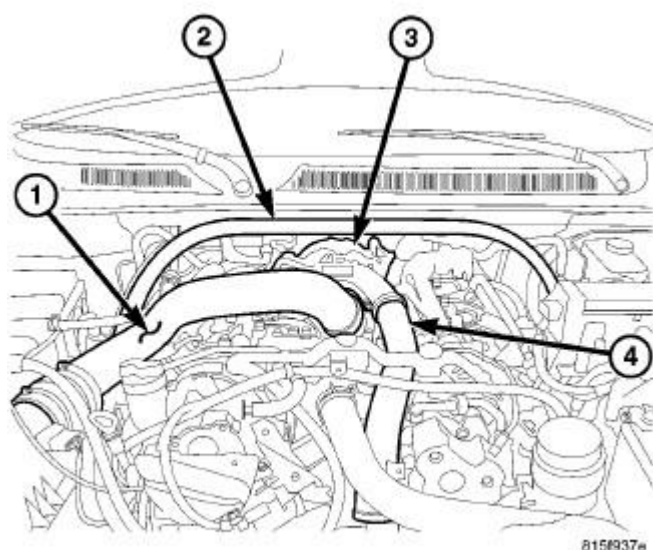


Fig. 9: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

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

13. Remove the strut tower support (2).
14. Remove the front and rear engine cover mounting brackets.
15. Remove the turbo heat shield.

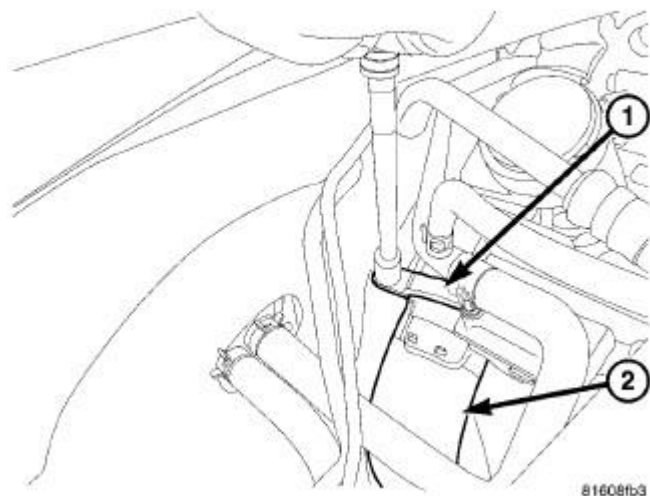


Fig. 10: CATALYTIC CONVERTER AT TURBOCHARGER
Courtesy of CHRYSLER LLC

- | |
|--------------------------------------|
| 1 - CLAMP
2 - CATALYTIC CONVERTER |
|--------------------------------------|

16. Remove lower catalytic converter to upper catalytic converter clamp (1) behind right cylinder head.
17. Disconnect the upper O2 sensor connectors.
18. Remove the differential side bracket and position aside the pressure sensors.
19. Raise and support the vehicle.
20. Remove front skid plates.
21. Remove transfer case skid plate.
22. Disconnect the catalytic exhaust temperature sensors.
23. Support transfer case.
24. Remove the transmission crossmember.

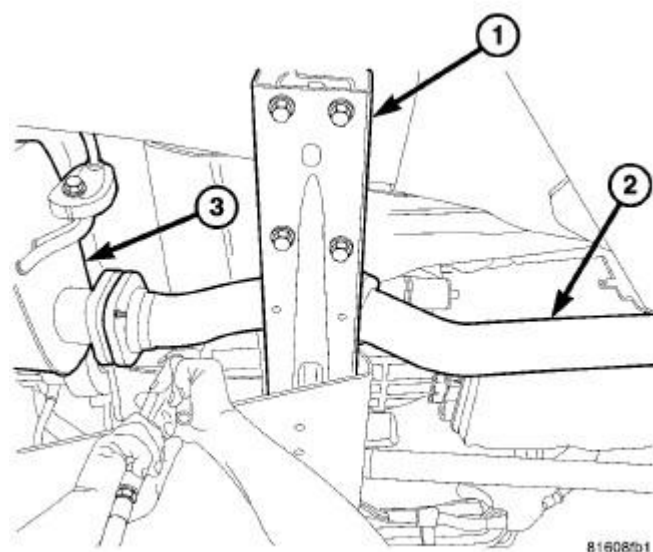


Fig. 11: FRONT EXHAUST PIPE AT MUFFLER
Courtesy of CHRYSLER LLC

1 - CROSS OVER 2 - FRONT EXHAUST PIPE 3 - MUFFLER

25. Remove catalytic converter clamp from exhaust pipe (2).
26. Disconnect the front exhaust pipe (2) at muffler (3).
27. Remove the catalytic converter and front exhaust pipe (2).
28. Remove transmission dipstick tube.
29. Carefully lower the transmission enough to gain access to the upper transmission to engine mounting bolts, and remove accessible bolts.
30. Raise transmission, install the transfer case cross over bolts, and remove transmission jack.
31. Remove remaining transmission to engine bolts.

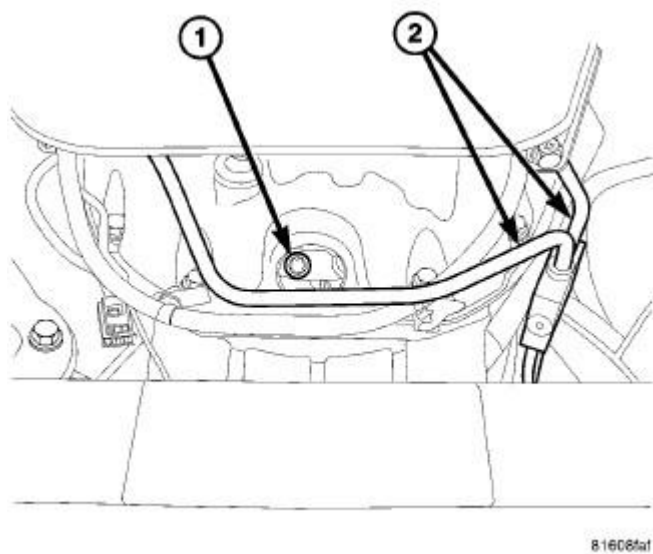


Fig. 12: TORQUE CONVERTER TO FLEX PLATE BOLTS
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - TORQUE CONVERTER BOLTS
2 - TRANSMISSION COOLER LINES</p> |
|---|

32. Remove the flex plate dust shield.
33. Paint mark the flex plate to torque converter relation and remove the torque converter bolts (1) through the access hole.
34. Disconnect Transmission wiring harness and position aside.

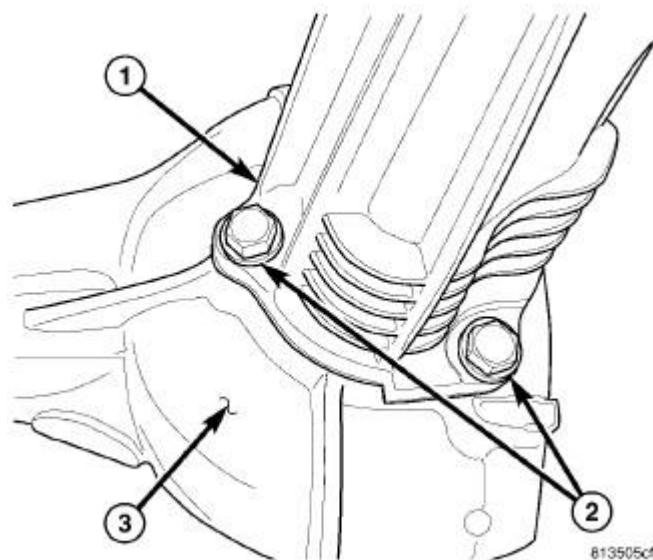


Fig. 13: AXLE TUBE BOLTS
Courtesy of CHRYSLER LLC

35. Remove the front differential assembly (3). Refer to **Differential and Driveline/Front Axle - C200F - Removal**.
36. Loosen both engine mount through bolts.

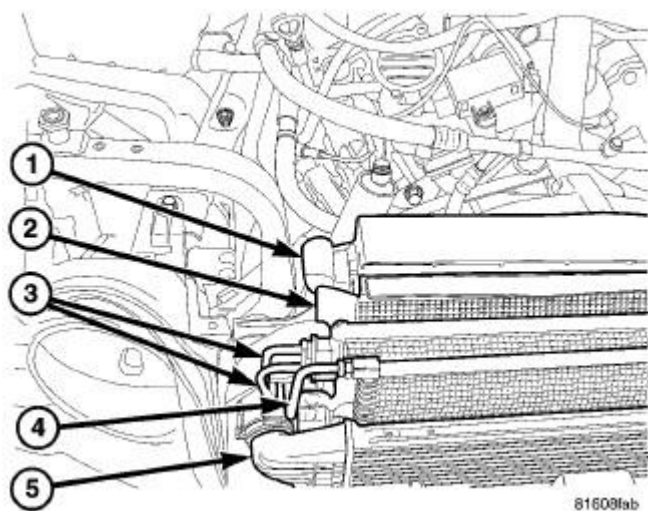


Fig. 14: COOLANT MODULE
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - RADIATOR
2 - A/C CONDENSER
3 - TRANSMISSION COOLER
4 - POWER STEERING COOLER
5 - CHARGE AIR COOLER |
|--|

37. Remove the lower radiator hose.
38. If equipped, Remove front tow hooks.
39. Lower the vehicle.
40. Remove the front grille and radiator upper core support. Remove the hood latch and position aside.
41. Remove the front core support brackets.
42. Remove upper radiator hose.
43. Remove the charge air outlet hose from the intercooler (5).
44. Remove the charge air inlet hose from the intercooler (5).
45. Disconnect the power steering reservoir hose to pump, at the reservoir.
46. Disconnect the suction/discharge lines at the H valve, condenser and accumulator.
47. Disconnect the transmission cooler (3) and power steering cooler lines (4) at the coolant module.
48. Position the radiator (1) deflectors aside and remove coolant module to core support fasteners.
49. Remove the upper center bumper mounting bolt.

50. Remove the coolant module assembly. Refer to **Cooling/Engine/RADIATOR, Engine Cooling - Removal**.

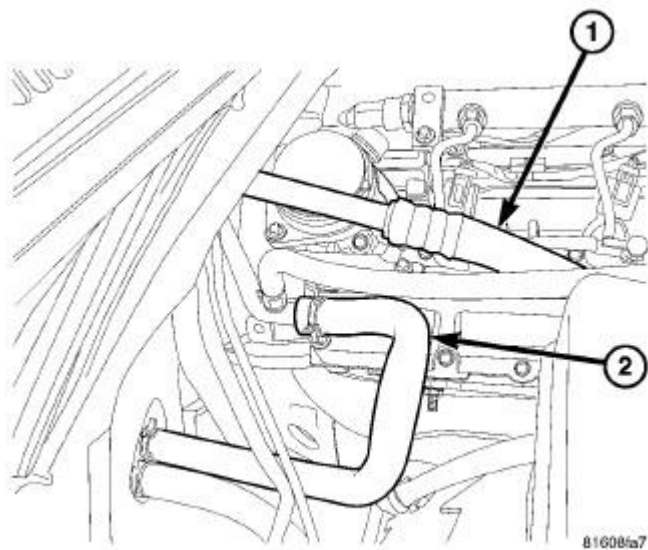


Fig. 15: HEATER HOSES
Courtesy of CHRYSLER LLC

1 - LOW PRESSURE A/C HOSE 2 - HOSE AND JUNCTION
--

51. Disconnect the heater hose (2) at cooler tube on the right cylinder head.
52. Disconnect the coolant by-pass hose (2) at the cooler tube on the right cylinder head.

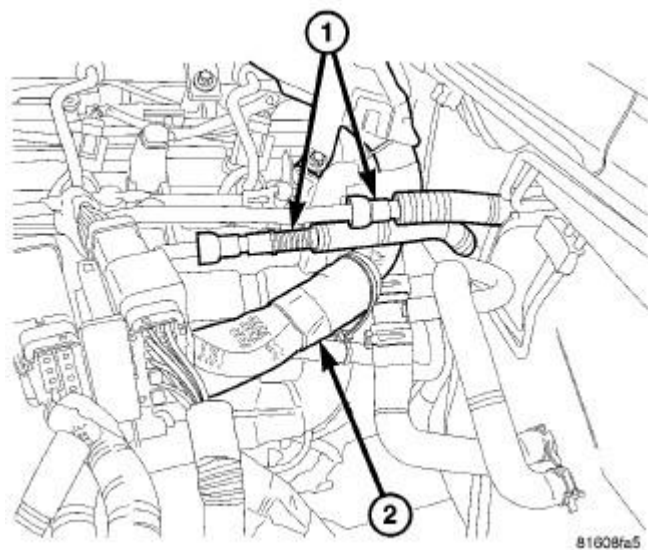


Fig. 16: FUEL LINES

Courtesy of CHRYSLER LLC

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

53. Remove the fuel lines (1) to the fuel rail using special tool #6507.
54. Loosen front axle vent tube from wiring harness and position aside.

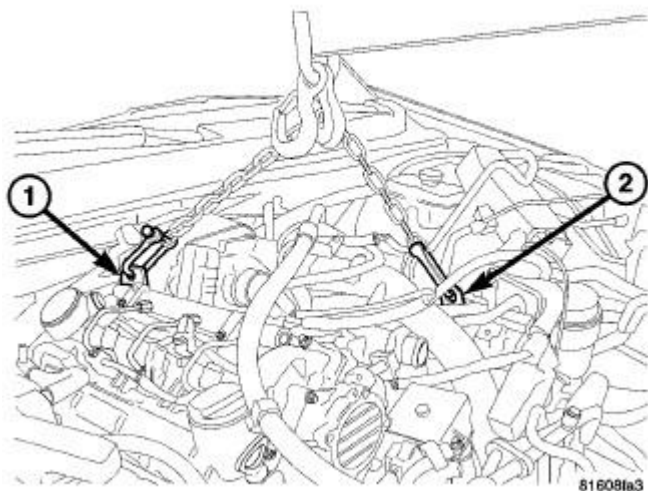


Fig. 17: ENGINE LIFTING POINTS

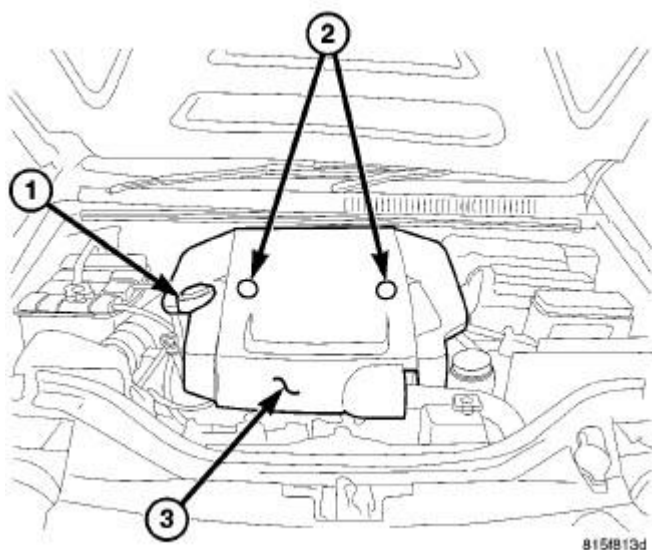
Courtesy of CHRYSLER LLC

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

55. Connect engine lift chain to engine lift fixtures (1).
56. Support the transmission with a floor jack.
57. Remove engine from vehicle.

INSTALLATION

ENGINE COVER

**Fig. 18: ENGINE COVER**

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - OIL FILLER CAP
2 - COVER FASTENERS
3 - ENGINE COVER |
|---|

1. Align the rear of the engine cover (3) with the rear mounting bracket slots and seat the cover into the bracket.
2. Push down on the cover (3) and install the fasteners (2).
3. Tighten fasteners to 5 N.m (44 in. lbs.).
4. Install the oil cap (1).

ENGINE INSTALLATION

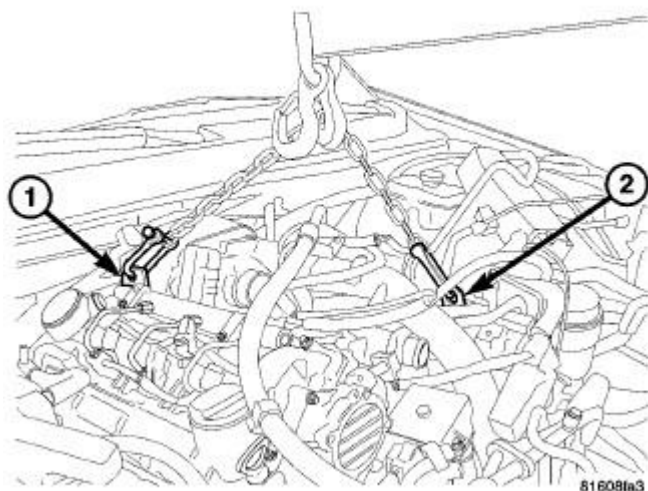


Fig. 19: ENGINE LIFTING POINTS

Courtesy of CHRYSLER LLC

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

1. Carefully align the engine assembly in the engine bay area and align with the transmission, **Do Not** lower the engine.

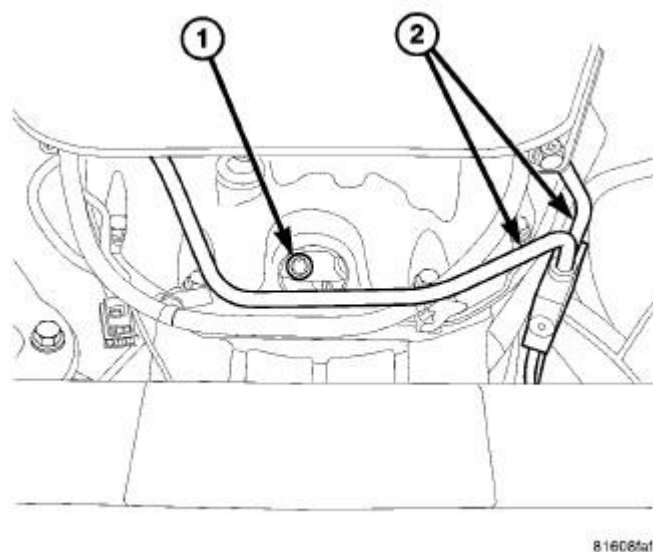


Fig. 20: TORQUE CONVERTER TO FLEX PLATE BOLTS

Courtesy of CHRYSLER LLC

- 1 - TORQUE CONVERTER BOLTS

2 - TRANSMISSION COOLER LINES

2. Align the engine to transmission, and lower the engine mounts into position.
3. Remove engine lifting device.
4. Route the transmission wiring harness through to the rear of the engine.
5. Raise and support the vehicle.
6. Install accessible engine to transmission housing bolts. Tighten bolts to 68 N.m (50 ft. lbs.).
7. Support the transmission and remove the rear transmission crossmember retaining bolts.
8. Lower the transmission and install the upper transmission to engine fasteners. Tighten bolts to 68 N.m (50 ft. lbs.).
9. Raise the transmission and install the transmission crossmember.
10. Install the flex plate to torque converter bolts (1).
11. Tighten engine mount through bolts to 30 N.m (22 ft. lbs.).

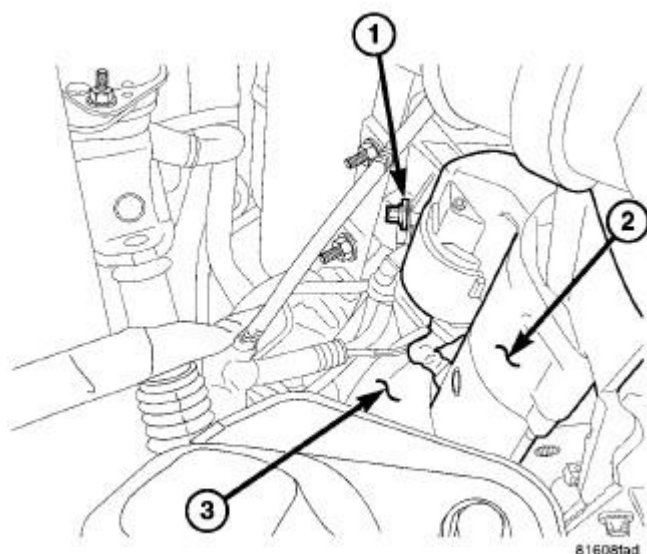


Fig. 21: STARTER AND MAIN ENGINE HARNESS GROUND

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - ENGINE WIRING HARNESS GROUND
2 - STARTER
3 - LEFT ENGINE MOUNT |
|--|

12. Install the engine ground wire above the starter (1). Tighten bolt to 14 N.m (10 ft. lbs.).
13. Install the starter wiring.

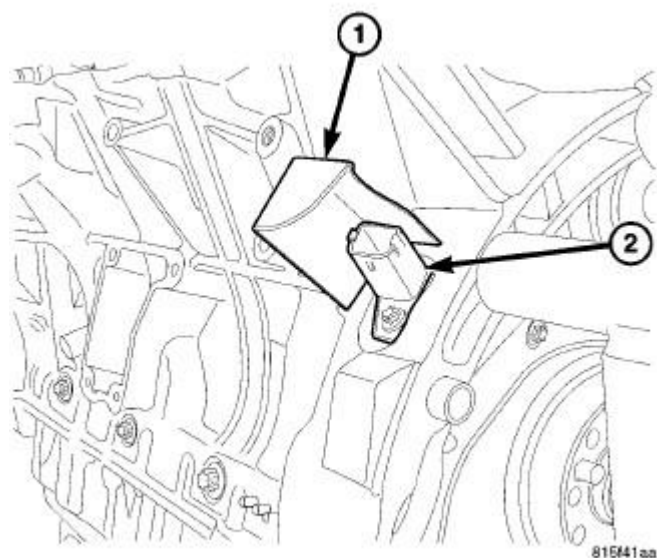


Fig. 22: CRANKSHAFT POSITION SENSOR
Courtesy of CHRYSLER LLC

- | |
|--------------------------------|
| 1 - HEAT SHIELD |
| 2 - CRANKSHAFT POSITION SENSOR |

14. Connect the crankshaft sensor (2) wiring harness connector.
15. Route the transmission wiring harness and make necessary sensor connections at the transmission.
16. Install the front axle housing. Refer to **Differential and Driveline/Front Axle - C200FE - Installation**.

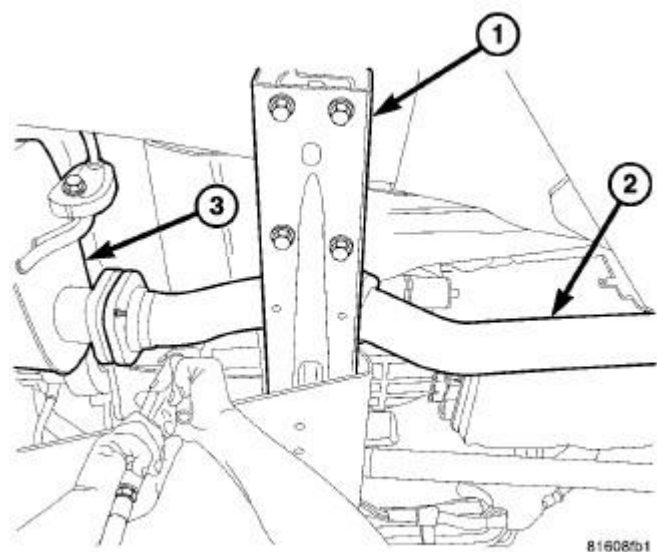


Fig. 23: FRONT EXHAUST PIPE AT MUFFLER
Courtesy of CHRYSLER LLC

- 1 - CROSS OVER
- 2 - FRONT EXHAUST PIPE
- 3 - MUFFLER

17. Install the catalytic converter and front exhaust pipe (2).
18. Install the transfer case shield.
19. Lower the vehicle.

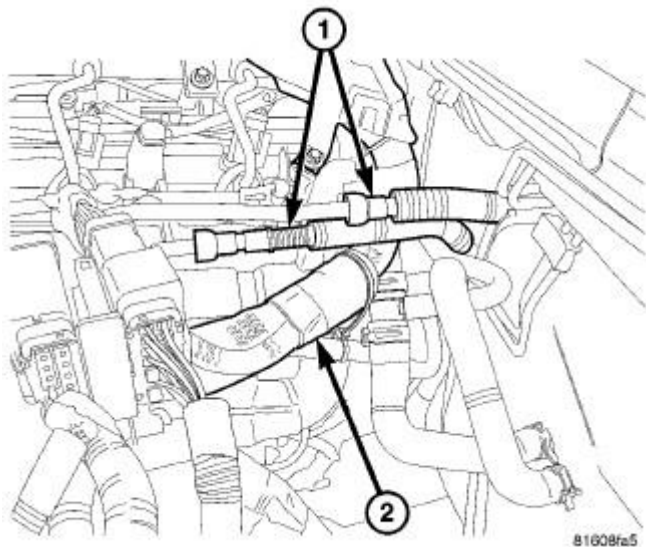
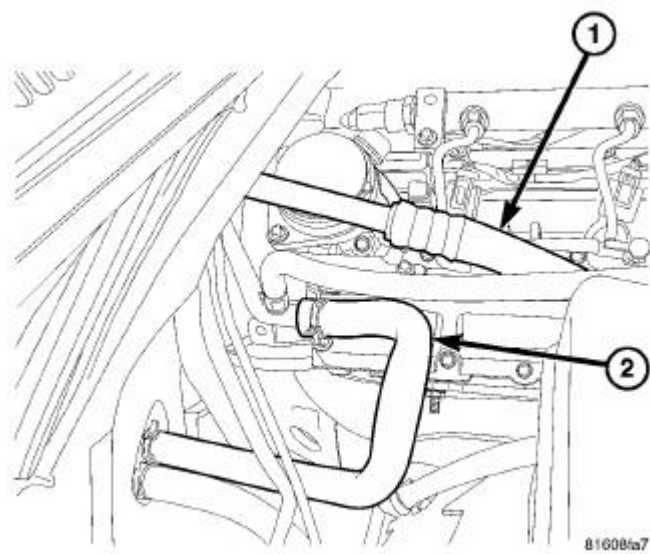


Fig. 24: FUEL LINES
Courtesy of CHRYSLER LLC

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

20. Install the fuel supply and return lines to the fuel pipe.

**Fig. 25: HEATER HOSES****Courtesy of CHRYSLER LLC**

1 - LOW PRESSURE A/C HOSE 2 - HOSE AND JUNCTION
--

21. Attach the axle vent tube to the wiring harness.
22. Secure the transmission oil level indicator.
23. Install the engine cover bracket.
24. Connect the A/C lines (1) at the expansion valve.
25. Connect the coolant hose, at the outer housing, by the generator.
26. Connect the coolant by-pass hose at the cooler tube (2) on the right cylinder head.
27. Connect the heater hose, at the cooler tube (2) on the right cylinder head.

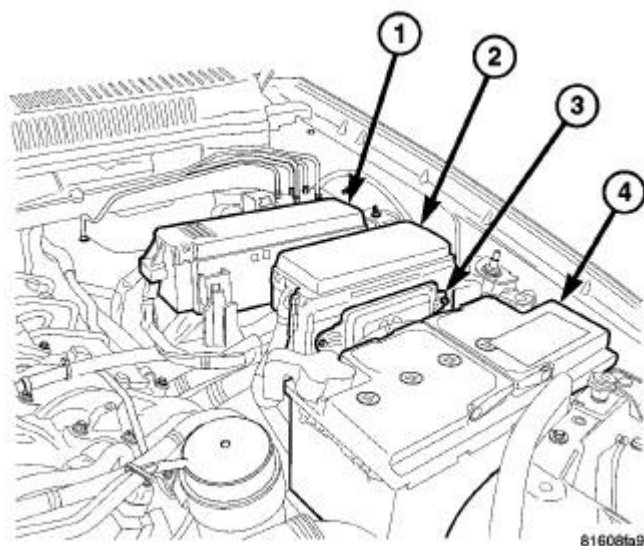


Fig. 26: POWER DISTRIBUTION CENTER AND FRONT CONTROL MODULE
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - POWER DISTRIBUTION CENTER (PDC)
2 - RELAY CENTER
3 - FRONT CONTROL MODULE (ECM)
4 - BATTERY |
|--|

28. Connect the wiring harness connectors to the PDC (1).
29. Connect the generator wiring.
30. Connect the A/C compressor wiring harness connector.
31. Connect the PCM wiring harness connectors.
32. Install the PDC (1) bracket and mount the PDC (1).

NOTE: Do Not connect the negative battery cable when installing the battery.

33. Install the battery (4) and tray.

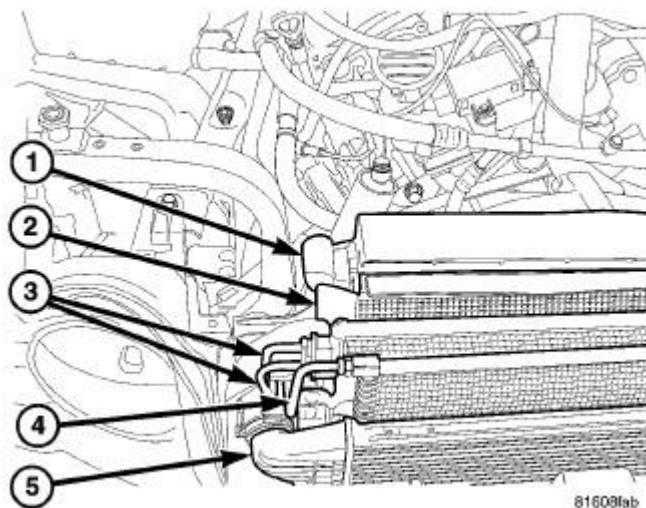


Fig. 27: COOLANT MODULE
Courtesy of CHRYSLER LLC

- 1 - RADIATOR
- 2 - A/C CONDENSER
- 3 - TRANSMISSION COOLER
- 4 - POWER STEERING COOLER
- 5 - CHARGE AIR COOLER

- 34. Install the coolant module assembly.
- 35. Connect the transmission cooler (3) and power steering cooler (4) lines to the coolant module.
- 36. Connect the suction/discharge lines at the A/C condenser and accumulator.
- 37. Connect the power steering reservoir hose to pump, at the reservoir.
- 38. Install the charge air inlet and outlet hoses at cooler (5).
- 39. Install the front core support bracket.
- 40. Install the front grille and upper radiator core support bracket with the hood latch.
- 41. Raise and support the vehicle.

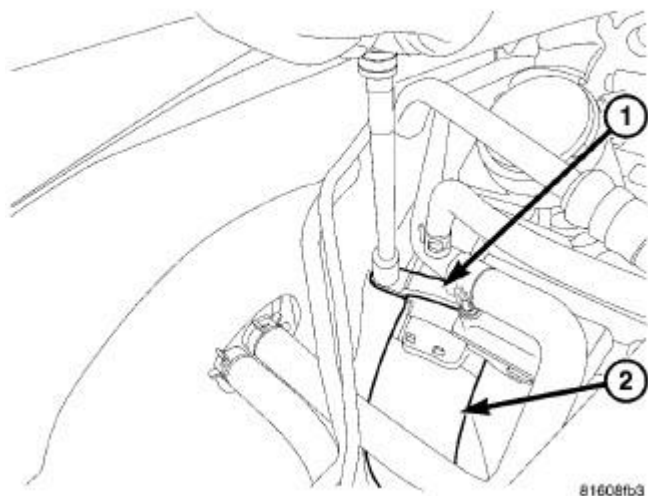


Fig. 28: CATALYTIC CONVERTER AT TURBOCHARGER
Courtesy of CHRYSLER LLC

- | |
|--------------------------------------|
| 1 - CLAMP
2 - CATALYTIC CONVERTER |
|--------------------------------------|

42. Install the power steering hydraulic lines at cooling fan. Refer to **Steering/Pump/HOSE, Power Steering - Installation** .
43. Install the lower radiator hose.
44. Lower the vehicle.
45. Install lower catalytic converter exhaust clamp (1) behind right cylinder head.

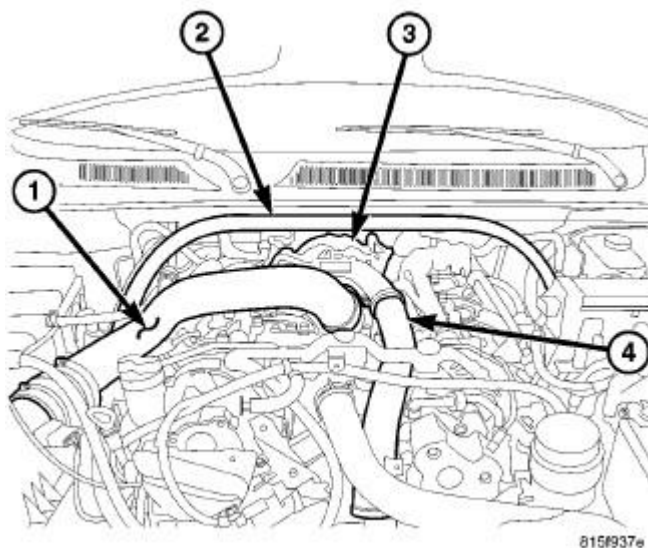


Fig. 29: STRUT TOWER SUPPORT

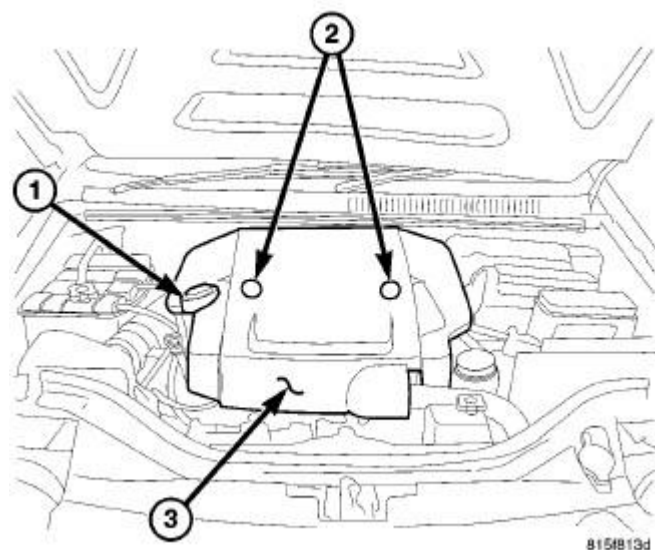
Courtesy of CHRYSLER LLC

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

46. Install the turbocharger (3) upper heat shield.
47. Install air cleaner housing and connect the air cleaner outlet tube (1) to the turbocharger. See **Engine/Air Intake System/BODY, Air Cleaner - Installation.**
48. Install the strut tower support (2).
49. Fill all appropriate fluid levels.
50. Evacuate and recharge air conditioning. Refer to **Heating and Air Conditioning/Plumbing - Standard Procedure .**
51. 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.

52. Start engine, allow to warm, turn engine off and inspect for leaks.
53. Bleed power steering system using the scan tool procedure. Refer to **Steering - Standard Procedure .**
54. Install lower splash shields. Refer to **Body/Exterior/SHIELD, Splash - Installation .**
55. Install front tires. Refer to **Tires and Wheels - Specifications .**

**Fig. 30: ENGINE COVER**

Courtesy of CHRYSLER LLC

- | |
|---------------------|
| 1 - OIL FILLER CAP |
| 2 - COVER FASTENERS |
| 3 - ENGINE COVER |

56. Install engine cover (3). See **Engine - Installation**.

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	9.5L (10 Qt.) W/Filter Change
Timing System	Chain Driven Dual Overhead Camshafts

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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

CRANKSHAFT

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Crankshaft Main Bearing Cap Bolts	-	
Thread Diameter	11 mm	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.

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	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

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2010 ENGINE 3.0L Turbo Diesel - Service Information - Commander

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.
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

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.

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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°
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	-	

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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**ENGINE 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')
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.

PISTONS**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.

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2010 ENGINE 3.0L Turbo Diesel - Service Information - Commander

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.

PISTON RINGS**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 (DT-ring)	83 X 2.0 X 3.4 mm	3.2678 X 0.0788 X 0.1339 in.

ENGINE CONNECTING RODS**ENGINE 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.

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2010 ENGINE 3.0L Turbo Diesel - Service Information - Commander

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

ENGINE BLOCK

ENGINE BLOCK

DESCRIPTIONS	N.m	In. Lbs.	Ft. Lbs.
Lower Oil Pan	12	160	9
Oil Drain Plug	30	265	22
Upper Oil Pan (M6)	14	124	10
Upper Oil Pan (M8)	20	177	15
Oil Pan To Timing Cover	14	124	10
Upper Oil Pan to Crankcase On Transmission Side	20	177	15
Bolt, oil pump cap with oil pipe to oil pump	12	106	9
Oil Pump	19	168	14
Oil Level Sensor Bracket	M6 x 8.8 - 8	70	-
	M6 x 10.9 - 12	106	9
	1st stage short arm - 15	1st stage short arm -132	11

2010 Jeep Commander Limited

2010 ENGINE 3.0L Turbo Diesel - Service Information - Commander

Connecting Rod	2nd stage long arm - 20	2nd stage long arm - 177	15
	Stage 3 short arm - 30	Stage 3 short arm - 265	22
	Stage 4 long arm - 40	Stage 4 long arm - 354	29
	Stage 5 short arm - 40	Stage 5 short arm - 354	36
	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
Bolt, crankshaft bearing cap to crankshaft bearing body	Stage 1 - 35	309	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
Lateral bolt, crankcase to crankcase bearing cap	Stage 1 - 53	309	39
	Stage 2 - 95 Degrees	Stage 2 - 95 Degrees	Stage 2 - 95 Degrees
Oil Jet	8	70	-
Rear cover	Stage 1 - 8	70	-
	Stage 2 - 10	88	-
Bolt, Balance Shaft Retaining Bracket	9	80	26
Bolt, Balance Shaft Correctional Weight	20	177	15
Bolt, Balance Shaft Correctional Weight Cover	8	71	-
Timing Chain Tensioning Rail Guide Pin	17	150	12
Timing Chain Slide Rail Guide Pin	17	150	12
Timing Chain Tensioner	80	708	59
Dual Mass Flywheel	Stage 1 - 45	398	33
	Stage 2 - 90 Degrees	Stage 2 - 90 Degrees	Stage 2 - 90 Degrees

2010 Jeep Commander Limited

2010 ENGINE 3.0L Turbo Diesel - Service Information - Commander

CYLINDER HEAD**CYLINDER HEAD**

DESCRIPTION	N.m	In. Lbs.	Ft. Lbs.
Intake Manifold	16	141	12
Fuel Filter Bracket	6	53	-
Swirl Valve Acuator	8	70	-
Cylinder Head Cover	Stage 1 - 4	35	-
	Stage 2 - 6	53	-
	Stage 3 - 8	70	-
Camshaft Drive Gear Bolts	18	159	13
Cylinder Head Bolts (M8)	20	177	15
Cylinder Head Bolts (M10)	Stage 1 - 10	88	10
	Stage 2 - 60	531	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 Degrees	Stage 5 - 90 Degrees	Stage 5 - 90 Degrees
Cylinder Head Bolt Length When New	205 mm		
Cylinder Head Bolt Max. length	207 mm		
Camshaft Retainer On Cylinder Head	8	70	-
Rail pressure sensor on rail	14	123	10
Bolt, tensioning claw to injector	Stage 1 - 7	62	-
	Stage 2 - 180 Degrees	Stage 2 - 180 Degrees	Stage 2 - 180 Degrees
Oil Separator Cover	14	123	10
Nut, exhaust manifold to cylinder head	25	221	18
Stud bolt, exhaust manifold to cylinder head	20	177	15
Flange connection, exhaust manifold or front exhaust pipes to exhaust collector	Stage 1 - 20	177	15
	Stage 2 - 90 Degrees	Stage 2 - 90 Degrees	Stage 2 - 90 Degrees
Bolt, exhaust line to exhaust collector pipe/turbocharger	20	177	15
EGR Cooler	12	106	9

FRONT OF ENGINE**FRONT OF ENGINE**

DESCRIPTION	N.m	In. Lbs.	Ft. Lbs.

2010 Jeep Commander Limited

2010 ENGINE 3.0L Turbo Diesel - Service Information - Commander

Vacuum Pump	9	80	-
Nut for high-pressure pump drive pinion gear	70	619	51
Bolt, high pressure pump to cylinder head	14	123	10
Fuel line on cylinder head cover / lifting eye / charge air manifold	M6 x 12 - 9	80	-
	M6 x 15 - 14	123	10
Connecting line between left and right rail	27	239	20
Pressure line on high pressure pump	33	292	24
Pressure line of high-pressure pump to rail	27	239	20
Pressure line union nut on rail	27	239	20
Pressure line union nut on injector	33	292	24
Bolt, rail to cylinder head	14	124	10
Bolt, retaining clamp of high-pressure line to cylinder head cover	14	124	10
Bolt connecting quantity control valve to high pressure pump housing flange	7	62	-
High pressure fitting on the high pressure pump	55	486	40
EGR Throttle Valve	9	79	-
Upper Idler Pulley	28	247	20
Bolt, poly-V-belt tensioning device to crankcase	58	513	43
Bolt, power steering oil reservoir to cylinder head cover and oil filter	14	123	10
Oil Filter Cap	25	221	18
Timing Case Cover To Crankcase	10	88	-
Crankshaft Damper	Stage 1 - 210	-	154
	Stage 2 - 180 degrees	Stage 2 - 180 degrees	Stage 2 - 180 degrees
Oil Filter Housing	14	123	10
Bracket to oil filter housing and cylinder head cover	14	123	10
Oil Cooler	12	106	9
Bolt connecting coolant pump housing to crankcase	10	88	-
Bolt, coolant thermostat housing to charge air manifold	9	79	-
High pressure fitting on the high pressure pump	55	40	354
Nut to high-pressure pump drive gear	70	51	451
Bolt, high-pressure pump to cylinder head	14	10	88
Pressure line on high-pressure pump	33	24	212

TURBOCHARGER AND EXHAUST

TURBOCHARGER AND EXHAUST

DESCRIPTION	N.m	In. Lbs.	Ft. Lbs.

2010 Jeep Commander Limited

2010 ENGINE 3.0L Turbo Diesel - Service Information - Commander

Turbocharger To Intake Manifold	10	88	-
Exhausts Tube At Turbocharger	Stage 1 - 20	177	15
	Stage 2 - 90 Degrees	Stage 2 - 90 Degrees	Stage 2 - 90 Degrees
Turbocharger Oil Feed Line At Crankcase	12	106	-
Turbocharger Oil Feed at Turbocharger	Stage 1 - 10	88	-
	Stage 2 - 30	265	22
Exhaust Pipe Support	30	265	22
Turbocharger Heat Shield to Bracket	8	70	-
Turbocharger Shield to Exhaust Collector	10	88	-
Bolt, engine charge air channel of turbocharger to charge air distribution pipe	8	70	-
Engine charge air duct upstream of charge air cooler on bracket	8	70	-
Bolt, engine charge air duct bracket to cylinder head	8	70	-
Bolt, charge air manifold to radiator support	20	177	15
Bracket, throttle valve actuator to cylinder head	9	79	-
Throttle valve actuator bracket and throttle valve actuator coupling flange	10	88	-
Throttle valve actuator on mixing chamber	5	44	-
Bolt, muffler to mixing chamber	8	70	-
Exhaust gas recirculation pipe to charge air distribution line	13	115	10
Exhaust gas recirculation pipe to exhaust collector	Stage 1 - 10	Stage 1 - 88	-
	Stage 2 - 90 Degrees	Stage 2 - 90 Degrees	Stage 2 - 90 Degrees
Union nut connecting pressure line to diesel particulate filter	45	398	33
Bolt for clamping plates of pressure lines	10	88	-
Clamp connecting diesel particulate filter to catalytic converter	35	309	26
Clamp connecting diesel particulate filter to rear muffler	45	398	33
Clamp connecting diesel particulate filter to front muffler	45	398	33

ENGINE MOUNTING

ENGINE MOUNTING

DESCRIPTION	N.m	In. Lbs.	Ft. Lbs.
Bolt, front engine mount to engine support	58	513	42
Bolt, rear engine mount to transmission	40	354	29
Bolt, rear engine mount to transmission carrier M8	30	265	22
Bolt, rear engine mount to transmission carrier M10	58	513	42

Bolt connecting engine support to left crankcase	20	177	15
Bolt connecting engine support to right crankcase	20	177	15

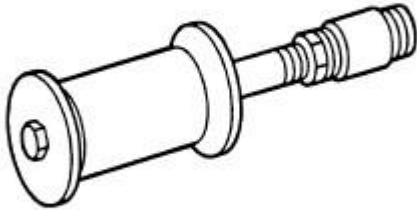
SPECIAL TOOLS

SPECIAL TOOLS



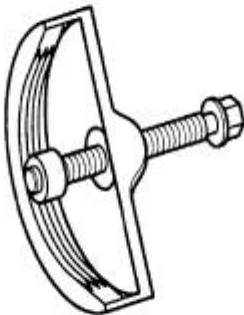
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Fig. 31: INSTALLER, FRONT CRANKSHAFT SEAL - 8936A
Courtesy of CHRYSLER LLC



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Fig. 32: HAMMER, SLIDE - 8937
Courtesy of CHRYSLER LLC



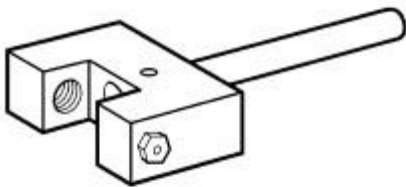
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Fig. 33: REMOVER, VIBRATION DAMPER - 8940
Courtesy of CHRYSLER LLC



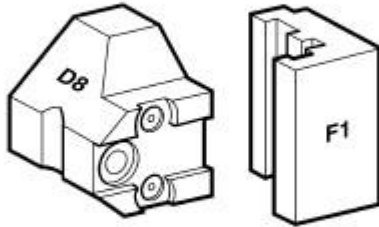
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Fig. 34: INSTALLER, REAR MAIN SEAL - 8944
Courtesy of CHRYSLER LLC



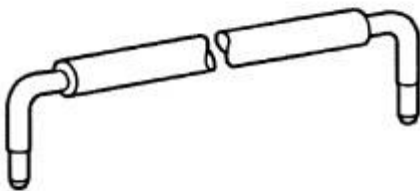
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Fig. 35: TOOL, CHAIN SEPARATOR - 8948
Courtesy of CHRYSLER LLC



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Fig. 36: PIECE, THRUST - 8949A
Courtesy of CHRYSLER LLC



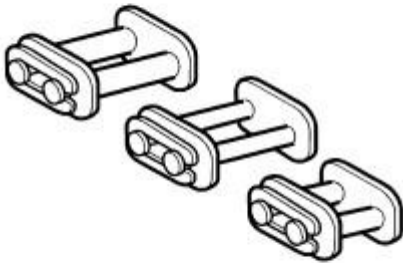
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Fig. 37: LOCKING PINS - 8929
Courtesy of CHRYSLER LLC



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Fig. 38: SCREW, PRESSING - 8950
Courtesy of CHRYSLER LLC



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Fig. 39: LINKS, ASSEMBLY - 8951
Courtesy of CHRYSLER LLC

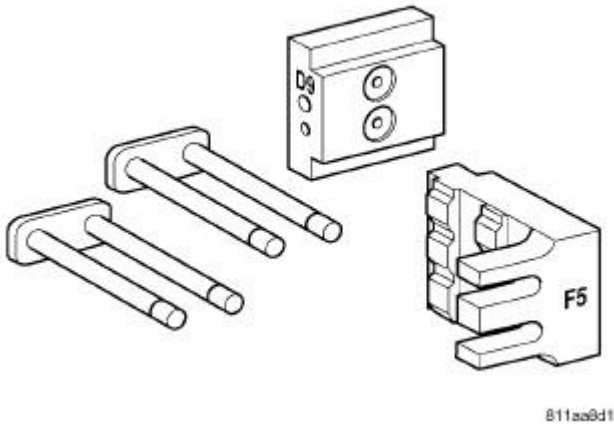


Fig. 40: INSERTS, ASSEMBLY - 8952A
Courtesy of CHRYSLER LLC

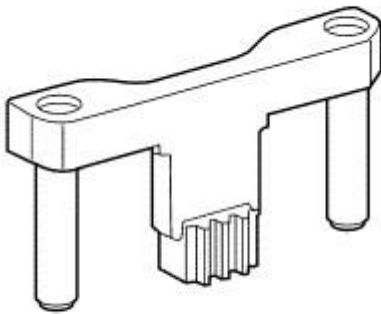


Fig. 41: TOOL, FLYWHEEL LOCKING - 9102
Courtesy of CHRYSLER LLC

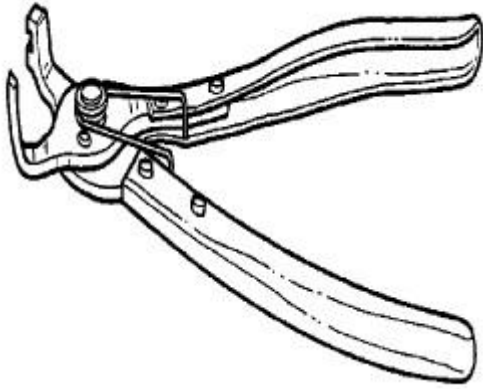


Fig. 42: PLIERS, FUEL LINE - 9539
Courtesy of CHRYSLER LLC

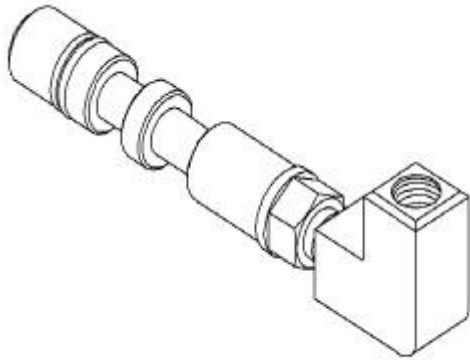


Fig. 43: ADAPTOR - 9543
Courtesy of CHRYSLER LLC

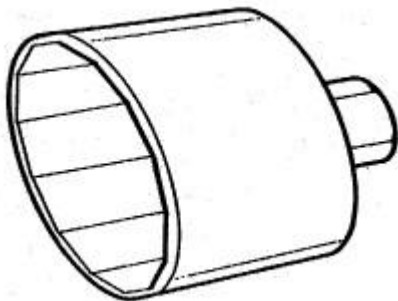


Fig. 44: Wrench, Oil Filter Cap - 9551
Courtesy of CHRYSLER LLC

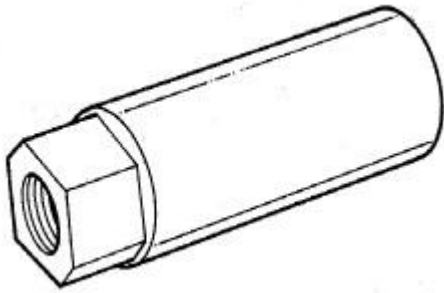
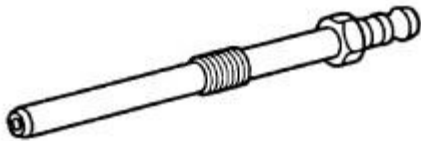


Fig. 45: Remover, Fuel Injector - 9552
Courtesy of CHRYSLER LLC



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Fig. 46: ADAPTER, COMPRESSION TESTER - 9553
Courtesy of CHRYSLER LLC

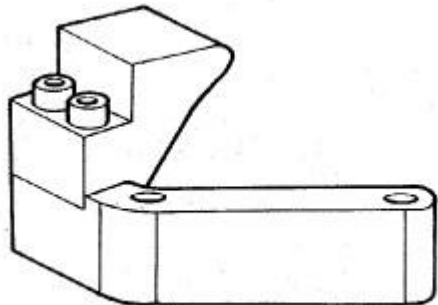


Fig. 47: GUIDE, TIMING CHAIN - 9554
Courtesy of CHRYSLER LLC

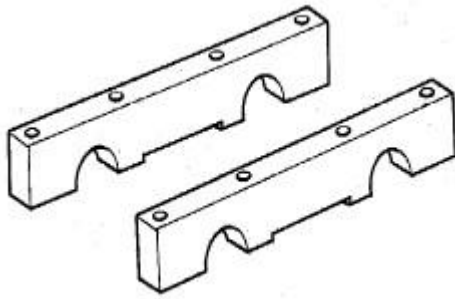


Fig. 48: Retainer, Camshafts - 9555

Courtesy of CHRYSLER LLC

AIR INTAKE SYSTEM

REMOVAL

AIR INTAKE TUBE

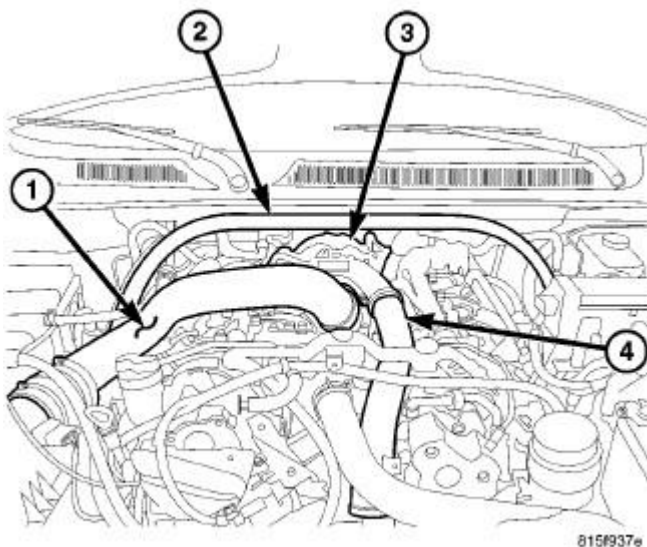


Fig. 49: STRUT TOWER SUPPORT

Courtesy of CHRYSLER LLC

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

1. Remove the engine cover. See **Engine - Removal**
2. Remove the intake air tube (4).

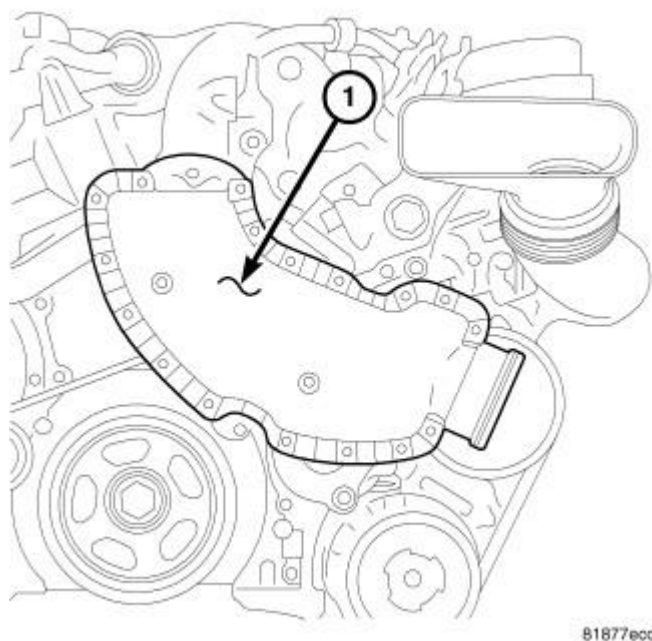


Fig. 50: MIXING CHAMBER
Courtesy of CHRYSLER LLC

3. Remove the mixing chamber (1).

AIR CLEANER

Removal

REMOVAL

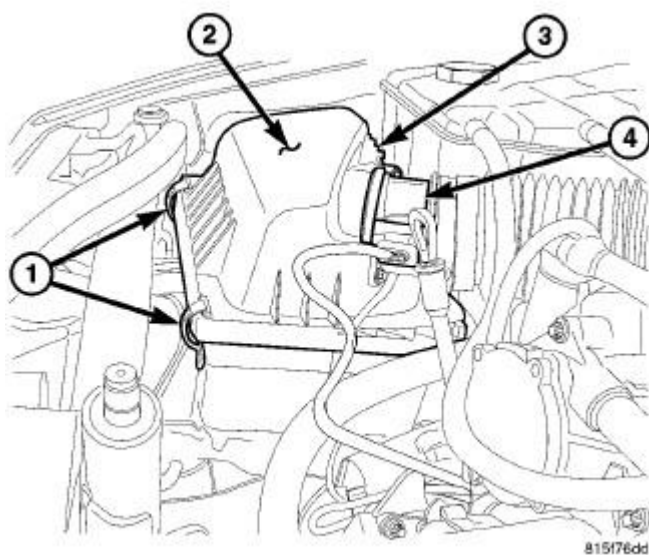


Fig. 51: AIR CLEANER COVER
Courtesy of CHRYSLER LLC

- 1 - SPRING CLIPS
- 2 - COVER
- 3 - AIR PRESSURE SENSOR
- 4 - MAF SENSOR

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

1. Disconnect the negative battery cable.
2. Disconnect the mass air flow (MAF) (4) and air pressure sensor (3) electrical connectors.
3. Pry up 2 spring clips (1) from front of housing cover (2) , (spring clips retain cover to housing).
4. Release housing cover (2) from locating tabs located on rear of housing, and lift cover.

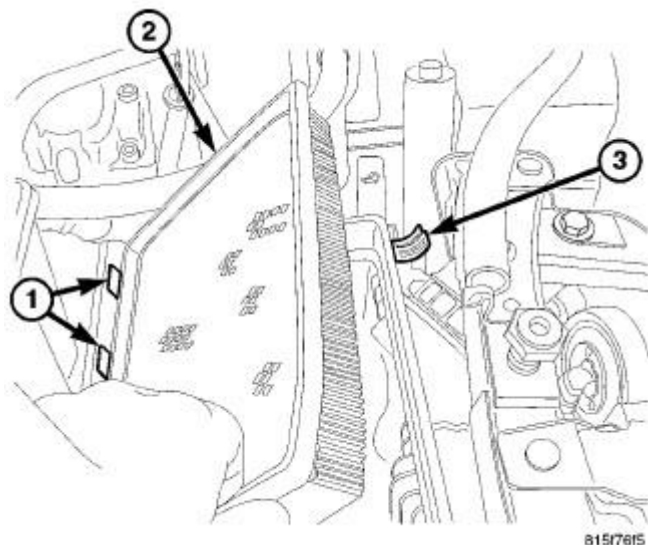


Fig. 52: AIR CLEANER ELEMENT
Courtesy of CHRYSLER LLC

- 1 - LOCATING TABS
- 2 - AIR CLEANER ELEMENT
- 3 - SPRING CLIP

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

Installation

INSTALLATION

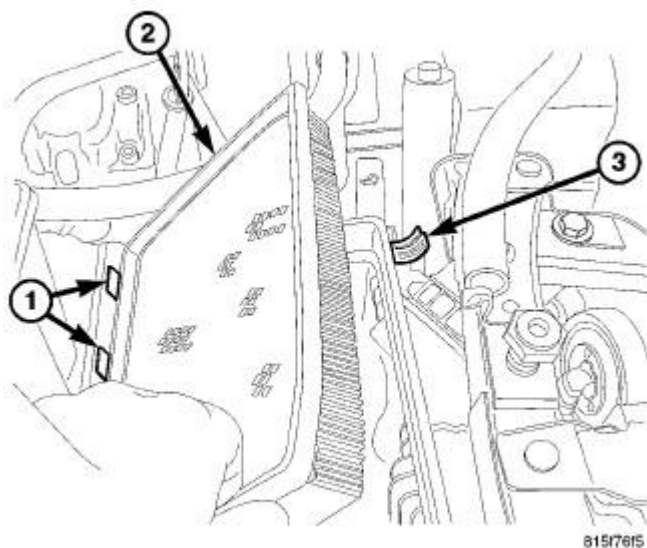


Fig. 53: AIR CLEANER ELEMENT
Courtesy of CHRYSLER LLC

- 1 - LOCATING TABS
- 2 - AIR CLEANER ELEMENT
- 3 - SPRING CLIP

NOTE: Clean housing and inspect the gasket for damage before installing a clean filter. Replace as necessary.

1. Install element into housing (2) .
2. Position housing cover into rear housing locating tabs (1) and seat cover onto housing.

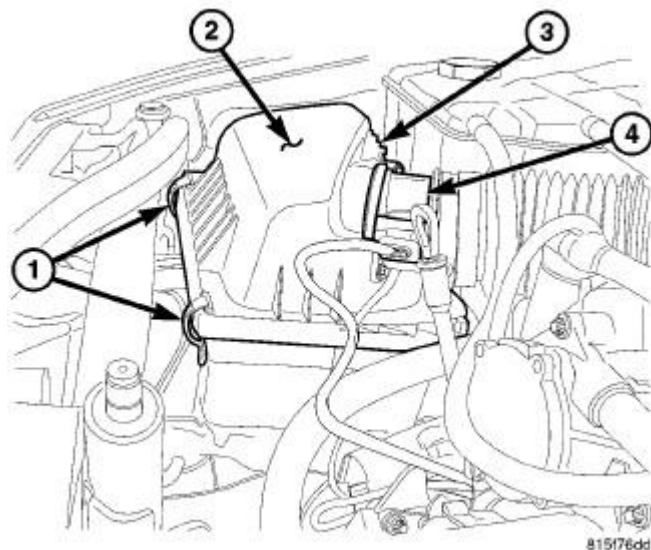
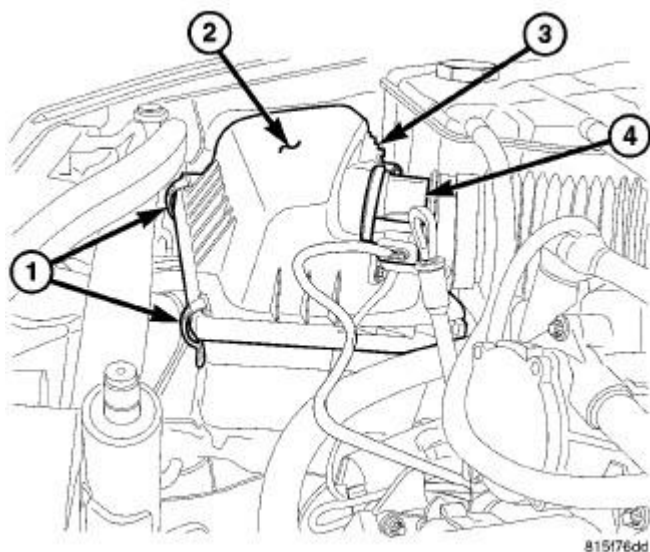


Fig. 54: AIR CLEANER COVER

Courtesy of CHRYSLER LLC

- 1 - SPRING CLIPS
- 2 - COVER
- 3 - AIR PRESSURE SENSOR
- 4 - MAF SENSOR

3. Pry up spring clips (1) and lock cover to housing.
4. Connect air intake duct and tighten clamp to 5 N.m (44 in. lbs.).
5. Connect the MAF (4) and air pressure sensor (3) electrical connectors.
6. Connect the negative battery cable.

BODY, AIR CLEANER**Removal****REMOVAL****Fig. 55: AIR CLEANER COVER**

Courtesy of CHRYSLER LLC

- 1 - SPRING CLIPS
- 2 - COVER
- 3 - AIR PRESSURE SENSOR
- 4 - MAF SENSOR

1. Disconnect the negative battery cable.
2. Disconnect the MAF (4) and air pressure sensor (3) electrical connectors .

3. Remove the air outlet hose from the air cleaner assembly.
4. Pry up two spring clips (1) from front of housing cover (2) (spring clips retain cover to housing).
5. Release housing cover (2) from locating tabs located on rear of housing, and remove cover (2).
6. Remove the rear lower housing to fender well fastener.
7. Remove the air inlet duct.
8. Pulling upward, remove the air cleaner housing.

Intake Air Tube

1. Remove the CCV hose at Oil separator. (During removal of the CCV hose do NOT disconnect CCV hose at the Air Tube)
2. Loosen the clamp on the Airbox outlet flex hose end.
3. Loosen the clamp on the Turbo inlet end.
4. Remove the retaining fastener.
5. Remove the intake air tube and ensure that Orange seal is not rolled or damaged.

NOTE: Any incorrect installation or miss alignment of the air tube can result oil leaks.

Mixing Chamber

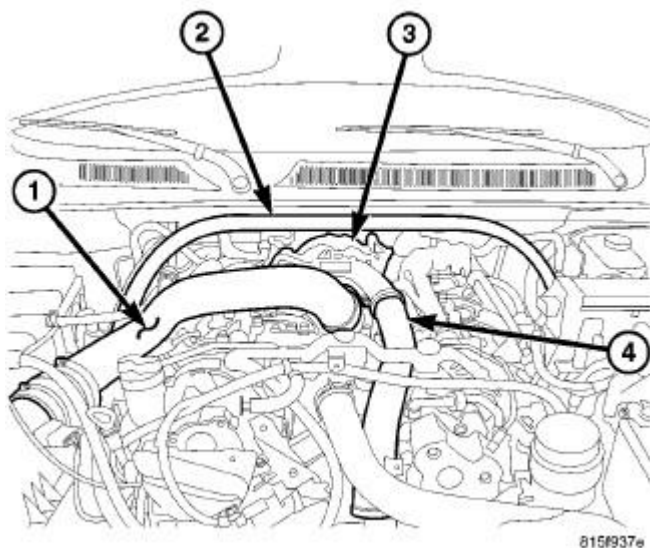


Fig. 56: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

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

4 - CHARGE AIR INLET TUBE

1. Remove the engine cover. See **Engine - Removal**.
2. Remove the intake air tube (4).

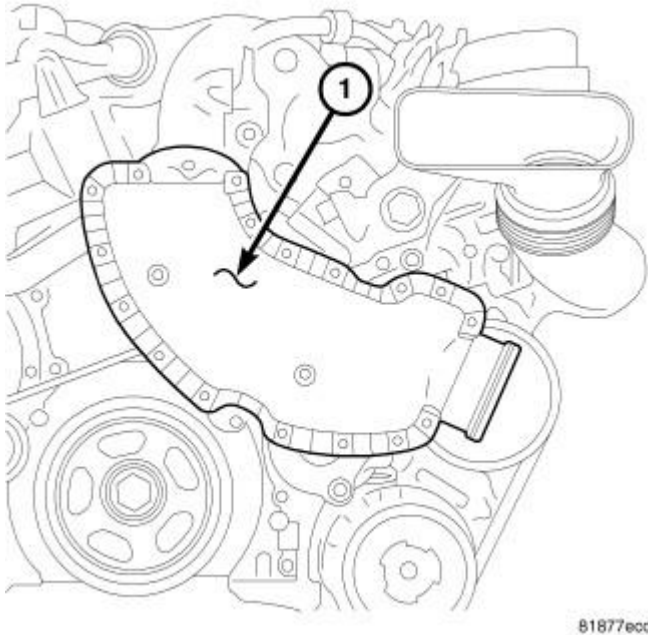


Fig. 57: MIXING CHAMBER
Courtesy of CHRYSLER LLC

3. Remove the mixing chamber (1).

Installation**INSTALLATION**

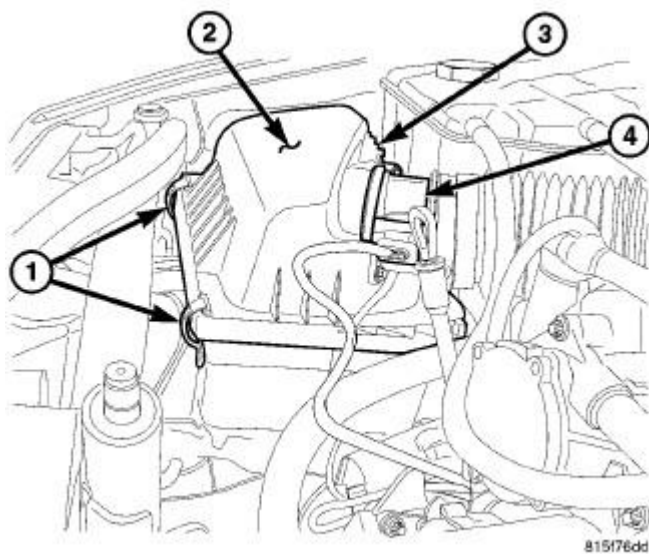


Fig. 58: AIR CLEANER COVER
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - SPRING CLIPS
2 - COVER
3 - AIR PRESSURE SENSOR
4 - MAF SENSOR |
|--|

1. Position the lower housing and attach the air inlet duct.
2. Install the lower housing to fender well fastener. Tighten fastener to 5 N.m (44 in. lbs.).
3. Install the air cleaner element.
4. Position housing cover (2) into housing locating tabs.
5. Pry up spring clips (1) and lock cover (2) to housing.
6. Install the air outlet tube. tighten clamp to 5 N.m (44 in. lbs.).
7. Connect the MAF (4) and air pressure sensor (3) wire harness connectors.
8. Connect the negative battery cable.

Intake Air Tube

1. Before tightening any clamps or fasteners perform the following.

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

2. Slide Air Inlet tube flex hose over airbox outlet fitting.

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.

3. Slide air Inlet tube over Turbo inlet fitting ensure that Orange seal is not rolled and is proper positioned.
4. Install retaining fastener located approximately 1 - 2 inches down stream of the airbox flex hose and tighten to specified torque. This will hold the tube in the proper position so that the clamps can now be tightened.
5. Tighten clamp on the Turbo inlet end first to the proper specified torque. Over tightening of the clamp may result in breakage of the air tube.
6. Tighten clamp on the airbox outlet flex hose end to the proper specified torque. Over tightening of the clamp may result in breakage of the air tube.
7. Attach CCV hose at Oil separator. (During removal of the CCV hose do NOT disconnect CCV hose at the Air Tube).

Mixing Chamber

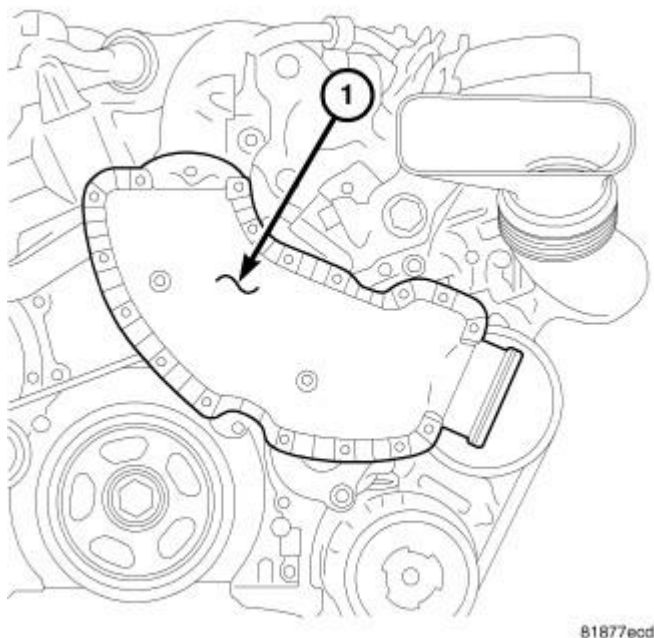


Fig. 59: MIXING CHAMBER
Courtesy of CHRYSLER LLC

1. Install the mixing chamber (1).

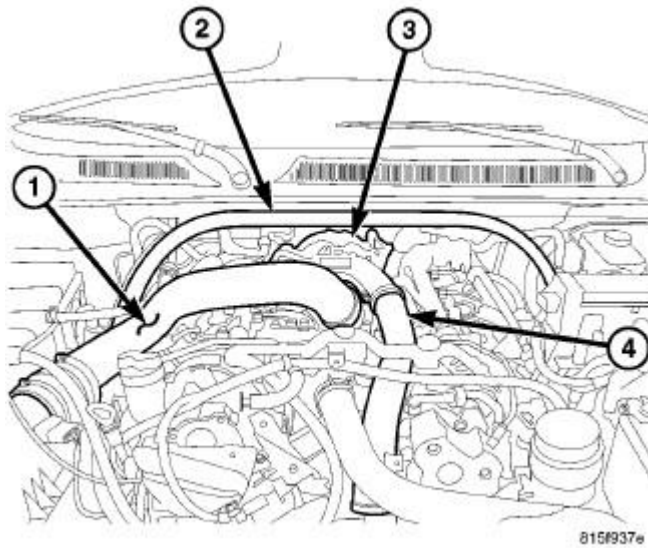


Fig. 60: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

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

2. Install the intake air tube (4).
3. Install the engine cover. See **Engine - Installation.**

CYLINDER HEAD

DESCRIPTION

DESCRIPTION

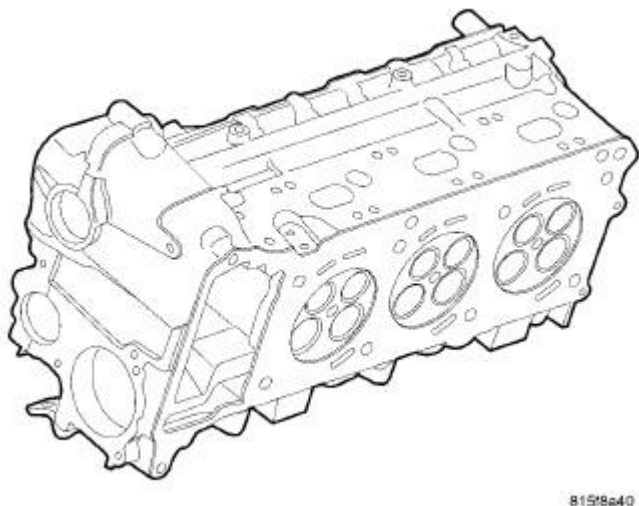


Fig. 61: CYLINDER HEAD
Courtesy of CHRYSLER LLC

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 resurfaceable. 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 [Engine/Cylinder Head - 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 in illustration.

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

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

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

VALVE SEALS - IN VEHICLE

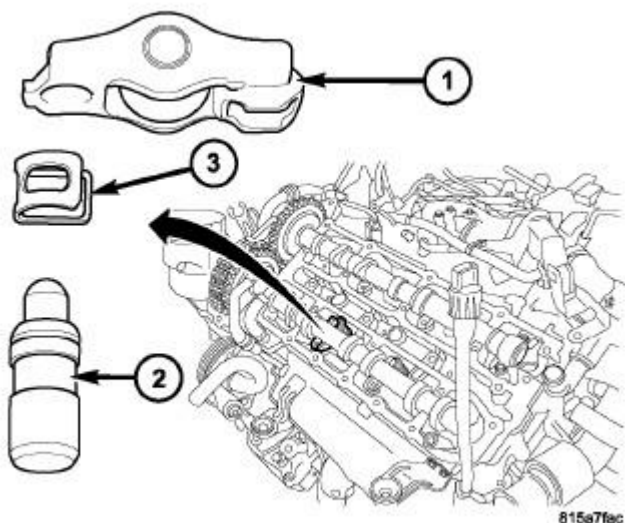


Fig. 62: ROCKER ARMS

Courtesy of CHRYSLER LLC

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

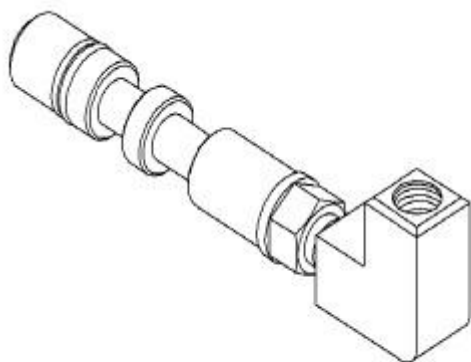
- Disconnect the negative battery cable.

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.

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

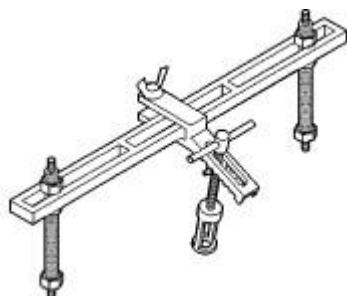
NOTE: Rocker arms and lifters must be installed in the same location as when removed and stored in the up right position.

- Remove the rocker arm (1) and lifter (2) assembly. See Engine/Cylinder Head/ROCKER ARM, Valve - Removal.

**Fig. 63: ADAPTOR - 9543**

Courtesy of CHRYSLER LLC

4. Install the Compression Test Adapter 9543 into the injector hole and secure in place using the fuel injector retaining claw and bolt.
5. Connect a regulated shop air supply to Compression Test Adapter 9543 and pressurize the cylinder.

**Fig. 64: Valve Spring Compressor MD998772A**

Courtesy of CHRYSLER LLC

6. Place shop towels around the working area of the cylinder head to prevent valve locks from accidentally entering the engine.
7. Using Valve Spring Compressor MD998772A, collapse the valve spring and remove the locks.
8. Remove the valve spring assembly.

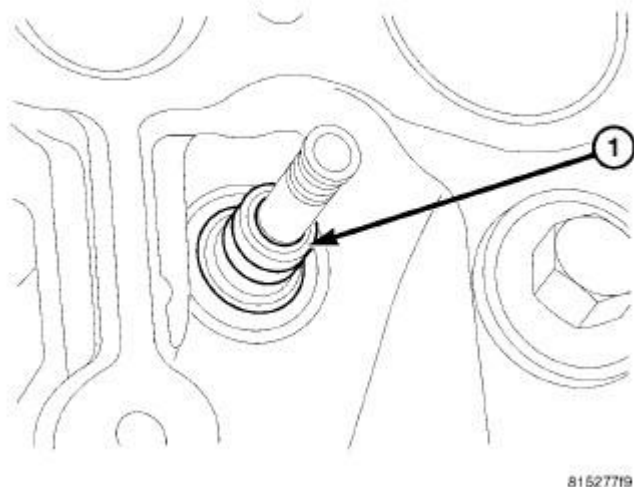


Fig. 65: VALVE SEAL
Courtesy of CHRYSLER LLC

9. Remove the valve seal (1).
10. Repeat this procedure for all valve seals.

VALVE SERVICE

Valve Guide Seals In Vehicle Service. See Engine/Cylinder Head - Standard Procedure.

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

DISASSEMBLY

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

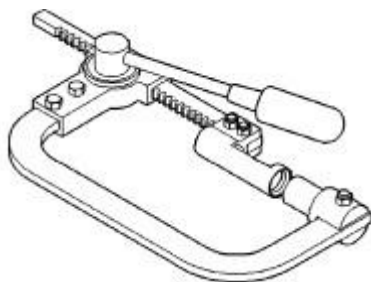


Fig. 66: Valve Spring Compressor C-3422CF
Courtesy of CHRYSLER LLC

2. Using Valve Spring Compressor C-3422CF, compress the valve spring.
3. Remove the valve spring retainer locks and remove the valve springs retainers and valve 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.

NOTE: Valves must be installed in the same location as when removed.

5. Remove the valves and place them in a rack in the same order as removed.

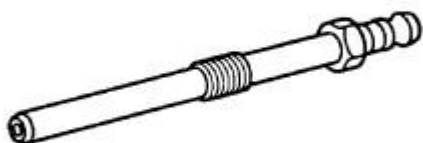
VALVE CLEANING

1. Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and cylinder head.
2. Clean and inspect all sealing surfaces.

INSPECTION

1. Inspect and replace valves displaying any of the following damage;
 - Burned valve face
 - Cracks on valve face
 - Pitting on valve face
 - Warping of valve face
 - Scuffing on valve stems
 - Bent valve stems

COMPRESSION TEST



80e492e9

Fig. 67: ADAPTER, COMPRESSION TESTER - 9553

Courtesy of CHRYSLER LLC

1. Warm up engine to operating temperature (approximately 80°C, 176°F).
2. Shut off engine.
3. Remove engine cover. See **Engine - Removal**.
4. Remove injectors. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Removal**.
5. Crank engine several times with the starter to eliminate combustion residues in the cylinders.
6. Insert Adapter 9553 into injector hole of cylinder to be tested. Install injector retainer.
7. Test compression pressure by cranking engine with starter for at least 8 revolutions.
8. Carry out test procedure at the remaining cylinders in the same way.
9. Compare pressure readings obtained with the specified pressures. If the pressure reading is below the minimum compression pressure or if the permissible difference between the individual cylinders is exceeded, see **Engine - Standard Procedure**.

3.0L COMPRESSION SPECIFICATION

COMPRESSION SPECIFICATION	
Minimum Allowable	18 bar (261 psi.)
Maximum Allowable	3 bar (44 psi.)
Difference Between Cylinders	
Average Compression Ratio	27 - 32 bar (391.5 - 464 psi)

10. Remove Adapter 9553 from cylinder head.
11. Install injectors. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Installation**.
12. Install engine cover. See **Engine - Installation**.

REMOVAL**LEFT**

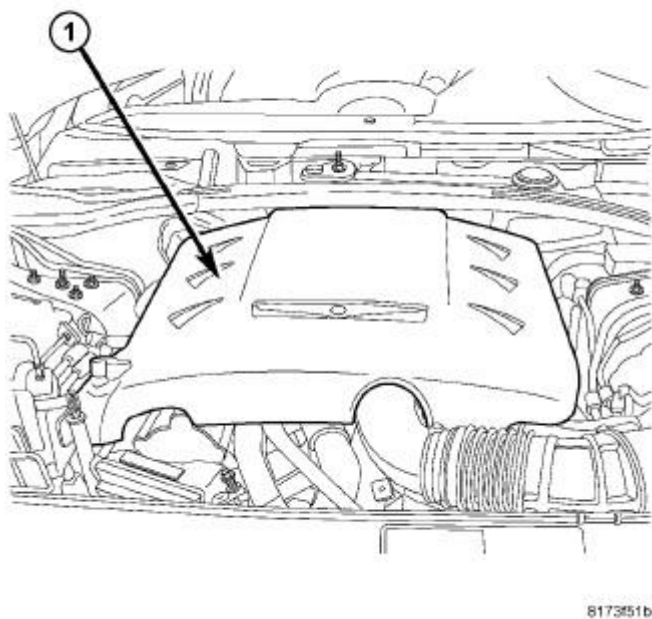


Fig. 68: ENGINE COVER
Courtesy of CHRYSLER LLC

1. Remove the engine cover (1) and brackets.

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.

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.

2. Remove both cylinder head covers. See Engine/Cylinder Head/COVER(S), Cylinder Head - Removal.

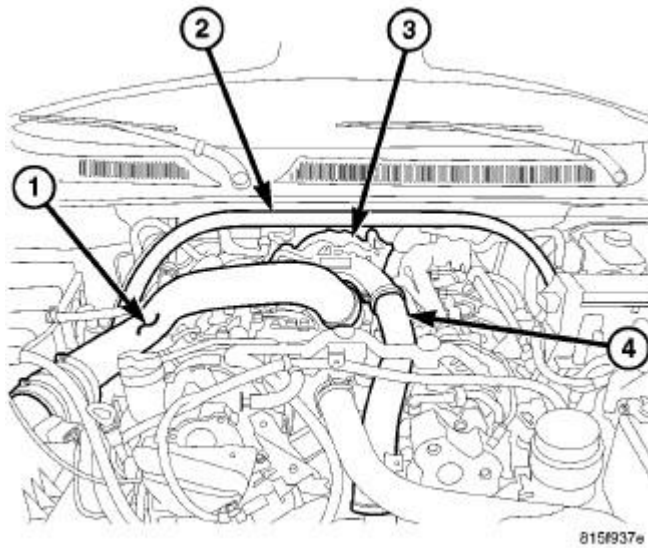


Fig. 69: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

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

3. Remove the strut tower support (2).
4. Drain the cooling system. Refer to **Cooling - Standard Procedure**.

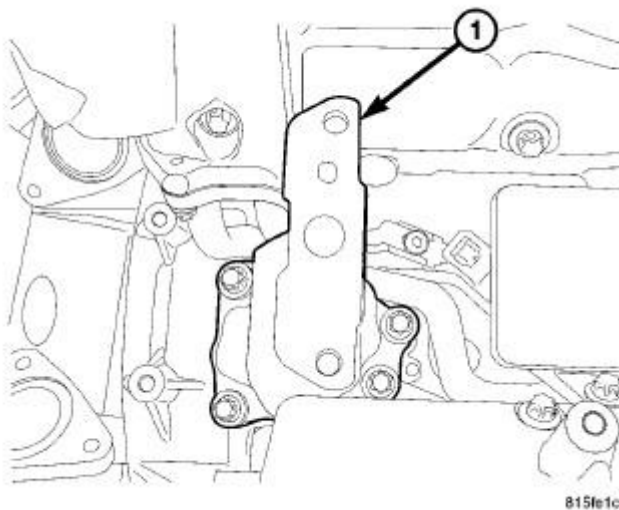


Fig. 70: TURBOCHARGER ADAPTOR
Courtesy of CHRYSLER LLC

- 1 - TURBOCHARGER ADAPTOR
- 2 - SWIRL VALVE ACTUATOR

5. Remove the turbocharger. See Engine/Turbocharger System/TURBOCHARGER - 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).

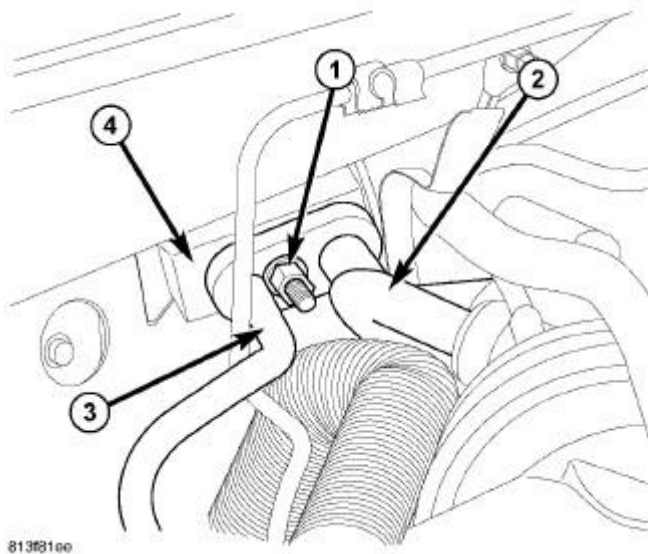


Fig. 71: A/C Expansion Valve Lines Removal & Installation
Courtesy of CHRYSLER LLC

7. Evacuate the A/C system. Refer to Heating and Air Conditioning/Plumbing - Standard Procedure.
8. Disconnect the A/C suction line (2) and the A/C liquid line (3) from the A/C expansion valve (4) and position aside. Refer to Heating and Air Conditioning/Plumbing/LINE, A/C Suction - Removal.
9. Raise and support the vehicle.

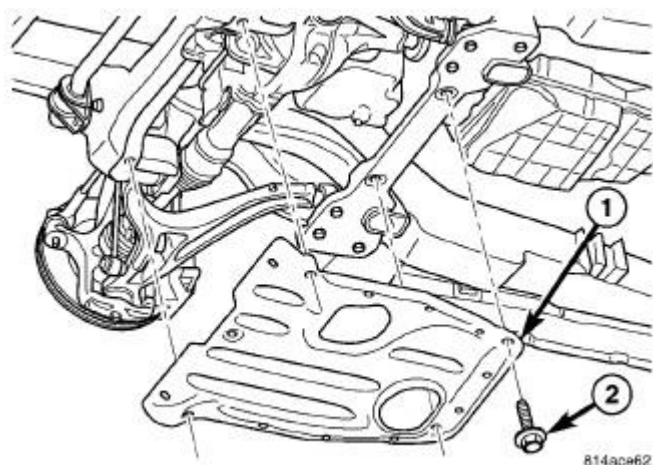


Fig. 72: UPDATED SKID PLATE
Courtesy of CHRYSLER LLC

10. Remove the front skid plate (1).

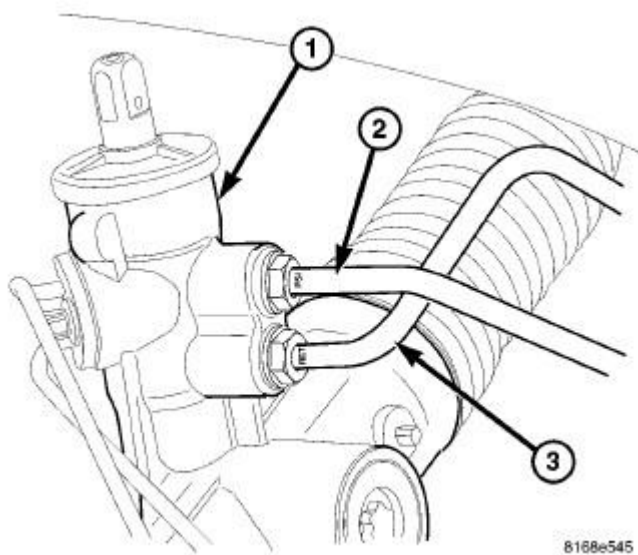


Fig. 73: LINES AT GEAR
Courtesy of CHRYSLER LLC

11. Remove the power steering pressure hose (2) and return hose (3) at the gear (1). Refer to **Steering/Pump/HOSE, Power Steering - Removal** .

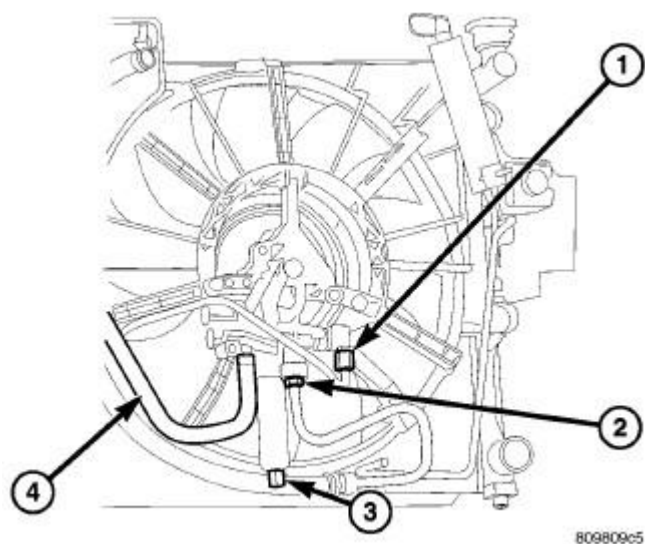


Fig. 74: HYDRAULIC LINES/HOSES AND ELECTRICAL CONNECTOR

Courtesy of CHRYSLER LLC

NOTE: The hydraulic fan drive is driven by the power steering pump. When removing lines or hoses from fan drive assembly use a drain pan to catch any power steering fluid that may exit the fan drive or the lines and hoses.

12. Remove the cooling fan module. Refer to Cooling/Engine/FAN, Cooling - Removal .
13. Lower the vehicle.
14. Remove the upper radiator hose.
15. Disconnect the coolant reservoir hose at thermostat housing and position aside.

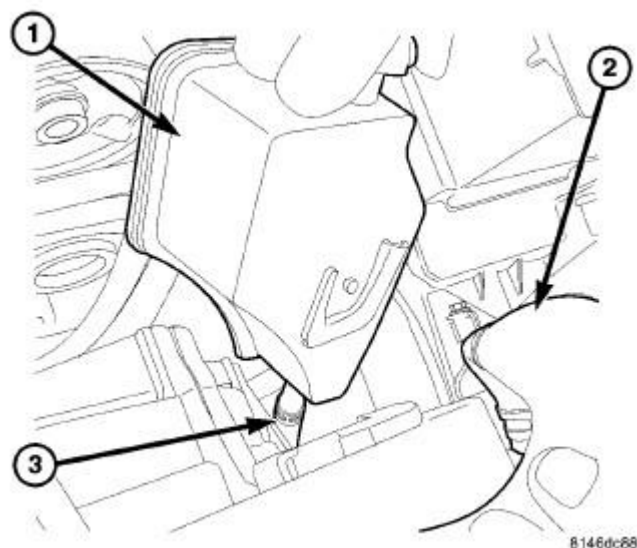


Fig. 75: FLUID RESERVOIR

Courtesy of CHRYSLER LLC

16. Remove the power steering pump reservoir. Refer to **Steering/Pump/RESERVOIR, Power Steering Pump - Removal**.

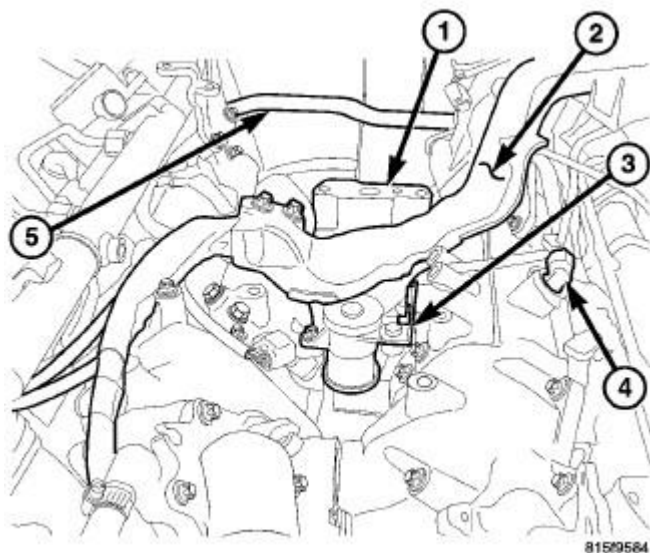
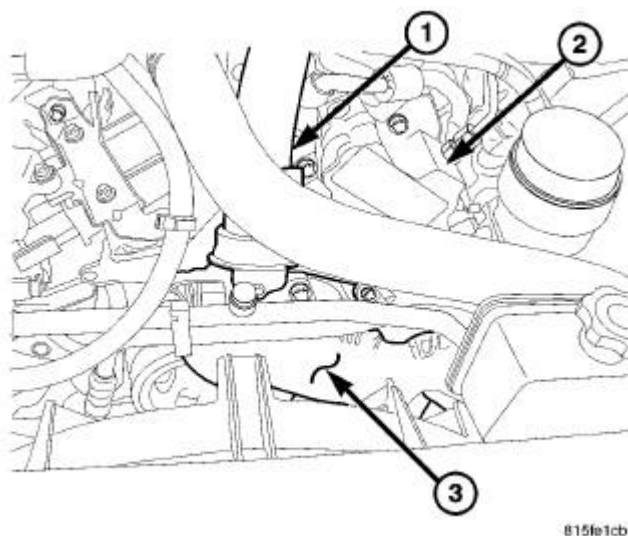


Fig. 76: MAIN ENGINE WIRING HARNESS

Courtesy of CHRYSLER LLC

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

17. Disconnect the swirl valve actuator (3), glow plugs, EGR pressure sensor and coolant temperature sensor (4) electrical connectors.
18. Remove the main engine wiring harness (2) fasteners and position the harness aside.

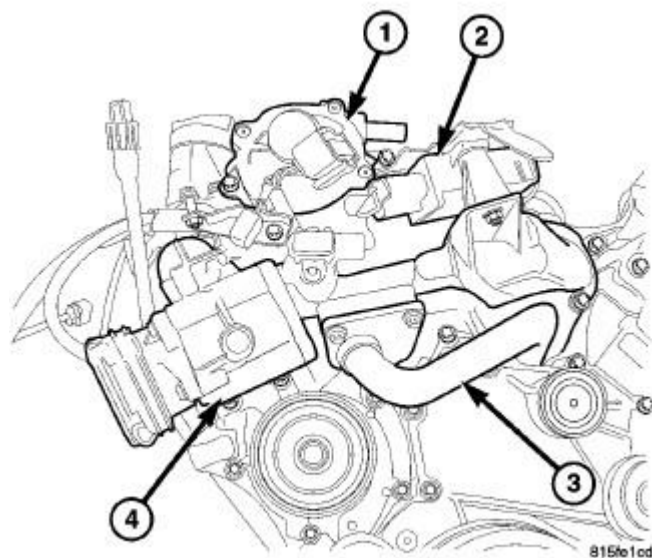


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Fig. 77: CHARGE AIR COOLER INLET WITH RESONATOR
Courtesy of CHRYSLER LLC

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

19. Remove the charge air cooler inlet pipe (1) and resonator (3).



815fe1cd

Fig. 78: AIR CONTROL VALVE
Courtesy of CHRYSLER LLC

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

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

20. Remove the EGR airflow control (4) and resonator.

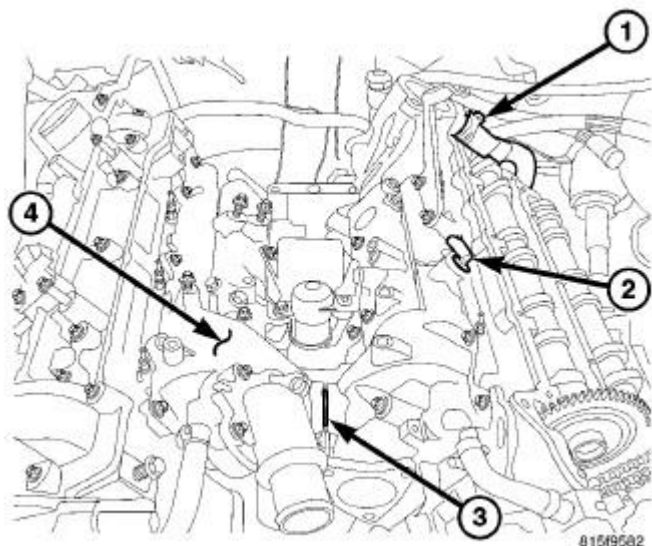


Fig. 79: INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

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

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 in the front of the intake manifold for leaks, repair as necessary.

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

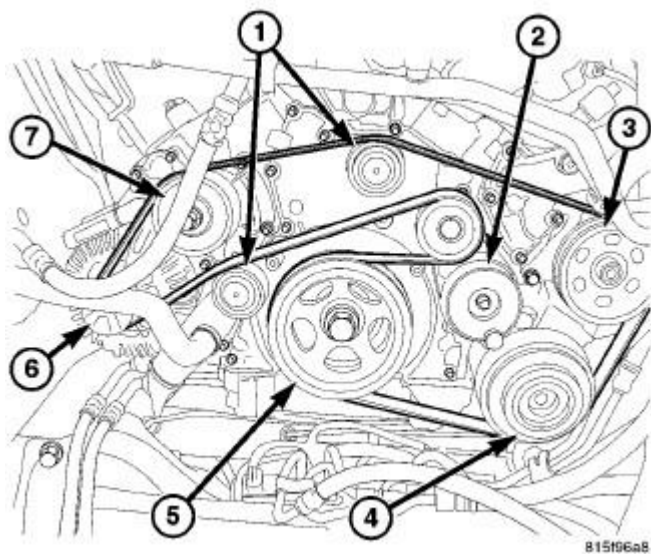


Fig. 80: ACCESSORY DRIVE BELT
Courtesy of CHRYSLER LLC

- | |
|--|
| <ul style="list-style-type: none">1 - IDLER PULLEYS2 - DRIVE BELT TENSIONER3 - POWER STEERING PUMP4 - AIR CONDITIONING COMPRESSOR5 - VIBRATION DAMPER6 - GENERATOR7 - WATER PUMP |
|--|

- 22. Remove the accessory drive belt. Refer to Cooling/Accessory Drive/BELT, Serpentine - Removal .
- 23. Remove the two idler pulleys (1).
- 24. Remove the belt tensioner (2).

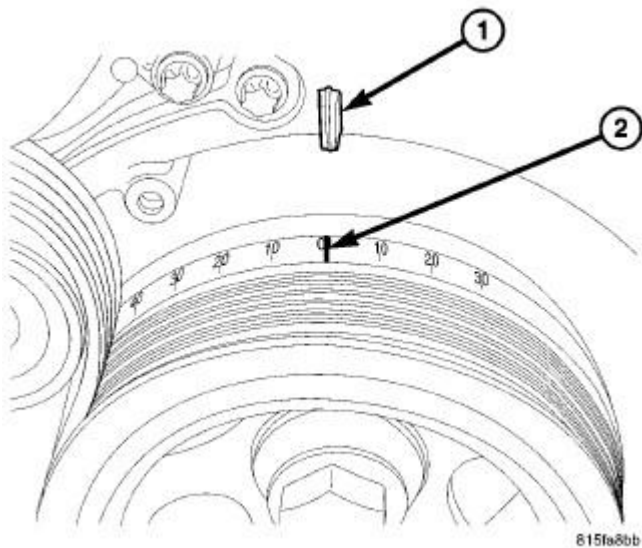


Fig. 81: VIBRATION DAMPER
Courtesy of CHRYSLER LLC

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

25. Rotate the engine by the crankshaft damper bolt to TDC.
26. Raise and support the vehicle.
27. Remove right side starter blank.

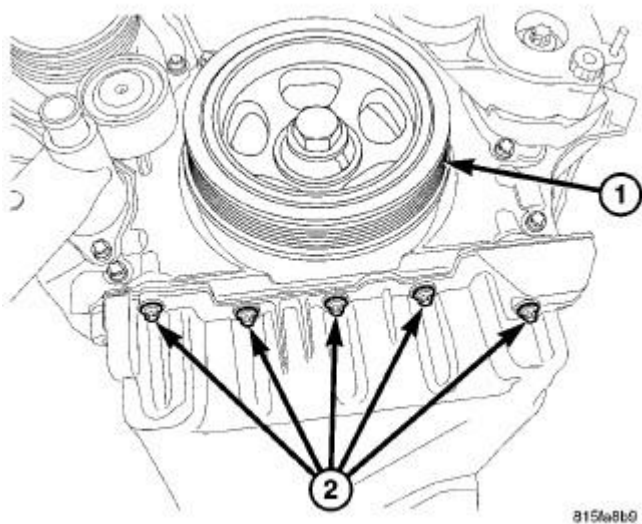


Fig. 82: FRONT OIL PAN
Courtesy of CHRYSLER LLC

- 1 - VIBRATION DAMPER
- 2 - OIL PAN BOLTS

28. Remove the front oil pan retaining bolts (2).
29. Lower the vehicle.

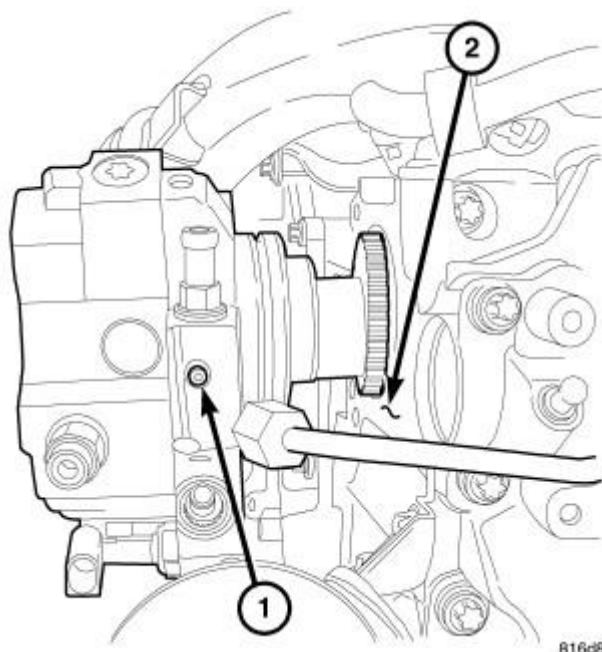
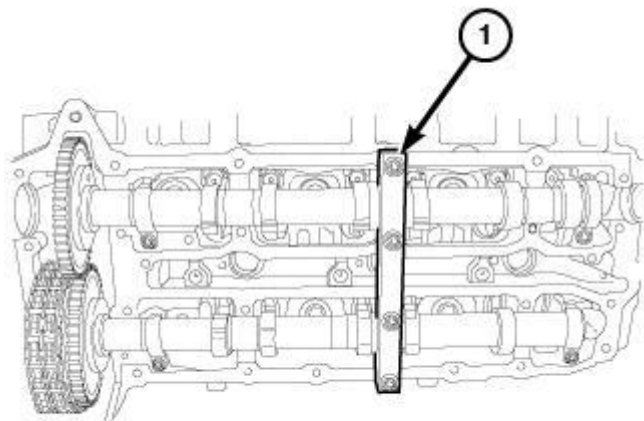


Fig. 83: HIGH PRESSURE PUMP INSTALLATION
Courtesy of CHRYSLER LLC

WARNING: High pressure fuel lines deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 1600 bar (23,200 psi). Use extreme caution when inspecting for high pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system.

30. Remove the high pressure pump. Refer to Fuel System/Fuel Delivery/PUMP, Fuel Injection - Removal.
31. Remove the glow plugs from the left cylinder head. Refer to Electrical/Ignition Control/PLUG, Glow - Removal.

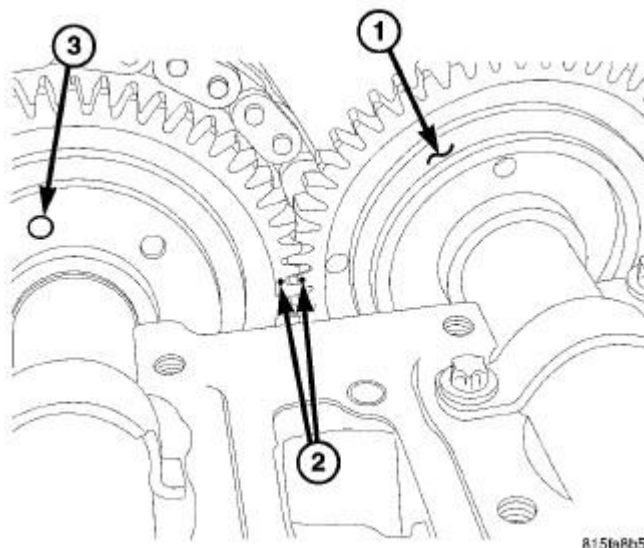


2686690

Fig. 84: Camshaft Holding Fixture 9555

Courtesy of CHRYSLER LLC

32. Install the Camshaft Holding Fixture 9555 (1) on both cylinder heads.



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Fig. 85: LEFT CAMSHAFT GEAR ALIGNMENT

Courtesy of CHRYSLER LLC

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

33. 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° until the camshaft marks (2) align together and the vibration

damper reaches TDC.

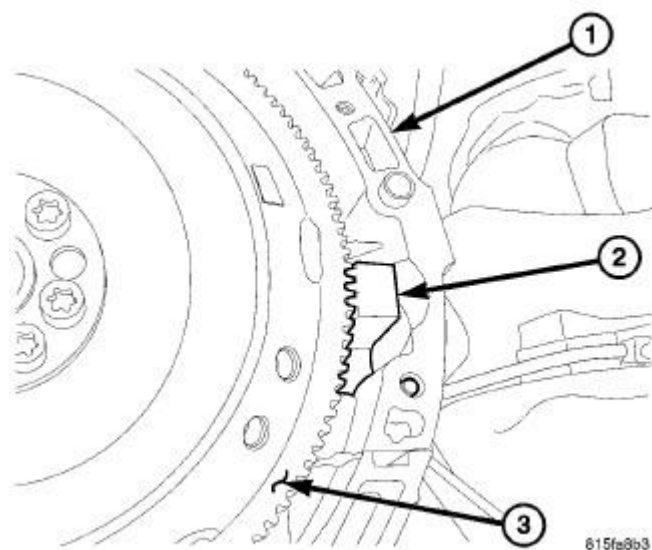


Fig. 86: SPECIAL TOOL 9102
Courtesy of CHRYSLER LLC

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

34. Raise and support the vehicle.
35. Install the Flywheel Lock (2) 9102 into the starter access blank.
36. Lower the vehicle.

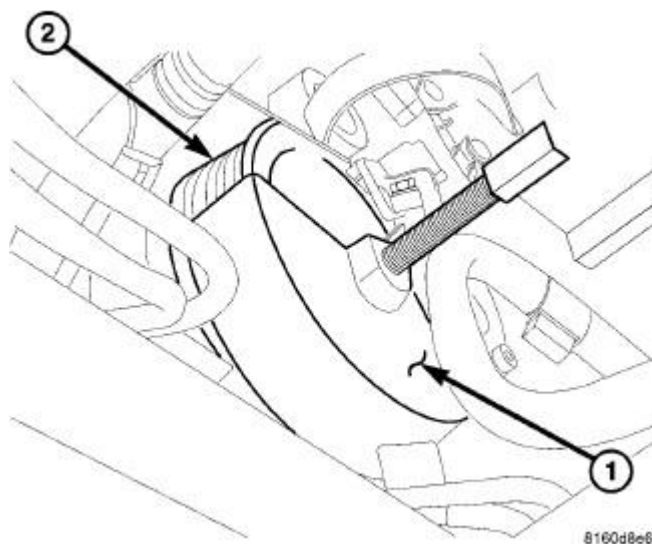


Fig. 87: CRANKSHAFT DAMPER REMOVER 9544

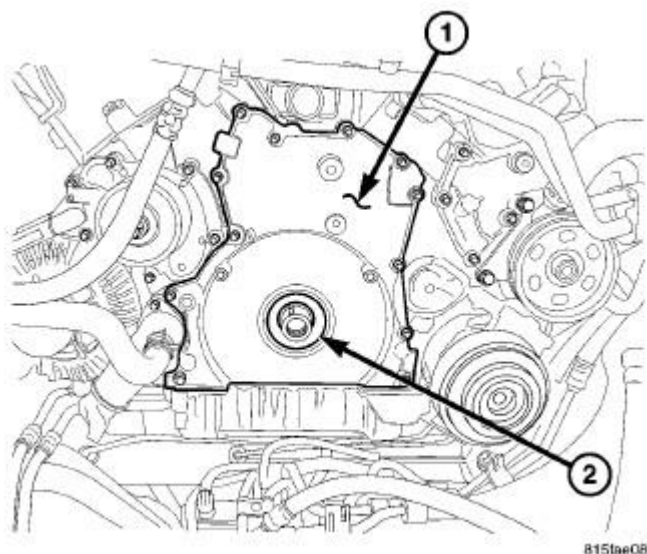
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - SPECIAL TOOL 9544
2 - VIBRATION DAMPER |
|---|

37. Remove the crankshaft damper bolt.
38. Install the Crankshaft Damper Remover (1) 9544.

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

39. Remove the crankshaft damper (2).

**Fig. 88: FRONT TIMING COVER**

Courtesy of CHRYSLER LLC

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

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

40. Remove the front timing chain cover (1).

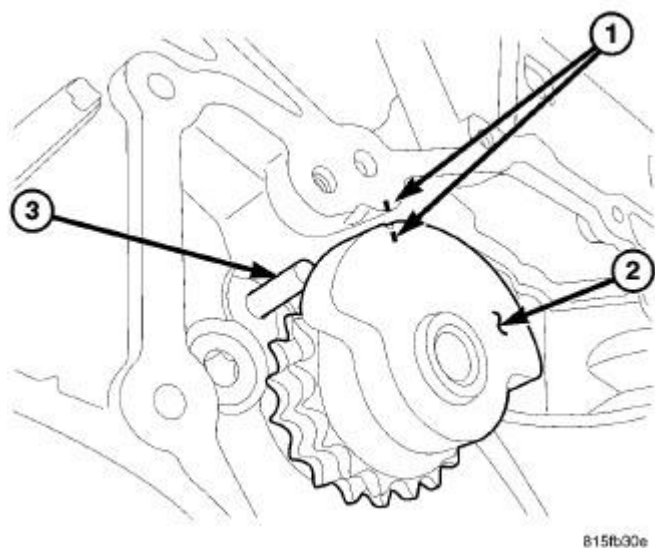


Fig. 89: BALANCE SHAFT INDEXING
Courtesy of CHRYSLER LLC

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

41. Paint mark or scribe the balance shaft (2) position to the engine block (1) and timing chain.
42. Paint mark or scribe the timing chain to crankshaft gear and camshaft drive gear relation.

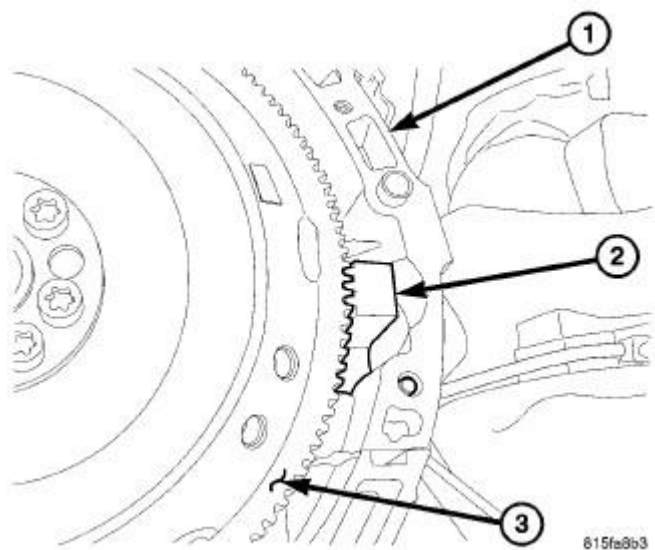


Fig. 90: FLYWHEEL LOCK 9102
Courtesy of CHRYSLER LLC

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

- 43. Raise and support the vehicle.
- 44. Remove the Flywheel Lock 9102 (2).
- 45. Lower the vehicle.

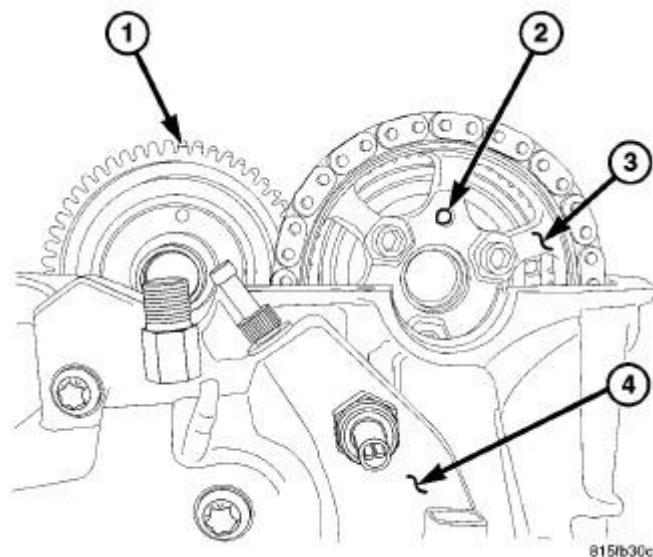


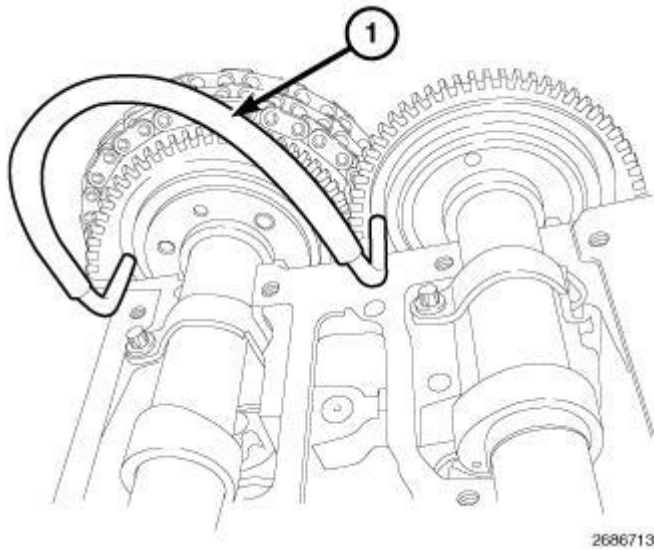
Fig. 91: LEFT EXHAUST CAMSHAFT DRIVE GEAR ALIGNMENT DOWEL
Courtesy of CHRYSLER LLC

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

- 46. Rotate the engine and remove the exhaust camshaft drive gear (3) lower bolt.

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

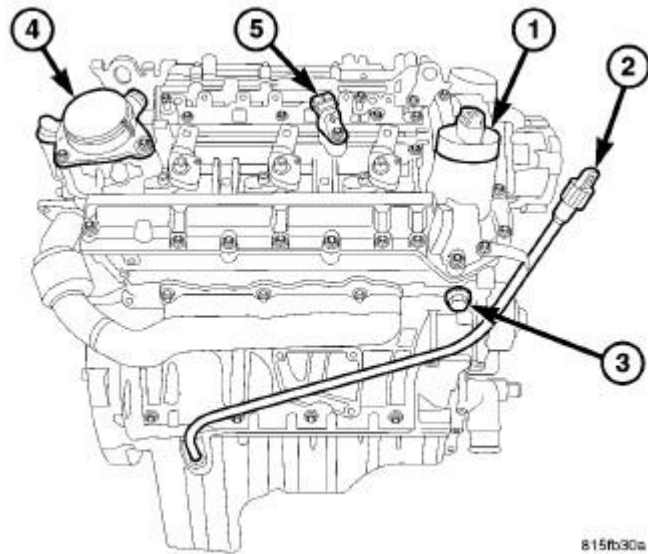
- 47. Rotate the engine back to TDC and check the alignment marks at the balance shaft, camshaft gear and crankshaft gear.



2686713

Fig. 92: Camshaft Locking Pins 8929
Courtesy of CHRYSLER LLC

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



815fb30a

Fig. 93: TIMING CHAIN ADJUSTER
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> |
|--|

49. Remove the timing chain tensioner (3).

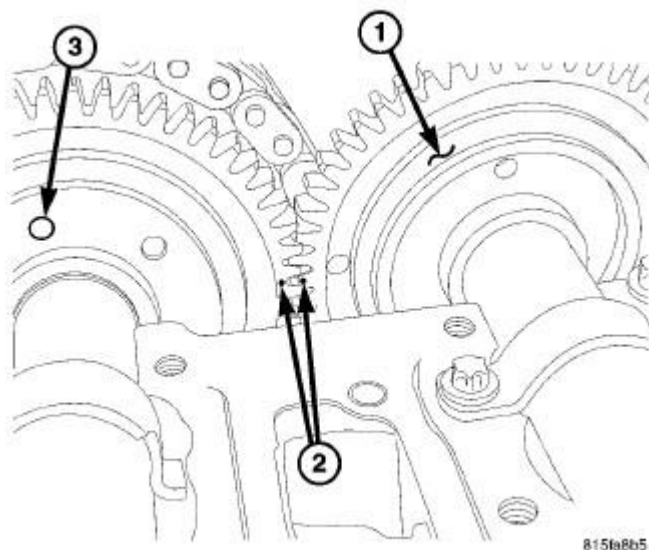


Fig. 94: LEFT CAMSHAFT GEAR ALIGNMENT
Courtesy of CHRYSLER LLC

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

50. Remove the exhaust camshaft drive gear (3) retaining bolts.
51. Separate the exhaust camshaft drive gear (3) and chain from the camshaft.
52. Remove the exhaust camshaft drive gear.

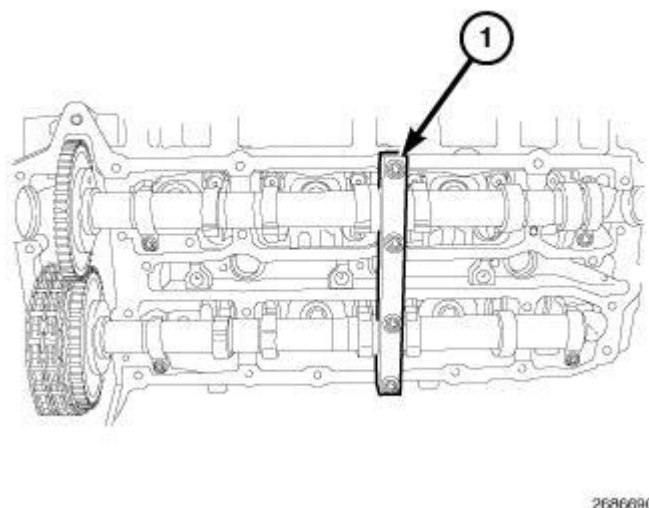


Fig. 95: Camshaft Holding Fixture 9555

Courtesy of CHRYSLER LLC

53. Remove the Camshaft Holding Fixture 9555 (1) from the left cylinder head.

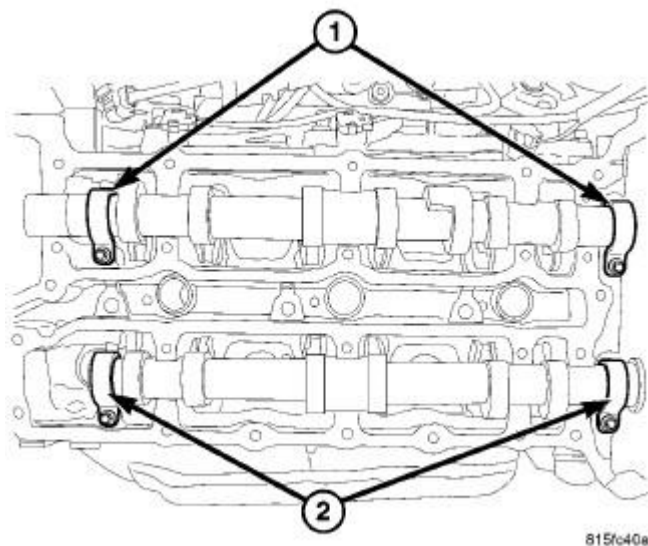


Fig. 96: CAMSHAFT RETAINERS

Courtesy of CHRYSLER LLC

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

54. Remove the intake and exhaust camshaft retainers (1, 2).
55. Remove the exhaust camshaft.
56. Remove the intake camshaft and gear.

NOTE: Note the location of the follower and tappet assemblies; they must be installed in the same location as when removed.

57. If required, remove the followers and tappets.

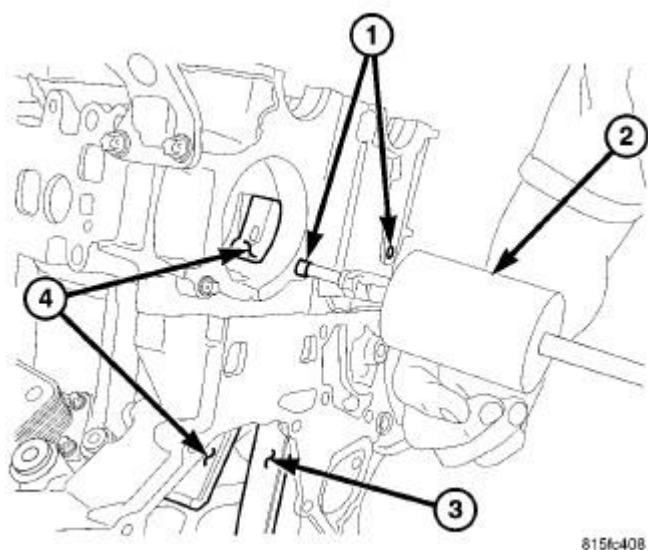


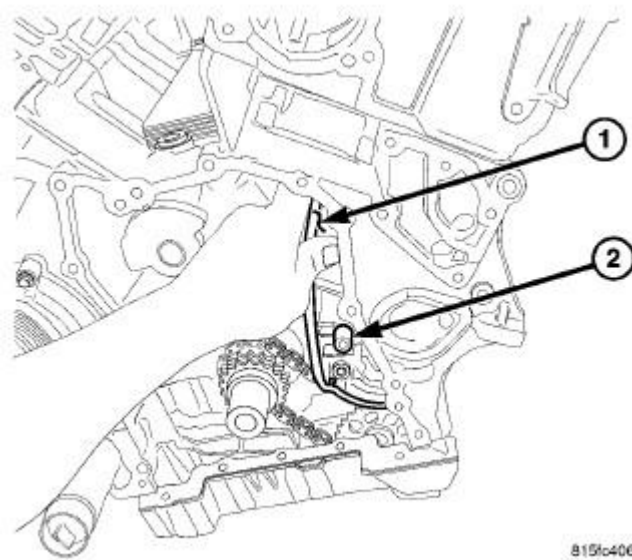
Fig. 97: LEFT UPPER TIMING CHAIN GUIDE PIN EXTRACTION

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - GUIDE PIN
2 - SLIDE HAMMER
3 - LOWER TIMING CHAIN GUIDE
4 - UPPER TIMING CHAIN GUIDE |
|---|

NOTE: If the engine is in the vehicle, use a bolt and a 2" long tube. Put the bolt in the tube and thread the bolt into the retaining pin (1). Tighten the bolt to pull the retaining pin out of the cylinder head and into the tube.

58. Using a slide hammer (2) and a screw, remove the left upper timing chain guide (4) retaining pins (1).



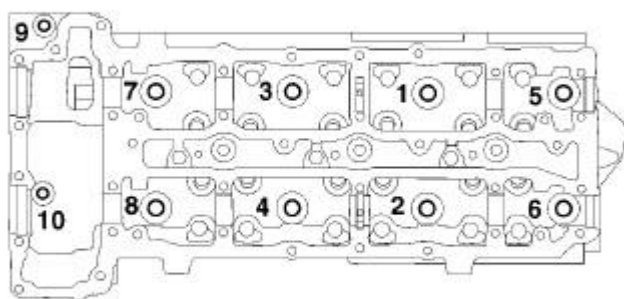
815tc406

Fig. 98: LEFT LOWER TIMING CHAIN GUIDE AND FASTENER

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - LEFT LOWER TIMING CHAIN GUIDE
2 - FASTENER |
|---|

59. Using a slide hammer and a screw, remove the left lower timing chain guide retaining pin (2) and guide (1).



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Fig. 99: CYLINDER HEAD TIGHTENING SEQUENCE

Courtesy of CHRYSLER LLC

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

NOTE: Do Not store the cylinder head on the sealing surface.

61. Remove the cylinder head and gasket from the engine block.
62. If required, remove the exhaust manifold.

RIGHT

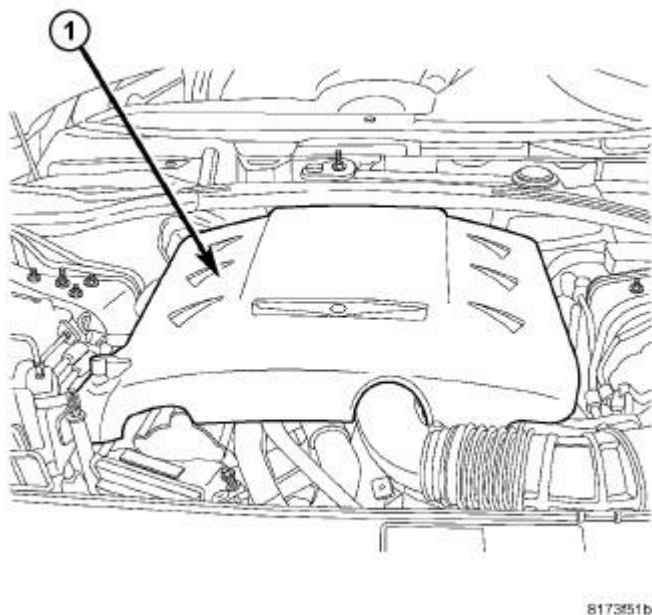


Fig. 100: ENGINE COVER
Courtesy of CHRYSLER LLC

1. Remove the engine cover (1) and brackets.

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.

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.

2. Remove both cylinder head covers. See Engine/Cylinder Head/COVER(S), Cylinder Head - Removal.

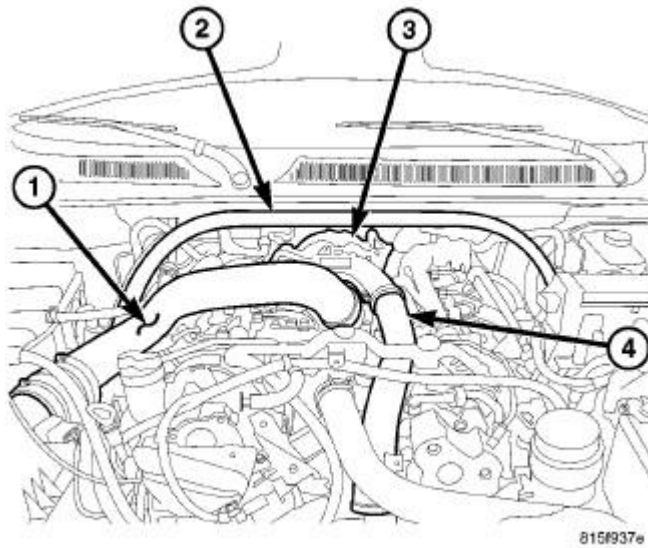


Fig. 101: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

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

- 3. Remove the strut tower support (2).
- 4. Drain the cooling system. Refer to **Cooling - Standard Procedure**.

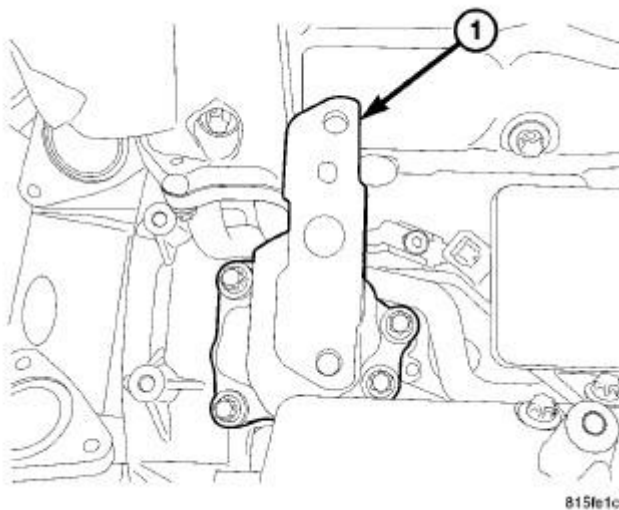


Fig. 102: TURBOCHARGER ADAPTOR
Courtesy of CHRYSLER LLC

- 1 - TURBOCHARGER ADAPTOR
- 2 - SWIRL VALVE ACTUATOR

5. Remove the turbocharger. See Engine/Turbocharger System/TURBOCHARGER - 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).

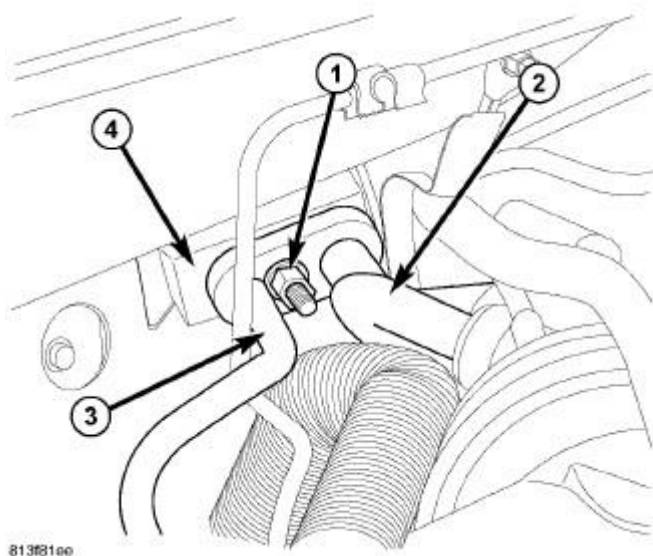


Fig. 103: A/C Expansion Valve Lines Removal & Installation
Courtesy of CHRYSLER LLC

7. Evacuate the A/C system. Refer to Heating and Air Conditioning/Plumbing - Standard Procedure .
8. Disconnect the A/C suction line (2) and the A/C liquid line (3) from the A/C expansion valve (4) and position aside. Refer to Heating and Air Conditioning/Plumbing/LINE, A/C Suction - Removal .
9. Raise and support the vehicle.

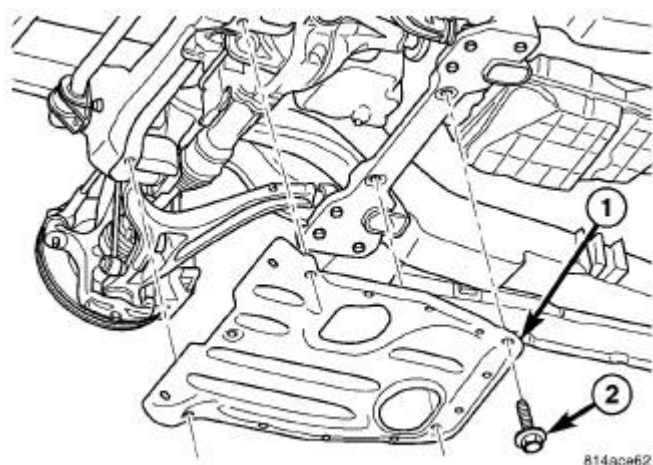


Fig. 104: UPDATED SKID PLATE
Courtesy of CHRYSLER LLC

10. Remove the front skid plate (1).

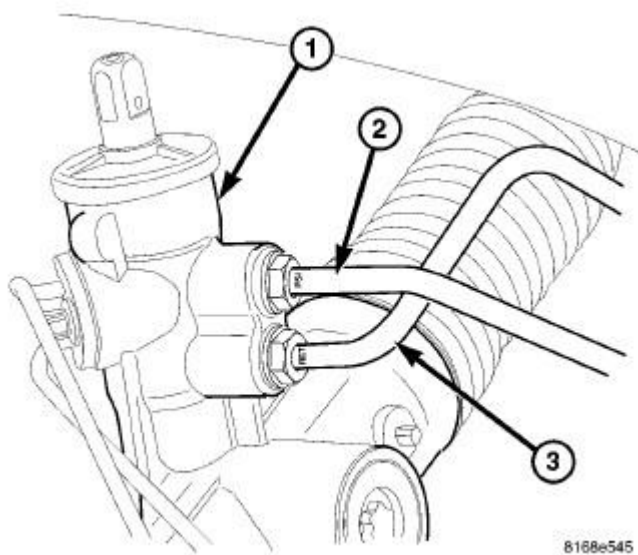


Fig. 105: LINES AT GEAR
Courtesy of CHRYSLER LLC

11. Remove the power steering pressure hose (2) and return hose (3) at the gear (1). Refer to **Steering/Pump/HOSE, Power Steering - Removal** .

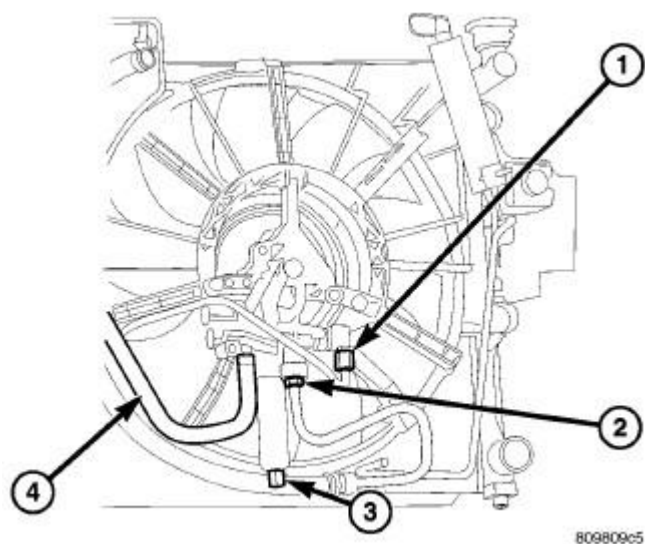


Fig. 106: HYDRAULIC LINES/HOSES AND ELECTRICAL CONNECTOR

Courtesy of CHRYSLER LLC

NOTE: The hydraulic fan drive is driven by the power steering pump. When removing lines or hoses from fan drive assembly use a drain pan to catch any power steering fluid that may exit the fan drive or the lines and hoses.

12. Remove the cooling fan module. Refer to Cooling/Engine/FAN, Cooling - Removal .
13. Lower the vehicle.
14. Remove the upper radiator hose.
15. Disconnect the vacuum hose at the vacuum pump and position aside.
16. Disconnect the coolant reservoir hose at thermostat housing and position aside.

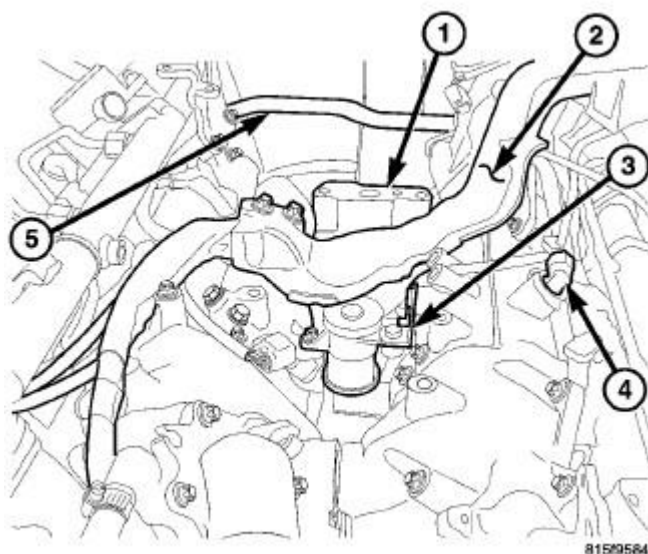
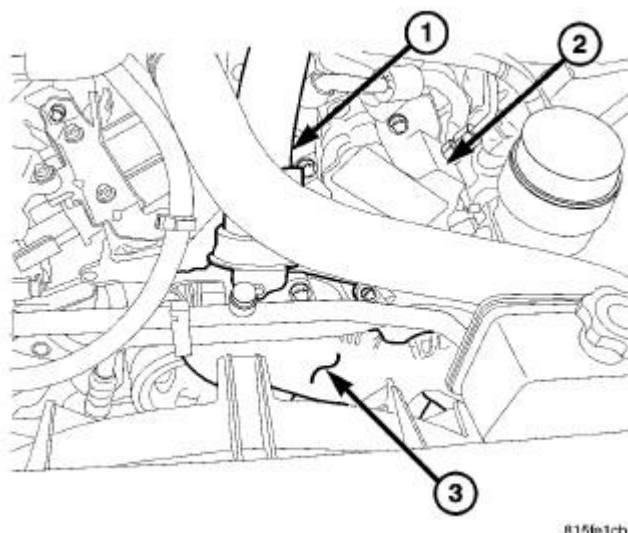


Fig. 107: MAIN ENGINE WIRING HARNESS

Courtesy of CHRYSLER LLC

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

17. Disconnect the swirl valve actuator (3), glow plugs, EGR pressure sensor and coolant temperature sensor (4) electrical connectors.
18. Remove the main engine wiring harness (2) fasteners and position the harness aside.

**Fig. 108: CHARGE AIR COOLER INLET WITH RESONATOR**

Courtesy of CHRYSLER LLC

- 1 - CHARGE AIR COOLER INLET PIPE
- 2 - HIGH PRESSURE INJECTION PUMP
- 3 - CHARGE AIR COOLER INLET RESONATOR

19. Remove the charge air cooler inlet pipe (1) and resonator (3).

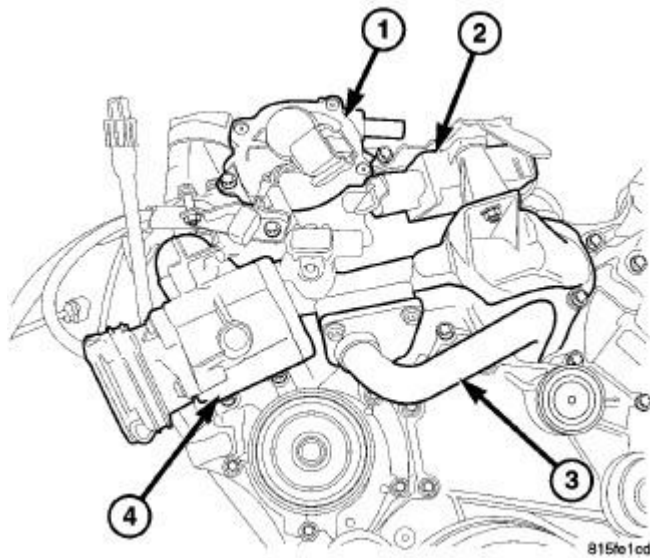


Fig. 109: AIR CONTROL VALVE
Courtesy of CHRYSLER LLC

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

20. Remove the EGR airflow control (4) and resonator.

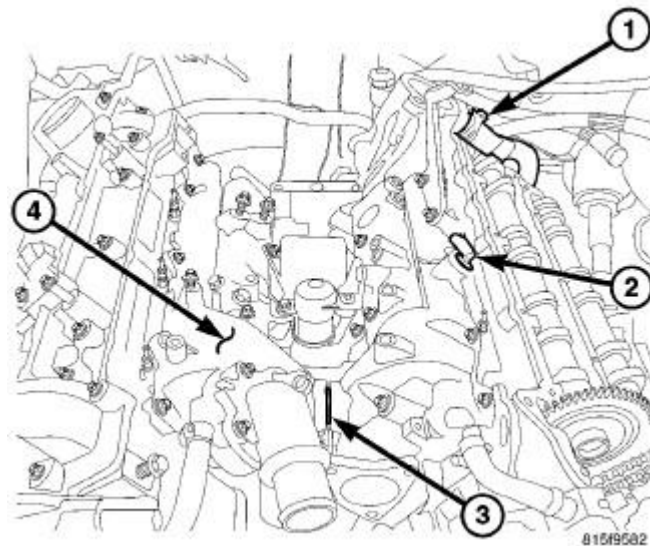


Fig. 110: INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

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

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 in the front of the intake manifold for leaks, repair as necessary.

21. Remove the intake manifold. See Engine/Manifolds/MANIFOLD, Intake - Removal.

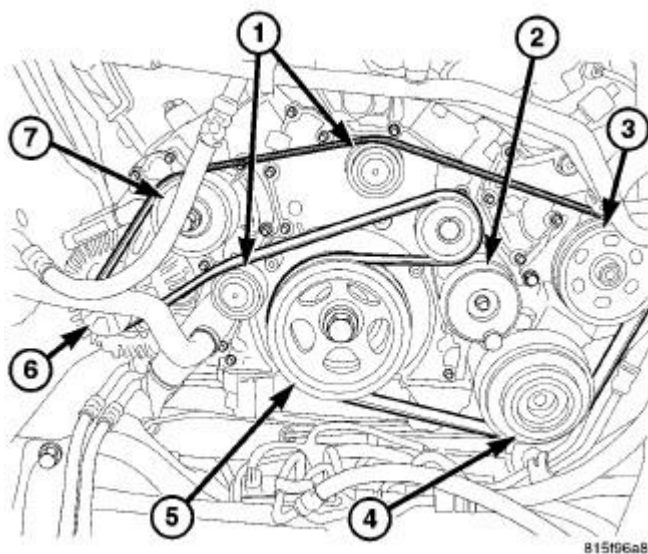


Fig. 111: ACCESSORY DRIVE BELT
Courtesy of CHRYSLER LLC

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

22. Remove the accessory drive belt. Refer to Cooling/Accessory Drive/BELT, Serpentine - Removal.
23. Remove the two idler pulleys (1).
24. Remove the belt tensioner (2).

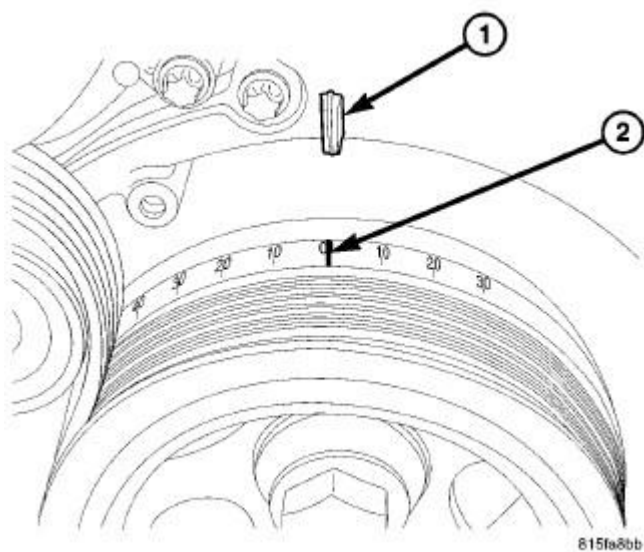


Fig. 112: VIBRATION DAMPER
Courtesy of CHRYSLER LLC

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

25. Rotate the engine by the crankshaft damper bolt to TDC.
26. Raise and support the vehicle.
27. Remove the right side starter blank.

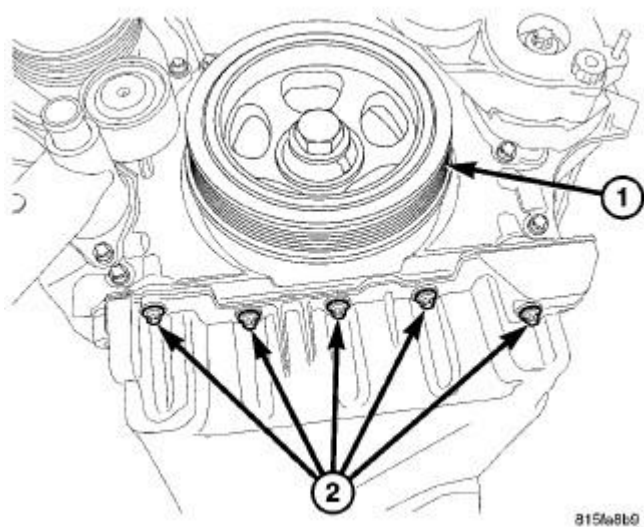


Fig. 113: FRONT OIL PAN
Courtesy of CHRYSLER LLC

- 1 - VIBRATION DAMPER
- 2 - OIL PAN BOLTS

28. Remove the front oil pan retaining bolts.
29. Lower the vehicle.

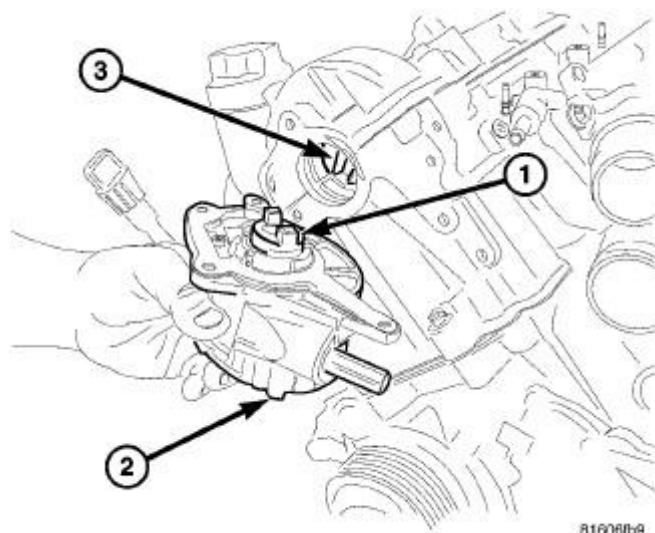
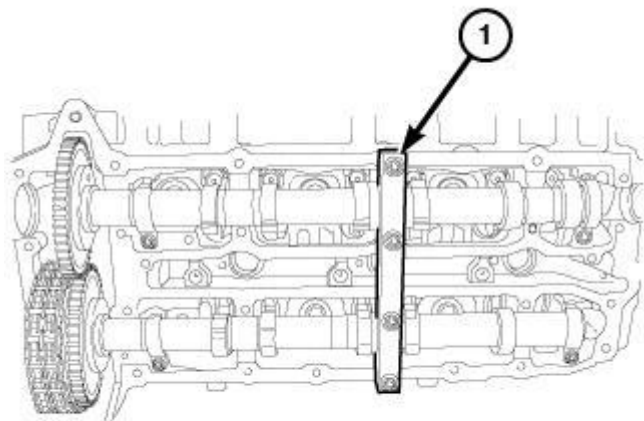


Fig. 114: Vacuum Pump
Courtesy of CHRYSLER LLC

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

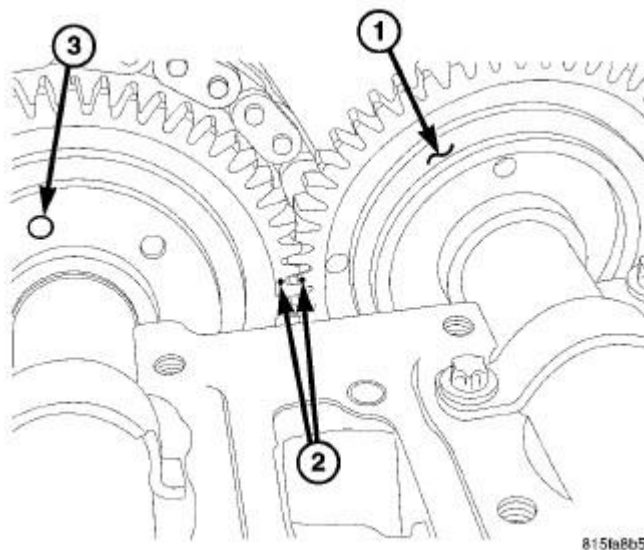
30. Remove the vacuum pump (2) and discard gasket.
31. Remove the glow plugs from the right cylinder head. Refer to **Electrical/Ignition Control/PLUG, Glow - Removal**.



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Fig. 115: Camshaft Holding Fixture 9555
Courtesy of CHRYSLER LLC

32. Install the Camshaft Holding Fixture 9555 (1) on both cylinder heads.



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Fig. 116: CAMSHAFT GEAR ALIGNMENT
Courtesy of CHRYSLER LLC

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

33. Observe the right 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 right 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.

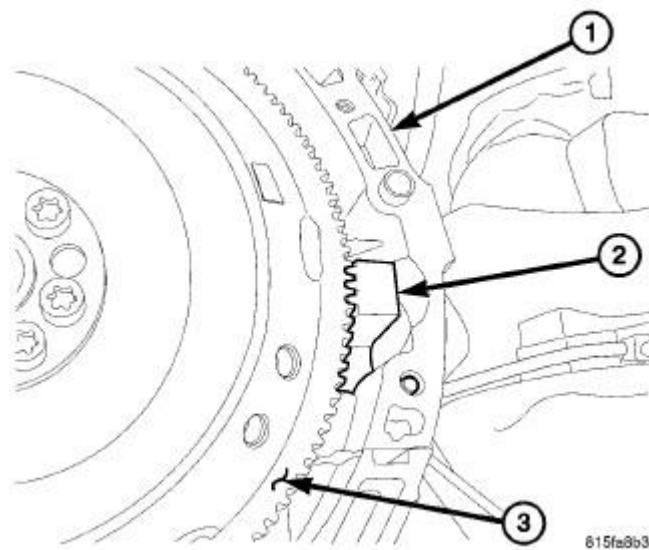


Fig. 117: SPECIAL TOOL 9102
Courtesy of CHRYSLER LLC

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

34. Raise and support the vehicle.
35. Install the Flywheel Lock (2) 9102 into the starter access blank.
36. Lower the vehicle.

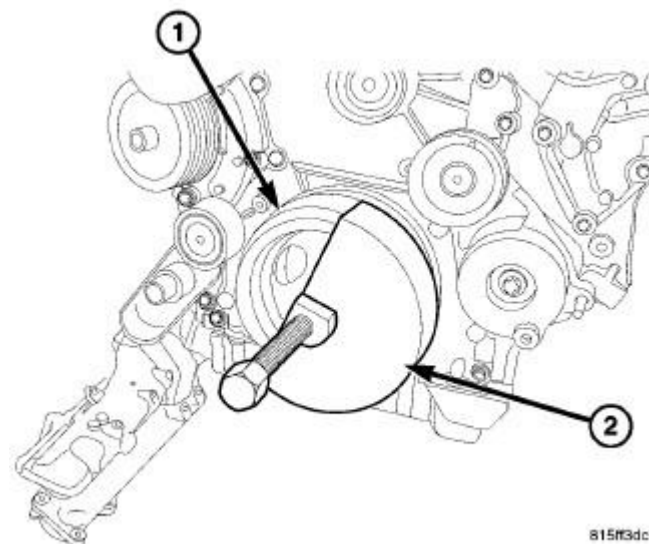


Fig. 118: VIBRATION DAMPER AND SPECIAL TOOL 9944
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - VIBRATION DAMPER
2 - SPECIAL TOOL 9544 |
|---|

37. Remove the crankshaft damper bolt.
38. Install the Crankshaft Damper Remover (2) 9544.

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

39. Remove the crankshaft damper (1).

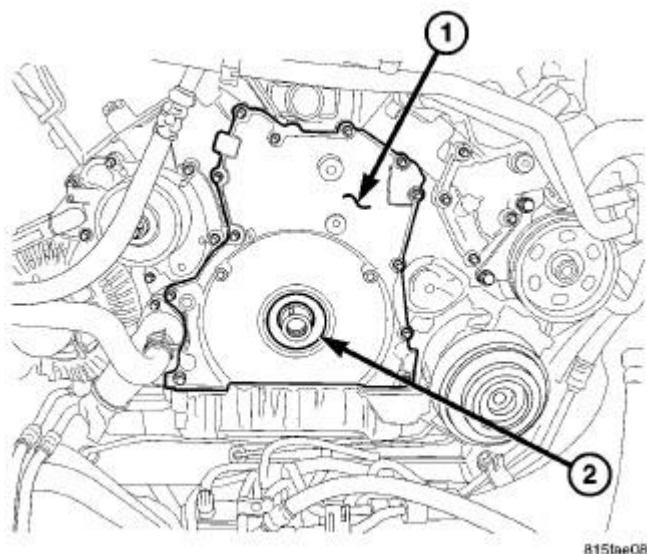


Fig. 119: FRONT TIMING COVER
Courtesy of CHRYSLER LLC

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

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

40. Remove the front timing chain cover (1).

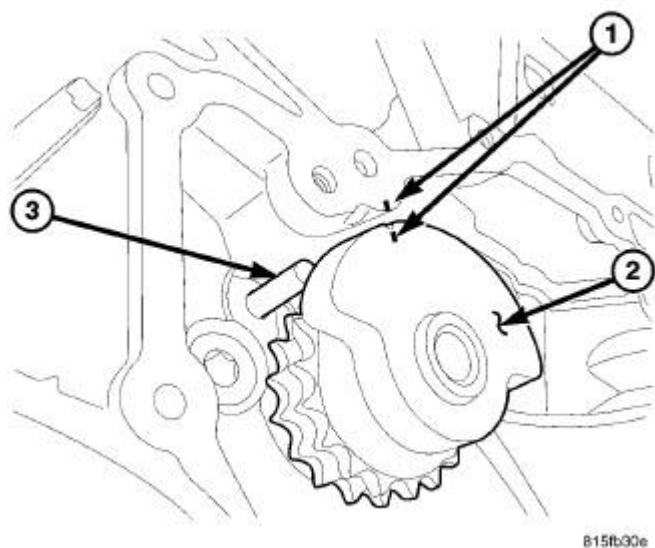


Fig. 120: BALANCE SHAFT INDEXING
Courtesy of CHRYSLER LLC

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

41. Paint mark or scribe the balance shaft (2) position to the engine block (1) and timing chain.
42. Paint mark or scribe the timing chain to crankshaft gear and camshaft drive gear relation.

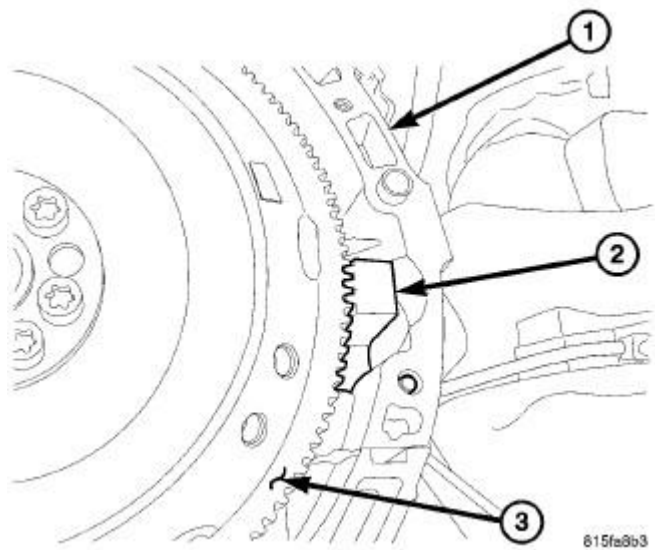


Fig. 121: SPECIAL TOOL 9102
Courtesy of CHRYSLER LLC

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

- 43. Raise and support the vehicle.
- 44. Remove the Flywheel Lock (2) 9102.
- 45. Lower the vehicle.

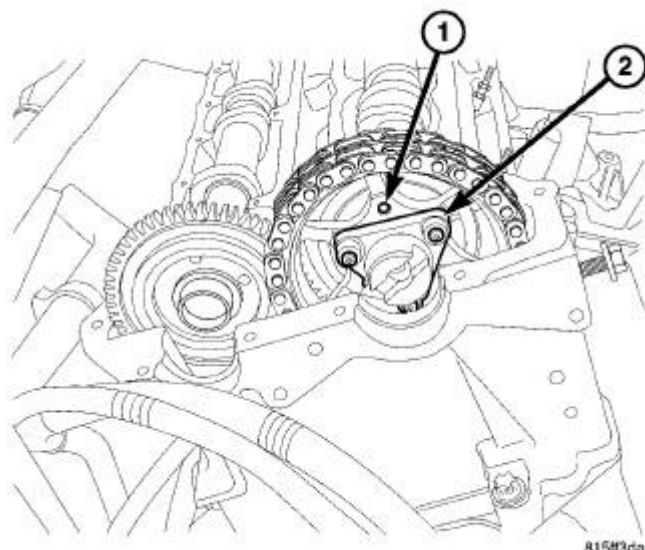


Fig. 122: RIGHT INTAKE CAMSHAFT DRIVE GEAR
Courtesy of CHRYSLER LLC

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

- 46. 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 when viewing through the camshaft seal access hole.

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

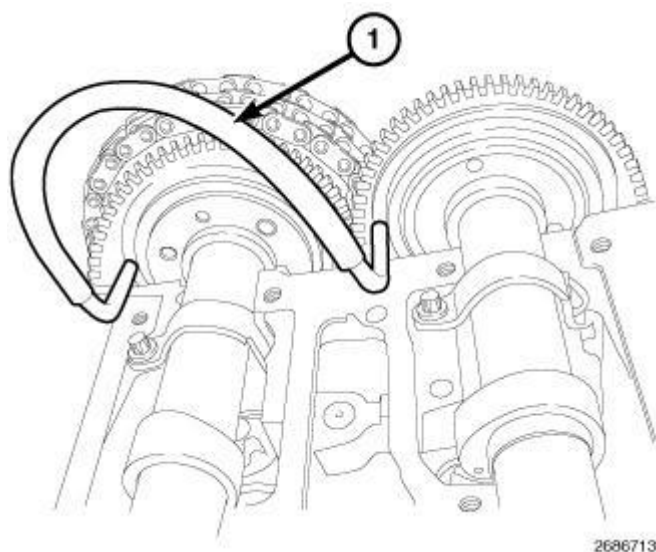


Fig. 123: Camshaft Locking Pins 8929
Courtesy of CHRYSLER LLC

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

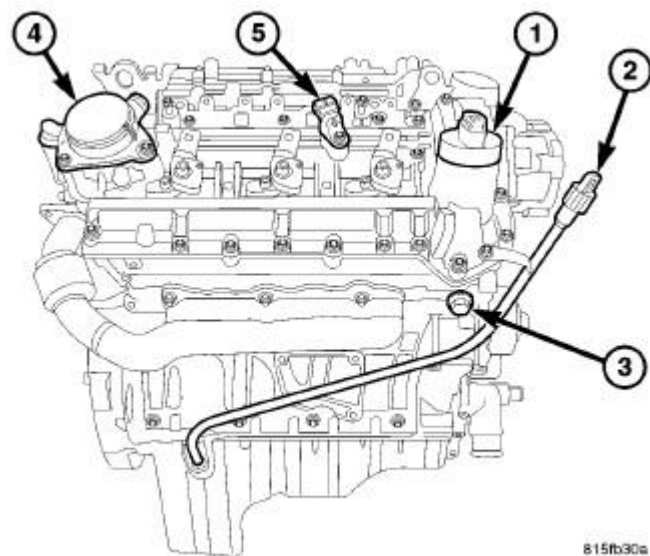


Fig. 124: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

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

49. Remove the timing chain tensioner (3).

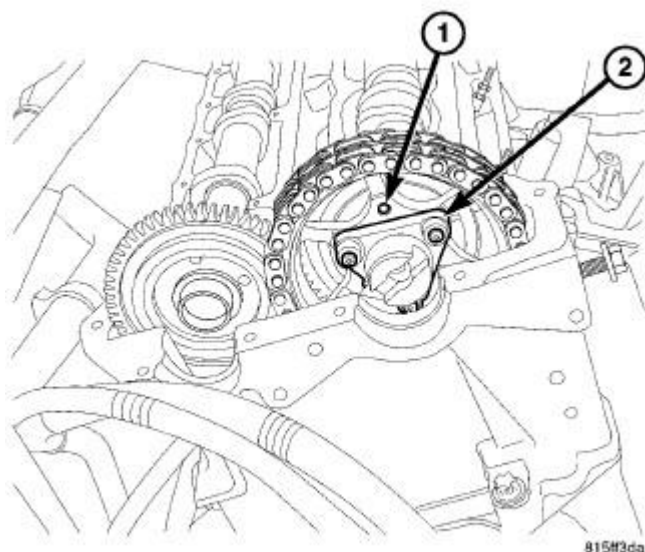


Fig. 125: RIGHT INTAKE CAMSHAFT DRIVE GEAR
Courtesy of CHRYSLER LLC

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

50. Remove the intake camshaft drive gear (2) retaining bolts.
51. Separate the intake camshaft drive gear (1) and chain from the camshaft.
52. Remove the intake camshaft drive gear.

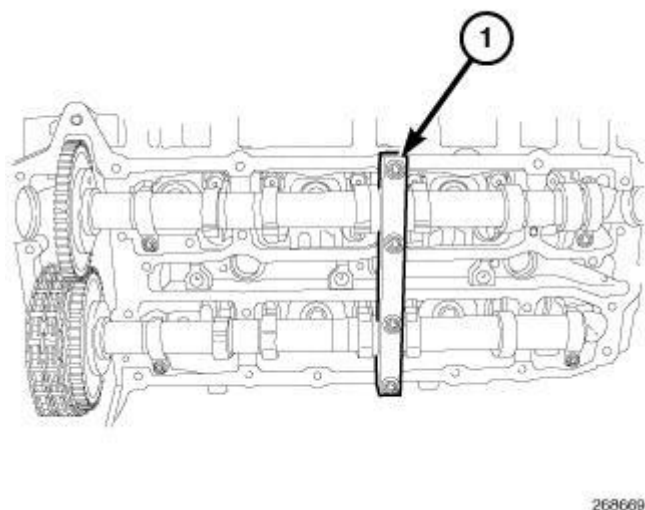


Fig. 126: Camshaft Holding Fixture 9555

Courtesy of CHRYSLER LLC

53. Remove the Camshaft Holding Fixture 9555 (1) from the right cylinder head.

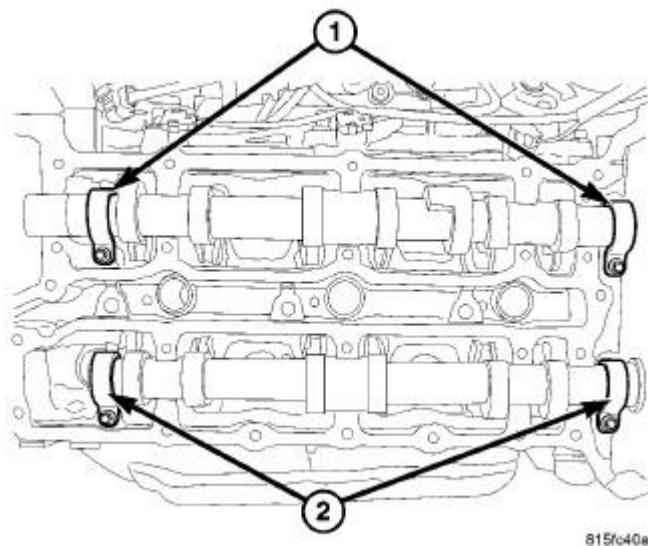


Fig. 127: CAMSHAFT RETAINERS

Courtesy of CHRYSLER LLC

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

54. Remove the intake and exhaust camshaft retainers (1,2).
55. Remove the intake camshaft.
56. Remove the exhaust camshaft and gear.

NOTE: Note the location of the follower and tappet assemblies; they must be installed in the same location as when removed.

57. If required, remove the followers and tappets.

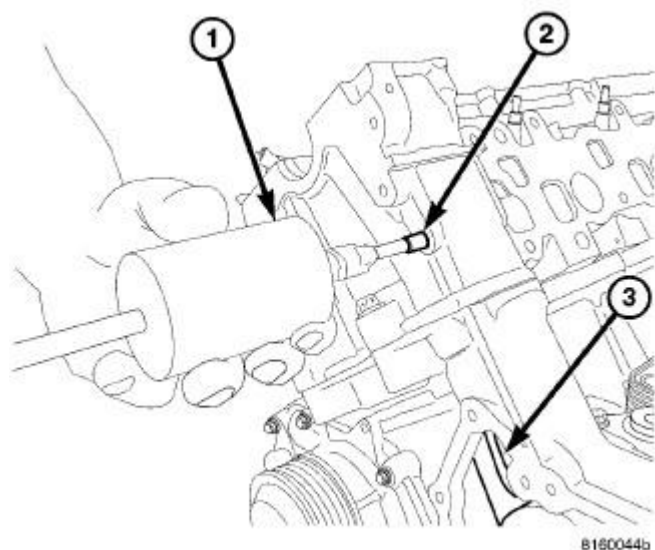


Fig. 128: UPPER TIMING CHAIN GUIDE AND PIN
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - SLIDE HAMMER
2 - RETAINING PIN
3 - UPPER TIMING CHAIN GUIDE |
|---|

NOTE: If the engine is in the vehicle, use a bolt and a 2" long tube. Put the bolt in the tube and thread the bolt into the retaining pin (2). Tighten the bolt to pull the retaining pin out of the cylinder head and into the tube.

58. Using a slide hammer (1) and a screw, remove the right upper timing chain guide (3) retaining pin (2).

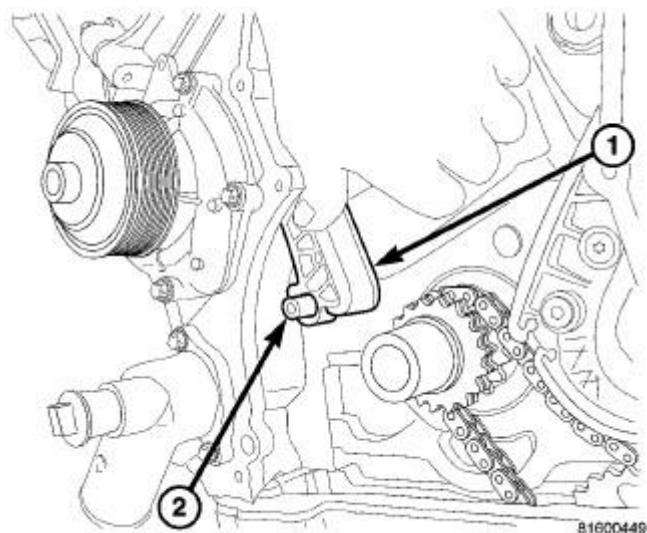
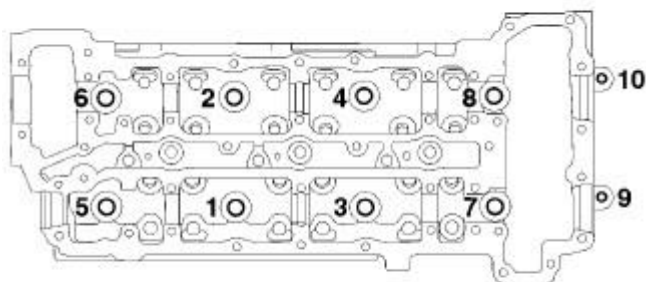


Fig. 129: RIGHT LOWER TIMING CHAIN GUIDE

Courtesy of CHRYSLER LLC

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

59. Remove the right lower timing chain guide retaining pin/bolt (2) and remove the guide (1).



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Fig. 130: RIGHT CYLINDER HEAD TIGHTENING SEQUENCE

Courtesy of CHRYSLER LLC

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

NOTE: Do Not store the cylinder head on the sealing surface.

61. Remove cylinder head and gasket from the engine block.
62. If required, remove the exhaust manifold.

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 [Engine - 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

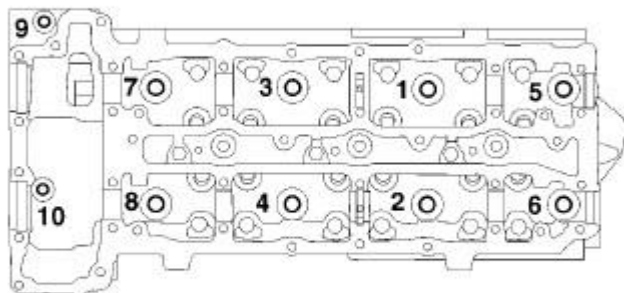
Use a straightedge and feeler gauge to check the flatness of the engine cylinder head and engine block mating surfaces.

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

INSTALLATION

LEFT

1. If removed, using a new exhaust manifold gasket, install the exhaust manifold and tighten nuts to 25 N.m (18 ft. lbs.).
2. Clean and inspect gasket mating surfaces. See Engine/Cylinder Head - Cleaning.
3. Position the new cylinder head gasket on the engine block. Be sure the coolant passages align (part number should be facing up).
4. Place the cylinder head on engine block.



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Fig. 131: 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 Engine/Cylinder Head - Standard Procedure. Do Not lubricate new cylinder head bolts. They are already coated with an anti scuff treatment.

5. Tighten the cylinder head bolts following the procedure below.

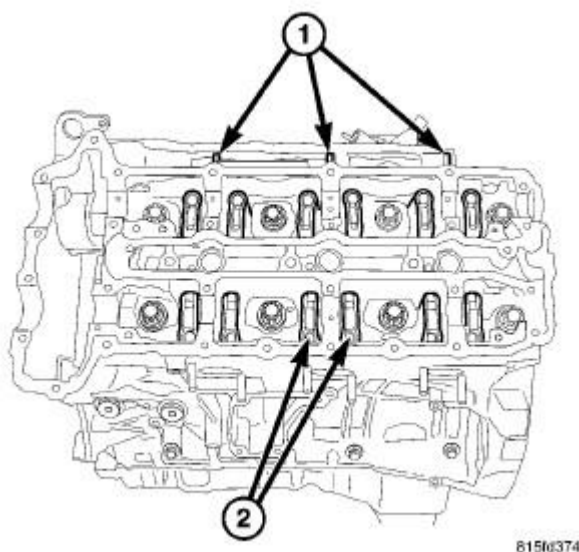


Fig. 132: TAPPET/CAMSHAFT FOLLOWER POSITION
Courtesy of CHRYSLER LLC

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

NOTE: Follower and tappet assemblies must be installed in same location as when 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 cylinder head bolts 9 and 10 to 20 N.m (15 ft. lbs.).
 - c. Tighten M12 cylinder head bolts 1 through 8 in the sequence shown in illustration an additional 90°.
 - d. Recheck and tighten M8 cylinder head bolts 9 and 10 to 20 N.m (15 ft. lbs.).
 - e. Once again, tighten M12 cylinder head bolts 1 through 8, in the sequence shown in illustration an additional 90°.
6. Install the followers and tappets (2) into their original position as noted during removal.
7. Install the glow plugs and tighten to 12 N.m (106 in. lbs.).

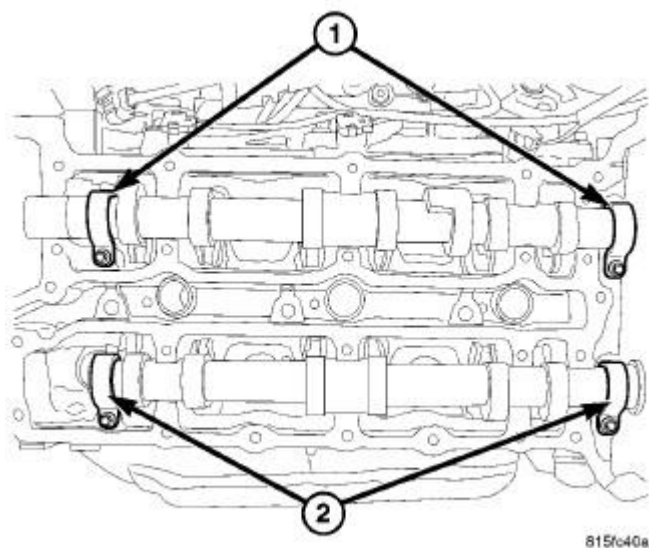


Fig. 133: CAMSHAFT RETAINERS

Courtesy of CHRYSLER LLC

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

8. Install the intake and exhaust camshaft retainers (1, 2) and tighten bolts to 8 N.m (71 in. lbs.).

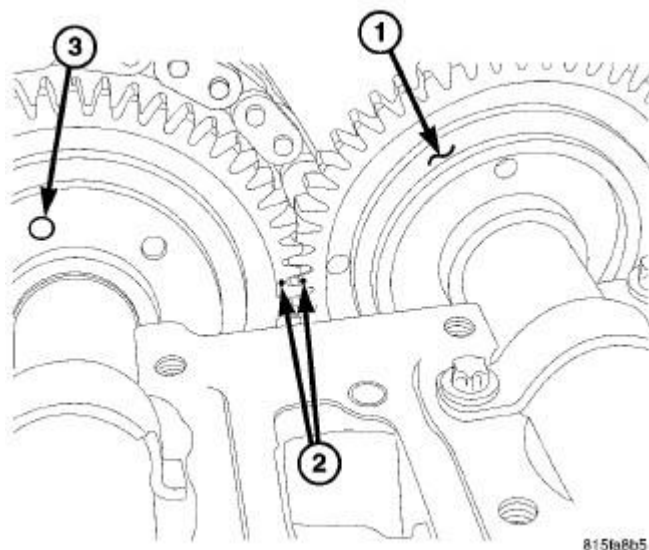


Fig. 134: CAMSHAFT GEAR ALIGNMENT

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 exhaust camshaft 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 onto the camshaft drive gear.

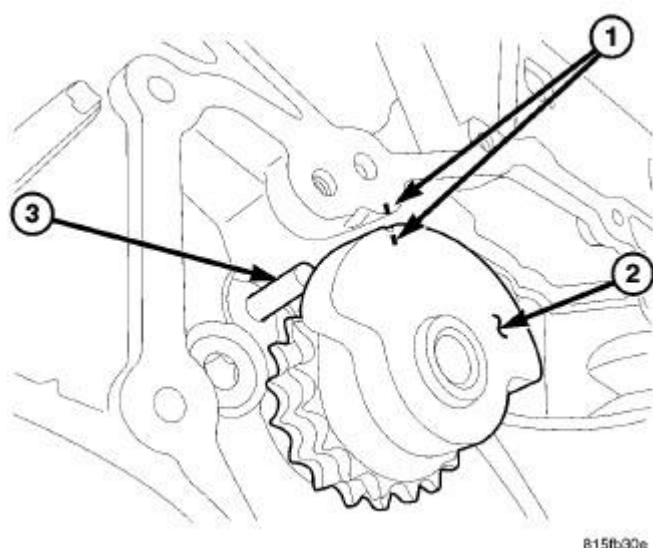


Fig. 135: BALANCE SHAFT INDEXING
Courtesy of CHRYSLER LLC

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

11. Align the balance shaft (2) with the scribe mark or paint mark (1) as noted during removal.

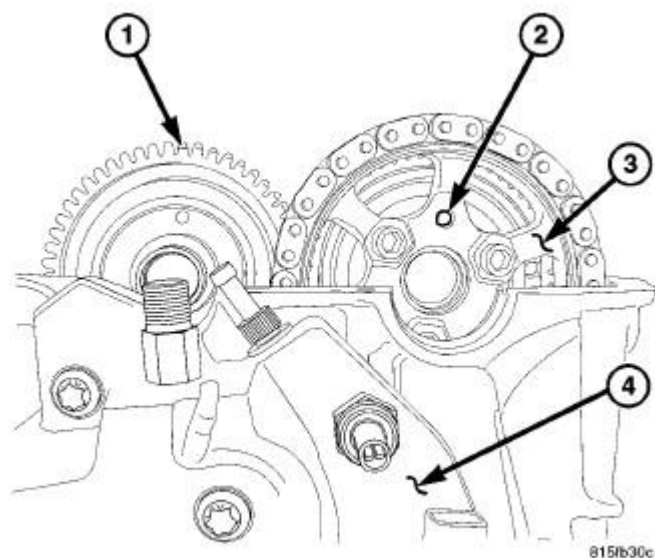


Fig. 136: LEFT EXHAUST CAMSHAFT DRIVE GEAR ALIGNMENT DOWEL
Courtesy of CHRYSLER LLC

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

12. Once the exhaust camshaft drive gear is mated with the timing chain, install the camshaft drive gear onto the exhaust camshaft and verify the balance shaft is aligned properly.
13. Install two of the exhaust camshaft drive gear bolts and tighten to 18 N.m (159 in. lbs.).

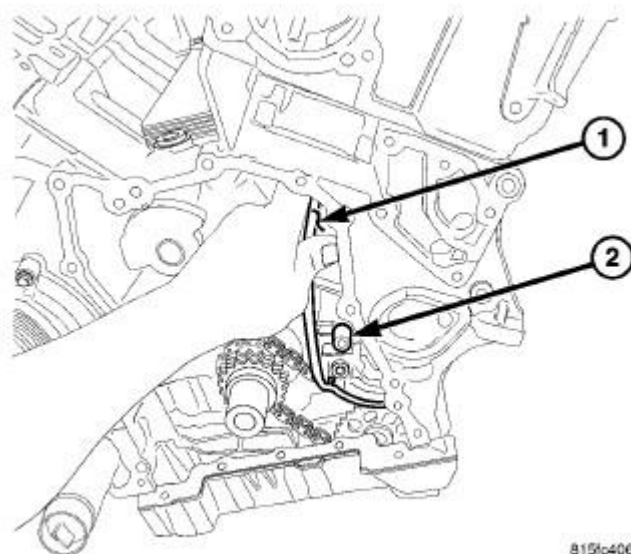
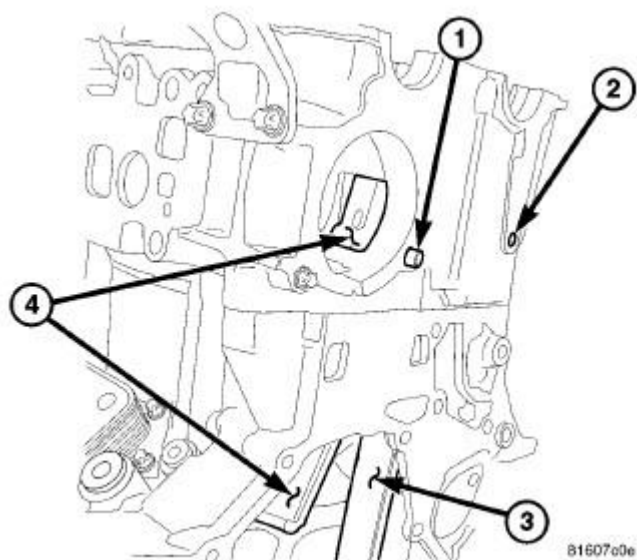


Fig. 137: LEFT LOWER TIMING CHAIN GUIDE AND FASTENER

Courtesy of CHRYSLER LLC

- 1 - LEFT LOWER TIMING CHAIN GUIDE
- 2 - FASTENER

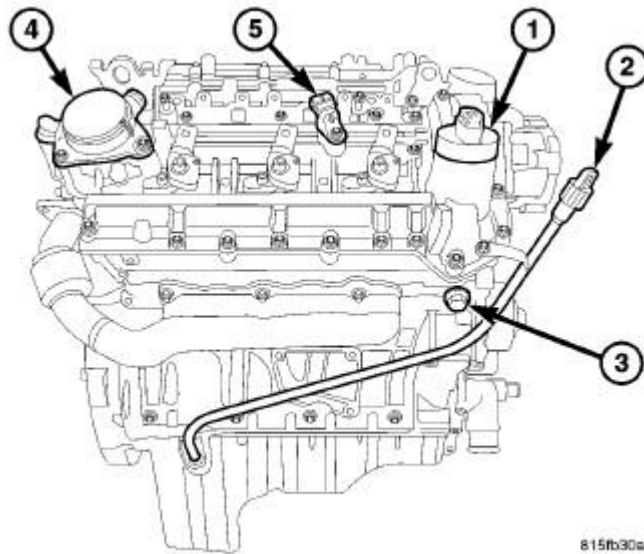
14. Install the left lower timing chain guide (1), seat the guide pin/bolt (2) and tighten to 12 N.m (106 in. lbs.).

**Fig. 138: 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. Position the left upper timing chain guide (4) and seat the retaining pins (1, 2).

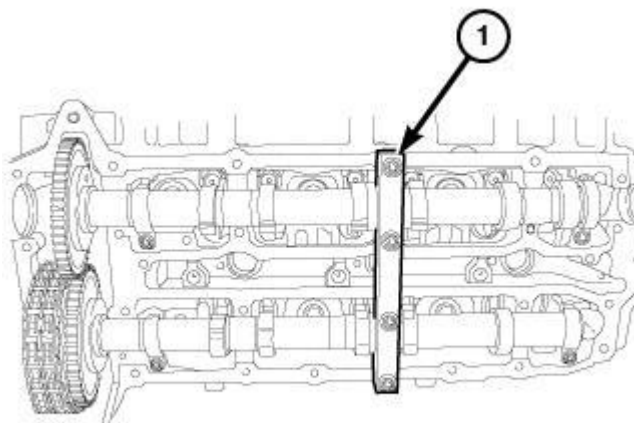


815fb30a

Fig. 139: 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).



2686890

Fig. 140: Camshaft Holding Fixture 9555
Courtesy of CHRYSLER LLC

17. Install the Camshaft Holding Fixture 9555 (1) on the left cylinder head.

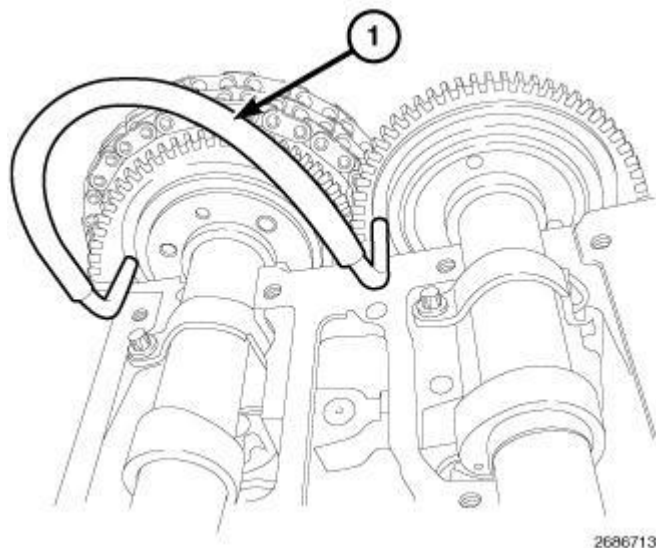


Fig. 141: Camshaft Locking Pins 8929
Courtesy of CHRYSLER LLC

18. Remove the camshaft Locking Pins 8929 (1) from the right camshaft gears.

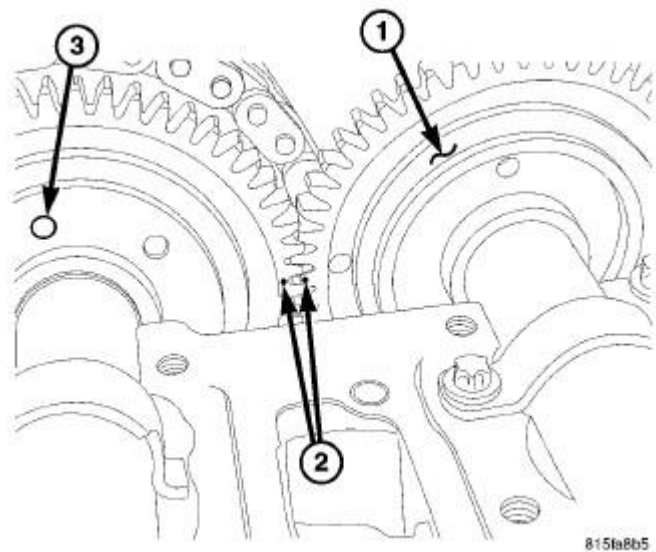


Fig. 142: CAMSHAFT GEAR ALIGNMENT
Courtesy of CHRYSLER LLC

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

19. Rotate the engine by the vibration damper bolt enough to gain access to the third camshaft drive gear bolt hole.
20. Install the third camshaft drive gear bolt and tighten to 18 N.m (159 in. lbs.).

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

WARNING: Check the timing chain for proper alignment on all timing gears. Failure to do so will result in immediate engine damage.

21. Rotate the engine back to TDC by the crankshaft damper bolt until the crankshaft, camshaft and balance shaft again line up at TDC.

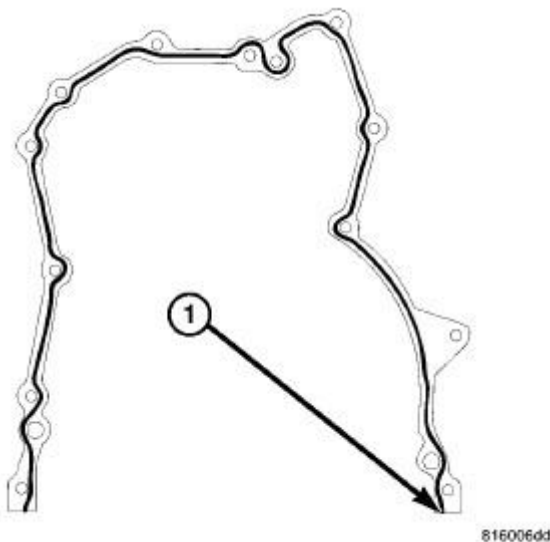


Fig. 143: TIMING COVER SEALING
Courtesy of CHRYSLER LLC

1 - 1.5 MM BEAD OF MOPAR ENGINE SEALANT RTV

NOTE: Sealing surfaces must be free of a gasket material and oil residue.

22. Clean and inspect all sealing surfaces.
23. Apply a 1.5 mm continuous bead of Mopar® Engine Sealant RTV (1) to the timing chain cover (1) and the front portion of the oil pan.

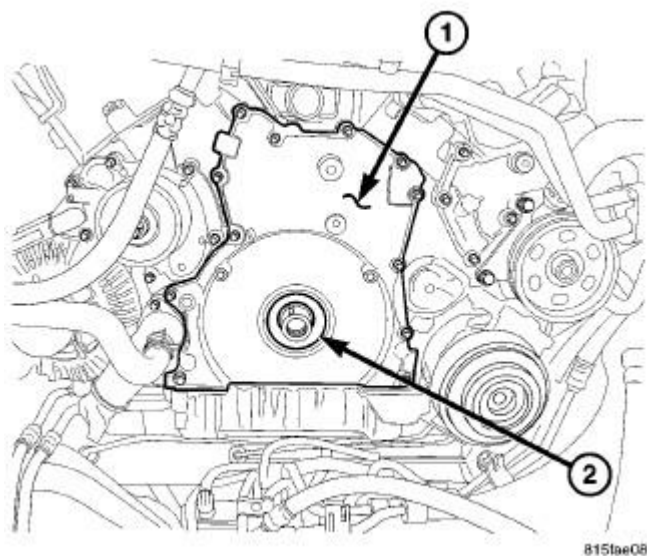


Fig. 144: FRONT TIMING COVER

Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - TIMING CHAIN COVER
2 - FRONT CRANKSHAFT SEAL</p> |
|---|

24. Install the timing chain cover (1) and tighten bolts to 8.5 N.m (74 in. lbs.).
25. Raise and support the vehicle.

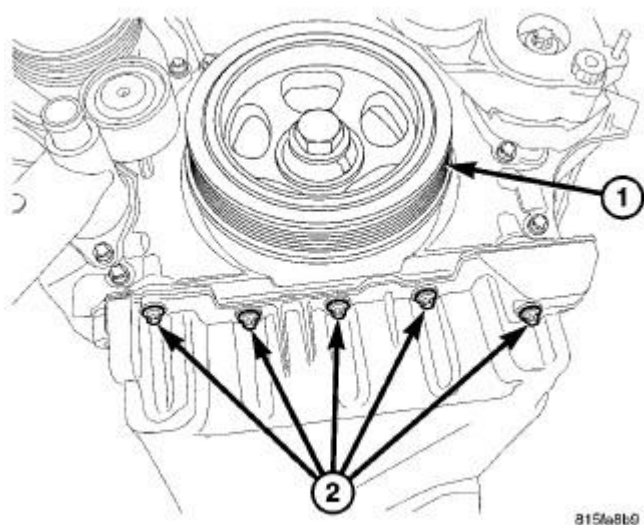


Fig. 145: FRONT OIL PAN

Courtesy of CHRYSLER LLC

- | |
|-----------------------------|
| <p>1 - VIBRATION DAMPER</p> |
|-----------------------------|

2 - OIL PAN BOLTS

26. Install the 5 front oil pan (2) to timing cover bolts and tighten to 20 N.m (15 ft. lbs.).

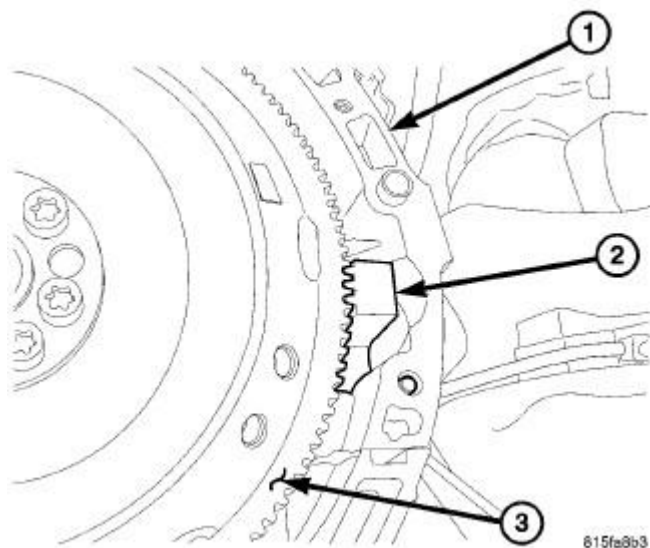
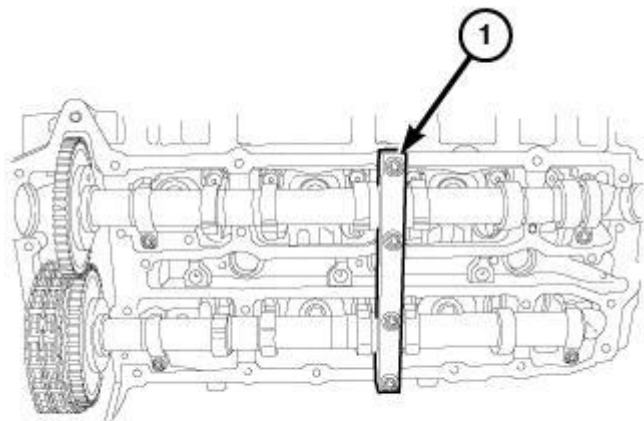


Fig. 146: SPECIAL TOOL # 9102

Courtesy of CHRYSLER LLC

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

27. Install the Flywheel Lock 9102 (2).
28. Lower the vehicle.
29. Install the crankshaft damper and tighten bolt to 200 N.m (148 ft. lbs.) and then tighten an additional 90°.



2686890

Fig. 147: Camshaft Holding Fixture 9555
Courtesy of CHRYSLER LLC

30. Remove the Camshaft Holding Fixture 9555 (1) from both cylinder heads.

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

31. Install both cylinder head covers. See Engine/Cylinder Head/COVER(S), Cylinder Head - Installation.
32. Install the glow plugs and tighten to 12 N.m (106 in. lbs.).

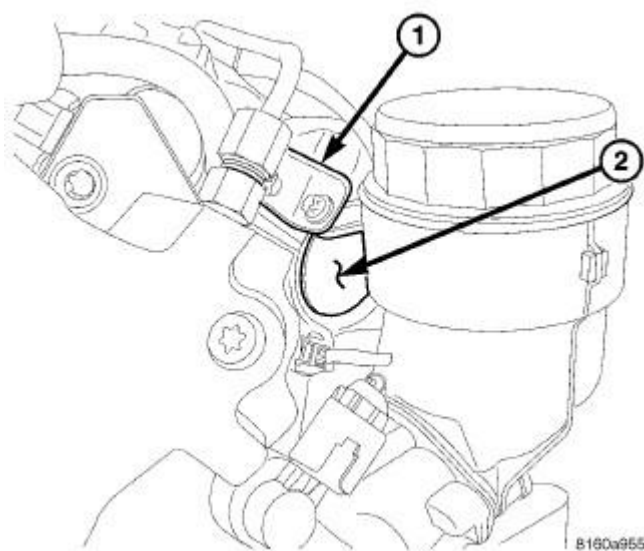


Fig. 148: LEFT FRONT CAMSHAFT SEAL WITH OIL FILTER HOUSING BRACKET
Courtesy of CHRYSLER LLC

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

33. Install the oil filter housing bracket (1) and tighten bolts to 13.8 N.m (122 in. lbs.).

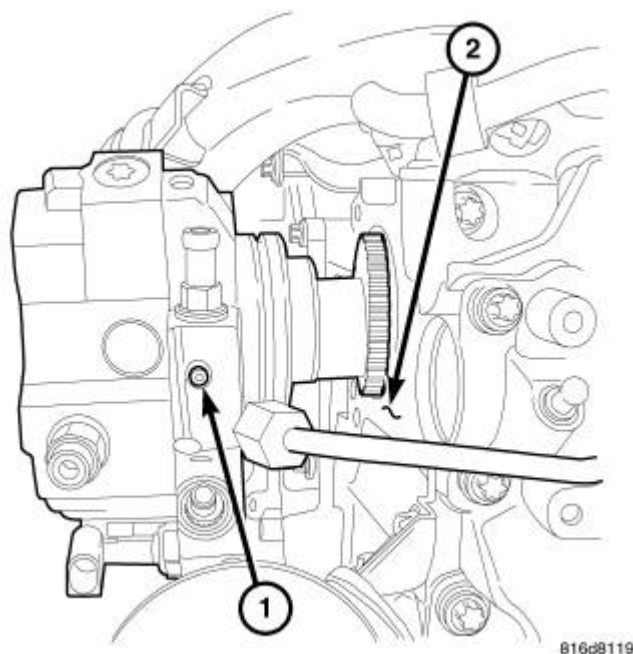


Fig. 149: HIGH PRESSURE PUMP INSTALLATION
Courtesy of CHRYSLER LLC

CAUTION: Do Not Force the high pressure pump into the left cylinder head or attempt to seat it by drawing it in with the bolts. The pump gear must be properly aligned with the drive gear on the camshaft before the high pressure pump will seat on the cylinder head mounting surface. Failure to properly align drive gears will damage the high pressure pump or camshaft drive gear.

34. Install the high pressure pump and tighten bolts to 13.5 N.m (120 in. lbs.). Refer to Fuel System/Fuel Delivery/PUMP, Fuel Injection - Installation .

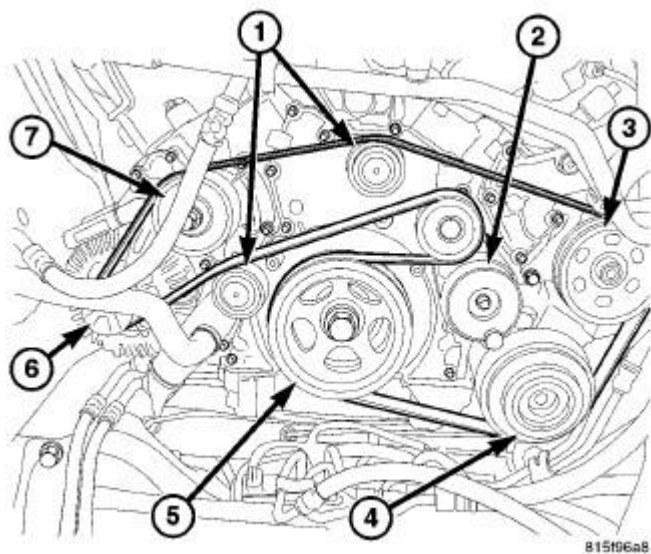


Fig. 150: ACCESSORY DRIVE BELT

Courtesy of CHRYSLER LLC

- | |
|--|
| <ul style="list-style-type: none">1 - IDLER PULLEYS2 - DRIVE BELT TENSIONER3 - POWER STEERING PUMP4 - AIR CONDITIONING COMPRESSOR5 - VIBRATION DAMPER6 - GENERATOR7 - WATER PUMP |
|--|

- 35. Install the accessory belt idler pulleys (1) and tighten bolts to 58 N.m (43 ft. lbs.).
- 36. Install the accessory drive belt tensioner (2) and tighten bolt to 58 N.m (43 ft. lbs.).
- 37. Install the accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation** .

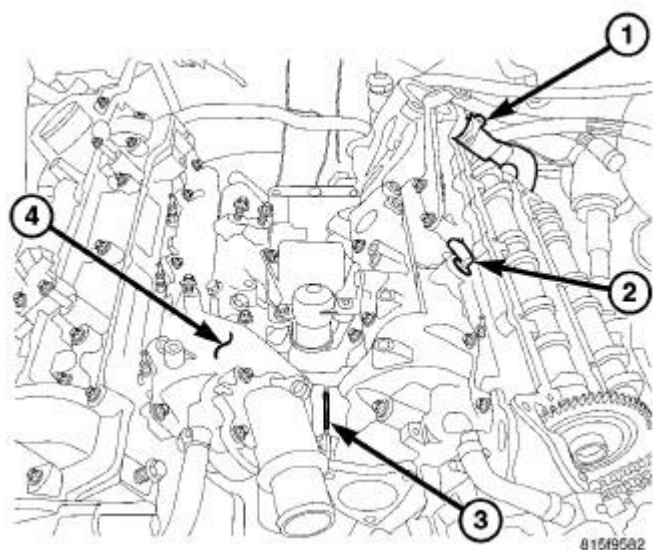


Fig. 151: INTAKE MANIFOLD

Courtesy of CHRYSLER LLC

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

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 in the front of the intake manifold for leaks, repair as necessary.

38. Install the intake manifold (4). See Engine/Manifolds/MANIFOLD, Intake - Installation.

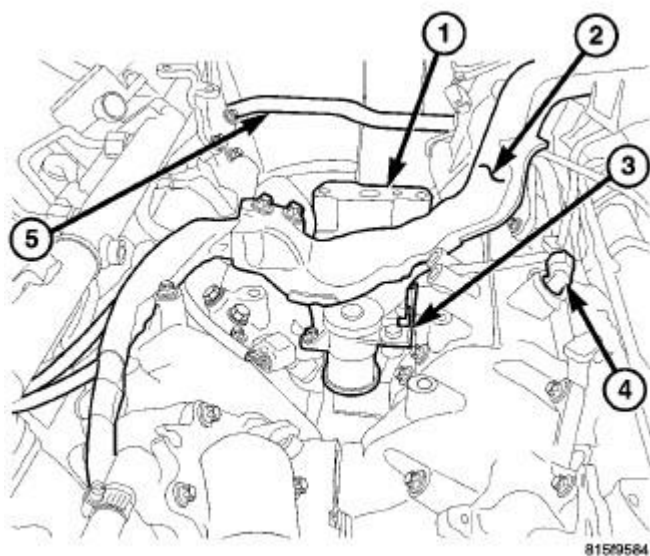


Fig. 152: MAIN ENGINE WIRING HARNESS

Courtesy of CHRYSLER LLC

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

39. Connect the swirl valve actuator (3), glow plugs, EGR pressure sensor and coolant temperature sensor (4) electrical connectors.

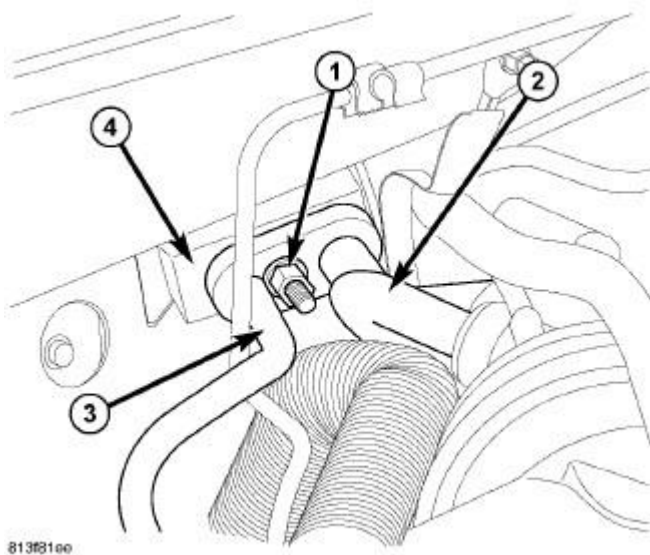


Fig. 153: A/C Expansion Valve Lines Removal & Installation

Courtesy of CHRYSLER LLC

40. Connect the A/C suction line (2) and the A/C liquid line (3) at the A/C expansion valve (4). Refer to **Heating and Air Conditioning/Plumbing/VALVE, A/C Expansion - Installation**.
41. Install the heater hose bracket and secure hoses.

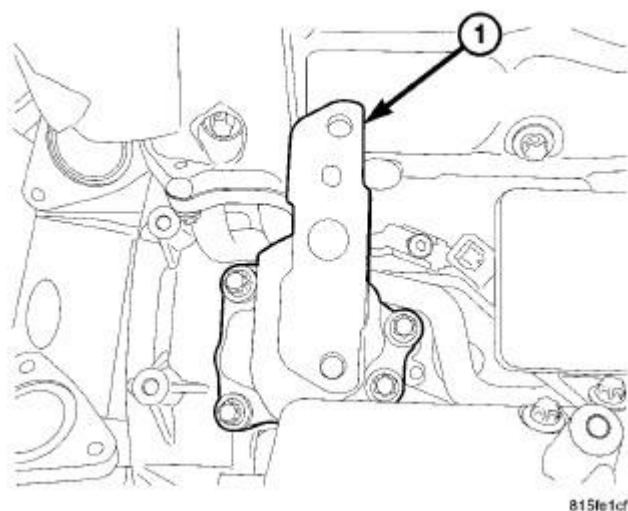


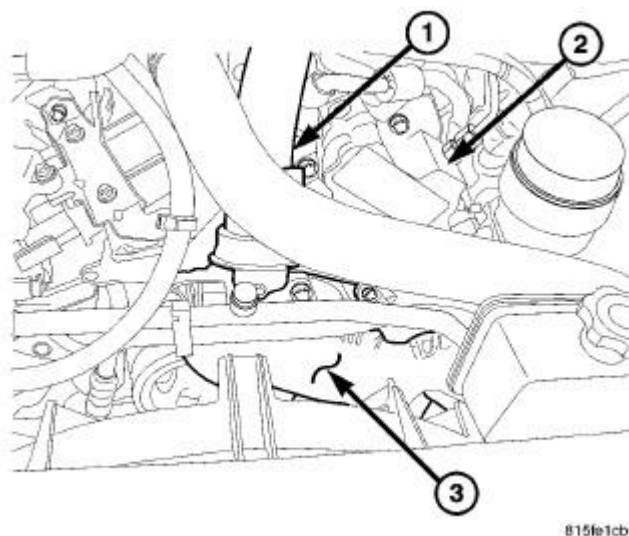
Fig. 154: TURBOCHARGER ADAPTOR

Courtesy of CHRYSLER LLC

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

CAUTION: Care must be taken when installing the turbocharger oil housing adaptor (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 with the gasket tabs secured to the adaptor and tighten bolts to 12 N.m (9 ft. lbs.).
43. Install the turbocharger. See **Engine/Turbocharger System/TURBOCHARGER - Installation**.

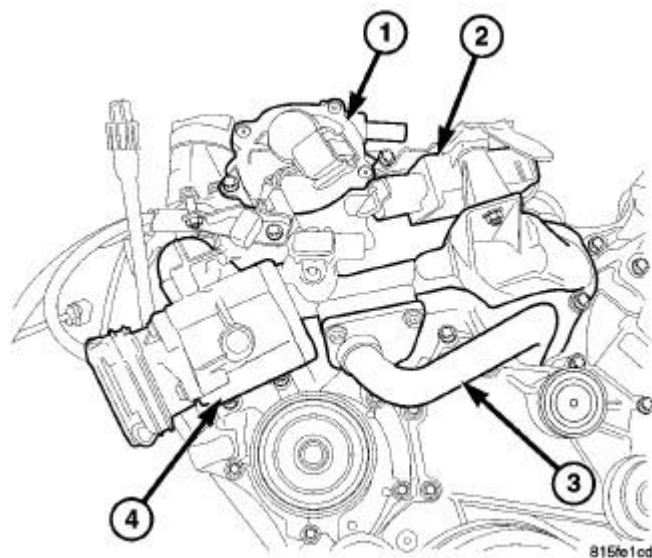


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Fig. 155: CHARGE AIR COOLER INLET WITH RESONATOR
Courtesy of CHRYSLER LLC

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

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



815fe1cd

Fig. 156: AIR CONTROL VALVE
Courtesy of CHRYSLER LLC

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

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

45. Install the EGR airflow control (4) and resonator.

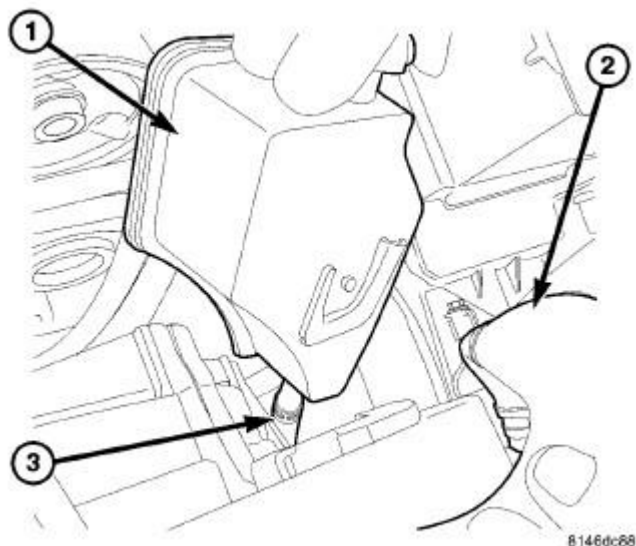


Fig. 157: FLUID RESERVOIR
Courtesy of CHRYSLER LLC

46. Install the power steering pump reservoir. Refer to **Steering/Pump/RESERVOIR, Power Steering Pump - Removal**.

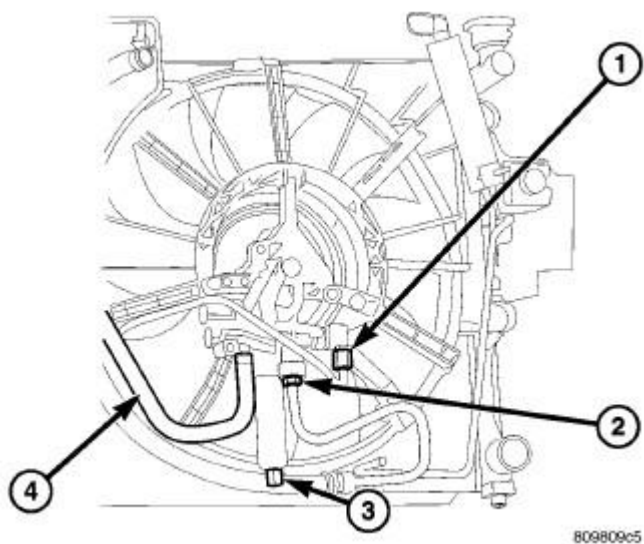


Fig. 158: HYDRAULIC LINES/HOSES AND ELECTRICAL CONNECTOR

Courtesy of CHRYSLER LLC

NOTE: Whenever the high pressure line fittings are removed from the hydraulic fan drive the O-rings located on the fittings must be replaced.

47. Install the cooling fan module. Refer to Cooling/Engine/FAN, Cooling - Installation.
48. Raise and support the vehicle.

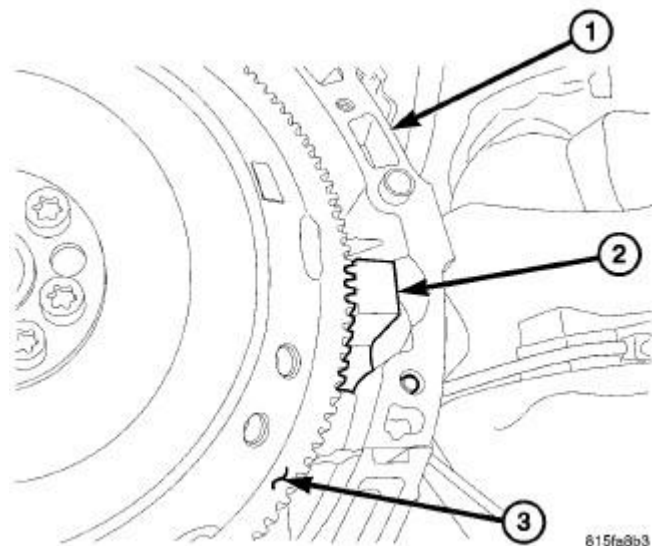


Fig. 159: SPECIAL TOOL # 9102
Courtesy of CHRYSLER LLC

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

49. Remove the Flywheel Lock (2) 9102.
50. Install the starter blank.

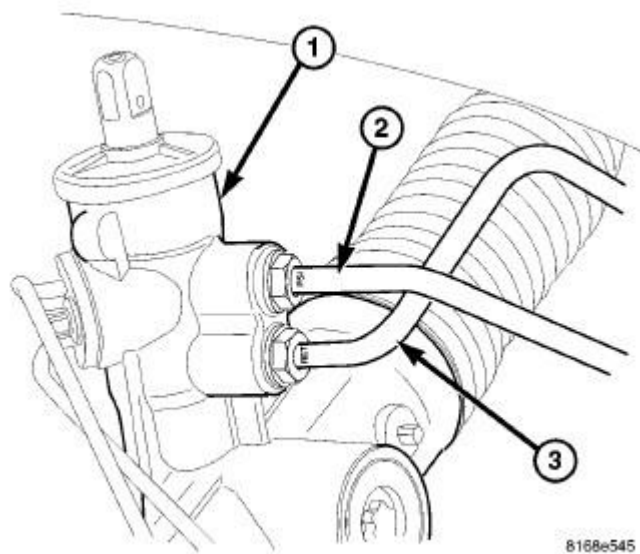


Fig. 160: LINES AT GEAR
Courtesy of CHRYSLER LLC

51. Install the power steering pressure hose (2) and return hose (3) at the gear (1). Refer to **Steering/Pump/HOSE, Power Steering - Installation** .

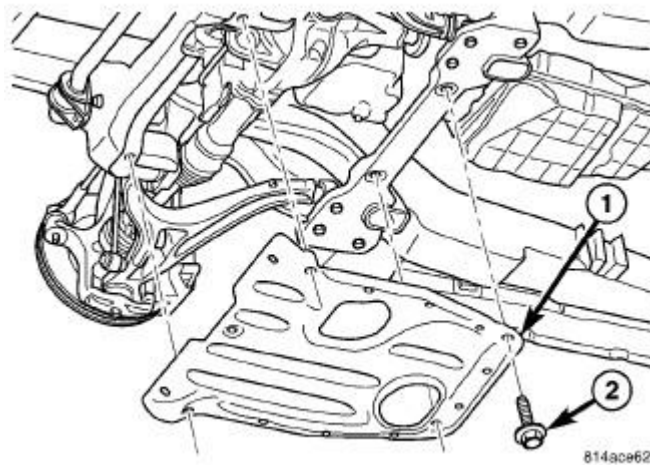


Fig. 161: UPDATED SKID PLATE
Courtesy of CHRYSLER LLC

52. Install the front skid plate.
53. Lower the vehicle.

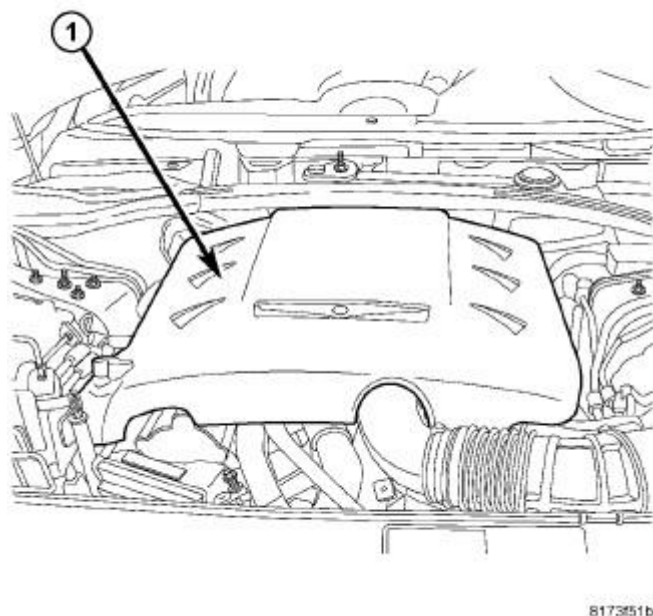


Fig. 162: ENGINE COVER
Courtesy of CHRYSLER LLC

54. Fill the cooling system. Refer to Cooling - Standard Procedure .
55. Charge the A/C system. Refer to Heating and Air Conditioning/Plumbing - Standard Procedure .

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.

56. Start the engine and allow to warm, turn engine off and inspect for leaks
57. Purge the air from the power steering system using the scan tool.
58. Install the engine cover (1).

RIGHT

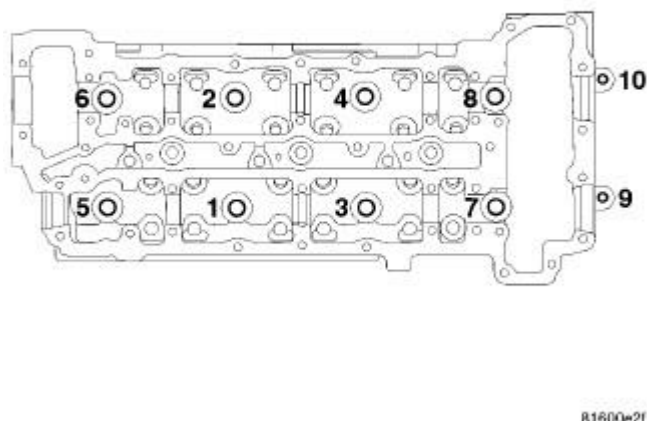


Fig. 163: RIGHT CYLINDER HEAD TIGHTENING SEQUENCE

Courtesy of CHRYSLER LLC

CAUTION: Inspect and measure all cylinder head bolt lengths. If out of specification, replace as necessary. See Engine/Cylinder Head - 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 Engine/Cylinder Head - 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.

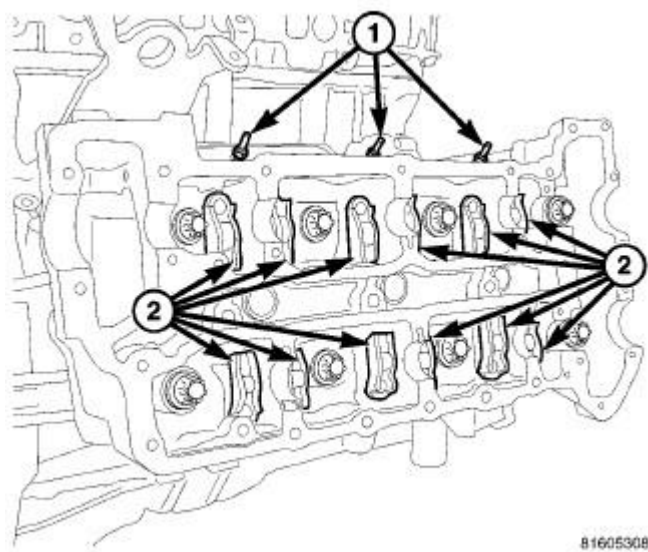


Fig. 164: RIGHT TAPPET/CAMSHAFT FOLLOWER POSITION

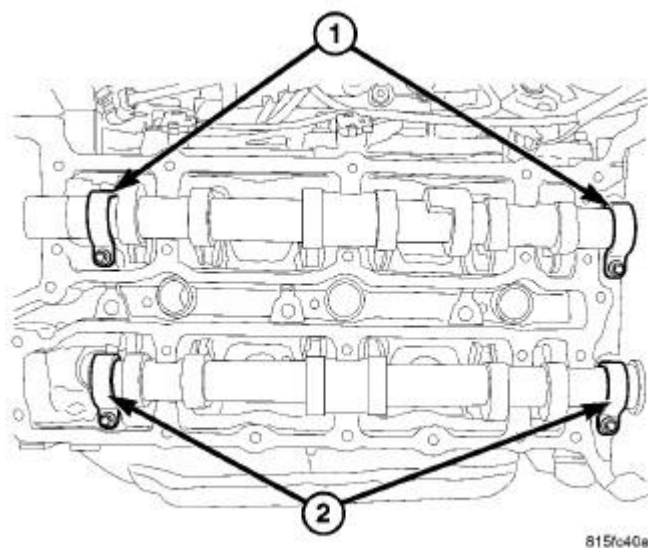
Courtesy of CHRYSLER LLC

1 - GLOW PLUGS

2 - TAPPET/CAMSHAFT FOLLOWER ASSEMBLY

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

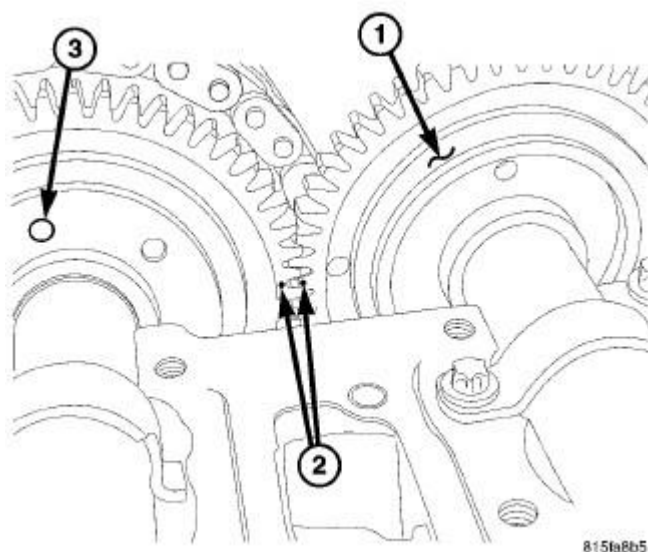
- a. Tighten M12 cylinder head bolts 1 through 8, in the sequence shown in illustration to 60 N.m (44 ft. lbs.).
- b. Tighten bolts 9 and 10 to 20 N.m (177 in. lbs.).
- c. Tighten 12 mm cylinder head bolts, 1 through 8, in sequence shown in illustration, an additional 90 degrees.
- d. Recheck and tighten 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 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 to 12.5 N.m (100 in. lbs.).

**Fig. 165: 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. 166: 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.

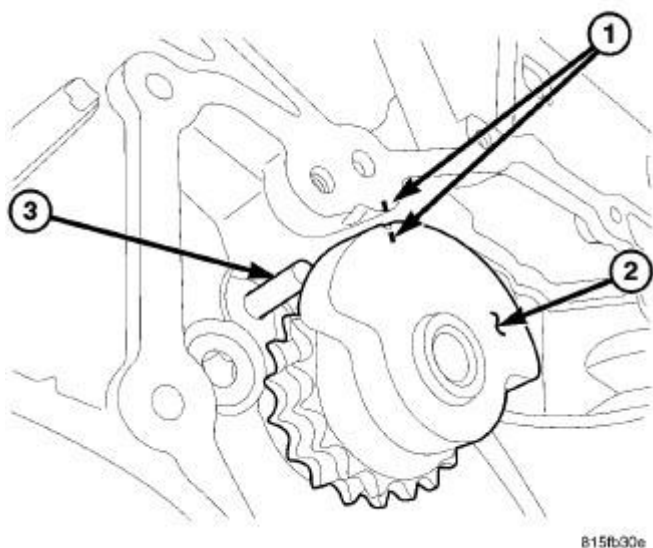


Fig. 167: BALANCE SHAFT INDEXING
Courtesy of CHRYSLER LLC

- 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.

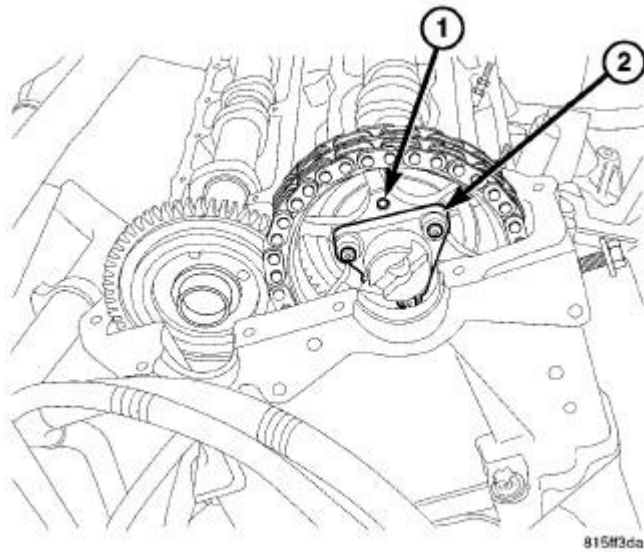


Fig. 168: RIGHT INTAKE CAMSHAFT DRIVE GEAR
Courtesy of CHRYSLER LLC

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

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

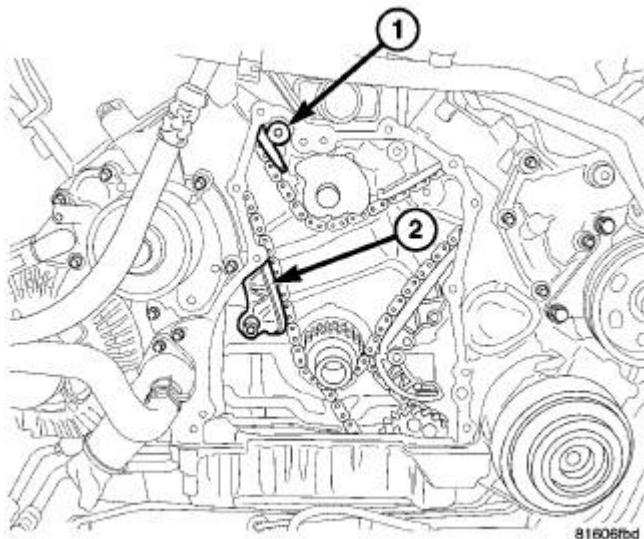


Fig. 169: RIGHT TIMING CHAIN GUIDES
Courtesy of CHRYSLER LLC

- | |
|------------------------------|
| 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.).

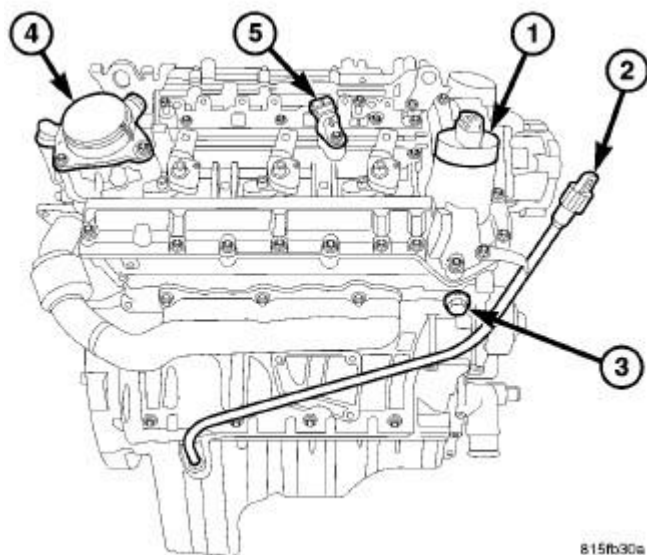


Fig. 170: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- | |
|------------------------------|
| 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).

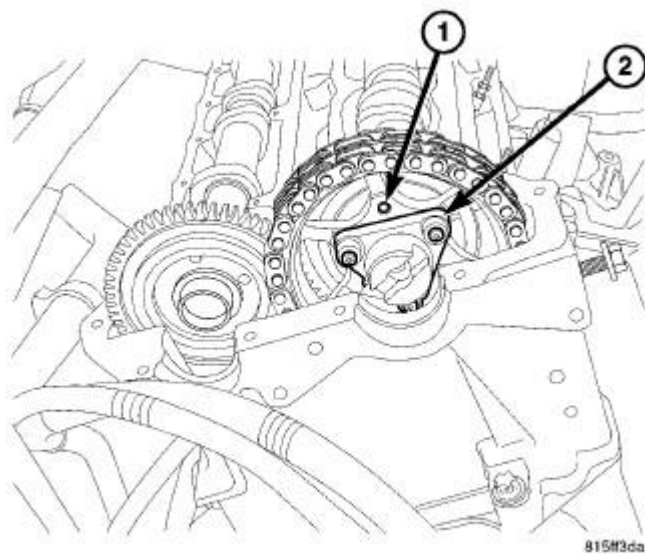


Fig. 171: RIGHT INTAKE CAMSHAFT DRIVE GEAR
Courtesy of CHRYSLER LLC

- | |
|---|
| 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.

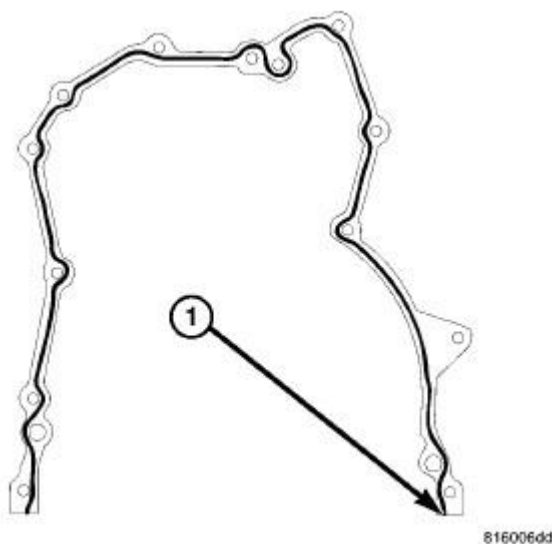


Fig. 172: TIMING COVER SEALING
Courtesy of CHRYSLER LLC

1 - 1.5MM 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.

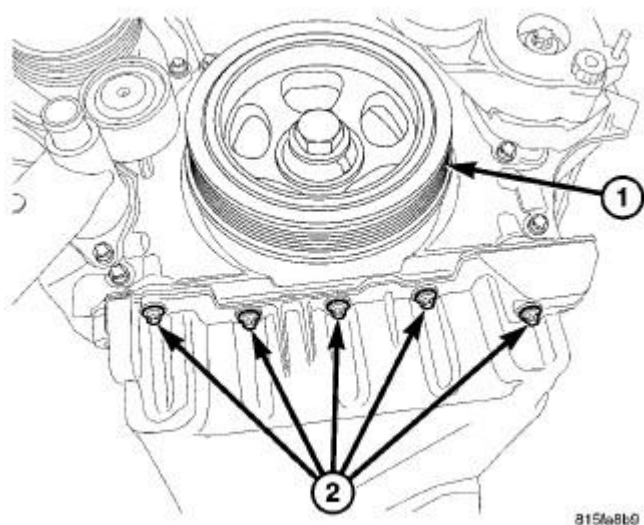


Fig. 173: FRONT OIL PAN
Courtesy of CHRYSLER LLC

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.).

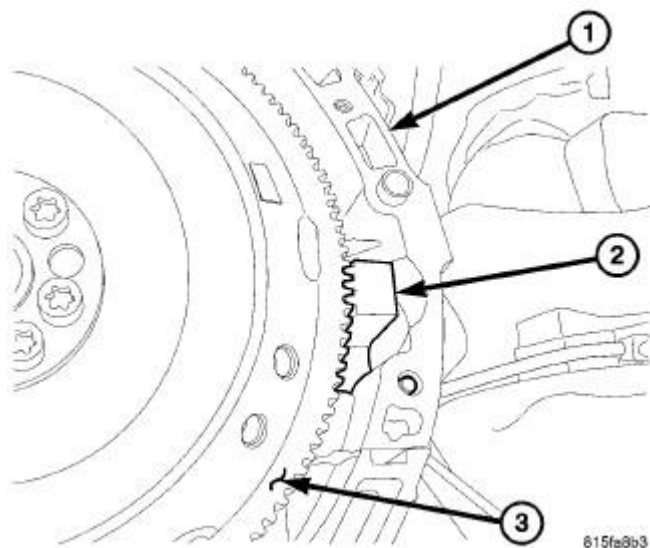
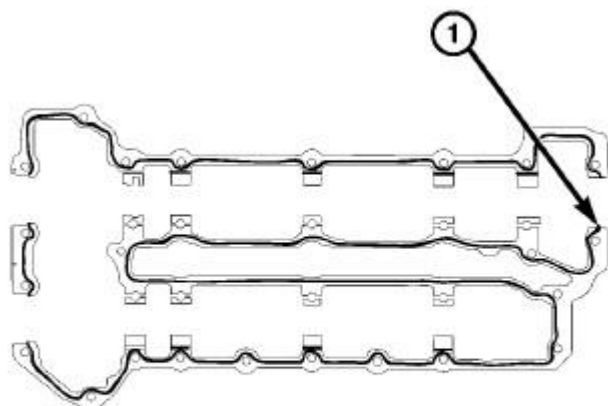


Fig. 174: SPECIAL TOOL # 9102

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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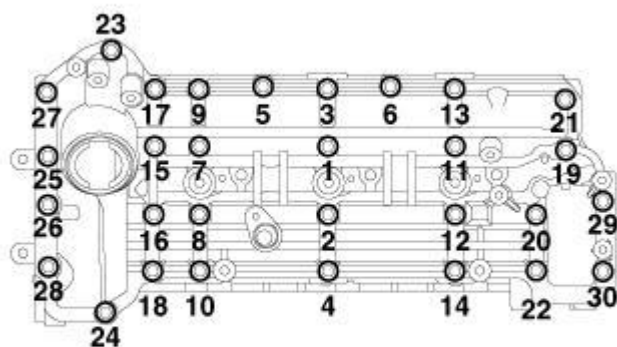
Fig. 175: RIGHT CYLINDER HEAD COVER SEALANT

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. 176: 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.).

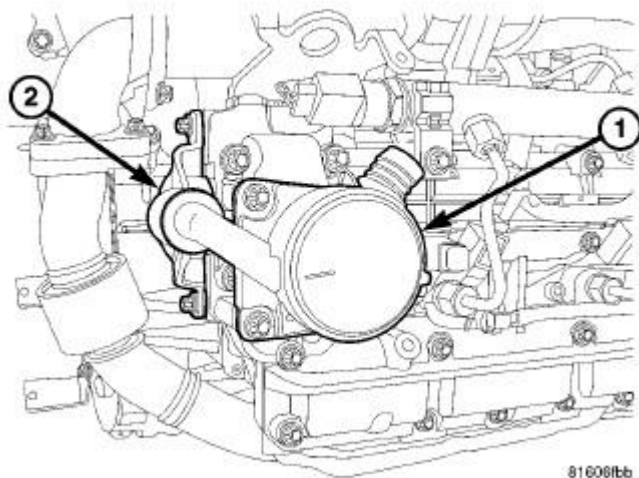


Fig. 177: OIL SEPARATOR
Courtesy of CHRYSLER LLC

- | |
|--|
| 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.).

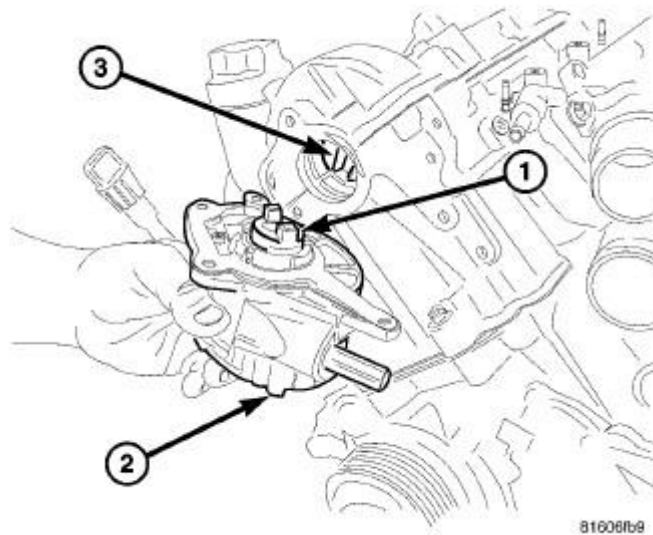


Fig. 178: VACUUM PUMP
Courtesy of CHRYSLER LLC

- 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.).

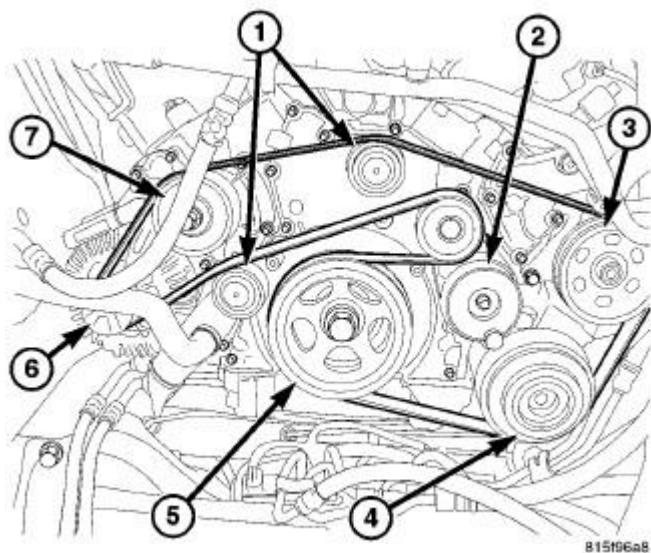


Fig. 179: ACCESSORY DRIVE BELT
Courtesy of CHRYSLER LLC

- 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.

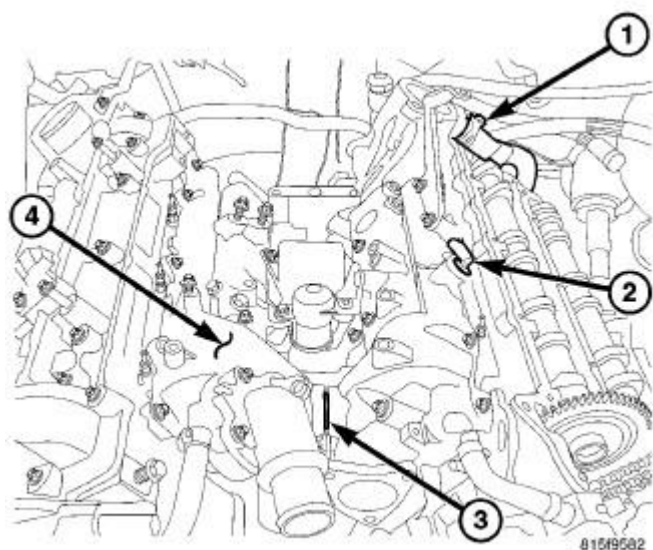


Fig. 180: INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

- | |
|---|
| 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.).

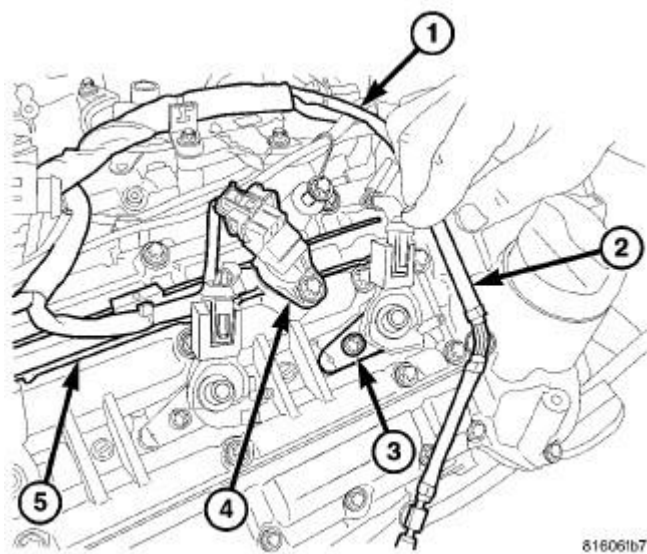


Fig. 181: RIGHT FUEL INJECTORS

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 |
|--|

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. Refer to Fuel System/Fuel Injection - Warning .

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).

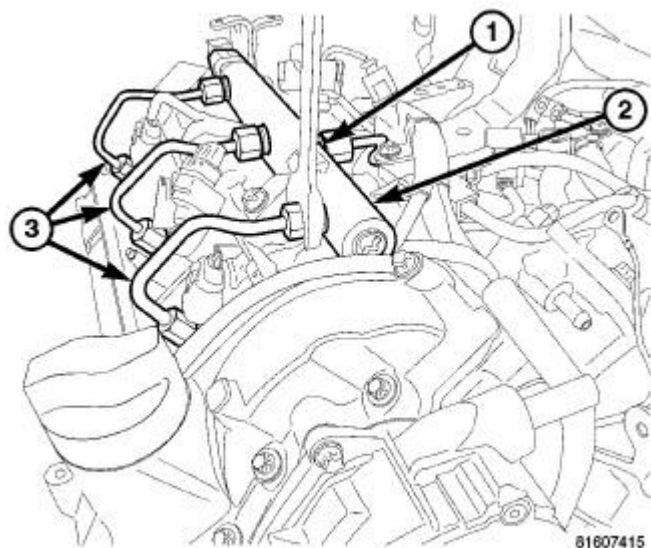


Fig. 182: RIGHT FUEL RAIL

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - FUEL RAIL TRANSFER LINE
2 - RIGHT FUEL RAIL
3 - HIGH PRESSURE FUEL LINES |
|--|

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.

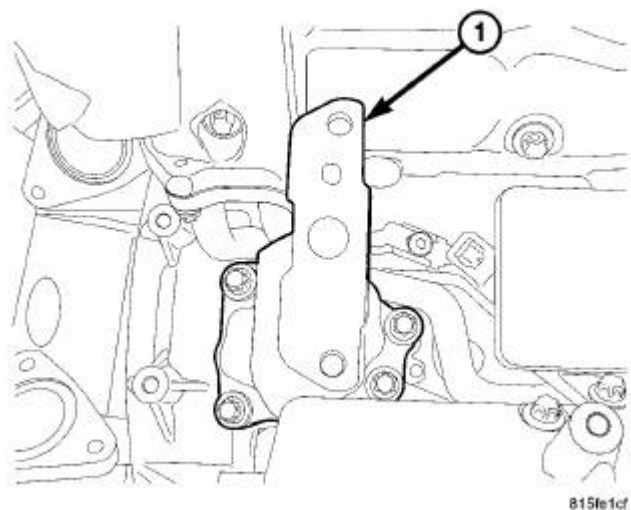


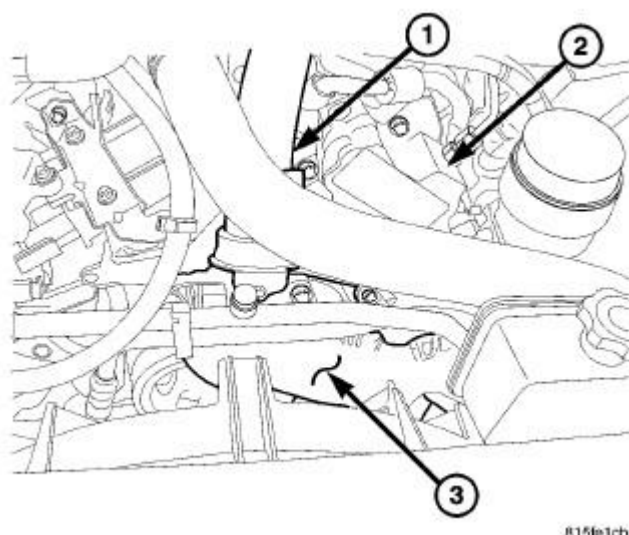
Fig. 183: TURBOCHARGER ADAPTOR

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 Engine/Turbocharger System/TURBOCHARGER - Installation.



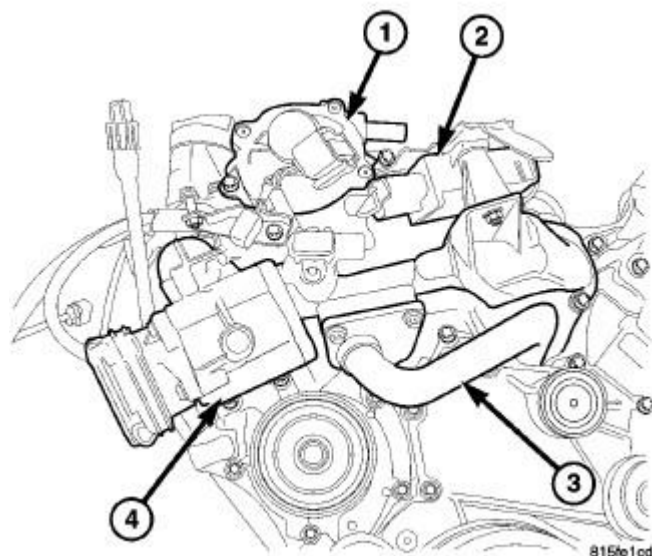
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Fig. 184: CHARGE AIR COOLER INLET WITH RESONATOR

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).



815fe1cd

Fig. 185: 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).

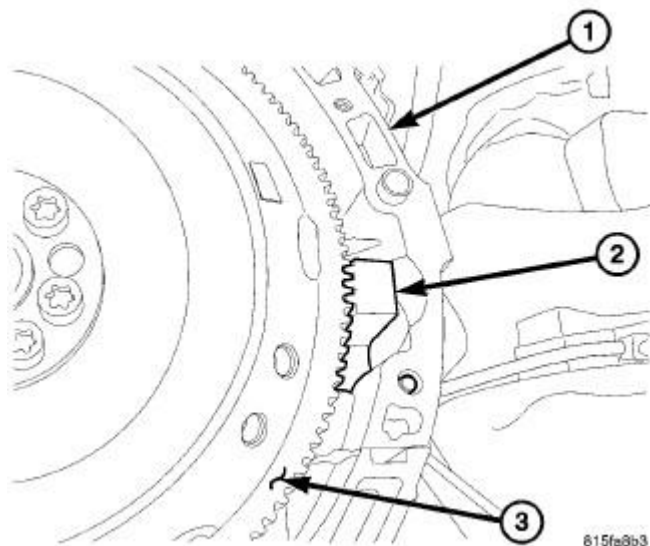


Fig. 186: SPECIAL TOOL # 9102
Courtesy of CHRYSLER LLC

- 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.

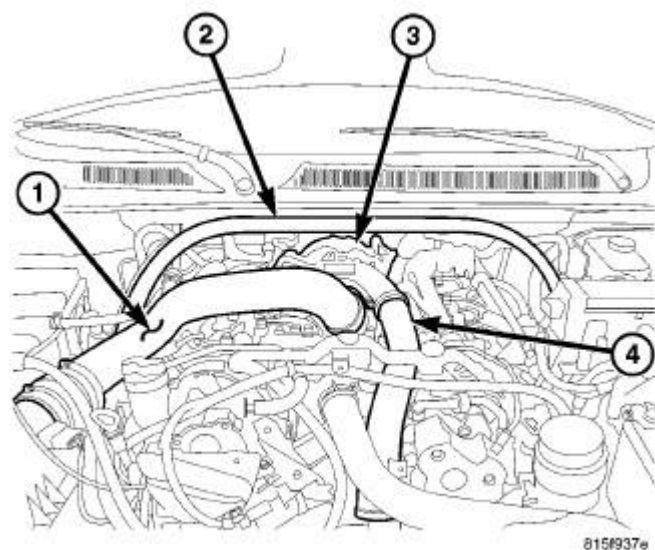


Fig. 187: STRUT TOWER SUPPORT

Courtesy of CHRYSLER LLC

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

56. Install the strut tower support (2).
57. 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 1350 bar (19,580 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.

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.

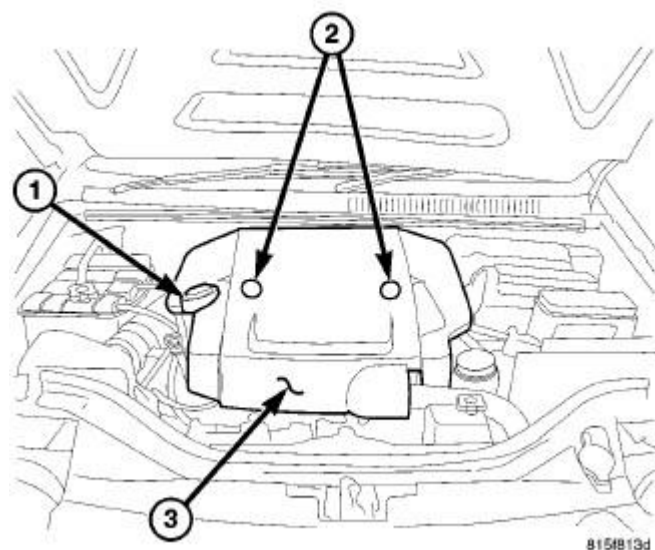


Fig. 188: ENGINE COVER
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - OIL FILLER CAP
2 - COVER FASTENERS
3 - ENGINE COVER |
|---|

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

1. Disconnect negative battery cable. Refer to Electrical/Battery System/CABLES, Battery - Removal .

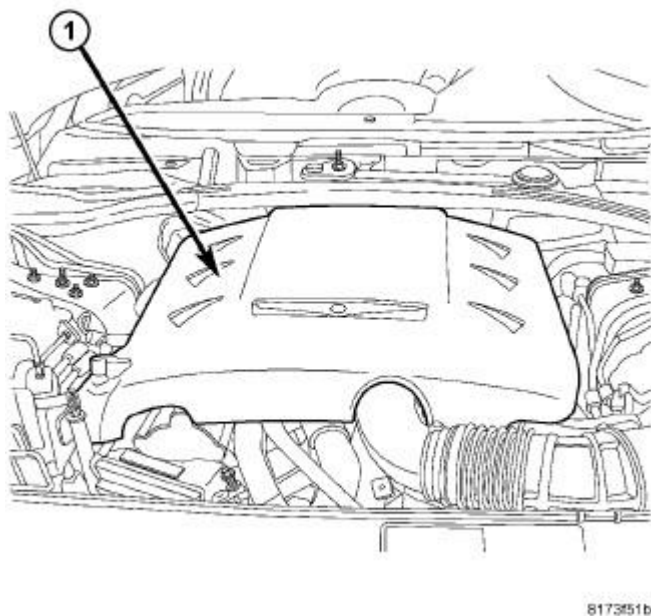


Fig. 189: ENGINE COVER
Courtesy of CHRYSLER LLC

2. Remove engine cover.

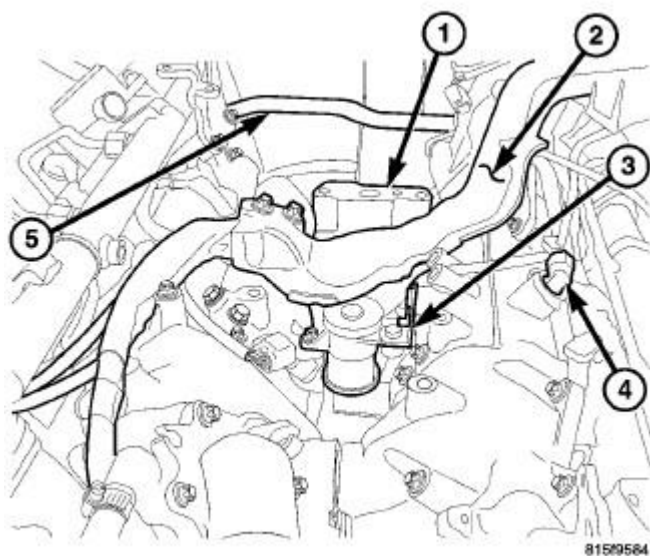


Fig. 190: MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

- | |
|--|
| 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.

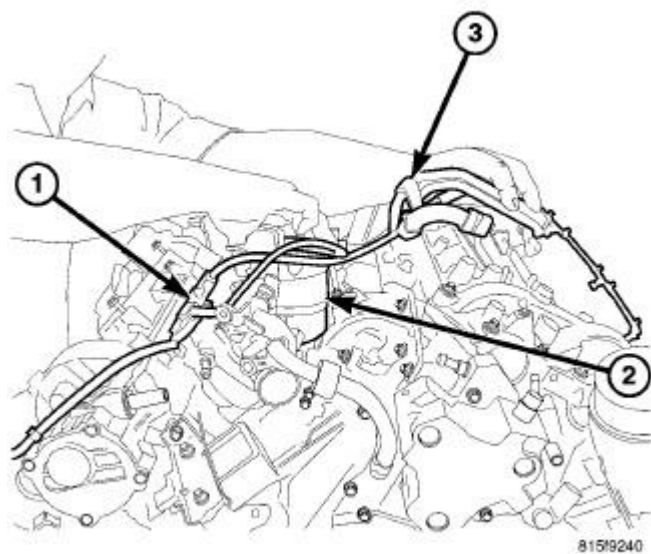


Fig. 191: FUEL FILTER, LINES AND HOSES
Courtesy of CHRYSLER LLC

- | |
|---|
| <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.

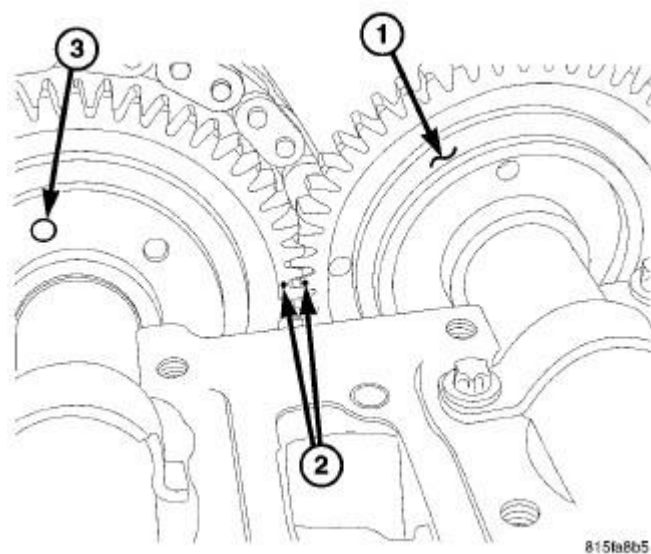


Fig. 192: CAMSHAFT GEAR ALIGNMENT
Courtesy of CHRYSLER LLC

- 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.

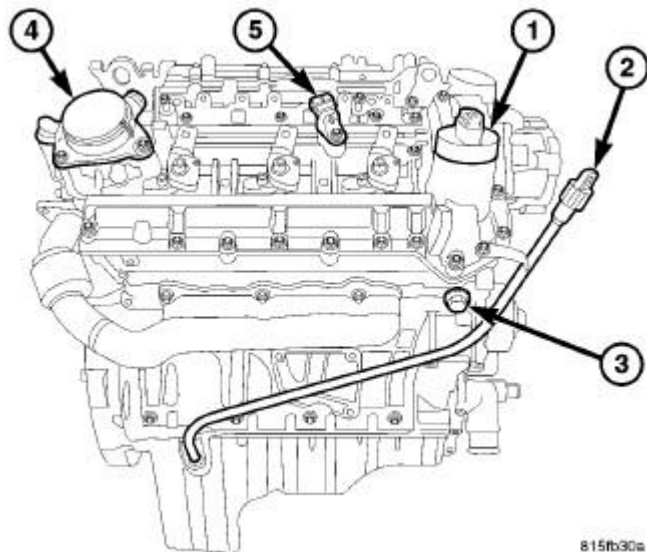


Fig. 193: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- 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.

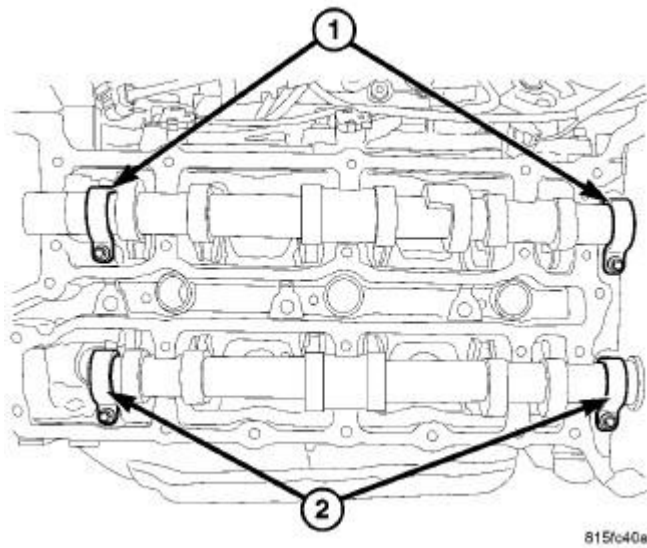


Fig. 194: CAMSHAFT RETAINERS
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - INTAKE CAMSHAFT RETAINERS
2 - EXHAUST CAMSHAFT RETAINERS</p> |
|---|

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

RIGHT

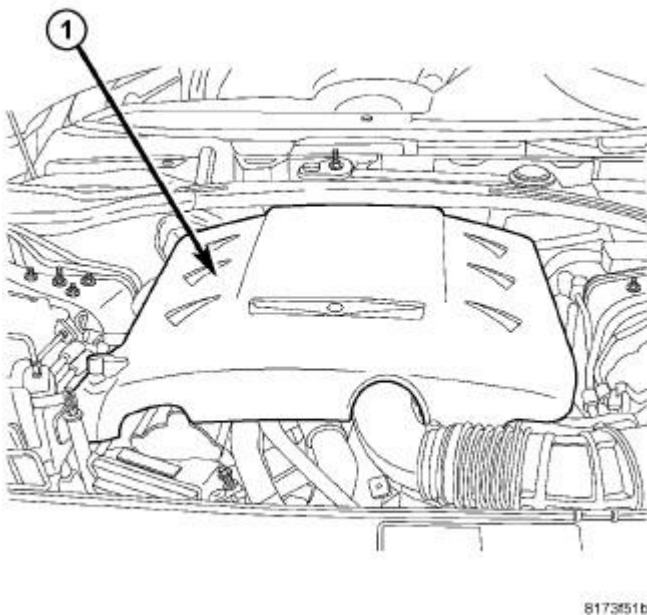
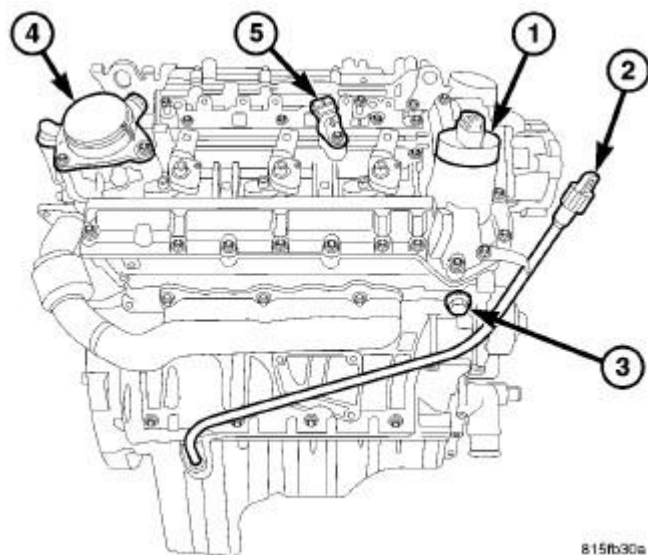


Fig. 195: ENGINE COVER

Courtesy of CHRYSLER LLC

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



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Fig. 196: 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. 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 Engine/Cylinder Head/COVER(S), Cylinder Head - Removal.

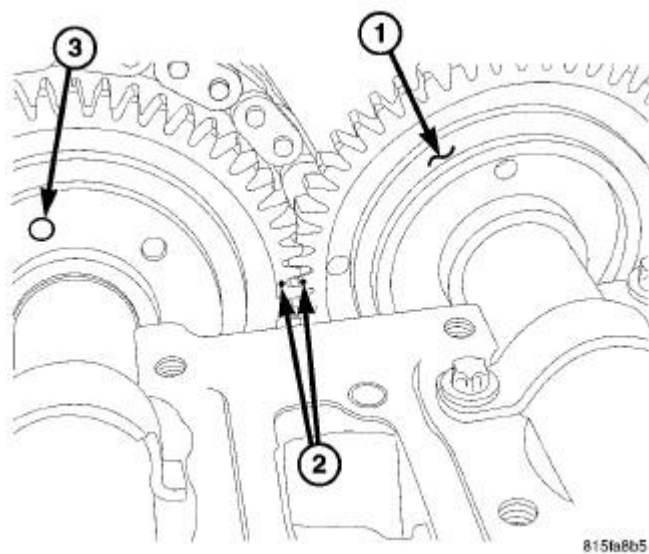


Fig. 197: CAMSHAFT GEAR ALIGNMENT

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.

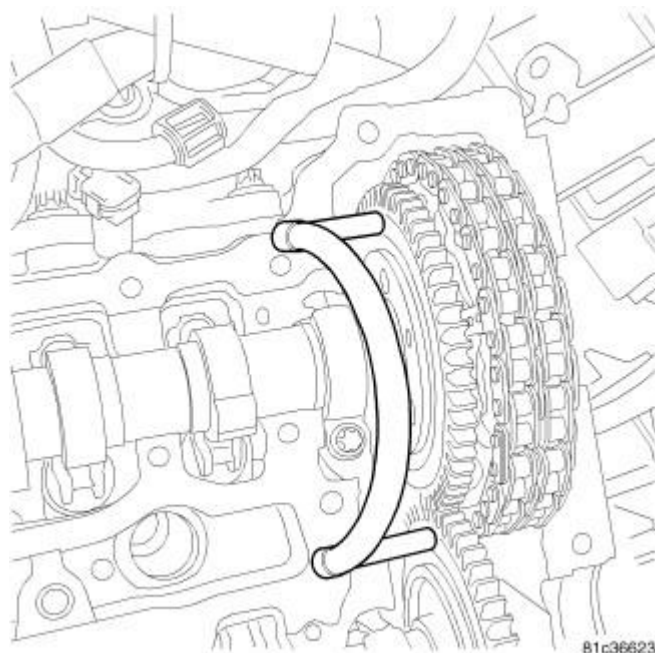
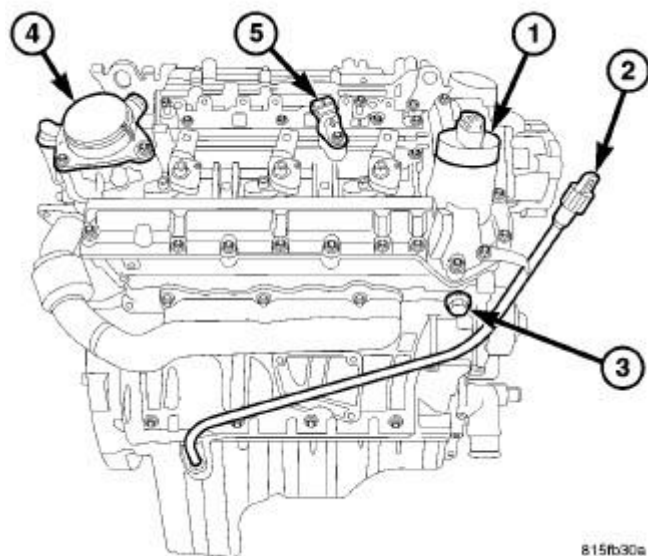


Fig. 198: CAMSHAFT PINS

Courtesy of CHRYSLER LLC

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.

**Fig. 199: 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).

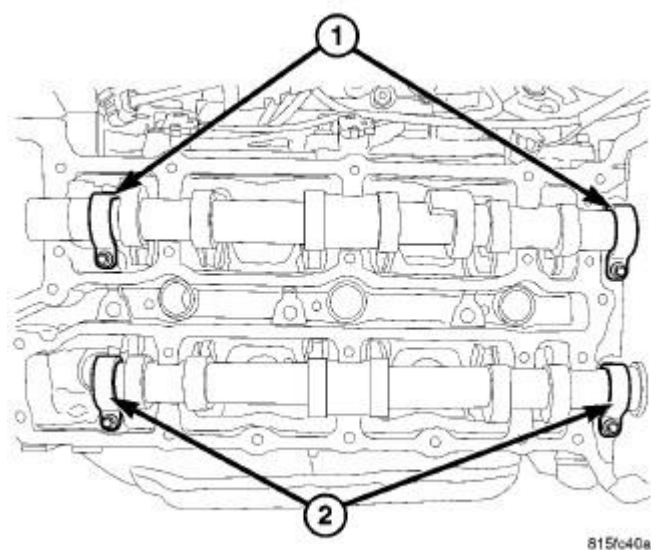


Fig. 200: CAMSHAFT RETAINERS

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

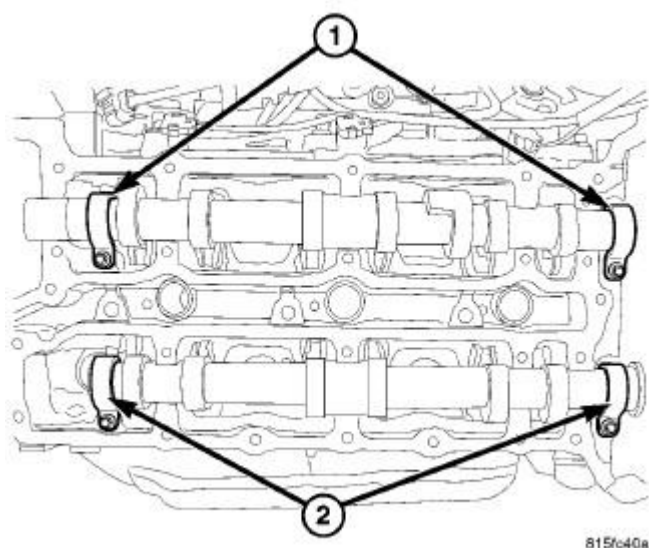


Fig. 201: CAMSHAFT RETAINERS

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.).

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 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. 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.

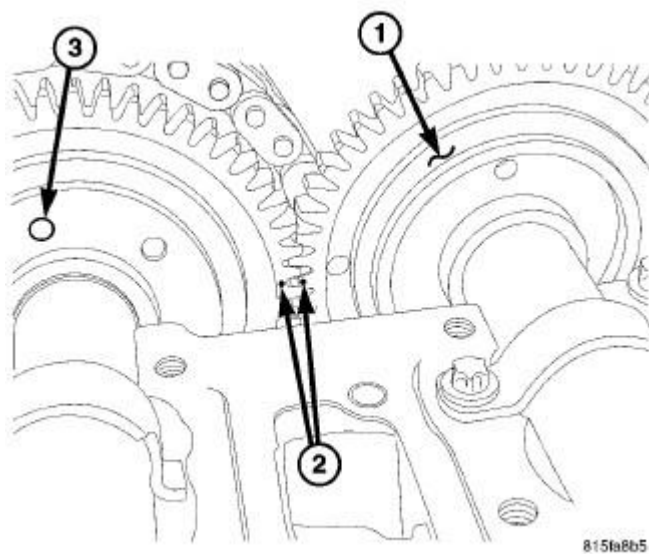


Fig. 202: CAMSHAFT GEAR ALIGNMENT
Courtesy of CHRYSLER LLC

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

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.

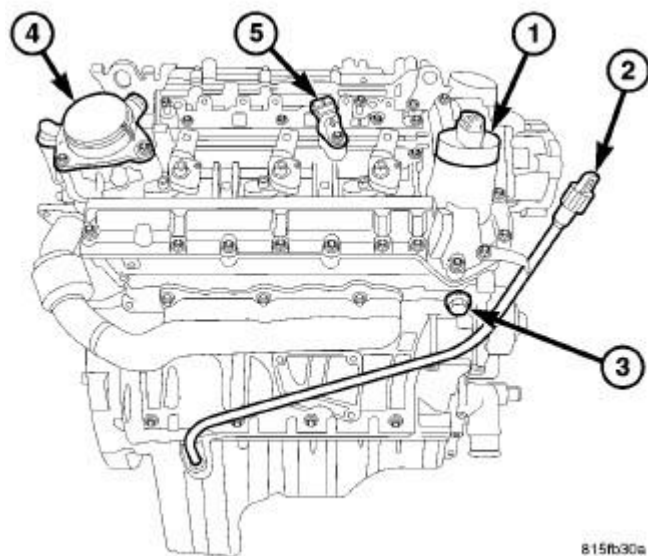


Fig. 203: TIMING CHAIN TENSIONER

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.

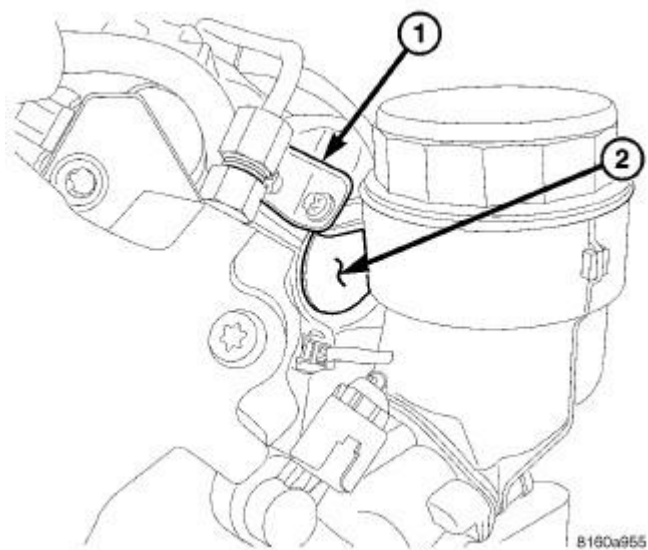


Fig. 204: LEFT FRONT CAMSHAFT SEAL WITH OIL FILTER HOUSING BRACKET

Courtesy of CHRYSLER LLC

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

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

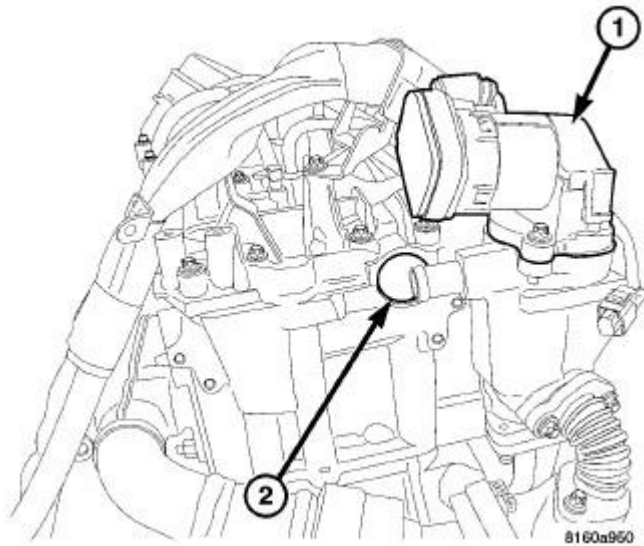


Fig. 205: LEFT REAR CAMSHAFT SEAL
Courtesy of CHRYSLER LLC

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

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

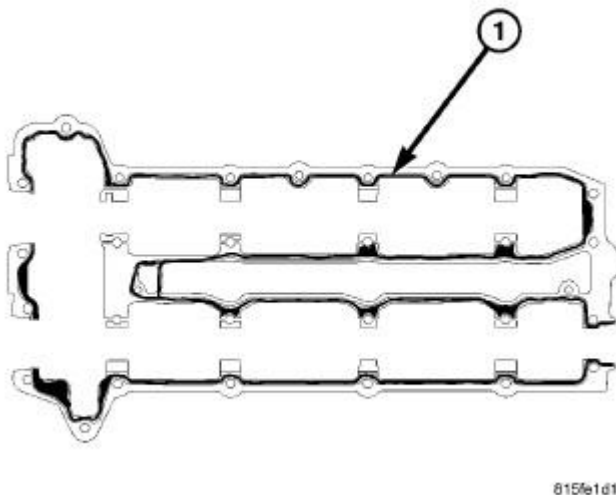


Fig. 206: Applying Cylinder Head Cover Sealant
Courtesy of CHRYSLER LLC

1 - 1.5MM 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 **Engine - Standard Procedure**.

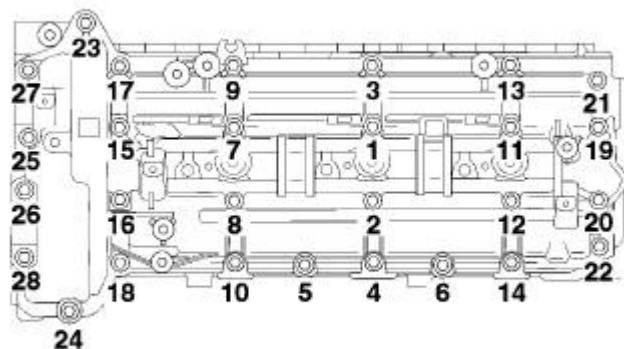


Fig. 207: LEFT CYLINDER HEAD COVER TIGHTENING SEQUENCE
Courtesy of CHRYSLER LLC

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. Using the sequence shown in illustration, tighten the cylinder head cover bolts to 4 N.m (35 in. lbs.), repeat the sequence and tighten to 8.4 N.m (75 in. lbs).

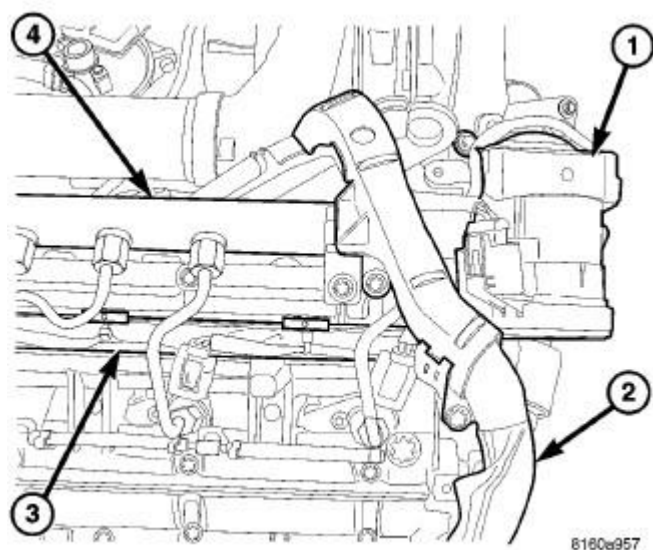


Fig. 208: EGR VALVE WITH MAIN ENGINE WIRING HARNESS

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. Do Not apply injector body lubricant near the injector nozzles.

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

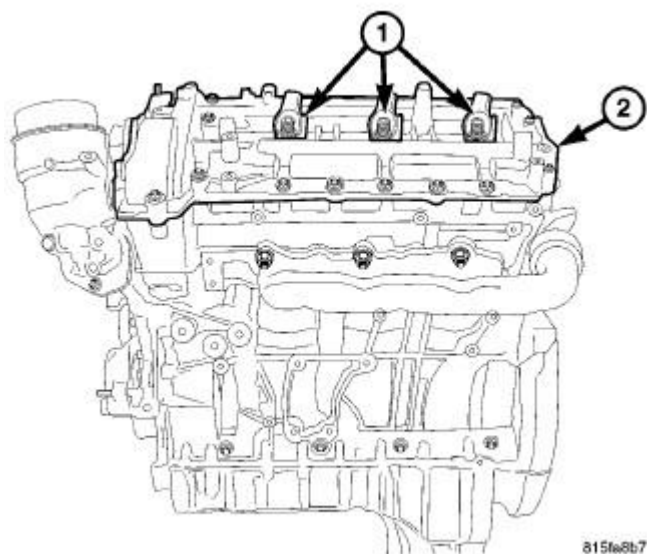


Fig. 209: Left Cylinder Head Cover
 Courtesy of CHRYSLER LLC

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.

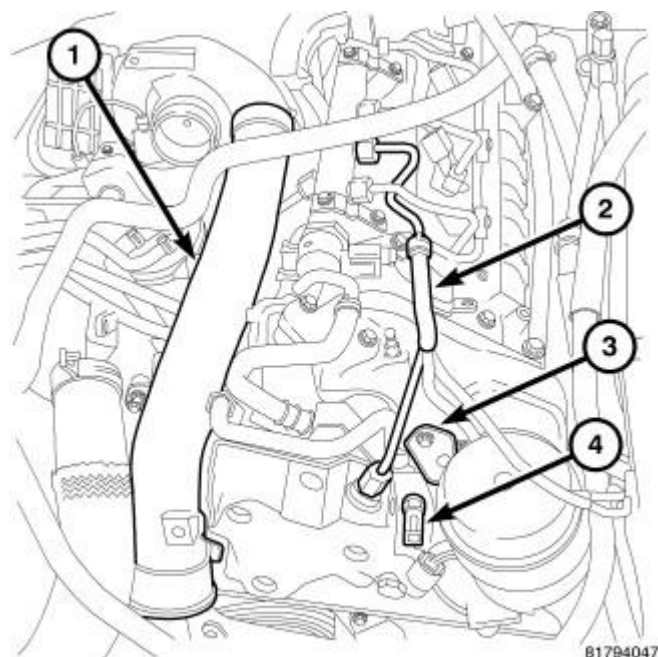


Fig. 210: Charge Air Cooler Inlet Pipe, High Pressure Line, Oil Filter Housing Bracket & Fuel Temperature Sensor Connector
Courtesy of CHRYSLER LLC

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.

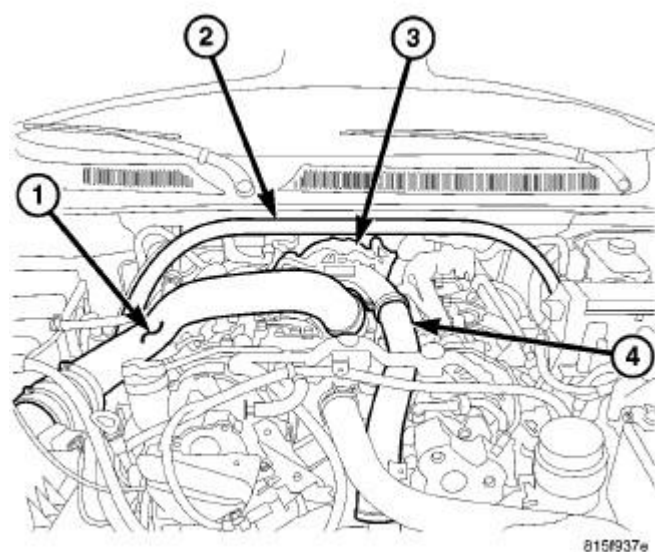


Fig. 211: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

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

29. Install the air filter housing and tube.
30. 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.

31. Start the engine, run until warm, turn engine off and inspect for leaks.

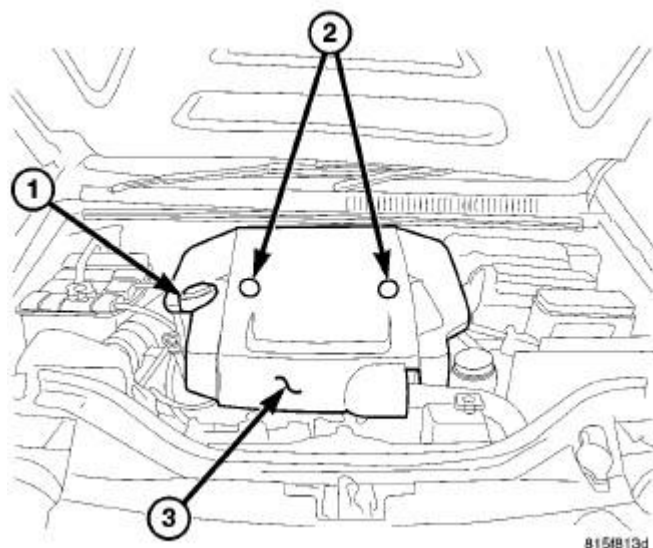


Fig. 212: ENGINE COVER
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - OIL FILLER CAP
2 - COVER FASTENERS
3 - ENGINE COVER |
|---|

32. Install the engine cover.
33. Connect 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.

34. Start engine, allow to warm, turn engine off and inspect for leaks.

RIGHT

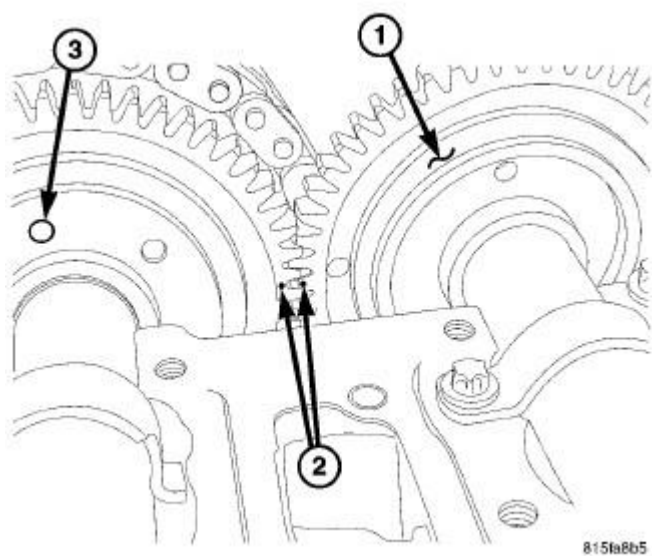


Fig. 213: Camshaft Gear Alignment
Courtesy of CHRYSLER LLC

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

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.

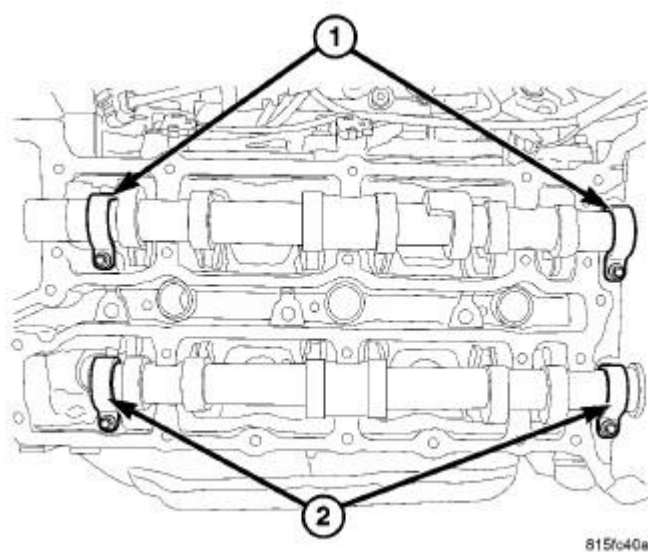


Fig. 214: Camshaft Retainers
Courtesy of CHRYSLER LLC

- 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.

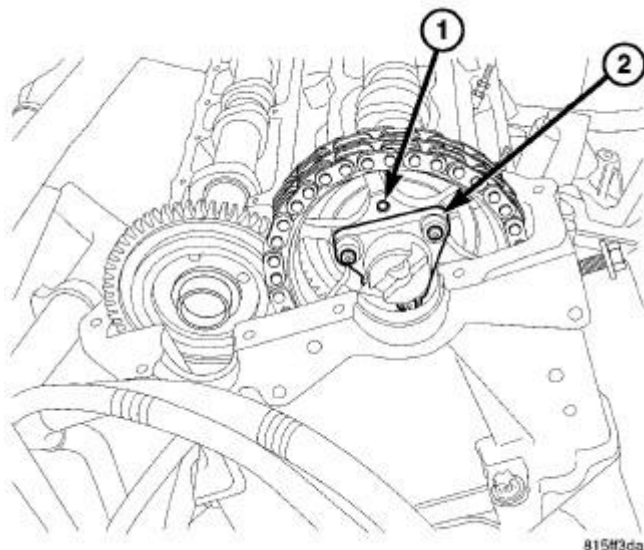


Fig. 215: Right Intake Camshaft Drive Gear
Courtesy of CHRYSLER LLC

- 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.

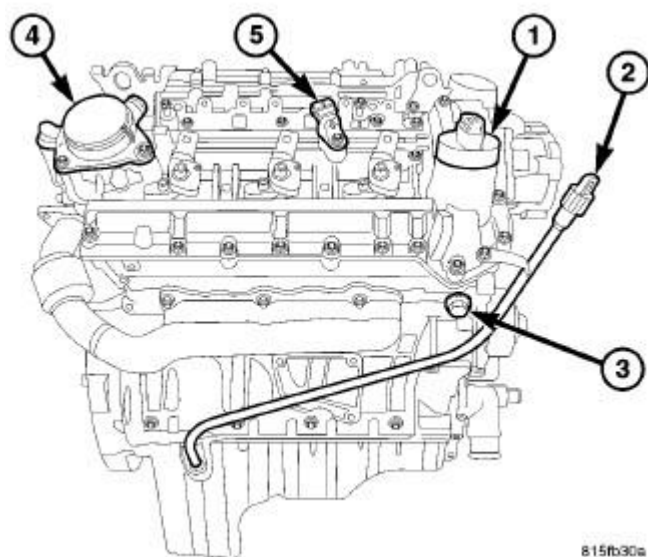
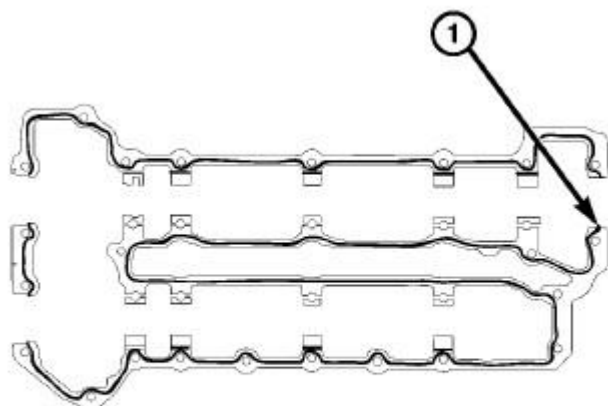


Fig. 216: Timing Chain Tensioner
Courtesy of CHRYSLER LLC

- | |
|------------------------------|
| 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 (3).



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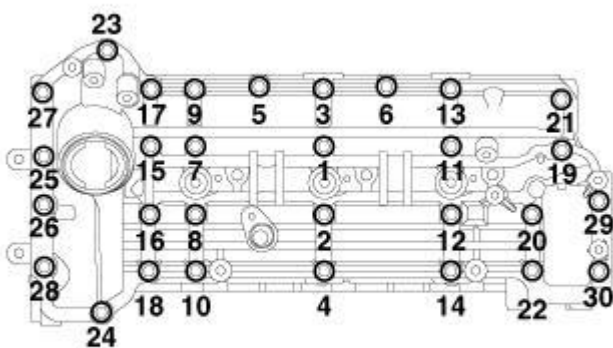
Fig. 217: RIGHT CYLINDER HEAD COVER SEALANT

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 1.5MM bead of Mopar® Engine RTV Sealant (1) to the cylinder head cover.



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Fig. 218: 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.).

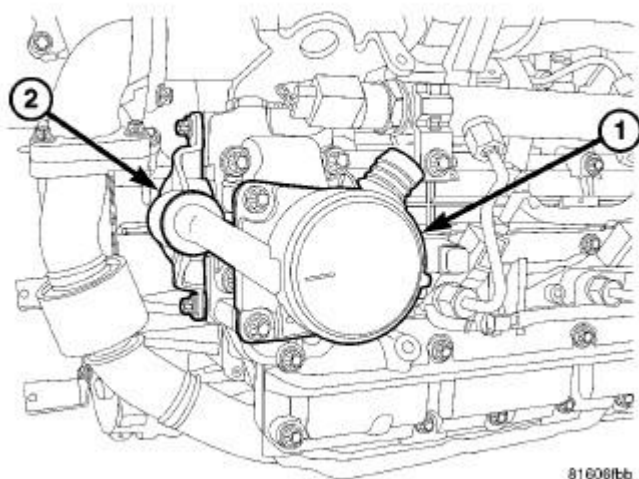


Fig. 219: OIL SEPARATOR
Courtesy of CHRYSLER LLC

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

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.).

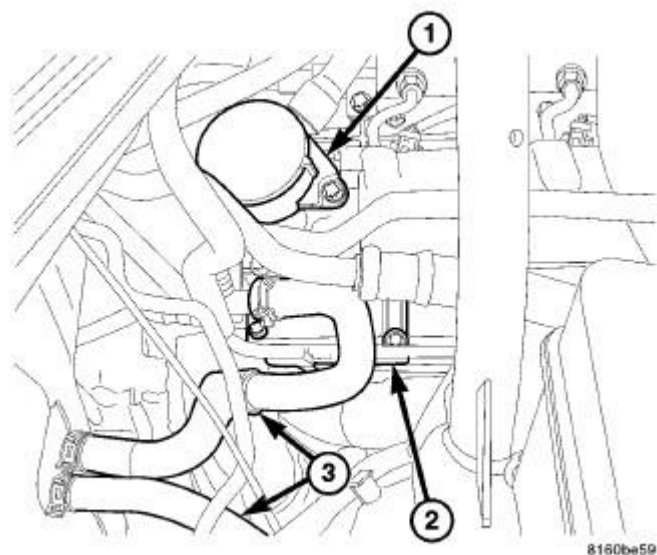
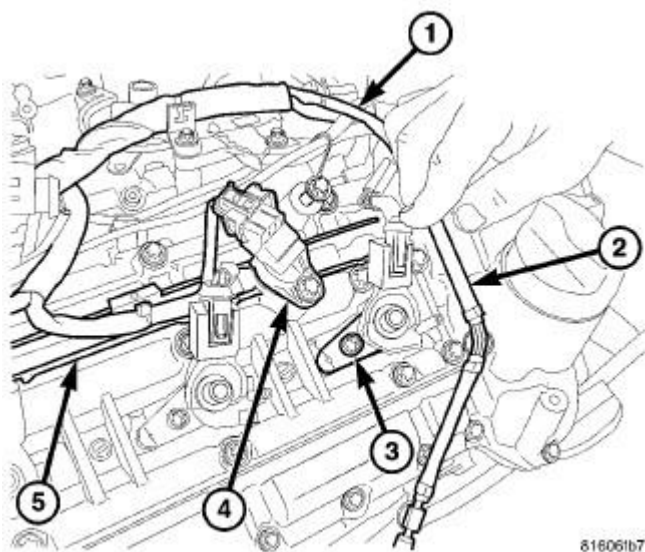


Fig. 220: HEATER HOSE WITH BRACKET

Courtesy of CHRYSLER LLC

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

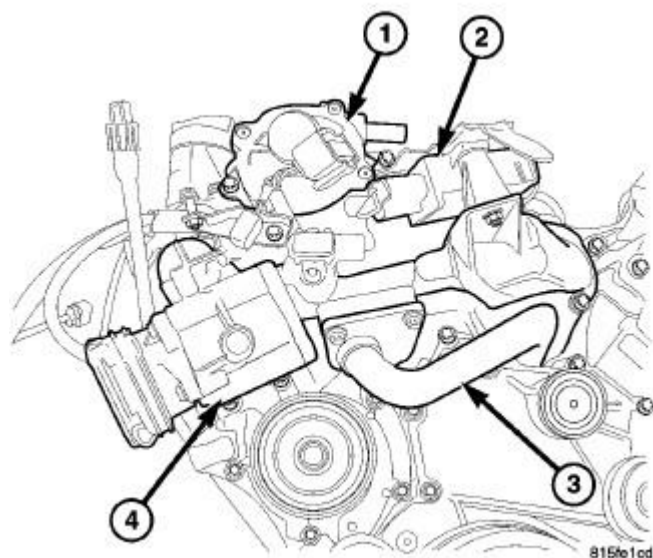
- 18. Secure the transmission tube fastener to the engine cover bracket.
- 19. Secure the heater hose bracket (2) to the cylinder head cover.

**Fig. 221: 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. 222: AIR CONTROL VALVE****Courtesy of CHRYSLER LLC**

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

25. Secure the engine oil indicator tube (4) 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).

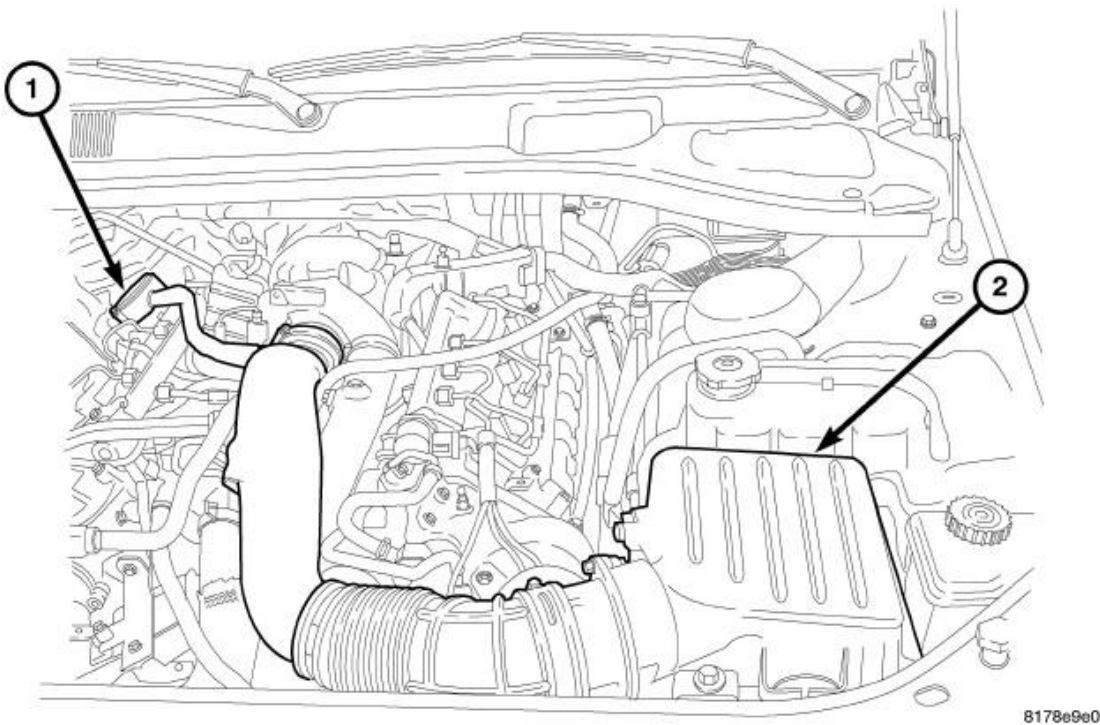


Fig. 223: FILTER HOUSING AND TUBE
Courtesy of CHRYSLER LLC

28. Install the air cleaner outlet tube to the turbocharger and secure the air cleaner housing cover (2)

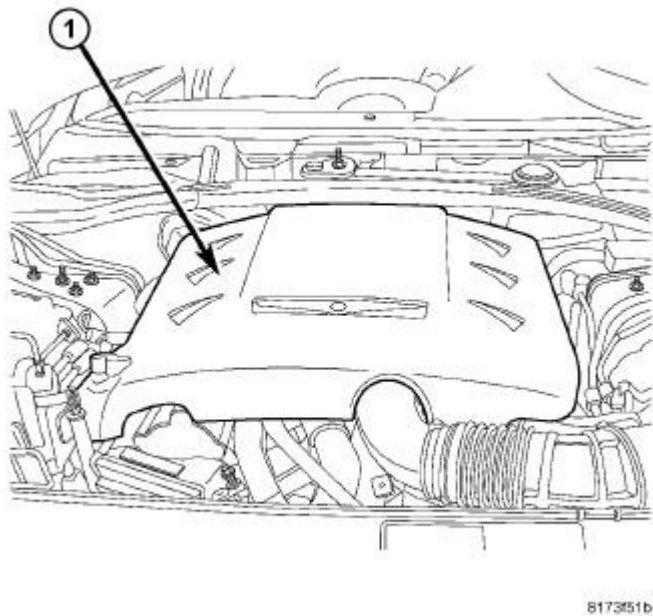


Fig. 224: ENGINE COVER
Courtesy of CHRYSLER LLC

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.

WARNING: Under no circumstances should gasoline be mixed with diesel fuel (not even during winter). The high pressure pump is lubricated by diesel fuel. Immediate fuel system damage may occur causing replacement and flushing of the complete diesel fuel system. High pressure pump seizure will cause metal particles to spread throughout the fuel circuit. All cdi fuel system components connected to the fuel circuit will have to be exchanged and the lines flushed.

COVER(S), CYLINDER HEAD

Description

DESCRIPTION

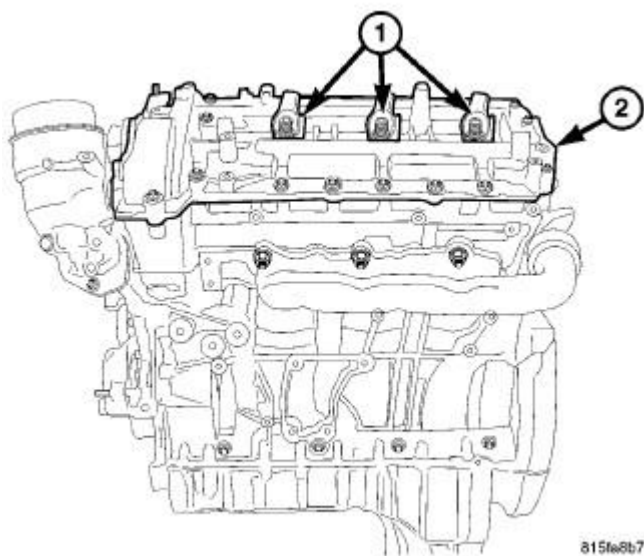


Fig. 225: Left Cylinder Head Cover
Courtesy of CHRYSLER LLC

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

LEFT

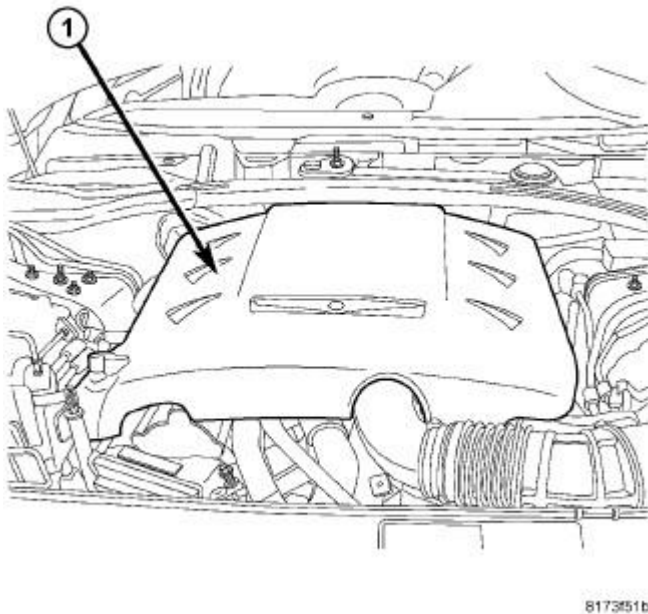


Fig. 226: ENGINE COVER
Courtesy of CHRYSLER LLC

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.

1. Remove the engine cover (1) and brackets.
2. Disconnect the generator power feed line and position aside.

WARNING: High pressure fuel lines deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 1600 bar (23,200 psi). Use extreme caution when inspecting for high pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system.

3. Release the fuel pressure.

-
- Diagram illustrating the front suspension assembly with numbered callouts:
1. Upper control arm
 2. Lower control arm
 3. Steering knuckle
 4. Ball joint
 5. Shock absorber
 6. Coil spring
 7. Spring plate
 8. Lower control arm

Courtesy of CHRYSLER LLC

5. Disconnect the positive and negative battery cables (8, 4). Refer to **Electrical/Battery System/CABLES, Battery - Removal** .
6. Remove the battery (5) and battery tray (7). Refer to **Electrical/Battery System/TRAY, Battery - Removal** .
7. Disconnect all Power Distribution Center (PDC) (1) and generator wiring harness cables and position aside.
8. Disconnect the PDC and support bracket and position aside.

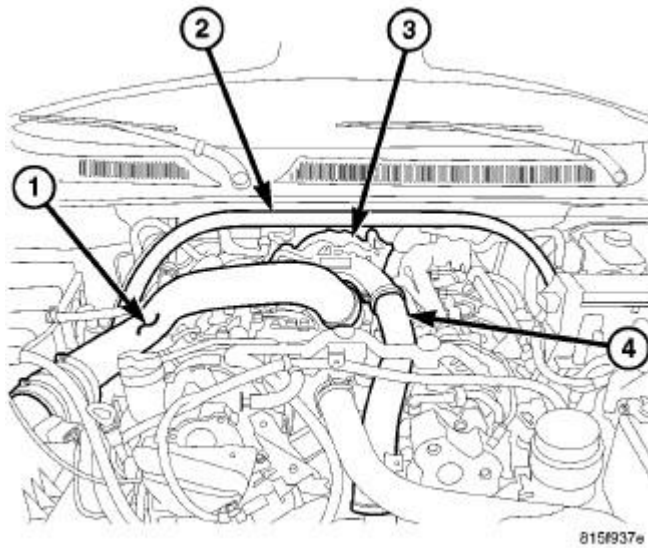


Fig. 228: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

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

9. Remove the strut tower support (2).

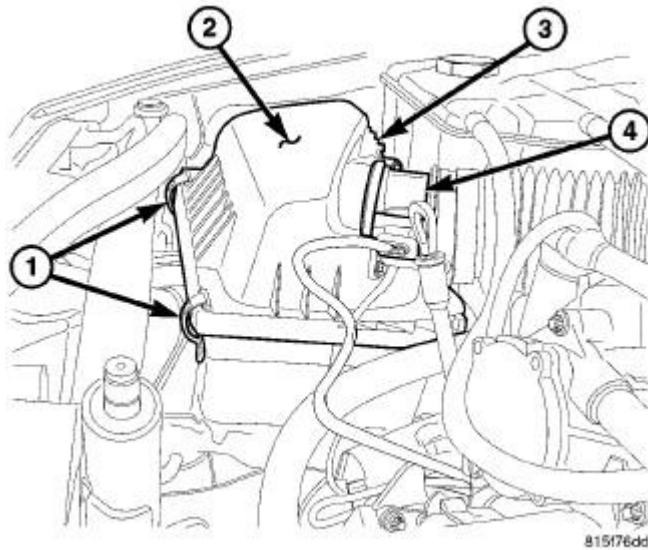


Fig. 229: AIR CLEANER COVER
Courtesy of CHRYSLER LLC

10. Remove the air cleaner housing (2) and duct.

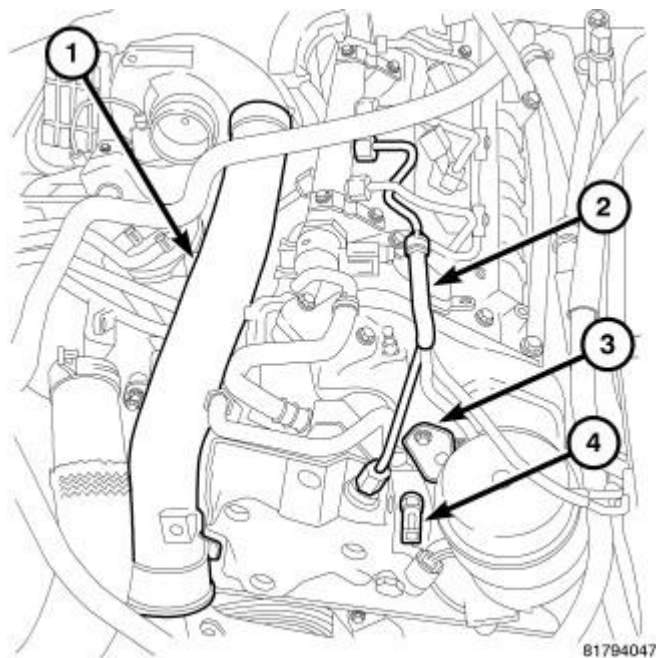


Fig. 230: Charge Air Cooler Inlet Pipe, High Pressure Line, Oil Filter Housing Bracket & Fuel Temperature Sensor Connector
Courtesy of CHRYSLER LLC

11. Remove the charge air cooler inlet pipe (1) and resonator.
12. Remove the high pressure line (2) from the fuel pump and the fuel rail.
13. Remove the oil filter housing bracket (3).
14. Disconnect the fuel temperature sensor connector (4).
15. Disconnect the fuel quantity solenoid connector.
16. Remove the engine harness retaining bolts and position the engine harness aside.
17. Remove the bolts from the intercooler air chamber.

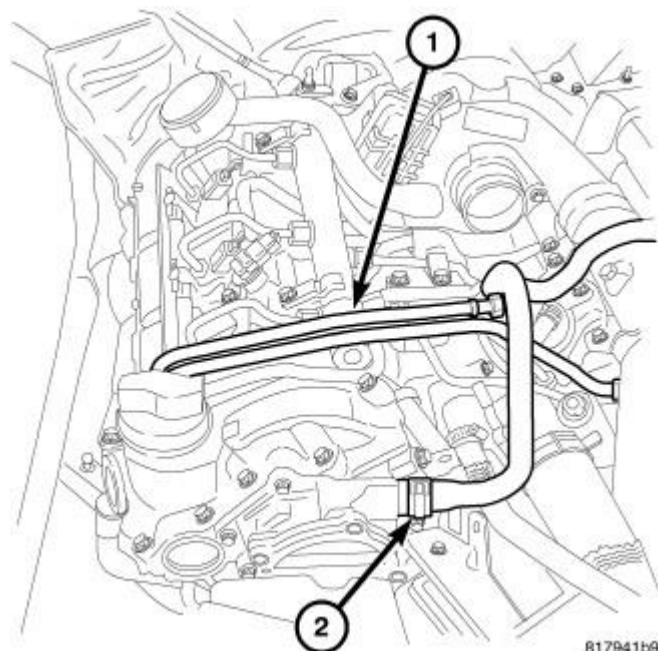


Fig. 231: Power Brake Booster Vacuum Line
Courtesy of CHRYSLER LLC

18. Remove the power brake booster vacuum hose (2) from the vacuum pump and position aside.

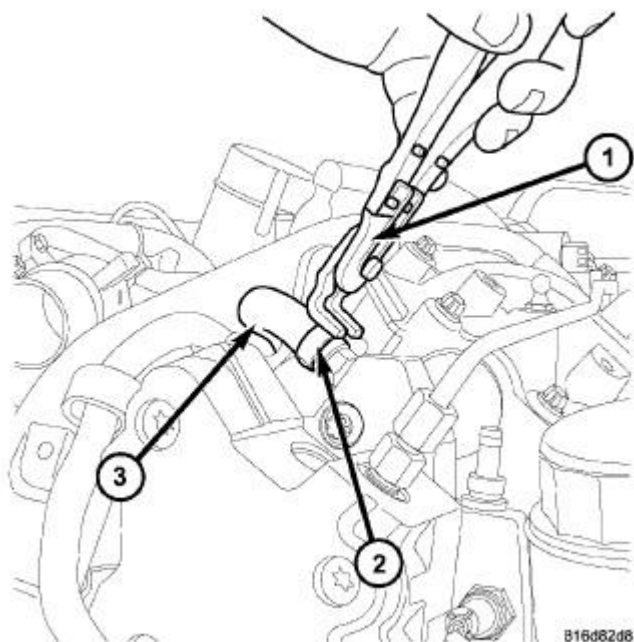


Fig. 232: PUMP FUEL LINE PLIERS
Courtesy of CHRYSLER LLC

19. Using fuel line pliers 9539 (1), remove the fuel return line clamp (2) at the high pressure fuel pump and remove the fuel return line (3).

20. Using fuel line pliers 9539, remove the fuel inlet supply clamp at the high pressure fuel pump and remove the fuel inlet line.

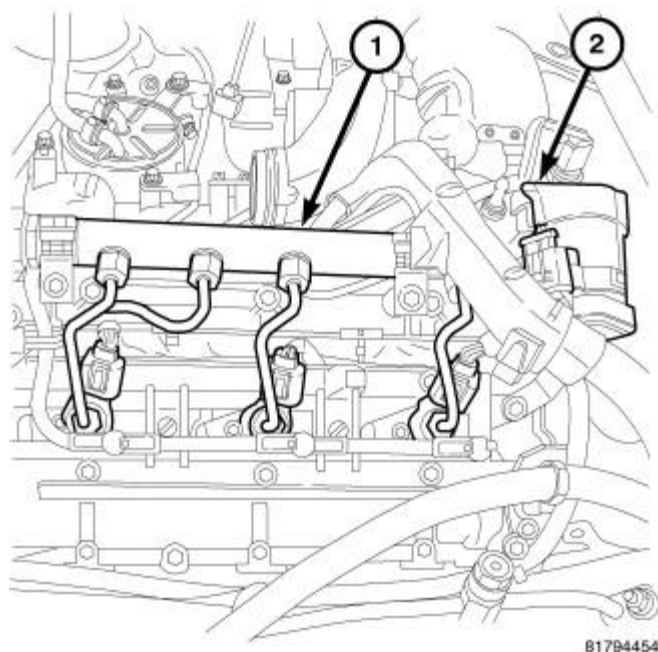


Fig. 233: EGR VALVE
Courtesy of CHRYSLER LLC

1 - FUEL RAIL
2 - EGR VALVE

21. Disconnect the EGR solenoid connector.
22. Remove the EGR valve (2).

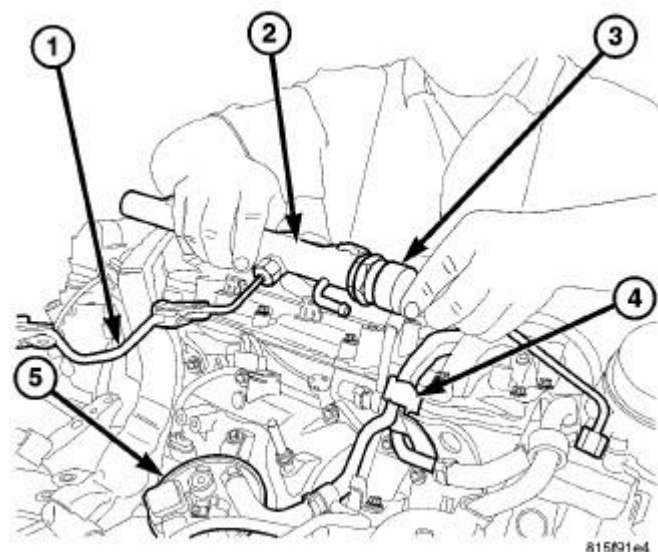


Fig. 234: LEFT FUEL RAIL
Courtesy of CHRYSLER LLC

- 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

- 23. Disconnect the fuel injector electrical connectors.
- 24. Remove the fuel injector wiring harness from the cylinder head cover and position aside.
- 25. Pull out tab on the fuel injector return hose retainers and disconnect the hoses.
- 26. Remove the high pressure fuel lines from the fuel injectors and fuel rail, including the fuel rail equalizing line (1).
- 27. Remove the fuel rail retaining bolts and remove the fuel rail (1).

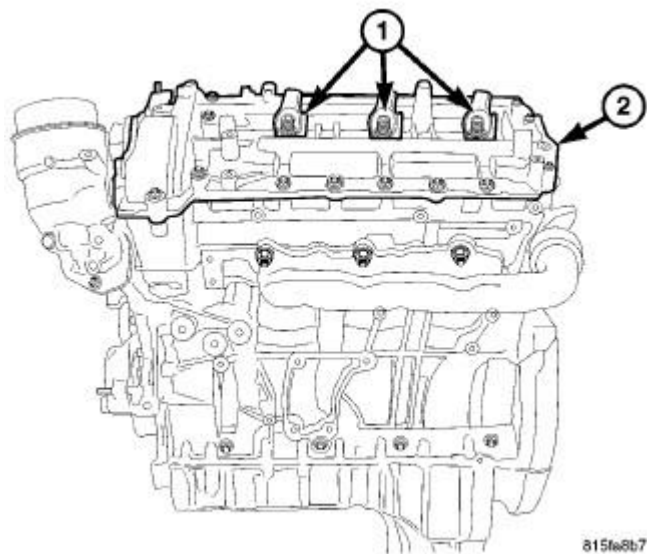


Fig. 235: Left Cylinder Head Cover
Courtesy of CHRYSLER LLC

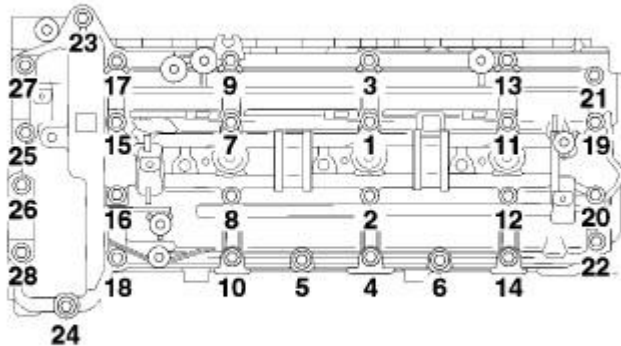
CAUTION: The fuel injector retaining claw bolts are torque to yield and must always be replaced.

- 28. Remove the fuel injector retaining claws and discard bolts.

CAUTION: The fuel injector sealing washers Must be replaced. Do Not use the old sealing washers.

NOTE: If the fuel injectors are tight, remove using tool 9552.

29. Remove the fuel injectors (1) and discard sealing washers.



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Fig. 236: LEFT CYLINDER HEAD COVER TIGHTENING SEQUENCE

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 is 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 reassembly.

30. Using the sequence shown in illustration, remove the cylinder head cover bolts and remove cover.

RIGHT

1. Disconnect the negative battery cable.
2. Position the coolant reservoir aside.
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.
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.
12. Pull out on the fuel injector return fuel hose retainers, disconnect the hoses and position aside.
13. Remove the right fuel injectors.
14. Remove the air conditioning (A/C) / heater hose bracket.
15. Remove the oil level indicator tube retaining bolt.
16. Remove the EGR air control valve assembly resonator.
17. Remove the vacuum pump.
18. Remove the cylinder head cover retaining bolts and remove cover.

Installation

RIGHT

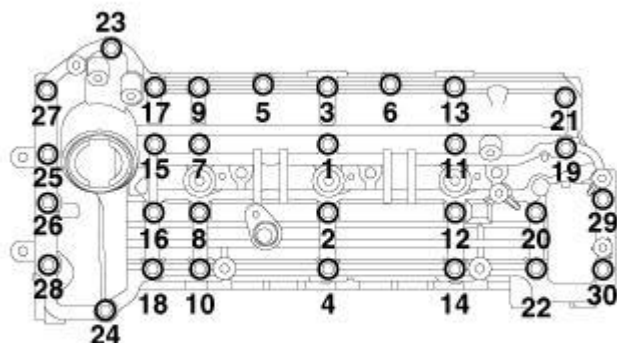
CAUTION: Exercise caution when servicing the cylinder head covers. If a cylinder head cover is damaged, the cylinder head must also be replaced. Do not rotate the engine without cam holding tool 9555 if the cylinder head covers are removed.

1. Clean and inspect all sealing surfaces.

NOTE: Care must be taken when sealing the covers, too much sealant or sealant improperly applied may effect camshaft main cap clearances.

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 Sealant or equivalent to the underside of the cylinder head cover. See Engine - Standard Procedure.



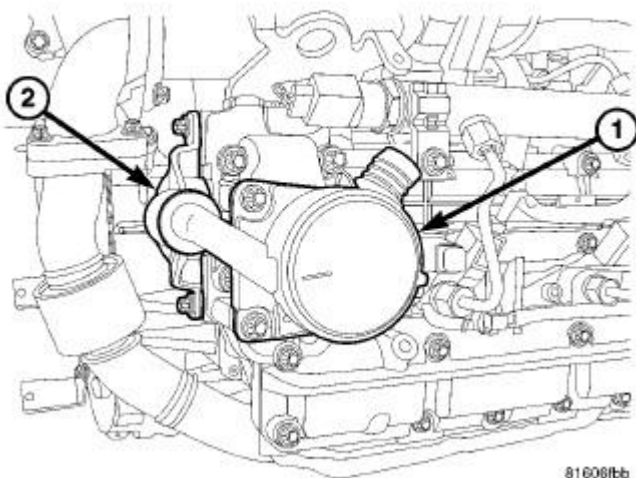
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Fig. 237: RIGHT CYLINDER HEAD COVER TIGHTENING SEQUENCE

Courtesy of CHRYSLER LLC

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

3. Carefully position the cylinder head cover and install the bolts into their original position as noted during removal.
4. Using the sequence shown in illustration, tighten the bolts to 4 N.m (35 in. lbs.) and then repeat the sequence to 8.4 N.m (75 in. lbs.).



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Fig. 238: OIL SEPARATOR

Courtesy of CHRYSLER LLC

- 1 - PCV HOUSING
- 2 - PCV HOUSING ADAPTOR

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.

5. Lubricate the fuel injector body and using new sealing washers, install the fuel injectors (1).

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

6. Install the fuel injector retaining claws and tighten new bolts to 7 N.m (62 in. lbs.) and then tighten an additional 180°.

NOTE: Whenever the PCV and PCV adapter is remove a new PCV camshaft seal must be installed.

7. Install the PCV (1) and the PCV adapter (2) with a new camshaft seal and tighten bolts to 11 N.m (97 in. lbs.).

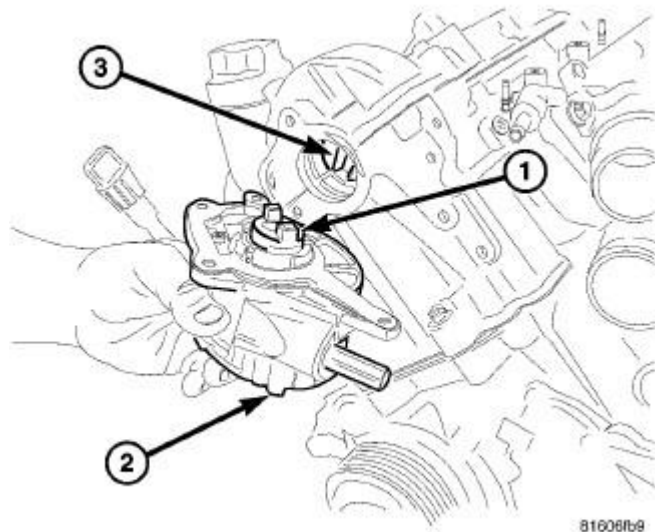


Fig. 239: VACUUM PUMP
Courtesy of CHRYSLER LLC

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

NOTE: Whenever the vacuum pump is removed a new vacuum pump gasket must be installed.

8. Using a new gasket, align the vacuum pump drive gear (1) with the camshaft drive gear (3) and tighten bolts to 9 N.m (80 in. lbs.).

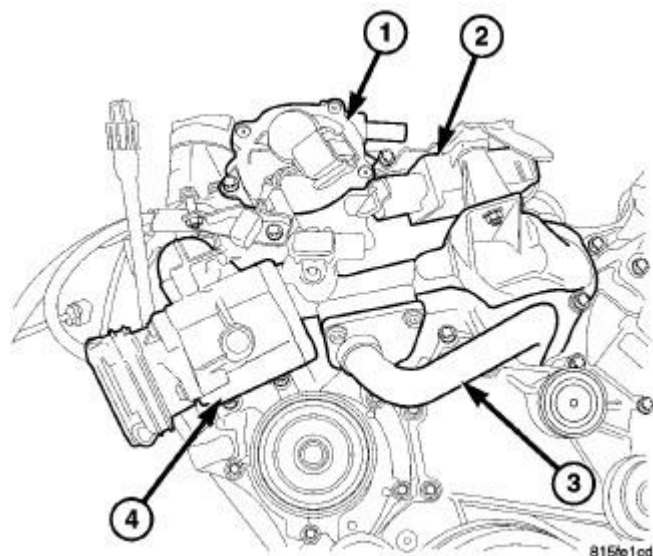


Fig. 240: AIR CONTROL VALVE
Courtesy of CHRYSLER LLC

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

9. Install the EGR airflow control (4) and resonator and tighten bolts to 9 N.m (80 in. lbs.).

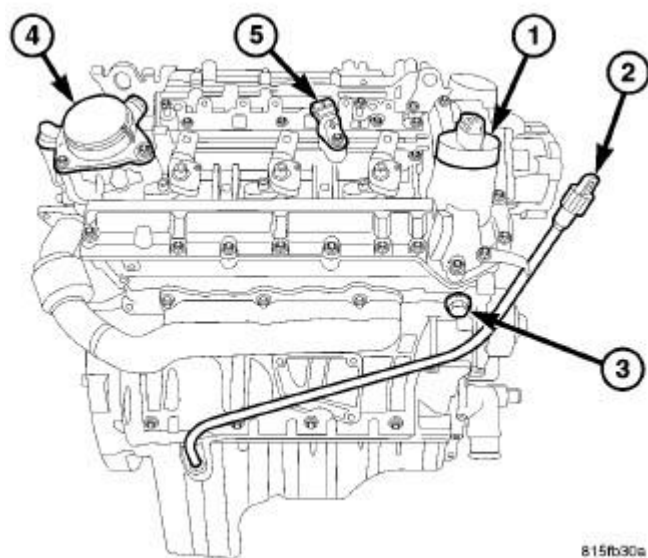


Fig. 241: TIMING CHAIN TENSIONER

Courtesy of CHRYSLER LLC

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

10. Install the oil level indicator tube (2) retainer and tighten bolt to 11 N.m (97 in. lbs.).
11. Install the A/C heater hose bracket and tighten bolts to 9 N.m (80 in. lbs.).

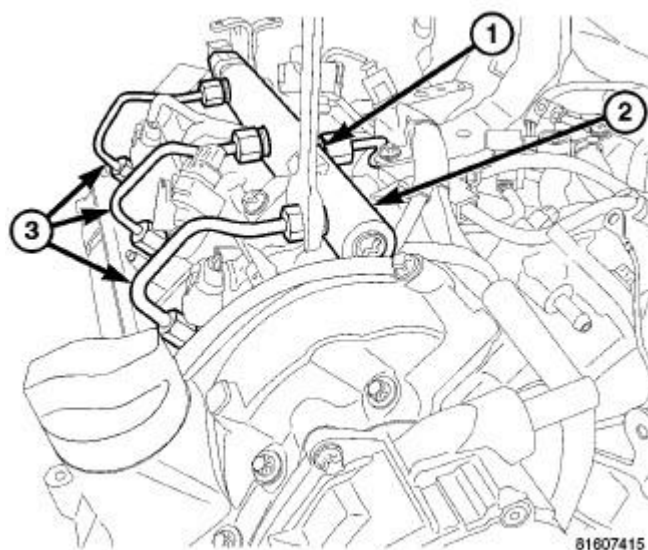


Fig. 242: RIGHT FUEL RAIL

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - FUEL RAIL TRANSFER LINE
2 - RIGHT FUEL RAIL
3 - HIGH PRESSURE FUEL LINES |
|--|

12. Install the fuel rail (2) and tighten bolts to 14 N.m (124 in. lbs.).

CAUTION: Inspect the fuel lines for wear or damage, look closely around the flange area and replace as necessary. Do Not over tighten.

13. Install the high pressure fuel lines (3) including the fuel rail equalizing line (1) and tighten the line nuts to 22 N.m (16 ft. lbs.).

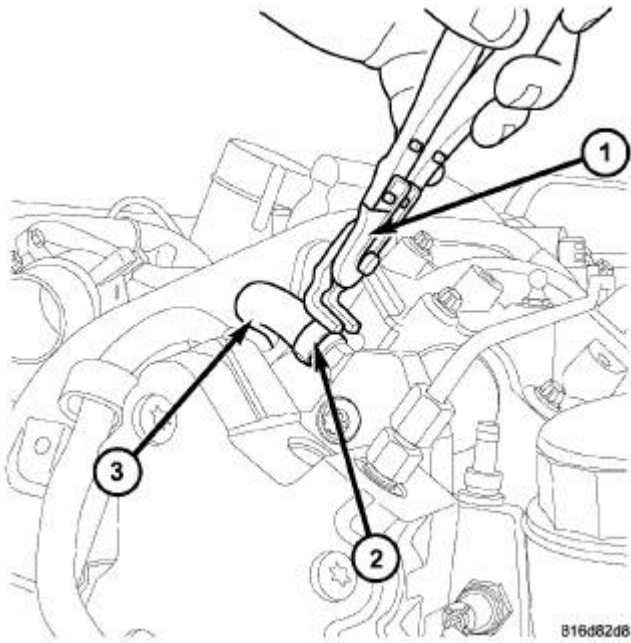


Fig. 243: PUMP FUEL LINE PLIERS

Courtesy of CHRYSLER LLC

14. Install the fuel inlet supply line at the high pressure fuel pump and using fuel line pliers 9539 (1) install the retaining clamp (2).
15. Install the fuel return line at the high pressure fuel pump and using fuel line pliers 9539 install the retaining clamp.

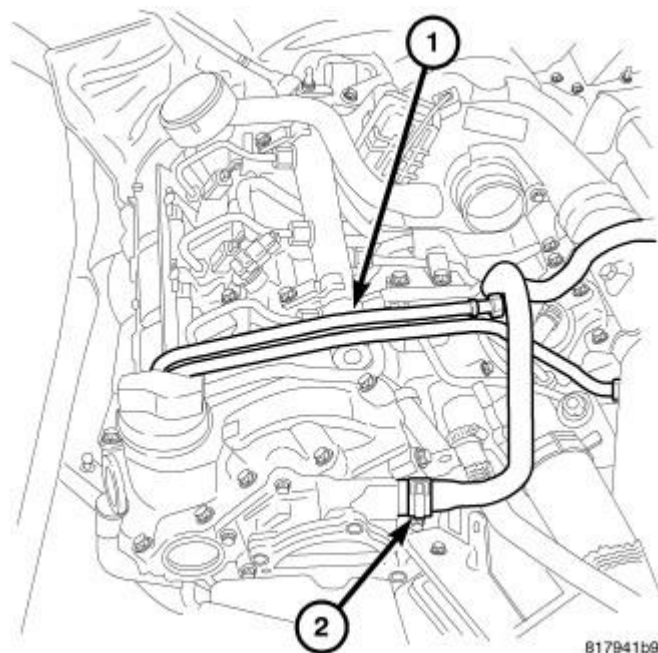


Fig. 244: Power Brake Booster Vacuum Line
Courtesy of CHRYSLER LLC

16. Connect the power brake booster vacuum hose (2) at the vacuum pump.

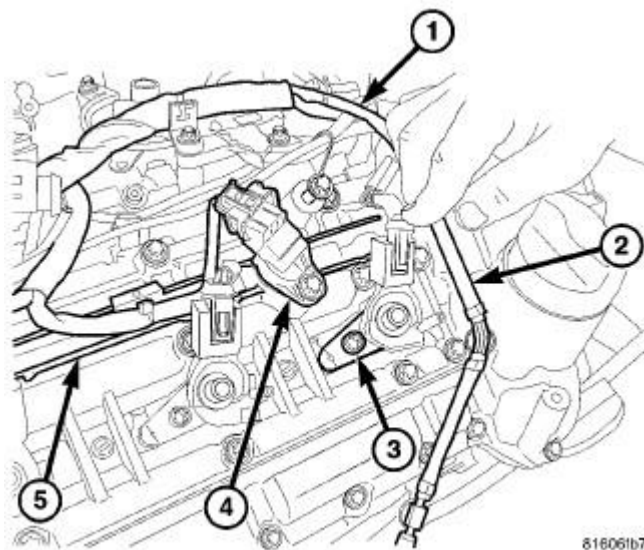


Fig. 245: RIGHT FUEL INJECTORS
Courtesy of CHRYSLER LLC

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

5 - ENGINE HARNESS ROUTING PATH

17. Position the engine wiring harness (1,5) and connect the CMP sensor (4), fuel rail pressure sensor and fuel injectors (3).
18. Connect the fuel return hoses (2) to the fuel injectors by pushing down on the hose retainers.

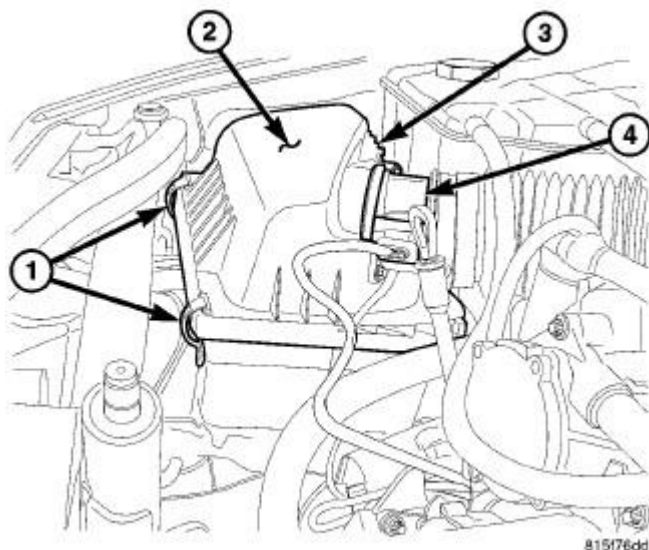


Fig. 246: AIR CLEANER COVER
Courtesy of CHRYSLER LLC

19. Install the air cleaner housing (2) and duct.
20. Connect the PCV hose to air inlet tube and connect the PCV heater wiring harness connector.

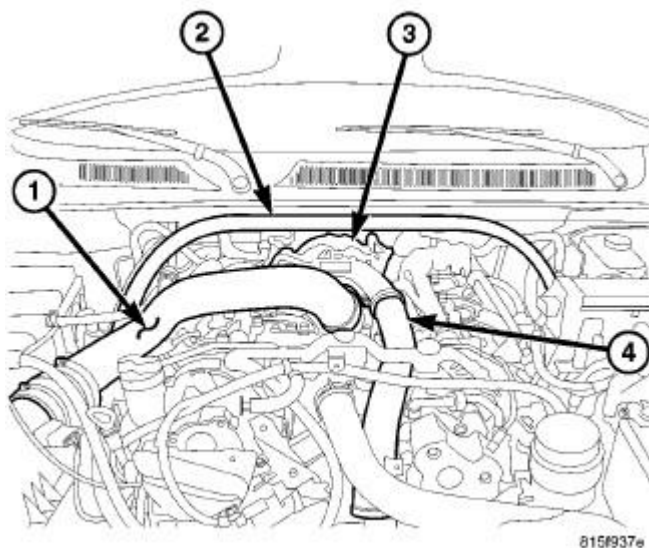


Fig. 247: STRUT TOWER SUPPORT

Courtesy of CHRYSLER LLC

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

21. Install the strut tower support (2).

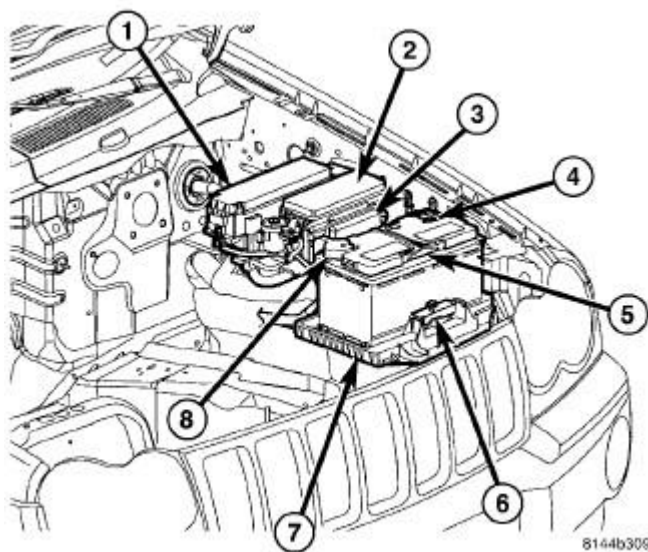
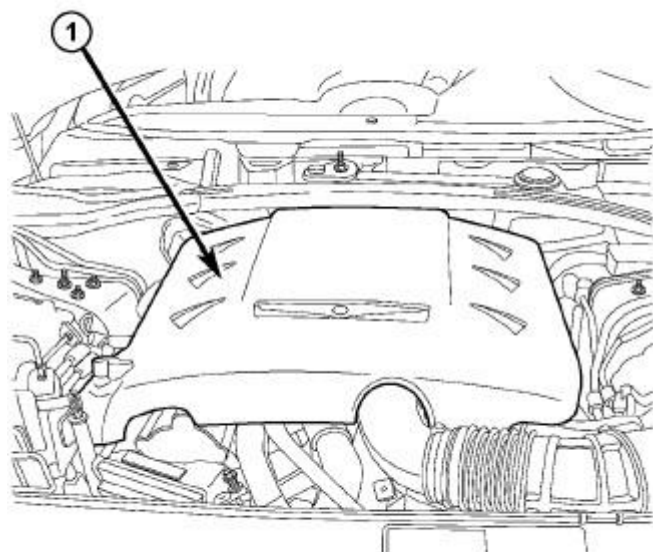


Fig. 248: Identifying Battery System Components, Power Distribution Center & Integrated Power Module

Courtesy of CHRYSLER LLC

- 22. Install the Power Distribution Center (PDC) support bracket and install the PDC (1).
- 23. Connect all PDC and generator wiring harness cables.
- 24. Install the battery tray (7) and battery (5). Refer to **Electrical/Battery System/TRAY, Battery - Removal** .
- 25. Install the front and rear engine cover brackets.
- 26. Connect the generator power feed line.
- 27. Install the coolant recovery bottle.
- 28. Connect the positive and negative battery cables (8, 4).



817351b

Fig. 249: ENGINE COVER

Courtesy of CHRYSLER LLC

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.

29. Start the engine, allow to warm, turn engine off and inspect for leaks.
30. Install the engine cover.

LEFT

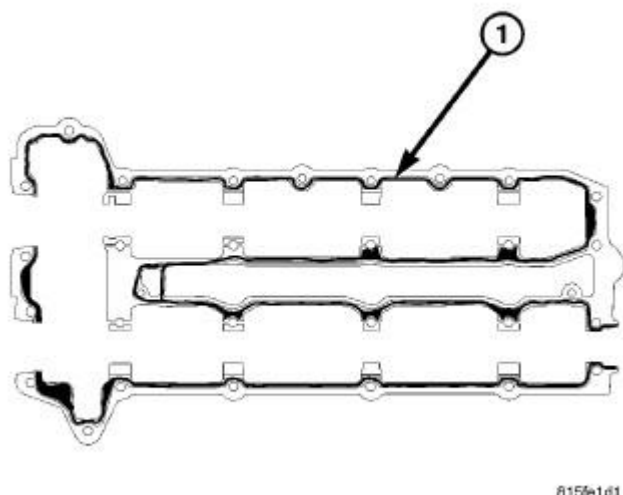


Fig. 250: Applying Cylinder Head Cover Sealant
Courtesy of CHRYSLER LLC

1 - 1.5 MM MOPAR ENGINE SEALANT RTV

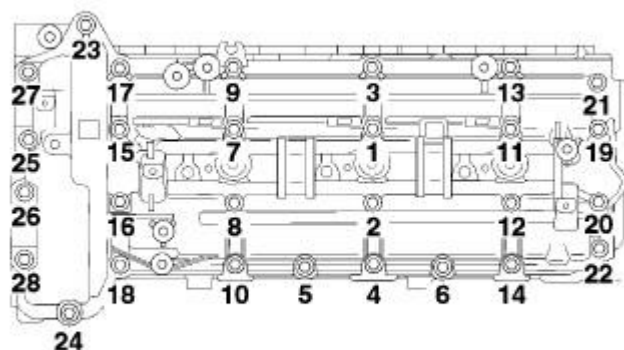
CAUTION: Exercise caution when servicing the cylinder head covers. If a cylinder head cover is damaged, the cylinder head must also be replaced. Do not rotate the engine without cam holding tool 9555 if the cylinder head covers are removed.

1. Clean and inspect all sealing surfaces.

NOTE: Care must be taken when sealing the covers, too much sealant or sealant improperly applied may effect camshaft main cap clearances.

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 Sealant or equivalent (1) to the underside of the cylinder head cover. See **Engine - Standard Procedure**.



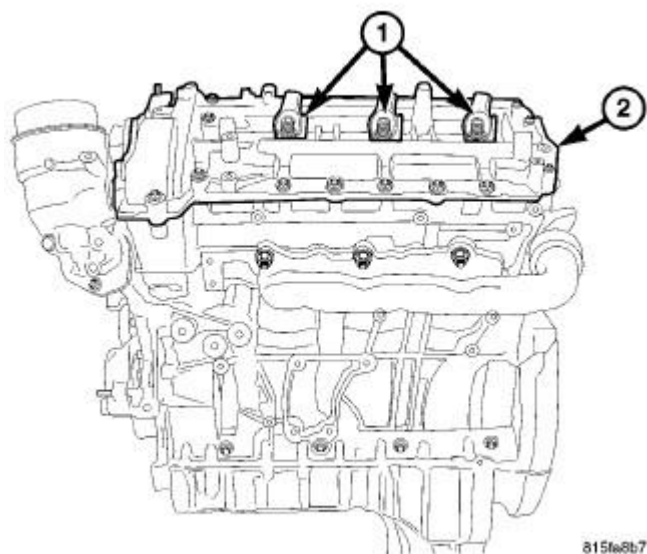
8160ac9a

Fig. 251: LEFT CYLINDER HEAD COVER TIGHTENING SEQUENCE

Courtesy of CHRYSLER LLC

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

3. Carefully position the cylinder head cover and install the bolts into their original location as noted during removal.
4. Using the sequence shown in illustration, tighten bolts to 4 N.m (35 in. lbs.) and then repeat the sequence to 8.4 N.m (75 in. lbs.).



815fe8b7

Fig. 252: 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. Do Not apply injector body lubricant near the injector nozzles.

5. Lubricate the fuel injector body and using new sealing washers, install the fuel injectors (1).

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

6. Install the fuel injector retaining claws and tighten new bolts to 7 N.m (62 in. lbs.) and then tighten an additional 180°.
7. Position the engine harness and install the retaining bolts.

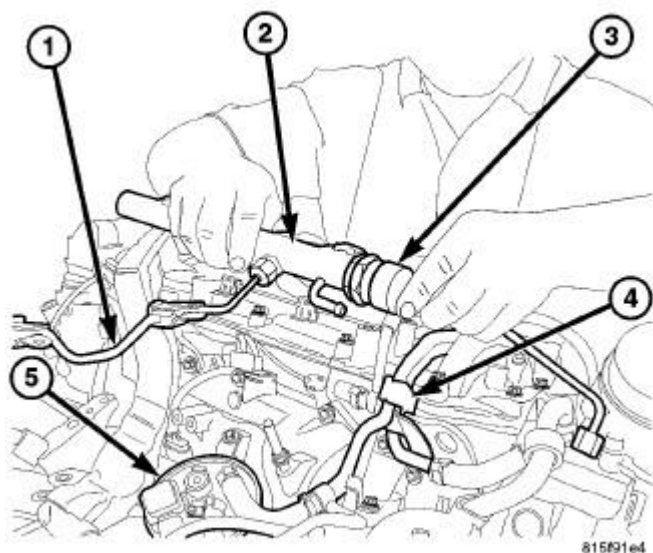


Fig. 253: LEFT FUEL RAIL
Courtesy of CHRYSLER LLC

- | |
|--|
| 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. Install the fuel rail (2) and tighten bolts to 14 N.m (124 in. lbs.).

CAUTION: Inspect the fuel lines for wear or damage, look closely around the flange area and replace as necessary. Do Not over tighten.

9. Install the high pressure fuel lines to the fuel injectors and fuel rail, including the fuel rail equalizing line (1) and tighten line nuts to 22 N.m (16 ft. lbs.)
10. Install the fuel return lines to the fuel injectors. Push down on the release lock tab to secure.
11. Position the fuel injector wiring harness at the cylinder head cover.
12. Connect the fuel injector electrical connectors.

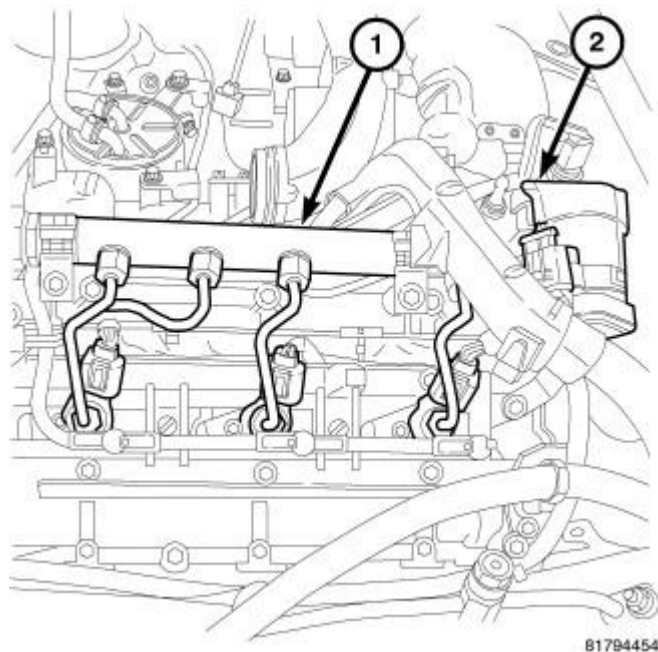


Fig. 254: EGR VALVE
Courtesy of CHRYSLER LLC

1 - FUEL RAIL
2 - EGR VALVE

13. Install the EGR valve (2).
14. Connect the EGR solenoid connector.

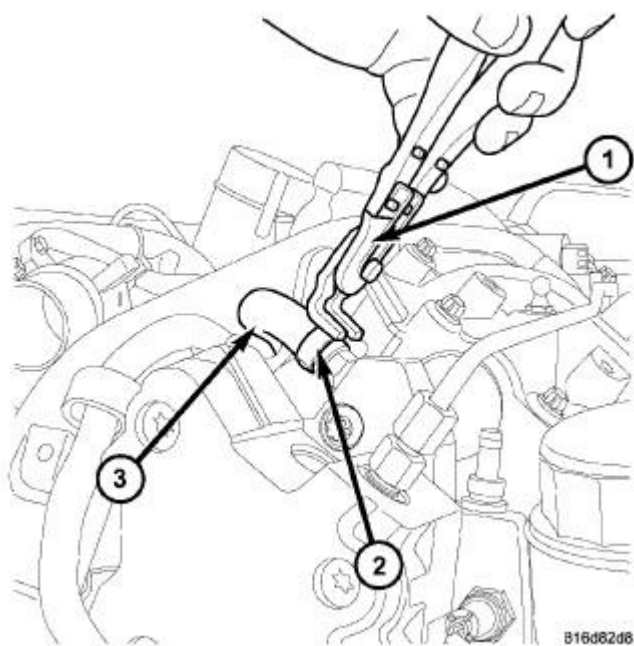


Fig. 255: PUMP FUEL LINE PLIERS

Courtesy of CHRYSLER LLC

15. Install the fuel inlet supply line at the high pressure fuel pump and using fuel line pliers 9539 (1) install the retaining clamp (2).
16. Install the fuel return line at the high pressure fuel pump and using fuel line pliers 9539 install the retaining clamp.

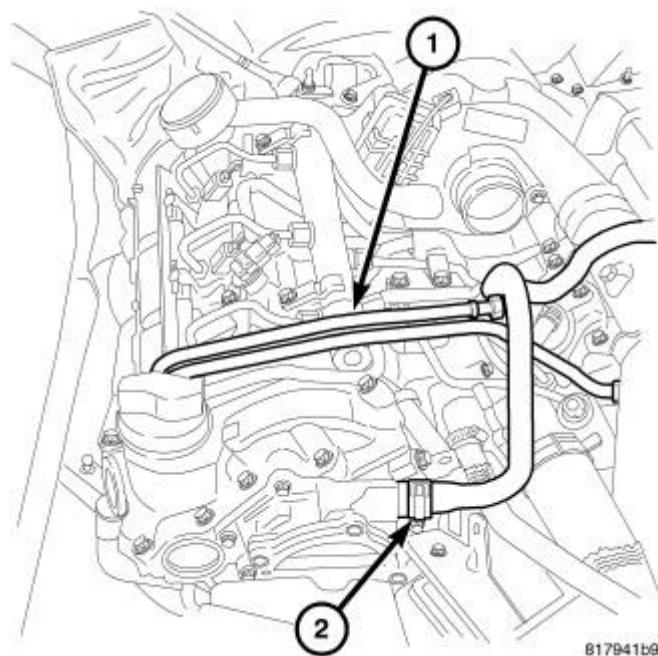


Fig. 256: Power Brake Booster Vacuum Line

Courtesy of CHRYSLER LLC

17. Connect the power brake booster vacuum hose (2) at the vacuum pump.

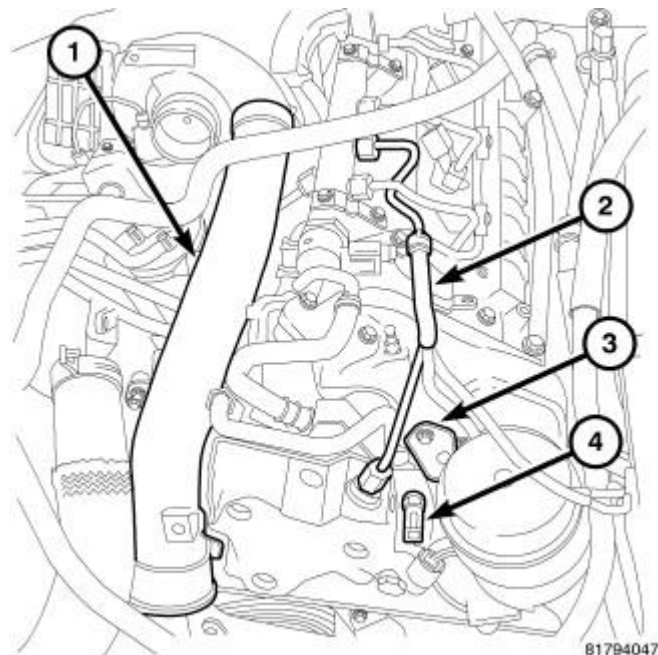


Fig. 257: Charge Air Cooler Inlet Pipe, High Pressure Line, Oil Filter Housing Bracket & Fuel Temperature Sensor Connector
Courtesy of CHRYSLER LLC

18. Connect the fuel temperature sensor connector (4).
19. Install the oil filter housing bracket (3).
20. Install the high pressure line (2) to the fuel pump and fuel rail, tighten the line nuts to 22 N.m (16 ft. lbs.).
21. Install the charge air cooler inlet pipe (1) and resonator.
22. Connect the fuel quantity solenoid connector.
23. Install the bolts at the intercooler air chamber.

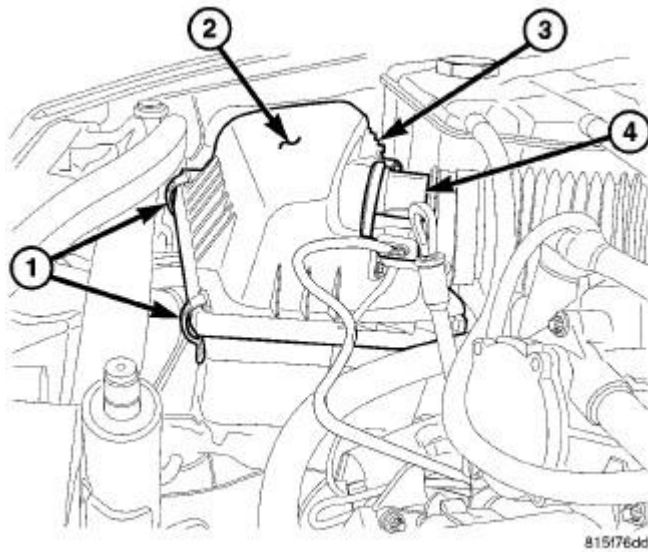


Fig. 258: AIR CLEANER COVER
Courtesy of CHRYSLER LLC

24. Install the air cleaner housing (2) and duct.

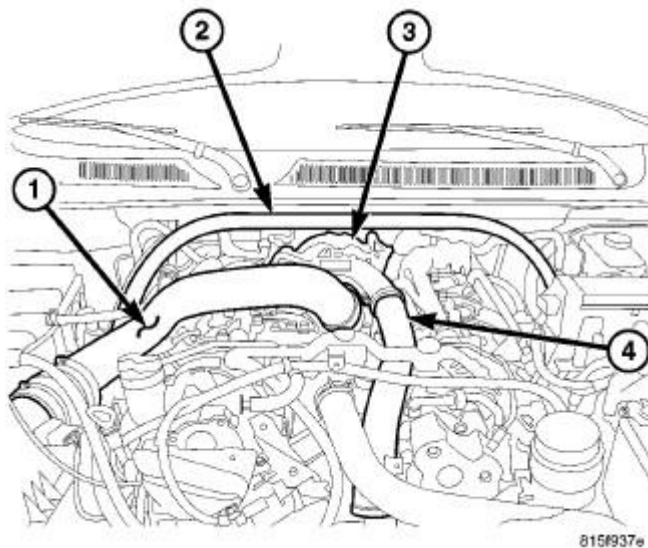


Fig. 259: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

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

25. Install the strut tower support (2).

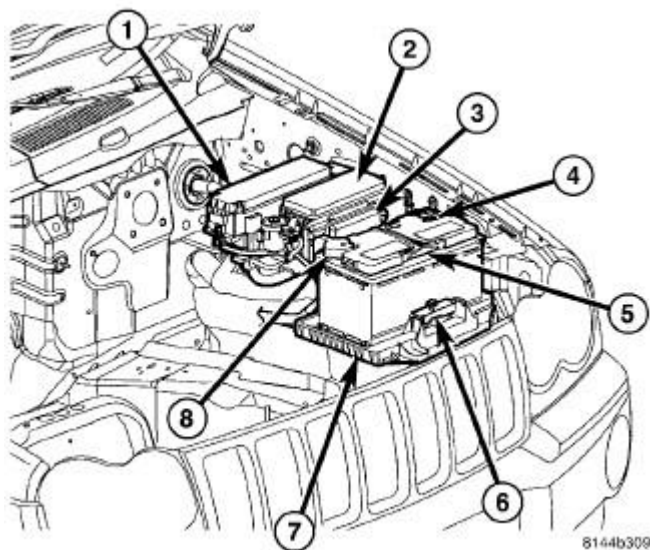
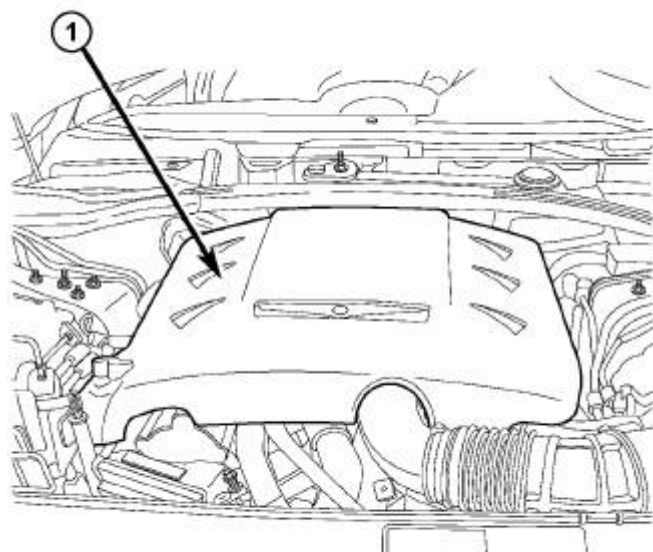


Fig. 260: Identifying Battery System Components, Power Distribution Center & Integrated Power Module

Courtesy of CHRYSLER LLC

26. Install the Power Distribution Center (PDC) support bracket and install the PDC (1).
27. Connect all PDC and generator wiring harness cables.
28. Install the battery tray (7) and battery (5). Refer to **Electrical/Battery System/TRAY, Battery - Removal**.
29. Install the front and rear engine cover brackets.
30. Connect the generator power feed line.
31. Install the coolant recovery bottle.
32. Connect the positive and negative battery cables (8, 4).



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Fig. 261: ENGINE COVER

Courtesy of CHRYSLER LLC

WARNING: High pressure fuel lines deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 1600 bar (23,200 psi). Use extreme caution when inspecting for high pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing personal injury or death. Inspect for high pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system.

33. Start the engine, run until warm, turn engine off and inspect for leaks).
34. Install the engine cover (1).

LIFTER(S), HYDRAULIC

Description

DESCRIPTION

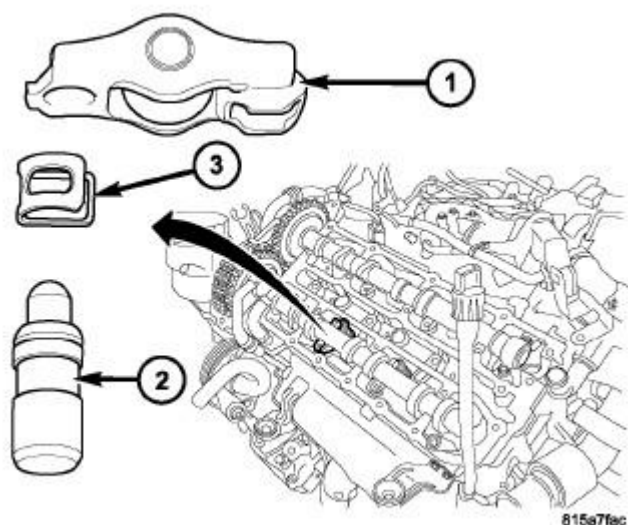


Fig. 262: ROCKER ARMS

Courtesy of CHRYSLER LLC

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

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

Removal

REMOVAL

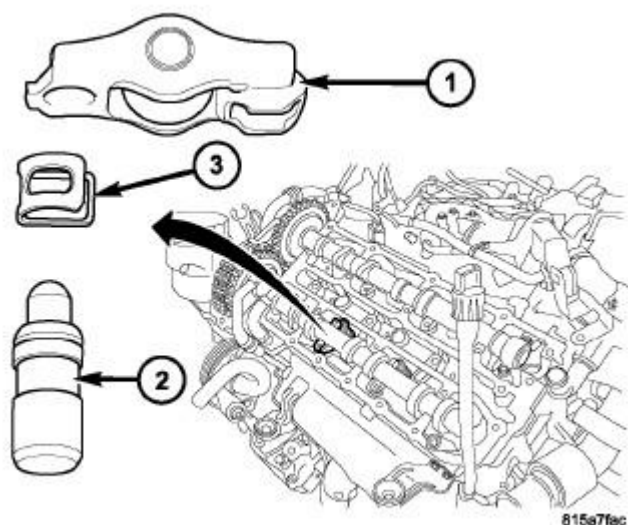


Fig. 263: ROCKER ARMS

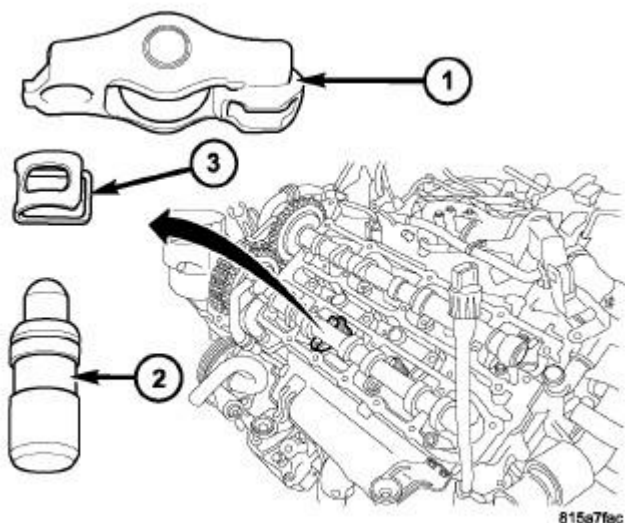
Courtesy of CHRYSLER LLC

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

1. Remove the appropriate camshafts. See **Engine/Cylinder Head/CAMSHAFT, Engine - 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. 264: 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

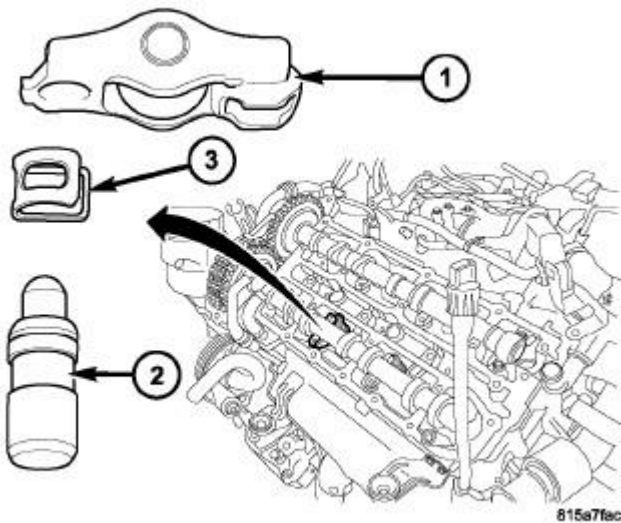


Fig. 265: ROCKER ARMS

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 Engine/Cylinder Head/CAMSHAFT, Engine - Installation.

ROCKER ARM, VALVE

Description

DESCRIPTION

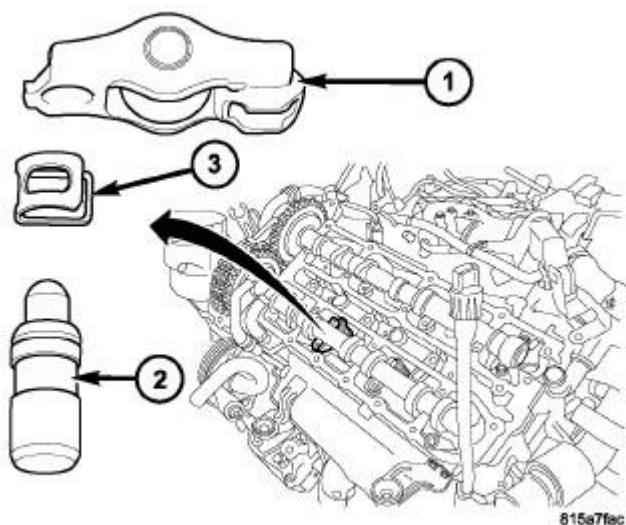


Fig. 266: ROCKER ARMS
Courtesy of CHRYSLER LLC

- | |
|--|
| 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.

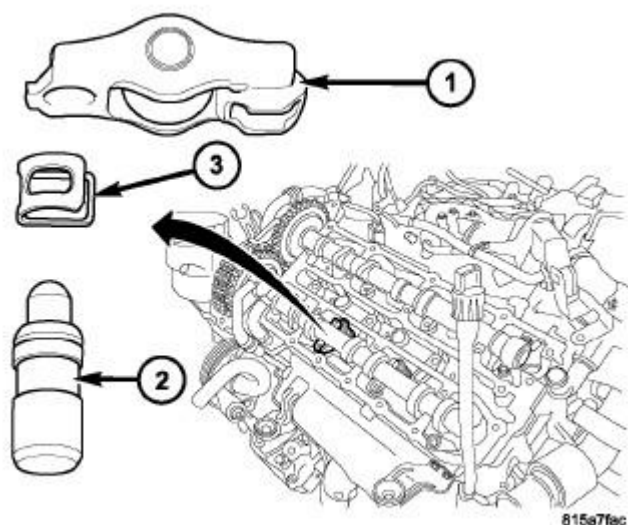
Operation

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. 267: ROCKER ARMS**

Courtesy of CHRYSLER LLC

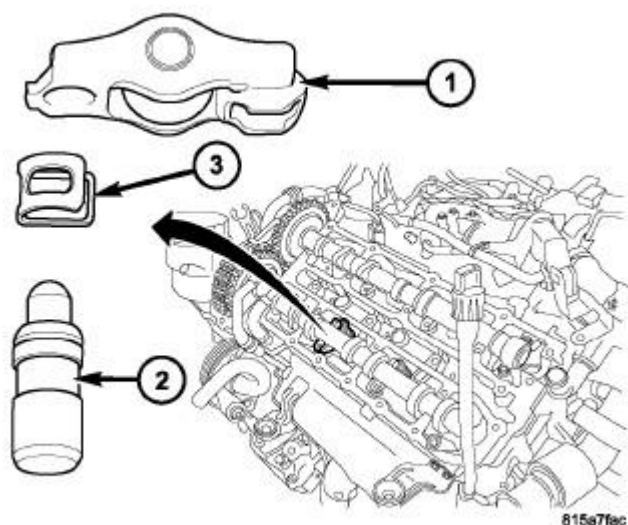
- | |
|--|
| 1 - ROCKER ARM
2 - HYDRAULIC LIFTER
3 - RETAINING CLIP |
|--|

1. Remove the appropriate camshafts. See **Engine/Cylinder Head/CAMSHAFT, Engine - 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. 268: 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 **Engine/Cylinder Head/CAMSHAFT, Engine - Installation**.

SEAL(S), CAMSHAFT

Removal

LEFT

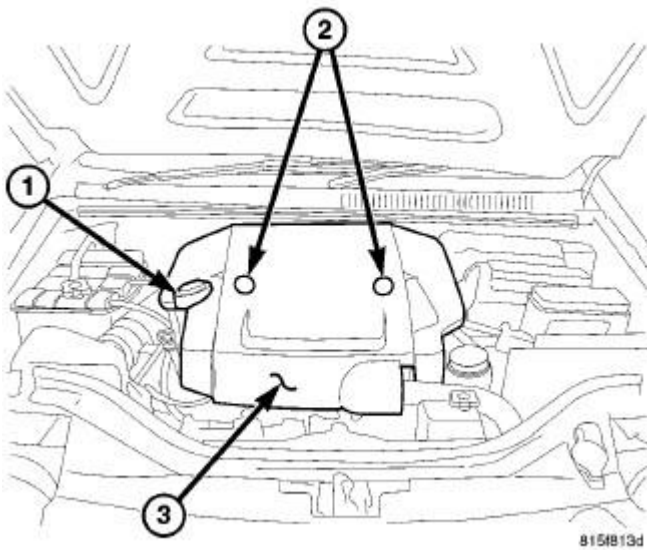


Fig. 269: ENGINE COVER
Courtesy of CHRYSLER LLC

- 1 - OIL FILLER CAP
- 2 - COVER FASTENERS
- 3 - ENGINE COVER

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

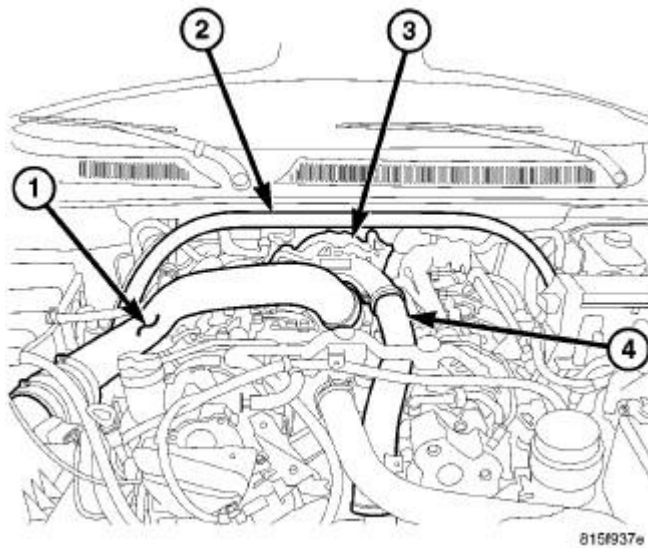


Fig. 270: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

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

3. Remove the strut tower support (2) .

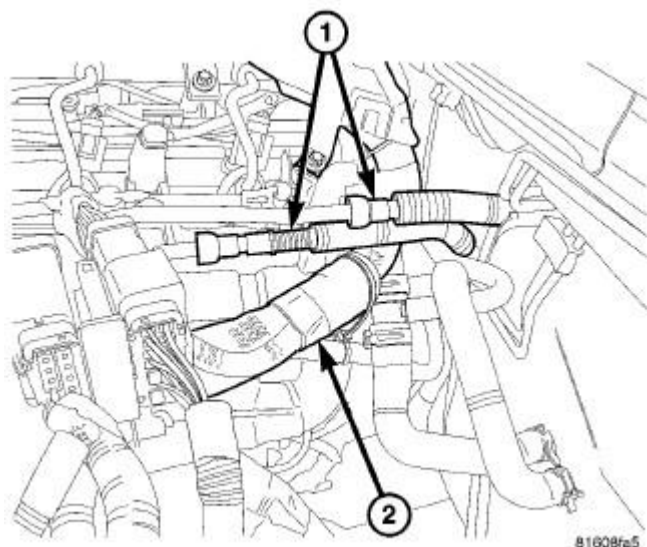


Fig. 271: FUEL LINES
Courtesy of CHRYSLER LLC

- 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.

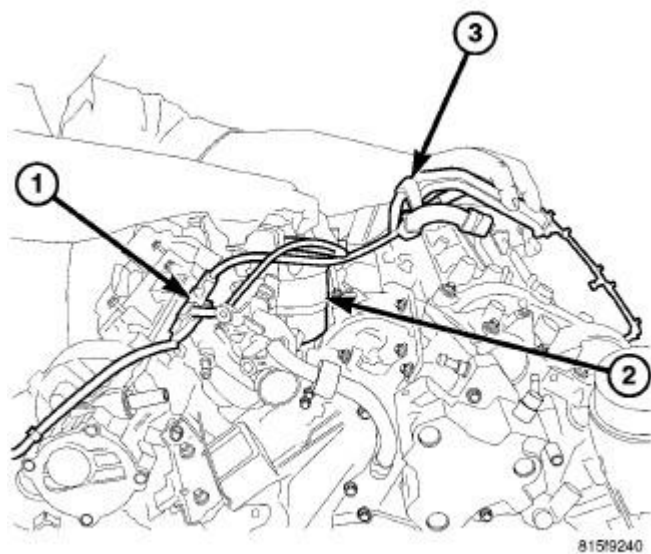


Fig. 272: FUEL FILTER, LINES AND HOSES
Courtesy of CHRYSLER LLC

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

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.

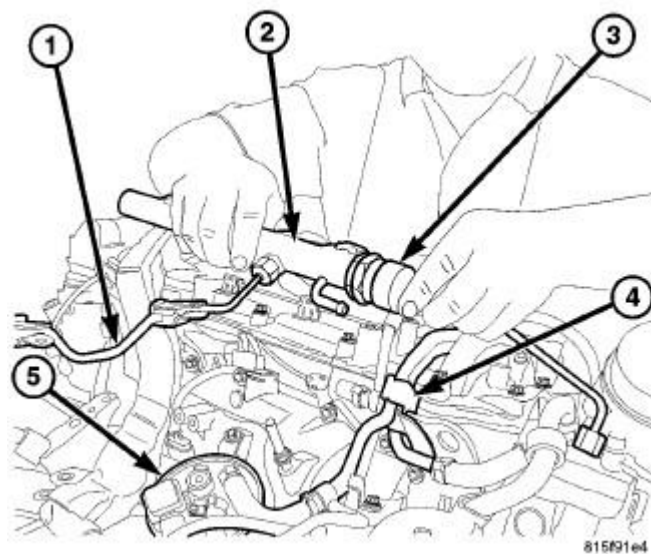


Fig. 273: LEFT FUEL RAIL
Courtesy of CHRYSLER LLC

- 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) .

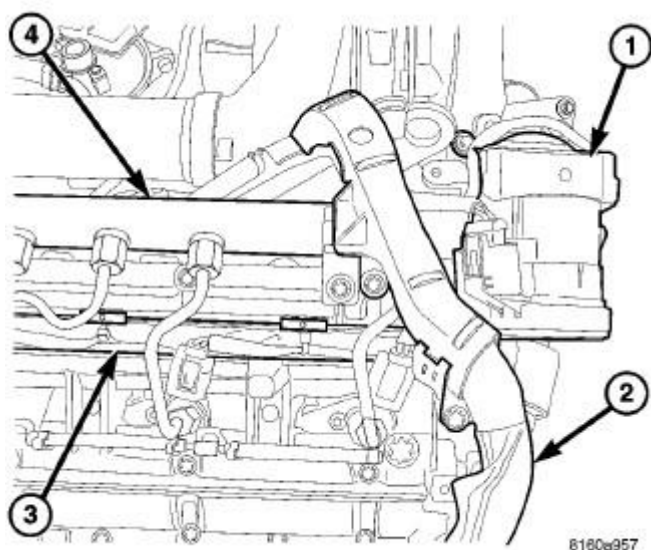


Fig. 274: EGR VALVE WITH MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

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

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

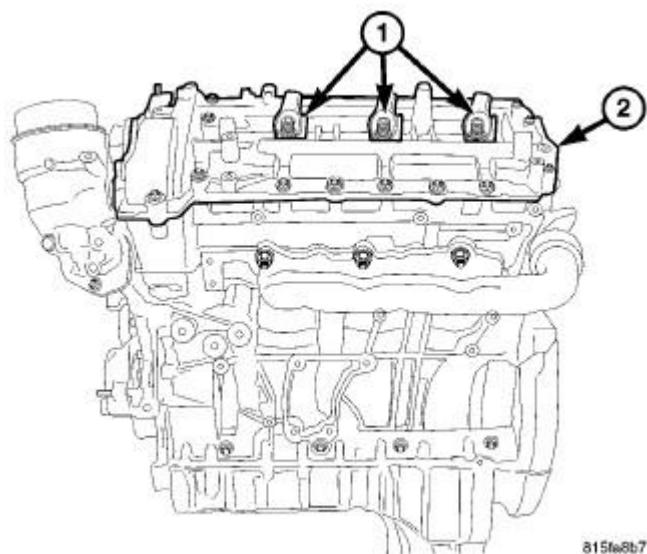


Fig. 275: LEFT CYLINDER HEAD COVER

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).

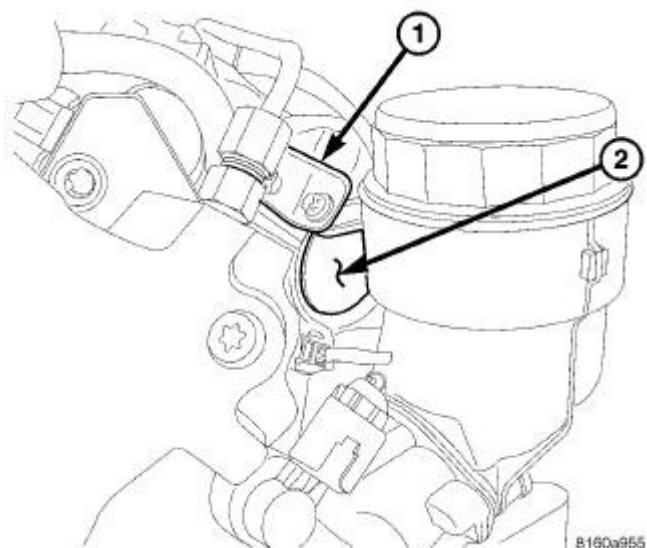


Fig. 276: LEFT FRONT CAMSHAFT SEAL WITH OIL FILTER HOUSING BRACKET
Courtesy of CHRYSLER LLC

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

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

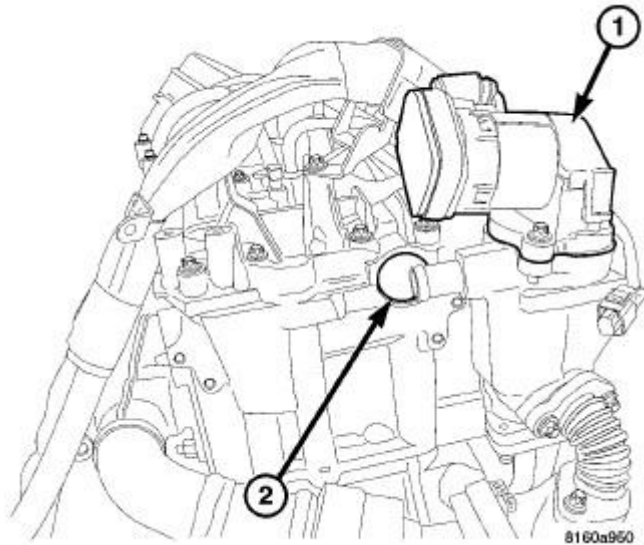


Fig. 277: LEFT REAR CAMSHAFT SEAL
Courtesy of CHRYSLER LLC

1 - EGR VALVE
2 - LEFT REAR CAMSHAFT OIL SEAL

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

RIGHT

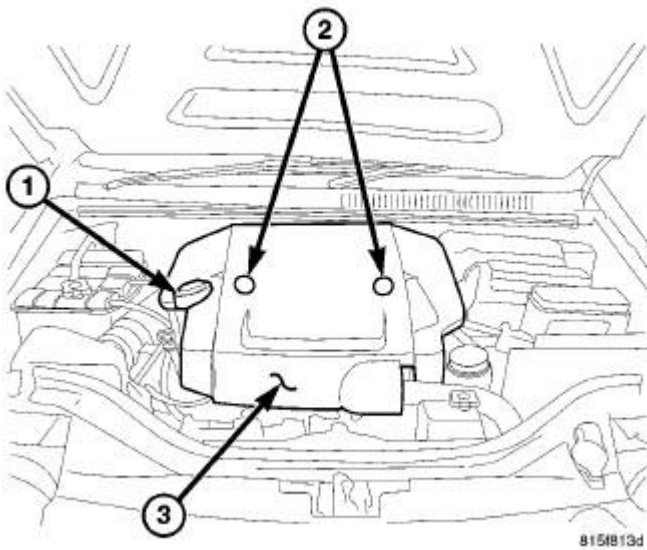


Fig. 278: ENGINE COVER

Courtesy of CHRYSLER LLC

- 1 - OIL FILLER CAP
- 2 - COVER FASTENERS
- 3 - ENGINE COVER

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

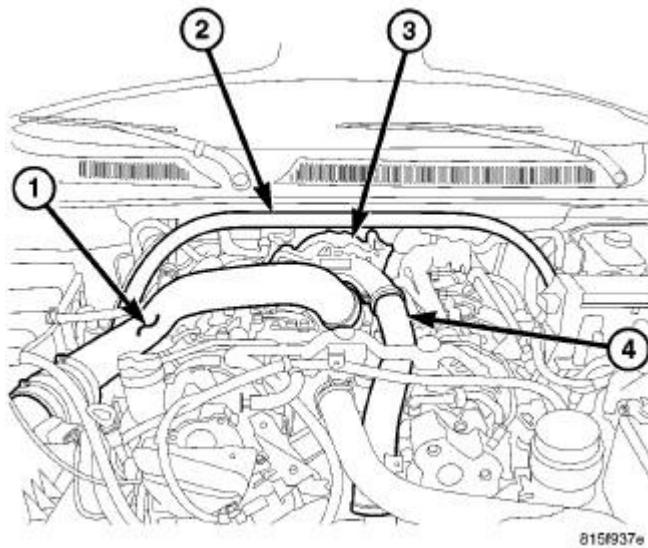


Fig. 279: STRUT TOWER SUPPORT

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) .

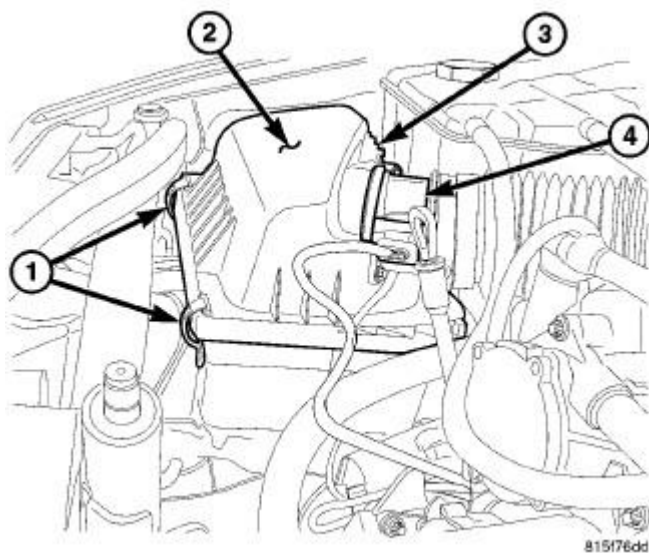


Fig. 280: AIR CLEANER COVER
Courtesy of CHRYSLER LLC

- 1 - SPRING CLIPS
- 2 - COVER
- 3 - AIR PRESSURE SENSOR
- 4 - MAF SENSOR

4. Remove the air inlet tube to the turbocharger along with the air cleaner cover (2) .

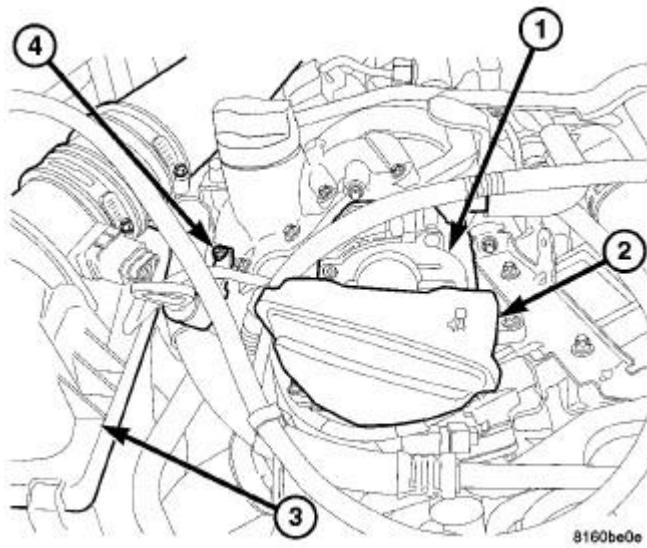


Fig. 281: AIR CONTROL VALVE RESONATOR
Courtesy of CHRYSLER LLC

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

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

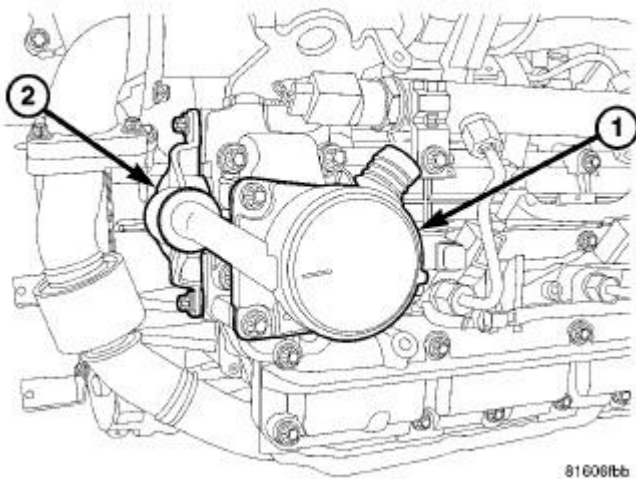


Fig. 282: OIL SEPARATOR

Courtesy of CHRYSLER LLC

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

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

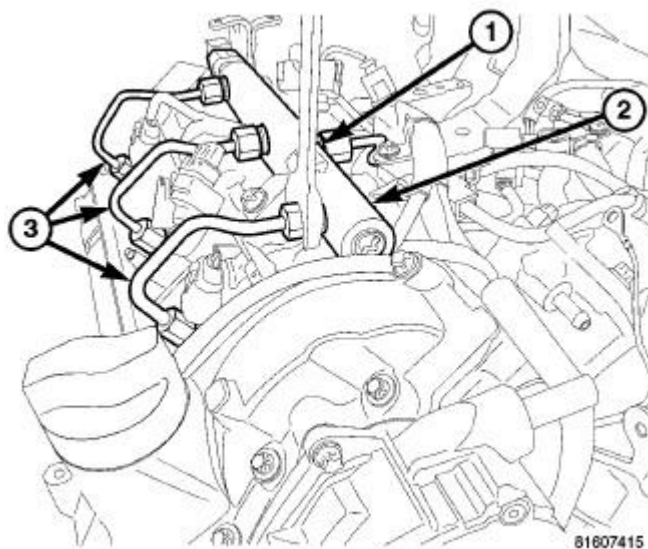


Fig. 283: RIGHT FUEL RAIL
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - FUEL RAIL TRANSFER LINE
2 - RIGHT FUEL RAIL
3 - HIGH PRESSURE FUEL LINES |
|--|

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

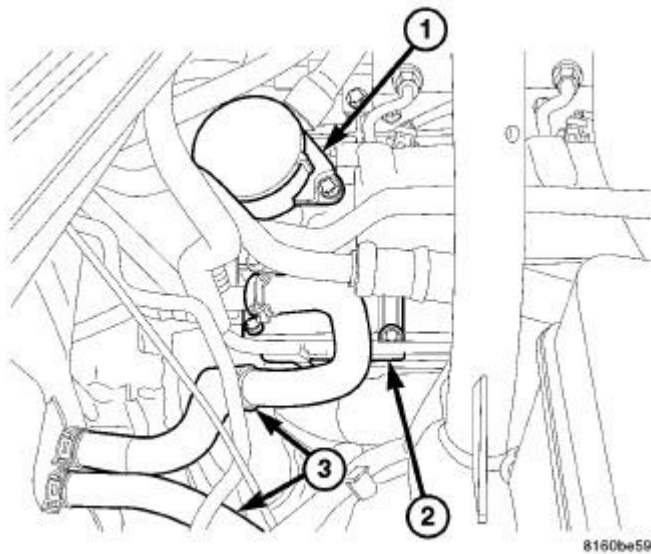


Fig. 284: HEATER HOSE WITH BRACKET
Courtesy of CHRYSLER LLC

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

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

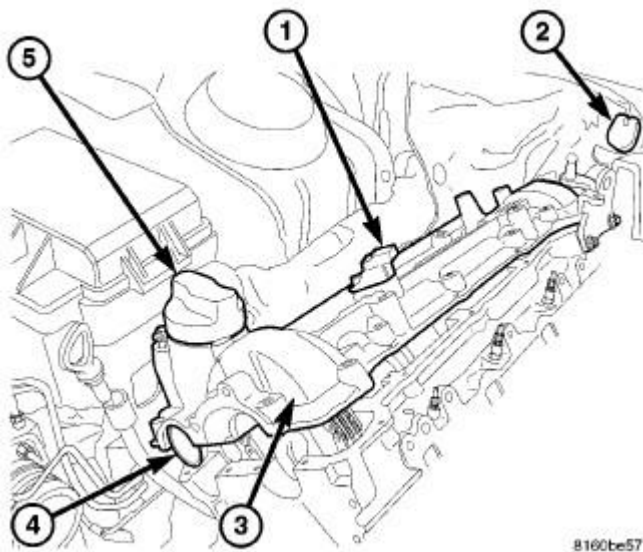


Fig. 285: RIGHT CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

- | |
|-------------------------------------|
| <p>1 - CAMSHAFT POSITION SENSOR</p> |
|-------------------------------------|

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

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

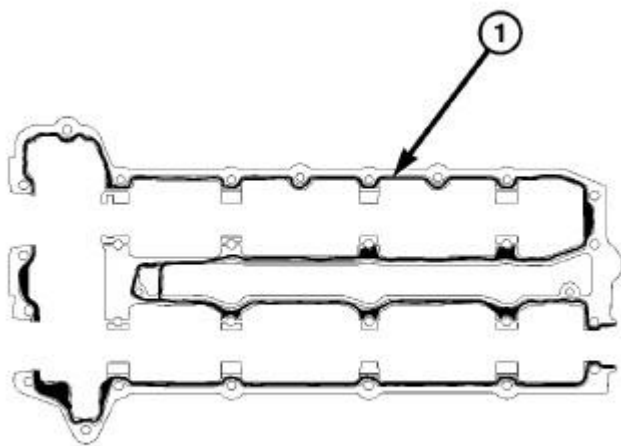
CAUTION: Care must be taken not to damage the cylinder head cover. If the sealant is difficult to separate, use a hand held heat gun and warm the area thoroughly along the sealer bead.

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

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

Installation

LEFT



815fe1d1

Fig. 286: SEALANT APPLICATION TO LEFT CYLINDER HEAD COVER

Courtesy of CHRYSLER LLC

1 - 1.5MM 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.

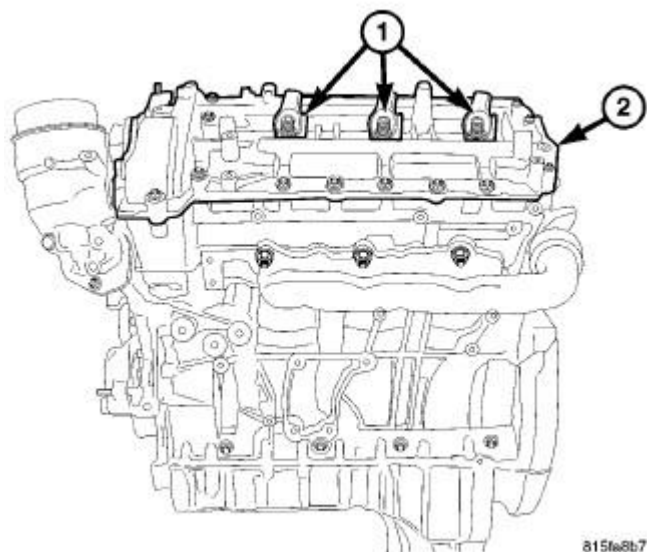


Fig. 287: LEFT CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

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

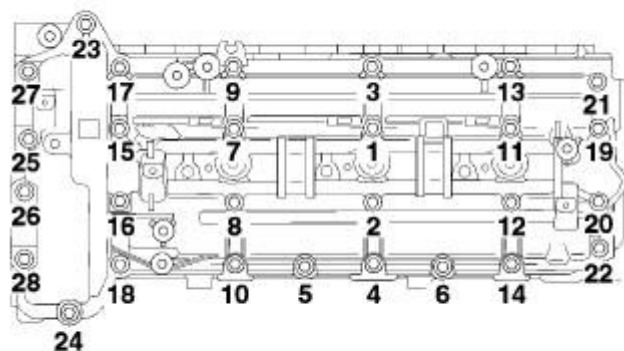


Fig. 288: LEFT CYLINDER HEAD COVER TIGHTENING SEQUENCE
Courtesy of CHRYSLER LLC

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.).

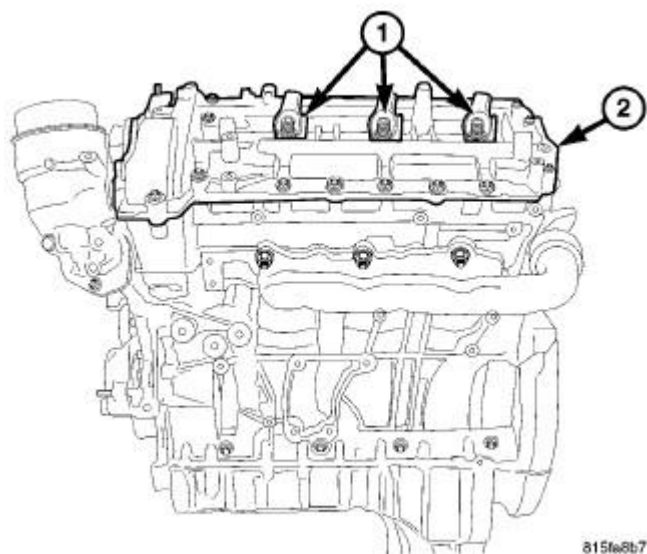


Fig. 289: LEFT CYLINDER HEAD COVER

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. Do Not apply injector body lubricant near the injector nozzles.

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°).

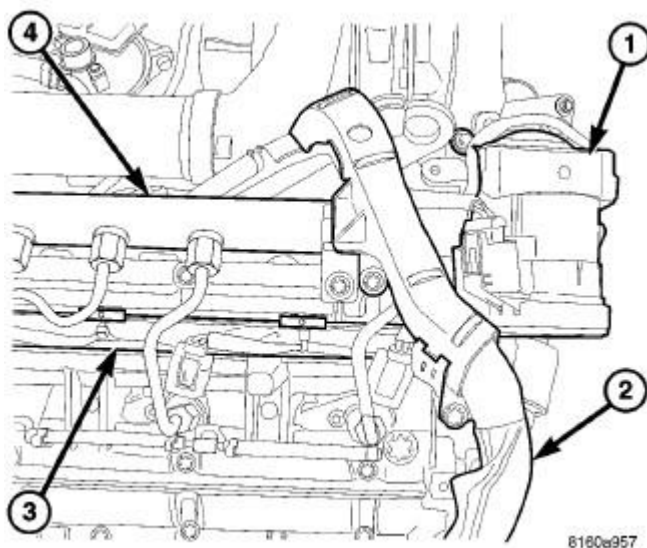


Fig. 290: EGR VALVE WITH MAIN ENGINE WIRING HARNESS

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.

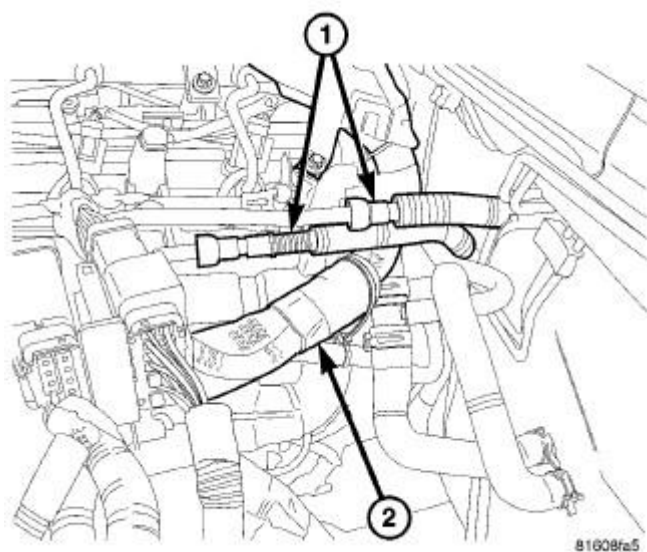


Fig. 291: FUEL LINES

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.

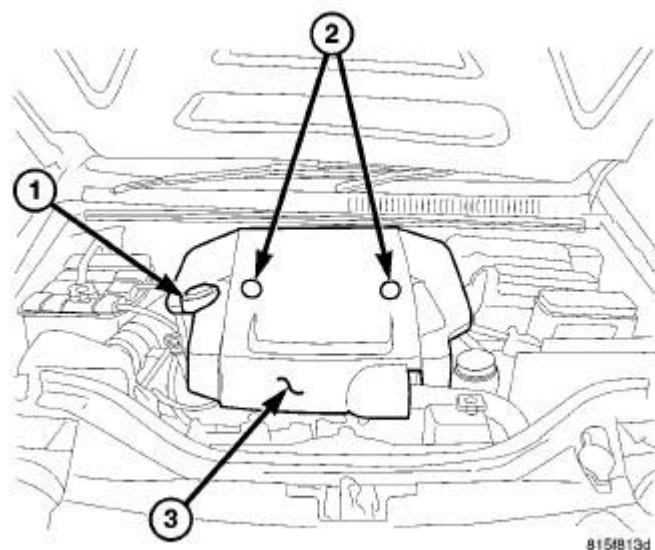


Fig. 292: ENGINE COVER
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - OIL FILLER CAP
2 - COVER FASTENERS
3 - ENGINE COVER |
|---|

15. Install the engine cover (3) and bracket.
16. 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.

17. Start engine, allow to warm, turn engine off and inspect for leaks.

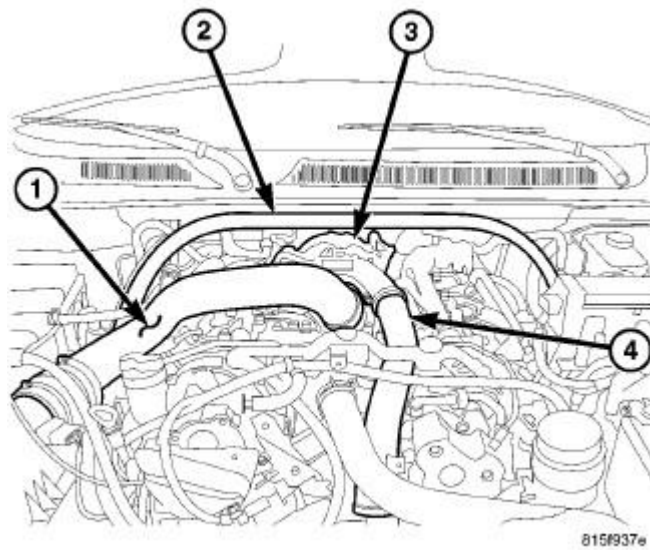


Fig. 293: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

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

18. Install the strut tower support (2) .

RIGHT

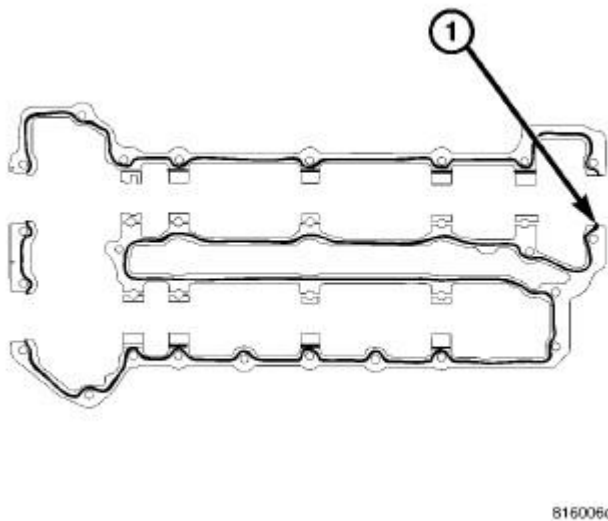


Fig. 294: RIGHT CYLINDER HEAD COVER SEALANT

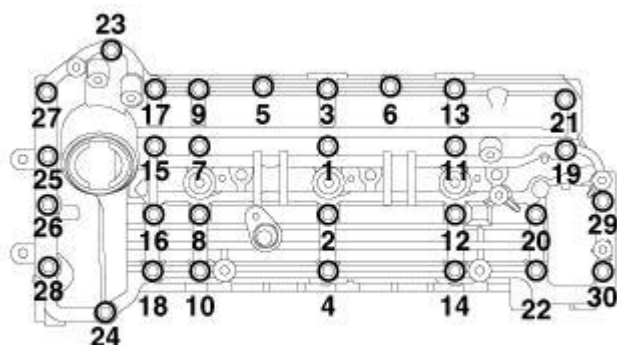
Courtesy of CHRYSLER LLC

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. 295: 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.).

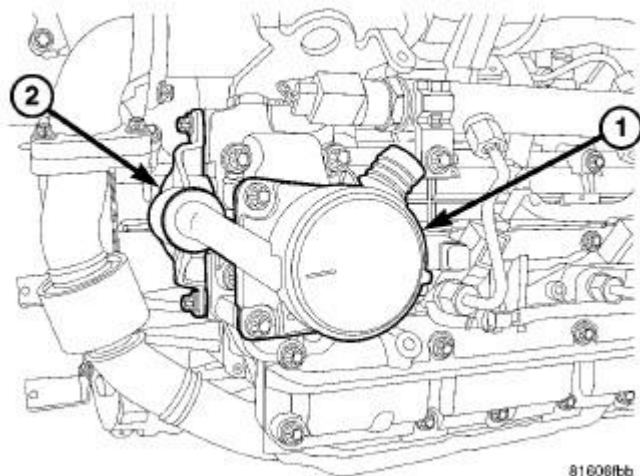


Fig. 296: OIL SEPARATOR
Courtesy of CHRYSLER LLC

- | |
|--|
| <p>1 - OIL SEPARATOR HOUSING
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.).

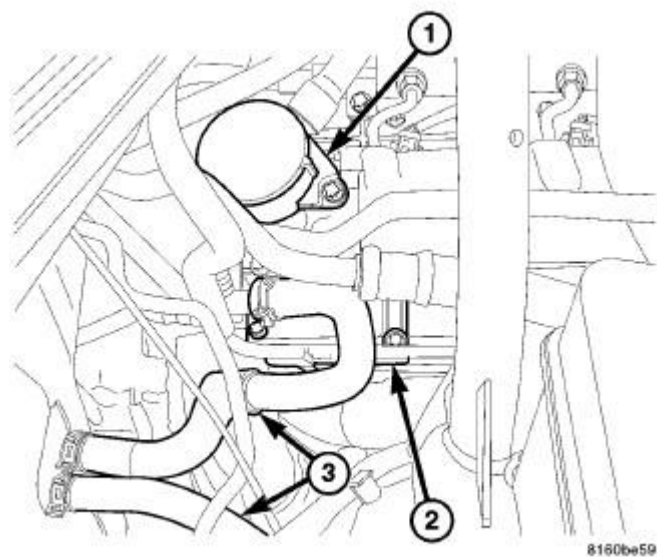


Fig. 297: HEATER HOSE WITH BRACKET
Courtesy of CHRYSLER LLC

- 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.

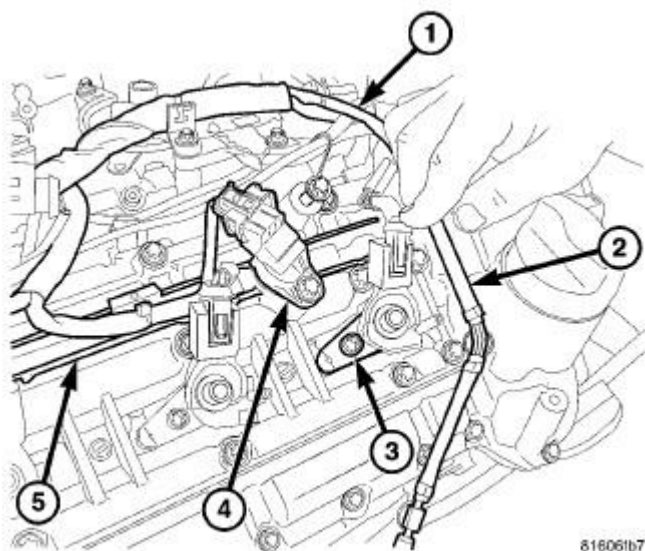


Fig. 298: RIGHT FUEL INJECTORS
Courtesy of CHRYSLER LLC

- 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.

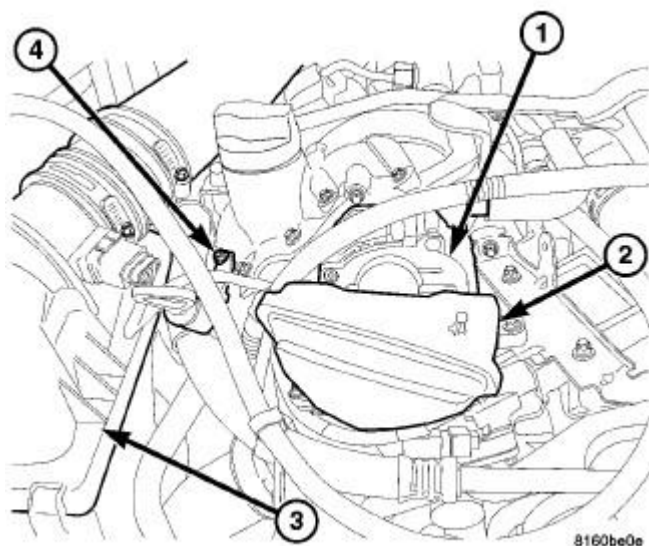


Fig. 299: AIR CONTROL VALVE RESONATOR
Courtesy of CHRYSLER LLC

- 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).

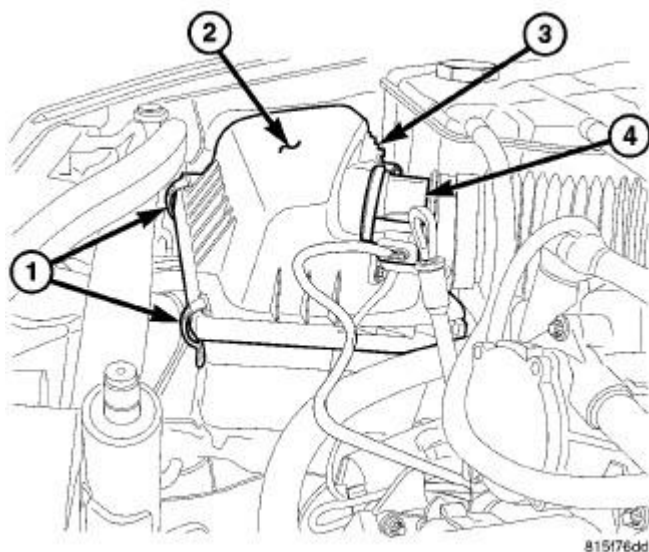


Fig. 300: AIR CLEANER COVER

Courtesy of CHRYSLER LLC

- 1 - SPRING CLIPS
- 2 - COVER
- 3 - AIR PRESSURE SENSOR
- 4 - MAF SENSOR

17. Install the air cleaner outlet tube to the turbocharger and secure the air cleaner housing cover (2) .

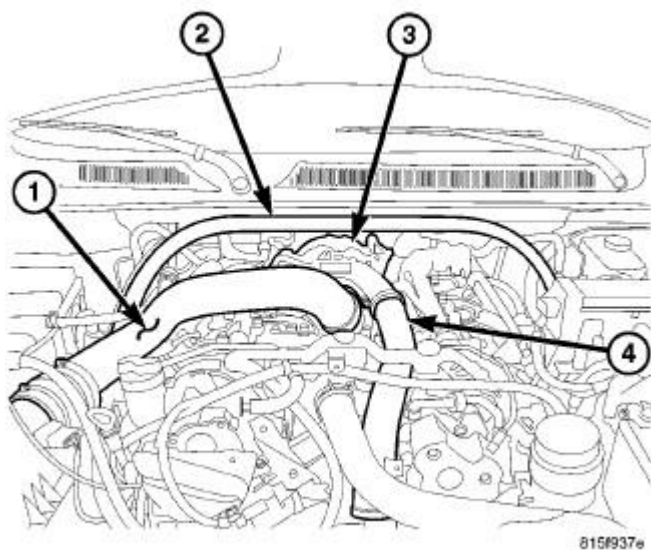
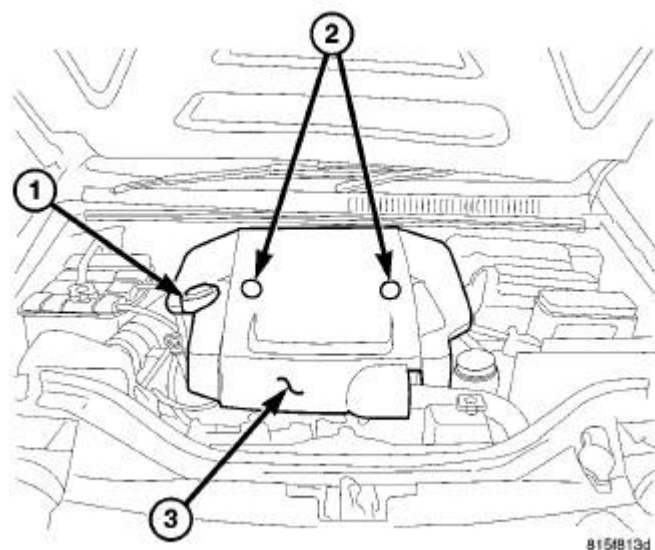


Fig. 301: STRUT TOWER SUPPORT

Courtesy of CHRYSLER LLC

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

18. Install the strut tower support (2) .

**Fig. 302: ENGINE COVER**

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - OIL FILLER CAP
2 - COVER FASTENERS
3 - ENGINE COVER |
|---|

19. Connect the negative battery cable.

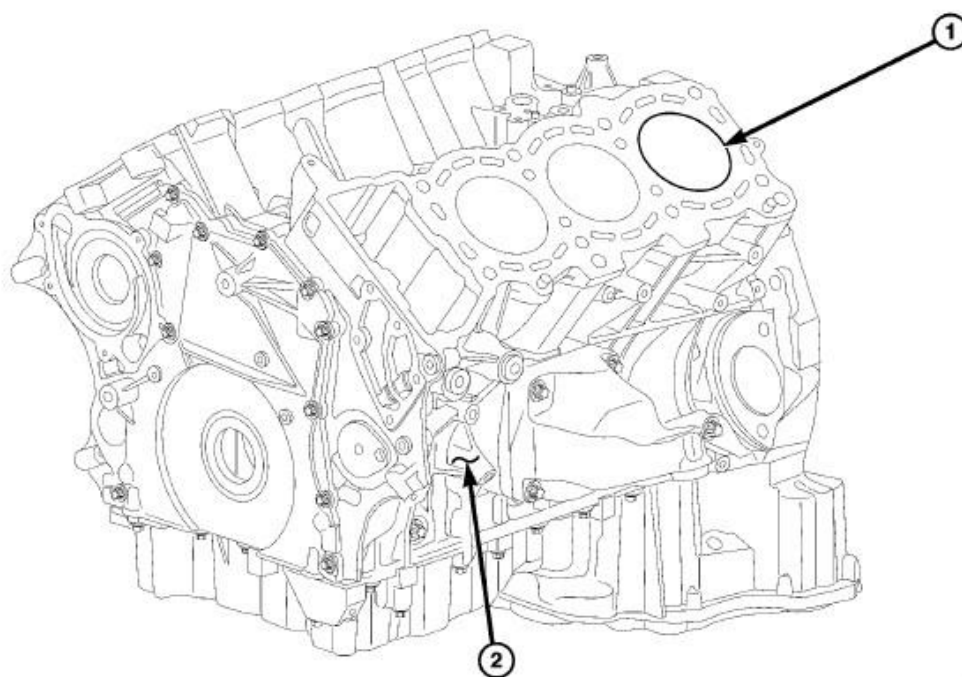
WARNING: High-pressure fuel lines deliver fuel under extreme pressure from the injection pump to the injectors. This may be as high as 1600 bar (23,200 psi). Use extreme caution when inspecting for high-pressure fuel leaks. Inspect high-pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system. Fuel under this amount of pressure can penetrate skin causing serious or fatal injury.

20. Start engine, allow to warm, turn engine off and inspect for leaks.
21. Install the engine cover.

ENGINE BLOCK

DESCRIPTION

DESCRIPTION



B15B57B

Fig. 303: 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.

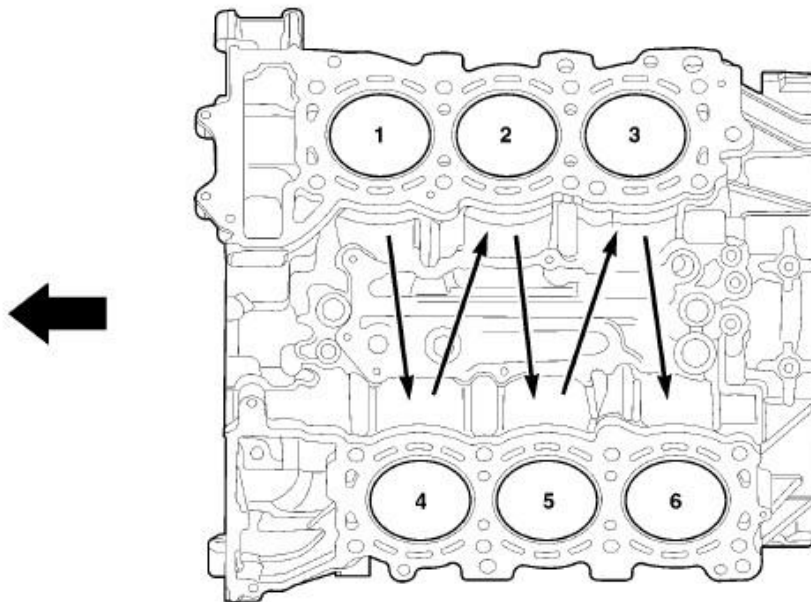


Fig. 304: INJECTION ORDER
Courtesy of CHRYSLER LLC

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

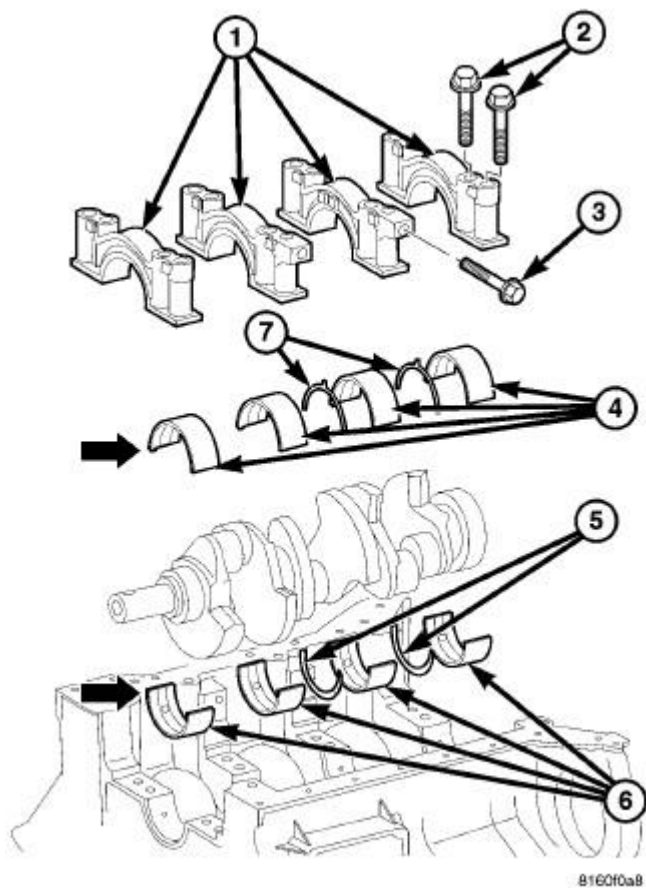


Fig. 305: CRANKSHAFT MAIN BEARINGS AND CAPS

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

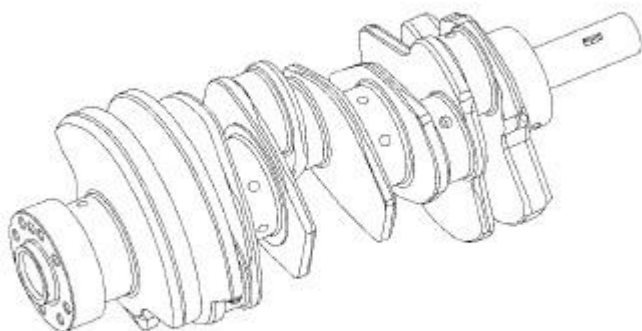
Stage	Color	Bearing Thickness	Applies To
1	Blue	2.250 mm-2.255 mm (0.0886-0.0888 in.)	Upper and Lower Bearings
2	Yellow	2.255 mm-2.260 mm (0.0888-0.0890 in.)	Upper and Lower Bearings
3	Red	2.260 mm-2.265 mm (0.0890-0.0892 in.)	Upper and Lower Bearings
4	White	2.265 mm-2.270 mm (0.0892-0.0894 in.)	Lower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

CRANKSHAFT

Description

DESCRIPTION



8160ef1b

Fig. 306: 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 plastigage. For bearing clearance specifications, see **Engine - 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 **Engine - Specifications**.

Removal

REMOVAL

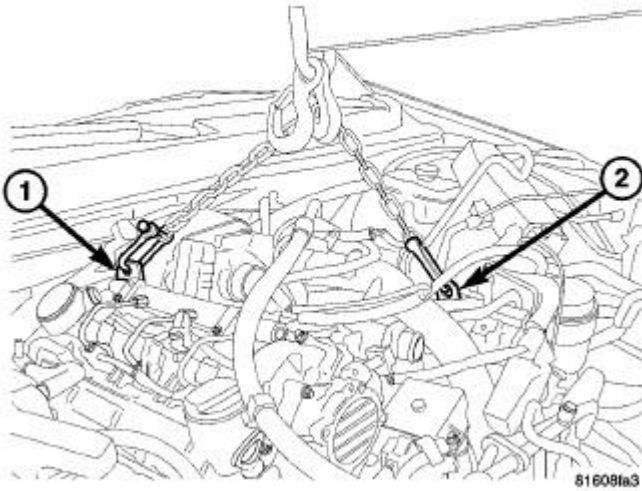


Fig. 307: ENGINE LIFTING POINTS

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 **Engine - Removal**.

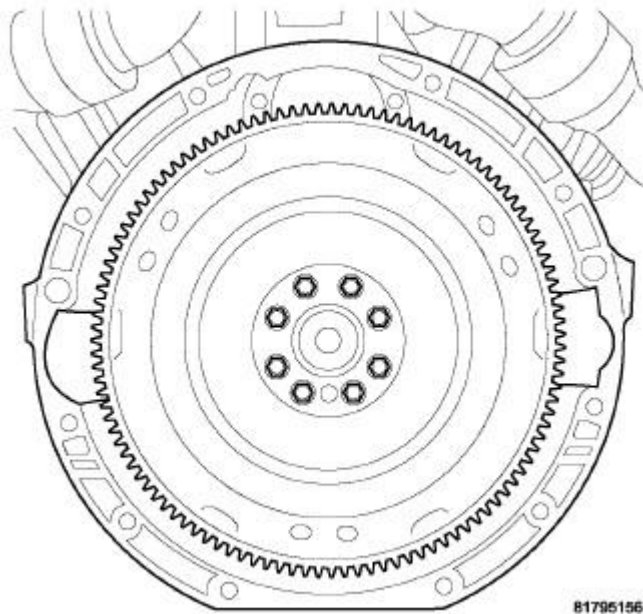


Fig. 308: FLEX PLATE

Courtesy of CHRYSLER LLC

3. Remove the flex plate.

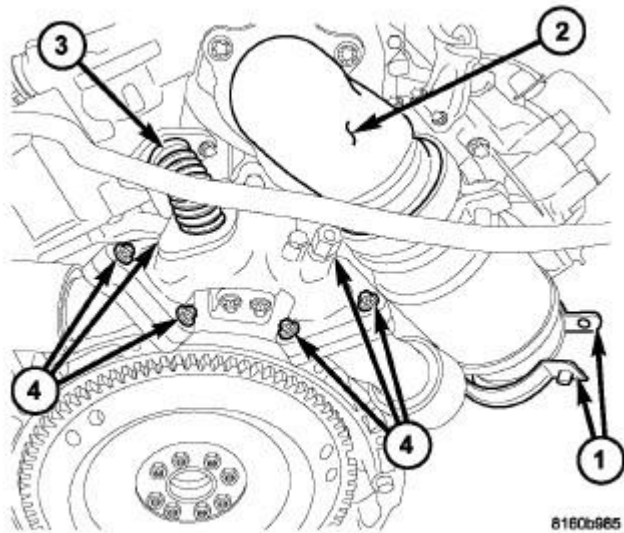


Fig. 309: Removing/Installing Air Intake, Turbo & Exhaust System Components
Courtesy of CHRYSLER LLC

4. Remove the turbocharger.

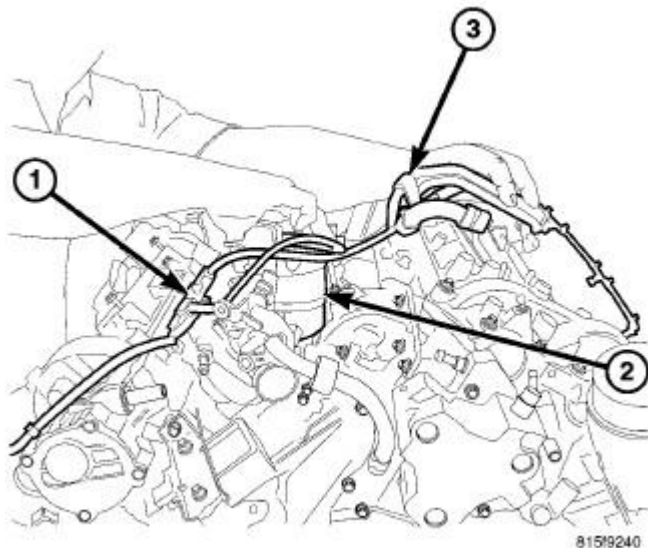


Fig. 310: FUEL FILTER, LINES AND HOSES
Courtesy of CHRYSLER LLC

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.

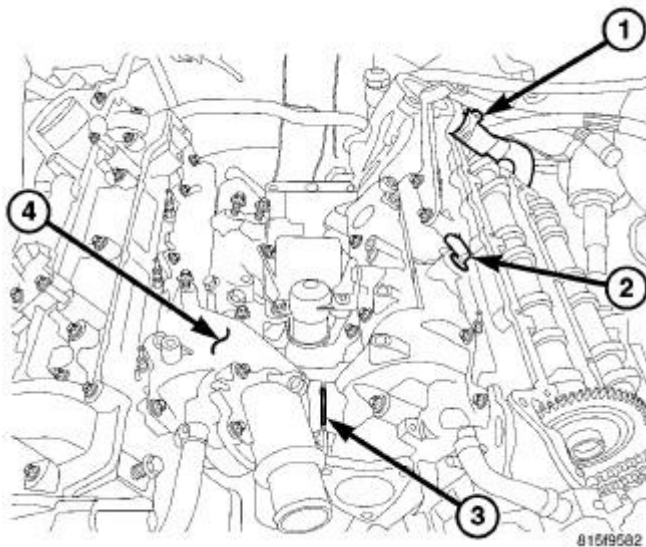


Fig. 311: INTAKE MANIFOLD

Courtesy of CHRYSLER LLC

1 - EGR COOLANT PIPE

2 - COOLANT TEMPERATURE SENSOR

3 - INTAKE COOLANT PASSAGE

4 - INTAKE MANIFOLD

7. Remove the intake manifold.

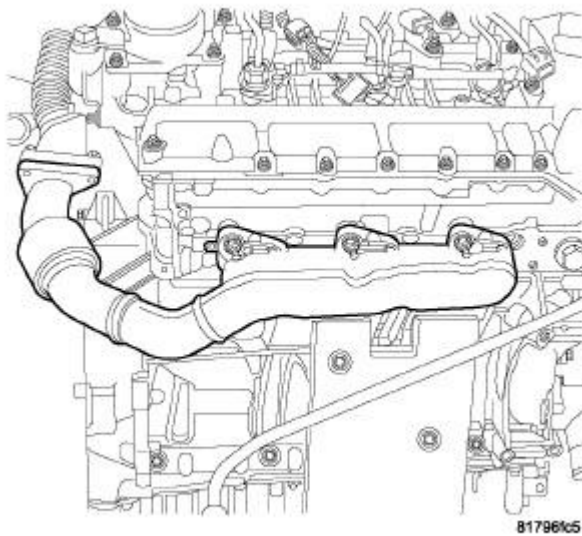


Fig. 312: RIGHT EXHAUST MANIFOLD
Courtesy of CHRYSLER LLC

8. Remove the exhaust manifolds.

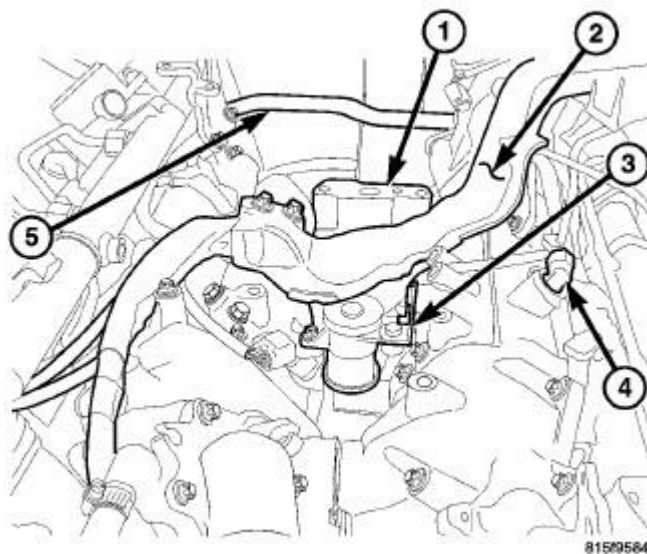
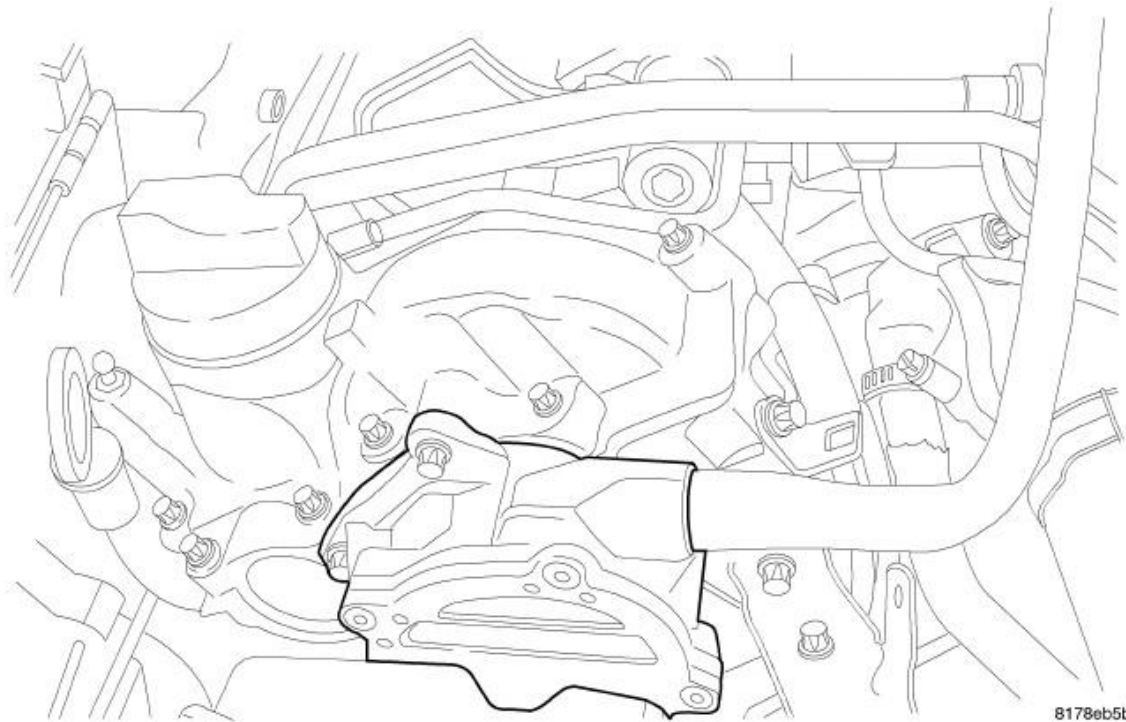


Fig. 313: MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

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

4 - COOLANT TEMPERATURE SENSOR

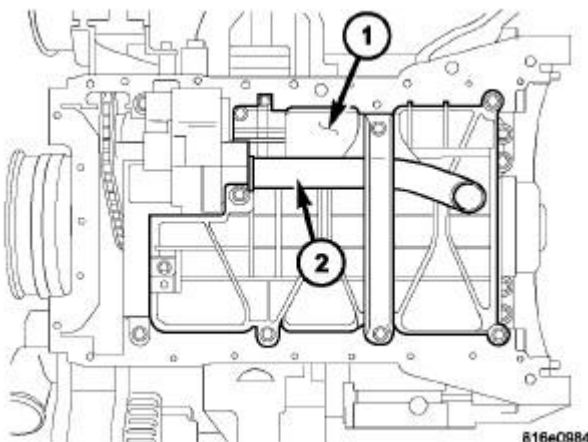
9. Remove the oil filter assembly.
10. Remove the water pump.
11. Remove the air flow control valve assembly.
12. Disconnect and remove the engine harness.



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Fig. 314: VACUUM PUMP
Courtesy of CHRYSLER LLC

13. Remove the vacuum pump.

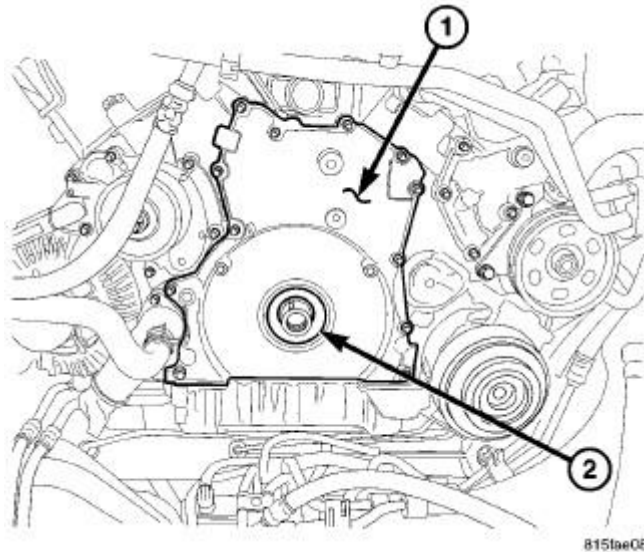


816e0984

Fig. 315: OIL PUMP COVER REMOVAL/INSTALLATION

Courtesy of CHRYSLER LLC

14. Remove the windage tray and lower oil pan. See Engine/Lubrication/PAN, Oil - Removal.
15. Remove the oil pump pickup tube. See Engine/Lubrication/PUMP, Engine Oil - Removal.
16. Remove the upper oil pan. See Engine/Lubrication/PAN, Oil - Removal.
17. Remove the oil pump. See Engine/Lubrication/PUMP, Engine Oil - Removal.

**Fig. 316: FRONT TIMING COVER**

Courtesy of CHRYSLER LLC

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

18. Remove the timing chain cover. See Engine/Valve Timing/COVER(S), Engine Timing - Removal.
19. Remove the timing chains.
20. Remove the timing chain tensioner. See Engine/Valve Timing/TENSIONER, Engine Timing - Removal.
21. Remove the right cylinder head. See Engine/Cylinder Head - Removal.
22. Remove the left cylinder head. See Engine/Cylinder Head - Removal.

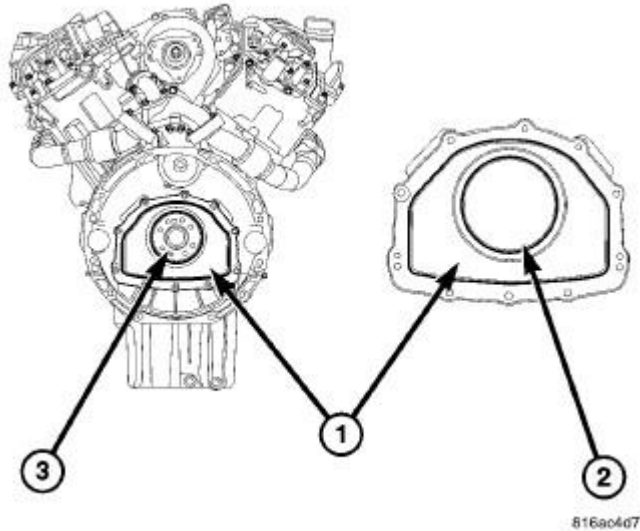


Fig. 317: REAR MAIN SEAL CARRIER
Courtesy of CHRYSLER LLC

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.

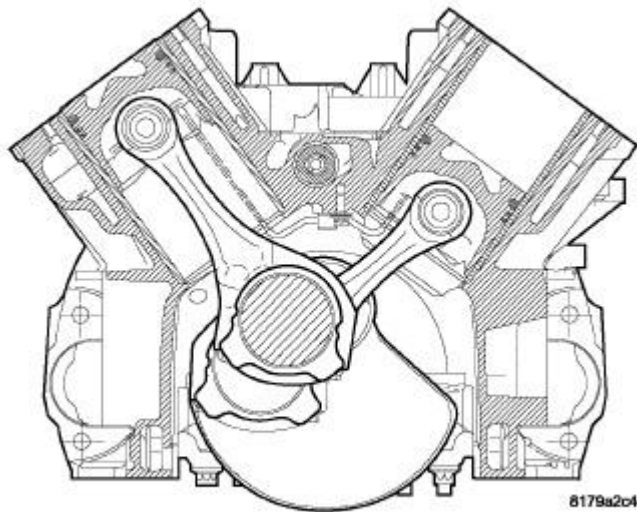


Fig. 318: BLOCK CUTAWAY
Courtesy of CHRYSLER LLC

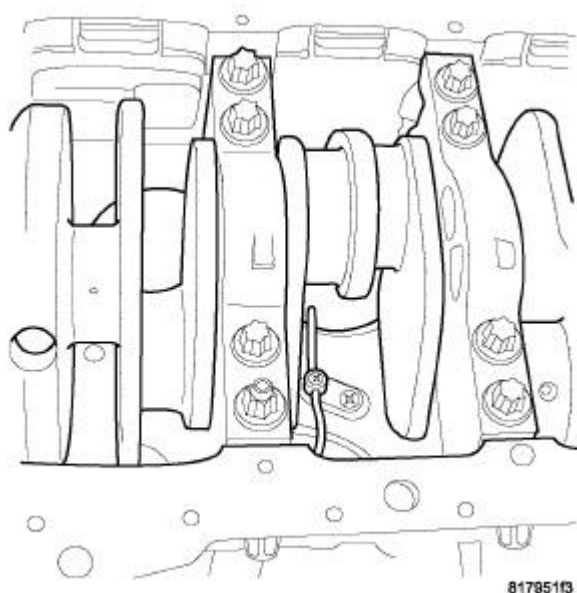
24. Remove the pistons and connecting rods. See **Engine/Engine Block/ROD, Piston and Connecting - Removal.**
25. Remove the oil jets. See **Engine/Lubrication/JET, Piston Oil Cooler - Removal.**



Fig. 319: 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. 320: 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 Engine/Engine Block/CRANKSHAFT - 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 Engine/Engine Block/CRANKSHAFT - 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.

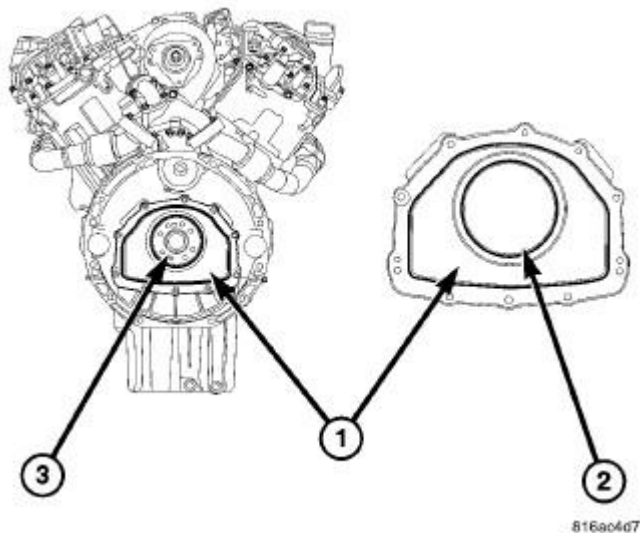


Fig. 321: REAR MAIN SEAL CARRIER
Courtesy of CHRYSLER LLC

12. Install the rear crankshaft oil seal.

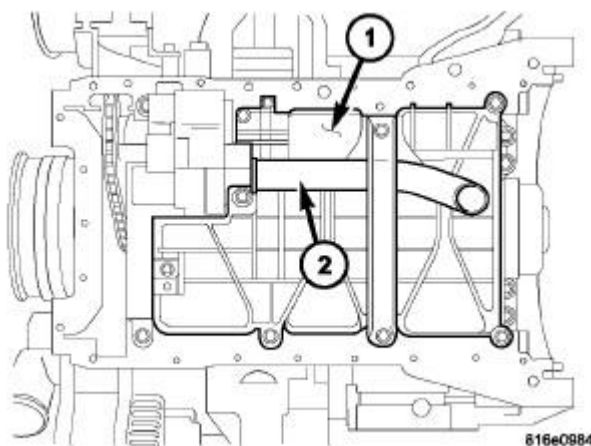


Fig. 322: OIL PUMP COVER REMOVAL/INSTALLATION
Courtesy of CHRYSLER LLC

13. Install the oil pump. See **Engine/Lubrication/PUMP, Engine Oil - 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 **Engine/Cylinder Head - Installation**.
18. Install the left cylinder head. See **Engine/Cylinder Head - Installation**.

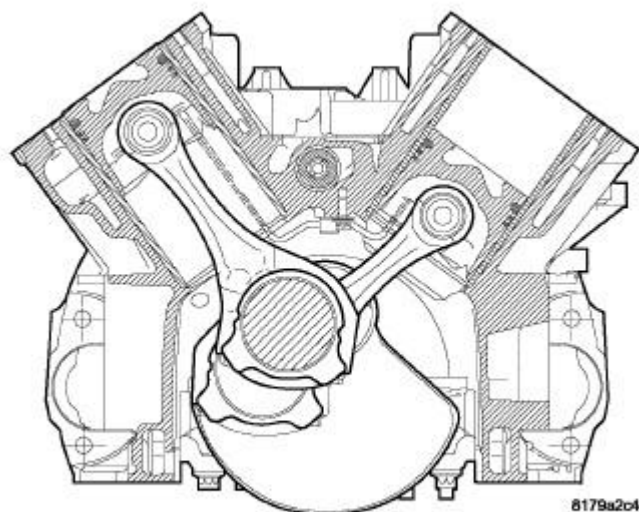


Fig. 323: BLOCK CUTAWAY
Courtesy of CHRYSLER LLC

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.

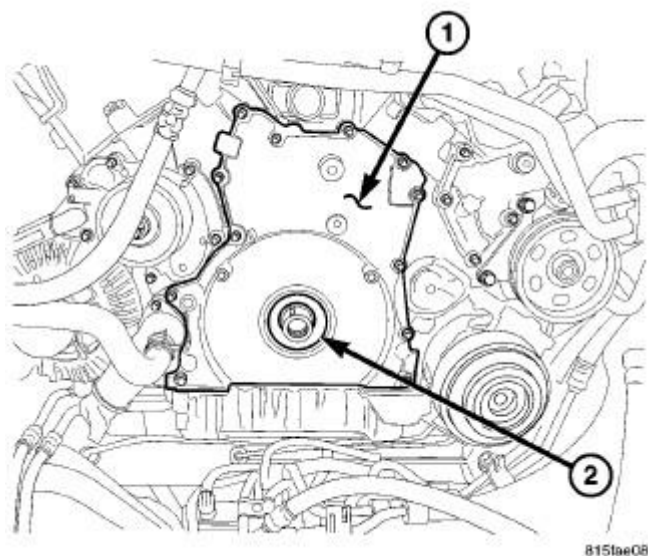


Fig. 324: FRONT TIMING COVER

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).

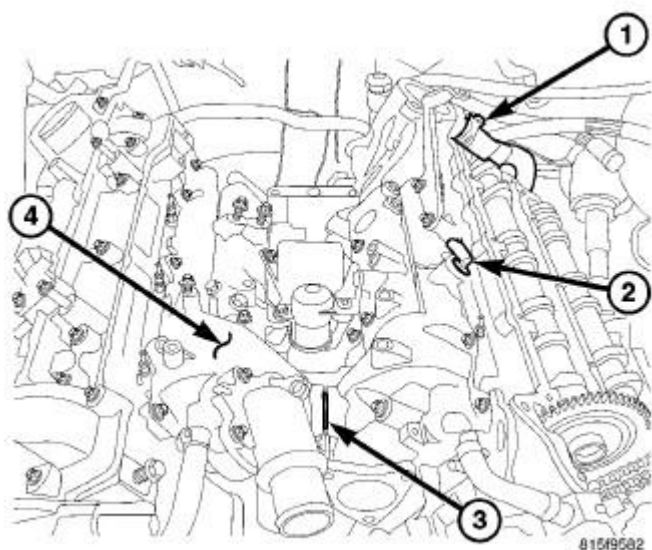


Fig. 325: INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

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

25. Install the intake manifold. See [Engine/Manifolds/MANIFOLD, Intake - Installation](#).

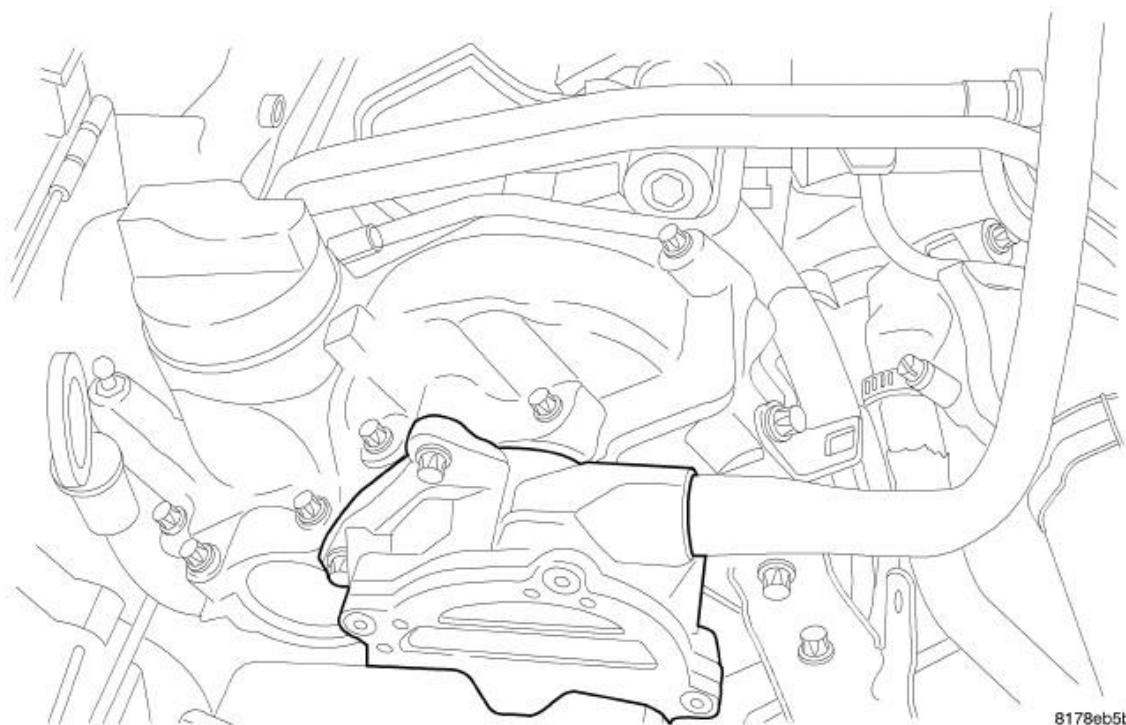
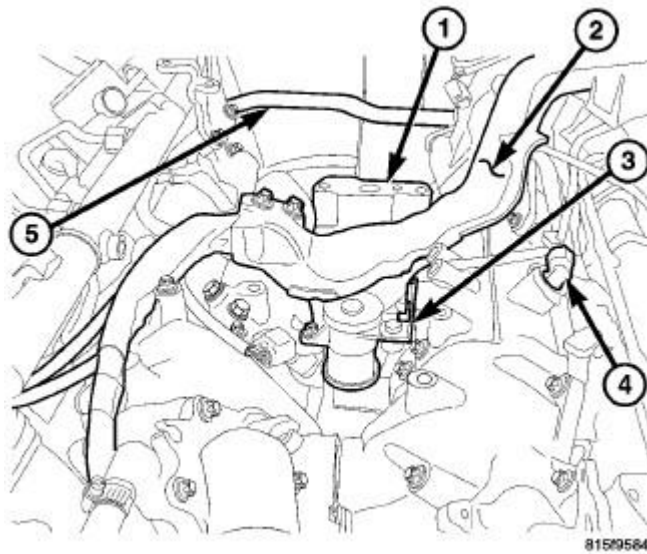


Fig. 326: VACUUM PUMP

Courtesy of CHRYSLER LLC

26. Install the vacuum pump.

**Fig. 327: 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.

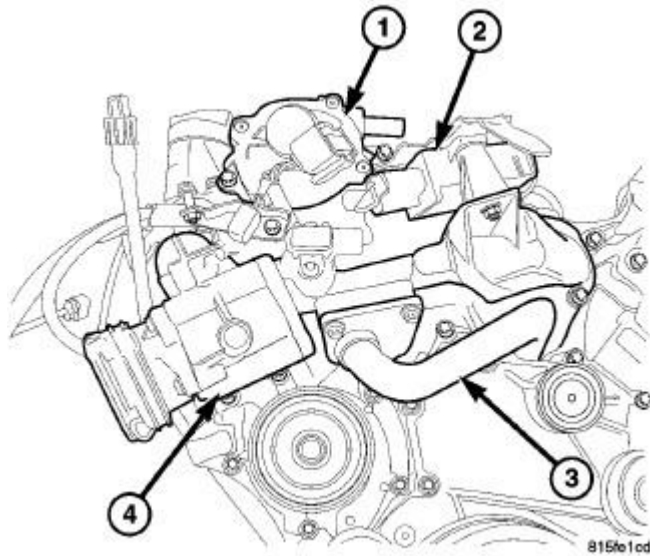


Fig. 328: AIR CONTROL VALVE
Courtesy of CHRYSLER LLC

- | |
|---|
| 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.

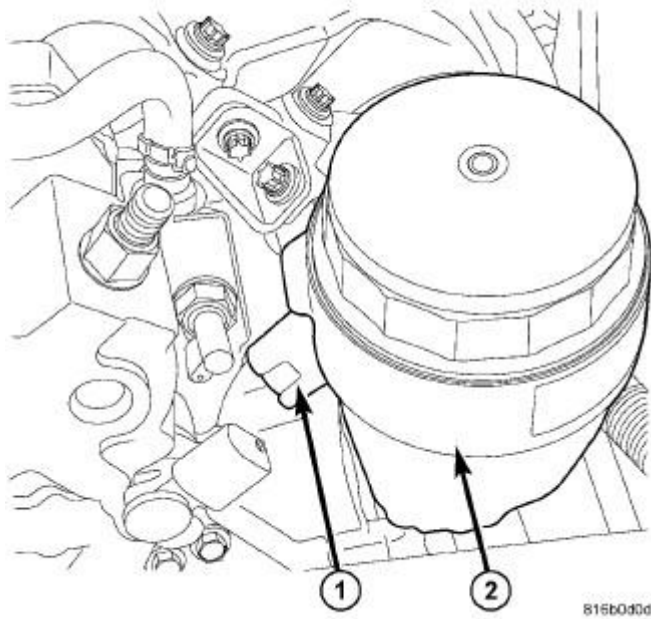


Fig. 329: OIL FILTER HOUSING
Courtesy of CHRYSLER LLC

30. Install the oil filter assembly.

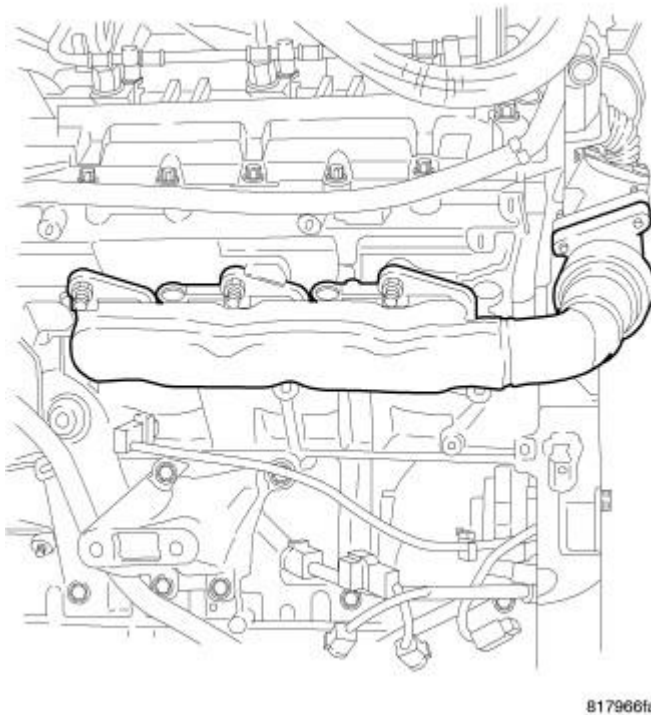


Fig. 330: EXHAUST MANIFOLD - LEFT
Courtesy of CHRYSLER LLC

31. Install the left exhaust manifold. See [Engine/Manifolds/MANIFOLD, Exhaust - Installation](#).
32. Install the right exhaust manifold. See [Engine/Manifolds/MANIFOLD, Exhaust - Installation](#).

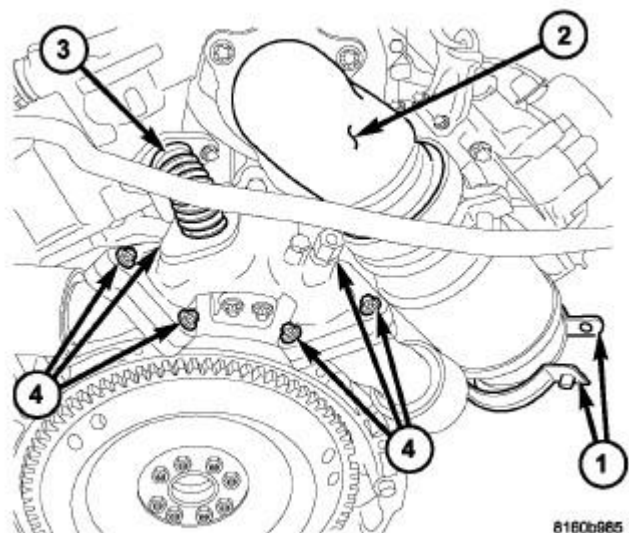


Fig. 331: Removing/Installing Air Intake, Turbo & Exhaust System Components
Courtesy of CHRYSLER LLC

33. Install the turbocharger. See [Engine/Turbocharger System/TURBOCHARGER - Installation](#).

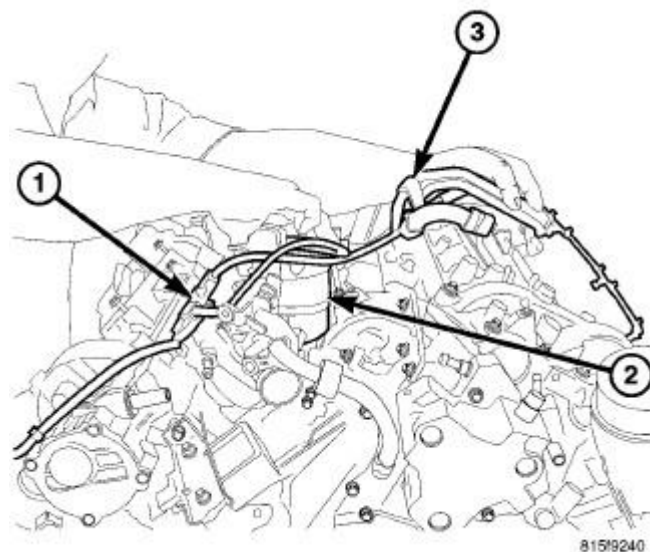


Fig. 332: FUEL FILTER, LINES AND HOSES
Courtesy of CHRYSLER LLC

- | |
|-----------------------------|
| 1 - RETURN FUEL HOSE BUNDLE |
| 2 - FUEL FILTER |

3 - LOW PRESSURE FUEL SUPPLY AND RETURN PIPE

34. Install the fuel rails and lines.

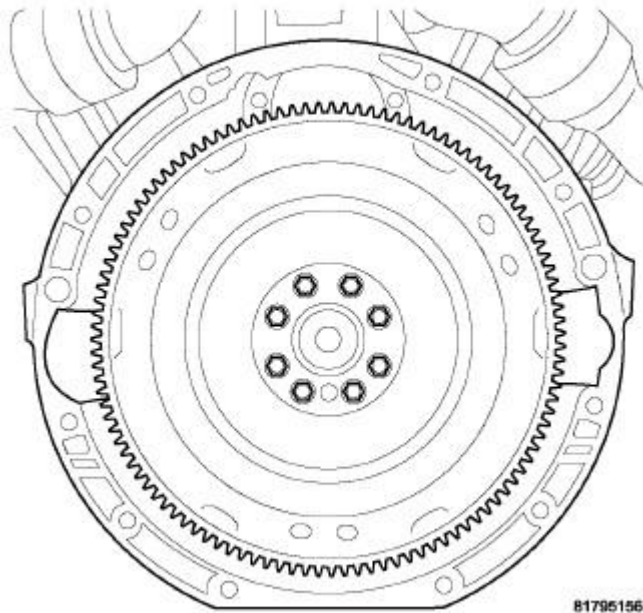


Fig. 333: FLEX PLATE
Courtesy of CHRYSLER LLC

35. Install the flex plate. See **Engine/Engine Block/FLEXPLATE - Installation.**

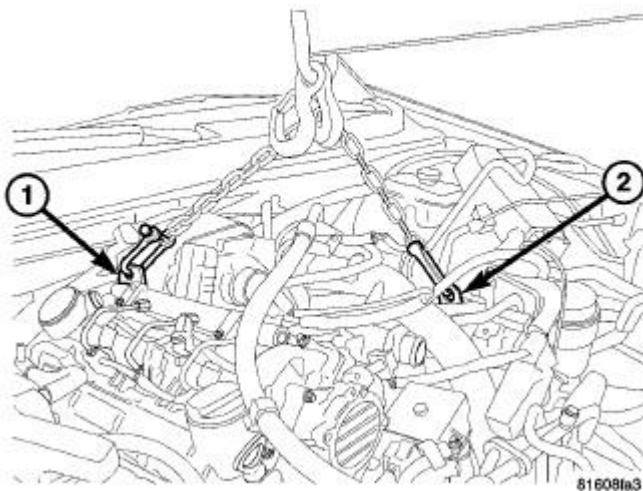


Fig. 334: ENGINE LIFTING POINTS
Courtesy of CHRYSLER LLC

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

36. Install engine in vehicle. See **Engine - 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 engine cover
3. Raise and support the vehicle.

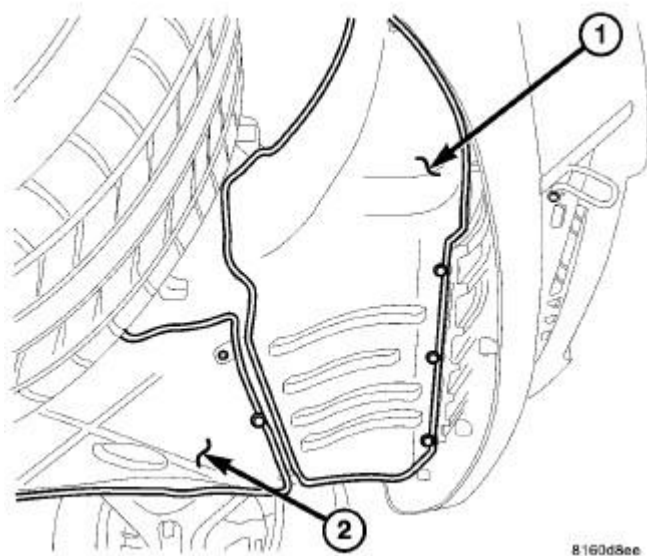


Fig. 335: FRONT SPLASH SHIELDS
Courtesy of CHRYSLER LLC

- 1 - FRONT SPLASH SHIELD
- 2 - INTERMEDIATE SPLASH SHIELD

4. Remove both front lower splash shields (1,2) .

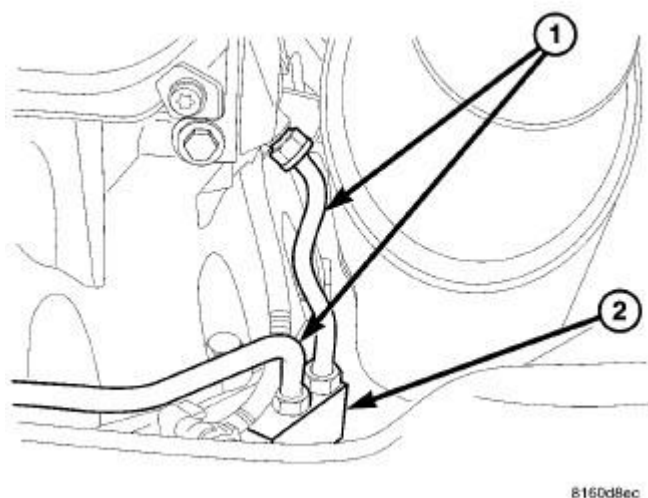


Fig. 336: TRANSMISSION THERMO-BLOCK
Courtesy of CHRYSLER LLC

1 - TRANSMISSION COOLER LINES 2 - THERMO-BLOCK

5. Drain coolant from radiator. Refer to Cooling - Standard Procedure .
6. Remove differential skid plate.
7. Remove the transmission thermal bypass valve (2) , and the cooler lines (1) between the block (2) and transmission.

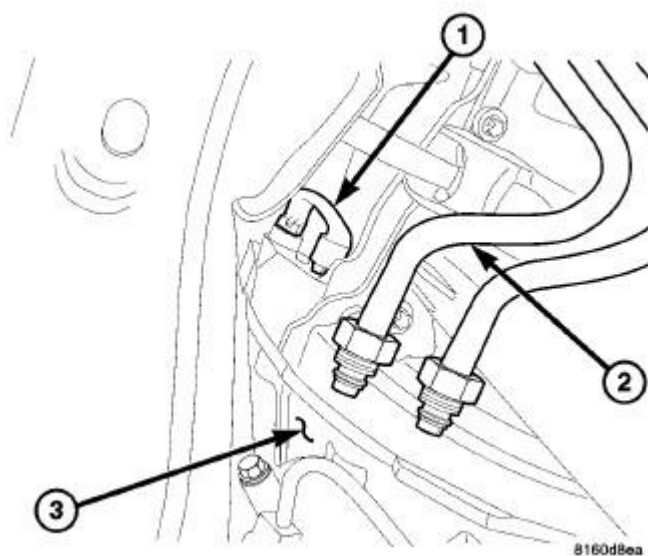


Fig. 337: SPECIAL TOOL #9102 CRANKSHAFT LOCK
Courtesy of CHRYSLER LLC

- 1 - #9102 CRANKSHAFT LOCK
- 2 - TRANSMISSION COOLER LINES
- 3 - TRANSMISSION

8. Remove the starter blank.
9. Install special tool #9102 flywheel locking tool (1). .
10. Remove fan module. Refer to **Cooling/Engine/FAN, Cooling - Removal** .
11. Remove air cleaner assembly.
12. Remove air charge outlet tube.
13. Remove intercooler resonator.

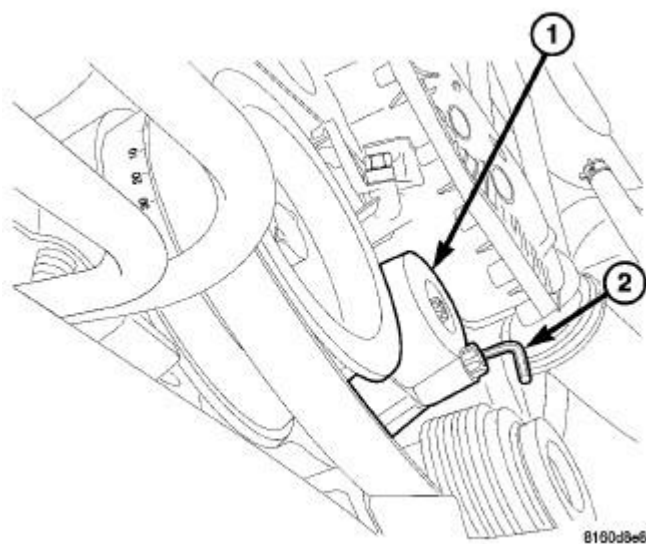


Fig. 338: DRIVE BELT TENSIONER RESET
Courtesy of CHRYSLER LLC

- 1 - DRIVE BELT TENSIONER
- 2 - DRIFT OR PIN

14. Release the accessory drive belt tension by resetting the drive belt tensioner (1) and installing a retaining pin.

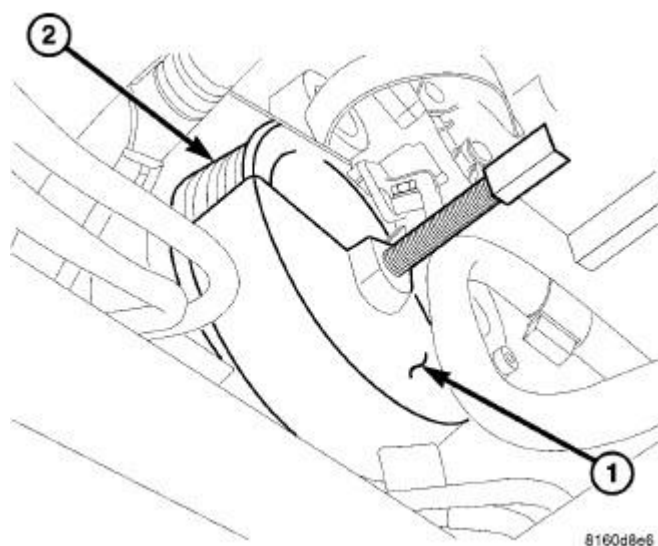


Fig. 339: SPECIAL TOOL #8940 VIBRATION DAMPER PULLER
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - SPECIAL TOOL #9544
2 - VIBRATION DAMPER |
|--|

15. Remove the vibration damper (2) bolt.
16. Install special tool #9544 vibration damper puller (1) .

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

17. Remove the vibration damper (2).

Installation

INSTALLATION

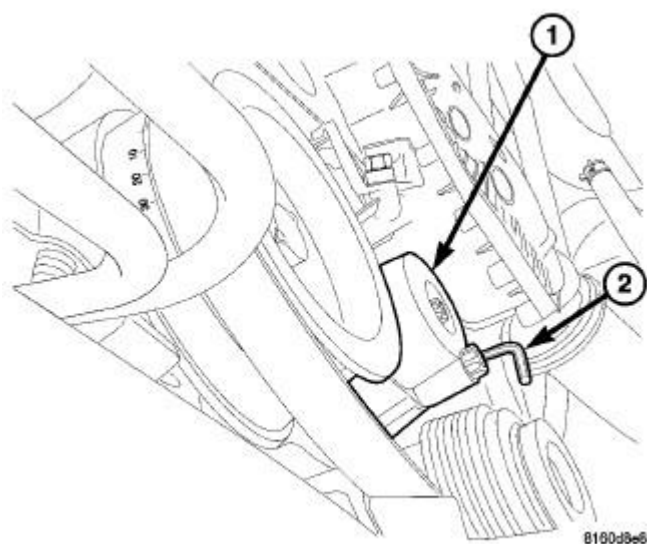


Fig. 340: DRIVE BELT TENSIONER RESET
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - DRIVE BELT TENSIONER
2 - DRIFT OR PIN |
|--|

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. Tighten the bolt to 210 Nm, plus 180 degrees (154 ft. lbs. plus 180 degrees).
2. Position the drive belt back onto the pulleys and release the belt tensioner (1) .
3. Install intercooler resonator.
4. Install air charge outlet tube.
5. Install air cleaner assembly.
6. Install fan module assembly. Refer to Cooling/Engine/FAN, Cooling - Installation .

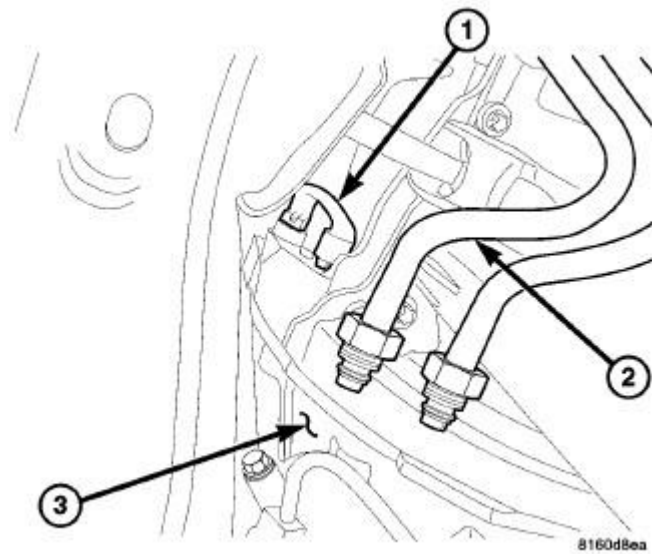


Fig. 341: SPECIAL TOOL #9102 CRANKSHAFT LOCK
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - #9102 CRANKSHAFT LOCK
2 - TRANSMISSION COOLER LINES
3 - TRANSMISSION</p> |
|---|

7. Remove special tool #9102 flywheel locking tool (1) .

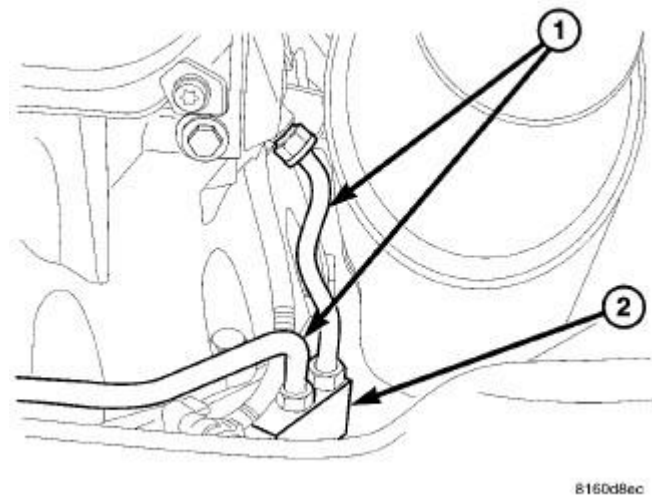
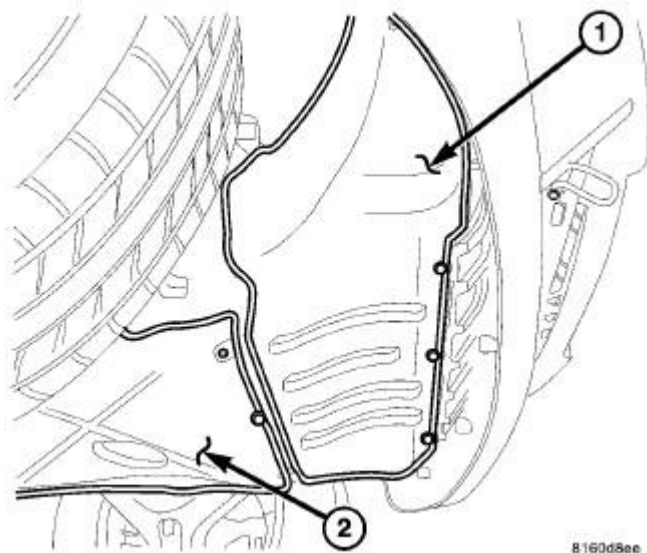


Fig. 342: TRANSMISSION THERO-BLOCK
Courtesy of CHRYSLER LLC

- | |
|--------------------------------------|
| <p>1 - TRANSMISSION COOLER LINES</p> |
|--------------------------------------|

2 - THERMO-BLOCK

8. Install the transmission thermal bypass valve (2) and transmission cooler lines (1) .
9. Installed the differential skid plate.

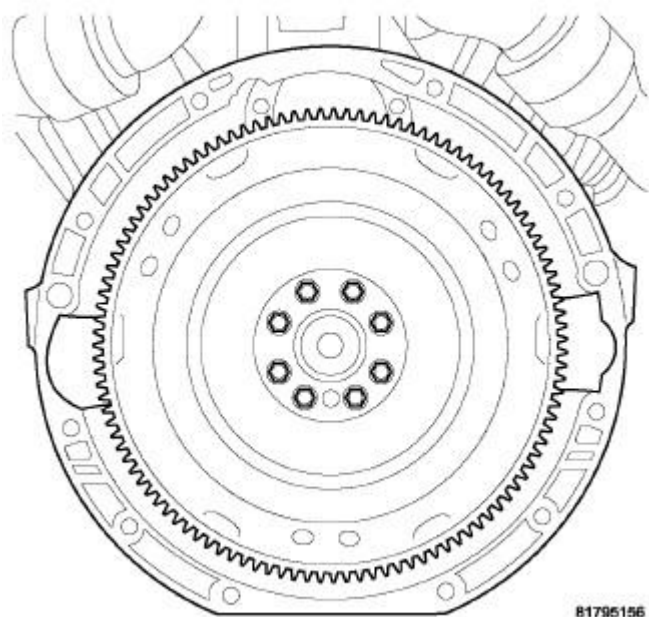
**Fig. 343: FRONT SPLASH SHIELDS**

Courtesy of CHRYSLER LLC

1 - FRONT SPLASH SHIELD**2 - INTERMEDIATE SPLASH SHIELD**

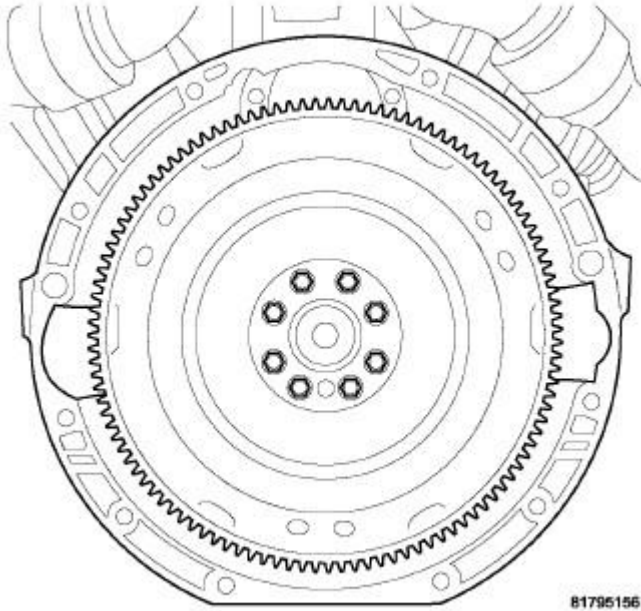
10. Install the intermediate (2) and front (1) underbody splash shields.
11. Lower the vehicle.
12. Connect negative battery cable.
13. Fill cooling system. Refer to **Cooling - Standard Procedure** .
14. Install engine trim cover.

FLEXPLATE**Description****DESCRIPTION**

**Fig. 344: 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. 345: 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**

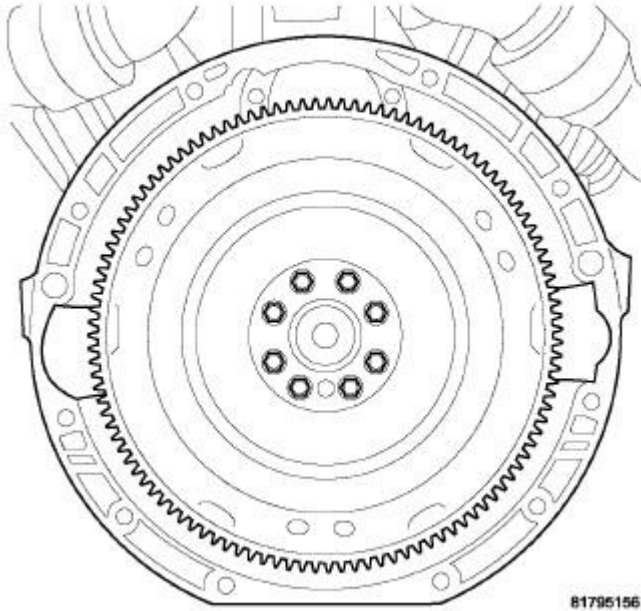


Fig. 346: FLEX PLATE

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

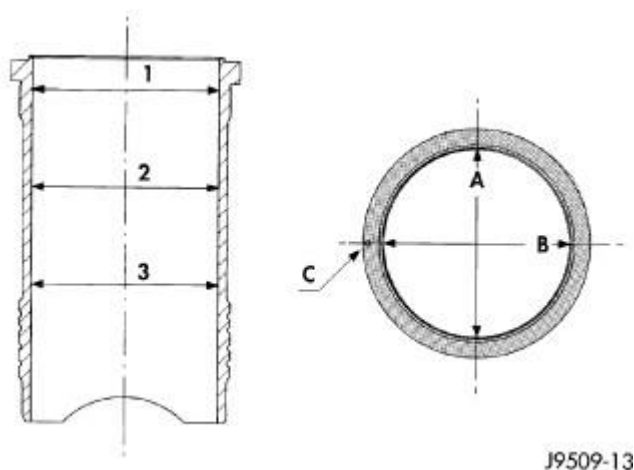


Fig. 347: LINER INSPECTION
Courtesy of CHRYSLER LLC

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

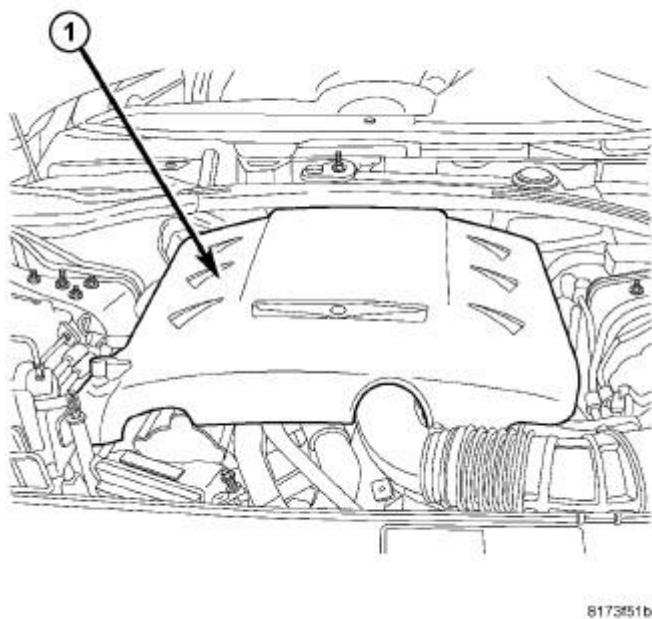


Fig. 348: ENGINE COVER
Courtesy of CHRYSLER LLC

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

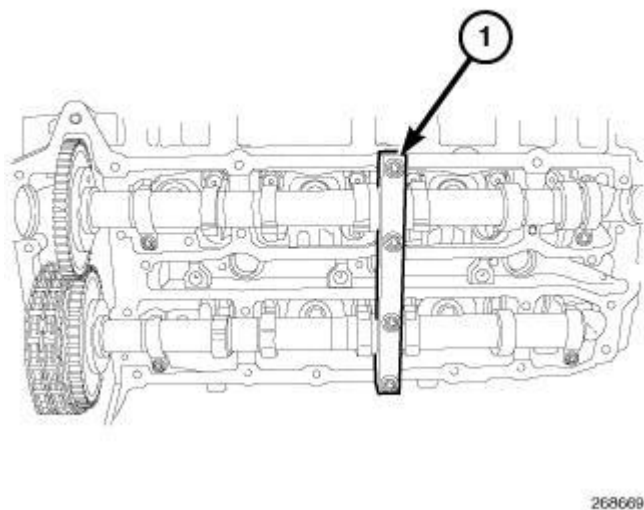


Fig. 349: Camshaft Holding Fixture 9555
Courtesy of CHRYSLER LLC

3. Remove both cylinder head covers. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal.**
4. Install the Camshaft Holding Fixture 9555 (1) on both cylinder heads.

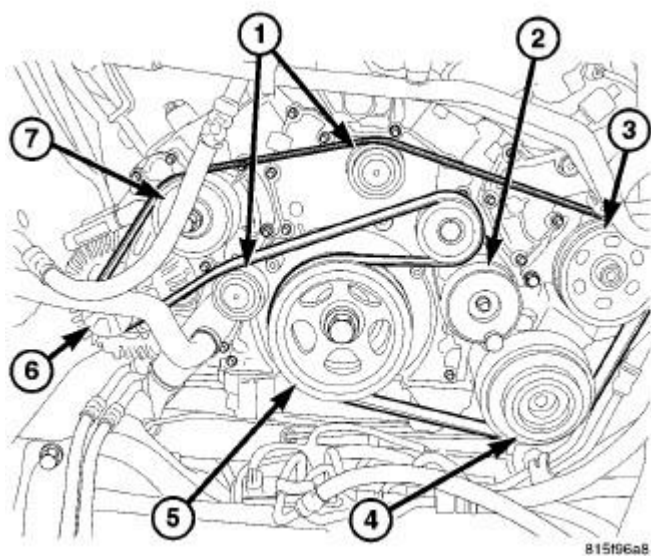


Fig. 350: ACCESSORY DRIVE BELT

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 .

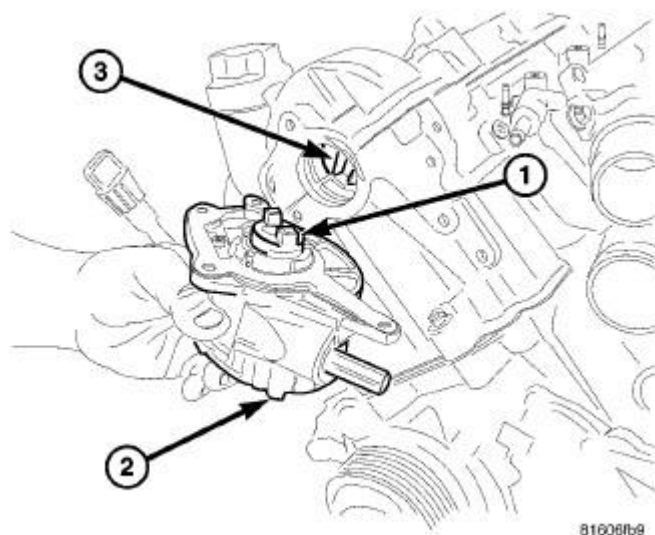


Fig. 351: Vacuum Pump
Courtesy of CHRYSLER LLC

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

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

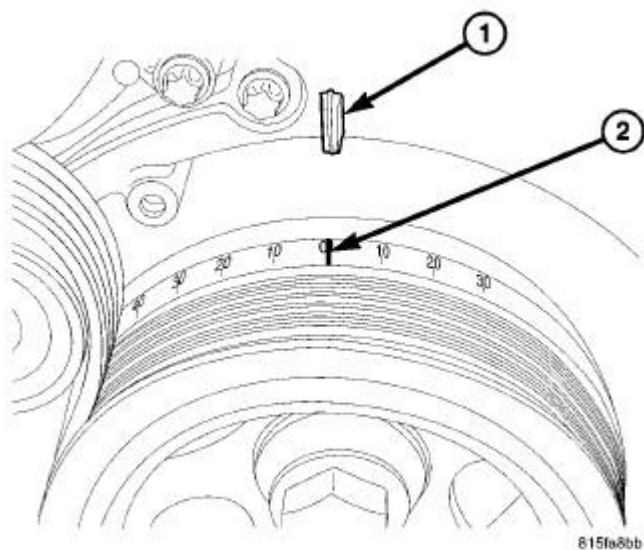


Fig. 352: VIBRATION DAMPER
Courtesy of CHRYSLER LLC

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

2 - VIBRATION DAMPER TDC MARK

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

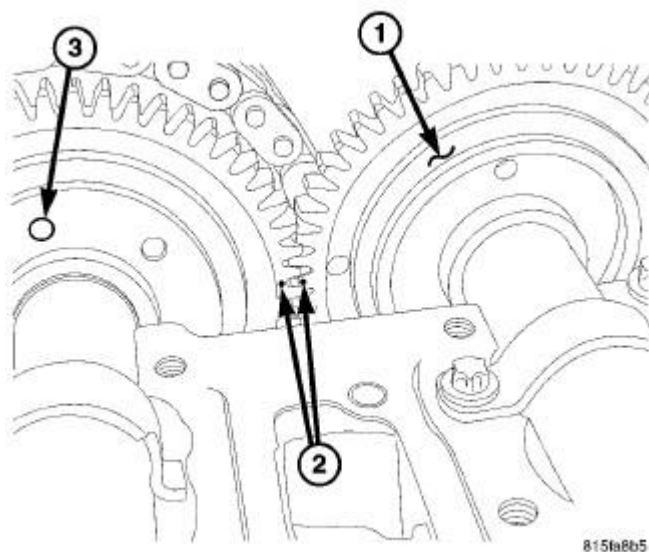


Fig. 353: CAMSHAFT GEAR ALIGNMENT

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.

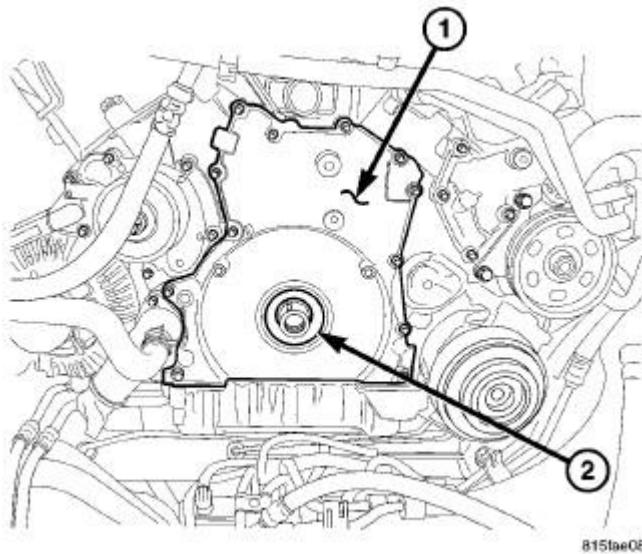


Fig. 354: FRONT TIMING COVER
Courtesy of CHRYSLER LLC

11. Remove the front timing chain cover (1). See Engine/Valve Timing/COVER(S), Engine Timing - Removal.

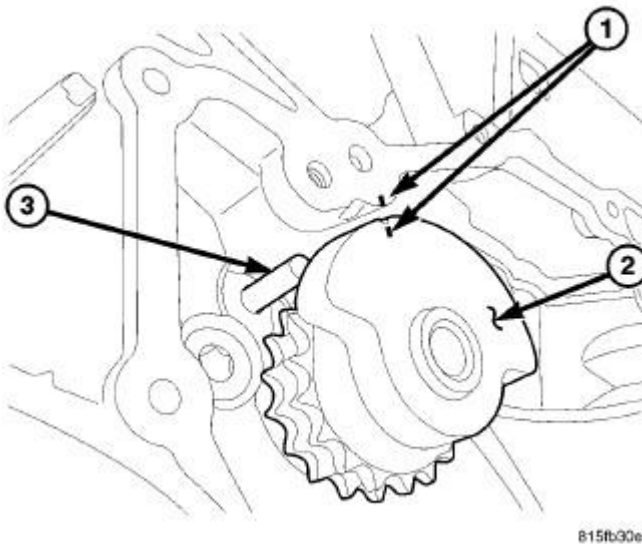


Fig. 355: BALANCE SHAFT INDEXING
Courtesy of CHRYSLER LLC

- | |
|---|
| <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.

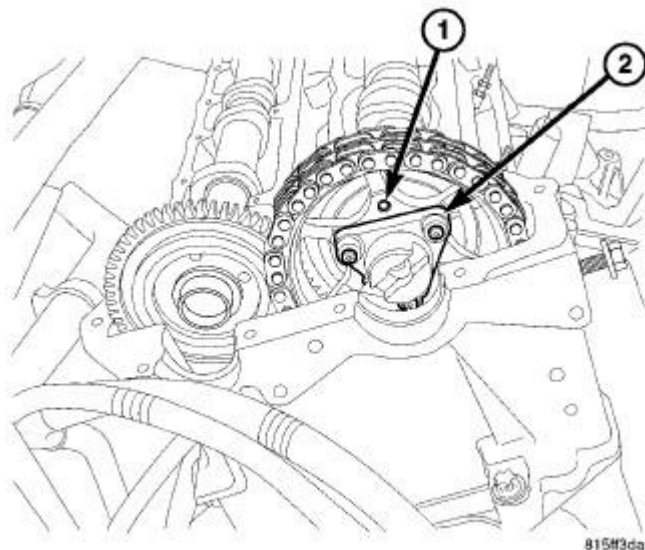


Fig. 356: RIGHT INTAKE CAMSHAFT DRIVE GEAR
Courtesy of CHRYSLER LLC

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.

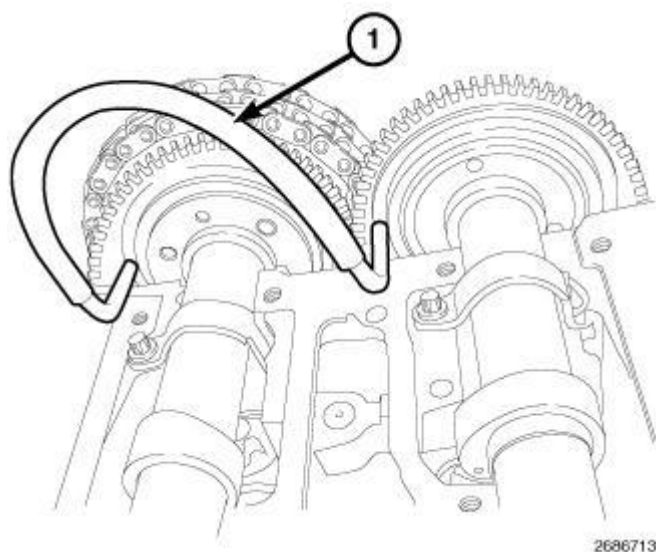


Fig. 357: Camshaft Locking Pins 8929
Courtesy of CHRYSLER LLC

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

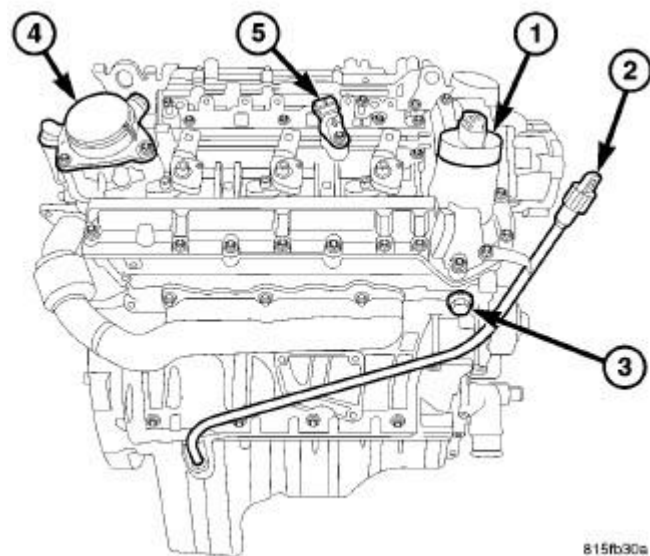


Fig. 358: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

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

17. Remove the timing chain tensioner (3).

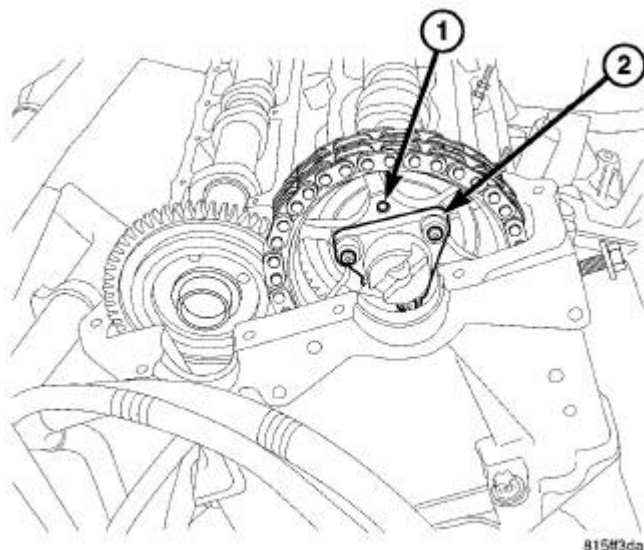


Fig. 359: RIGHT INTAKE CAMSHAFT DRIVE GEAR
Courtesy of CHRYSLER LLC

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.

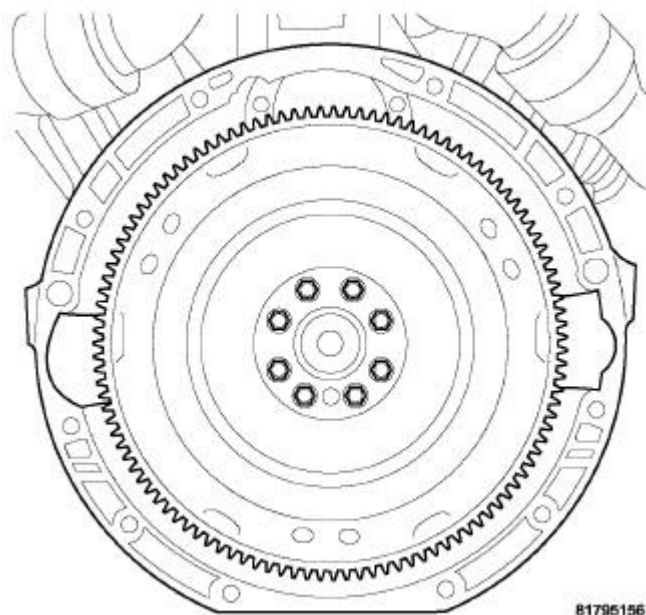


Fig. 360: Flex Plate

Courtesy of CHRYSLER LLC

21. Remove the flexplate. See **Engine/Engine Block/FLEXPLATE - Removal.**

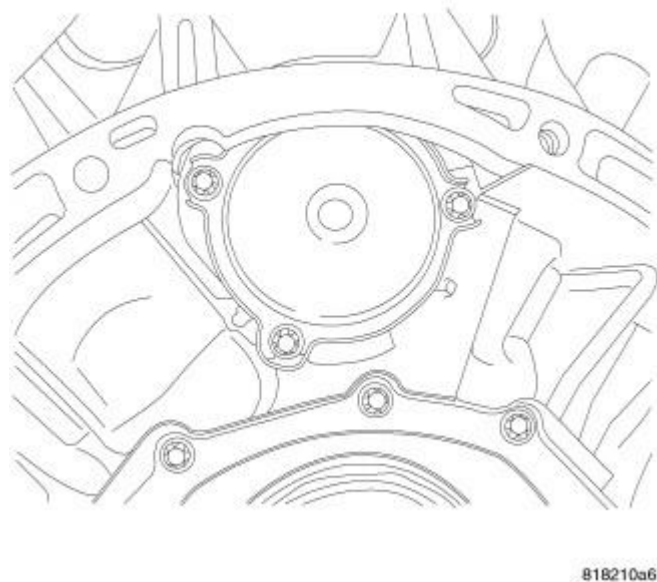


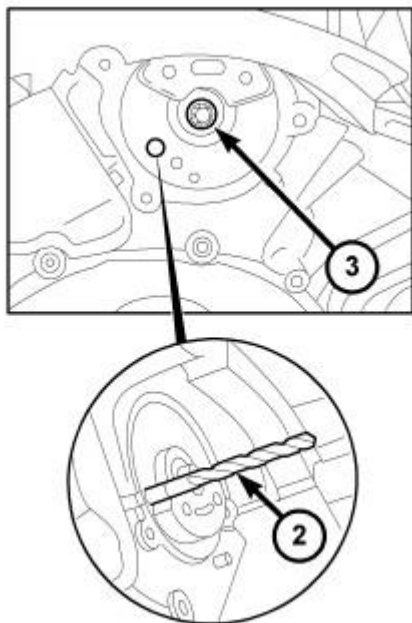
Fig. 361: BALANCE SHAFT REAR COVER

Courtesy of CHRYSLER LLC

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

replaced.

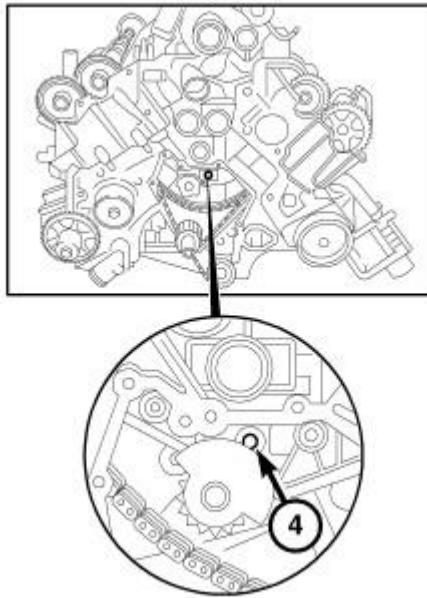
22. Remove the rear balance shaft cover retaining bolts, remove and discard the balance shaft cover.



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Fig. 362: 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).



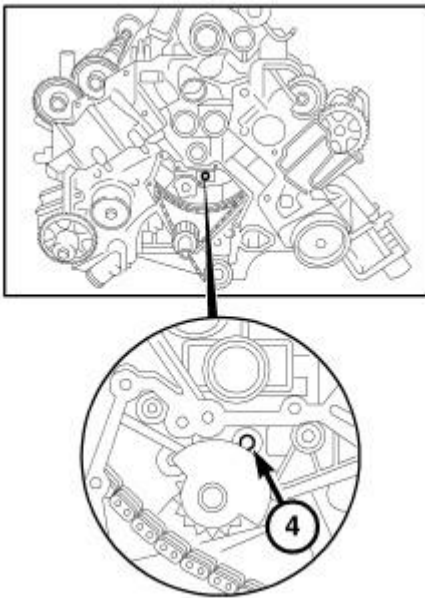
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Fig. 363: BALANCE SHAFT ALIGNMENT FRONT
Courtesy of CHRYSLER LLC

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



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Fig. 364: 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.

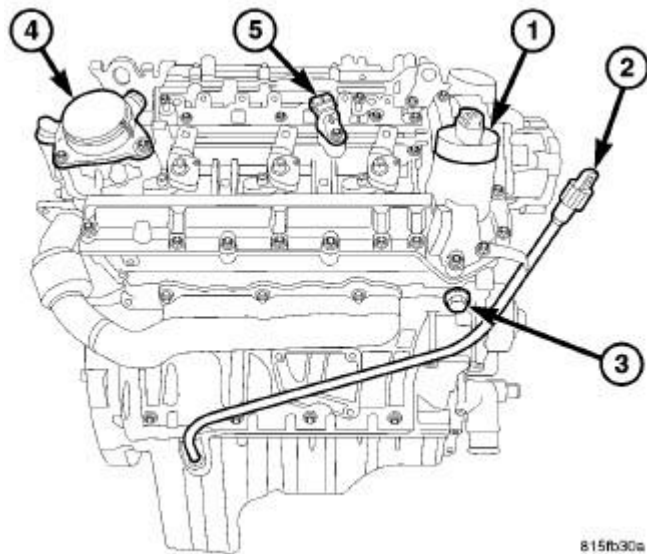
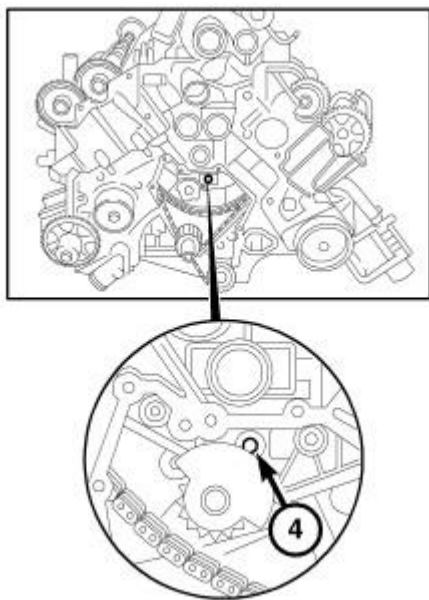


Fig. 365: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

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

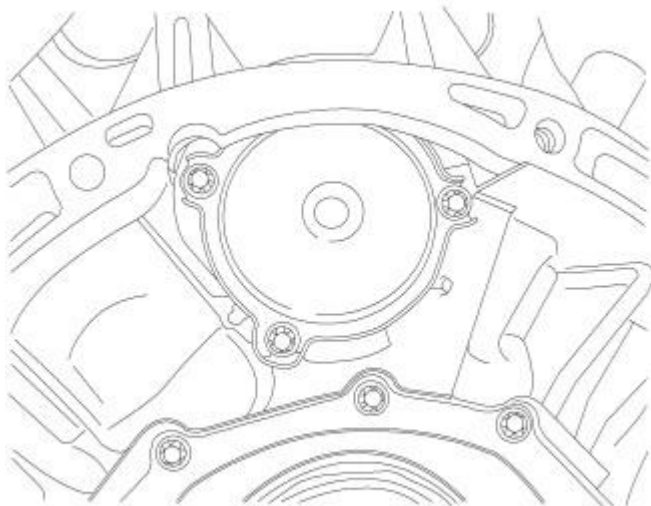
3. Install the timing chain tensioner. Tighten to 80 N.m (59 ft. lbs.).
4. Be sure that the camshafts and crankshaft are all set to their correct timing positions.



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Fig. 366: 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. 367: 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 **Engine/Valve Timing/COVER(S), Engine Timing - 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

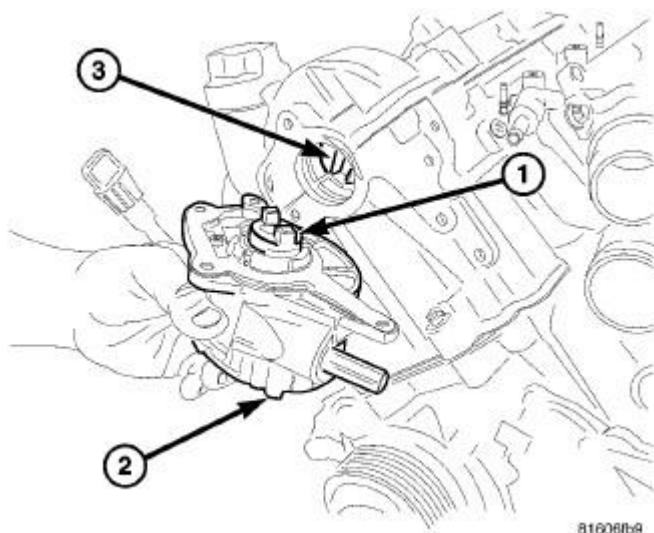


Fig. 368: Vacuum Pump

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.

Diagnosis and Testing

VACUUM PUMP

1. Connect a vacuum gauge to the booster check valve with a short length of hose and T-fitting.
2. Start the engine allowing the engine to run for 30 seconds. Vacuum should be 18 inches HG (609 millibars). Verify the vacuum line is not leaking. If no leak is present, replace vacuum pump. See **Engine/Engine Block/PUMP, Vacuum - Removal**.

Operation

OPERATION

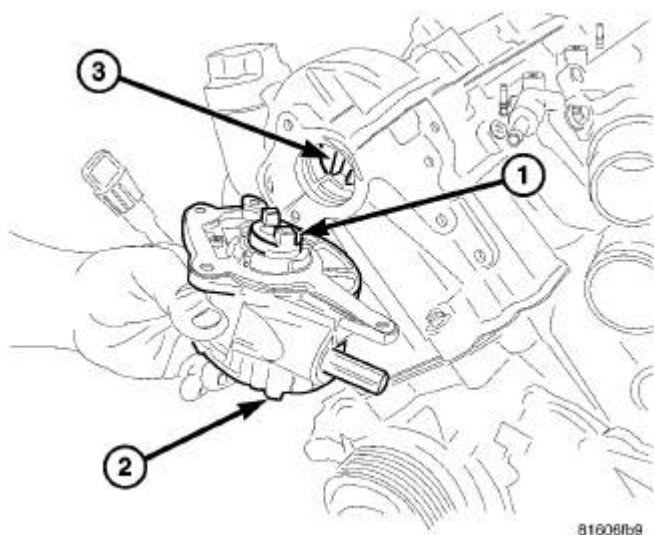


Fig. 369: Vacuum Pump
Courtesy of CHRYSLER LLC

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

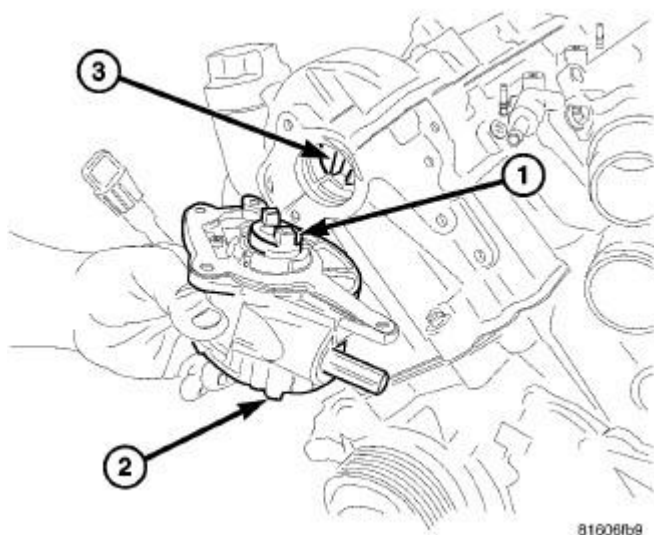


Fig. 370: Vacuum Pump

Courtesy of CHRYSLER LLC

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

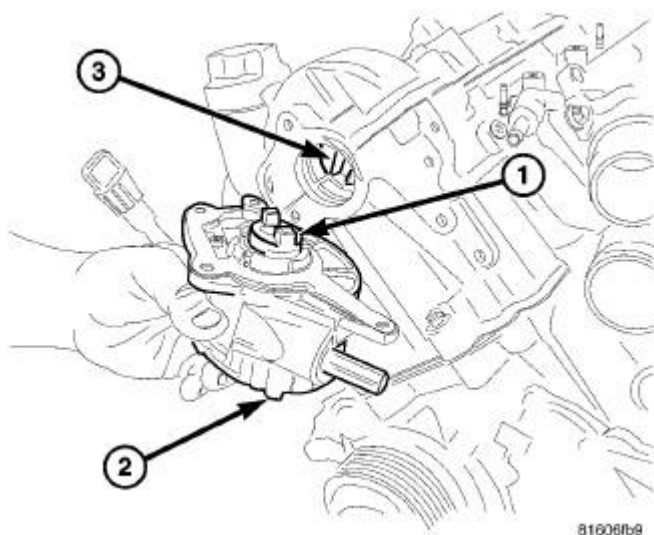
1. Disconnect negative battery cable.
2. Remove vacuum line at vacuum pump.

NOTE: **Observe position of driver on rear of pump.**

3. Remove vacuum pump and seals.
4. Clean all sealing surfaces.

Installation

INSTALLATION

**Fig. 371: 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

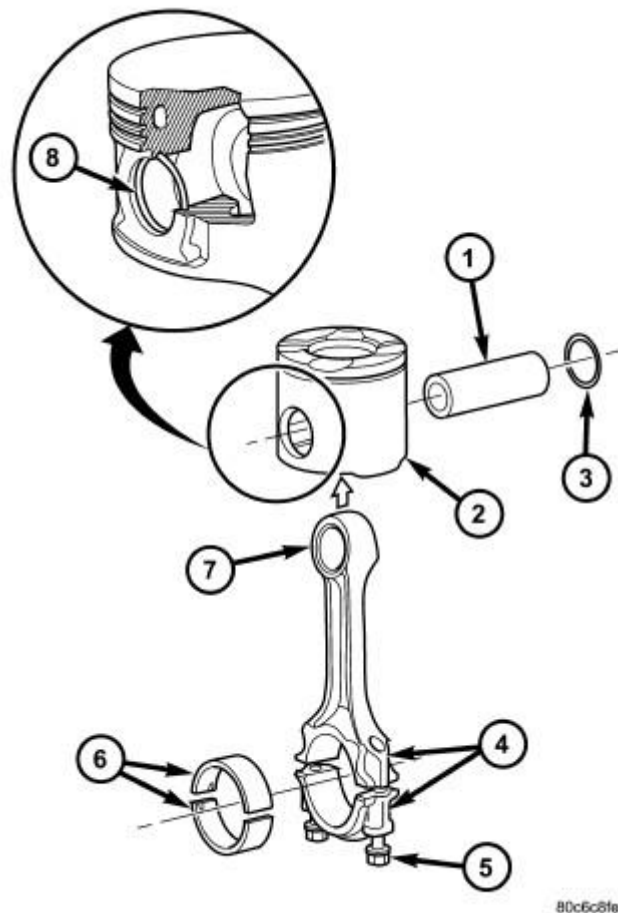


Fig. 372: PISTON AND CONNECTING ROD ASSEMBLY
 Courtesy of CHRYSLER LLC

- 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

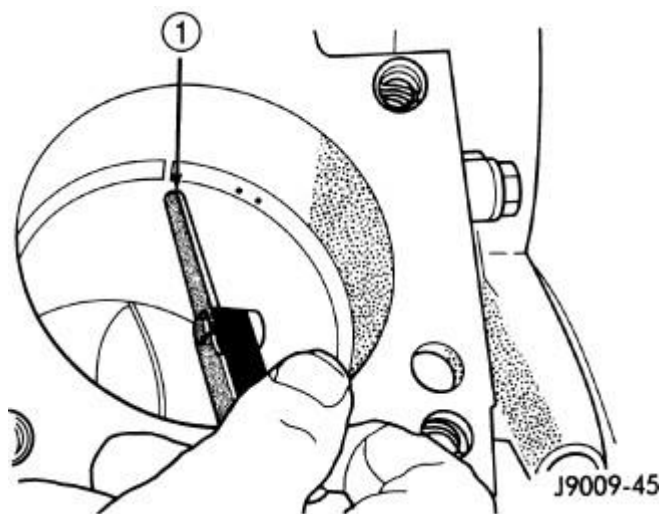
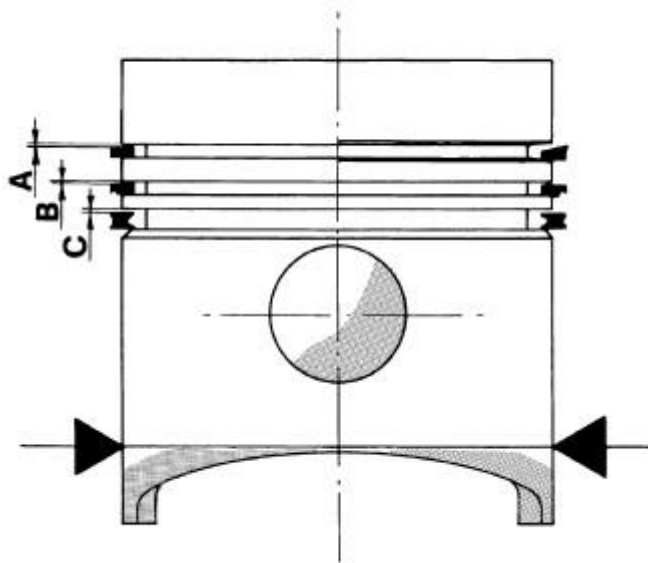


Fig. 373: RING END GAP MEASUREMENT
Courtesy of CHRYSLER LLC

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. 374: 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.

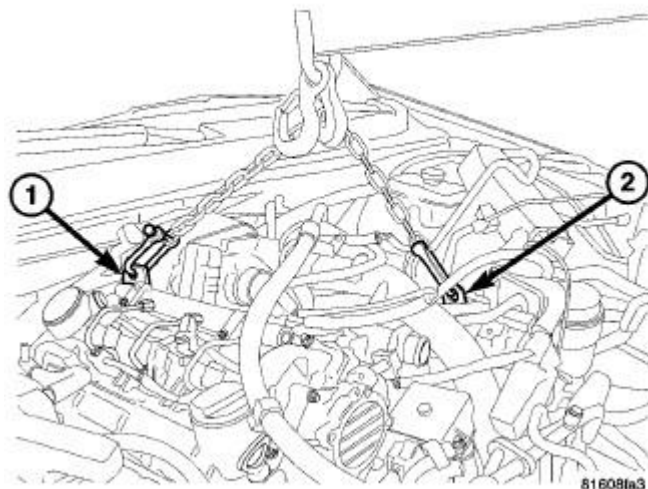


Fig. 375: ENGINE LIFTING POINTS

Courtesy of CHRYSLER LLC

2. Remove the engine from the vehicle. See Engine - Removal.
3. Remove the flexplate. See Engine/Engine Block/FLEXPLATE - Removal.
4. Remove both cylinder heads. See Engine/Cylinder Head - Removal.

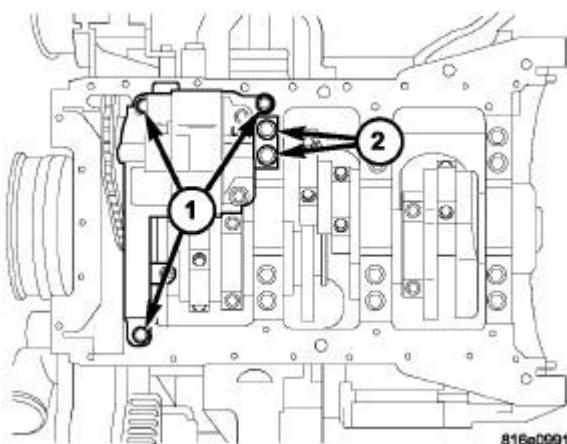


Fig. 376: OIL PUMP

Courtesy of CHRYSLER LLC

5. Remove the oil pump and pickup tube. See Engine/Lubrication/PUMP, Engine Oil - 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.

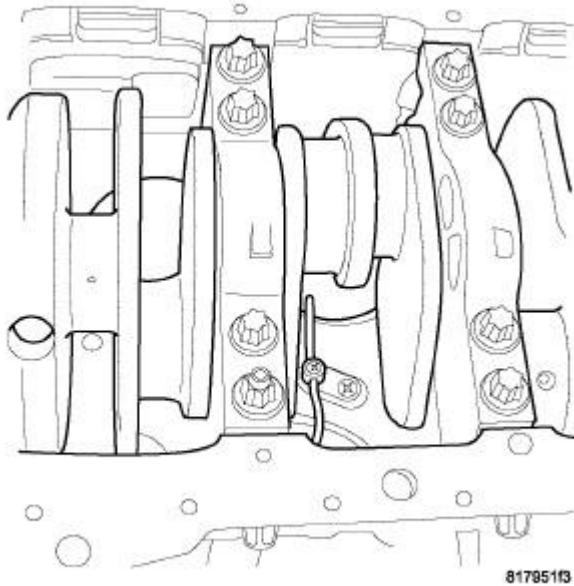


Fig. 377: Oil Jet

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

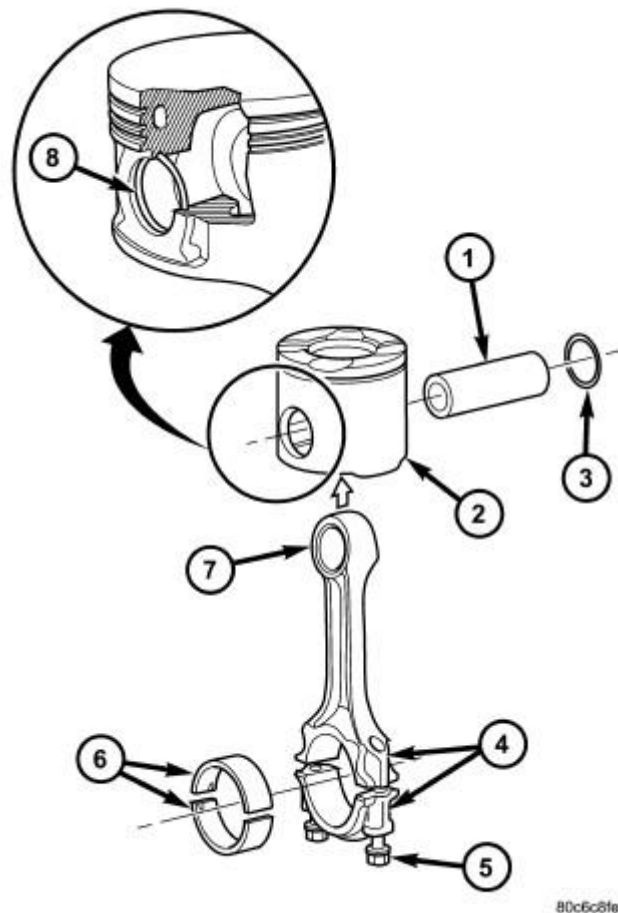


Fig. 378: PISTON AND CONNECTING ROD ASSEMBLY

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 **Engine - Specifications**.
6. Repeat this procedure for the remaining pistons and connecting rod assemblies.

PISTON RING - REMOVAL

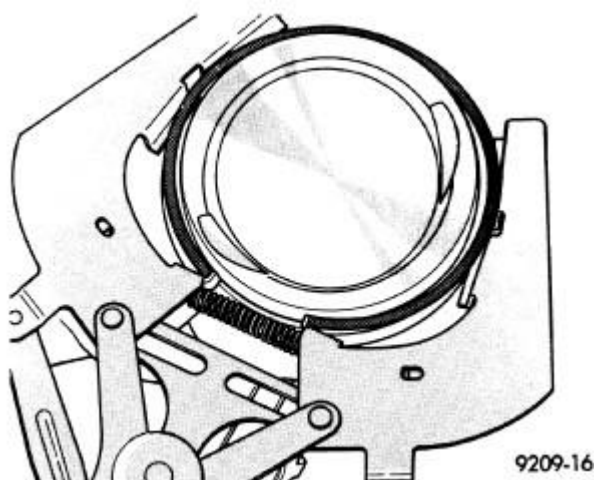


Fig. 379: PISTON RINGS - REMOVAL/INSTALLATION
Courtesy of CHRYSLER LLC

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 Engine - 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

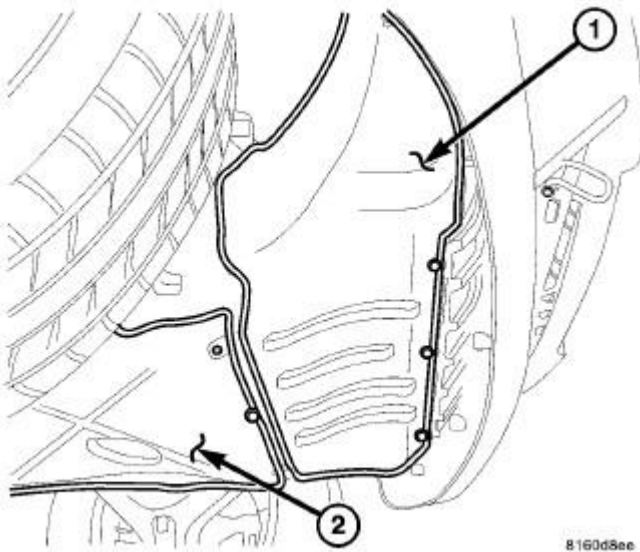


Fig. 380: FRONT SPLASH SHIELDS
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - FRONT SPLASH SHIELD
2 - INTERMEDIATE SPLASH SHIELD |
|---|

1. Disconnect negative battery cable.

2. Raise and support the vehicle.
3. Remove both front lower splash shields.

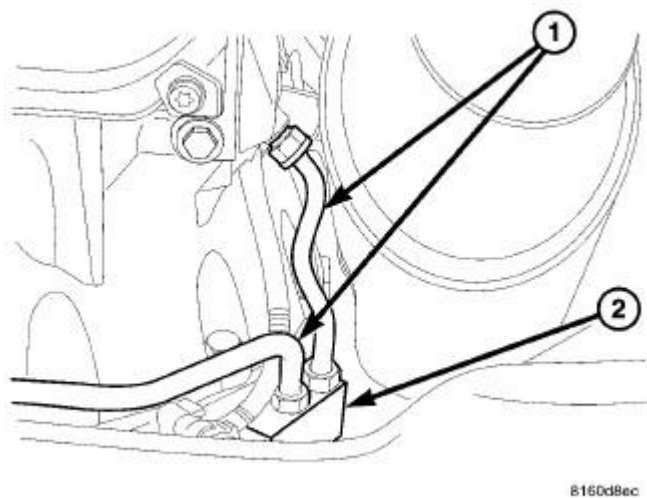


Fig. 381: TRANSMISSION THEROMO-BLOCK
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - TRANSMISSION COOLER LINES
2 - THERMO-BLOCK</p> |
|---|

4. Remove the transmission thermal bypass valve and the cooler lines between the block and transmission.

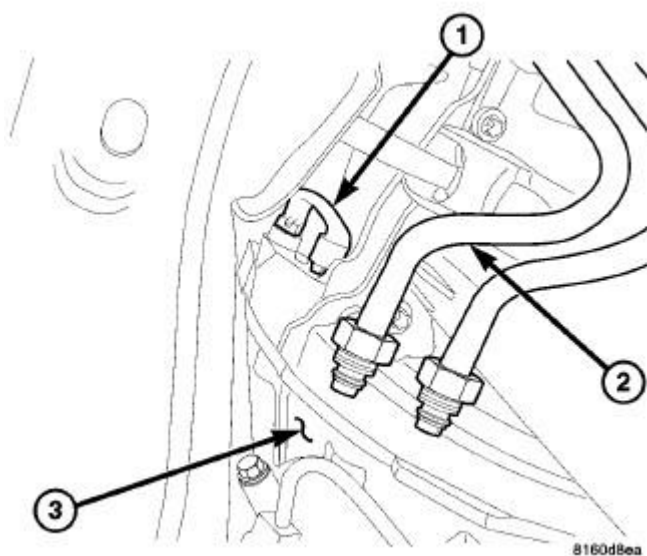


Fig. 382: SPECIAL TOOL #9102 CRANKSHAFT LOCK
Courtesy of CHRYSLER LLC

- 1 - #9102 CRANKSHAFT LOCK
- 2 - TRANSMISSION COOLER LINES
- 3 - TRANSMISSION

5. Remove the starter blank.
6. Install # 9102 flywheel locking tool .

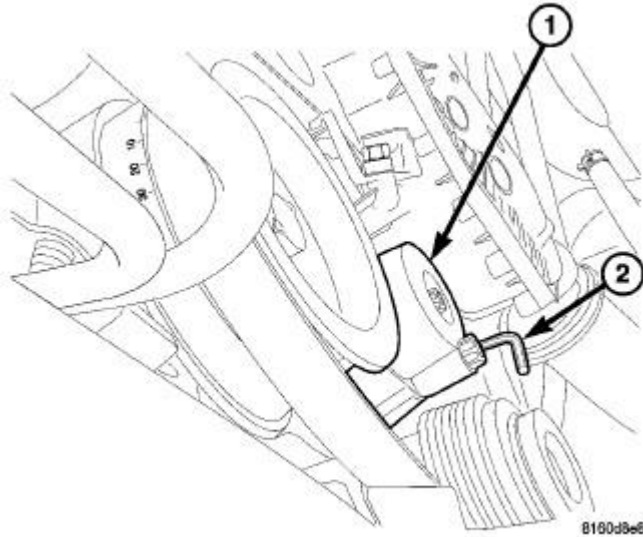


Fig. 383: DRIVE BELT TENSIONER RESET
Courtesy of CHRYSLER LLC

- 1 - DRIVE BELT TENSIONER
- 2 - DRIFT OR PIN

7. Release the accessory drive belt tension by resetting the drive belt tensioner and installing a retaining pin.

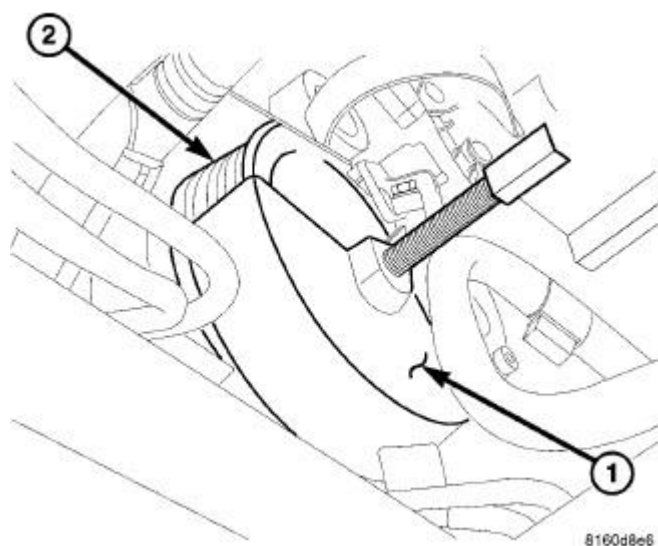


Fig. 384: SPECIAL TOOL #9544 VIBRATION DAMPER PULLER
Courtesy of CHRYSLER LLC

- | |
|------------------------|
| 1 - SPECIAL TOOL #9544 |
| 2 - VIBRATION DAMPER |

8. Remove the vibration damper bolt.
9. Install special tool #9544 (1) vibration damper puller.
10. Remove the vibration damper (2).

CAUTION: Care must be taken when removing the crankshaft seal. DO NOT damage or gouge the timing chain cover.

11. Using suitable seal puller, remove the front crankshaft seal.

Installation

INSTALLATION

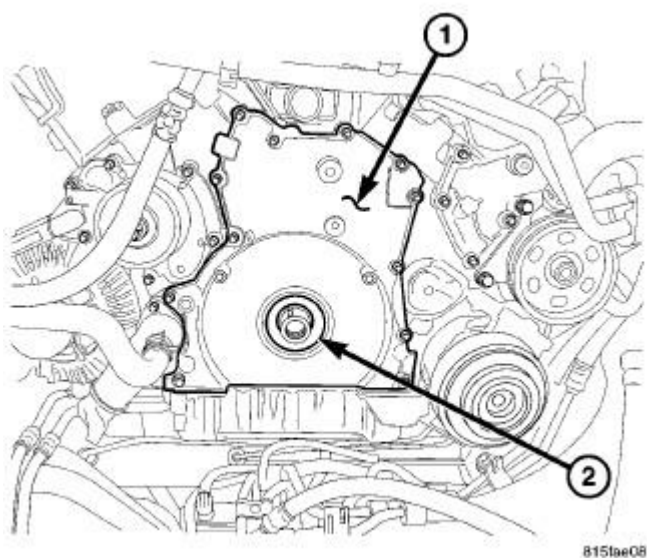


Fig. 385: FRONT TIMING COVER

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. Install crankshaft oil seal (2) using Installer 8936A.
3. Align the alignment key in the crankshaft with the key way in the damper and install the vibration damper. Tighten bolt to 304 N.m, plus 90° (224 ft. lbs., plus 90°).

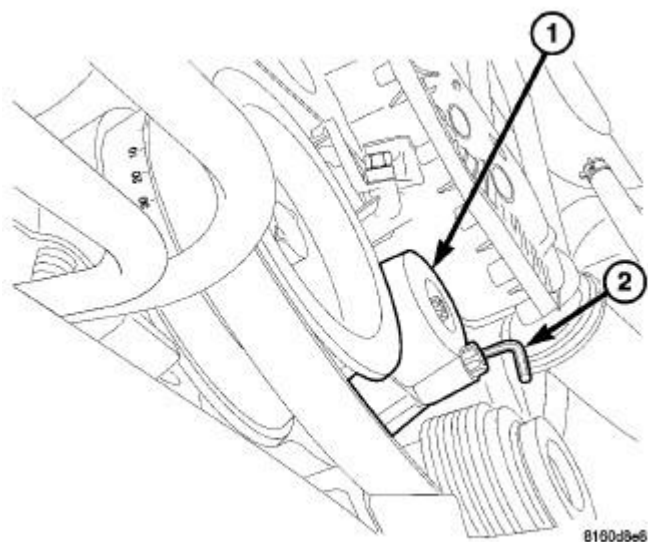


Fig. 386: DRIVE BELT TENSIONER RESET
Courtesy of CHRYSLER LLC

1 - DRIVE BELT TENSIONER
2 - DRIFT OR PIN

4. Position the drive belt back onto the pulleys and release the belt tensioner.

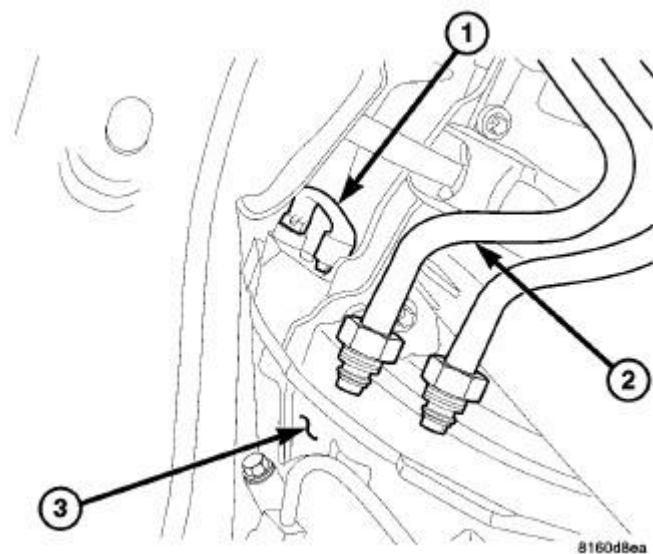


Fig. 387: SPECIAL TOOL #9102 CRANKSHAFT LOCK
Courtesy of CHRYSLER LLC

1 - CRANKSHAFT LOCK 9102
2 - TRANSMISSION COOLER LINES

3 - TRANSMISSION

5. Remove Crankshaft Lock 9102. .

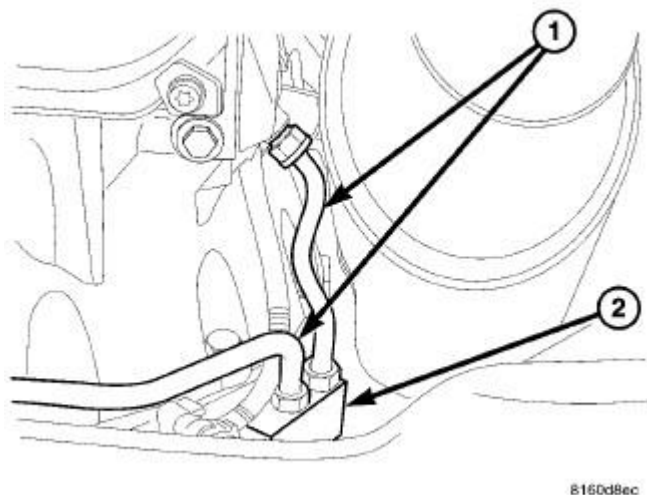


Fig. 388: TRANSMISSION THERO-BLOCK
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - TRANSMISSION COOLER LINES
2 - THERMO-BLOCK</p> |
|---|

6. Install the transmission thermal bypass valve (2) and transmission cooler lines (1) .

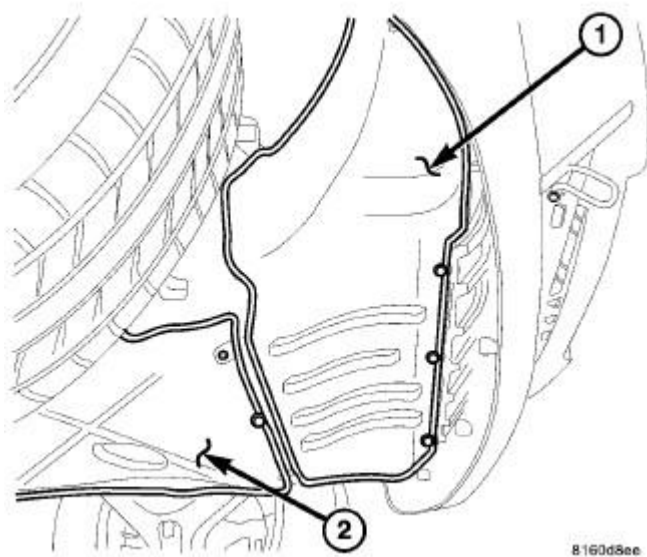


Fig. 389: FRONT SPLASH SHIELDS

Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - FRONT SPLASH SHIELD
2 - INTERMEDIATE SPLASH SHIELD |
|---|

7. Install the intermediate (2) and front (1) underbody splash shields.
8. Lower the vehicle.
9. Connect negative battery cable.

SEAL, CRANKSHAFT OIL, REAR

Description

DESCRIPTION

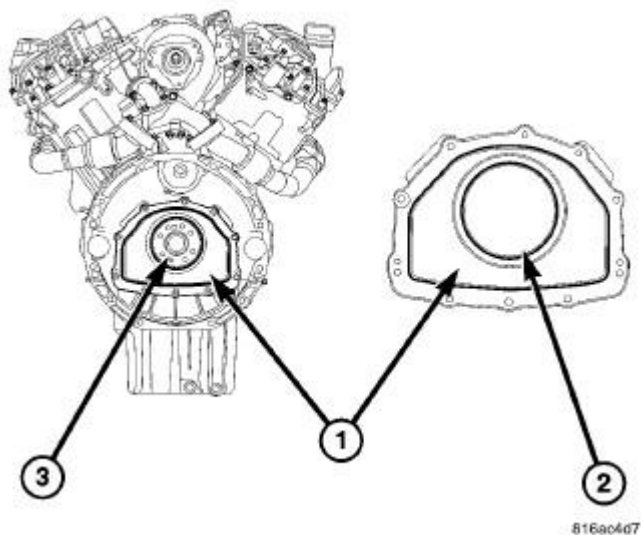


Fig. 390: REAR MAIN SEAL CARRIER

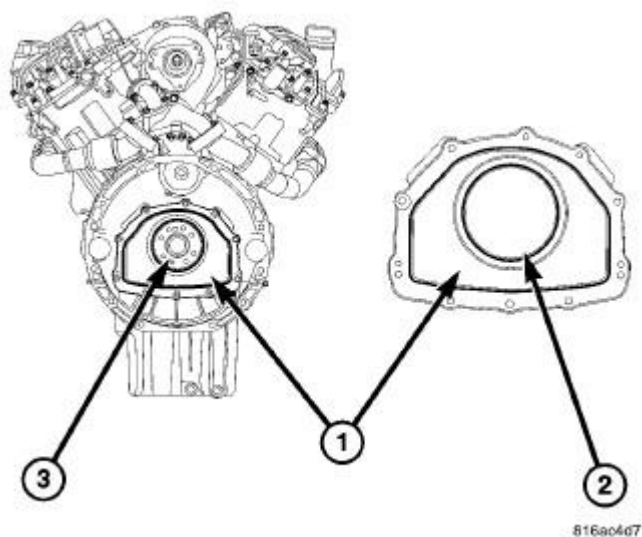
Courtesy of CHRYSLER LLC

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 is bolted to the cylinder block and oil pan. 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 (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. 391: 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

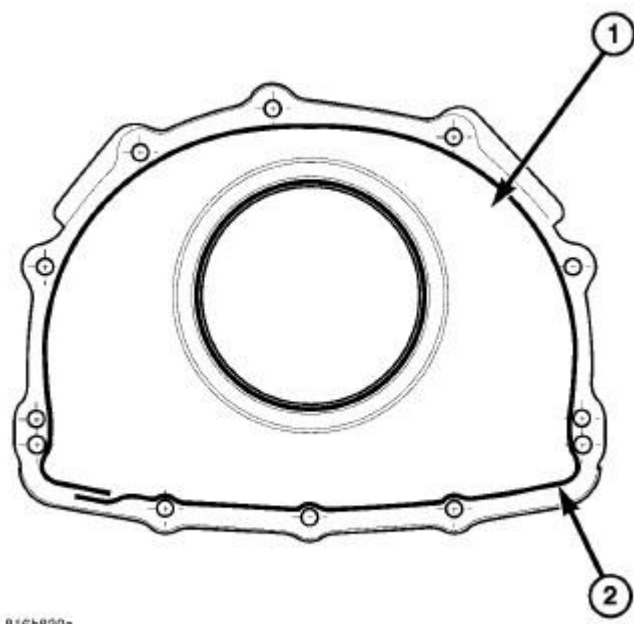


Fig. 392: Sealant Application Pattern
Courtesy of CHRYSLER LLC

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.).

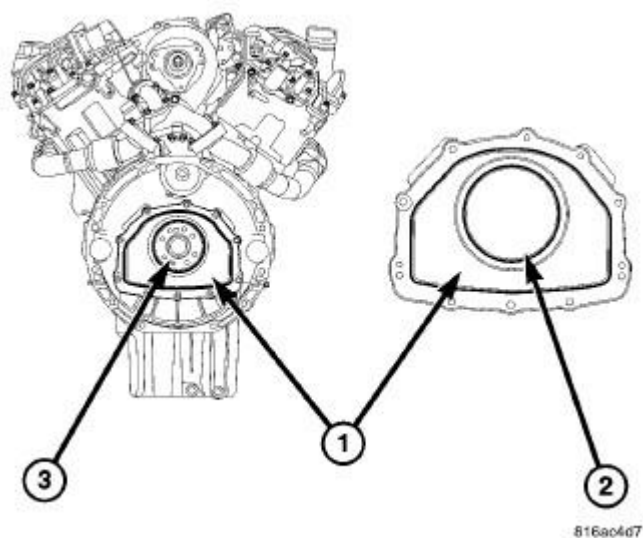


Fig. 393: REAR MAIN SEAL CARRIER
Courtesy of CHRYSLER LLC

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 **Engine/Engine Block/FLEXPLATE - Installation.**
5. Install the transmission. Refer to **Transmission and Transfer Case/Automatic - NAG1 - Installation .**

ENGINE MOUNTING

INSULATOR, ENGINE MOUNT, LEFT

Removal

REMOVAL

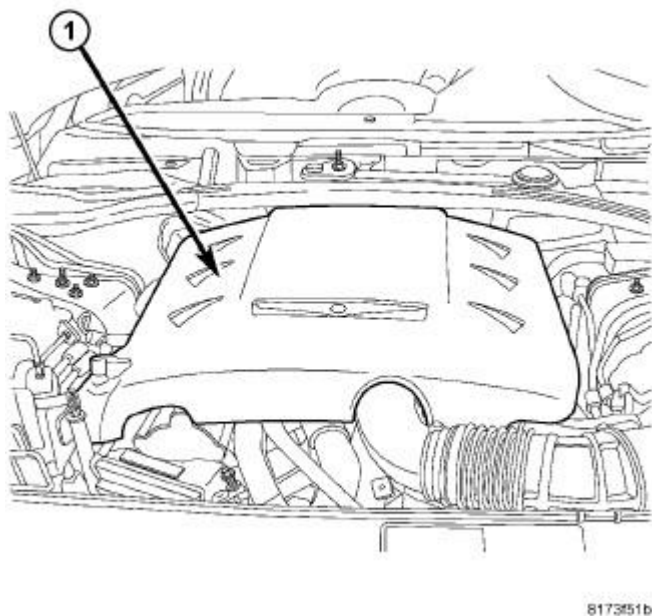


Fig. 394: ENGINE COVER

Courtesy of CHRYSLER LLC

1. Remove the engine cover (1) and brackets. See **Engine - Removal.**
2. Remove the coolant recovery bottle.

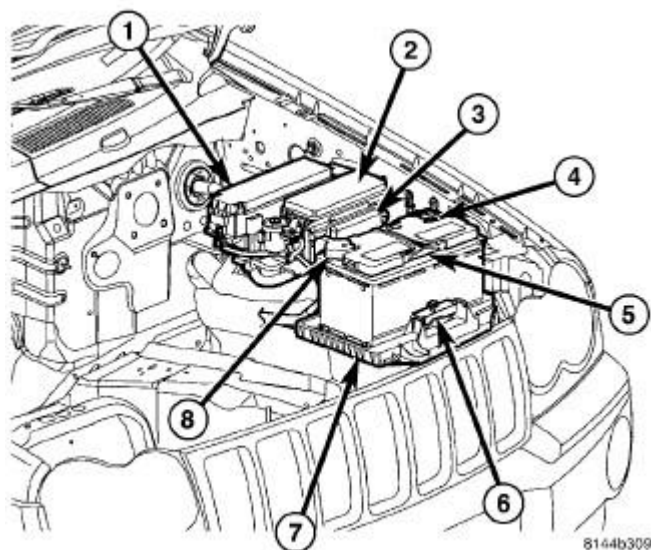


Fig. 395: Identifying Battery System Components, Power Distribution Center & Integrated Power Module

Courtesy of CHRYSLER LLC

3. Disconnect the positive and negative battery cables (8, 4). Refer to **Electrical/Battery System/CABLES, Battery - Removal**.
4. Remove the battery (5) and battery tray (7). Refer to **Electrical/Battery System/TRAY, Battery - Removal**.
5. Disconnect all Power Distribution Center (PDC) (1) and generator wiring harness cables and position aside.
6. Disconnect the PDC and support bracket and position aside.

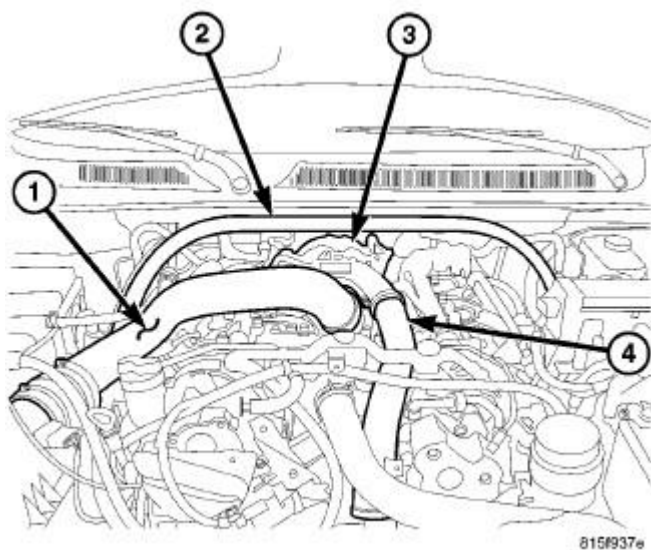


Fig. 396: STRUT TOWER SUPPORT

Courtesy of CHRYSLER LLC

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

7. Remove the strut tower support (2).

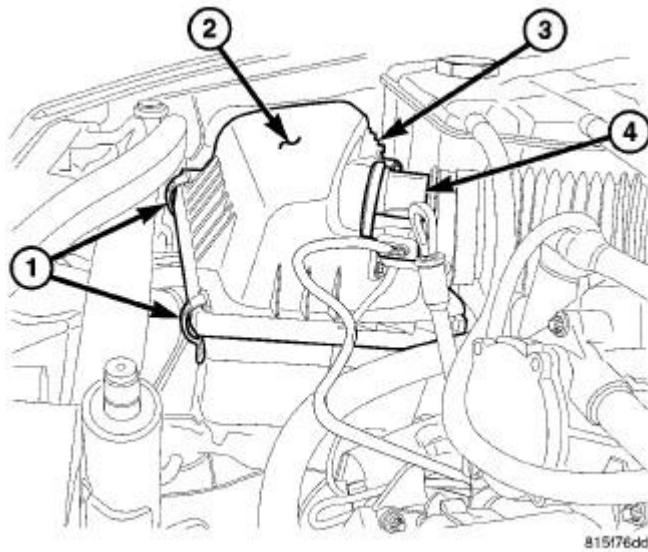


Fig. 397: AIR CLEANER COVER

Courtesy of CHRYSLER LLC

8. Remove the air cleaner housing (2) and duct.

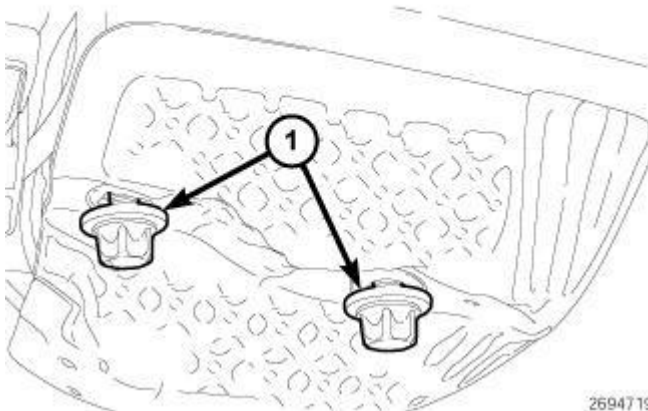
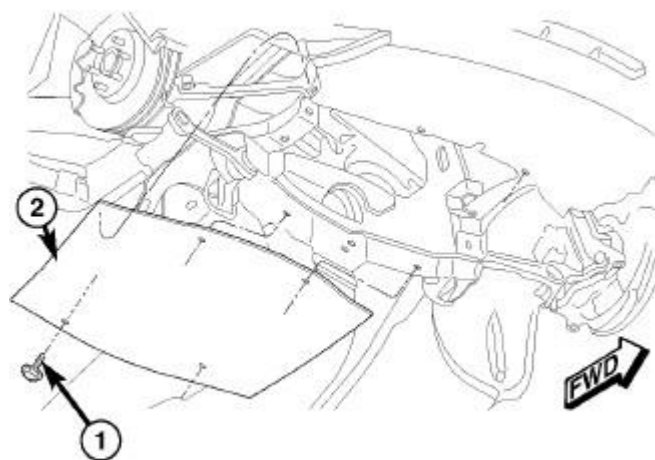


Fig. 398: Left Engine Mount Heat Shield Retaining Bolts
Courtesy of CHRYSLER LLC

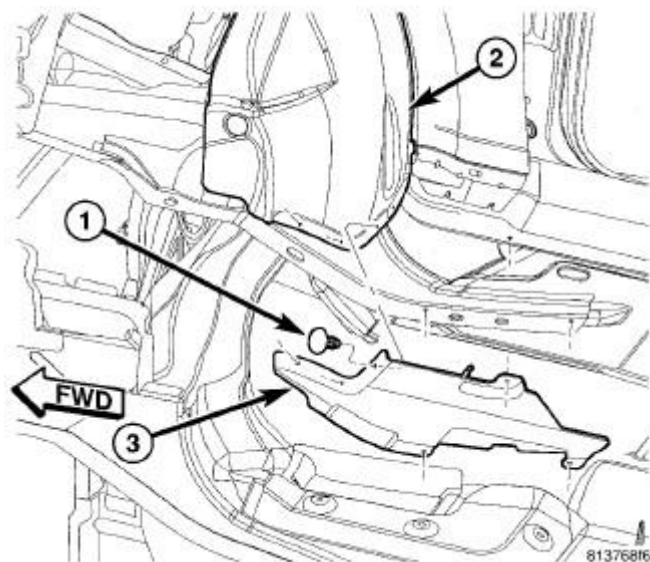
9. Remove the left engine mount heat shield retaining bolts (1) and remove the heat shield.
10. Raise and support the vehicle.



813530c9

Fig. 399: Rear Belly Pan
Courtesy of CHRYSLER LLC

11. Removed the belly pan (2).



81376816

Fig. 400: Removing/Installing Shield
Courtesy of CHRYSLER LLC

12. Remove the left tire and wheel.
13. Remove the push-pins (1) that secure the left lower front wheelhouse shield (3) to the body.
14. Remove the left lower front wheelhouse shield from the vehicle.

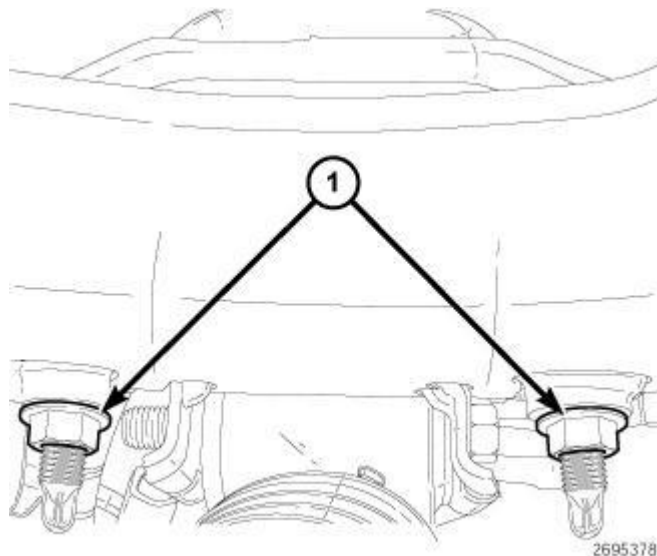


Fig. 401: Right Lower Engine Mount Retaining Nuts
Courtesy of CHRYSLER LLC

15. Remove the right lower engine mount retaining nuts (1) at the frame.

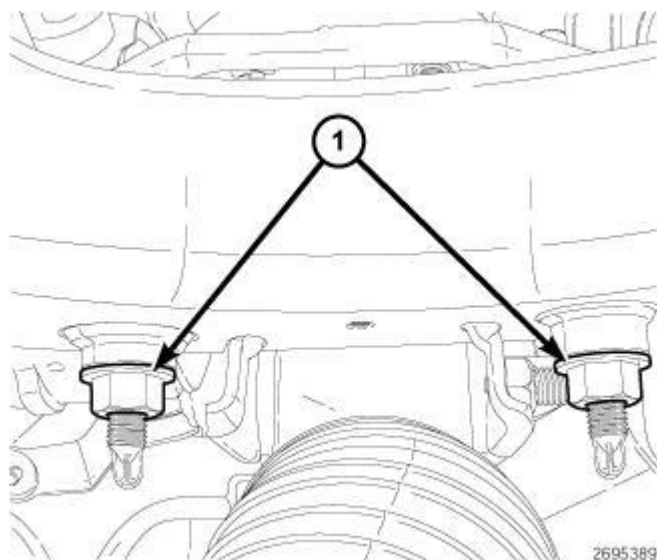


Fig. 402: Left Lower Engine Mount Retaining Nuts
Courtesy of CHRYSLER LLC

16. Remove the left lower engine mount retaining nuts (1) at the frame.
17. Lower the vehicle.

NOTE: Care must be taken not to crush the turbocharger against the windshield cowl when raising and supporting the engine.

18. Using Engine Support Fixture 8534B, lift engine enough to gain access to the engine mount without damaging the turbocharger.

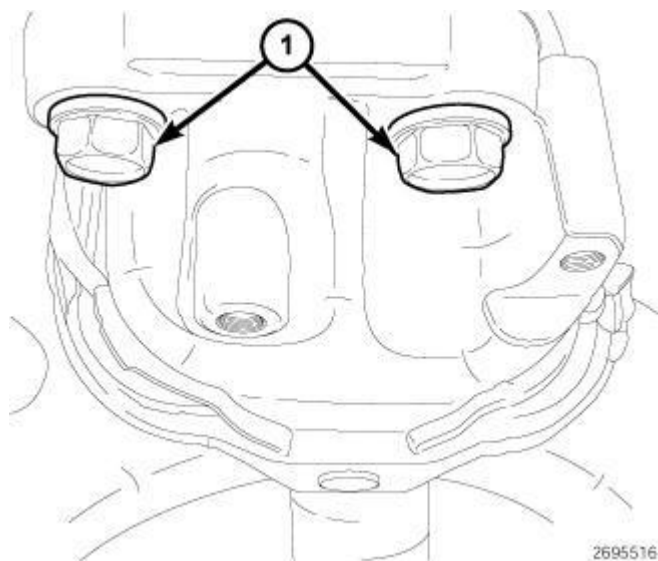


Fig. 403: Left Upper Engine Mount Retaining Bolts
Courtesy of CHRYSLER LLC

19. Remove the left upper engine mount retaining bolts (1).
20. Remove the left engine mount.

Installation

INSTALLATION

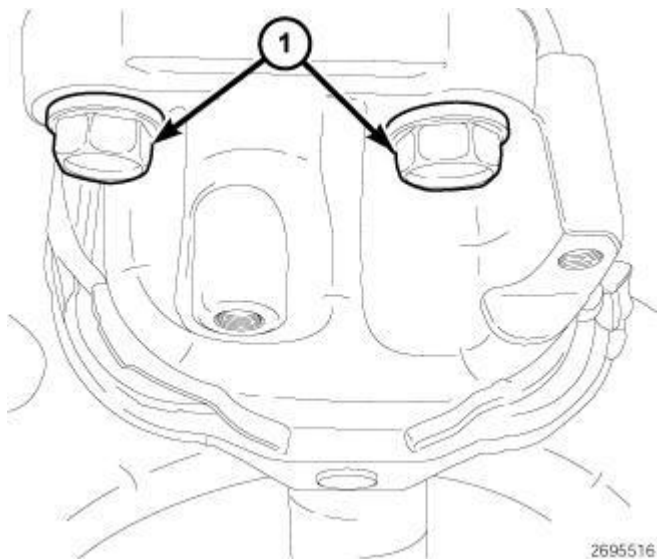


Fig. 404: Left Upper Engine Mount Retaining Bolts
Courtesy of CHRYSLER LLC

1. Install the left upper engine mount retaining bolts (1) and tighten to 58 N.m (42 ft. lbs.).
2. Lower the vehicle.
3. Lower the engine into position and remove Engine Support Fixture 8534B.
4. Raise and support the vehicle.

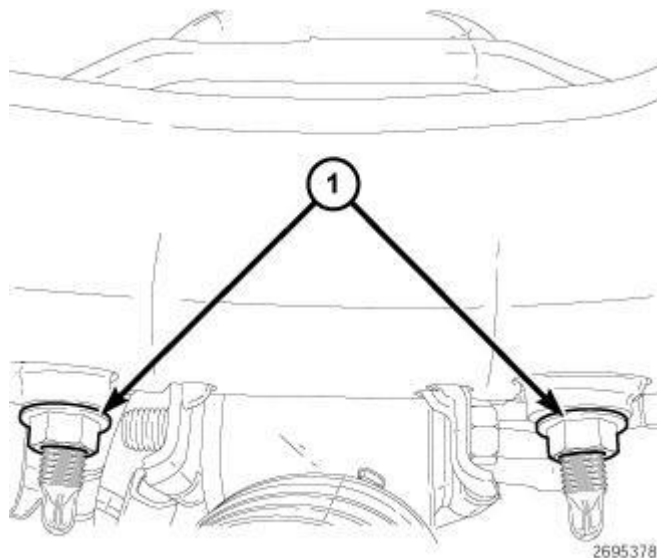


Fig. 405: Right Lower Engine Mount Retaining Nuts
Courtesy of CHRYSLER LLC

5. Install the left lower engine mount retaining nuts (1) and tighten to 60 N.m (44 ft. lbs.).

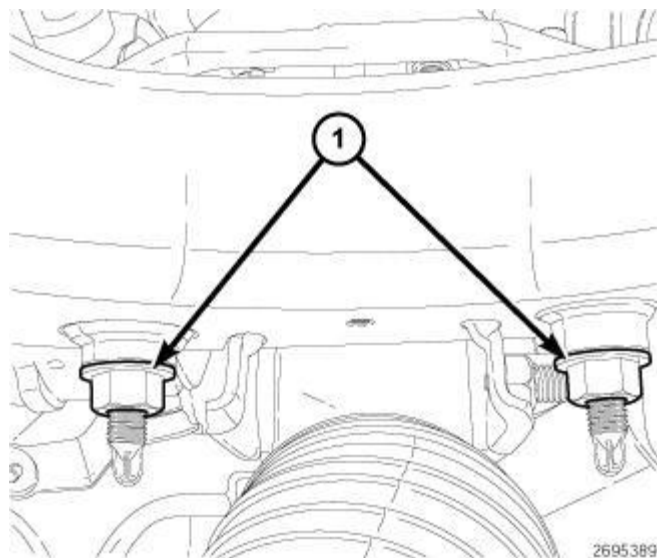


Fig. 406: Left Lower Engine Mount Retaining Nuts
Courtesy of CHRYSLER LLC

6. Install the right lower engine mount retaining nuts (1) and tighten to 60 N.m (44 ft. lbs.).

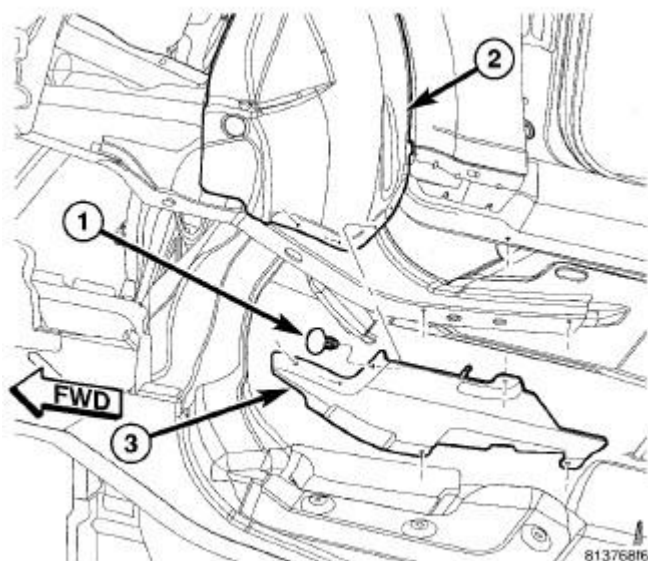


Fig. 407: Removing/Installing Shield
Courtesy of CHRYSLER LLC

7. Position the left lower front wheelhouse shield and install the push-pins (1).
8. Install the tire and wheel.

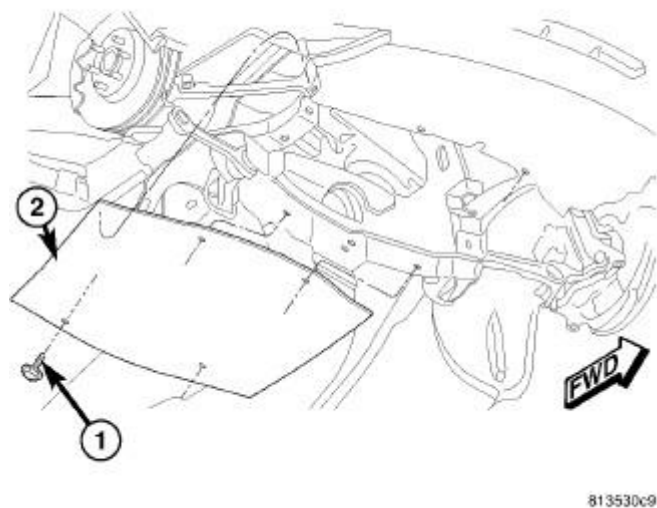


Fig. 408: Rear Belly Pan
Courtesy of CHRYSLER LLC

9. Install the belly pan (2).
10. Lower the vehicle.

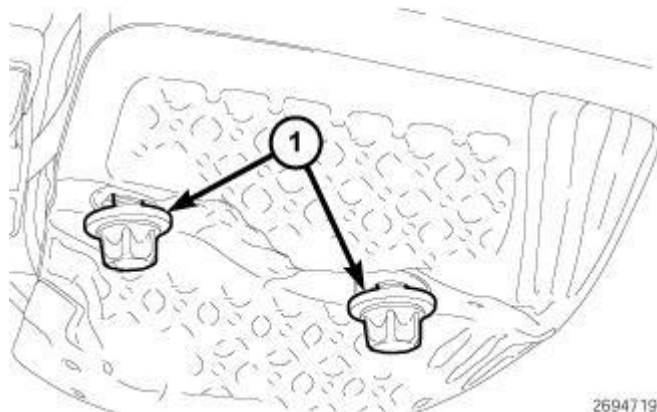


Fig. 409: Left Engine Mount Heat Shield Retaining Bolts
Courtesy of CHRYSLER LLC

11. Position the left engine mount heat shield, install retaining bolts (1) and tighten to 8 N.m (70 in. lbs.).

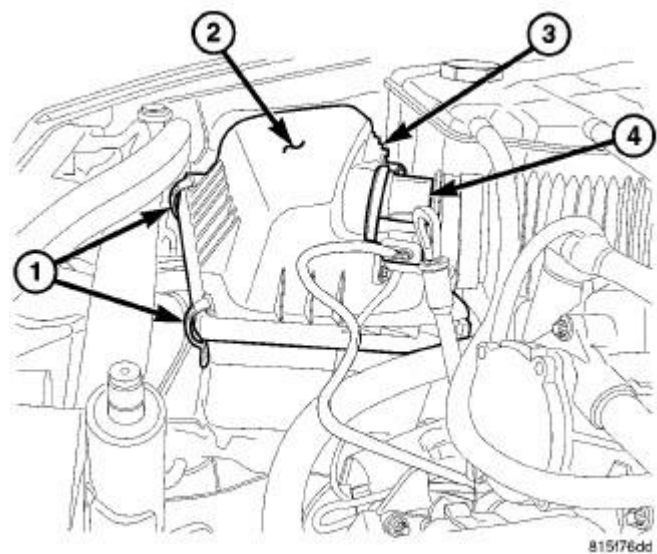


Fig. 410: AIR CLEANER COVER
Courtesy of CHRYSLER LLC

12. Install the air cleaner housing (2) and duct.

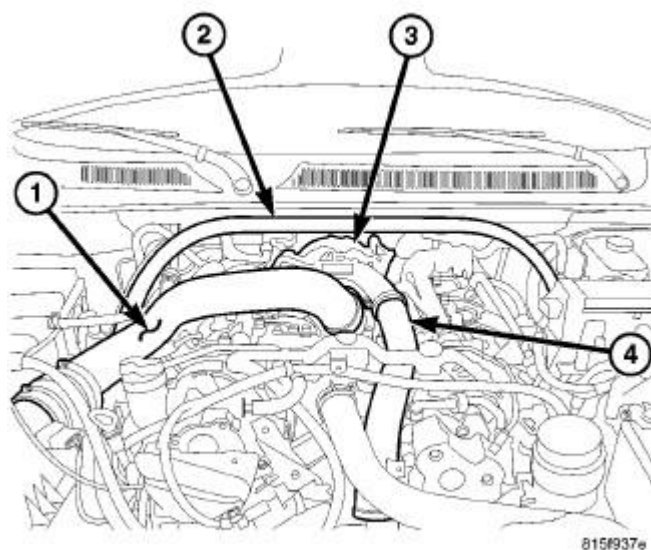


Fig. 411: STRUT TOWER SUPPORT

Courtesy of CHRYSLER LLC

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

13. Install the strut tower support (2).

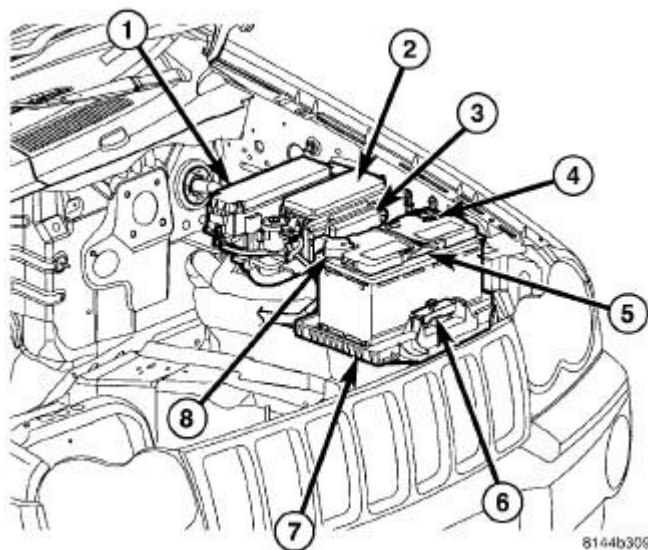


Fig. 412: Identifying Battery System Components, Power Distribution Center & Integrated Power Module

Courtesy of CHRYSLER LLC

14. Position the Power Distribution Center (PDC) (1) and connect support bracket.
15. Position and connect all PDC and generator wiring harness cables.
16. Install the battery tray (7) and battery (5). Refer to **Electrical/Battery System/TRAY, Battery - Installation** .
17. Connect the positive and negative battery cables (8, 4). Refer to **Electrical/Battery System/CABLES, Battery - Installation** .
18. Install the coolant recovery bottle.

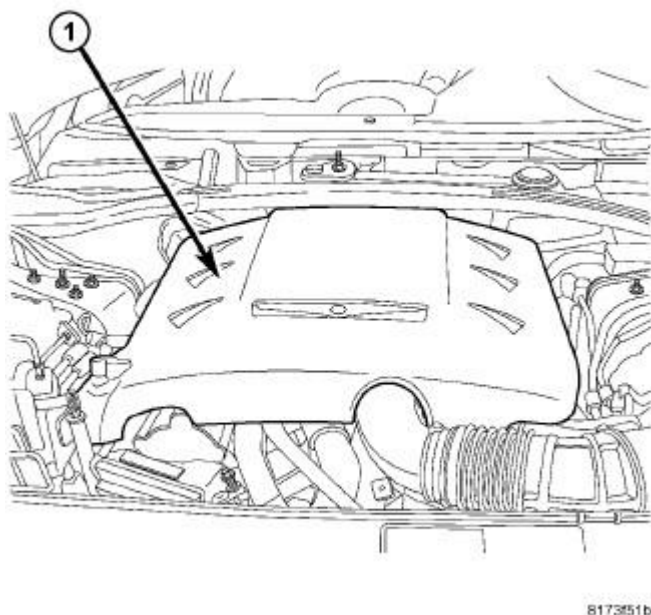


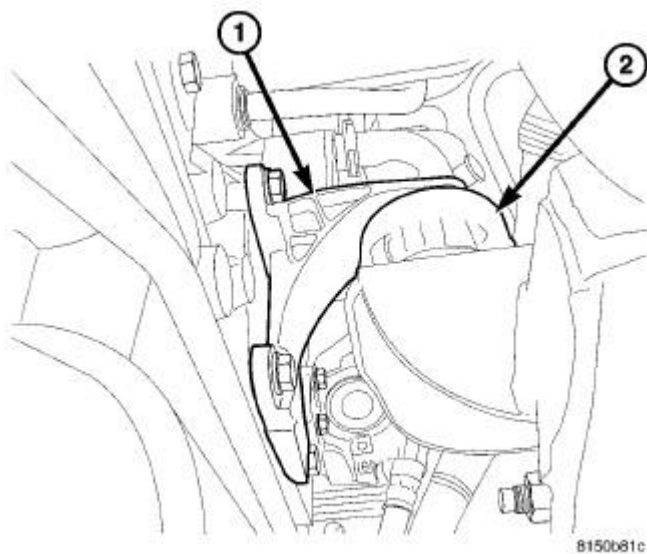
Fig. 413: ENGINE COVER
Courtesy of CHRYSLER LLC

19. Install the engine cover brackets and engine cover (1). See **Engine - Installation**.

INSULATOR, ENGINE MOUNT, RIGHT

Removal

REMOVAL

**Fig. 414: RIGHT ENGINE MOUNT**

Courtesy of CHRYSLER LLC

1 - RIGHT ENGINE MOUNT BRACKET

2 - RIGHT ENGINE MOUNT

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

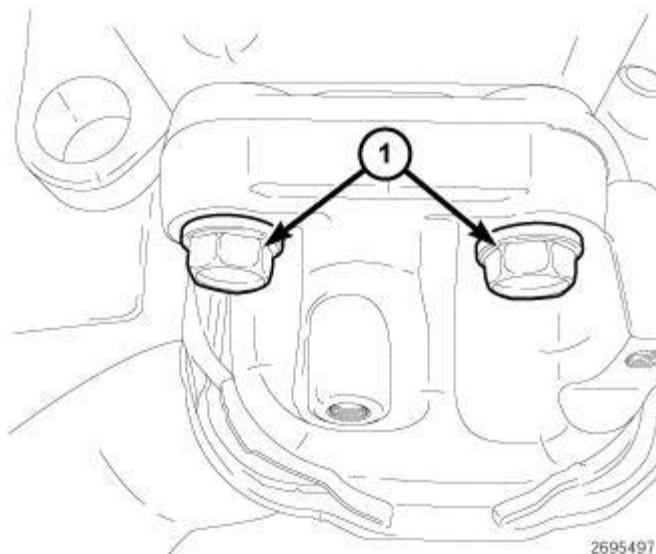


Fig. 415: Right Upper Engine Mount Retaining Bolts
Courtesy of CHRYSLER LLC

1. Position the right engine mount, install retaining bolts (1) and tighten to 58 N.m (42 ft. lbs.).
2. Lower the vehicle.
3. Lower the engine into position and remove Engine Support Fixture 8534B.
4. Raise and support the vehicle.

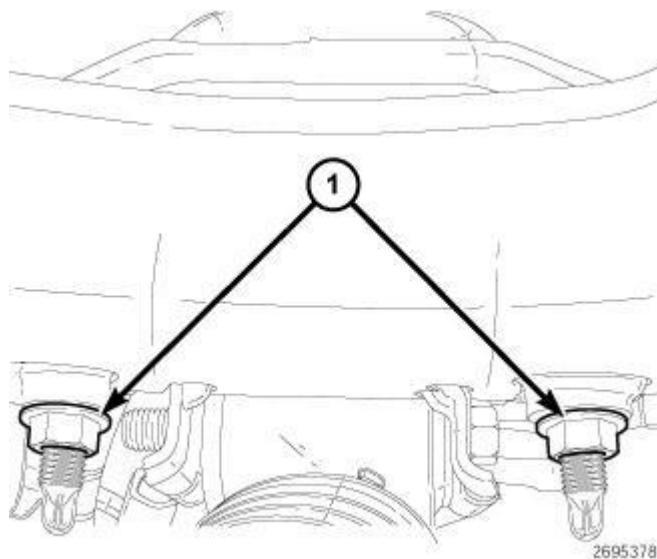


Fig. 416: Right Lower Engine Mount Retaining Nuts
Courtesy of CHRYSLER LLC

5. Install the left lower engine mount retaining nuts (1) and tighten to 60 N.m (44 ft. lbs.).

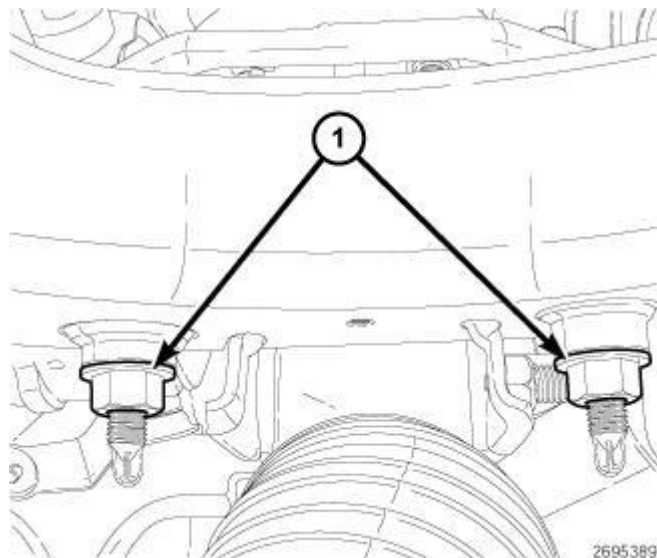


Fig. 417: Left Lower Engine Mount Retaining Nuts
 Courtesy of CHRYSLER LLC

6. Install the right lower engine mount retaining nuts (1) and tighten to 60 N.m (44 ft. lbs.).

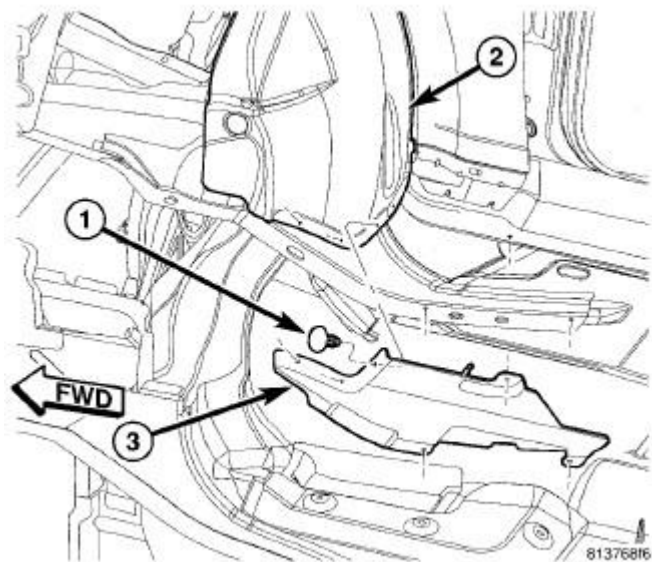


Fig. 418: Removing/Installing Shield
 Courtesy of CHRYSLER LLC

7. Position the right lower front wheelhouse shield and install the push-pins (1), (left side shown in illustration right side similar).
8. Install the tire and wheel.

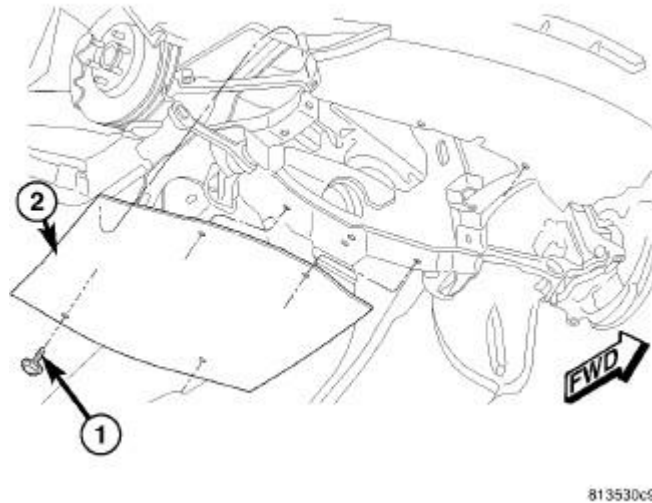


Fig. 419: Rear Belly Pan
Courtesy of CHRYSLER LLC

9. Install the belly pan (2).
10. Lower the vehicle.

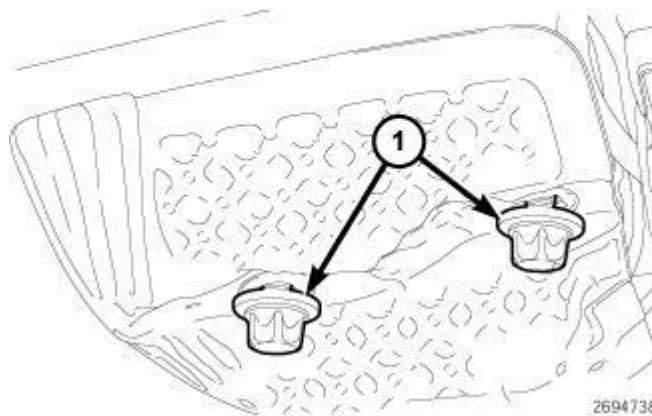


Fig. 420: Right Engine Mount Heat Shield Retaining Bolts
Courtesy of CHRYSLER LLC

11. Position the right engine mount heat shield, install retaining bolts (1) and tighten to 8 N.m (70 in. lbs.).

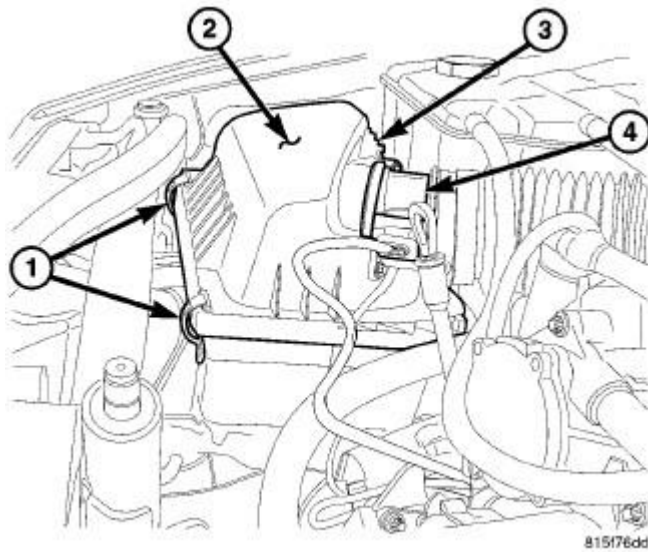


Fig. 421: AIR CLEANER COVER
Courtesy of CHRYSLER LLC

12. Install the air cleaner housing (2) and duct.

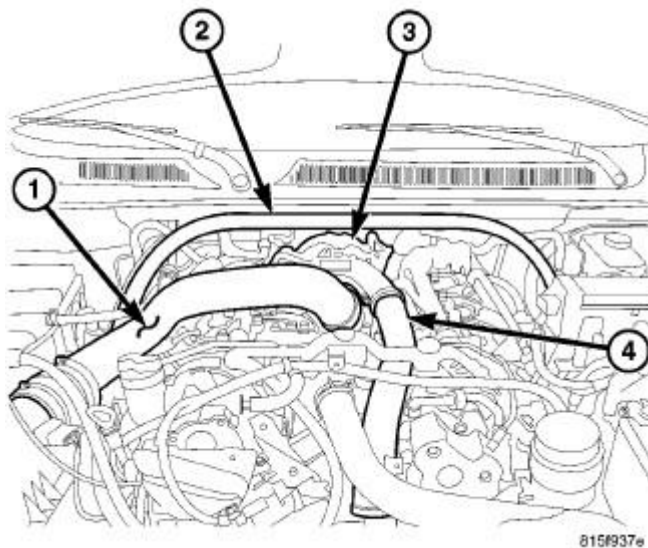


Fig. 422: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

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

13. Install the strut tower support (2).

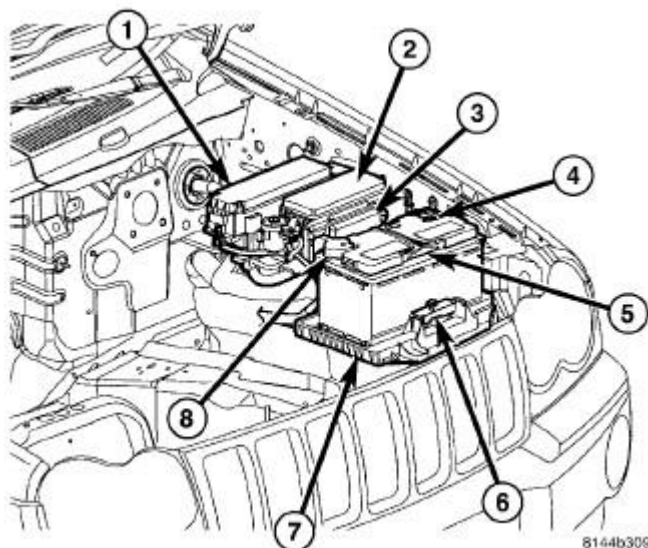


Fig. 423: Identifying Battery System Components, Power Distribution Center & Integrated Power Module

Courtesy of CHRYSLER LLC

14. Position the Power Distribution Center (PDC) (1) and connect support bracket.
15. Position and connect all PDC and generator wiring harness cables.
16. Install the battery tray (7) and battery (5). Refer to **Electrical/Battery System/TRAY, Battery - Installation** .
17. Connect the positive and negative battery cables (8, 4). Refer to **Electrical/Battery System/CABLES, Battery - Installation** .
18. Install the coolant recovery bottle.

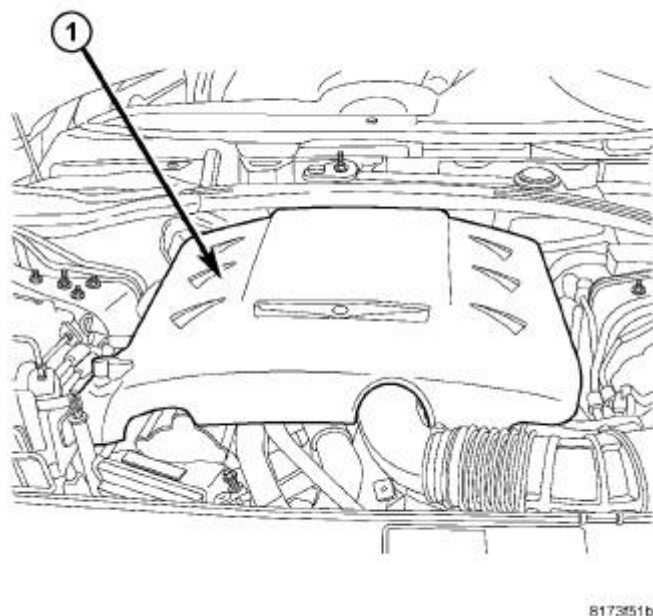


Fig. 424: ENGINE COVER
Courtesy of CHRYSLER LLC

19. Install the engine cover brackets and engine cover (1). See Engine - Installation.

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

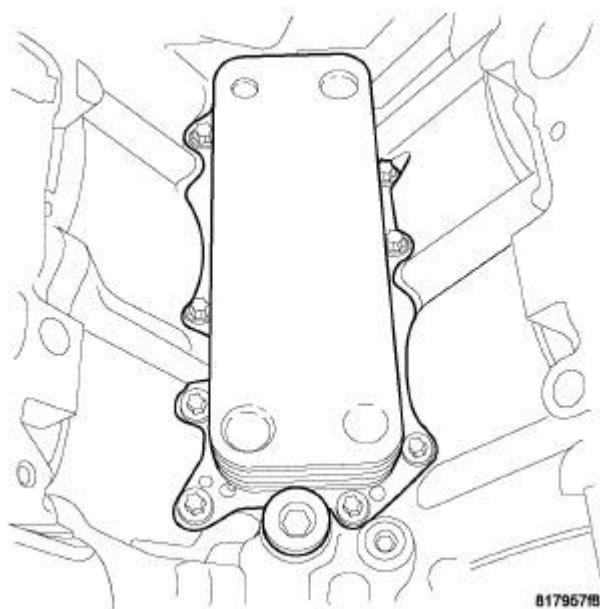


Fig. 425: Heat Exchanger
Courtesy of CHRYSLER LLC

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.

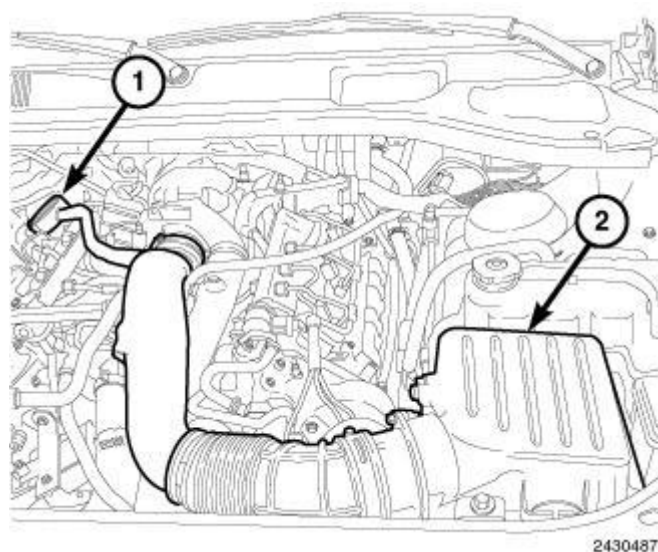


Fig. 426: Air Cleaner Assembly
Courtesy of CHRYSLER LLC

3. Remove the air cleaner assembly (2). See **Engine/Air Intake System/BODY, Air Cleaner - Removal.**
4. Remove the coolant reservoir and hoses.

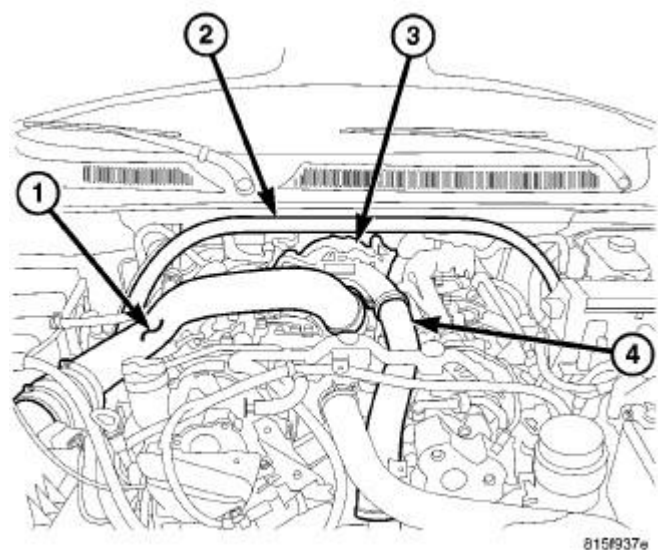


Fig. 427: Strut Tower Support
Courtesy of CHRYSLER LLC

5. Remove the charge air cooler hose between turbocharger and cooler (4).
6. Remove the turbocharger (3). See **Engine/Turbocharger System/TURBOCHARGER - Removal.**

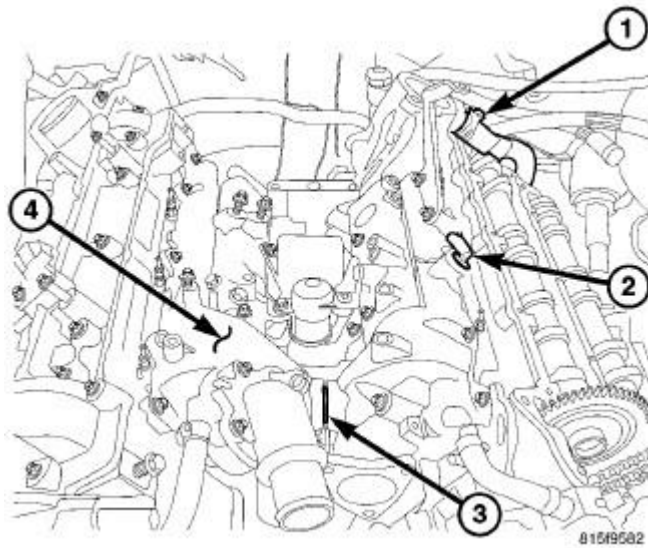


Fig. 428: Intake Manifold & Connections
Courtesy of CHRYSLER LLC

7. Remove the intake manifold (4). See **Engine/Manifolds/MANIFOLD, Intake - Removal.**

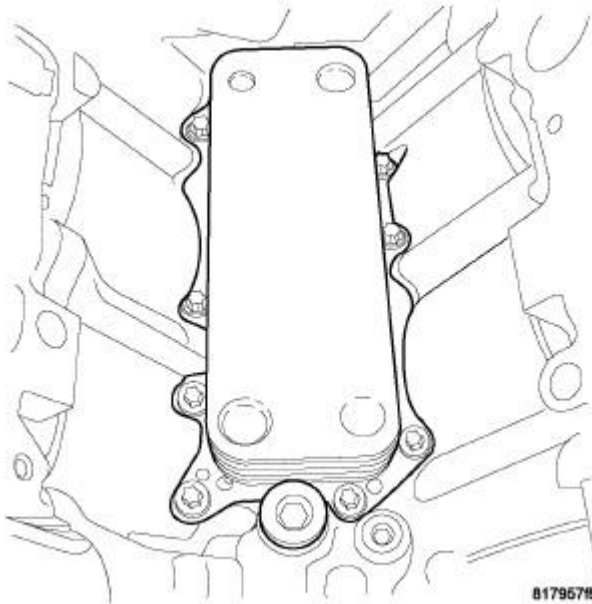
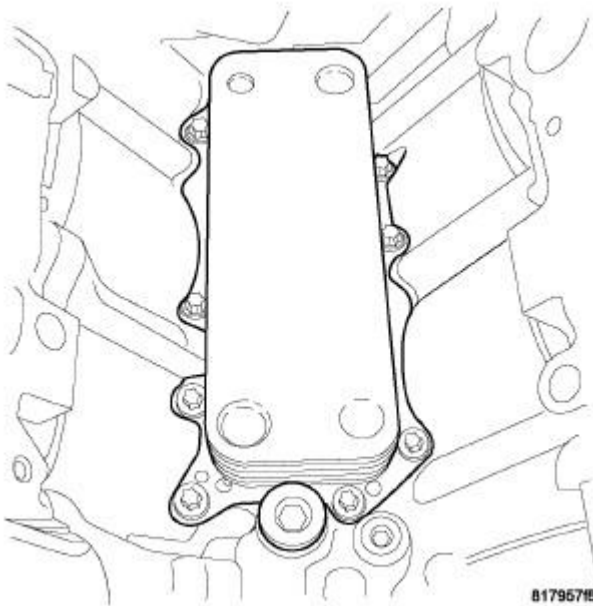


Fig. 429: Heat Exchanger
Courtesy of CHRYSLER LLC

8. Remove the engine oil cooler.

Installation

INSTALLATION

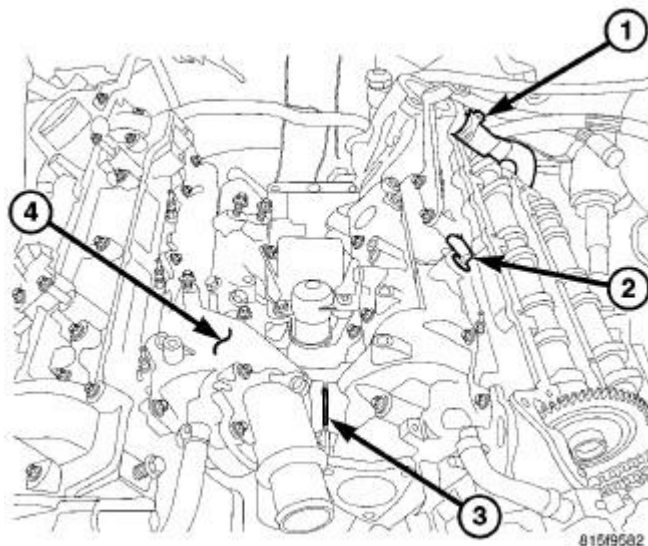


817957B

Fig. 430: 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.).



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Fig. 431: Intake Manifold & Connections

Courtesy of CHRYSLER LLC

3. Install the intake manifold (4). See [Engine/Manifolds/MANIFOLD, Intake - Installation](#).

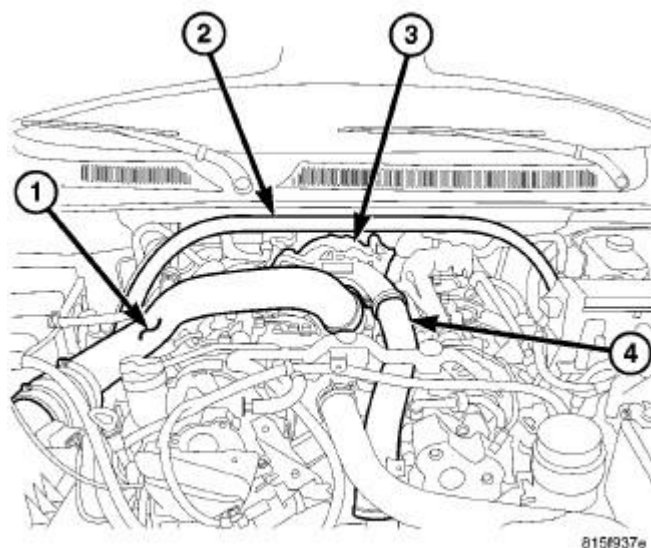


Fig. 432: Strut Tower Support
Courtesy of CHRYSLER LLC

4. Install the turbocharger (3). See [Engine/Turbocharger System/TURBOCHARGER - Installation](#).
5. Install the charge air hose (4).
6. Install coolant reservoir and hoses.
7. Install air cleaner assembly. See [Engine/Air Intake System/BODY, Air Cleaner - 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

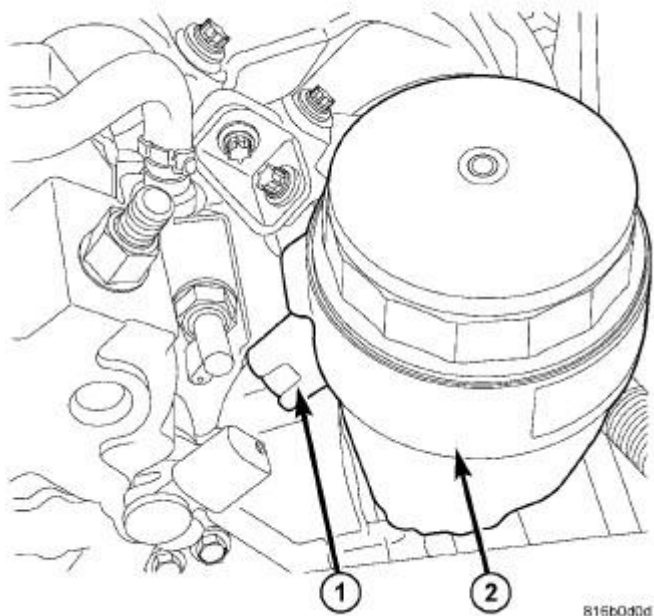


Fig. 433: Oil Filter Housing
Courtesy of CHRYSLER LLC

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.

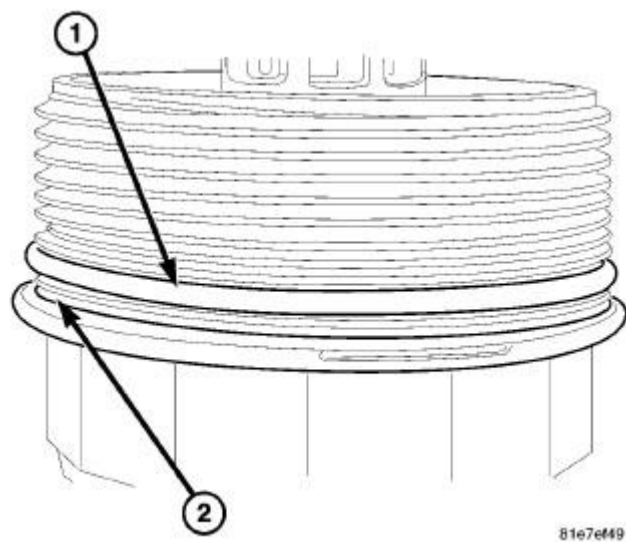
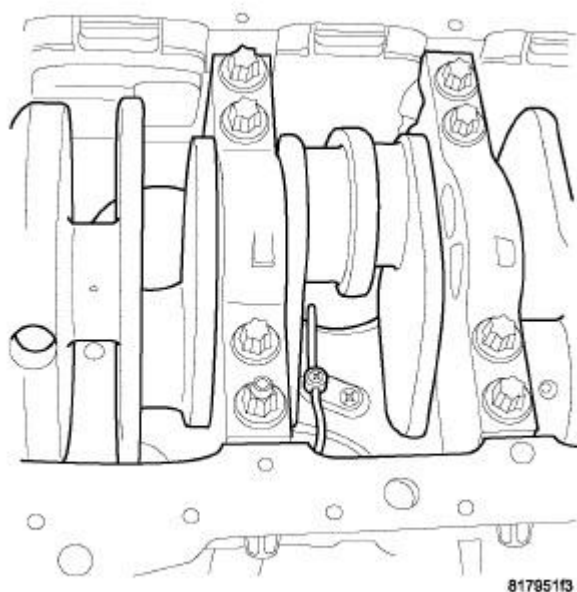


Fig. 434: O-RING LOCATION

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. 435: 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**

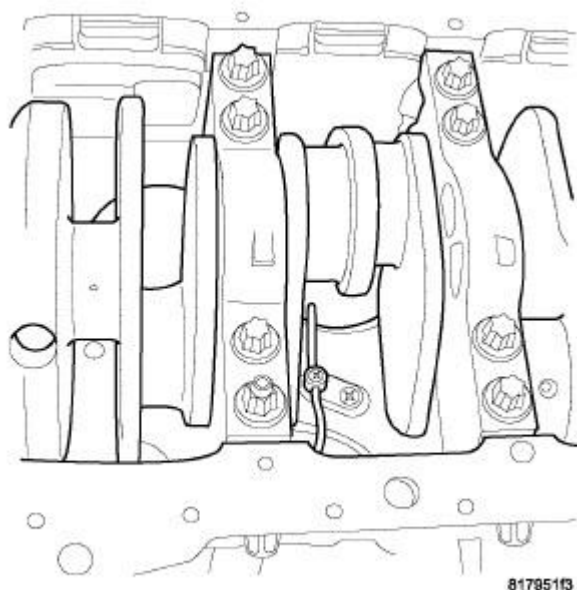


Fig. 436: Oil Jet

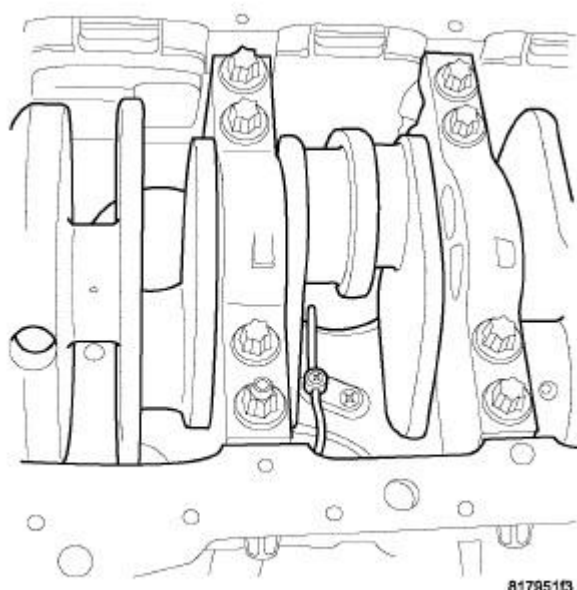
Courtesy of CHRYSLER LLC

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. 437: 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 section for oil specifications. Refer to **Vehicle Quick Reference/Capacities and Recommended Fluids - Description** .

PAN, OIL

Removal

REMOVAL

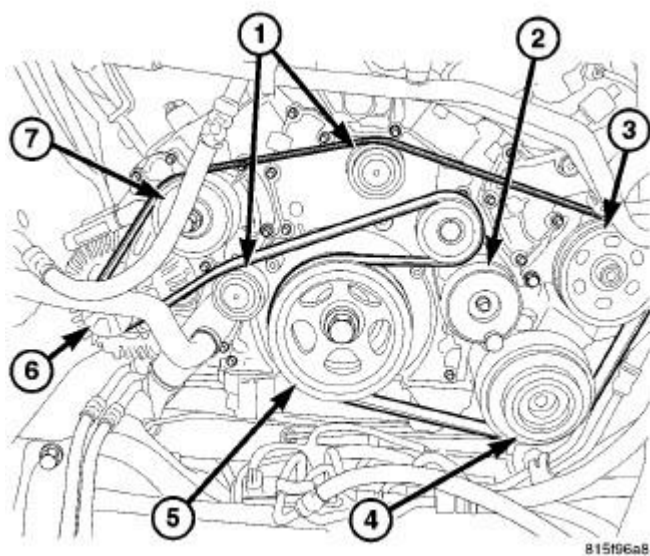


Fig. 438: ACCESSORY DRIVE BELT
Courtesy of CHRYSLER LLC

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

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

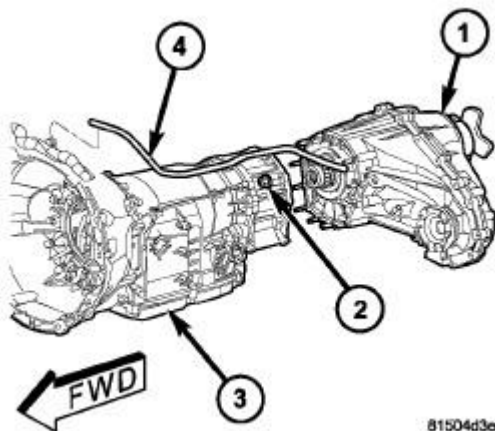


Fig. 439: Removing/Installing Transfer Case
Courtesy of CHRYSLER LLC

- 1 - NV140 TRANSFER CASE
- 2 - NUTS
- 3 - TRANSMISSION
- 4 - TRANSFER CASE VENT TUBE

3. Remove the transfer case. Refer to **Transmission and Transfer Case/Transfer Case - Description** .
4. Remove the transmission. Refer to **Transmission and Transfer Case/Automatic - NAG1 - Removal** .

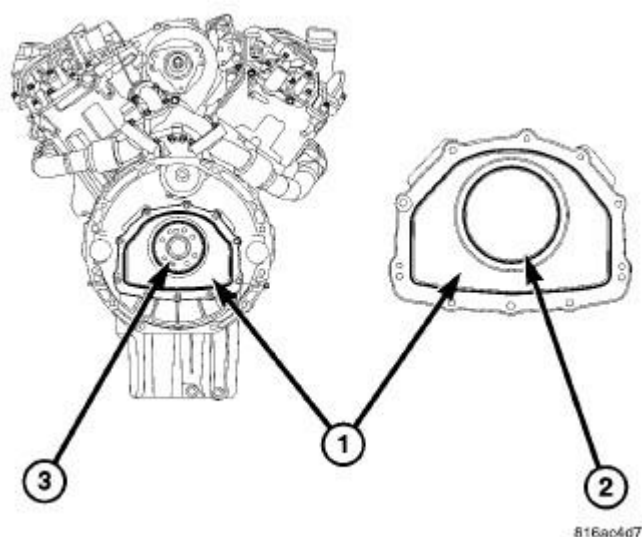


Fig. 440: REAR MAIN SEAL CARRIER
Courtesy of CHRYSLER LLC

5. Remove the flex plate. See **Engine/Engine Block/FLEXPLATE - Removal**.

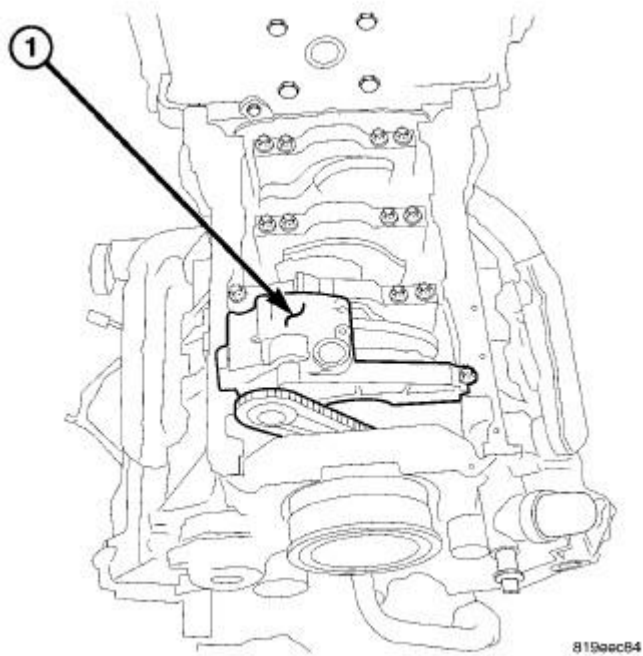


Fig. 441: Locating Oil Pump
Courtesy of CHRYSLER LLC

6. Remove the 5 bolts on the bottom of the rear main seal carrier.
7. Remove oil pan bolts.
8. Remove the oil pan.

Installation

INSTALLATION

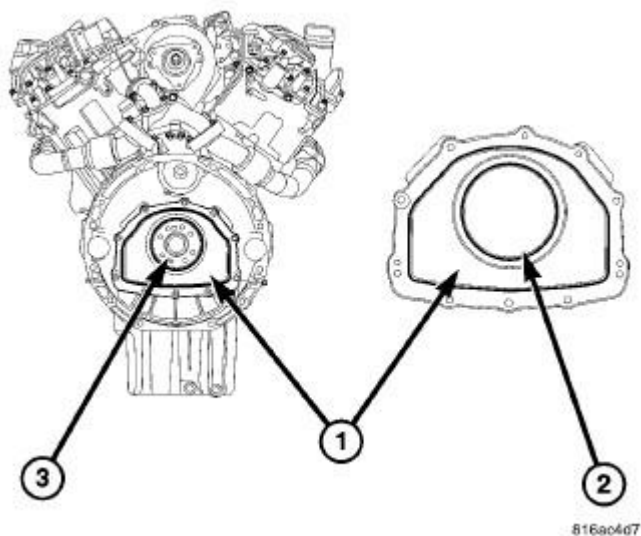
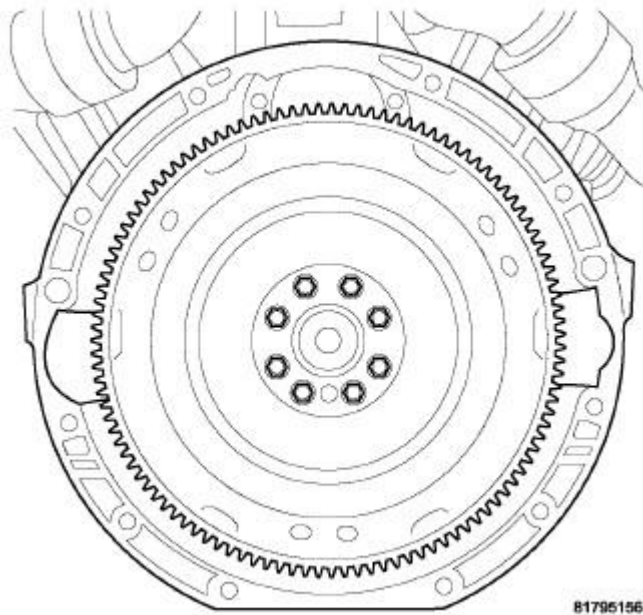


Fig. 442: REAR MAIN SEAL CARRIER

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 N.m (106 in. lbs.).
 2. Install the bolts holding the rear main seal carrier (1) to the oil pan. Tighten the bolts to 9 N.m (7 ft. lbs.).

**Fig. 443: FLEX PLATE**

Courtesy of CHRYSLER LLC

3. Install the flex plate. See **Engine/Engine Block/FLEXPLATE - 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 N.m (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

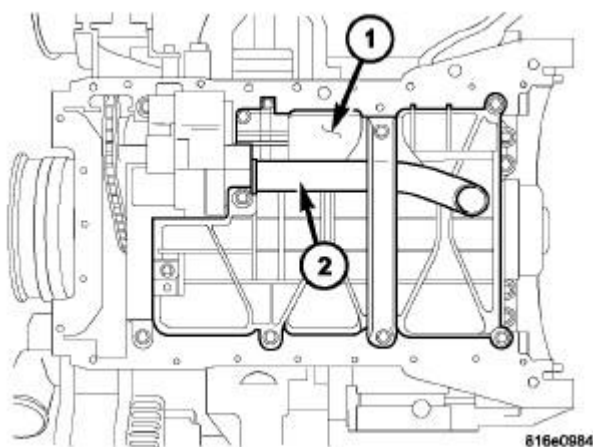


Fig. 444: OIL PUMP COVER REMOVAL/INSTALLATION
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Raise vehicle on hoist.
3. Remove oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.
4. Remove oil pump pickup tube retaining bolt and pull pickup tube from engine block. Discard O-rings.

OIL PUMP

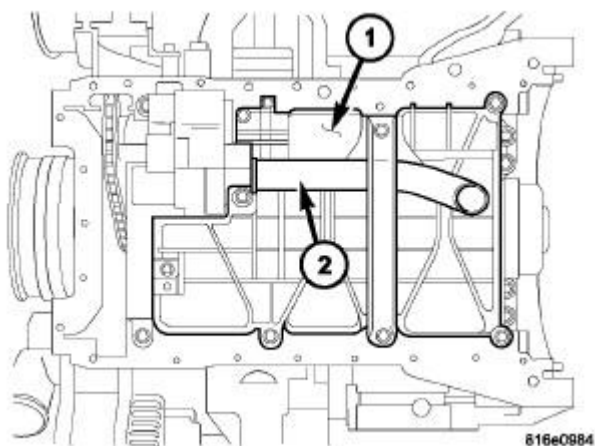


Fig. 445: OIL PUMP COVER REMOVAL/INSTALLATION
Courtesy of CHRYSLER LLC

1. Remove oil pan. See Engine/Lubrication/PAN, Oil - Removal.
2. Remove fasteners at the oil pump cover.

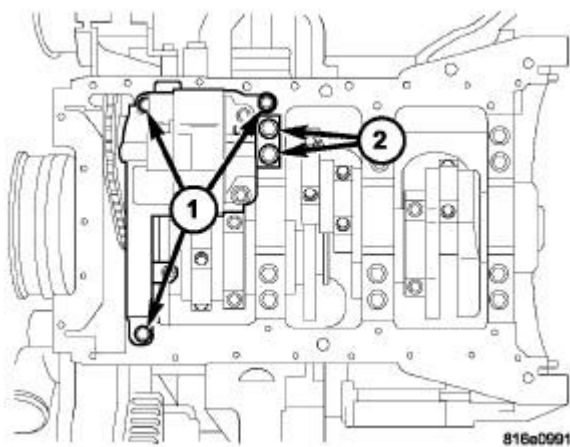


Fig. 446: OIL PUMP
Courtesy of CHRYSLER LLC

3. Remove oil pump fasteners (1).
4. Remove oil pump from the crankcase.

Installation

OIL PUMP PICKUP TUBE

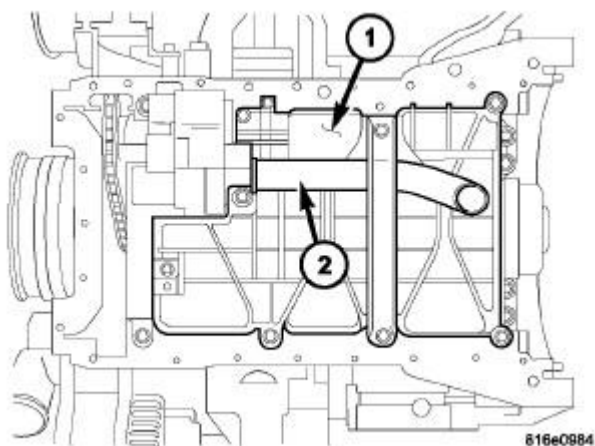


Fig. 447: OIL PUMP COVER REMOVAL/INSTALLATION
Courtesy of CHRYSLER LLC

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 **Engine/Lubrication/PAN, Oil - Installation.**
4. Refill engine oil to proper level.
5. Connect negative battery cable.

OIL PUMP

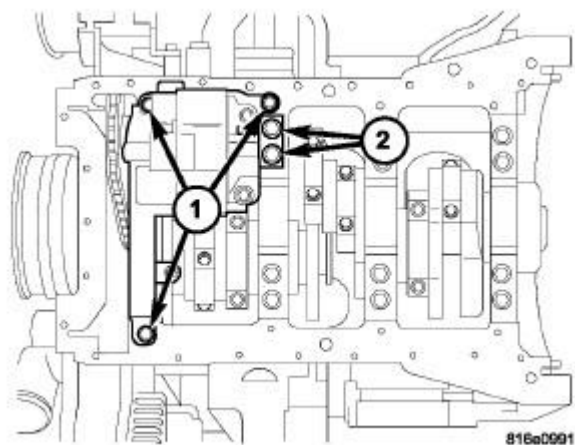


Fig. 448: OIL PUMP
Courtesy of CHRYSLER LLC

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.

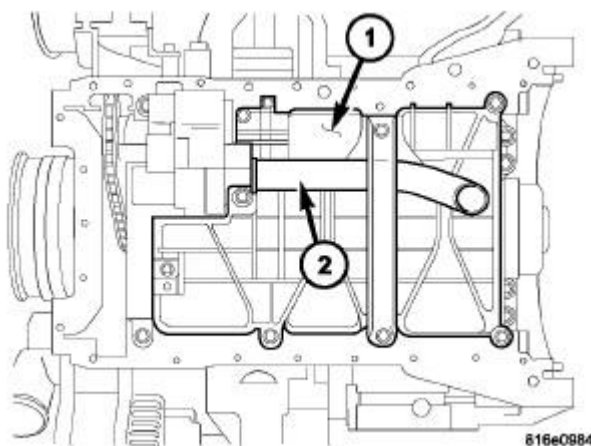


Fig. 449: OIL PUMP COVER REMOVAL/INSTALLATION
Courtesy of CHRYSLER LLC

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.

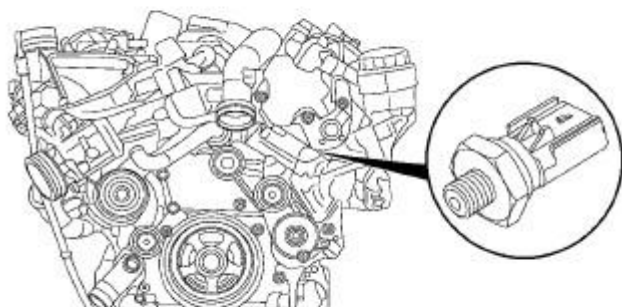
WARNING: Before checking the engine oil level turn the engine off and wait 15 minutes for the oil to return to the oil pan.

6. Install oil pan. See Engine/Lubrication/PAN, Oil - Installation.

SENSOR, OIL PRESSURE

Description

DESCRIPTION



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Fig. 450: OIL PRESSURE SENSOR**Courtesy of CHRYSLER LLC**

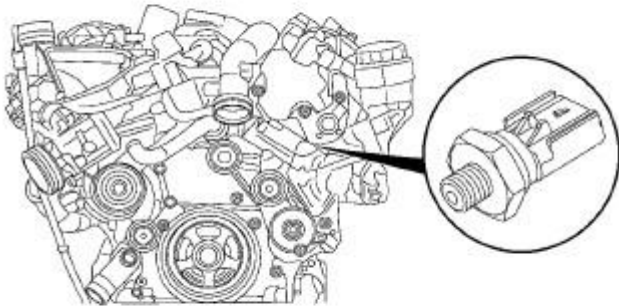
The engine oil pressure sensor is mounted on the front of the oil filter housing. The sensor provides an output voltage to the ECM that corresponds to the engine oil pressure. Under certain operating conditions, for example low oil pressure, it may be necessary for the ECM to increase the engine idle 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**

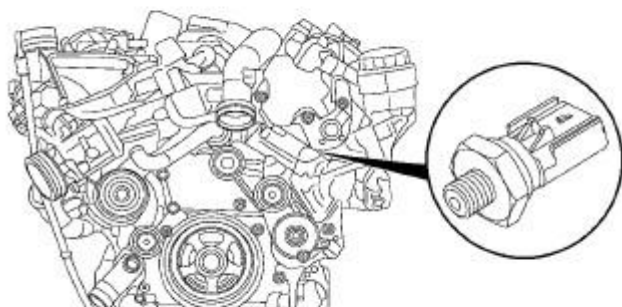


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Fig. 451: OIL PRESSURE SENSOR**Courtesy of CHRYSLER LLC**

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**



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Fig. 452: OIL PRESSURE SENSOR

Courtesy of CHRYSLER LLC

1. Install the engine oil pressure sensor to the engine. Torque 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.

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**

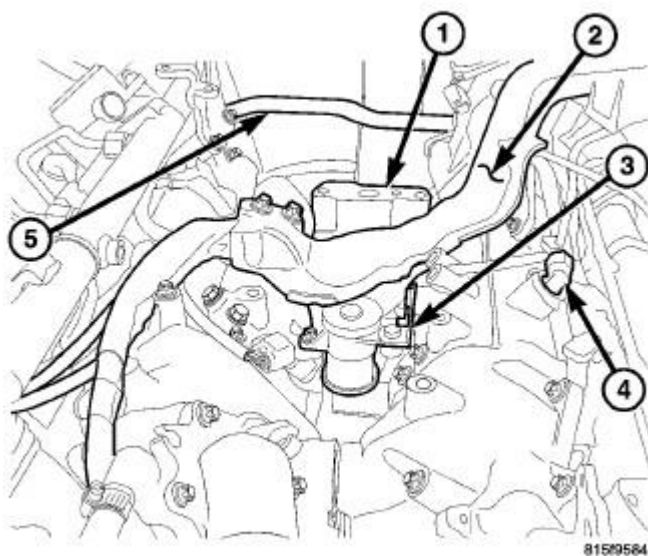


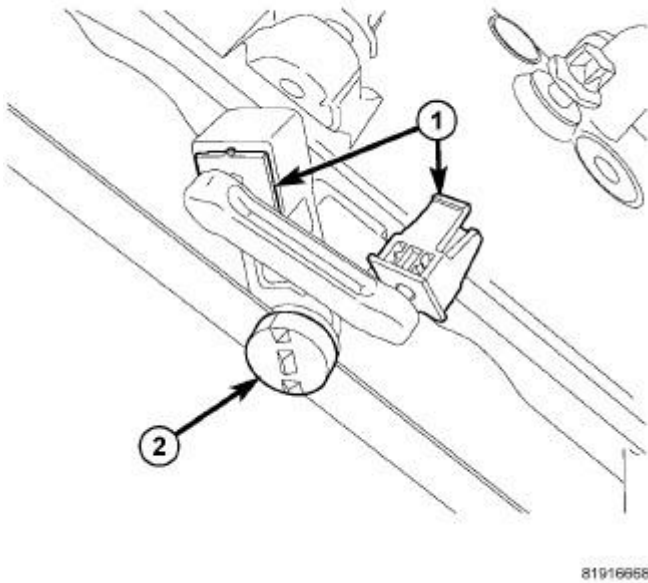
Fig. 453: MAIN ENGINE WIRING HARNESS

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. 454: 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**

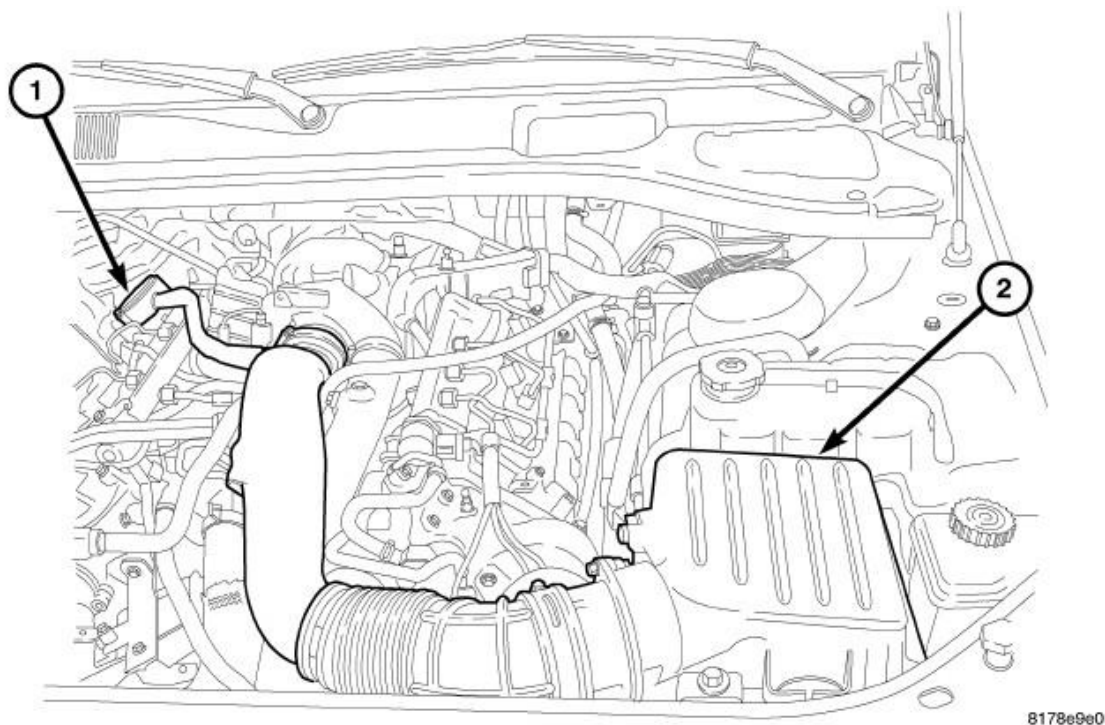


Fig. 455: FILTER HOUSING AND TUBE

Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable. Refer to Electrical/Battery System/CABLES, Battery - Removal.
2. Remove the engine cover. See Engine - Removal.
3. Remove the intake air housing (2) and tube. See Engine/Air Intake System/BODY, Air Cleaner - Removal.
4. Remove PCV valve (1).

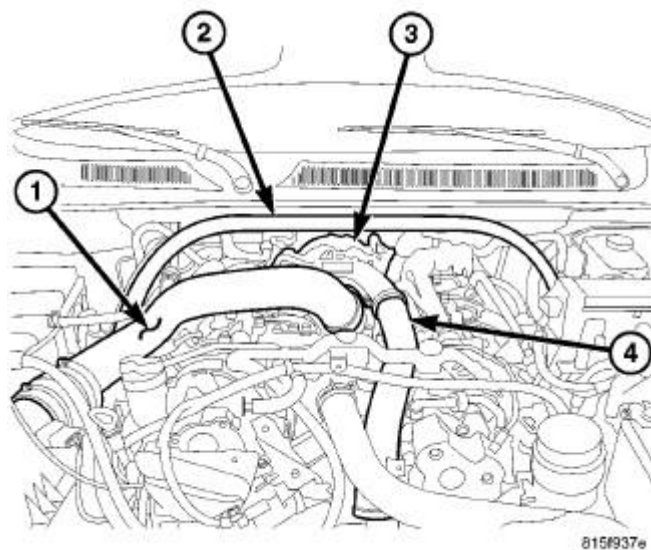


Fig. 456: STRUT TOWER SUPPORT

Courtesy of CHRYSLER LLC

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

5. Remove the charge air cooler tube (4).

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.

6. Remove the turbocharger (3). See Engine/Turbocharger System/TURBOCHARGER - Removal.

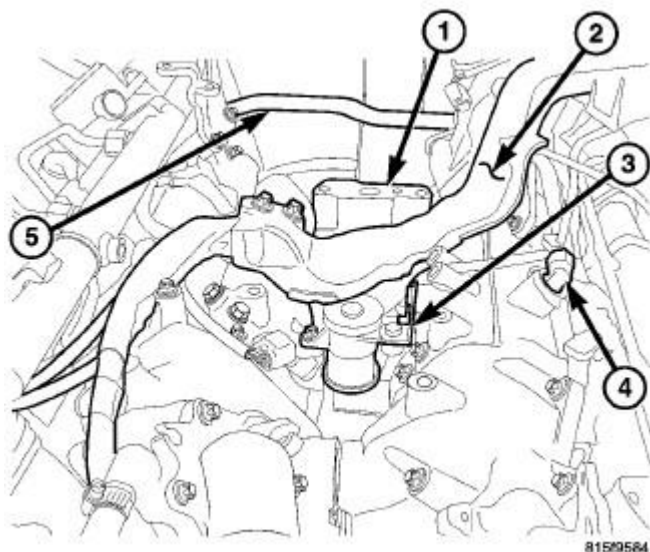


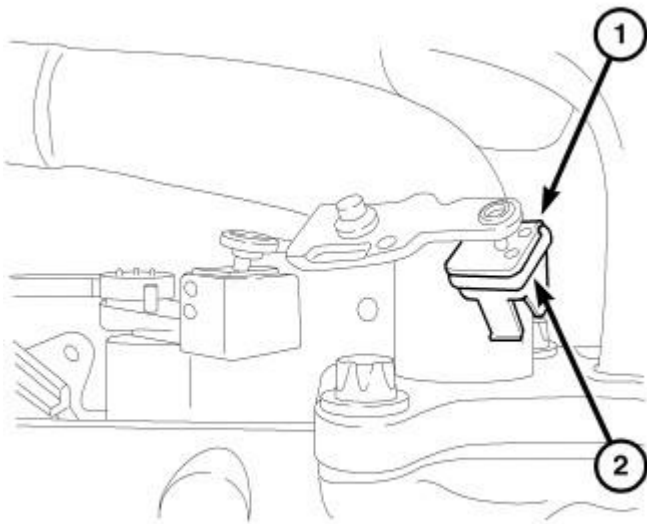
Fig. 457: MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

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

7. Disconnect the engine harness (2) and position aside.
8. Disconnect the swirl valve actuator connector.
9. Remove the swirl valve actuator clips.
10. Remove the swirl valve actuator (3).

Installation

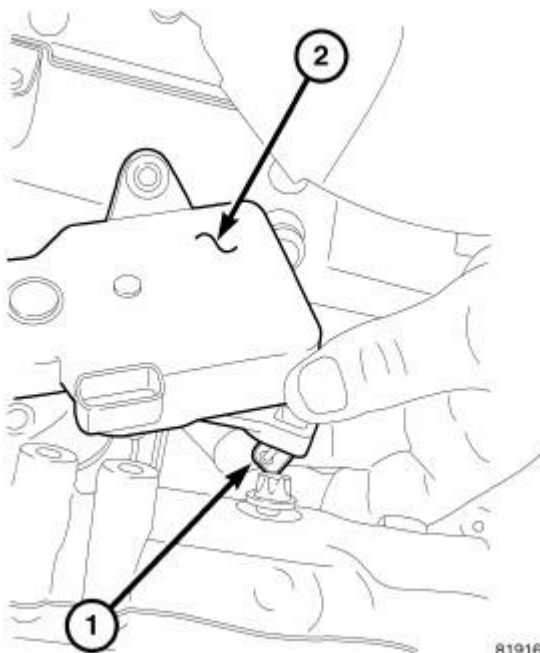
INSTALLATION



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Fig. 458: 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.



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Fig. 459: INSTALL CLIP

Courtesy of CHRYSLER LLC

2. Position the clip into the actuator arm and push the clip partially into the arm.

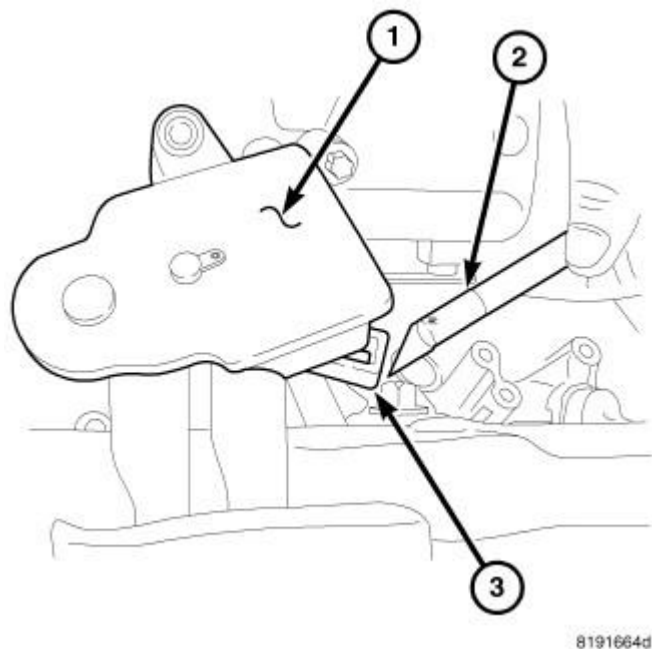


Fig. 460: REMOVE O-RINGS

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.

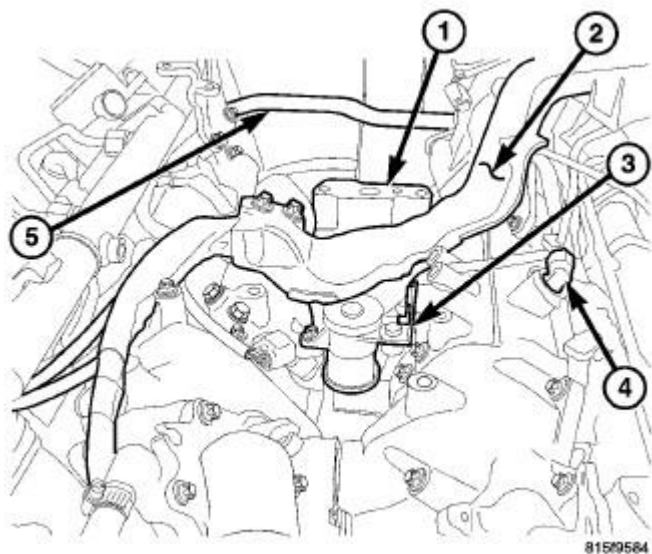


Fig. 461: MAIN ENGINE WIRING HARNESS

Courtesy of CHRYSLER LLC

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

4. Install the swirl valve actuator (3). 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 Engine/Turbocharger System/TURBOCHARGER - Installation.

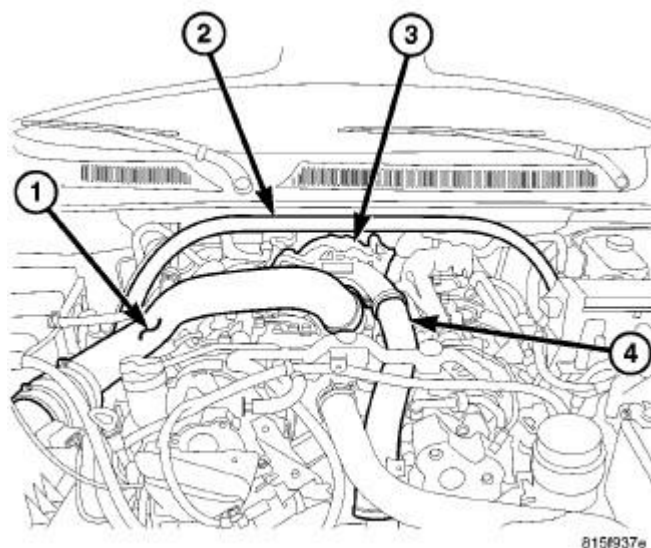


Fig. 462: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

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

8. Install the turbocharger (3). See Engine/Turbocharger System/TURBOCHARGER - Installation.
9. Install the charge air cooler tube (4).

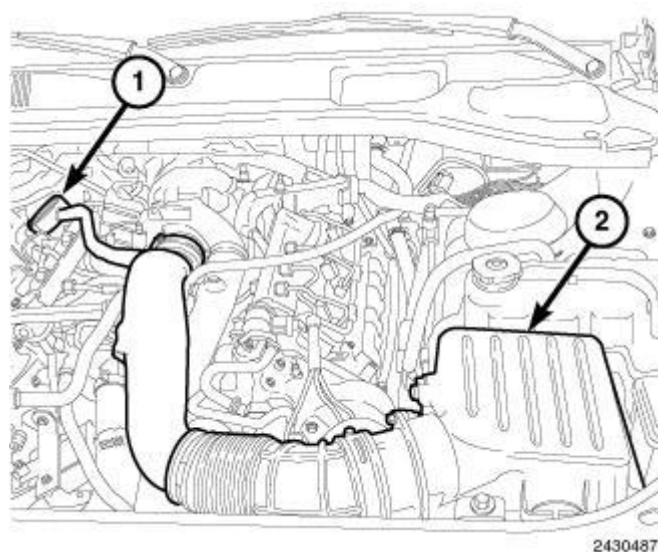


Fig. 463: Air Cleaner Assembly
Courtesy of CHRYSLER LLC

10. Install the air cleaner housing (2) and air tube. See Engine/Air Intake System/BODY, Air Cleaner - Installation.
11. Fill the cooling system. Refer to Cooling - Standard Procedure.
12. Install the engine cover. See Engine - Installation.
13. Connect the battery. Refer to Electrical/Battery System/CABLES, Battery - Installation.

LINKAGE, SWIRL VALVE

Description

DESCRIPTION

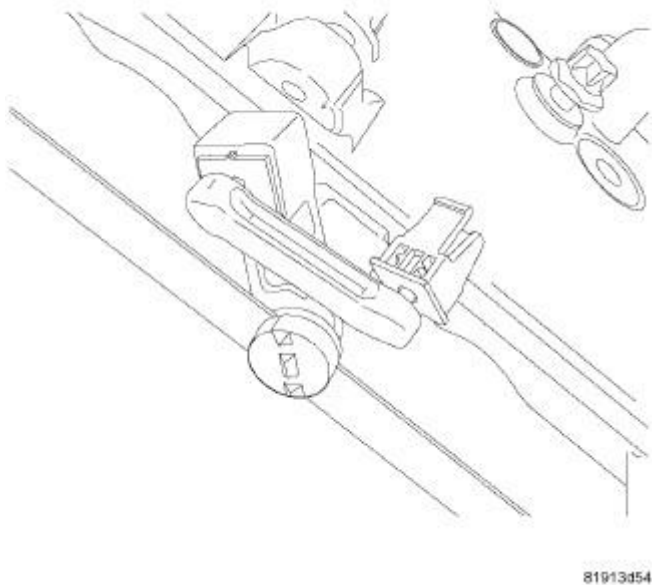


Fig. 464: SWIRL VALVE LINKAGE

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

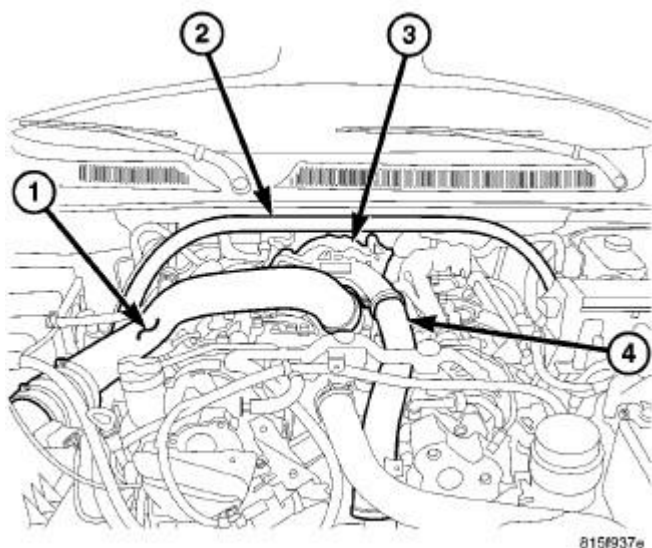
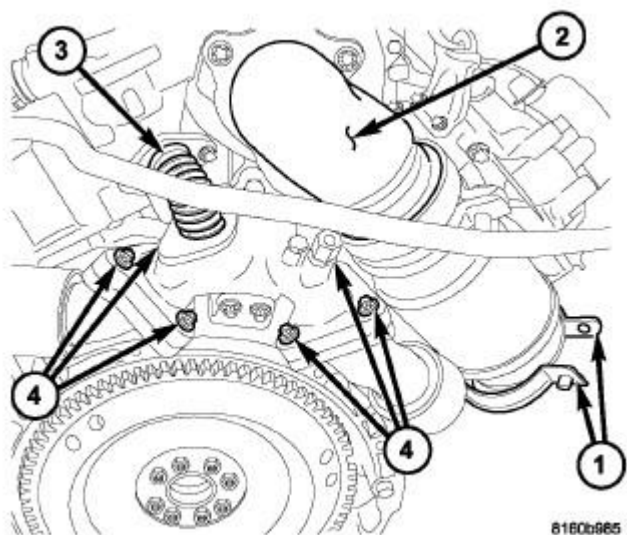


Fig. 465: STRUT TOWER SUPPORT

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/Battery System/CABLES, Battery - Removal.
2. Remove the engine cover. See Engine - Removal.
3. Remove the air cleaner assembly. See Engine/Air Intake System/BODY, Air Cleaner - 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. 466: Removing/Installing Air Intake, Turbo & Exhaust System Components**

Courtesy of CHRYSLER LLC

9. Remove the turbocharger. See Engine/Turbocharger System/TURBOCHARGER - Removal.
10. Remove the EGR tube (3).

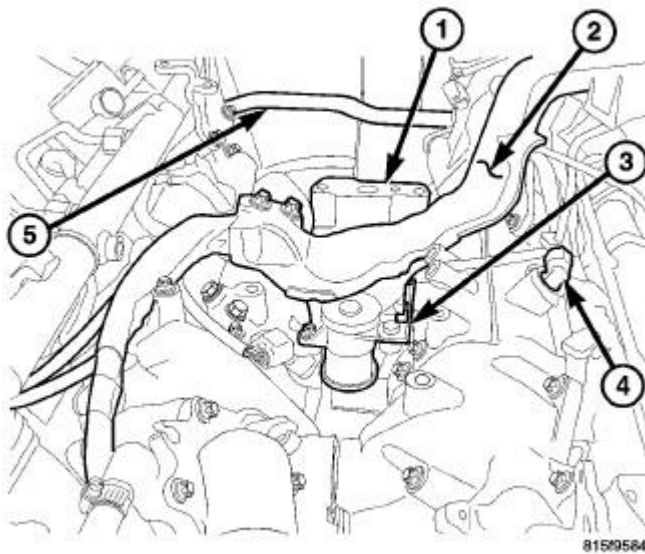


Fig. 467: MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

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

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.

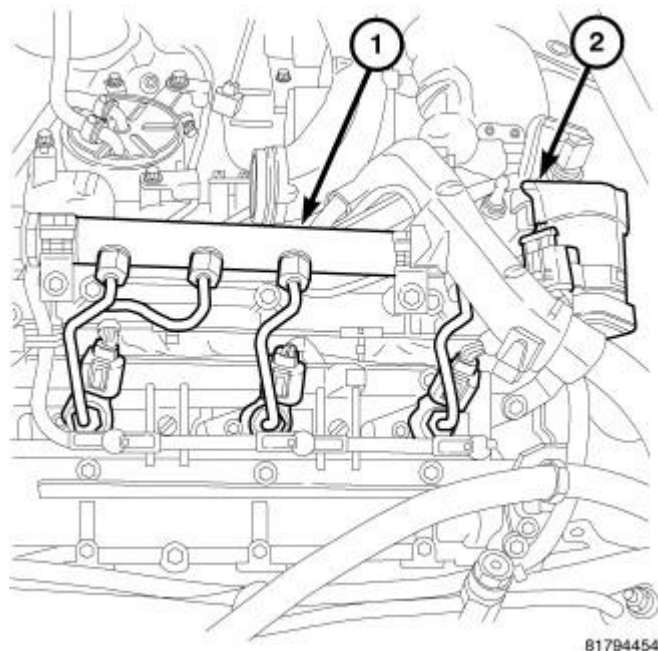


Fig. 468: EGR VALVE
Courtesy of CHRYSLER LLC

1 - FUEL RAIL
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**.

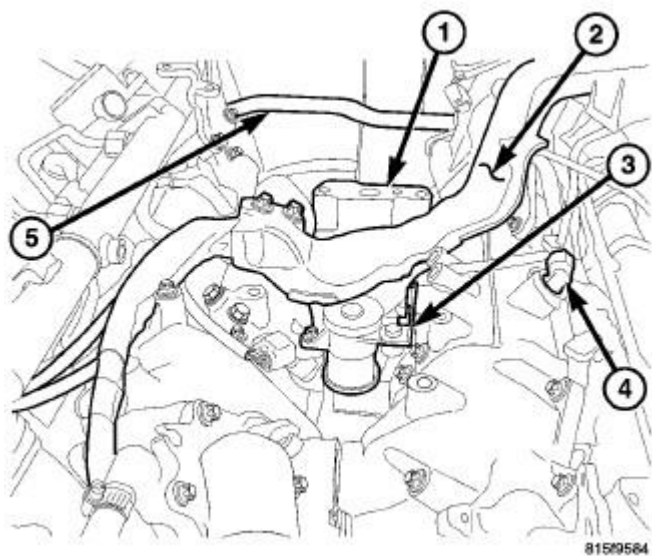


Fig. 469: MAIN ENGINE WIRING HARNESS

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.

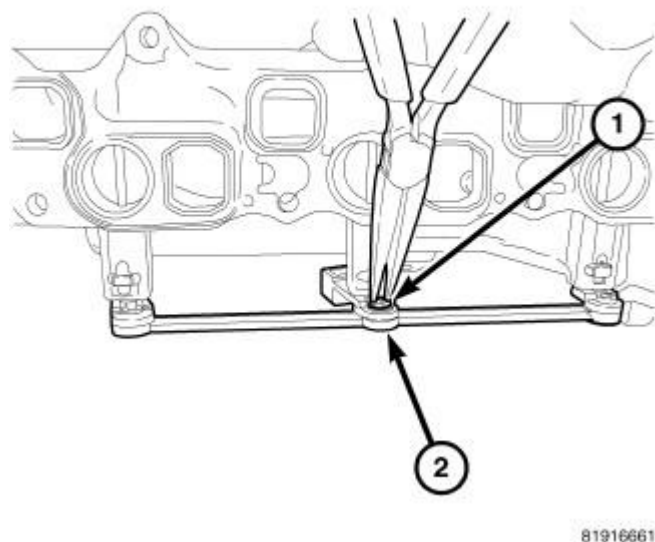


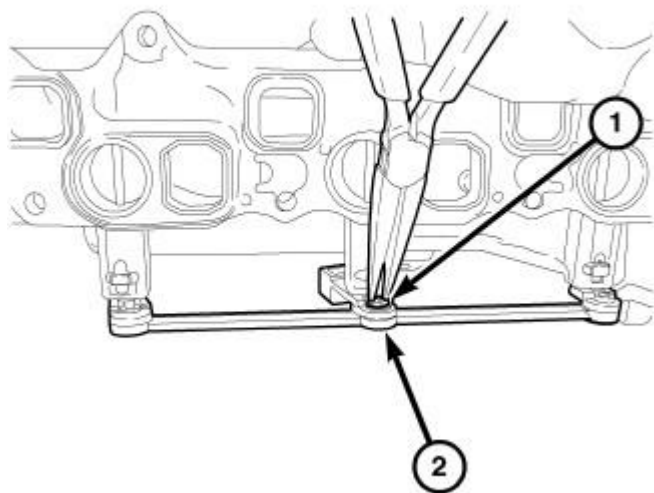
Fig. 470: REMOVE/INSTALL ROUND CLIPS

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

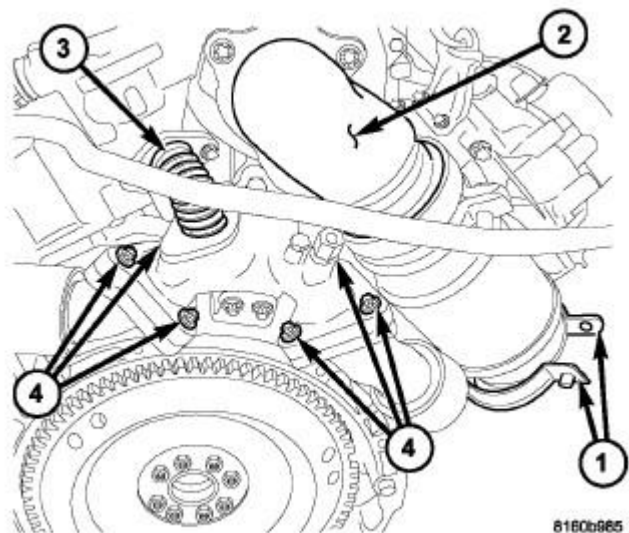


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Fig. 471: REMOVE/INSTALL ROUND CLIPS

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. 472: Removing/Installing Air Intake, Turbo & Exhaust System Components

Courtesy of CHRYSLER LLC

4. Install the EGR cooler.
5. Position the intake manifold and torque 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.

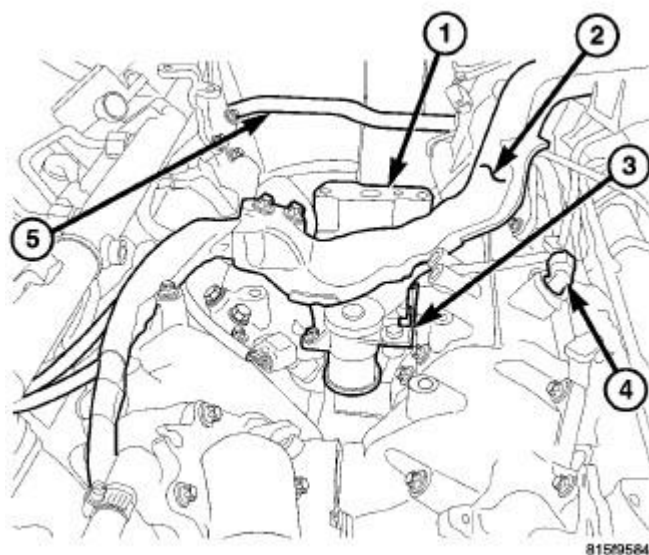


Fig. 473: MAIN ENGINE WIRING HARNESS

Courtesy of CHRYSLER LLC

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

12. Install the swirl valve actuator. See **Engine/Manifolds/ACTUATOR, Swirl Valve - Installation.**
13. Install the fuel filter assembly. Refer to **Fuel System/Fuel Delivery/SEPARATOR and FILTER, Fuel and Water - 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 **Engine/Turbocharger System/TURBOCHARGER - 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 Engine/Air Intake System/BODY, Air Cleaner - Installation.
26. Install the engine cover. See Engine - Installation
27. Connect the battery cables. Refer to Electrical/Battery System/CABLES, Battery - Installation.

MANIFOLD, EXHAUST

Removal

RIGHT

WARNING: The normal operating temperature of the exhaust system is very high. Therefore, never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operation time.

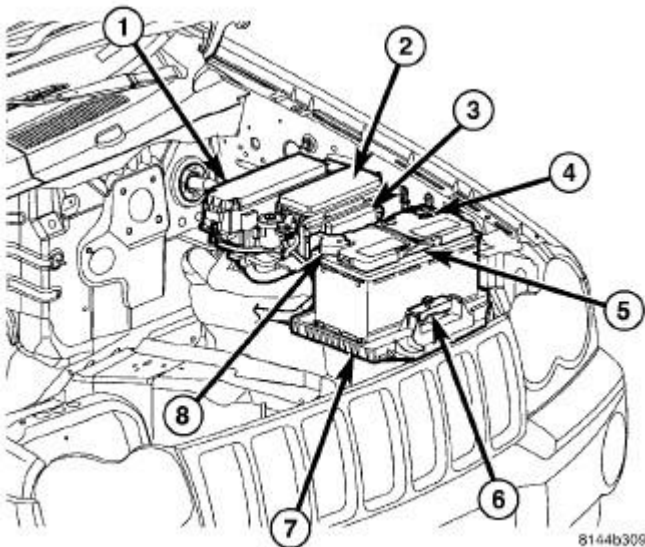


Fig. 474: Identifying Battery System Components, Power Distribution Center & Integrated Power Module

Courtesy of CHRYSLER LLC

1. Disconnect the positive and negative battery cables (8, 4). Refer to Electrical/Battery System/CABLES, Battery - Removal.
2. Remove the battery (5) and battery tray (7). Refer to Electrical/Battery System/TRAY, Battery - Removal.
3. Disconnect all Power Distribution Center (PDC) (1) and generator wiring harness cables and position aside.

4. Disconnect the PDC and support bracket and position aside.

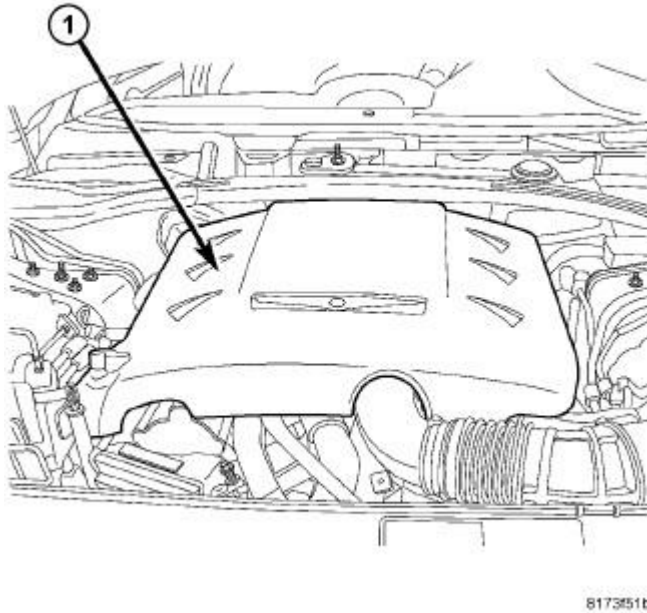


Fig. 475: ENGINE COVER
Courtesy of CHRYSLER LLC

5. Remove the engine cover (1) and brackets.
6. Disconnect the generator power feed line and position aside.
7. Remove the coolant recovery bottle.

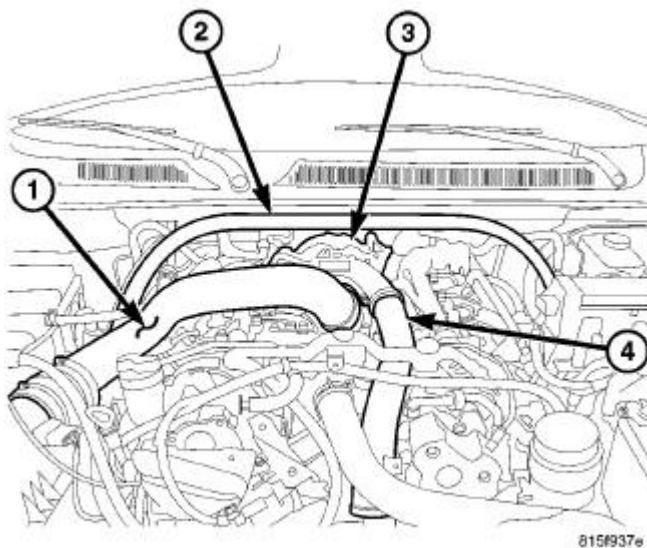


Fig. 476: STRUT TOWER SUPPORT

Courtesy of CHRYSLER LLC

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

8. Remove the strut tower support (2).
9. Remove the turbo heat shield (3).

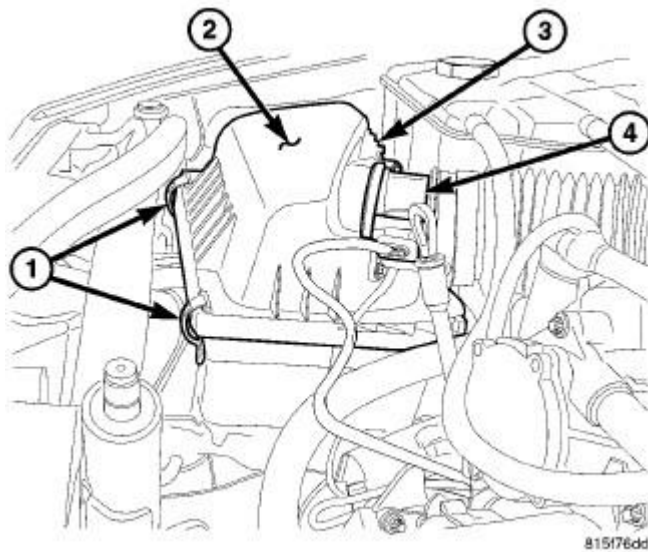


Fig. 477: AIR CLEANER COVER
Courtesy of CHRYSLER LLC

10. Remove the air cleaner assembly. See Engine/Air Intake System/BODY, Air Cleaner - Removal.

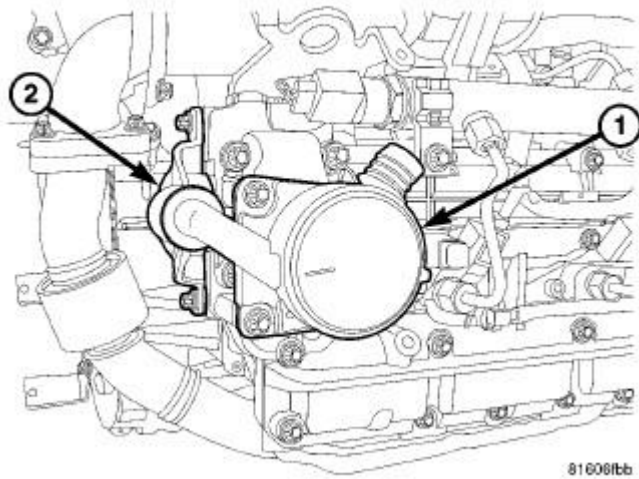


Fig. 478: OIL SEPARATOR
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - PCV HOUSING
2 - PCV HOUSING ADAPTOR |
|--|

11. Remove the vapor control valve (1).
12. Remove the front and rear heater and A/C line bracket retaining bolts and position aside.

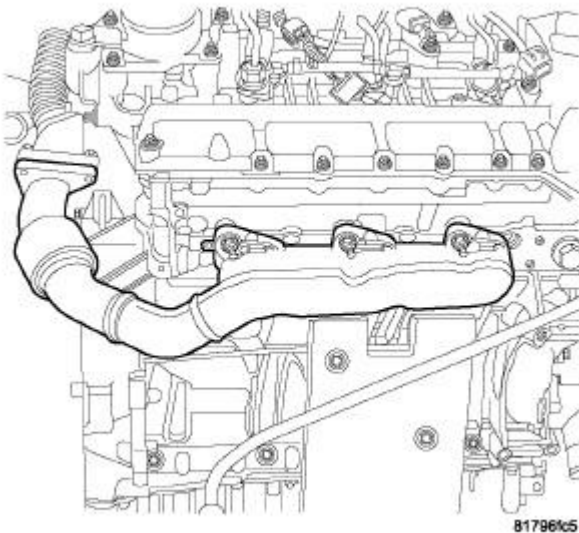


Fig. 479: RIGHT EXHAUST MANIFOLD

Courtesy of CHRYSLER LLC

13. Remove the right exhaust manifold upper retaining nuts.

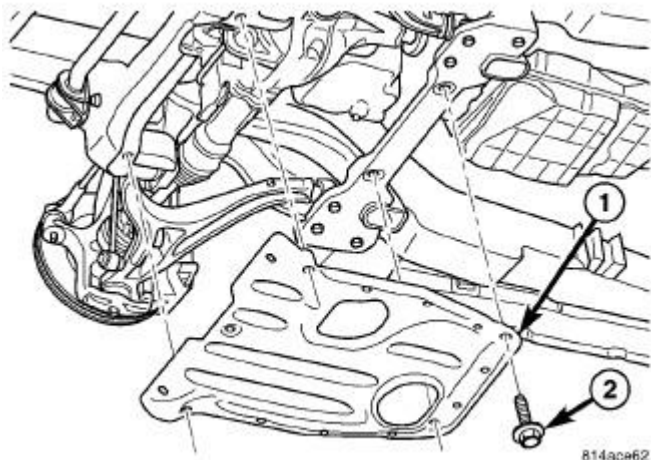


Fig. 480: UPDATED SKID PLATE
Courtesy of CHRYSLER LLC

14. Raise and support the vehicle.
15. Remove the front skid plate retainers (2) and remove the front skid plate (1).

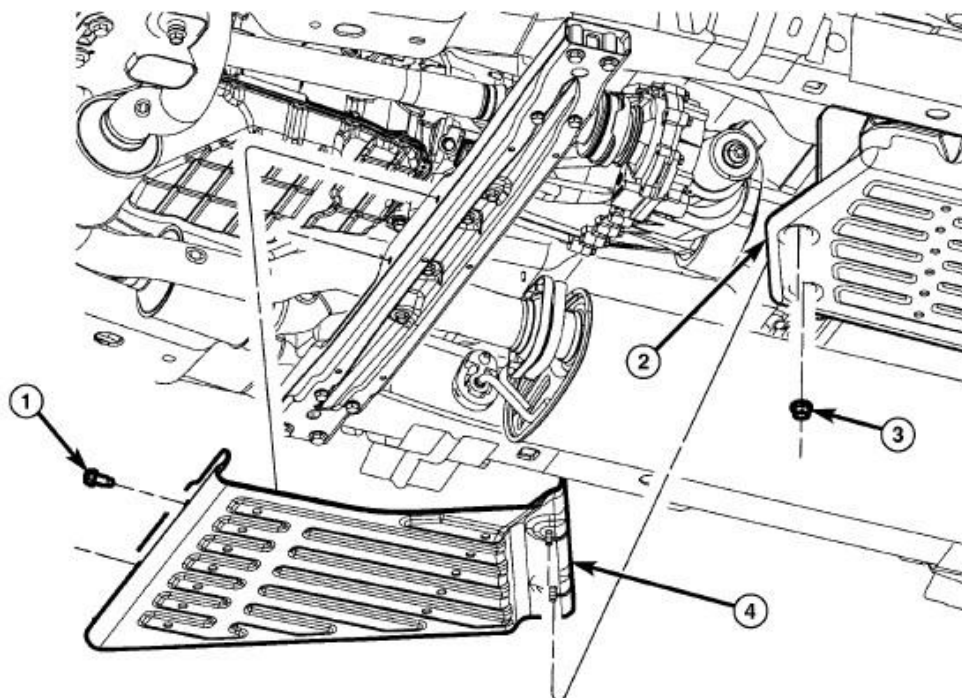


Fig. 481: TRANSFER CASE SKID PLATE
Courtesy of CHRYSLER LLC

16. If equipped, remove the transfer case skid plate crossmember retaining bolts (1).
17. If equipped, remove the skid plate retaining nuts (3) and remove the transfer case skid plate (4).

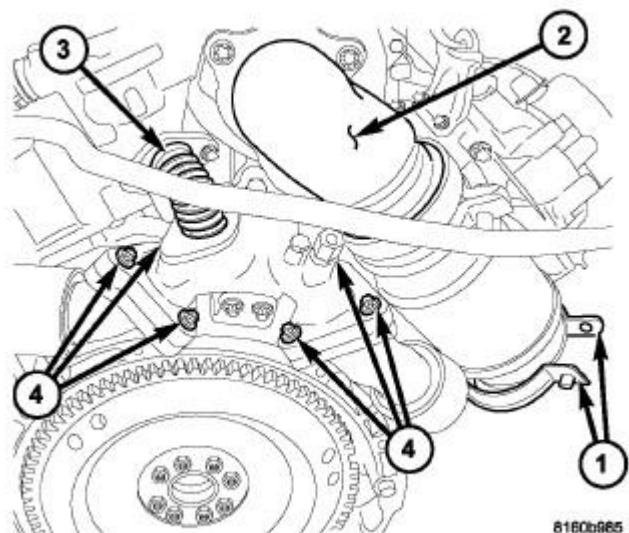


Fig. 482: Removing/Installing Air Intake, Turbo & Exhaust System Components
Courtesy of CHRYSLER LLC

18. Disconnect the upper O2 sensor.
19. Disconnect the catalytic converter temperature sensors.
20. Remove the exhaust elbow (2) to pre-converter exhaust clamp.
21. Remove the exhaust elbow at the turbo.
22. Remove the pre-converter to catalytic converter clamp (1) and remove pre-converter.
23. Remove the right exhaust manifold to turbo retaining bolts (4).

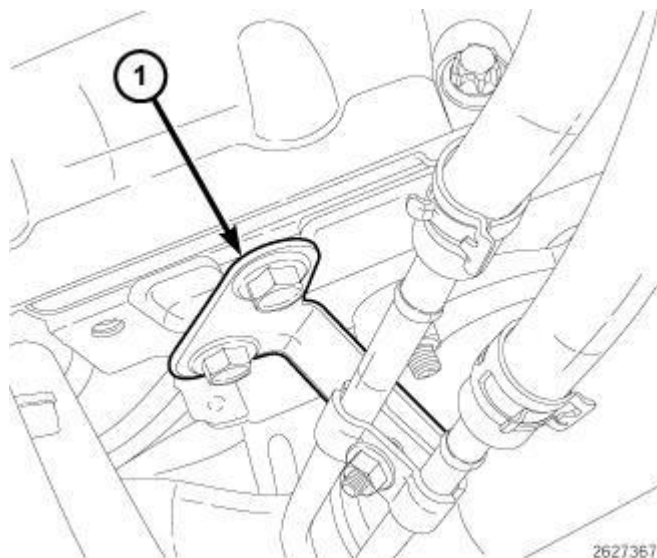
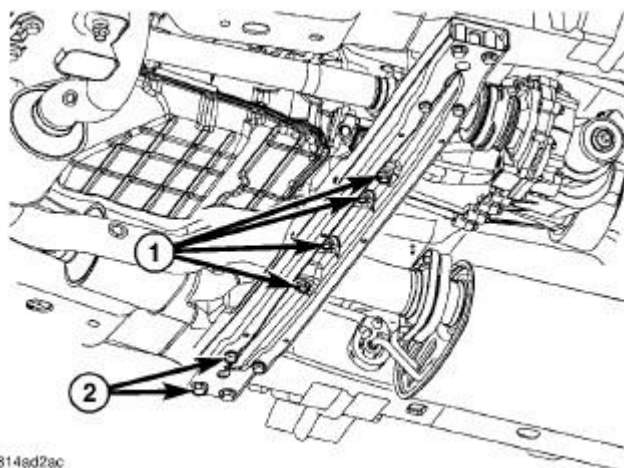


Fig. 483: Differential Pressure Sensor Port Bracket
Courtesy of CHRYSLER LLC

24. Disconnect the differential pressure sensor ports.
25. Remove the differential pressure sensor port bracket (1) and position the ports aside.



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Fig. 484: TRANSFER CASE SKID PLATE
Courtesy of CHRYSLER LLC

26. Support the transmission with a suitable lifting device and slightly raise transmission to relieve load on crossmember.
27. Remove retainers (1) securing the transmission mount to crossmember.
28. Remove retainers (2) securing the crossmember to frame and remove crossmember.
29. Remove the catalytic converter. Refer to **Exhaust System/CONVERTER, Catalytic - Removal** .

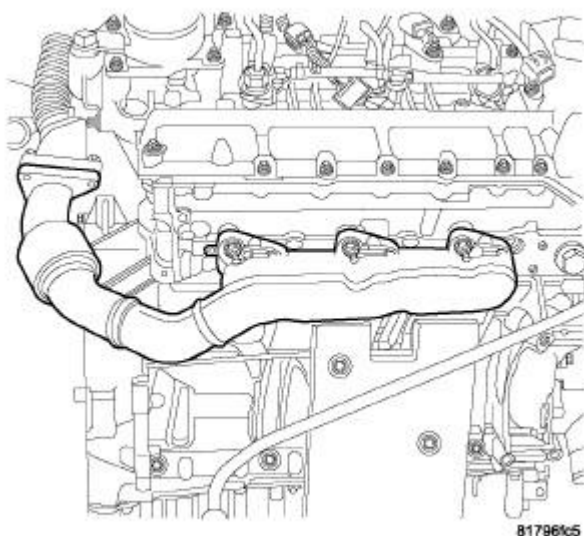


Fig. 485: RIGHT EXHAUST MANIFOLD
 Courtesy of CHRYSLER LLC

30. Remove the right exhaust manifold 3 lower retaining nuts and remove the exhaust manifold.

LEFT

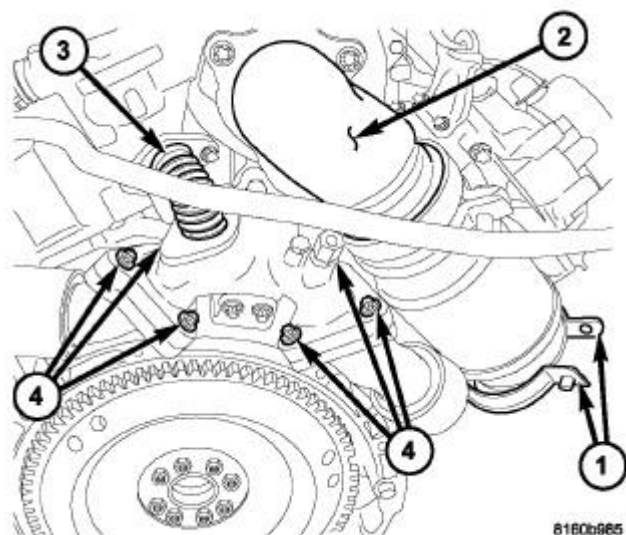


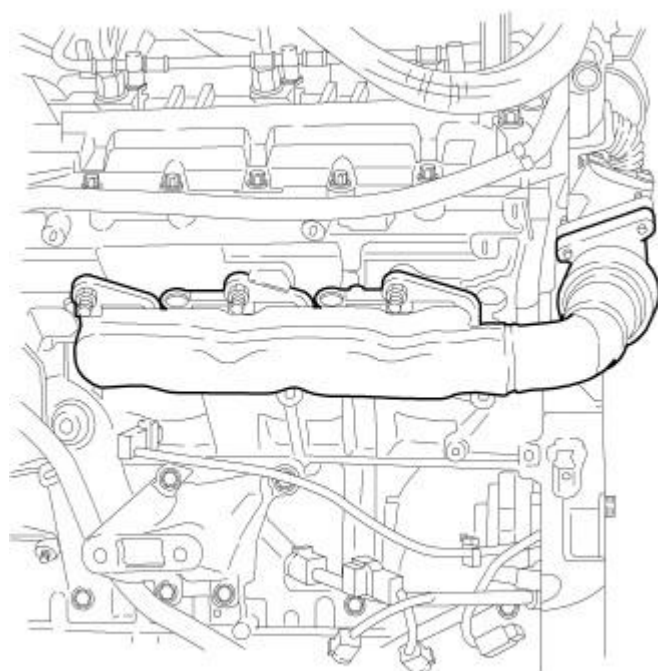
Fig. 486: Removing/Installing Air Intake, Turbo & Exhaust System Components
 Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable. Refer to Electrical/Battery System/CABLES, Battery - Removal .

2. Remove the engine cover. See **Engine - 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. 487: Exhaust Manifold - Left
Courtesy of CHRYSLER LLC

7. Remove the left exhaust manifold.

Installation

RIGHT

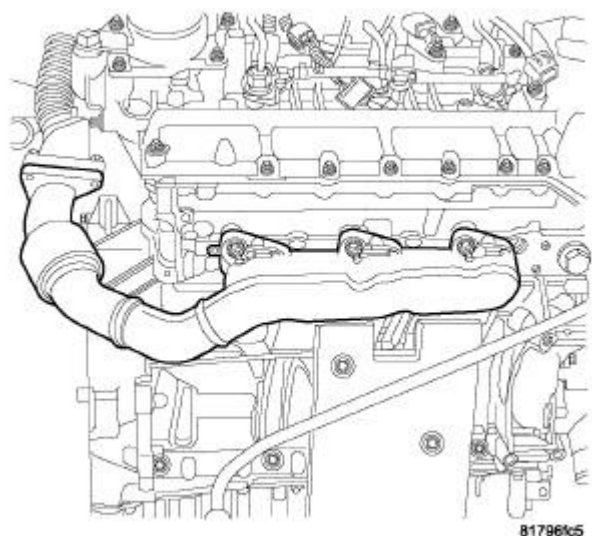


Fig. 488: RIGHT EXHAUST MANIFOLD

Courtesy of CHRYSLER LLC

1. Clean the cylinder head and exhaust manifold sealing surfaces.
2. Using a new exhaust manifold gasket, position the exhaust manifold to the cylinder head.
3. Install the lower manifold retaining nuts finger tight.

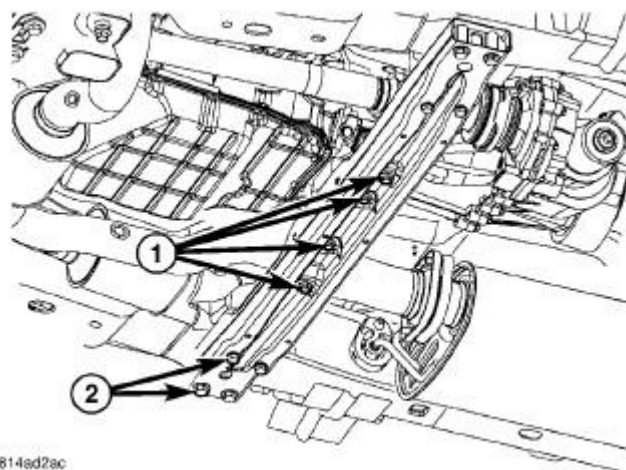


Fig. 489: TRANSFER CASE SKID PLATE

Courtesy of CHRYSLER LLC

4. Install the catalytic converter. Refer to **Exhaust System/CONVERTER, Catalytic - Installation**.
5. Position the rear transmission crossmember, install bolts (2) securing crossmember to frame and tighten to 68 N.m (50 ft. lbs.).

6. Lower transmission onto the crossmember, install bolts (1) securing transmission mount to crossmember and tighten to 47 N.m (39 ft. lbs.).
7. Remove the lifting device supporting transmission.

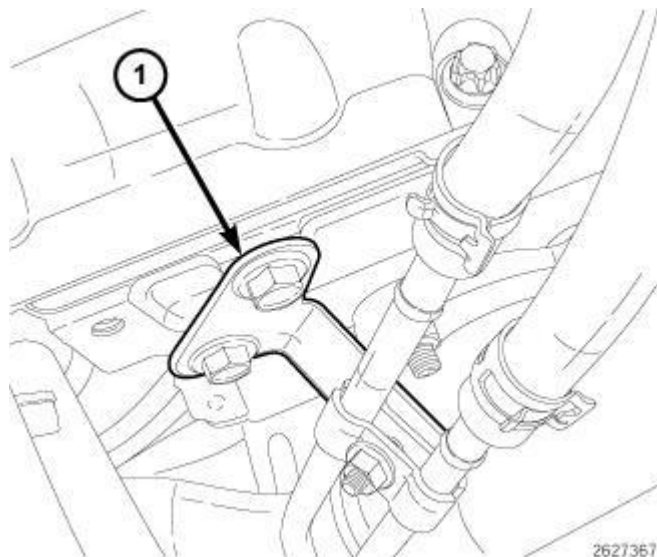


Fig. 490: Differential Pressure Sensor Port Bracket
Courtesy of CHRYSLER LLC

8. Position and connect the differential pressure sensor ports.
9. Install the differential pressure sensor port bracket (1) and tighten bolts to 10 N.m (89 in. lbs.).

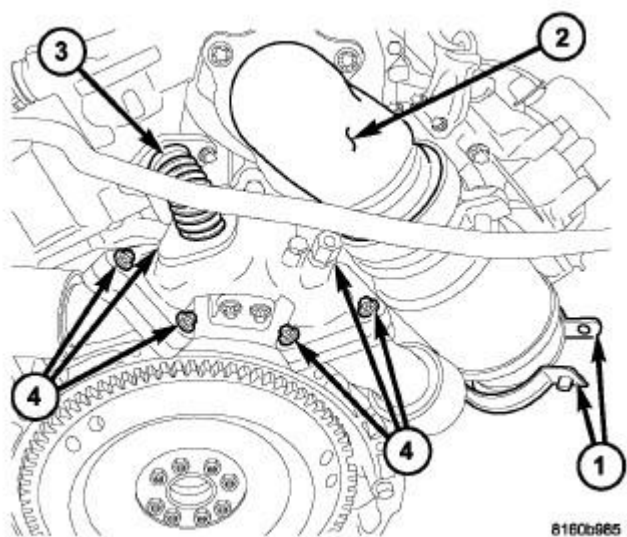


Fig. 491: Removing/Installing Air Intake, Turbo & Exhaust System Components
Courtesy of CHRYSLER LLC

10. Using a new exhaust manifold to crossover pipe gasket, position the right exhaust manifold to crossover

- pipe, install retaining bolts (4) and tighten to 10 N.m (89 in. lbs.).
11. Using a new exhaust elbow to turbo gasket, position the exhaust elbow (2) to the turbo, install retaining bolts and tighten to 20 N.m (15 ft. lbs.) then an additional 90° turn.
 12. Position the pre-converter to the catalytic converter, install the pre-converter to catalytic converter clamp (1) and tighten to 35 N.m (26 ft. lbs.).
 13. Position the exhaust elbow (2) to the pre-converter, install the pre-converter to exhaust elbow clamp and tighten to 35 N.m (26 ft. lbs.).
 14. Connect the catalytic converter temperature sensor electrical connectors.
 15. Connect the upper O2 sensor electrical connector.

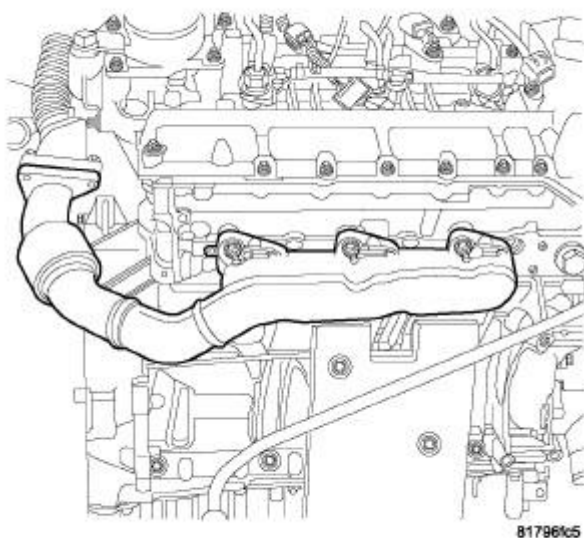


Fig. 492: RIGHT EXHAUST MANIFOLD
Courtesy of CHRYSLER LLC

16. Lower the vehicle.
17. Install the right exhaust manifold upper retaining nuts and tighten to 25 N.m (18 ft. lbs.).
18. Raise and support the vehicle.
19. Tighten the right exhaust manifold lower retaining nuts to 25 N.m (18 ft. lbs.).

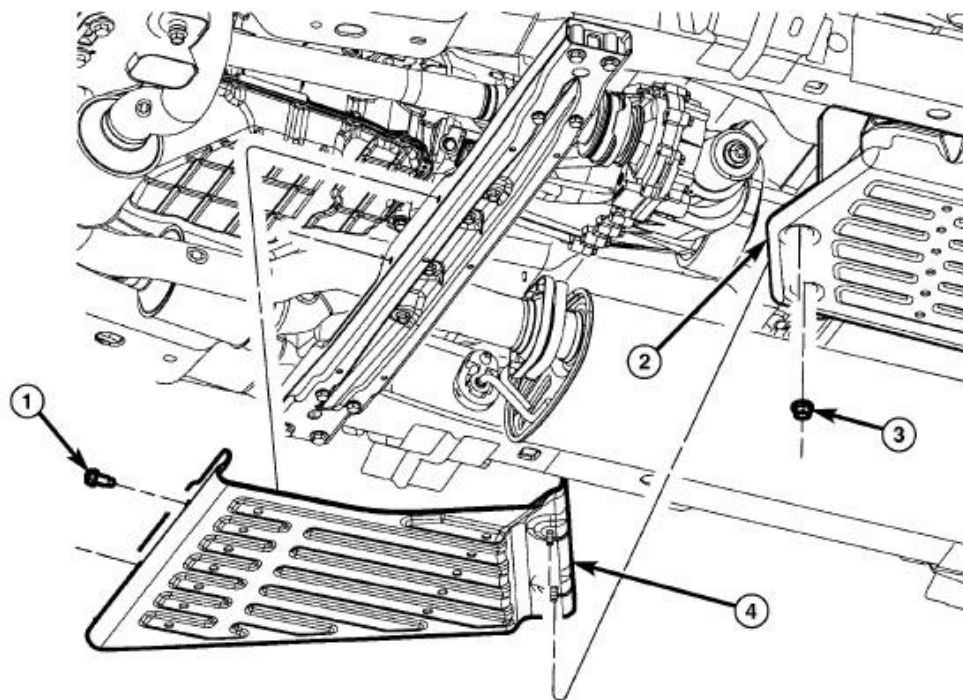


Fig. 493: TRANSFER CASE SKID PLATE

Courtesy of CHRYSLER LLC

20. If removed, position the transfer case skid plate (4), install the crossmember retaining bolts (1) and tighten to 47 N.m (35 ft. lbs.).
21. If removed, install the skid plate retaining nuts (3) and tighten to 81 N.m (60 ft. lbs.).

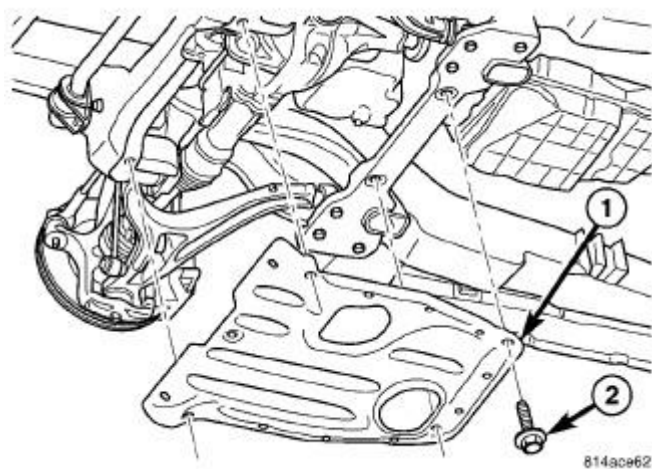


Fig. 494: UPDATED SKID PLATE

Courtesy of CHRYSLER LLC

22. Position the front skid plate (1) and tighten retainers (2) to 28 N.m (21 ft. lbs.).
23. Lower the vehicle.

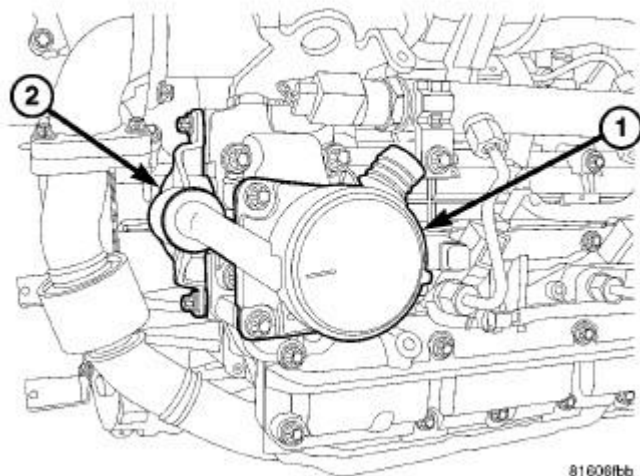


Fig. 495: OIL SEPARATOR
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - PCV HOUSING
2 - PCV HOUSING ADAPTOR |
|--|

24. Lubricate the Positive Crankcase Ventilation (PCV) O-ring with clean engine oil.
25. Carefully position the vapor control valve (1), push down on the PCV to seat.
26. Install the vapor control valve and tighten retainers to 11 N.m (97 in. lbs.).
27. Position the heater and A/C line front and rear brackets and tighten retainers to 10 N.m (88 in. lbs.).

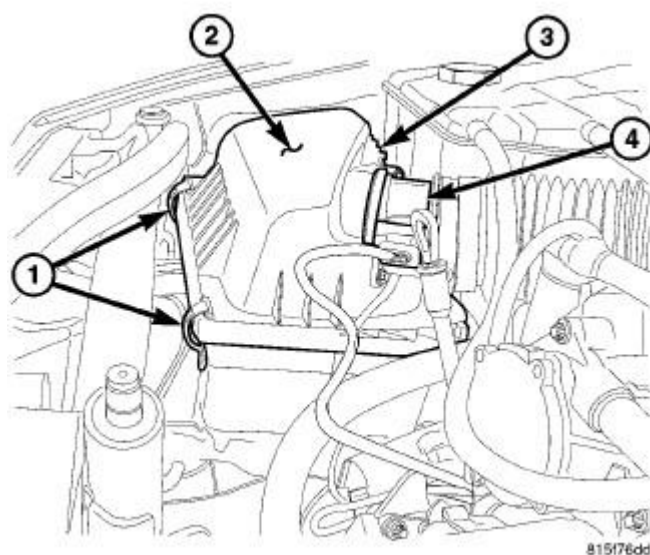


Fig. 496: AIR CLEANER COVER
Courtesy of CHRYSLER LLC

28. Install the air cleaner assembly. See **Engine/Air Intake System/BODY, Air Cleaner - Installation.**

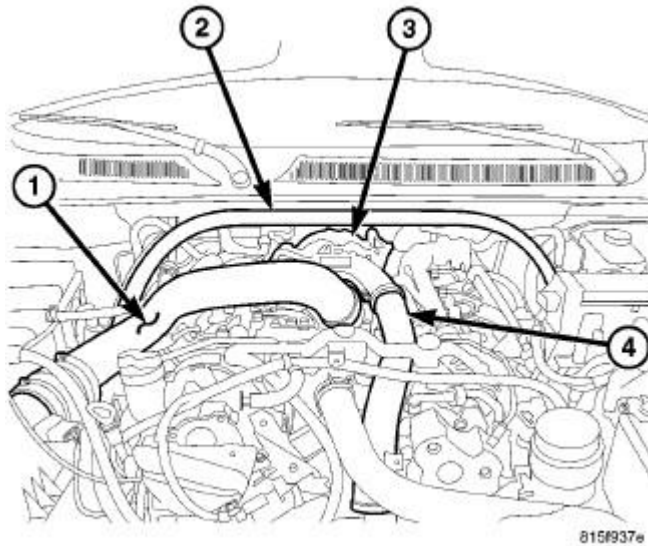
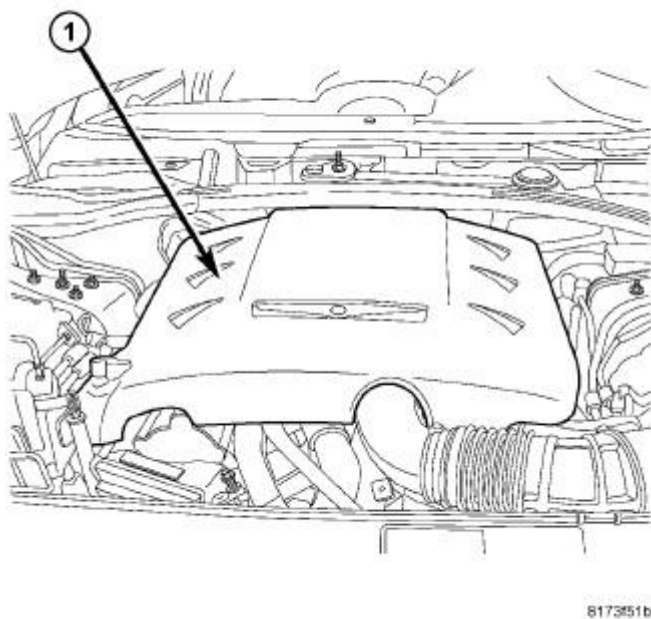


Fig. 497: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

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

29. Position the turbo heat shield (3) and tighten retainers to 10 N.m (88 in. lbs.).
30. Position the strut tower support (2) and tighten retainers to 38 N.m (28 ft. lbs.).

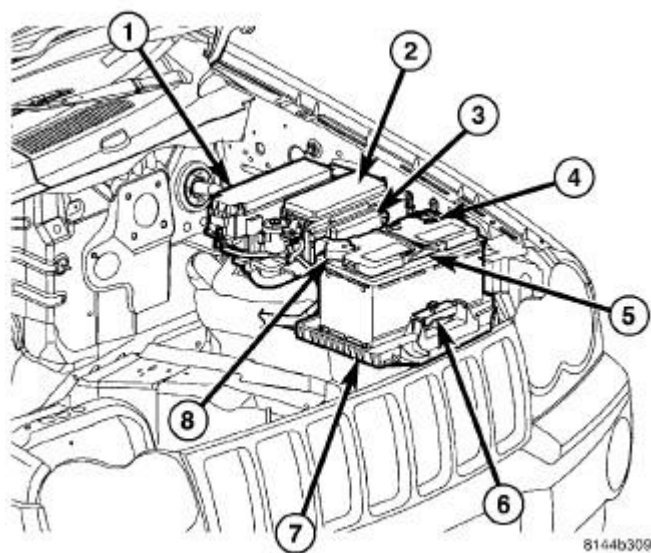


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Fig. 498: ENGINE COVER

Courtesy of CHRYSLER LLC

31. Install the coolant recovery bottle.
32. Position and connect the generator power feed line.
33. Install the engine cover brackets and the engine cover (1).

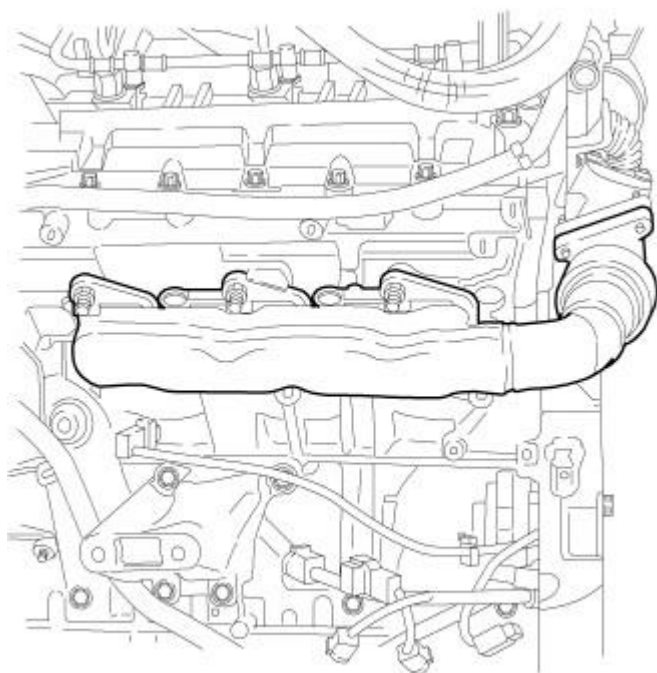


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Fig. 499: Identifying Battery System Components, Power Distribution Center & Integrated Power Module

Courtesy of CHRYSLER LLC

34. Install the Power Distribution Center (PDC) support bracket and install the PDC (1).
35. Install the battery tray (7) and battery (5). Refer to **Electrical/Battery System/TRAY, Battery - Installation** .
36. Position and connect all PDC (1) and generator wiring harness cables.
37. Connect the positive and negative battery cables (8, 4). Refer to **Electrical/Battery System/CABLES, Battery - Installation** .
38. Start the engine and check for leaks.

LEFT

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Fig. 500: 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 N.m (222 in. lbs.)

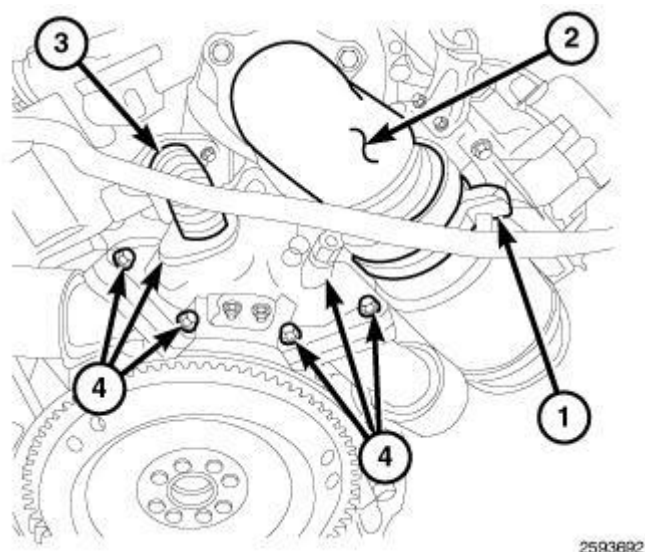


Fig. 501: Pre-Catalytic Converter Clamp, Exhaust Elbow, EGR Tube & Retaining Bolts
Courtesy of CHRYSLER LLC

4. Install the three exhaust manifold bolts (4) on the left side from the crossover pipe to manifold flange. Tighten to 22 N.m (177 in. lbs.), and then add another 90° of rotation.
5. Install EGR tube (3). Tighten to 10 N.m (88 in. lbs.) and then add another 90° of rotation.
6. Install the exhaust elbow (2) to turbocharger bolts. Tighten to 20 N.m (177 in. lbs.) and then add another 90° of rotation.
7. Install the turbocharger heat shield. Tighten to 10 N.m (88 in. lbs.).
8. Install the engine cover. See **Engine - Installation**.
9. Connect the negative battery cable. Refer to **Electrical/Battery System/CABLES, Battery - Installation** .

MANIFOLD, INTAKE

Description

DESCRIPTION

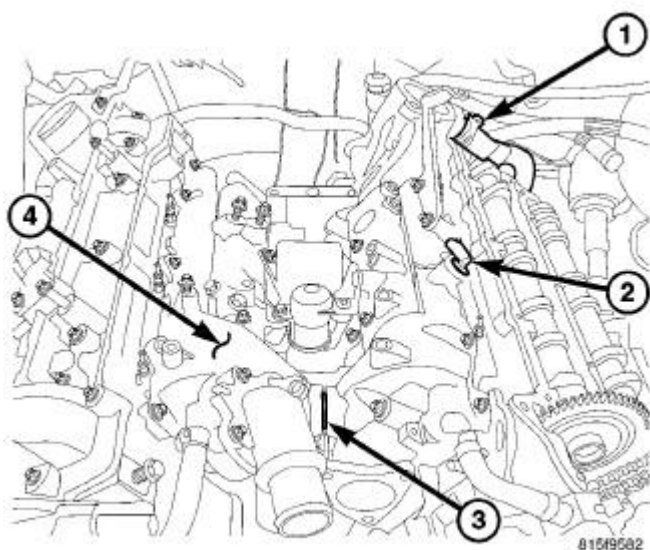


Fig. 502: Intake Manifold & Connections
Courtesy of CHRYSLER LLC

- 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

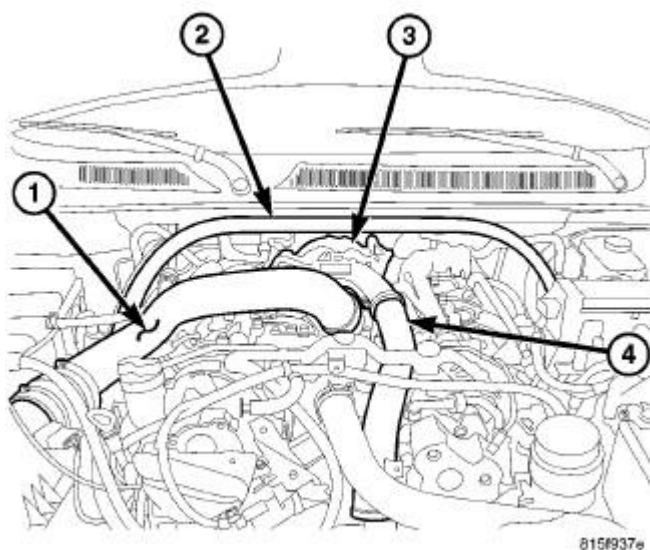


Fig. 503: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

- | |
|---|
| 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 Engine - 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 turbocharger. See Engine/Turbocharger System/TURBOCHARGER - Removal.

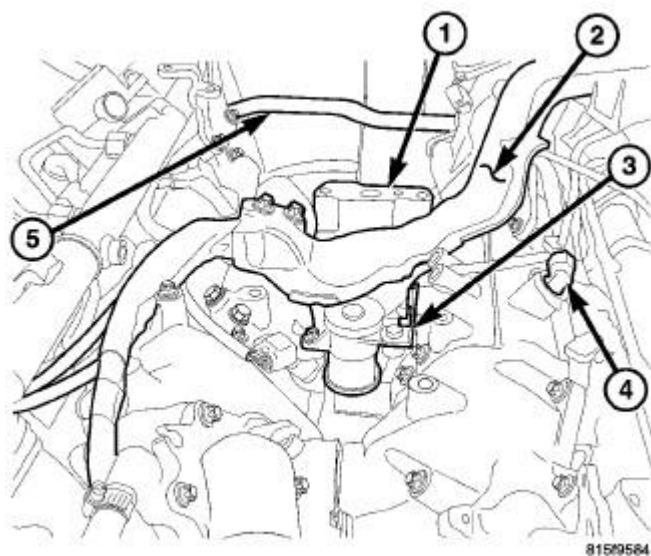


Fig. 504: MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

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

10. 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.

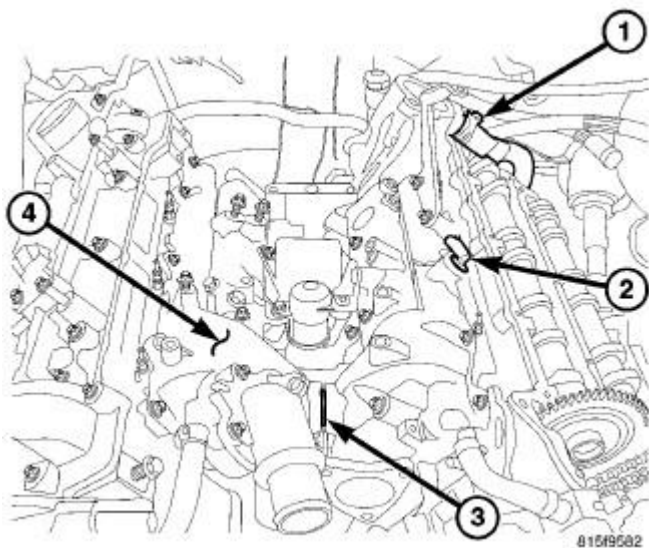


Fig. 505: Intake Manifold & Connections
Courtesy of CHRYSLER LLC

- | |
|---|
| 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.).

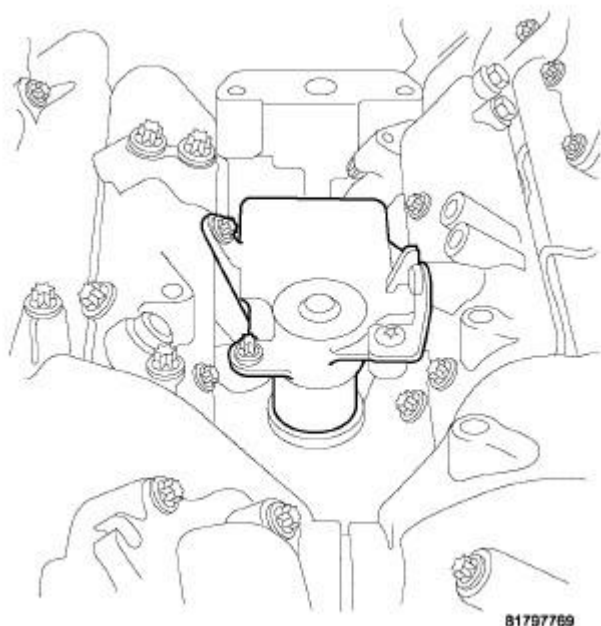


Fig. 506: SWIRL VALVE ACTUATOR

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.

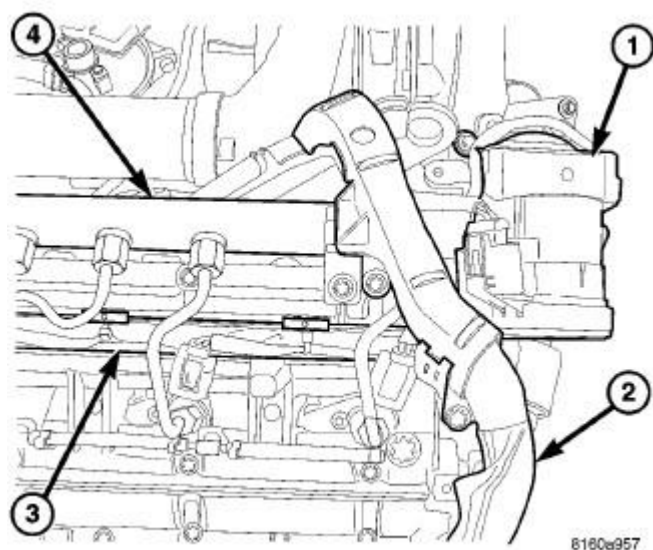


Fig. 507: EGR VALVE WITH MAIN ENGINE WIRING HARNESS
Courtesy of CHRYSLER LLC

- | |
|---|
| 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 Engine/Turbocharger System/TURBOCHARGER - 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.

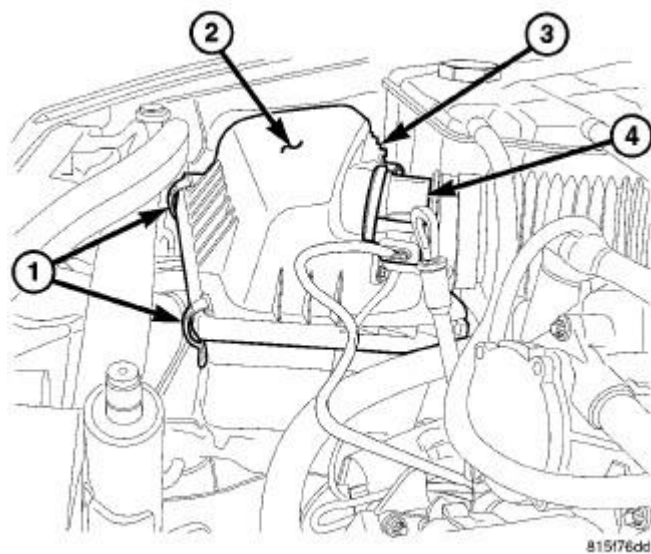


Fig. 508: AIR CLEANER COVER

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 a inlet air compressor which is part of the turbocharger housing, charge air cooler locate in front of the radiator, and charge air cooler plumbing. The is also a electronic control valve placed after the charge air cooler, inline, that assists with air flow during the EGR operating mode.

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.

Removal**REMOVAL**

WARNING: If the engine was just turned off, the air intake system tubes may be hot.

NOTE: Note the location of the rubber air charge cooler to A/C condenser and air charger cooler to radiator air seals. The seals are use to prevent overheating and improve charge air and A/C efficiency.

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.

1. Disconnect the battery negative cable.
2. Drain the fluid out of the power steering fluid reservoir.
3. Raise and support the vehicle.
4. Remove the front tow hook(s). Refer to Frame and Bumpers/Frame/HOOK(S), Tow - Removal .
5. Remove the lower charge air cooler bolts.
6. Lower the vehicle.

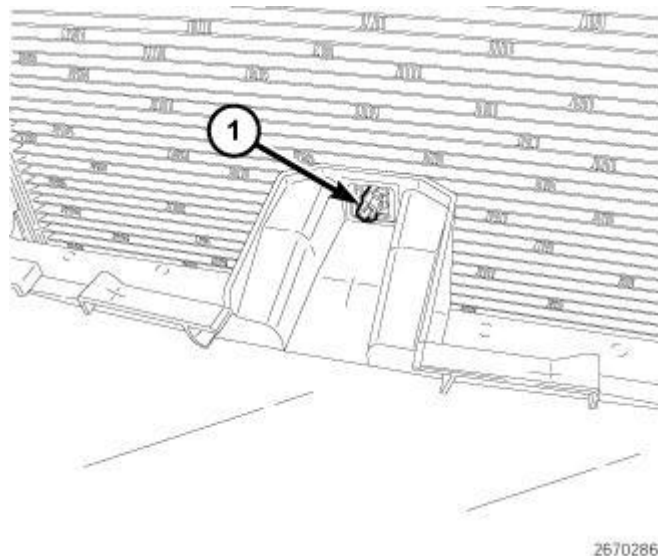


Fig. 509: Center Fascia Retainer
Courtesy of CHRYSLER LLC

7. Remove the front grille. Refer to **Body/Exterior/GRILLE - Removal**.
8. Remove the center fascia retainer (1).

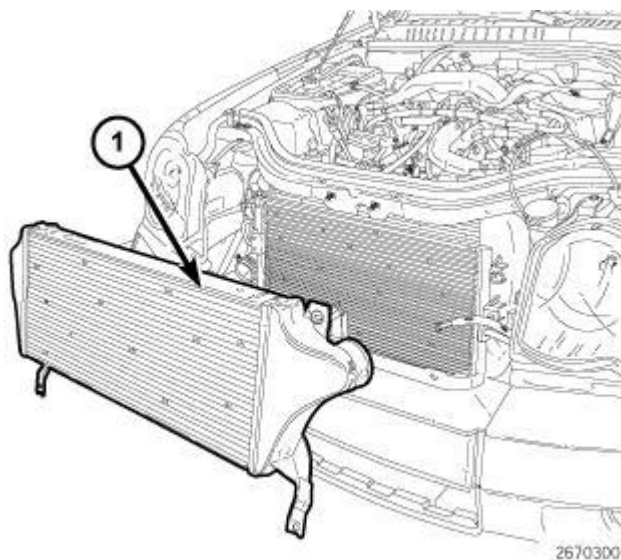


Fig. 510: Charge Air Cooler
Courtesy of CHRYSLER LLC

9. Remove the transmission oil/power steering cooler. Refer to **Steering/Pump/COOLER, Power Steering - Removal**.
10. Remove the hoses from the charge air cooler (1).
11. Remove the upper charge air cooler bolts.

NOTE: Care must be taken not to damage the charge air cooler fins and the fins of

other ancillary cooler components.

12. Remove the charge air cooler (1) by lifting straight up and out.

Inspection**INSPECTION**

Visually inspect the charge air cooler and plumbing for cracks, holes, loose clamps, or damage. Inspect the tubes, fins, and welds for tears, breaks, or other damage. Replace the charge air cooler if damage is found.

Installation**INSTALLATION**

1. Position charge air cooler and install mounting bolts. Tighten bolts to 47 N.m (35 ft. lbs.).

NOTE: When servicing the Air Charge Cooler and/or Turbocharger, the Air Charger Hose (orange) seal located between the Air Charge Hose and Turbocharger must be replaced.

2. Install the boost tubes to the charge air cooler. With the clamps in position, tighten the clamps to 11 N.m (95 in. lbs.)
3. Install the front fascia. Refer to **Frame and Bumpers/Bumpers/FASCIA, Front - Installation** .
4. Connect the battery negative cable.
5. Start engine and check for leaks.

TURBOCHARGER**Description****DESCRIPTION**

CAUTION: The turbocharger is a performance part and must not be tampered with. The actuator bracket is an integral part of the turbocharger. Tampering with the actuator or other 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 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

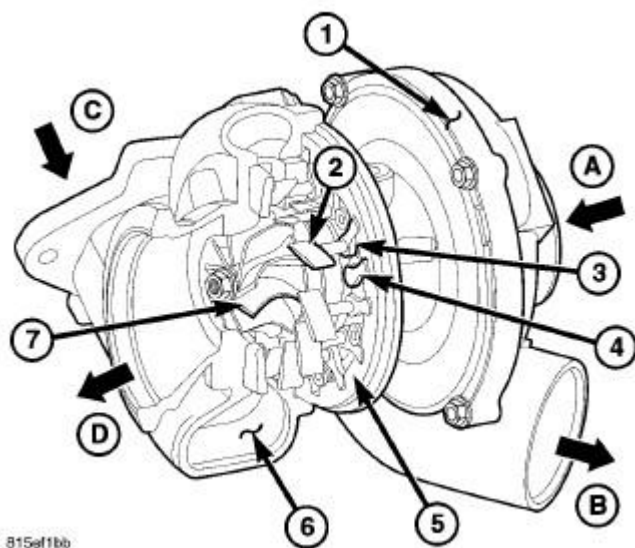


Fig. 511: TURBOCHARGER COMPONENTS
Courtesy of CHRYSLER LLC

- 1 - COMPRESSOR HOUSING
- 2 - GUIDE VANE
- 3 - GUIDE STUD OF GUIDE VANE
- 4 - GUIDE STUD OF CONTROL LINKAGE
- 5- ADJUSTING RING
- 6 - TURBINE HOUSING
- 7 - TURBINE WHEEL
- A - TURBO INLET (FRESH AIR)
- B - TURBO OUTLET (COMPRESSED AIR)
- C - EXHAUST GASES TO TURBINE WHEEL
- D - EXHAUST OUTLET

The exhaust gases of the engine are directed through the exhaust manifold into the turbine housing (6) onto the turbine wheel (7) . The flow energy of the exhaust gases cause the turbine wheel (7) to rotate. Consequently, the compressor wheel, which is connected through the turbine shaft with the turbine wheel (7), is driven at the same speed. The fresh air (A) 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 (2) . The guide stud (3) of the control linkage of the boost pressure actuator turns the adjusting ring (5) in the turbine housing (6) . As a result, all the guide vanes (3) whose guide studs (4) likewise mesh into the adjusting ring (5), are also turned .

At low speeds, the flow cross-section is reduced by closing the guide vanes (2) . Consequently the speed at which the exhaust gas impacts on the turbine wheel (7) is increased, as a result of which the speed of the turbocharger and thus the charge pressure rises.

At high engine speeds the guide vanes (2) are increasingly opened and the flow cross-section is thus enlarged, as a result of which the speed of the turbocharger reduces and the charge 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 below should be inspected. If a DTC for the inlet or intake air temperature has been stored, refer to the appropriate diagnostics.

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 the 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 the 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: Make sure that the correct part number, or superseding part number, is installed. Refer to MOPAR® for the correct part number information.
- 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.

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.

2. If the actuator mechanism doesn't move at all check power and ground supply of the actuator.
3. If the actuator mechanism doesn't move even though the electrical connection has been verified or moves erratically the turbocharger assembly is defective and must be replaced.

Removal

REMOVAL

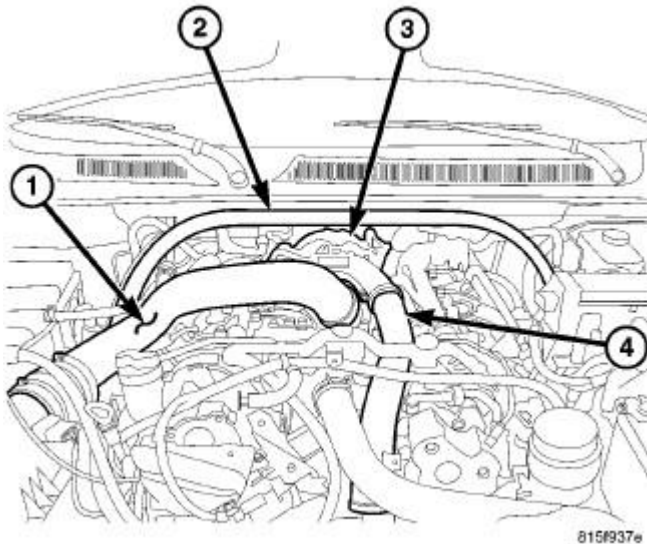


Fig. 512: STRUT TOWER SUPPORT

Courtesy of CHRYSLER LLC

- | |
|-----------------------------|
| 1 - AIR CLEANER OUTLET TUBE |
| 2 - STRUT TOWER SUPPORT |

3 - TURBOCHARGER

4 - CHARGE AIR INLET TUBE

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.

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. Remove the engine trim cover.
3. Raise and support the vehicle.
4. Remove the lower engine cover/splash shield.
5. Drain the engine coolant. Refer to Cooling - Standard Procedure .
6. Lower the vehicle.
7. Remove the coolant recovery bottle. Refer to Cooling/Engine/BOTTLE, Pressurized Coolant - Removal .
8. Remove the battery. Refer to Electrical/Battery System/BATTERY - Removal .
9. Remove the battery tray. Refer to Electrical/Battery System/TRAY, Battery - Removal .
10. Remove the power distribution center (PDC) and it's support bracket.
11. Disconnect all PDC and generator wiring harnesses.
12. Remove the strut tower support (2).
13. Remove the air cleaner assembly and air intake tube (air cleaner to turbo) (1). See Engine/Air Intake System/BODY, Air Cleaner - Removal.
14. Remove the transmission fill tube and trim cover bracket.
15. Remove the vapor control valve.
16. Remove the air charge outlet tube (turbo to cooler) (4).
17. Remove the turbo heat shield (3).

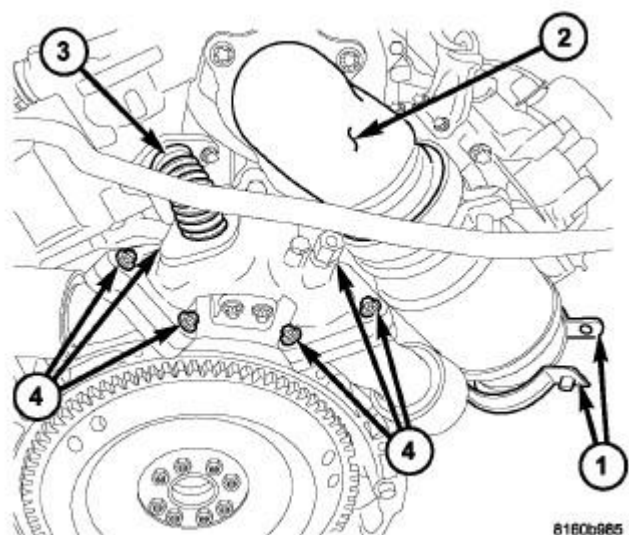


Fig. 513: Removing/Installing Air Intake, Turbo & Exhaust System Components
Courtesy of CHRYSLER LLC

18. Disconnect the exhaust elbow at turbo (2).
19. Disconnect the EGR tube at manifold to left cylinder head (3).
20. Remove the left and right exhaust manifold retaining bolts and gaskets (4).

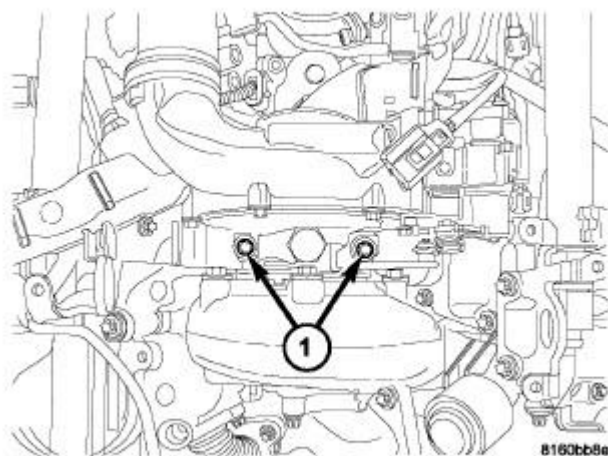


Fig. 514: Turbocharger To Intake Manifold Retaining Bolts
Courtesy of CHRYSLER LLC

21. Remove the two turbocharger manifold to support brace bolts.
22. Remove the turbocharger to intake manifold retaining bolts (1).

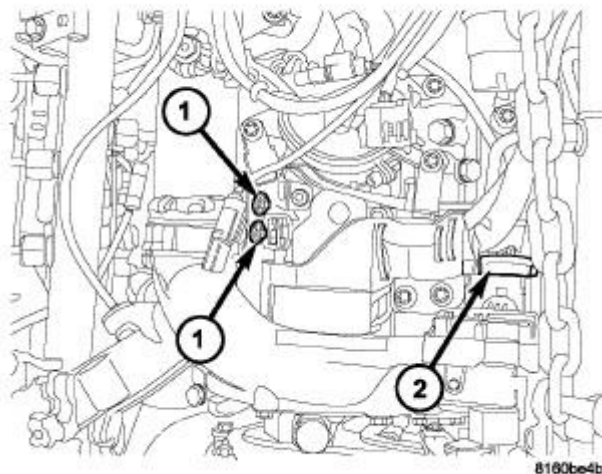


Fig. 515: Front Bracket Retaining Bolts & Boost Pressure Servo Connector
Courtesy of CHRYSLER LLC

23. Disconnect turbo boost pressure servo connector (2).
24. Remove the turbo front bracket retaining bolts (1).
25. Remove the turbocharger and exhaust crossover pipe as an assembly.
26. If necessary, disassemble the exhaust crossover pipe from the turbocharger.

Installation

INSTALLATION

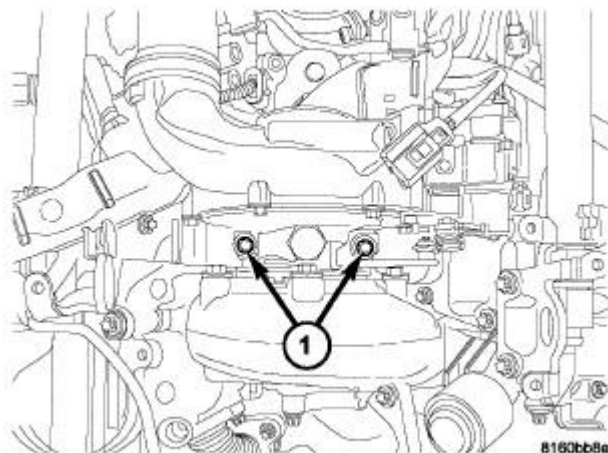


Fig. 516: Turbocharger To Intake Manifold Retaining Bolts

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.

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. Position the turbocharger, exhaust crossover pipe and gasket onto the exhaust manifold and intake manifold as an assembly.

CAUTION: Make sure the gasket is installed properly or the turbo oil feed hole will be blocked.

3. Connect the turbo boost pressure servo connector.
4. Install the two turbocharger manifold to support brace bolts. Tighten the bolts to 8 N.m (71 ft. lbs.).
5. Install the turbocharger to intake manifold retaining bolts (1). Tighten the bolts (1) to 10 N.m (89 lbs. in.).

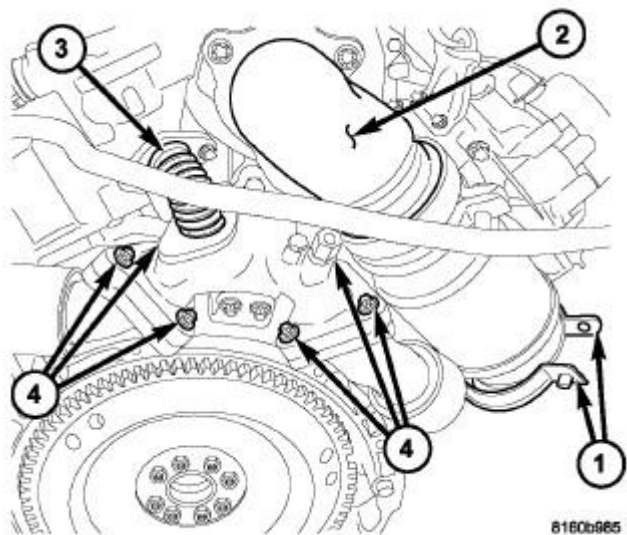


Fig. 517: Removing/Installing Air Intake, Turbo & Exhaust System Components
Courtesy of CHRYSLER LLC

6. Install the left and right exhaust manifold retaining bolts (4) and gaskets. Tighten the bolts (4) to 20 N.m (15 ft. lbs.) then add another 90° of rotation.
7. Reconnect the EGR tube at manifold to the left cylinder head (3).
8. Install the exhaust elbow (4) to the turbocharger. Tighten the bolts to 20 N.m (15 ft. lbs.) then add another 90° of rotation.
9. Install the transmission fill tube and trim cover bracket.
10. Raise the vehicle and install the catalytic converter to the downstream catalytic converter clamp (1).

11. Install front splash shield.

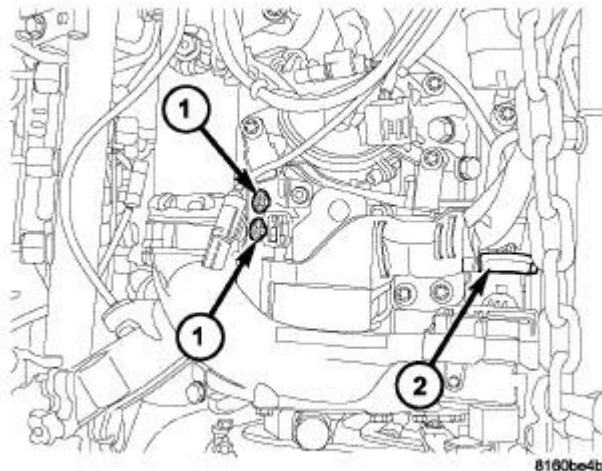


Fig. 518: Front Bracket Retaining Bolts & Boost Pressure Servo Connector
Courtesy of CHRYSLER LLC

12. Lower vehicle, install the turbo front bracket retaining bolts (1).

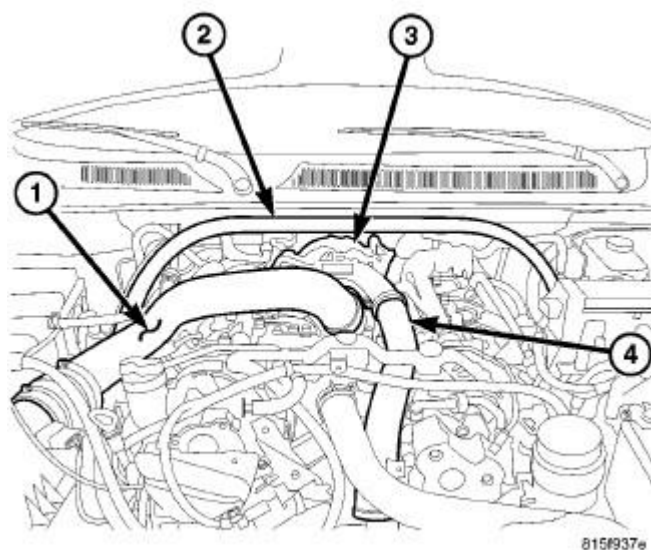


Fig. 519: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - AIR CLEANER OUTLET TUBE
2 - STRUT TOWER SUPPORT
3 - TURBOCHARGER</p> |
|---|

4 - CHARGE AIR INLET TUBE

13. Install the turbo heat shield (3).
14. Install the vapor control valve.
15. Install air tube (turbo to cooler) (4).
16. Install the engine cover bracket.
17. Install air intake tube (air cleaner to turbo) (1).
18. Install the air cleaner assembly.
19. Install the strut tower support (2).
20. Connect all PDC and generator wiring harnesses.
21. Install the power distribution center (PDC) and it's support bracket.
22. Install the coolant recovery bottle. Refer to Cooling/Engine/BOTTLE, Pressurized Coolant - Installation .
23. Refill the cooling system. Refer to Cooling - Standard Procedure .
24. Install the engine trim cover.
25. Reconnect the negative battery cable.
26. Start the engine, check for any exhaust or coolant leaks, repair as necessary. Refer to Cooling - Diagnosis and Testing . Refer to Exhaust System - Diagnosis and Testing .

VALVE TIMING

CHAIN AND SPROCKETS, TIMING

Removal

TIMING CHAIN GUIDE

NOTE: When servicing the timing chain guides, both the upper and the lower guide should be replaced in pairs.

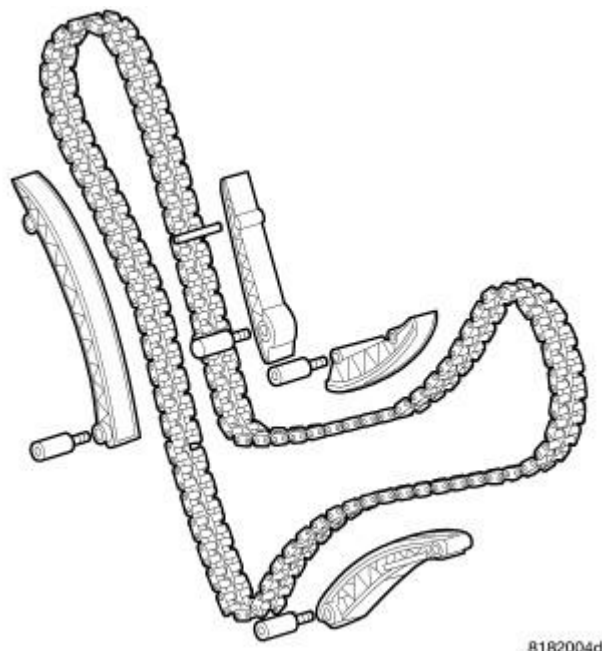


Fig. 520: TIMING CHAIN AND GUIDES

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 **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
3. Remove the right cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
4. Remove the timing chain cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.

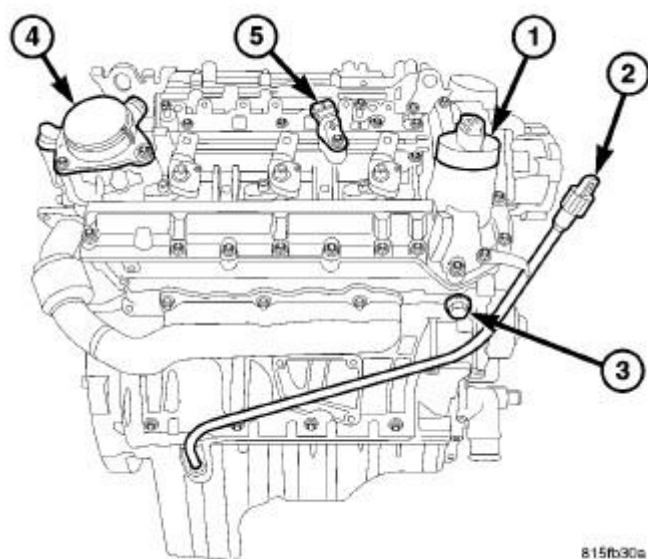


Fig. 521: TIMING CHAIN ADJUSTER

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).

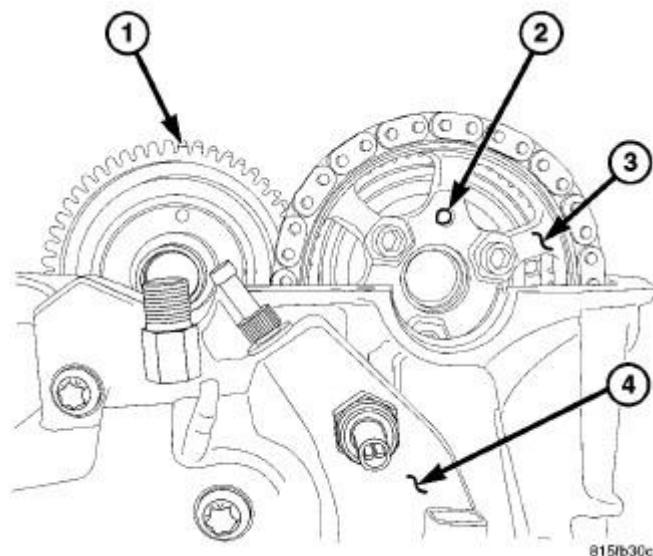


Fig. 522: LEFT EXHAUST CAMSHAFT DRIVE GEAR ALIGNMENT DOWEL
Courtesy of CHRYSLER LLC

- 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.

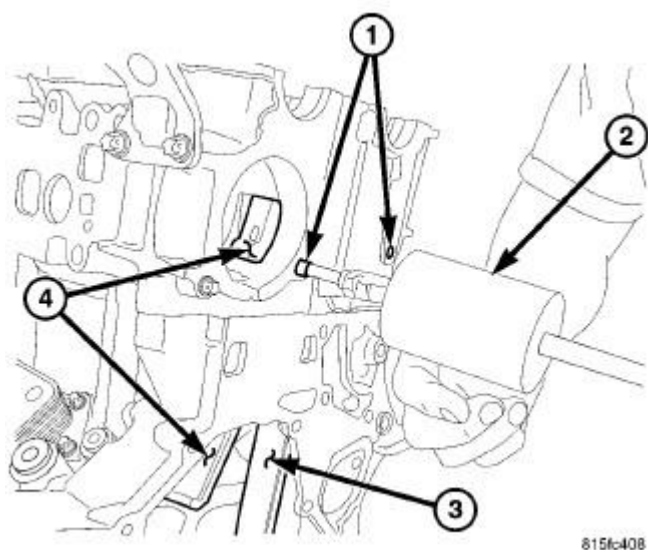


Fig. 523: LEFT UPPER TIMING CHAIN GUIDE PIN EXTRACTION
Courtesy of CHRYSLER LLC

- | |
|---|
| 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.

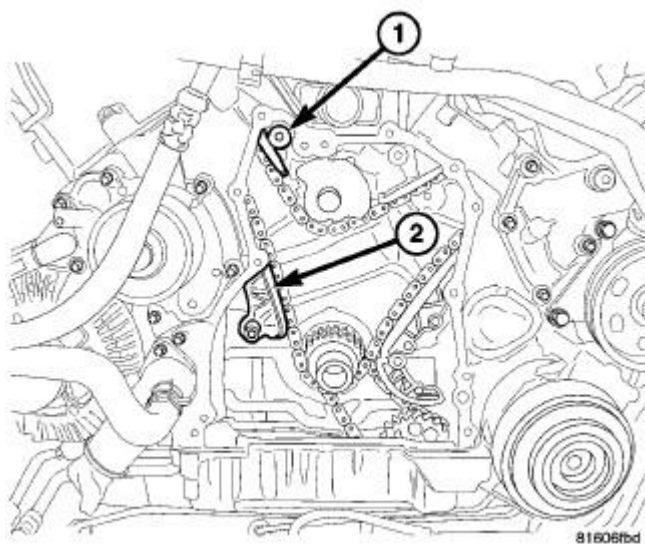
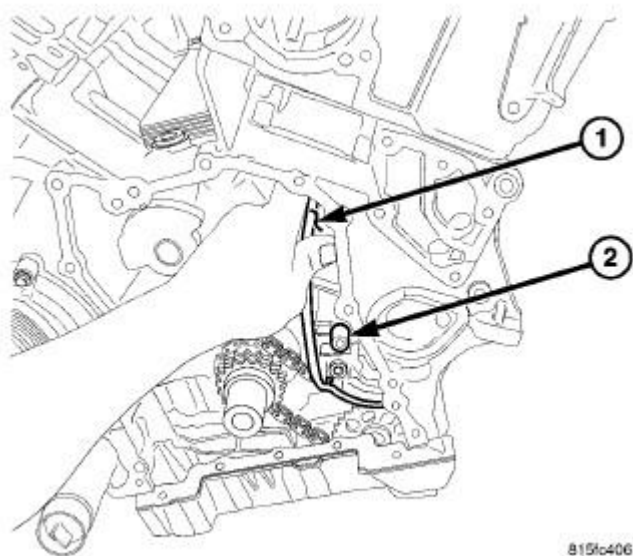


Fig. 524: RIGHT TIMING CHAIN GUIDES

Courtesy of CHRYSLER LLC

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

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. 525: 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 **Engine/Cylinder Head - Removal**.
3. Remove timing chain cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.

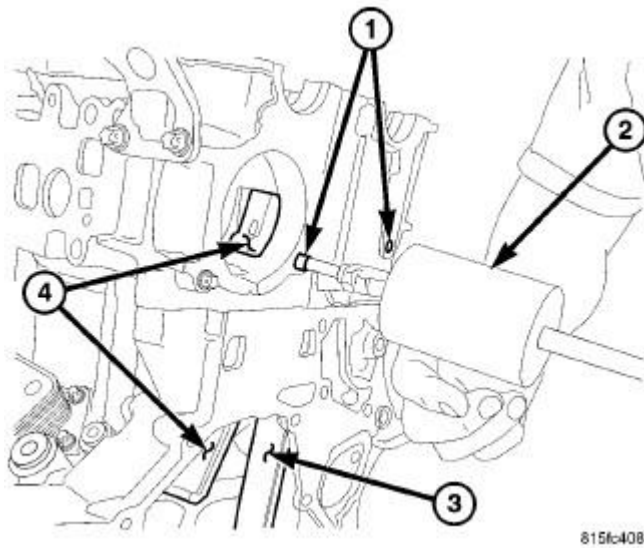


Fig. 526: LEFT UPPER TIMING CHAIN GUIDE PIN EXTRACTION
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - GUIDE PIN
2 - SLIDE HAMMER
3 - LOWER TIMING CHAIN GUIDE
4 - UPPER TIMING CHAIN GUIDE</p> |
|---|

4. Remove the timing chain guide pin.
5. Remove the timing chain retaining bolt.
6. Remove the timing chain tensioner.

TIMING CHAIN

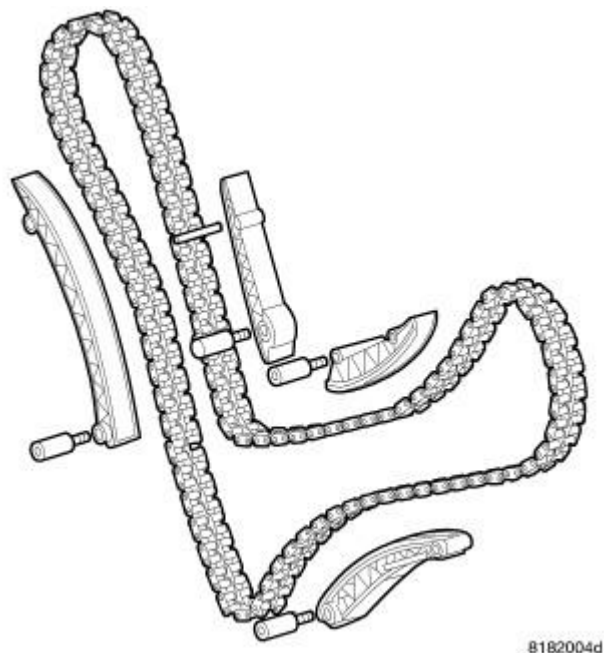


Fig. 527: TIMING CHAIN AND GUIDES

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.

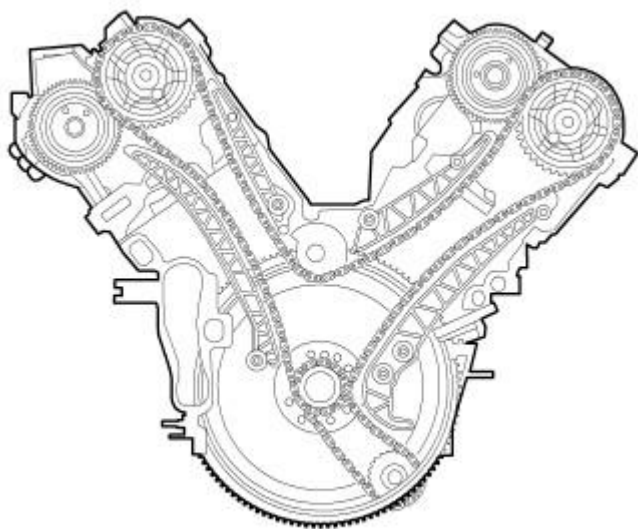
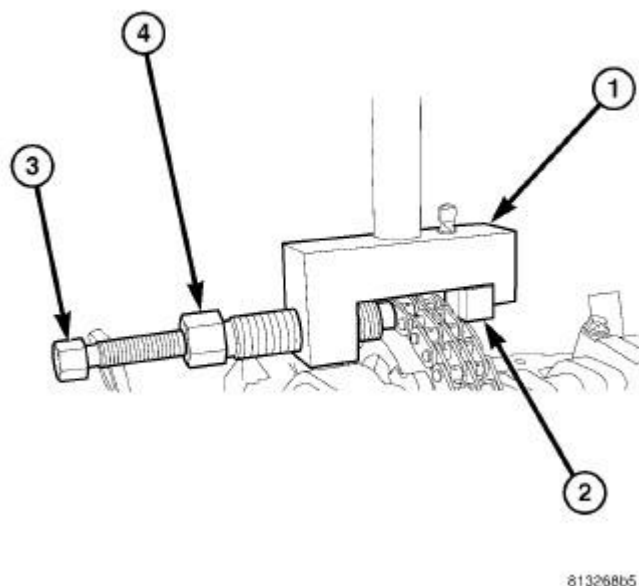


Fig. 528: TIMING

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 Engine/Cylinder Head/COVER(S), Cylinder Head - 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. 529: SPECIAL TOOL #9312-1**

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 (1) 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.

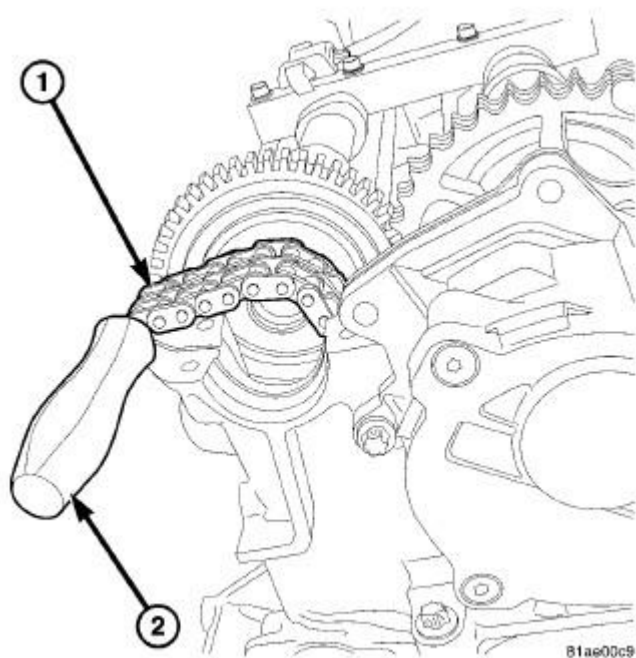


Fig. 530: PREVENT CHAIN FROM FALLING
Courtesy of CHRYSLER LLC

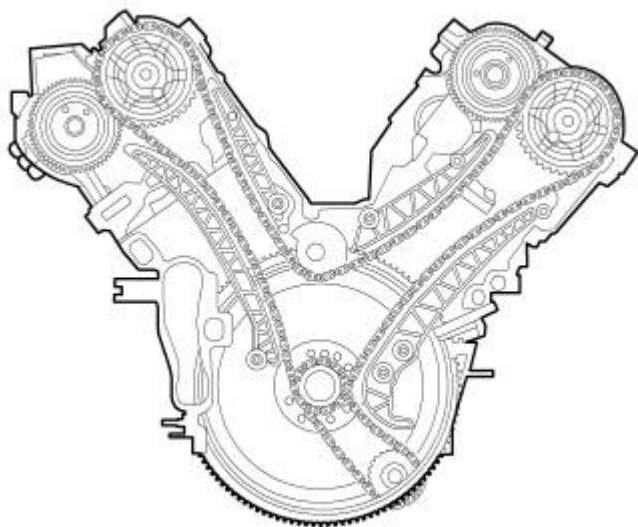
8. Carefully turn the thrust pin (2) 9312-13 of the Chain Link Remover/Installer (1) 9312A clockwise while holding the handle until the rivet is pressed out and the chain is separated. Discard the loose link and plates.
9. Use a small screwdriver to prevent the timing chain from slipping into the engine.

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.

Inspection

INSPECTION



81820051

Fig. 531: TIMING

Courtesy of CHRYSLER LLC

1. Remove the left cylinder head cover. See Engine/Cylinder Head/COVER(S), Cylinder Head - Removal.
2. Remove the right cylinder head cover. See Engine/Cylinder Head/COVER(S), Cylinder Head - Removal.

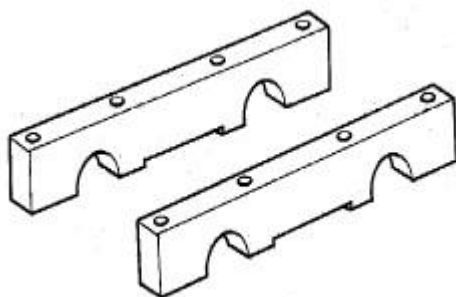
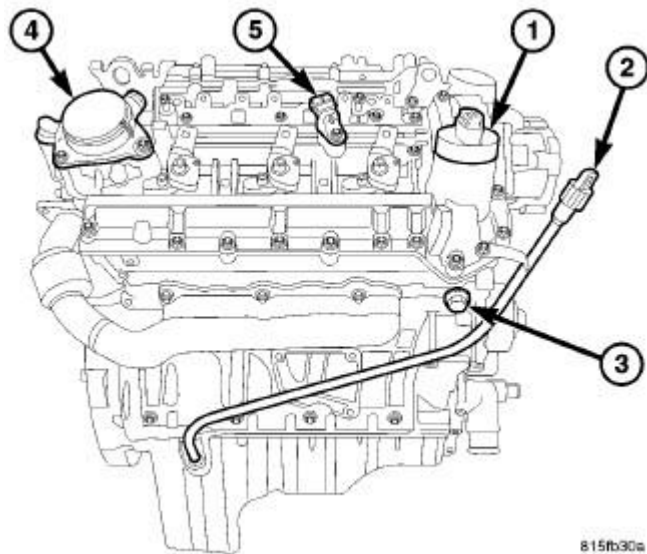


Fig. 532: Retainer, Camshafts - 9555

Courtesy of CHRYSLER LLC

3. Install the camshaft retainers.

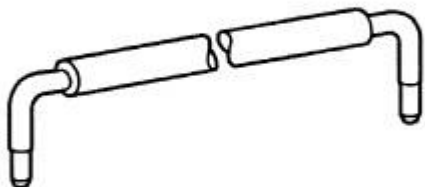


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Fig. 533: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

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

4. Make sure that the timing chain cover is fully seated.



80e492c7

Fig. 534: #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 GUIDE

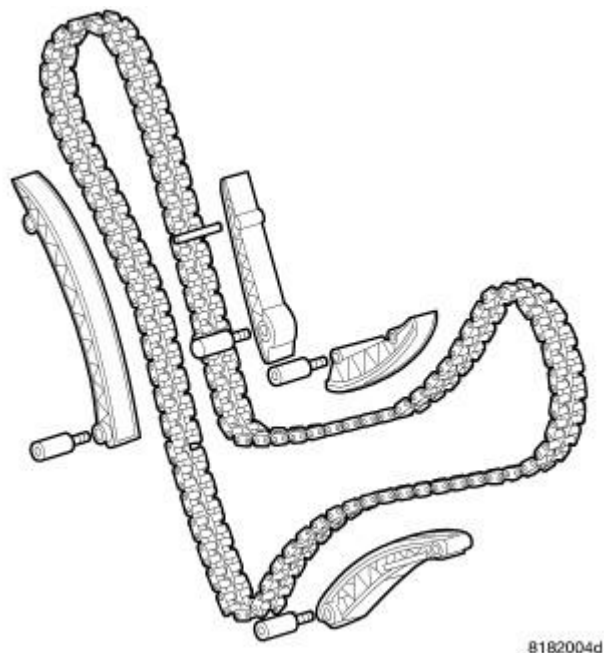


Fig. 535: TIMING CHAIN AND GUIDES

Courtesy of CHRYSLER LLC

NOTE: Carefully clean all mating surfaces with appropriate solvents to assure that no grease or oil is present during reassembly.

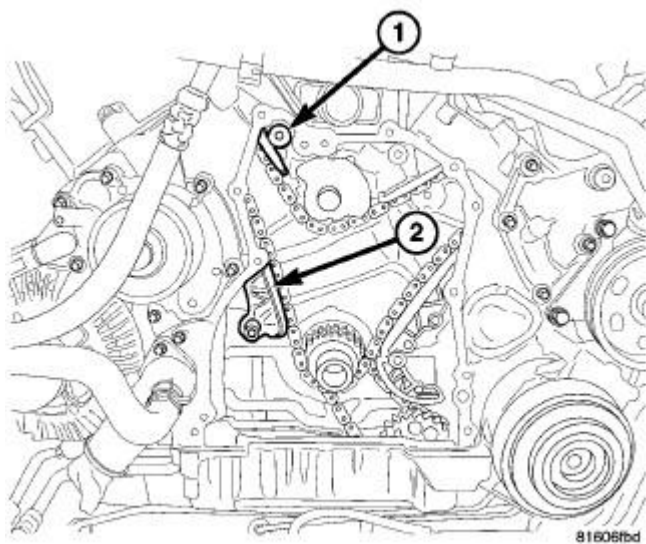


Fig. 536: RIGHT TIMING CHAIN GUIDES

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.

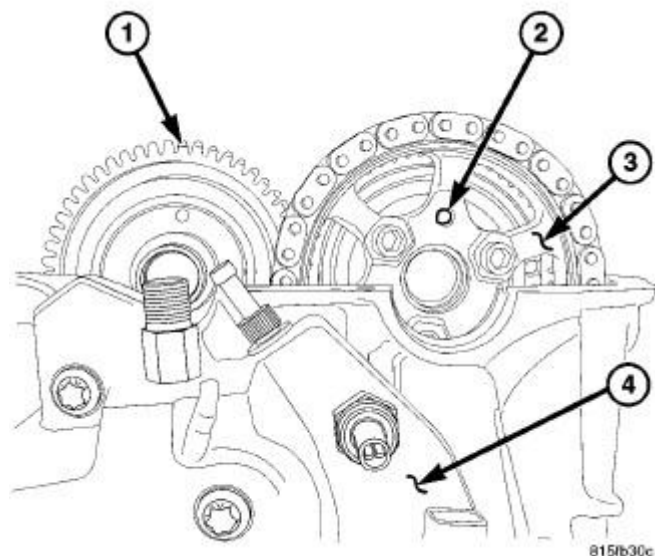


Fig. 537: LEFT EXHAUST CAMSHAFT DRIVE GEAR ALIGNMENT DOWEL
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - LEFT INTAKE CAMSHAFT
2 - LEFT EXHAUST CAMSHAFT DRIVE GEAR
ALIGNMENT DOWEL
3 - LEFT EXHAUST CAMSHAFT DRIVE GEAR
4 - HIGH PRESSURE FUEL INJECTION PUMP</p> |
|---|

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.).

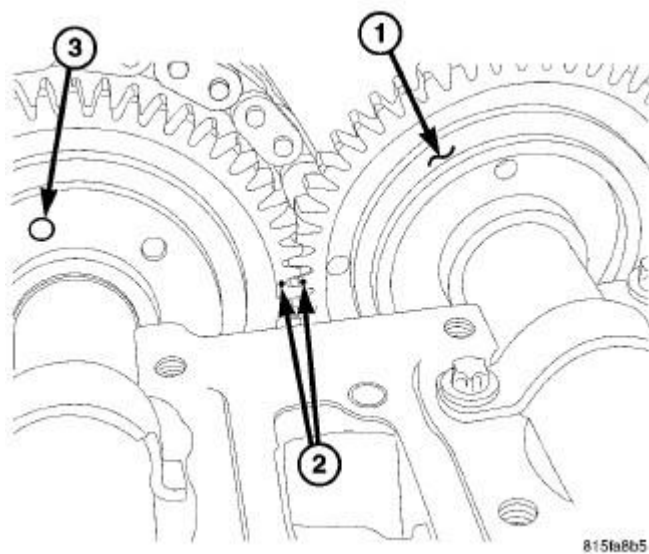


Fig. 538: LEFT CAMSHAFT GEAR ALIGNMENT
Courtesy of CHRYSLER LLC

- | |
|--|
| 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.).

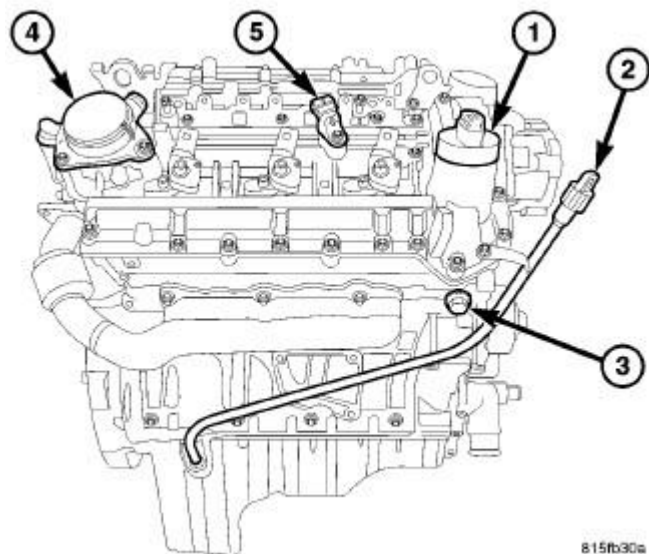


Fig. 539: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- 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 **Engine/Valve Timing/COVER(S), Engine Timing - 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

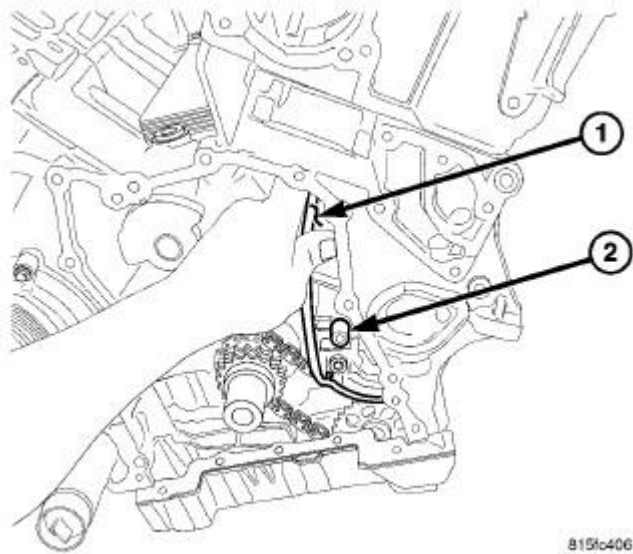


Fig. 540: Left Lower Timing Chain Guide And Fastener
Courtesy of CHRYSLER LLC

- 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 **Engine/Valve Timing/COVER(S), Engine Timing - 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 **Engine/Cylinder Head - Installation**.
6. Install the cylinder head covers. See **Engine/Cylinder Head/COVER(S), Cylinder Head - 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.

TIMING CHAIN

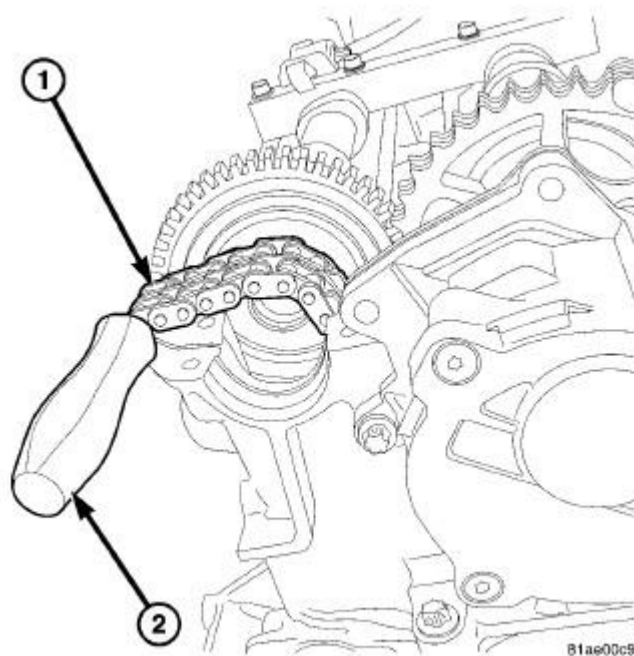


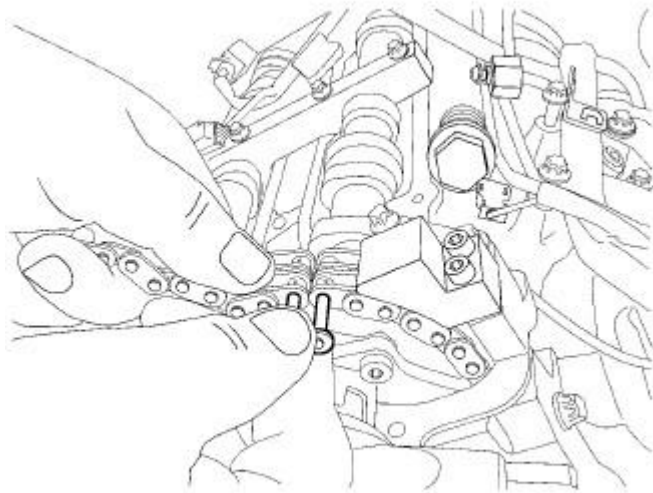
Fig. 541: PREVENT CHAIN FROM FALLING
Courtesy of CHRYSLER LLC

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.

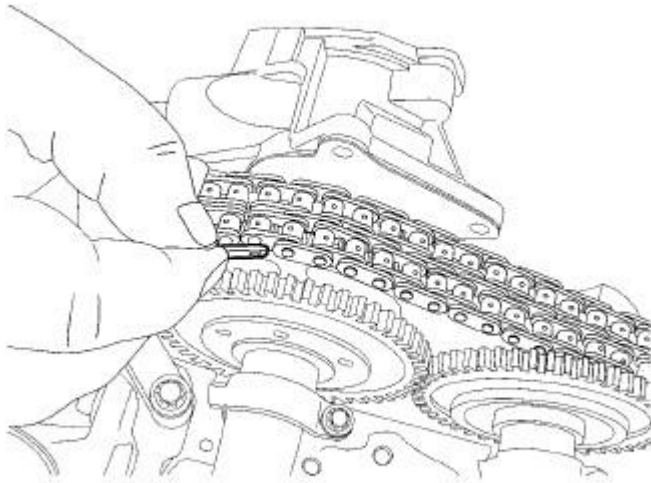


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Fig. 542: MASTER LINK
Courtesy of CHRYSLER LLC

CAUTION: Always install the new timing chain with the oil holes pointing up.
Failure to do so will result in severe engine damage.

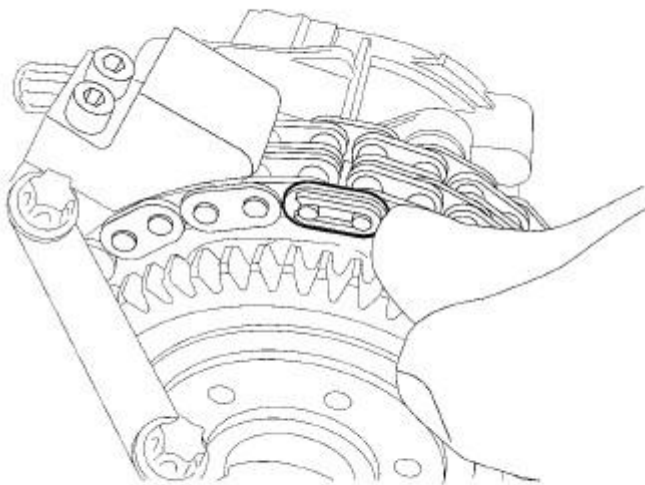
2. Connect new timing chain, oil hole side up and old timing chain with the assembly link.



81ae00bc

Fig. 543: MASTER LINK - REVERSE SIDE
Courtesy of CHRYSLER LLC

3. Place the baking plate on the back side of the master link.



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Fig. 544: MASTER LINK CLIP
Courtesy of CHRYSLER LLC

4. Place the master link clip on the master link.

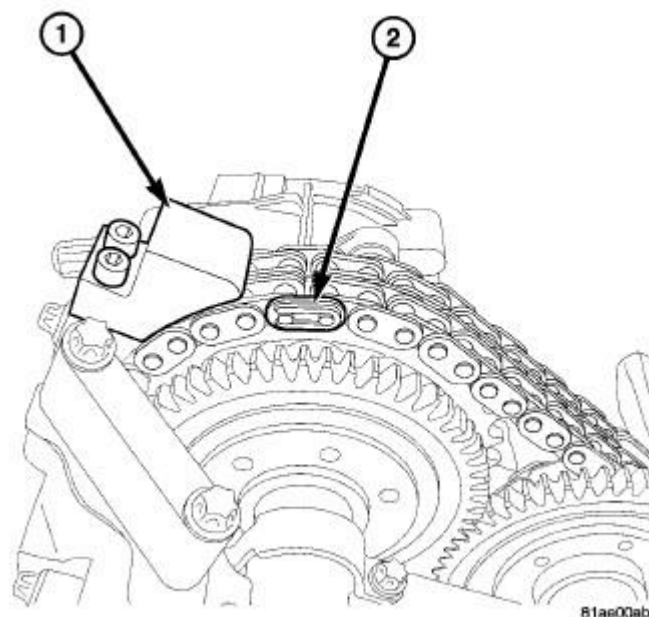


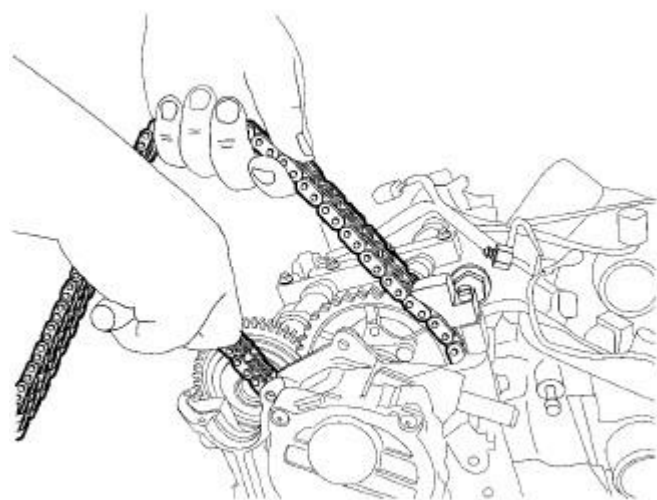
Fig. 545: MASTER LINK CLIP INSTALLED

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. 546: 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.

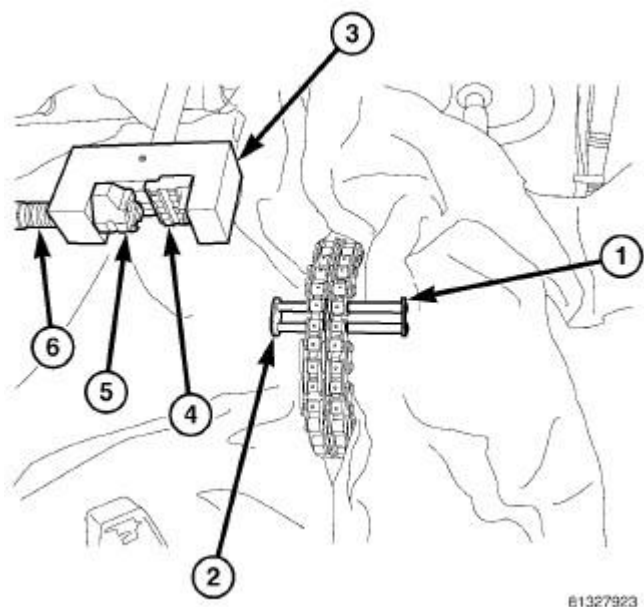
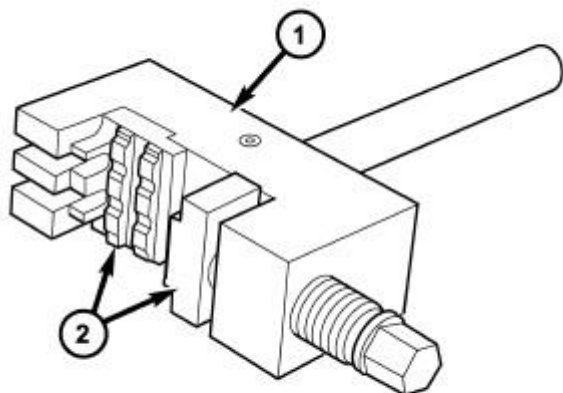


Fig. 547: Removal/Installation Chain Link
Courtesy of CHRYSLER LLC

- 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.



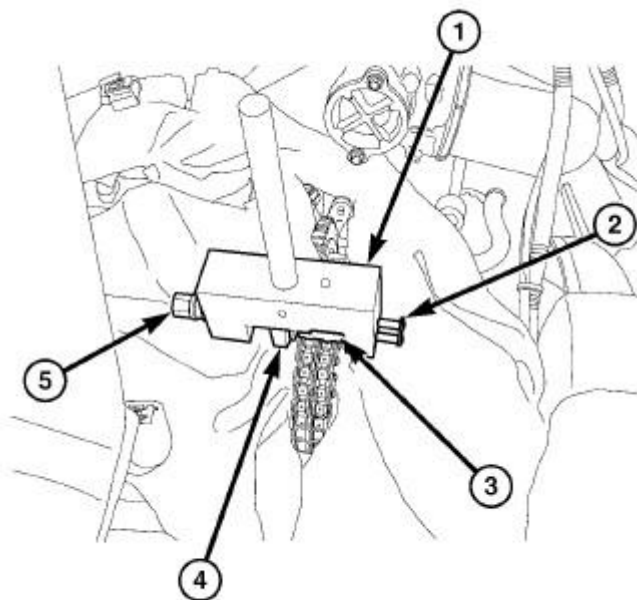
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Fig. 548: INSTALLING ASSEMBLY INSERTS INTO RIVETING TOOL
 Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - CHAIN LINK REMOVER/INSTALLER 9312A
2 - INSERTS 9312-7 and 9312-10 |
|--|

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. 549: Installing Chain Link Remover/Installer 9312A On Riveting Tool
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.

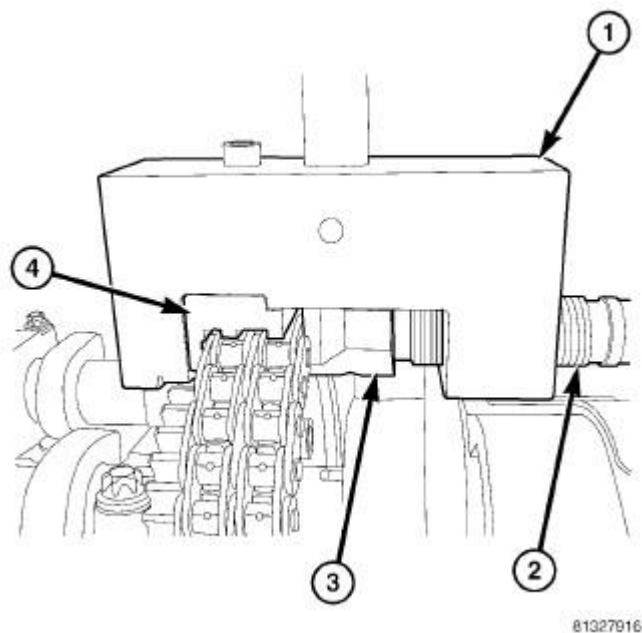


Fig. 550: Outer Plate Installation
Courtesy of CHRYSLER LLC

- 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.

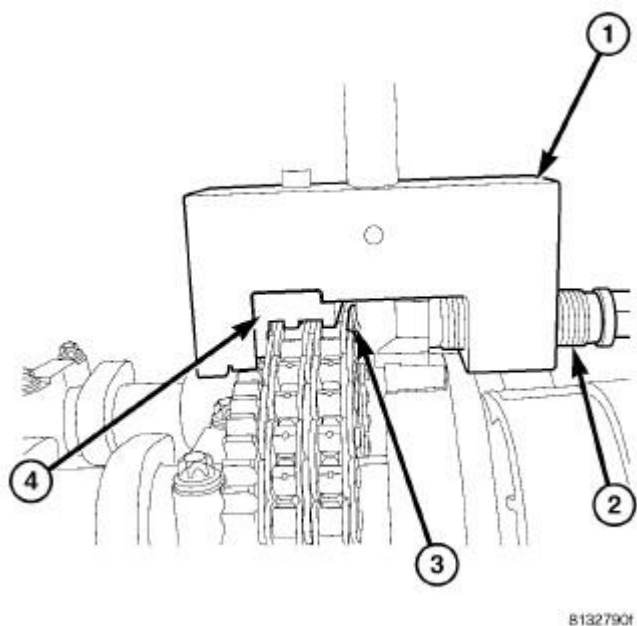


Fig. 551: Riveting Link Pins
Courtesy of CHRYSLER LLC

- 1 - CHAIN LINK REMOVER/INSTALLER 9312A
- 2 - THRUST SPINDLE
- 3 - RIVETING PROFILE
- 4 - INSERT 9312-6

22. Inspect riveting, re-rivet if required.

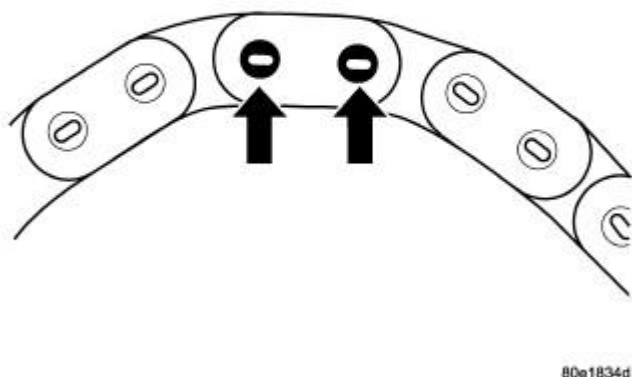


Fig. 552: RIVET INSPECTION
Courtesy of CHRYSLER LLC

23. Install cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation.**
24. Install engine cover. See **Engine - Installation.**
25. Connect negative battery cable.
26. Start engine and inspect for leaks. Care must be taken to observe the fuel system warnings.

COVER(S), ENGINE TIMING

Removal

REMOVAL

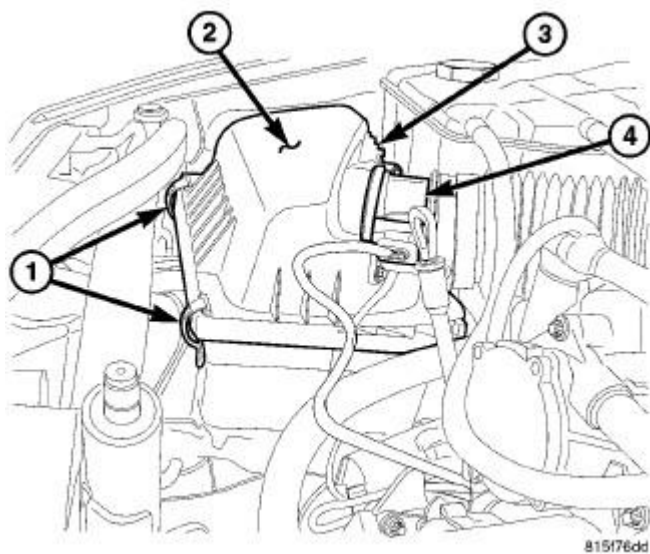


Fig. 553: AIR CLEANER COVER
Courtesy of CHRYSLER LLC

- 1 - SPRING CLIPS
- 2 - COVER
- 3 - AIR PRESSURE SENSOR
- 4 - MAF SENSOR

1. Disconnect negative battery cable. Refer to Electrical/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.

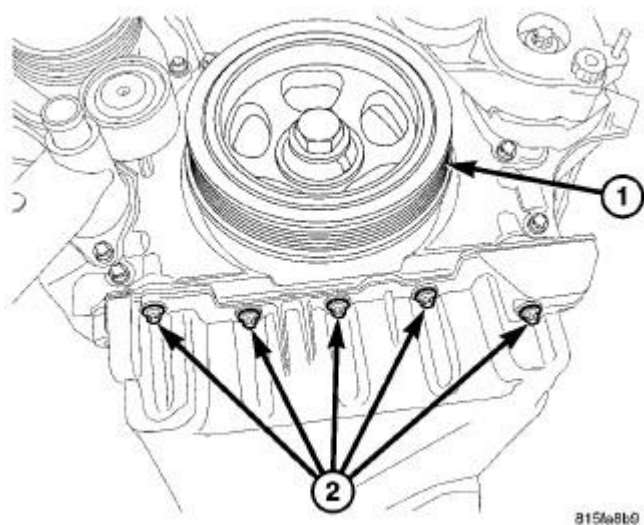


Fig. 554: Vibration Damper & Front Oil Pan Bolts
 Courtesy of CHRYSLER LLC

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.

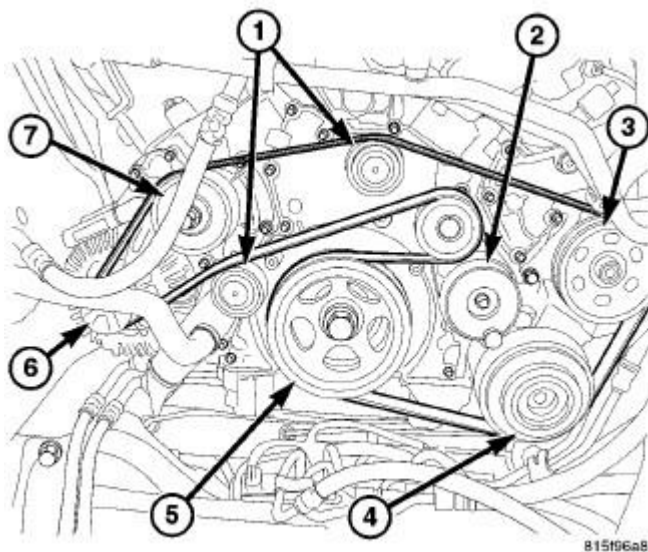


Fig. 555: Accessory Drive Belt Routing
Courtesy of CHRYSLER LLC

- 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.

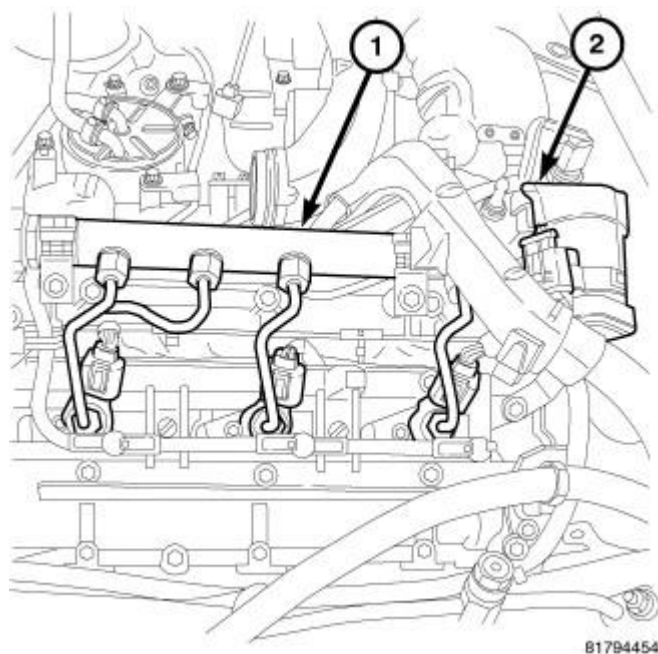


Fig. 556: EGR VALVE
Courtesy of CHRYSLER LLC

- 1 - FUEL RAIL
- 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.

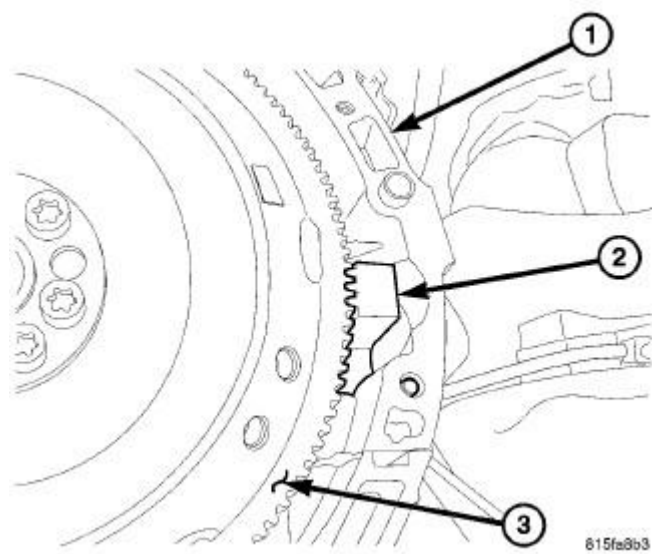


Fig. 557: Special Tool # 9102
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - ENGINE BLOCK
2 - SPECIAL TOOL #9102
3 - FLEX PLATE</p> |
|---|

24. Raise and support the vehicle.
25. Remove the starter blank.
26. Install special tool 9102 crankshaft lock.
27. Lower the vehicle.

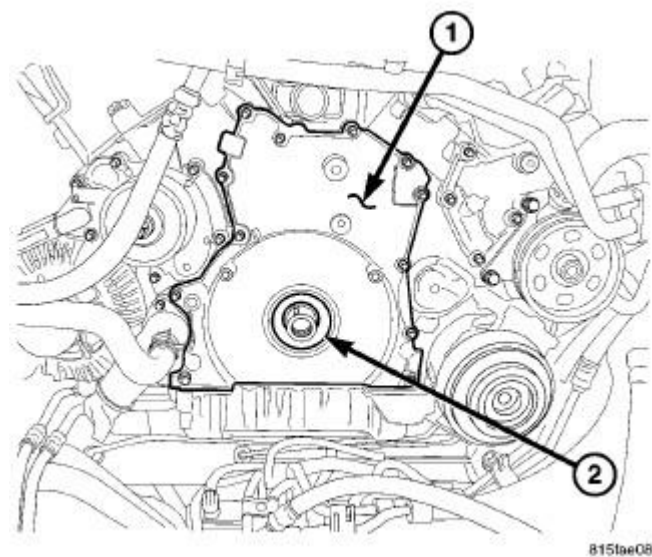


Fig. 558: FRONT TIMING COVER

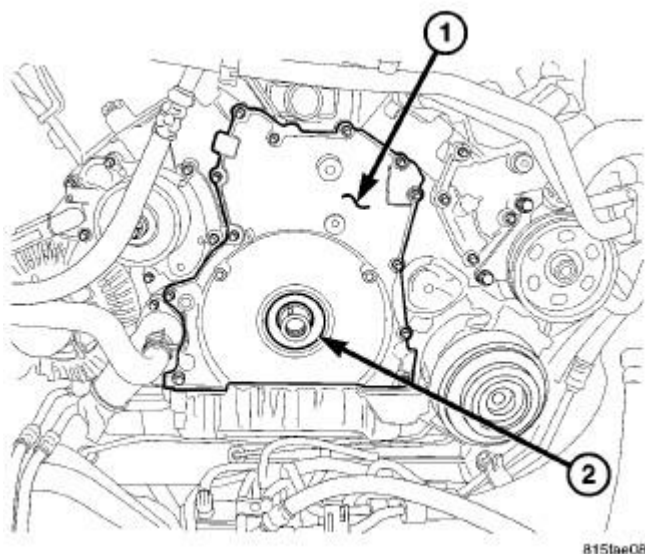
Courtesy of CHRYSLER LLC

- | |
|---|
| 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. 559: 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.

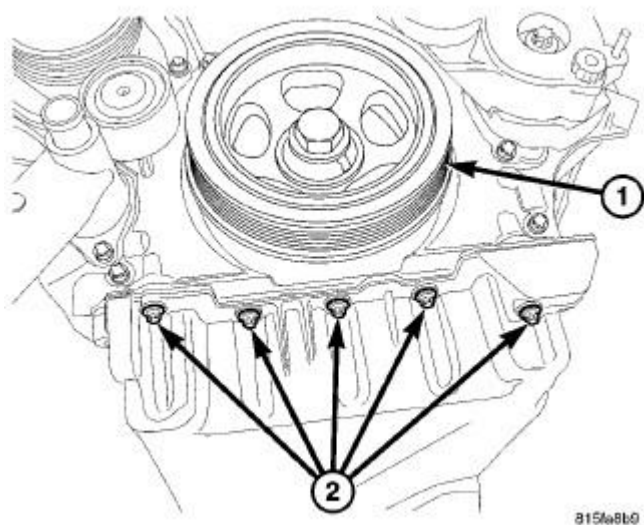


Fig. 560: Vibration Damper & Front Oil Pan Bolts
Courtesy of CHRYSLER LLC

1 - VIBRATION DAMPER
2 - OIL PAN BOLTS

4. Install the front oil pan bolts. Tighten bolts to 14 N.m (10 ft. lbs.).
5. Lower the vehicle.

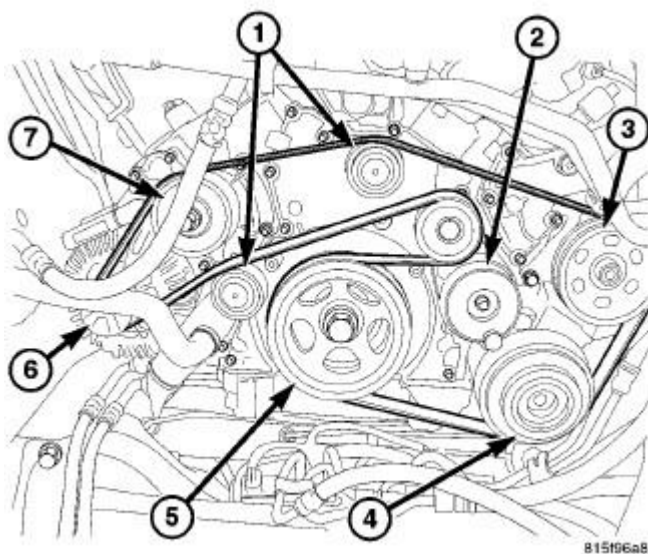


Fig. 561: Accessory Drive Belt Routing
Courtesy of CHRYSLER LLC

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 58 N.m (43 ft. lbs.).
9. Install the accessory drive belt.

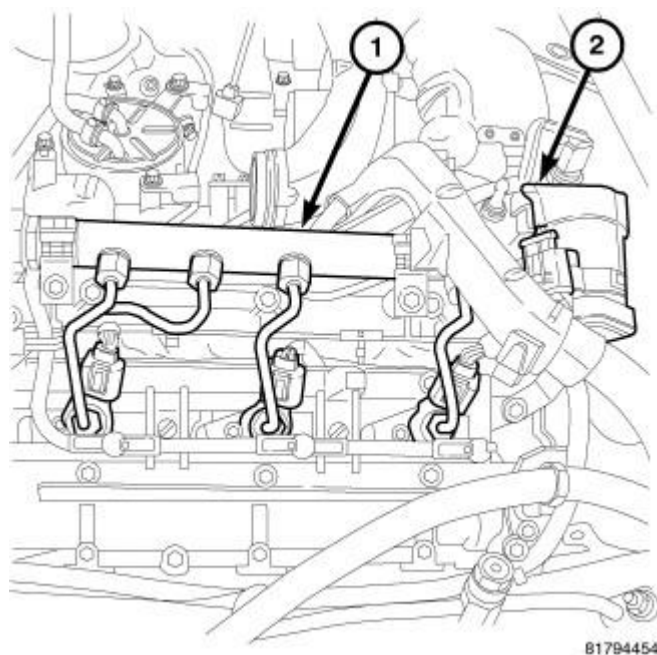


Fig. 562: EGR VALVE
 Courtesy of CHRYSLER LLC

- 1 - FUEL RAIL
- 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.

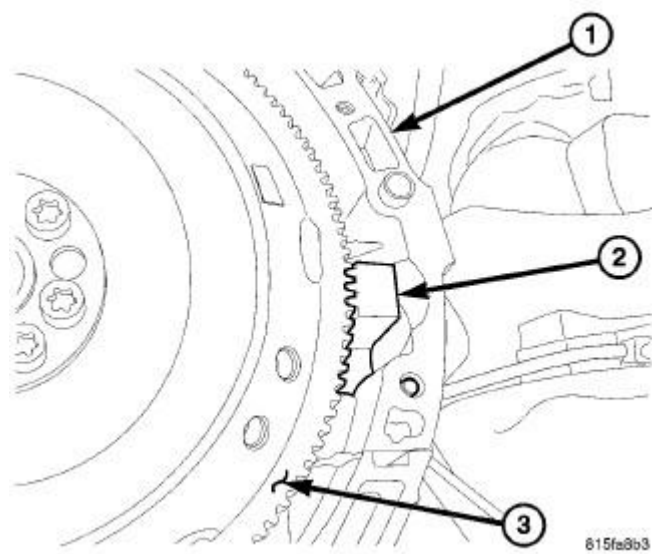
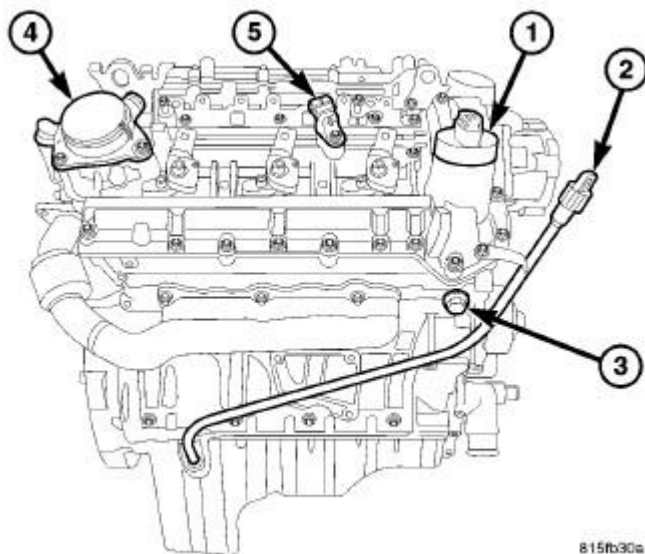


Fig. 563: SPECIAL TOOL # 9102
Courtesy of CHRYSLER LLC

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

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****Fig. 564: 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**

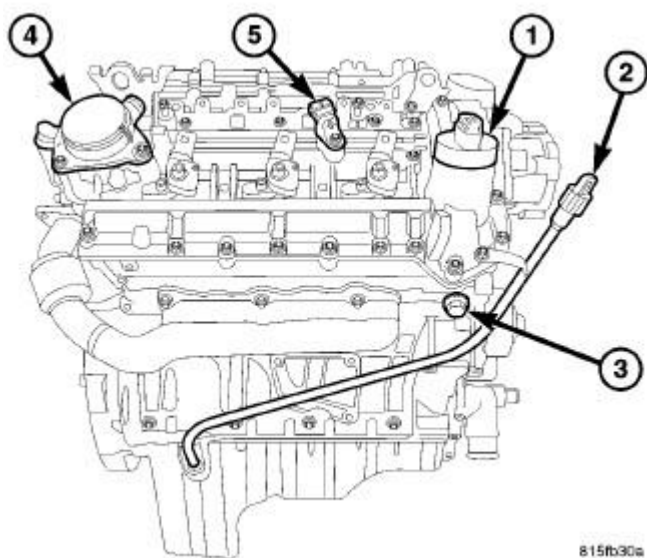


Fig. 565: TIMING CHAIN TENSIONER

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 **Engine - Removal**.
3. Remove the engine intake air duct.
4. Remove air cleaner housing. See **Engine/Air Intake System/AIR CLEANER - Removal**.
5. Remove the cable strap from the engine wiring harness.
6. Remove the timing chain tensioner.

Installation

INSTALLATION

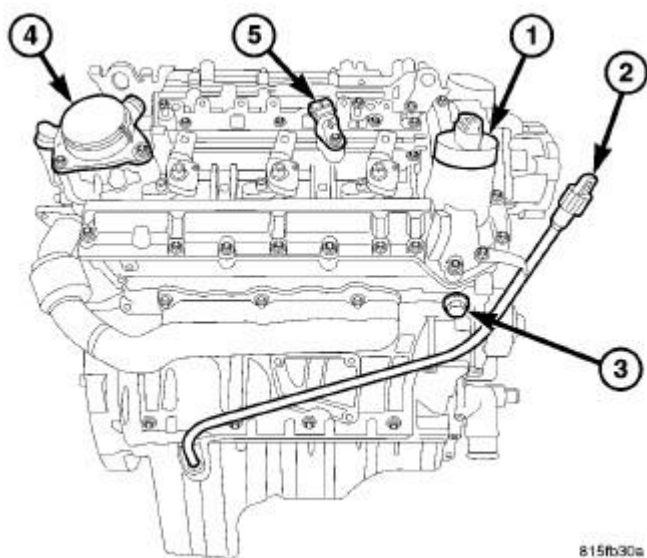


Fig. 566: TIMING CHAIN TENSIONER
Courtesy of CHRYSLER LLC

- 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.