2011 ENGINE

2.8L Diesel - Service Information - Liberty

DESCRIPTION

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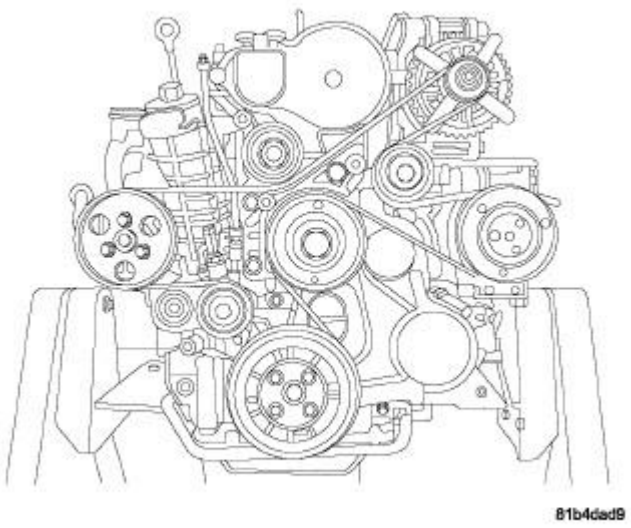

Fig. 1: 2.8L Engine
Courtesy of CHRYSLER LLC

The 2.8L (2777cc) four-cylinder "common rail" direct injection engine is an in-line overhead valve design. The engine utilize a cast iron cylinder block. The engine has a one piece aluminum cylinder head with four valves per cylinder and dual overhead cam shafts. The 2.8L is turbocharged, intercooled and also equipped with a EGR cooler.

The identification stamp for the 2.8L is located on the left side of the engine block, above the starter. The engine code label is located on the front timing cover and is the same as the engine I.D. and serial number. There is also a fuel system label on the front timing cover used for fuel system identification during ECM programming.

STANDARD PROCEDURE

DUST COVERS AND CAPS

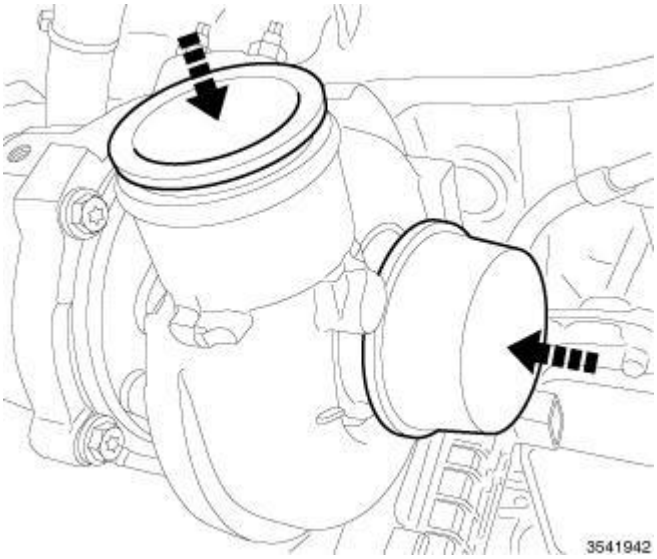

Fig. 2: Covers/Caps
Courtesy of CHRYSLER LLC

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

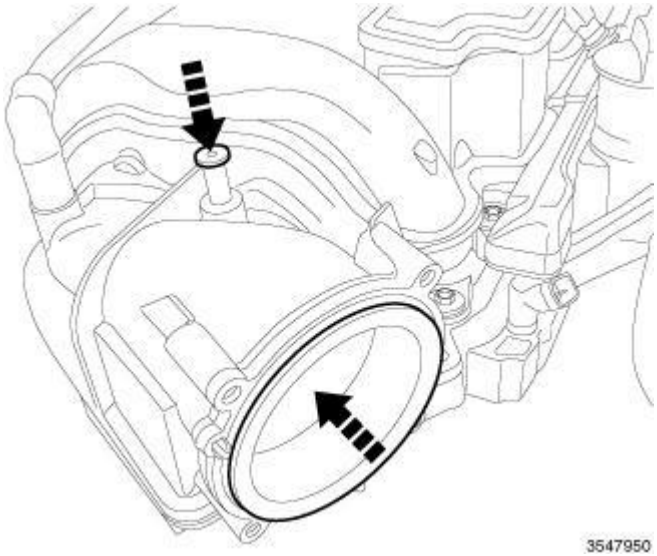

Fig. 3: Opening Cover
Courtesy of CHRYSLER LLC

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

STANDARD PROCEDURE - ENGINE GASKET SURFACE PREPARATION

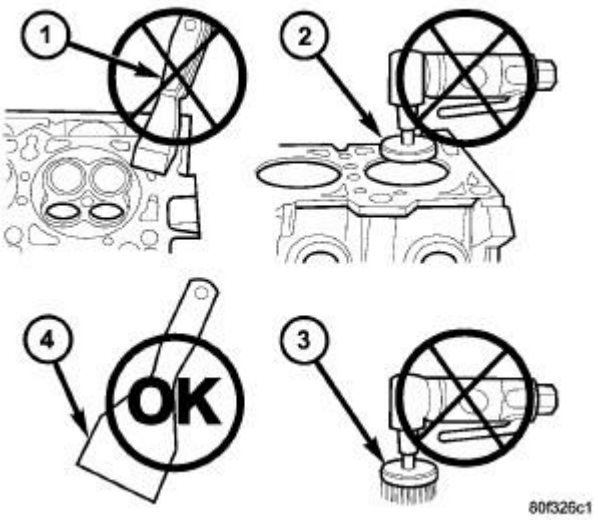

Fig. 4: Proper Tool Usage For Surface Preparation
Courtesy of CHRYSLER LLC

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, a wire brush, or 3M Roloc™ Bristle Disc (white or yellow) (3).

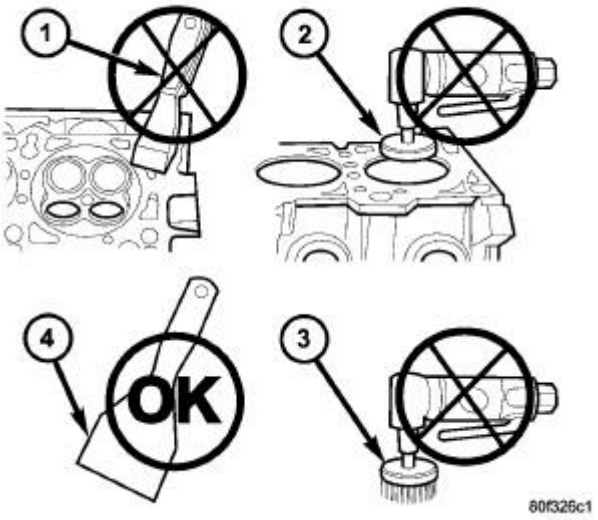

Fig. 5: Proper Tool Usage For Surface Preparation
Courtesy of CHRYSLER LLC

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

Only use the following for cleaning gasket surfaces:

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

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

SPECIFICATIONS

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2.8L Engine Specifications	
Engine	2.8L JK/KK
Engine Type	2.8L - 16 Valves
Displacement	2777 cc
Bore	94.00
Stroke	100.05
Power (VGT) JK - KK	147 kW (200CV) @ 3600 RPM
Torque (ATX) JK - KK	460 N.m @ 1600 - 2600 RPM
Torque (MTX) JK - KK	410 N.m @ 2000 - 3200 RPM
Cylinders	4 In line
Injection Order	1-3-4-2
Compression Ratio	16.5:1
Vacuum at idle	600 mm/HG (27.5 In/HG) @ 800 RPM
Idle Speed (ATX) JK	760 +/- 50 RPM
Idle Speed (ATX) KK	730 +/- 50 RPM
Idle Speed (MTX) JK - KK	875 +/- 50 RPM
Maximum RPM in Gear	6600 RPM
Maximum RPM in neutral	ATX 3000 MTX 3000
Belt tension	Automatic Belt Tensioner
Thermostat opening	90°C +/- 2°C
Generator Rating	Denso 12V-180A; JK MTX 12V-220A
Emissions Level	EU5
Block configuration/Material	Open/Cast Iron
Cylinder Head	Dual Overhead Cam
Timing System	Belt

Fuel System	CP1H HP pump, 1800 bar, Piezo Injectors CRI 13.2
Fuel Supply	Electric Fuel Pump In the Fuel Tank
Electronic Control Unit	EDC 17
Timing System	Belt Driven DOHC Overhead Camshaft
Air Intake	Dry Filter With turbocharger and Charge Air Cooler
Fuel System	Direct Fuel Injection Common Rail System
Emission Devices	Cooled EGR (electric DC motor) Electric Intake Throttle Fast Metallic Glow plugs
Combustion Cycle	4 Stroke
Cylinder Compression Difference Between Cylinders	10 bar (145 psi)
Cooling System	Water Cooling
Turbocharging:	Single VGT with REA
Intake Ports	Aluminum heads with traditional dual side intake and exhaust ports. One intake port is helical and the other has a directed entry.
Crankshaft	8 Counterweights with an incorporated balance shaft gear.
Camshafts	2 overhead camshafts with axial front bearings and identical camshaft caps, finger followers, and hydraulic lifters.
Intake AND Exhaust Valves	Flat with fire deck face.
Intake Manifold	Plastic, with integrated swirl control flap and actuator
Lubrication	Pressure Lubricated By Rotary Pump
Minimum Oil Pressure (warm)	0.7 BAR at idle / 2.5 BAR at 3800 rpm
Engine Rotation	Clockwise Viewed From Front Cover
Engine Oil Capacity With Filter	6.6L (7 Quarts)

2.8L Engine Specifications	
Cylinder Head	
Cylinder head height	135.5 mm (5.334 in.)
Cylinder head flatness deformation tolerance	0.075 mm (0.003 in.)
Cylinder head gasket thickness	
0 Hole	1.10 mm (0.043 in)
1 Hole	1.20 mm (0.047 in)
2 Holes	1.30 mm (0.051 in)
Intake Manifold	
Intake manifold flatness deformation tolerance	0.075 mm (0.003 in.)
Exhaust Manifold	
Exhaust manifold flatness deformation tolerance	0.075 mm (0.003 in.)
Tappets	
Hydraulic tappet outside diameters	11.994 mm +/- 0.06 mm (0.472 in +/- 0.002)
Valves	
Intake valve face angle	45°30'

Exhaust valve face angle	45°30'
Intake Valve Head Diameter	32 mm (1.25 in.)
Exhaust Valve Head Diameter	29.4 mm (1.15 in.)
Intake Valve Stem Diameter	5.97 mm (0.235 in.)
Exhaust Valve Stem Diameter	5.96 mm (0.235 in.)
Intake Valve Guide Stem Clearance	
Min	0.030 mm (0.0012 in.)
Max	0.060 mm (0.0024 in.)
Exhaust Valve Guide Stem Clearance	
Min	0.040 mm (0.0016 in.)
Max	0.070 mm (0.0028 in.)
Valve Springs	
Free Length	50.8 mm (2 in.)
Closed Valve	38 mm (1.49 in.)
Opened Valve	29 mm (1.14 in.)
Camshafts	
Camshaft End Play	
Max	0.350 mm (0.014 in.)
Min	0.150 mm (0.006 in.)
Outer Journal Diameter (at crankshaft)	25.95 mm +/- 0.01 mm (1.021 mm +/-.0004 in)
Inner Journal Diameter (at cylinder head)	26.00 mm + 0.015 mm (1.027 mm.0006 in)
Crankshaft Journal Clearance.	
Max	0.075 mm (0.003 in.)
Min	0.030 mm (0.0012 in)
Connecting Rods	
Connecting Rod Diameter (Small End)	32 mm (1.26 in.)
Connecting Rod Diameter (Large End)	57.563 mm (2.266 in.)
Piston Pin	
Diameter	32 mm (1.26 in.)
Length	70.7 mm - 71.00 mm (2.78 in - 2.79 in.)
Crankshaft	
End Play	0.1 mm - 0.33 mm (0.004 in. - 0.013 in.)
Bearing Selection Refer to **BEARING SELECTION CHARTS**.	
Engine Block	
Cylinder Bore Internal Diameter	94 mm (3.700 in.)
Cylinder Bore Out-Of-Round	0.007 mm (0.0003 in.)
Oversized Piston	+0.40 mm (+0.015 in.)
Fuel System	
Injection Pressure	1800 Bar
High Pressure Pump	CP1H

ECU	EDC17
Injectors	Piezo CRI 3.2
Glow Plugs	
Make/Type	Bosch / GLP2 HS
Voltage	4.4V
Lubrication System	
Oil Pump Outer Rotor End Play	
Min	0.01 (0.0004 in.)
Max	0.09 (0.0036 in.)
Oil Pump Inner Rotor End Play	
Max	0.01 mm (0.0004 in.)
Min	0.09 mm (0.0036 in.)
Oil Pump Outer Rotor to Body Diameter Clearance	
Max	0.130 mm (0.052 in.)
Min	0.230 mm (0.0091 in)
Oil Pressure Relief Valve	
Opening Pressure	5 Bar
Oil Pressure Valve Spring Free Length	46.8 mm (1.84 in)
Minimum Oil Pressure (Warm)	
at Idle	0.7 Bar
at 3800 RPM	2.5 Bar
Cooling System	
Thermostat Opening Temperature	90°C +/- 2 (194°F +/-2)
Pressure Cap Setting	1.2 Bar
Engine Oil	
Specification Refer to **Capacities and Recommended Fluids , Description** .	
Coolant	
Specification Refer to **Capacities and Recommended Fluids , Description** .	

Cylinder Head Gasket Selection		
	Millimeters	Inches
DISTANCE FROM PISTON AT TDC TO CYLINDER BLOCK	0.300 - 0.399	0.0119 - 0.0158
CYLINDER HEAD GASKET THICKNESS	1.10	0.0434
PISTON	0.700-0.800	0.0276 -0.0315

CLEARANCE		
DISTANCE FROM PISTON AT TDC TO CYLINDER BLOCK	0.400 - 0.499	0.0158 - 0.0197
CYLINDER HEAD GASKET THICKNESS	1.20	0.0473
PISTON CLEARANCE	0.701-0.800	0.0276 -0.0315
DISTANCE FROM PISTON AT TDC TO CYLINDER BLOCK	0.500 - 0.600	0.0197 - 0.0237
CYLINDER HEAD GASKET THICKNESS	1.30	0.0512
PISTON CLEARANCE	0.700-0.800	0.0276 -0.0315

TORQUE SPECIFICATIONS

ENGINE BLOCK

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Air Temp/Pressure sensor	12	-	106
Balance Shaft	33	24	-
Connecting Rod Caps	Refer to **ROD, Piston and Connecting , Installation**.		
Dipstick Tube (block)	33	24	-
Dipstick Tube (sump)	11	-	97
Engine Block Plug	30	22	-

Engine Mount Bolts	54	40	-
Lower Oil Pan	Refer to **PAN, Oil , Installation**.		
Main Bearing Caps	Refer to **CRANKSHAFT , Installation**.		
Oil Cooler Bolts	32	24	-
Oil Cooler Coolant Adapter Tube at Oil Filter Housing Bolt	11	-	97
Oil Cooler Coolant Tube Bolt	15	-	133
Oil Drain Plug	54	40	-
Oil Filter Cap	25	18	-
Oil Filter Housing Bolts	33	24	-
Oil Jet	11	-	97
Oil Pickup Tube	15	-	133
Oil Pressure Sensor	14	-	124
Oil Temperature Sensor	20	-	177
Upper Oil Pan (M6 bolt)	15	-	133
Upper Oil Pan (M8 bolt)	32	24	-
Wire Harness Support Bracket Bolt	45	33	-

CYLINDER HEAD

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Camshaft Bearing Cap Bolts	11	-	97
Camshaft Position Sensor Bolt	11	-	97
Camshaft Sprocket Bolt	80	59	-
Cylinder Head Bolts	Refer to **Cylinder Head , Installation**.		
Cylinder Head Cover Bolts	11	-	97
EGR Air Flow Control Valve	11	-	97
EGR Cooler Manifold Nuts	25	18	-
EGR Cooler Manifold Elbow Bolt	11	-	97
EGR Cooler Manifold Support Bracket Bolts	45	33	-

EGR Cooler Support Bracket Bolts	25	18	
Exhaust Manifold Nuts	36	27	-
Front Camshaft Journal Bolts	11	-	97
Fuel Injector Bolts	33	24	-
Fuel Rail	24	18	-
Fuel Tubes at Fuel Injector	28	20	-
Fuel Tubes at Fuel Rail	5 + 75°	-	44 + 75°
Glow Plugs	14	-	124
High Pressure Fuel Line Bracket bolt	15	-	133
High Pressure Fuel Feed Line at Fuel Rail	5 + 75°	-	44 + 75°
High Pressure Fuel Feed Line at the High Pressure Pump	28	20	-
Intake Manifold Nuts	Refer to **MANIFOLD, Intake , Installation**.		
Turbocharger Nuts	25	18	-
Turbocharger Adapter (oil feed line to engine block connection) Bolts	54	40	-
Turbocharger Brace Bolt	32	24	-
Turbocharger Oil Feed Line at the Engine Block	32	24	-
Turbocharger Oil Feed Line Nipple at Engine Block	54	40	-
Turbocharger Oil Feed Line Banjo Bolt at the Turbocharger	25	18	-
Turbocharger Oil Return Line Bolts	15	-	133
Vacuum Tube Nuts	11	-	97

FRONT ENGINE

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Crankshaft Pulley Bolt	32	24	-
Crankshaft Sprocket Bolt	100 + 120°	74 + 120°	-
Front Cover Bolts	33	24	-
Front Engine Lifting Bracket Bolts	45	33	-
Fuel Quantity Solenoid Bolts	7	-	62
High Pressure Fuel Pump Blocker Nuts	25	18	-
High Pressure Fuel Pump Nuts	25	18	-

High Pressure Fuel Pump Sprocket Nut	88	65	-
Inner Timing Belt Cover	11	-	97
Outer Timing Belt Cover (lower)	8	-	71
Outer Timing Belt Cover (upper)	8	-	71
Timing Belt Tensioner	28	21	-
Water Pump	32	24	-

REAR ENGINE

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Crankshaft Sensor	11	-	97
CKP Cover Plate	15	-	133
Flex Plate (ATX)	Refer to **FLEXPLATE , Installation**.		
Rear Cover	15	-	133
Trans Adapter Plate (allen bolts)	79	58	-
Trans Adapter Plate (hex bolt)	69	51	-

ACCESSORY DRIVE

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
A/C Compressor Bolts	28	21	-
A/C Compressor Nuts	28	21	-
A/C Compressor/Generator Bracket Bolts	45	33	-
Accessory Drive Belt Tensioner Bolt	45	33	-
Accessory Drive Idler Pulley Bolt	45	33	-
Generator Bolts	33	24	-
Power Steering Pump Bolts	33	24	-
Power Steering Pump Pulley Bolts	33	24	-

REMOVAL

REMOVAL

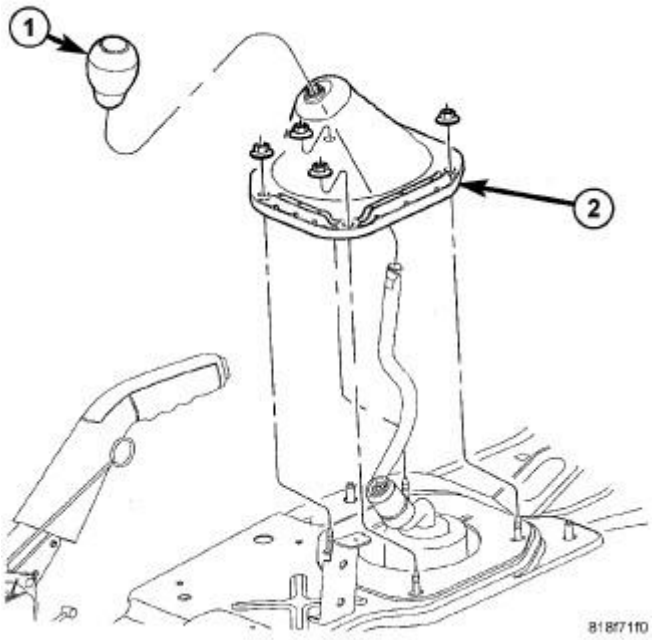

Fig. 6: Shift Knob & Shift Boot
Courtesy of CHRYSLER LLC

1. Remove the battery. Refer to **BATTERY , Removal** .
2. On manual transmission models, remove the shift boot (2), shift knob (1) and console.

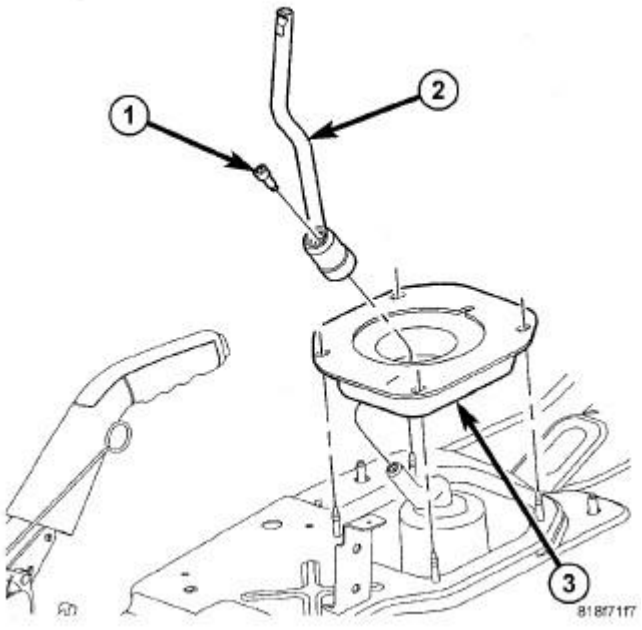

Fig. 7: Removing/Installing Shift Lever Screw, Lever & Inner Boot
Courtesy of CHRYSLER LLC

3. On manual transmission models, remove the inner shift boot (3), shift lever (2) and lever screw (1).
4. Remove the engine cover.
5. Remove the four retainers and the engine silencer.
6. Recover the A/C refrigerant. Refer to **Plumbing , Standard Procedure** .
7. Remove the engine skid plate.
8. Remove the lower air deflector from the radiator.
9. Drain the engine coolant. Refer to **Standard Procedure** .
10. Drain the engine oil.
11. Using a new copper sealing washer, tighten oil drain plug to 54 N.m (40 ft. lbs.).

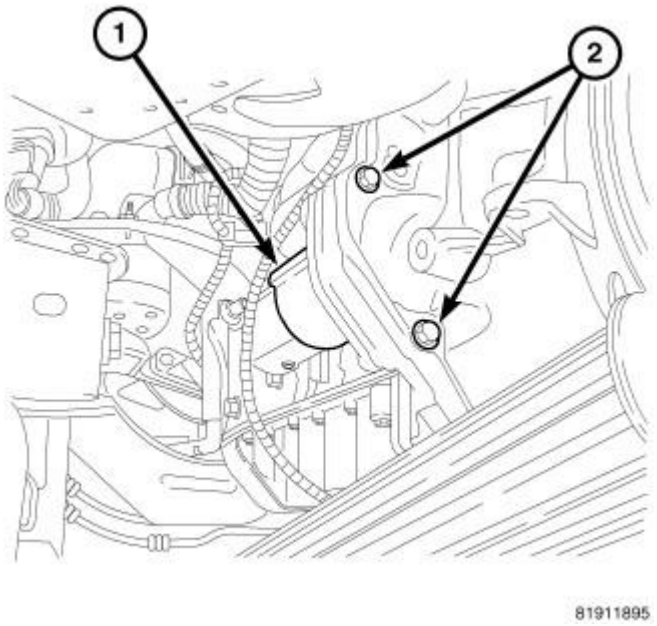

Fig. 8: Starter Mounting 2.8L Diesel
Courtesy of CHRYSLER LLC

NOTE: Starter shown in illustration for a manual transmission.

12. Remove the starter. Refer to **STARTER , Removal** .
13. Remove the ground cable from engine block and position aside the harness.
14. Remove lower radiator hose clip at fan shroud.

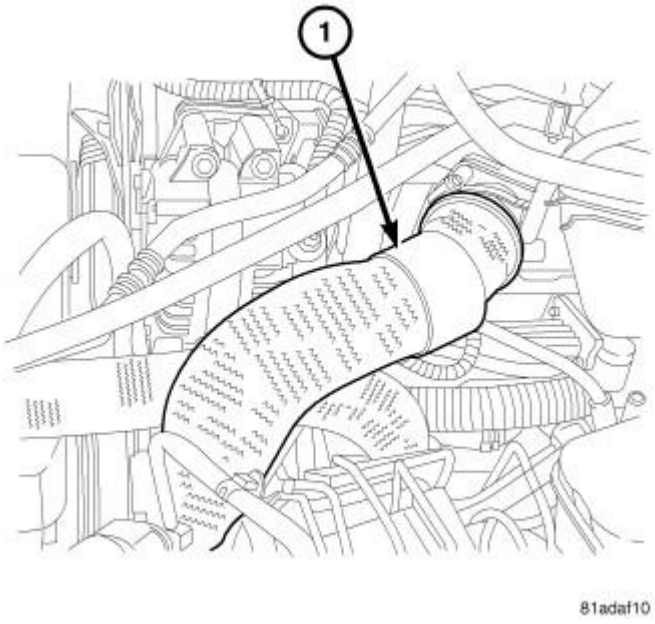

Fig. 9: Charge Outlet Hose
Courtesy of CHRYSLER LLC

15. Remove the charge outlet hose (1) from EGR air flow control valve.
16. Remove the air cleaner body. Refer to **BODY, Air Cleaner , Removal**.
17. Remove the turbocharger air inlet hose at turbocharger.
18. Remove the charge inlet hose.
19. Remove the three wire harness retainers.
20. Remove the windshield washer reservoir and engine coolant recovery bottle. Refer to **BOTTLE, Coolant Recovery , Removal** .
21. Remove the Charge Air Cooler (CAC) outlet hose (1) at (CAC).
22. Remove the upper radiator hose at radiator.
23. Remove the A/C discharge line clip at fan shroud.
24. Remove the serpentine belt. Refer to **BELT, Serpentine , Removal** .
25. Disconnect the fan harness connector.
26. Remove the viscous fan assembly. Refer to **FAN, Cooling, Electric , Removal** .

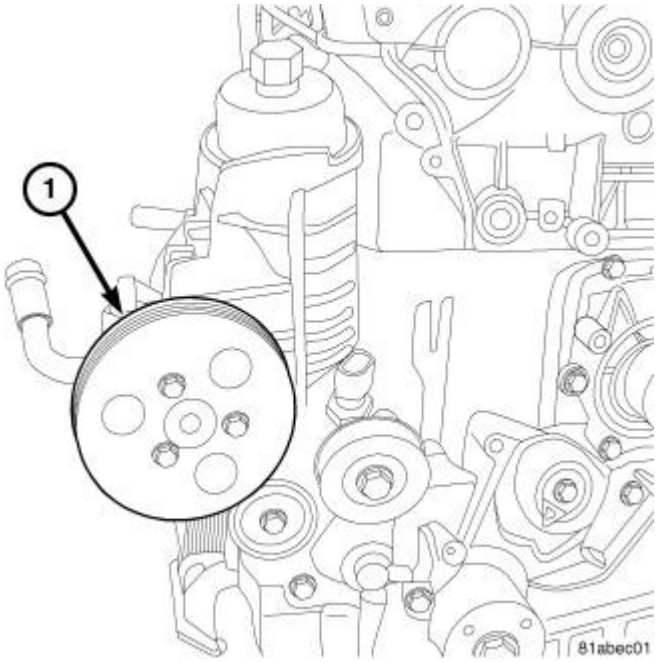

Fig. 10: Power Steering Pump Pulley
Courtesy of CHRYSLER LLC

27. Remove the power steering pump. Refer to **Pump , Removal** .
28. Disconnect the brake booster vacuum hose.
29. Disconnect the heater core coolant hoses from heater core.

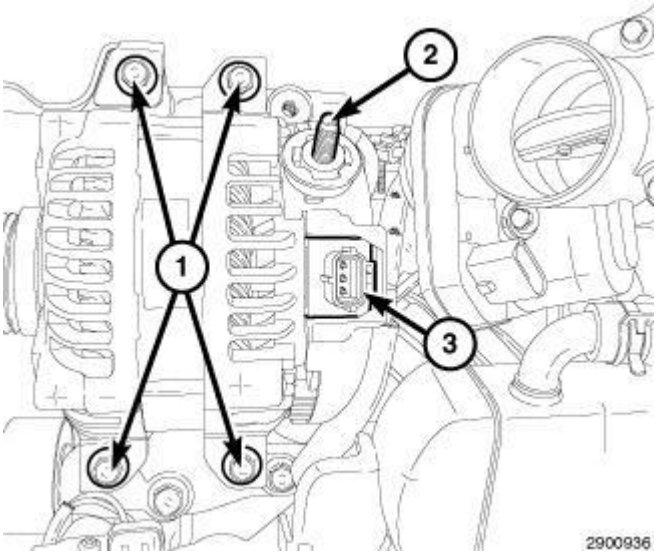

Fig. 11: Generator Bolts & Connector
Courtesy of CHRYSLER LLC

30. Remove the generator. Refer to **GENERATOR , Removal** .

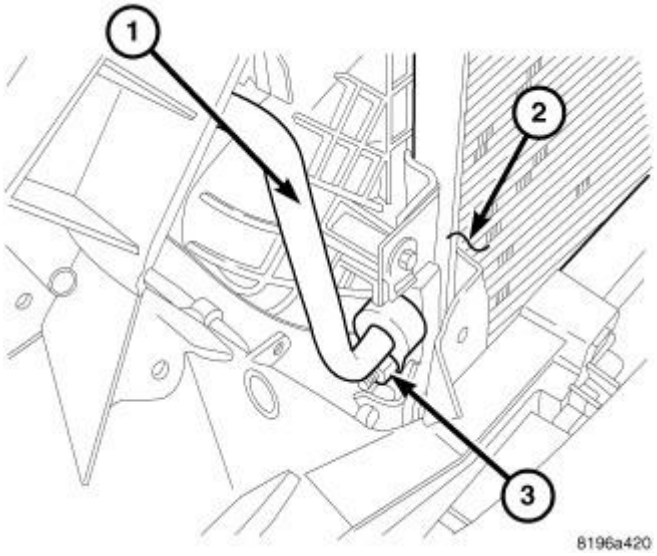

Fig. 12: A/C Line, Condenser & Nut
Courtesy of CHRYSLER LLC

31. Remove nut (3) and the A/C line (1) at the condenser (2).
32. Install tape or plugs to the discharge line and condenser.
33. Remove nut securing wire harness to suction line.
34. Depending on model year, remove the one or two nuts that secure the A/C suction line to the top of the engine.
35. Remove the nut that secures the A/C suction line to the A/C compressor.
36. Remove and discard O-ring, gaskets and install protective caps.
37. Disconnect the A/C compressor harness connector.
38. Remove bolts and the A/C compressor.

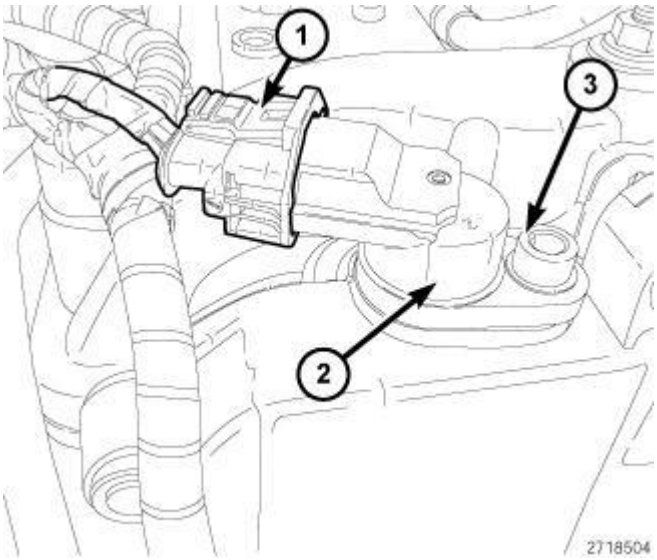

Fig. 13: Camshaft Position Sensor Harness Connector, Sensor & Bolt
Courtesy of CHRYSLER LLC

39. Disconnect the camshaft position sensor harness connector (1).

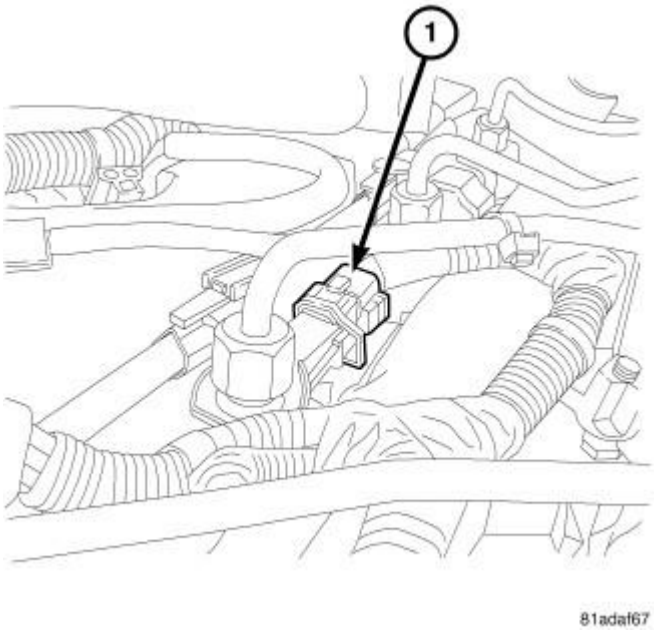

Fig. 14: Injector Connector
Courtesy of CHRYSLER LLC

40. Disconnect the fuel injector harness connectors (1).

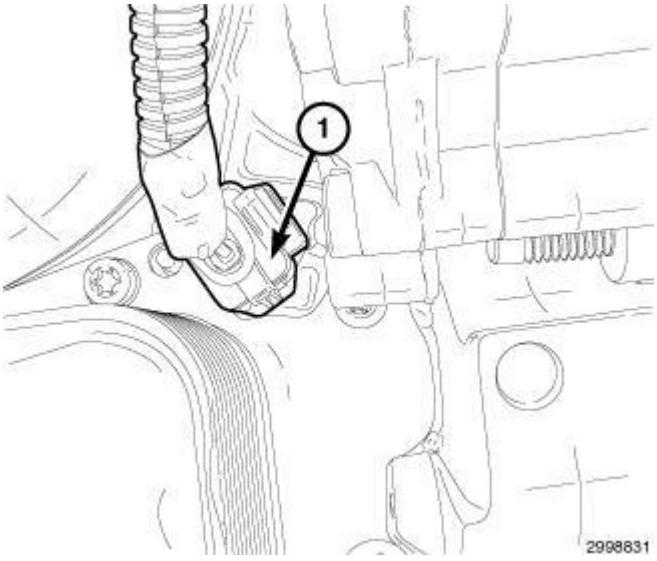

Fig. 15: Oil Temperature Sensor Harness Connector
Courtesy of CHRYSLER LLC

41. Disconnect the oil temperature sensor harness connector.

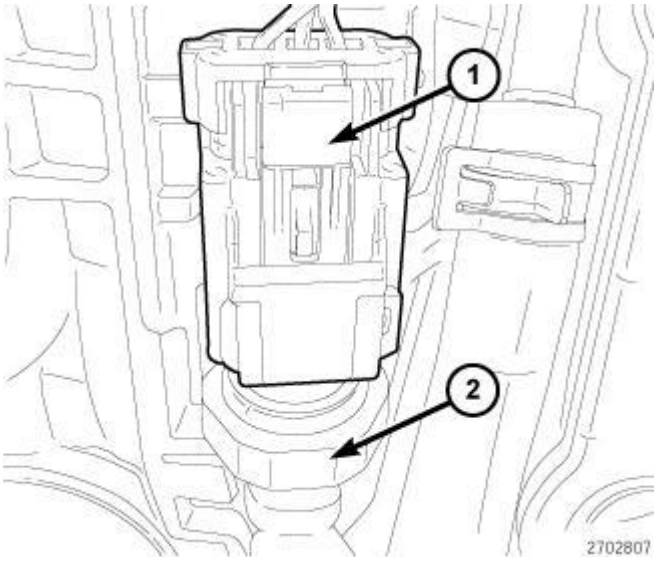

Fig. 16: Oil Pressure Switch & Harness Connector
Courtesy of CHRYSLER LLC

42. Disconnect the oil pressure switch harness connector (1).

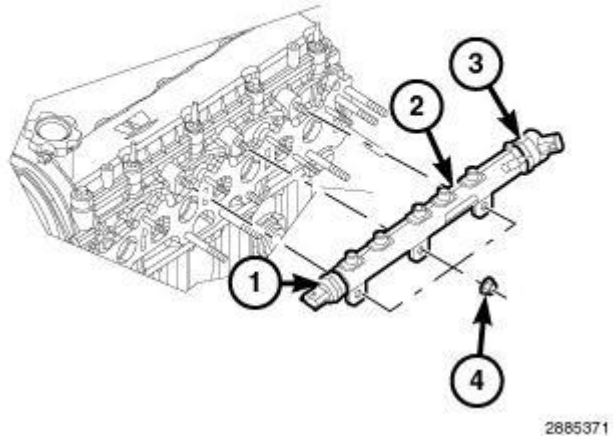

Fig. 17: Fuel Rail Pressure Sensor, Fuel Rail, Pressure Solenoid & Nuts
Courtesy of CHRYSLER LLC

43. Disconnect the fuel pressure sensor harness connector (1).
44. Disconnect the fuel pressure solenoid harness connector (3).

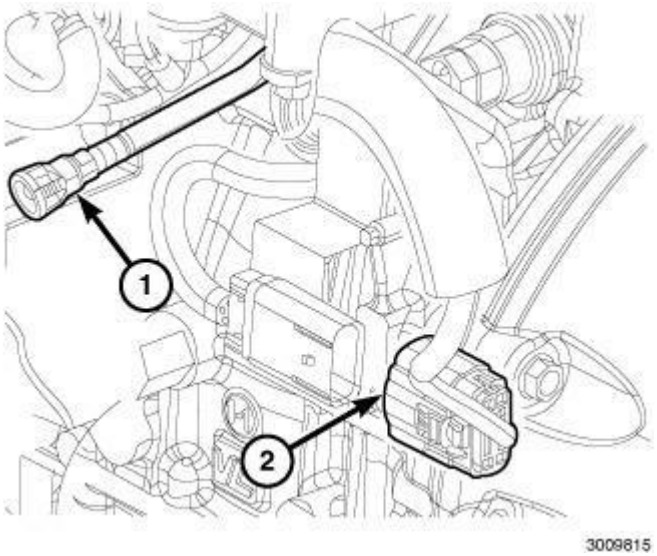

Fig. 18: Fuel Rail Fuel Return Line & Multi-Sensor Jumper Harness Connector
Courtesy of CHRYSLER LLC

45. Disconnect the turbocharger actuator harness connector.
46. Disconnect the A/C pressure transducer harness connector.
47. Disconnect the EGR airflow control valve harness connector.
48. Disconnect the fuel supply and return lines at high pressure pump.
49. Disconnect the fuel rail fuel return line (1).
50. Disconnect the multi-sensor jumper harness connector (2) and position aside the wiring harness.

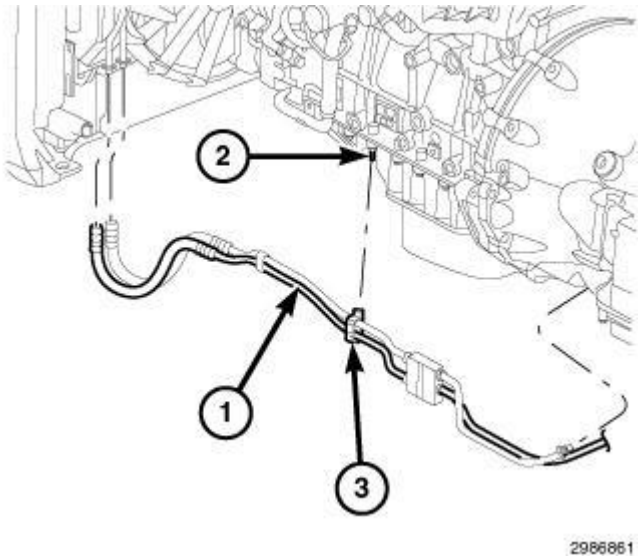

Fig. 19: Transmission Cooler Line, Oil Pan Stud & Clip
Courtesy of CHRYSLER LLC

NOTE: The plastic clip that secures the transmission oil cooler lines to oil pan stud/bolt is a one time use clip that need to be replace each time the line is

removed.

51. On automatic transmission models, remove the transmission cooler line (1) from oil pan stud (2) and discard clip (3).

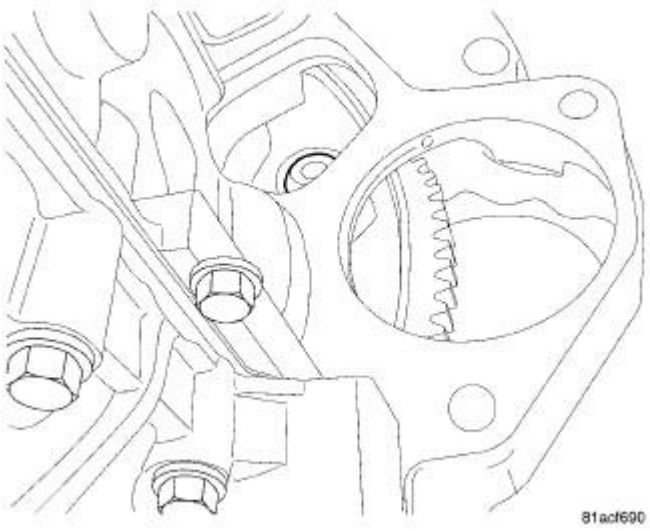

Fig. 20: Flex Plate Bolts
Courtesy of CHRYSLER LLC

52. Remove the Crankshaft Position Sensor (CKP). Refer to **SENSOR, Crankshaft Position , Removal** .
53. Remove the torque converter to flex plate bolts.
54. Remove the transmission fill tube.
55. On manual transmission models, remove the manual transmission. Refer to **Removal** .

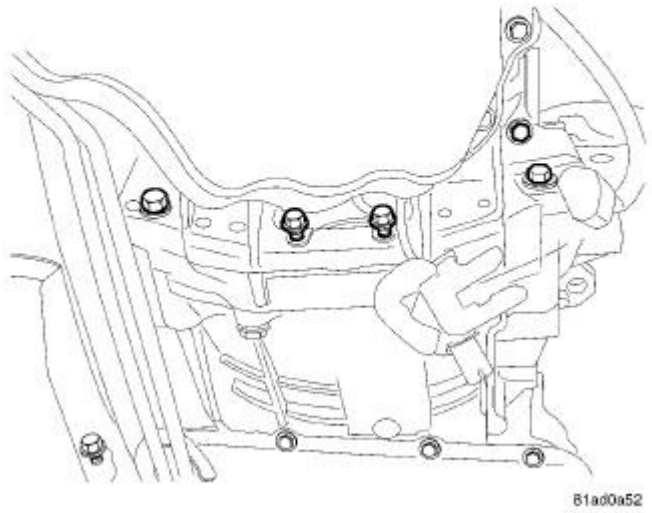

Fig. 21: Bell Housing Bolts
Courtesy of CHRYSLER LLC

56. Remove the transmission to engine bolts.
57. Remove the catalytic converter. Refer to **CONVERTER, Catalytic , Removal** .

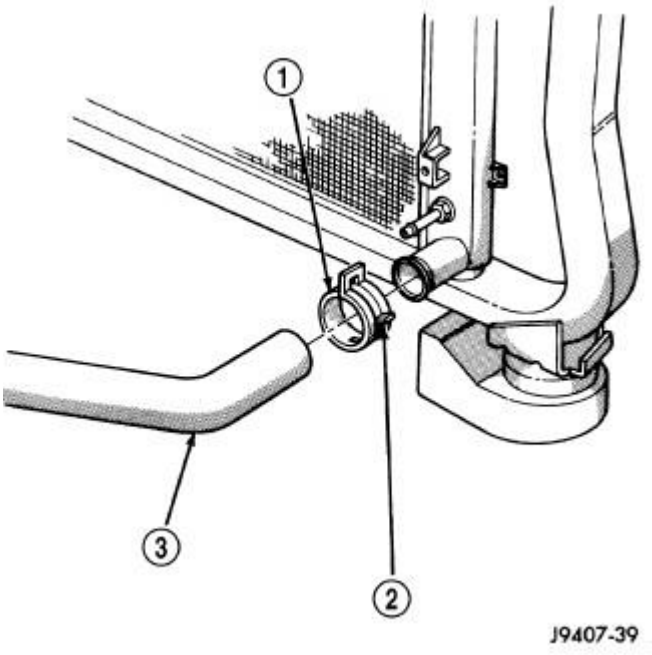

Fig. 22: Removing/Installing Lower Radiator Hose
Courtesy of CHRYSLER LLC

1 - TYPICAL CONSTANT TENSION HOSE CLAMP
2 - CLAMP NUMBER/LETTER LOCATION
3 - TYPICAL HOSE

58. Remove the upper radiator hose at thermostat housing.
59. Remove the lower radiator hose (2).

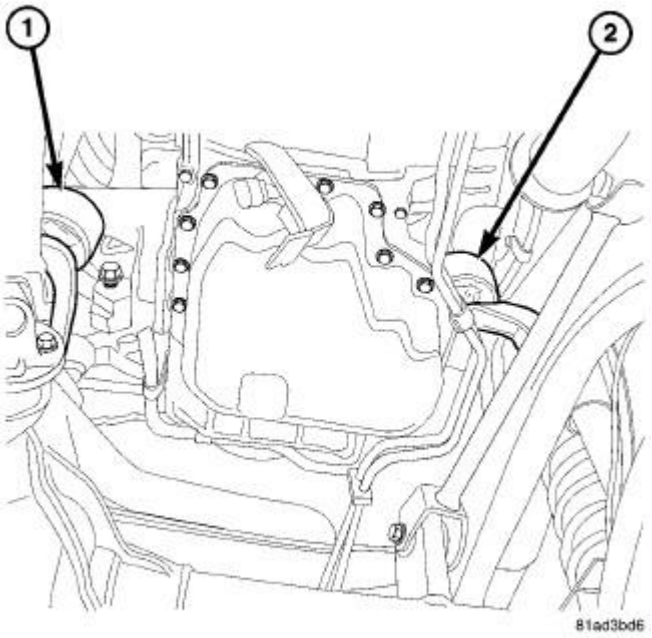

Fig. 23: Engine Mounts
Courtesy of CHRYSLER LLC

60. Remove the left engine mount nut.
61. Remove the right engine mount nut.
62. Install a suitable engine lifting device.
63. Remove the engine.

INSTALLATION

INSTALLATION

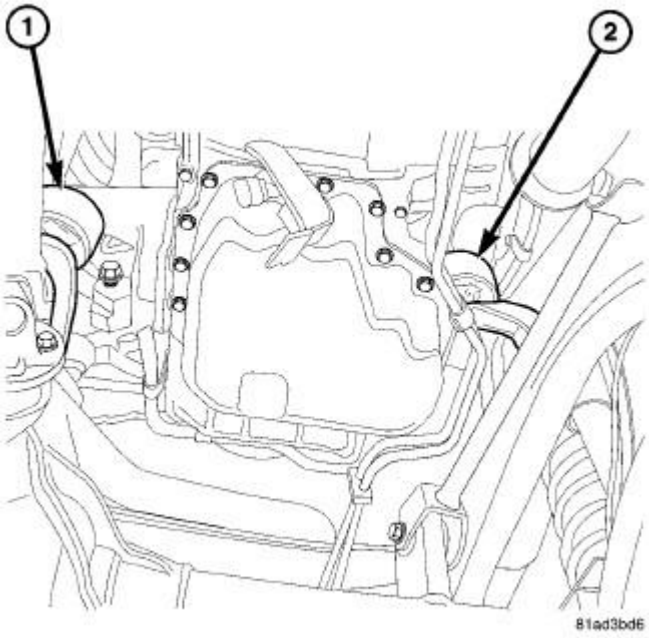

Fig. 24: Engine Mounts
Courtesy of CHRYSLER LLC

1. Install the engine.
2. Remove the engine lift.
3. Install the bolt to the left engine nut. Tighten nut to 54 N.m (40 ft. lbs.).
4. Install the bolt to the right engine nut. Tighten nut to 54 N.m (40 ft. lbs.).

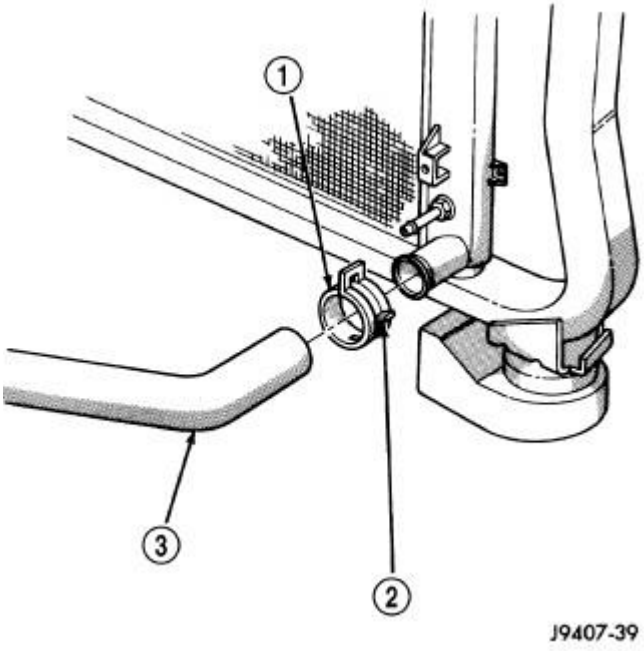

Fig. 25: Removing/Installing Lower Radiator Hose
Courtesy of CHRYSLER LLC

1 - TYPICAL CONSTANT TENSION HOSE CLAMP
2 - CLAMP NUMBER/LETTER LOCATION
3 - TYPICAL HOSE

5. Install the lower radiator hose (2).
6. Install the upper radiator hose to thermostat housing.

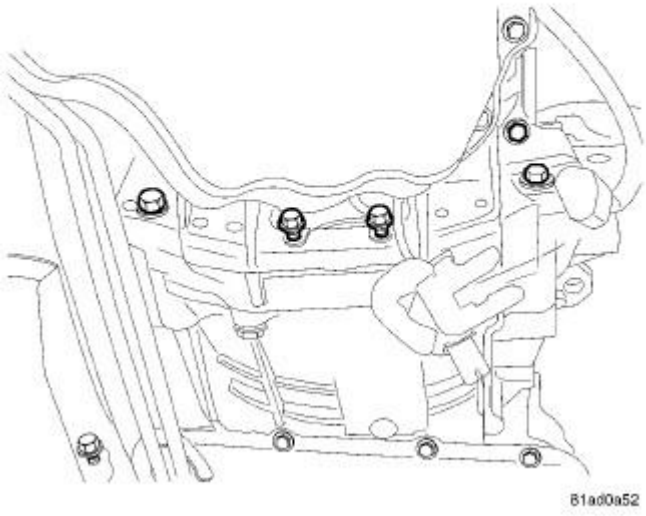

Fig. 26: Bell Housing Bolts
Courtesy of CHRYSLER LLC

7. Install the catalytic converter to engine bolts. Refer to **CONVERTER, Catalytic , Installation** .
8. Install the transmission line bracket at the oil pan.
9. Install the transmission to engine bolts. Tighten bolts to 39 N.m (29 ft. lbs.).

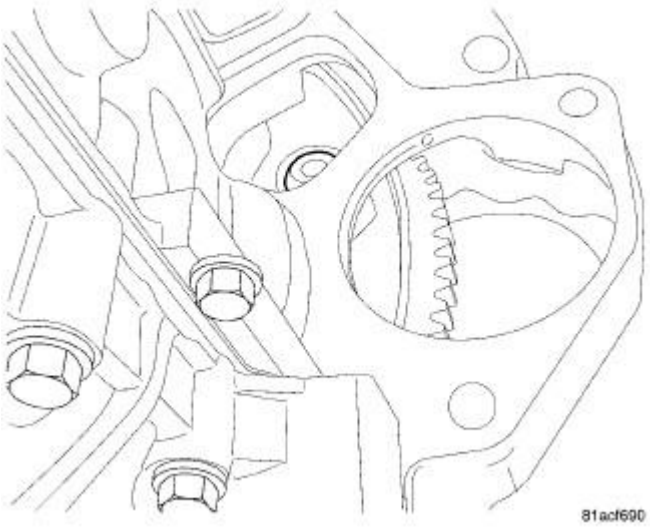

Fig. 27: Flex Plate Bolts
Courtesy of CHRYSLER LLC

10. On manual transmission models, install the manual transmission. Refer to **Installation** .
11. Install the transmission fill tube. Tighten bolts to 10 N.m (89 in. lbs.).
12. Install the torque converter to flex plate bolts. Tighten bolts to 42 N.m (31 ft. lbs.).
13. Install the Crankshaft Position Sensor (CKP). Refer to **SENSOR, Crankshaft Position , Installation** .

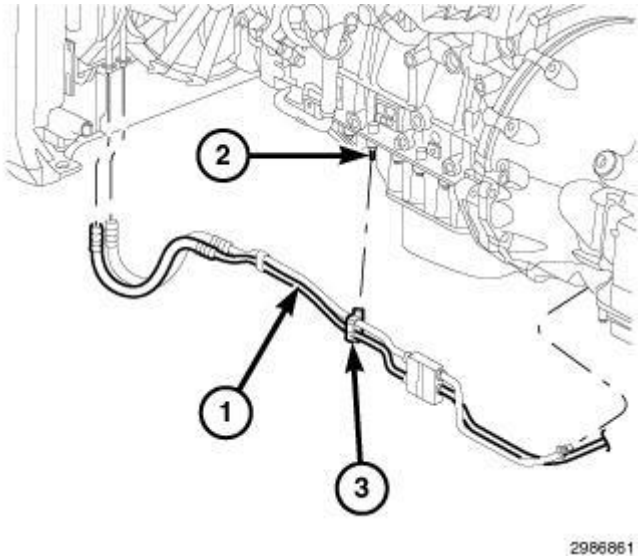

Fig. 28: Transmission Cooler Line, Oil Pan Stud & Clip
Courtesy of CHRYSLER LLC

NOTE: The plastic clip that secures the transmission oil cooler lines to oil pan stud/bolt is a one time use clip that need to be replace each time the line is removed.

14. On automatic transmission models, install the transmission cooler line (1) to the oil pan stud (2) using a new clip (3).

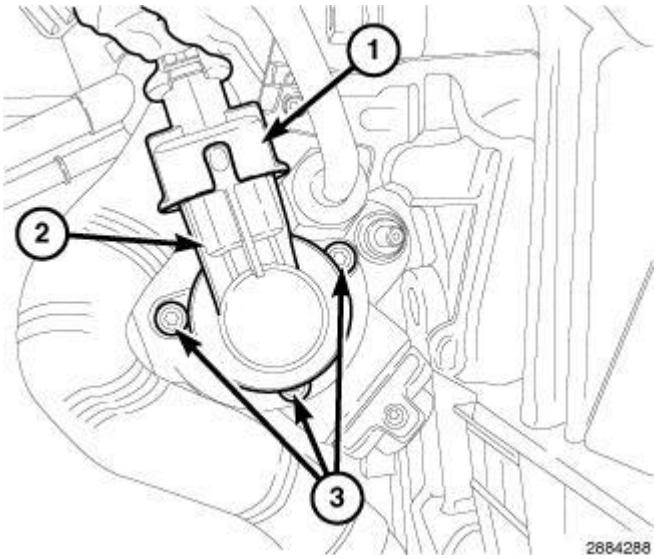

Fig. 29: Fuel Quantity Solenoid, Connector & Bolts
Courtesy of CHRYSLER LLC

15. Position the engine wiring harness.
16. Connect the fuel quantity solenoid harness connector (1).
17. Connect the IAT/BPS harness connector.
18. Connect the EGR airflow control valve harness connector.
19. Connect the A/C pressure transducer harness connector.
20. Connect the turbocharger actuator harness connector.

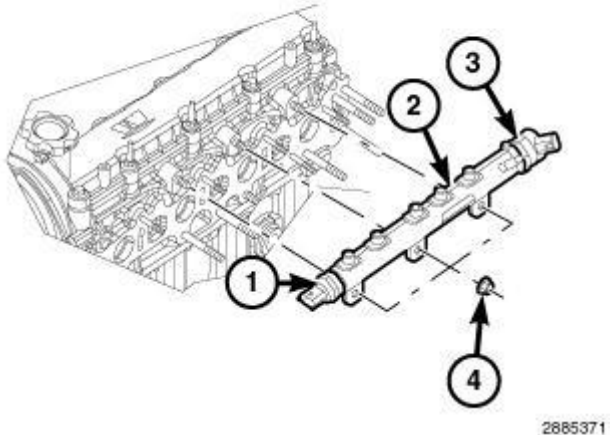

Fig. 30: Fuel Rail Pressure Sensor, Fuel Rail, Pressure Solenoid & Nuts
Courtesy of CHRYSLER LLC

21. Connect the fuel pressure solenoid harness connector (3).
22. Connect the fuel pressure sensor harness connector (1).

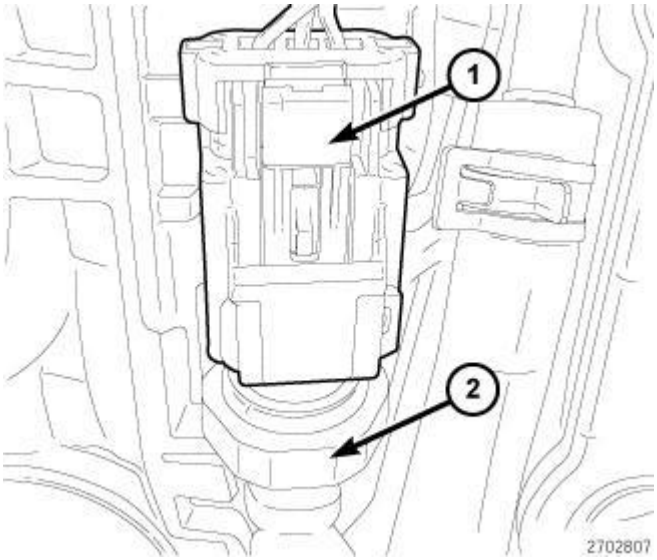

Fig. 31: Oil Pressure Switch & Harness Connector
Courtesy of CHRYSLER LLC

23. Connect the oil pressure switch harness connector (1).

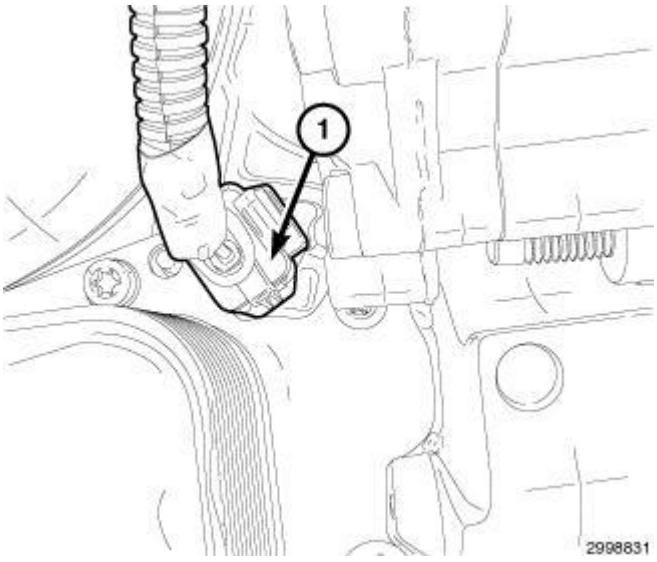

Fig. 32: Oil Temperature Sensor Harness Connector
Courtesy of CHRYSLER LLC

24. Connect the oil temperature sensor harness connector.

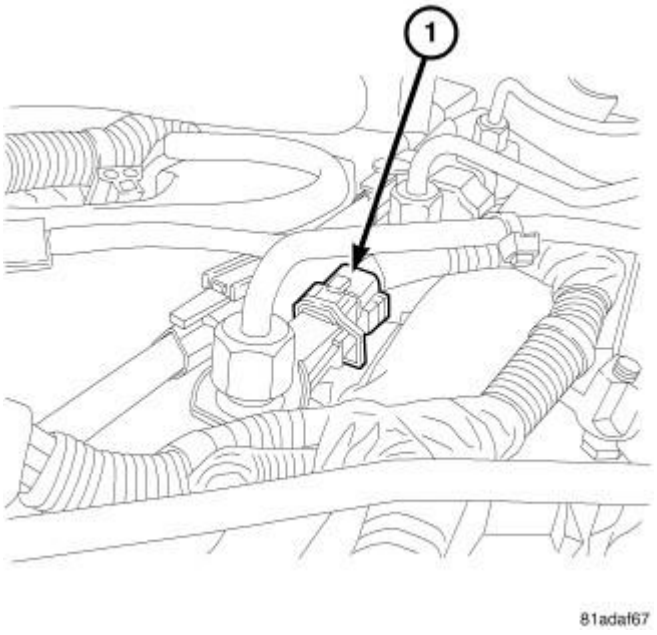

Fig. 33: Injector Connector
Courtesy of CHRYSLER LLC

25. Disconnect the fuel injector harness connectors (1).

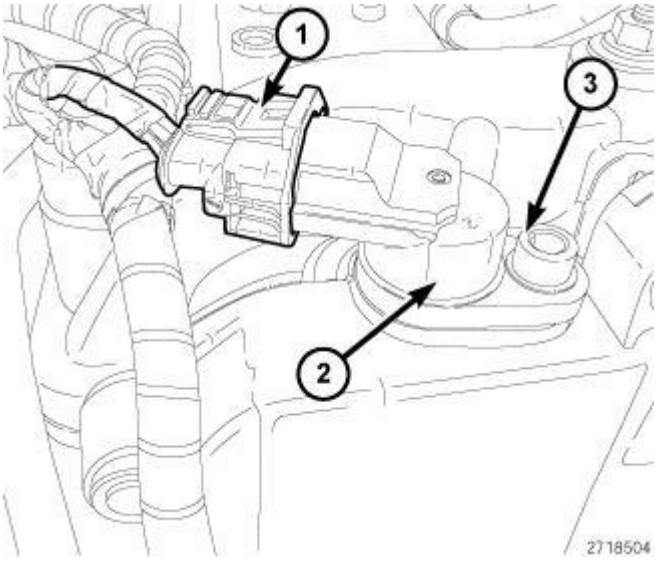

Fig. 34: Camshaft Position Sensor Harness Connector, Sensor & Bolt
Courtesy of CHRYSLER LLC

26. Connect the camshaft position sensor harness connector (1).
27. Install the A/C compressor (3). Tighten the bolts to 32 N.m (24 ft. lbs.).
28. Connect the A/C compressor harness connector.
29. Remove the tape or plugs from the opened refrigerant line fittings and the compressor ports.
30. Lubricate new O-ring seals with clean refrigerant oil and install them and new gaskets on the refrigerant

line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

31. Connect the A/C suction line (4) and A/C discharge line (1) to the A/C compressor (3).
32. Install the nuts (5) that secure the A/C suction and discharge lines to the A/C compressor. Tighten the nuts to 12 N.m (106 in. lbs.).
33. Depending on model year, install the one or two nuts (2) that secure the A/C suction line to the top of the engine. Tighten the nuts to 5 N.m (44 in. lbs.).

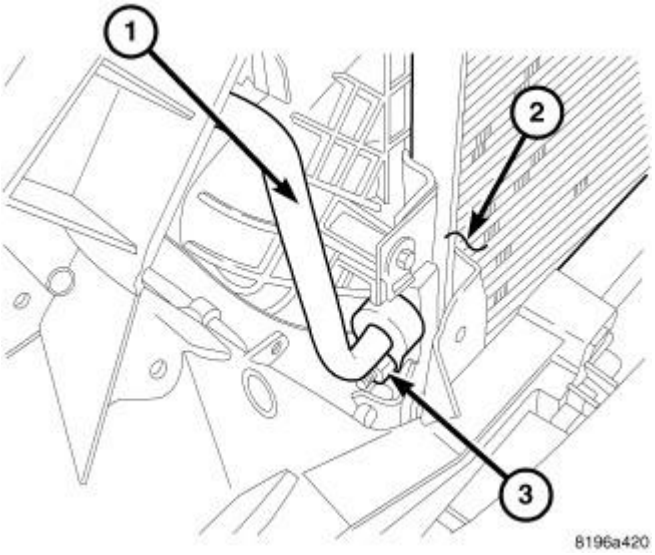

Fig. 35: A/C Line, Condenser & Nut
Courtesy of CHRYSLER LLC

34. Remove the tape or plugs from the discharge line and condenser.
35. Lubricate new rubber O-ring seals with clean refrigerant oil and install them and new gaskets onto the discharge line fittings. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the A/C compressor in the vehicle.

NOTE: Rotate and tilt the A/C discharge line as necessary to connect it from the A/C condenser.

36. Position the A/C discharge line (1) into the engine compartment and connect it to the A/C condenser (2).
37. Install the nut (3) that secures the A/C discharge line to the A/C condenser. Tighten the nut to 23 N.m (17 ft. lbs.).
38. Install the nut securing wire harness to suction line.

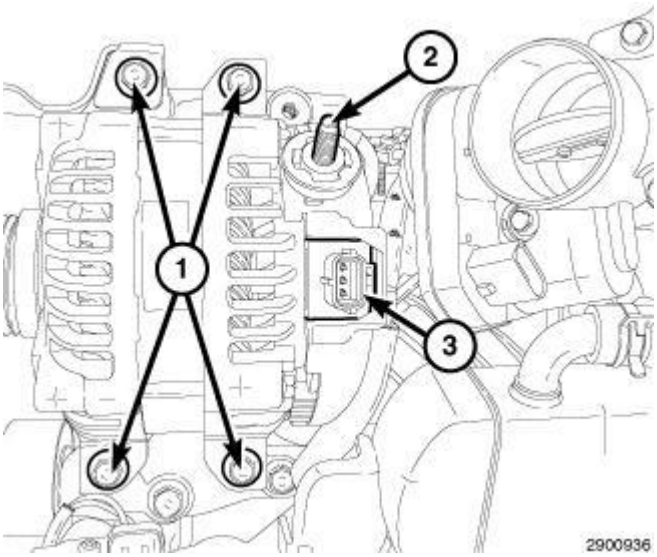

Fig. 36: Generator Bolts & Connector
Courtesy of CHRYSLER LLC

39. Install the generator. Refer to **GENERATOR , Installation** .

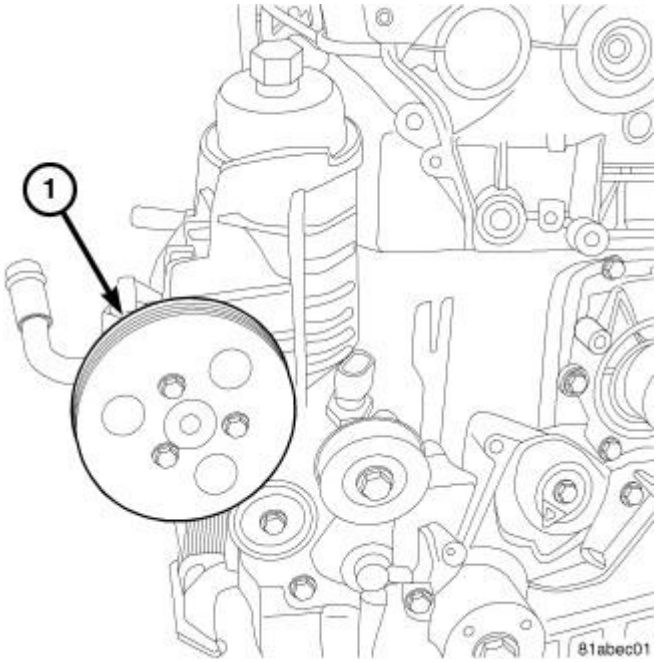

Fig. 37: Power Steering Pump Pulley
Courtesy of CHRYSLER LLC

40. Connect the heater core coolant hoses to heater core.
41. Connect the brake booster vacuum hose.
42. Install the fuel filter/water separator. Refer to **SEPARATOR and FILTER, Fuel and Water , Installation** .
43. Connect the fuel rail fuel return line (1).

44. Install the fuel supply and return lines.
45. Install the power steering pump. Refer to **Pump , Installation** .

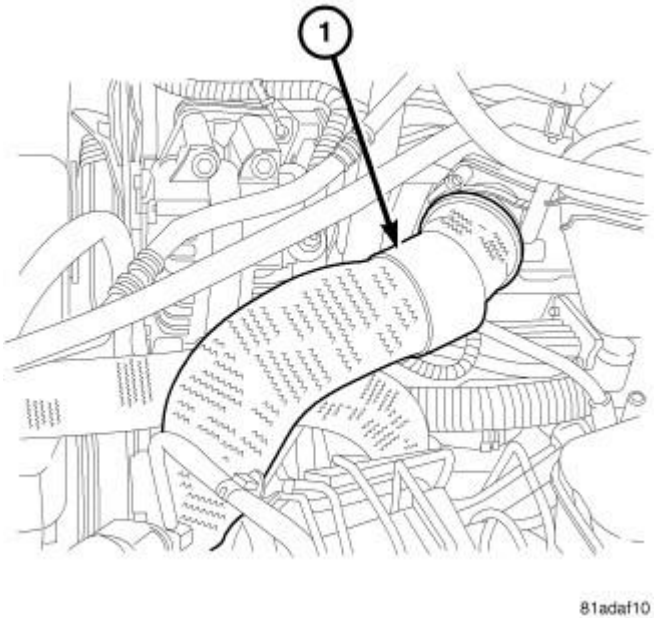

Fig. 38: Charge Outlet Hose
Courtesy of CHRYSLER LLC

46. Install the viscous fan assembly. Refer to **FAN, Cooling, Electric , Installation** .
47. Connect the fan harness connector.
48. Install the serpentine belt. Refer to **BELT, Serpentine , Installation** .
49. Install the A/C discharge line clip to fan shroud.
50. Install the upper radiator hose to radiator.
51. Install the Charge air Cooler (CAC) outlet hose (1) at (CAC).
52. Install the windshield washer reservoir and engine coolant recovery bottle. Refer to **BOTTLE, Coolant Recovery , Installation** .
53. Install the three wire harness retainers.
54. Install the charge inlet hose.
55. Install the turbocharger air inlet hose to turbocharger.
56. Install the air cleaner body. Refer to **BODY, Air Cleaner , Installation**.
57. Install the charge outlet hose (1) to EGR air flow control valve.

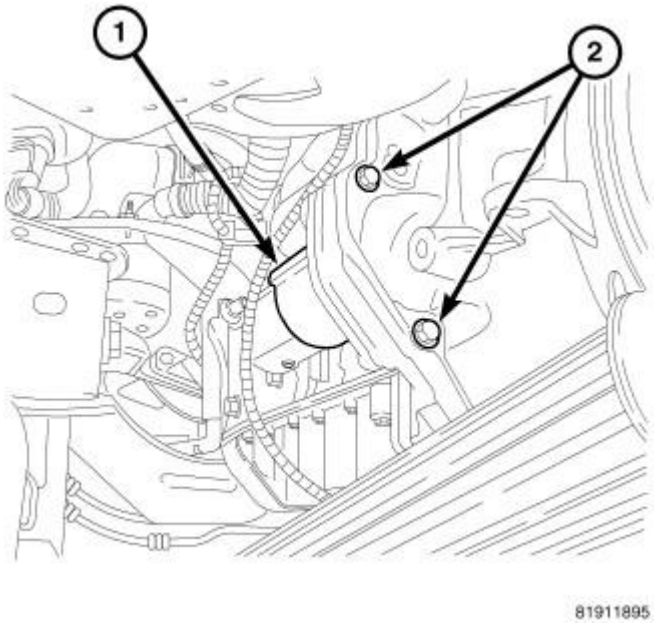

Fig. 39: Starter Mounting 2.8L Diesel
Courtesy of CHRYSLER LLC

58. Install the lower radiator hose clip to fan shroud.
59. Install the ground cable to engine block.
60. Install the starter. Refer to **STARTER , Installation** .
61. Install the lower air deflector to the radiator.
62. Install the engine skid plate.
63. Evacuate the refrigerant system. Refer to **Plumbing , Standard Procedure** .
64. Charge the refrigerant system. Refer to **Plumbing , Standard Procedure** .
65. Fill the engine cooling system. Refer to **Standard Procedure** .
66. Fill the engine with recommended oil.
67. Install the engine silencer and securely tighten the four retainers.
68. Install the engine cover.

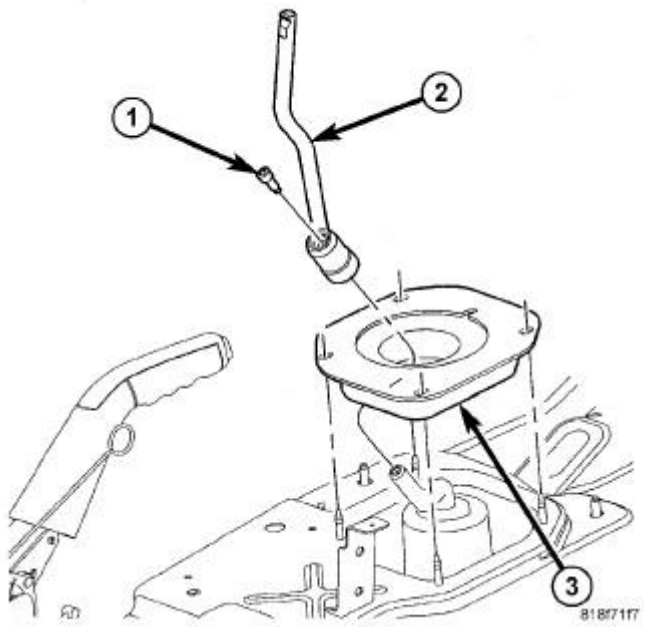

Fig. 40: Removing/Installing Shift Lever Screw, Lever & Inner Boot
Courtesy of CHRYSLER LLC

69. On manual transmission models, install inner shift boot (3), shift lever (2) and lever screw (1).

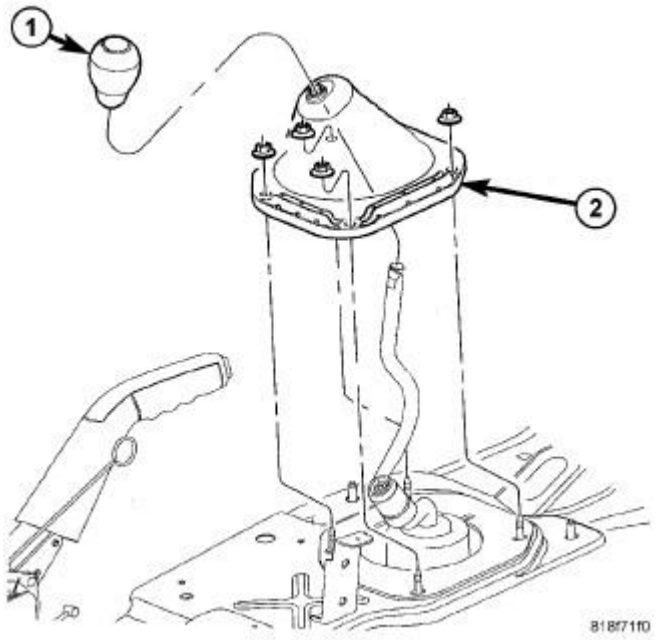

Fig. 41: Shift Knob & Shift Boot
Courtesy of CHRYSLER LLC

70. On manual transmission models, install shift boot (2), shift knob (1) and console.
71. Install the battery. Refer to **BATTERY , Installation** .

SPECIAL TOOLS

SPECIAL TOOLS

	1023 - Puller (Originally Shipped In Kit Number(s) 8678.) 10368 - Set, Universal Protective Cap 6958 - Wrench, Spanner (Originally Shipped In Kit Number(s) 6947, 6949, 6966, 8204, 8204CC, 8667.) 8534B - Support Fixture, Engine (Originally Shipped In Kit Number(s) 8534, 8534B, 8849, 9565.) 9022 - Test Plug (Originally Shipped In Kit Number(s) 8848, 8849, 8849CC.) 9937-1 - Installer, Seal (Originally Shipped In Kit Number(s) 9937.) 9937-2 - Guide, Seal (Originally Shipped In Kit Number(s) 9937.) C-3339A - Set, Dial Indicator (Originally Shipped In Kit Number(s) 9202.) MD998772A - Compressor, Valve Spring (Originally Shipped In Kit Number(s) 8678, 8853, 8854.) MD998772A-15 - Adapter (Originally Shipped In Kit Number(s) 8678, 8853, 8854.) VM.10010 - Adapter, Compression Test VM.10012 - Balance Shaft Split Gear Align VM.10334 - Alignment Tool, Exhaust Manifold VM.10335 - Installer Tool, Front Seal VM.1055 - Locking Tool (Originally Shipped In Kit Number(s) 9599.) VM.1057 - Installer, Seal (Originally Shipped In Kit Number(s) 9599.) VM.1058 - Remover, Seal (Originally Shipped In Kit Number(s) 9599.) VM.9990 - Tool, Front And Rear Seal VM.9991 - Alignment Tool, Camshaft Sprocket VM.9992 - Adapter, 90 Degree AtDC VM.9993 - Installer, Crankshaft Rear Oil Seal

CYLINDER HEAD

DESCRIPTION

DESCRIPTION

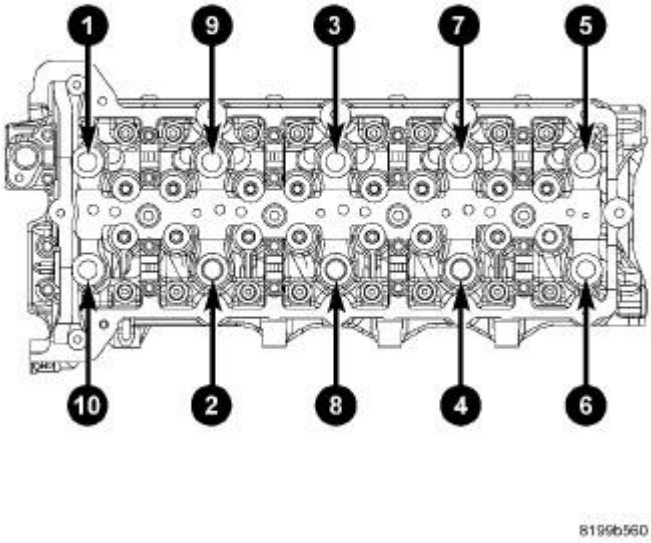

Fig. 42: Cylinder Head Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

The 2.8L aluminum, overhead valve cylinder head is torqued in a cross pattern. The cylinder head itself is not resurfacable.

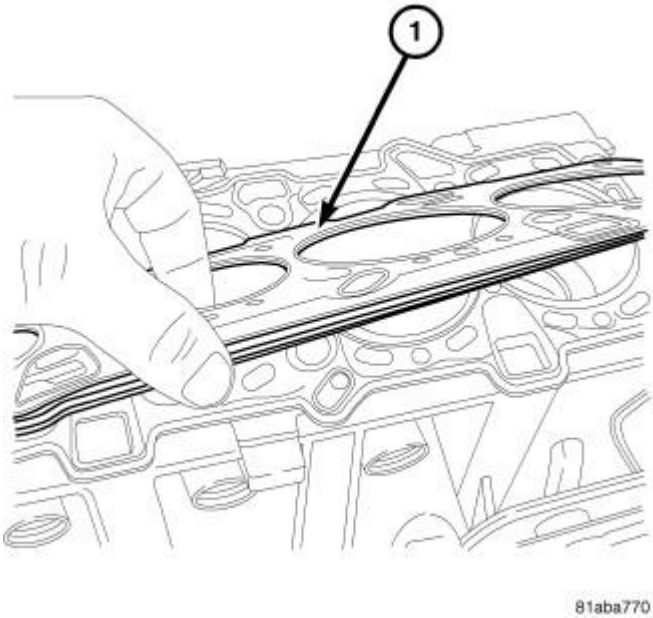

Fig. 43: MLS Head Gasket
Courtesy of CHRYSLER LLC

1. The cylinder head uses a selectable Multi-layered Steel gasket that is available in three sizes.

STANDARD PROCEDURE

VALVE SEALS - IN VEHICLE

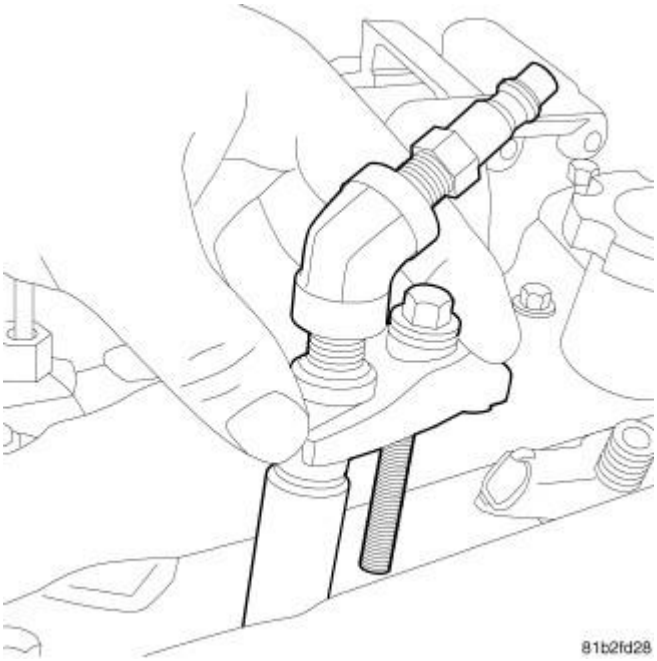

Fig. 44: Compression Tester
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.

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

2. Remove the rocker arms. Refer to **ROCKER ARM, Valve , Removal**.
3. Install the Compression Tester Adaptor Tool VM.10010, into the injector hole and retain with an injector hold down (2) bolt.
4. Prepare the (special tool #MD998772A, Compressor, Valve Spring) for usage by inverting the tool to cylinder head holding screws so that the thread size matches the cylinder head.
5. Install the (special tool #MD998772A, Compressor, Valve Spring) onto cylinder head and using (special tool #MD998772A-15, Adapter), place the adaptor over the valve spring.
6. Connect a regulated air supply (3) to Compression Test Adapter Tool VM.10010 and pressurize the cylinder.
7. Place shop towels around the working area of the cylinder head to prevent valve locks from accidently entering the engine.

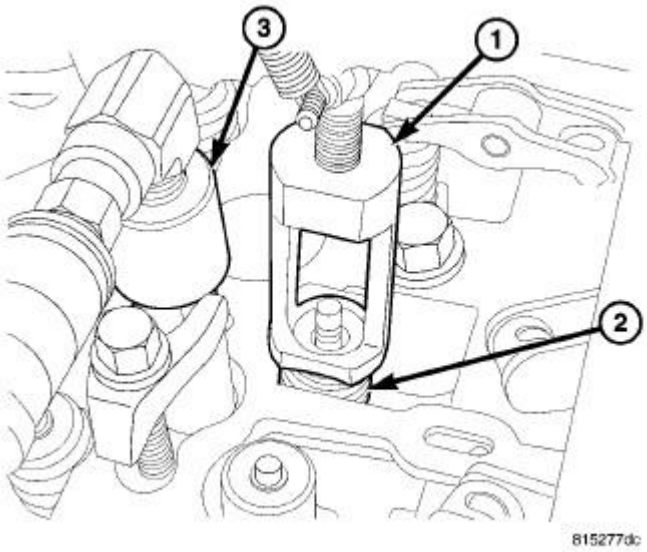

Fig. 45: Adaptors & Valve Spring
Courtesy of CHRYSLER LLC

8. Using the (special tool #MD998772A-15, Adapter) (1), collapse the valve spring (2) and remove the locks.
9. Remove the valve spring (2) assembly.

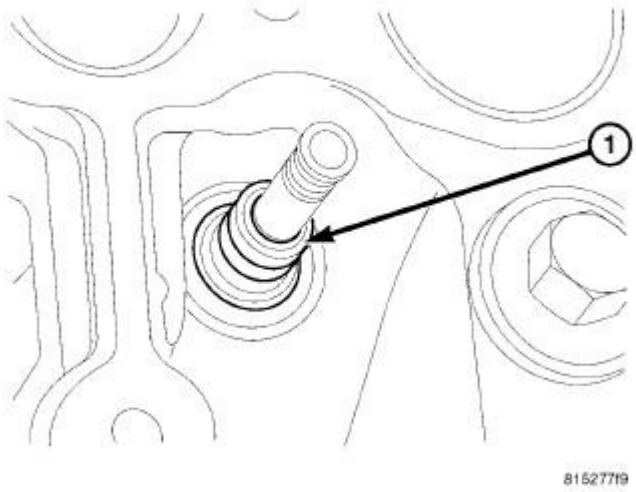

Fig. 46: Valve Seal
Courtesy of CHRYSLER LLC

1 - VALVE SEAL

10. Remove the valve seal (1).

11. Repeat this procedure for all cylinders.
12. Install the rocker arms. Refer to **ROCKER ARM, Valve , Installation**.
13. Connect the negative battery cable.

VALVE SERVICE

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

DISASSEMBLY

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

VALVE CLEANING

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

INSPECTION

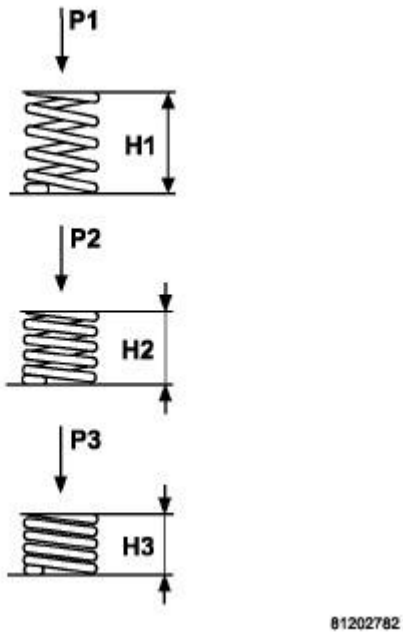

Fig. 47: Valve Spring Load Heights

Courtesy of CHRYSLER LLC

LOAD Kg		HEIGHT mm		STATE
P1	0.00	H1	50.8	FREE LENGTH
P2	182-5 +10%	H2	38.0	VALVE CLOSED
P3	395±5%	H3	29.0	VALVE OPEN

1. Inspect for cracks in the combustion chambers and valve ports.
2. Inspect for cracks on the exhaust seat.
3. Inspect for cracks in the gasket surface at each coolant passage.
4. Inspect valves for burned, cracked or warped heads.
5. Inspect for scuffed or bent valve stems.
6. Replace valves displaying any damage.
7. Check valve spring height. Refer to **Fig. 47**.

VALVE SEAT REFACING

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

VALVE GUIDES

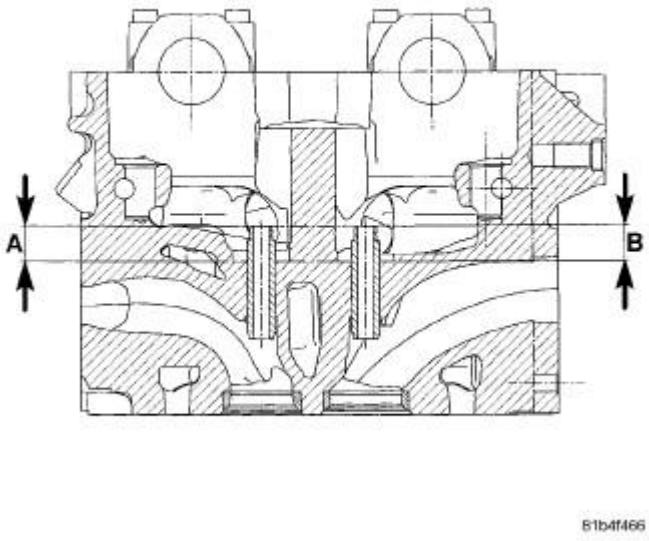

Fig. 48: Valve Height
Courtesy of CHRYSLER LLC

1. Valve Guides height requirement.
2. Measurement A and B: 13.50 mm - 14.00 mm. (0.570 in - 0.590 in)

VALVE STEM-TO-GUIDE CLEARANCE MEASUREMENT

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

REMOVAL

REMOVAL

1. Remove the battery. Refer to **BATTERY , Removal** .
2. On 4x4 models, remove the front axle. Refer to **Removal** .
3. Remove the intake manifold. Refer to **MANIFOLD, Intake , Removal**.
4. Remove the exhaust manifold. Refer to **MANIFOLD, Exhaust , Removal**.
5. Remove the camshafts. Refer to **CAMSHAFT, Engine , Removal**.

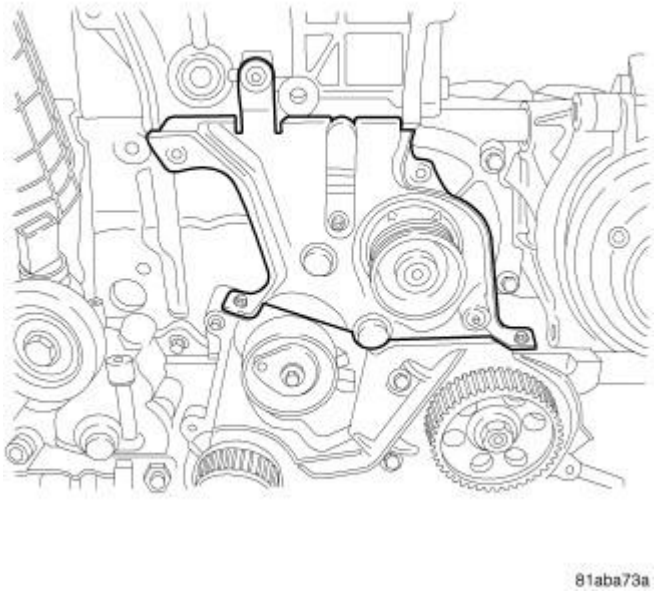

Fig. 49: Inner Front Cover
Courtesy of CHRYSLER LLC

6. Remove the inner timing belt cover.

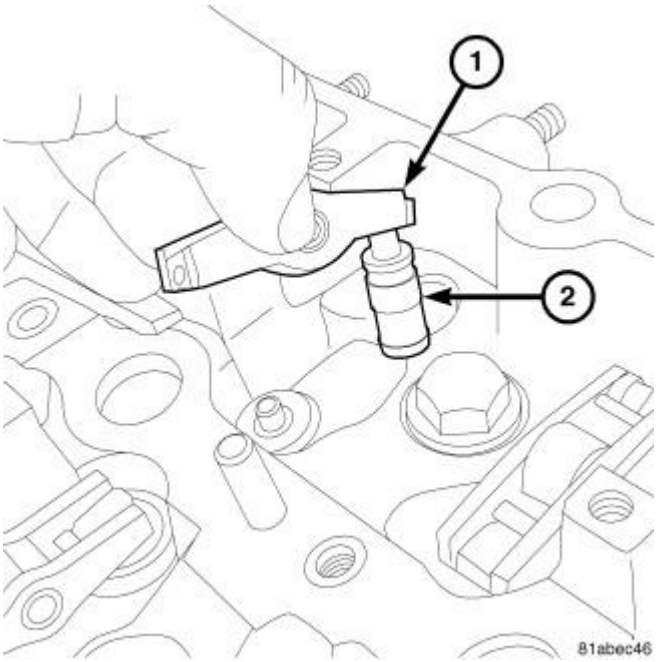

Fig. 50: Rocker Arms & Hydraulic Lifters
Courtesy of CHRYSLER LLC

NOTE: Observe the position of the rocker arms and lifters. Always return the rocker arms and lifters to their original location.

7. Remove the rocker arms (1) and hydraulic lifters (2).
8. Remove the cylinder head bolts.
9. Remove the cylinder head.

CLEANING

CLEANING

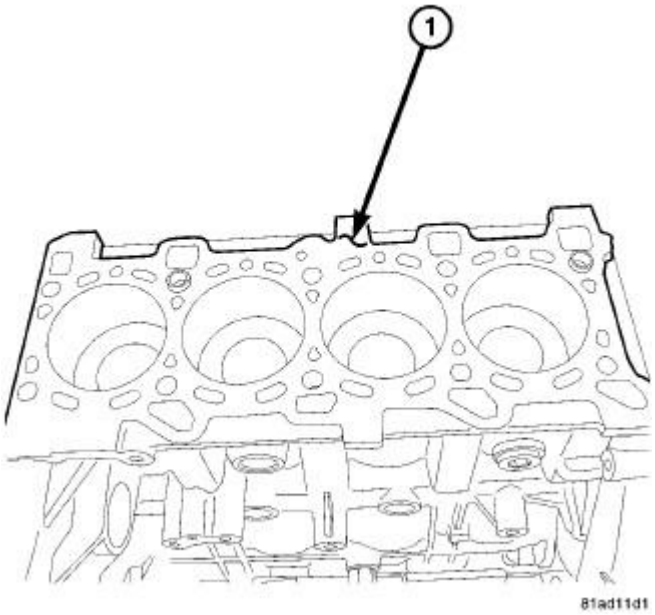

Fig. 51: Engine Block
Courtesy of CHRYSLER LLC

Thoroughly clean the engine cylinder head and cylinder block mating surfaces. Clean the intake and exhaust manifold and engine cylinder head mating surfaces. Remove all gasket material and carbon. Refer to **STANDARD PROCEDURE - ENGINE GASKET SURFACE PREPARATION**.

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

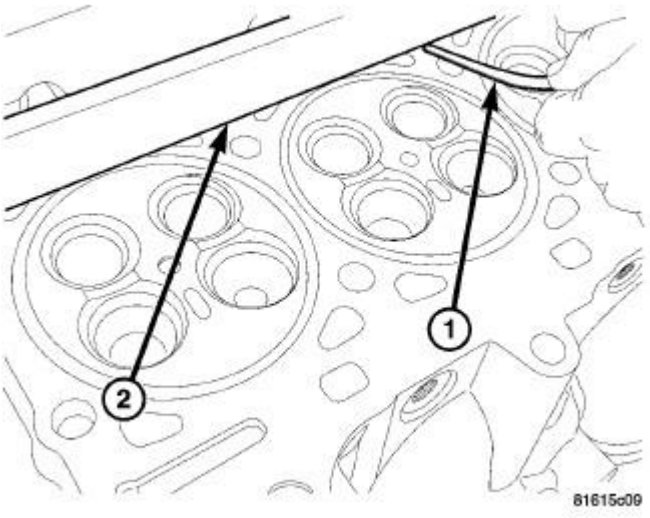

Fig. 52: Measuring Cylinder Head Flatness (1 Of 2)
Courtesy of CHRYSLER LLC

1 - FEELER GAUGE
2 - STEEL STRAIGHT EDGE

CAUTION: The cylinder head surface and straight edge must be absolutely clean before the flatness measurement is taken. DO NOT check flatness across the combustion chamber area or on the marks left by the gasket stopper.

Use a cleaned straight edge (2) and feeler (1) gauge to check the flatness. Lie the straight edge (2) parallel across the cooling ports. Measure before each combustion chamber toward the outer edge of the cylinder head, above and below each combustion chamber, between each combustion chamber, top and bottom, on the cylinder head and block mating surfaces. The **maximum** allowed warpage is 0.075mm (0.003 in.).

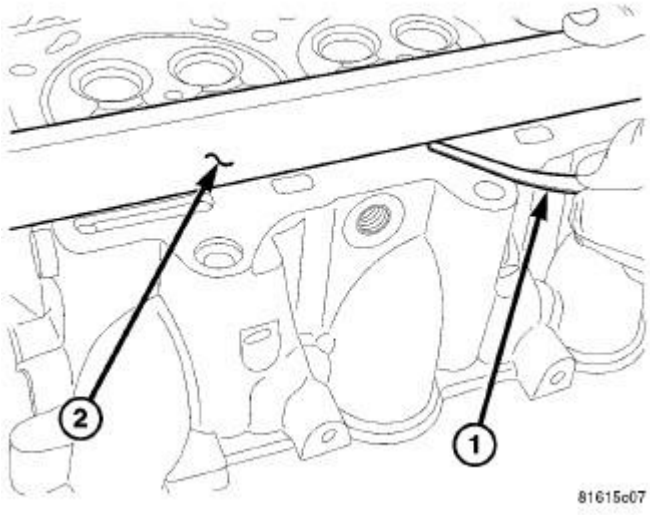

Fig. 53: Measuring Cylinder Head Flatness (2 Of 2)
Courtesy of CHRYSLER LLC

1 - Item_1
2 - Item _2

The minimum cylinder head thickness is 135.5 mm (5.33 in.).

INSTALLATION

INSTALLATION

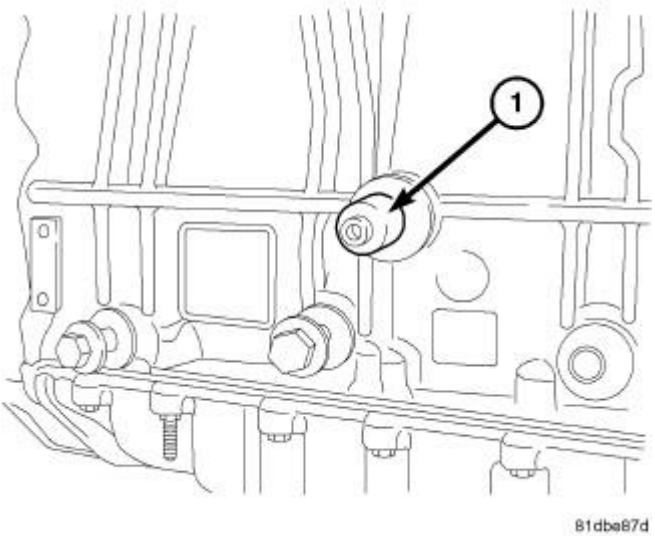

Fig. 54: Crankshaft Locking Tool
Courtesy of CHRYSLER LLC

1. Remove the Crankshaft Locking Tool (special tool #VM.9992, Adapter, 90 Degree ATDC) (1).

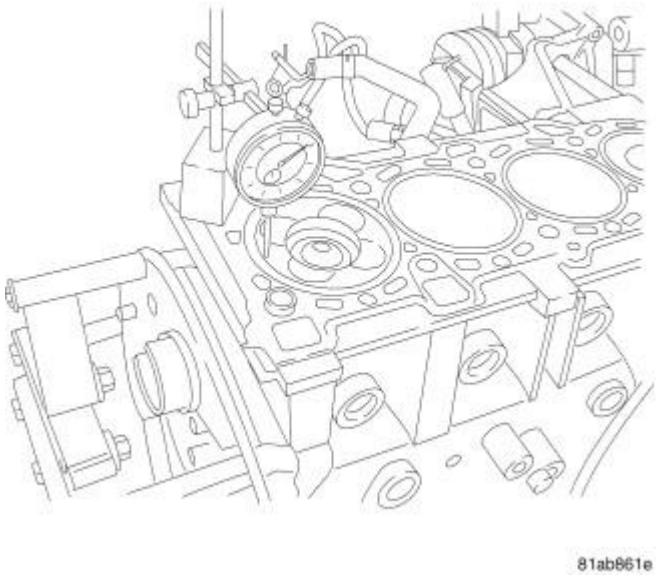

Fig. 55: Measuring Height Of Piston At Top Dead Center Using Suitable Dial Indicator
Courtesy of CHRYSLER LLC

2. Set the number one piston to top dead center (TDC).
3. Using a suitable dial indicator, assemble as illustrated.

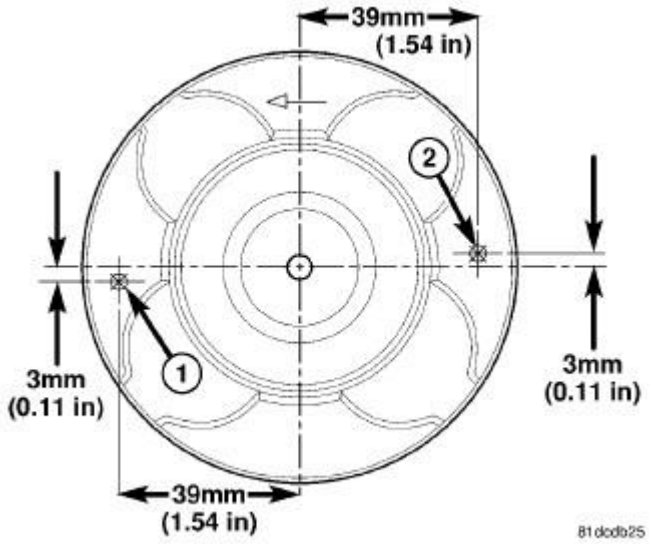

Fig. 56: Piston Protrusion Measurement
Courtesy of CHRYSLER LLC

4. Zero the dial indicator on the top of the piston at location shown in illustration (1).

5. Use the dial indicator to measure the height of the piston at top dead center to the cylinder block and record measurements.
6. Zero the dial indicator on the top of the piston at location shown in illustration (2).
7. Use the dial indicator to measure the height of the piston at top dead center to cylinder block and record measurements.
8. Repeat the procedure for each cylinder.
9. Average the 4 piston protrusion readings to determine the required gasket thickness.

Cylinder Head Gasket Selection		
	Millimeters	Inches
DISTANCE FROM PISTON AT TDC TO CYLINDER BLOCK	0.300 - 0.399	0.0119 - 0.0158
CYLINDER HEAD GASKET THICKNESS	1.10	0.0434
PISTON CLEARANCE	0.701 - 0.800	0.0276 - 0.0315
DISTANCE FROM PISTON AT TDC TO CYLINDER BLOCK	0.400 - 0.499	0.0158 - 0.0197
CYLINDER HEAD GASKET THICKNESS	1.20	0.0473
PISTON CLEARANCE	0.701 - 0.800	0.0276 - 0.0315
DISTANCE FROM PISTON AT TDC TO CYLINDER BLOCK	0.500 - 0.600	0.0197 - 0.0237
CYLINDER HEAD GASKET	1.30	0.0512

THICKNESS		
PISTON CLEARANCE	0.700 - 0.800	0.0276 - 0.0315

10. Select the appropriate cylinder head gasket from the cylinder head gasket chart.

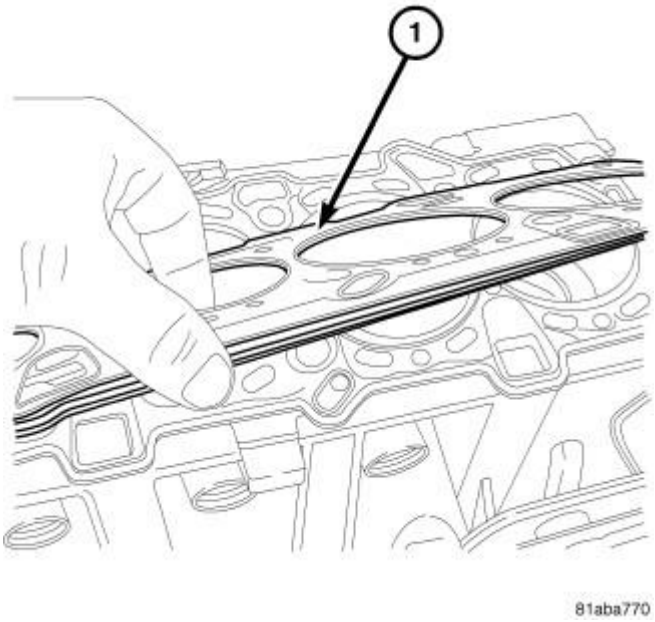

Fig. 57: MLS Head Gasket
Courtesy of CHRYSLER LLC

11. Install the head gasket (1).
12. Install the cylinder head.

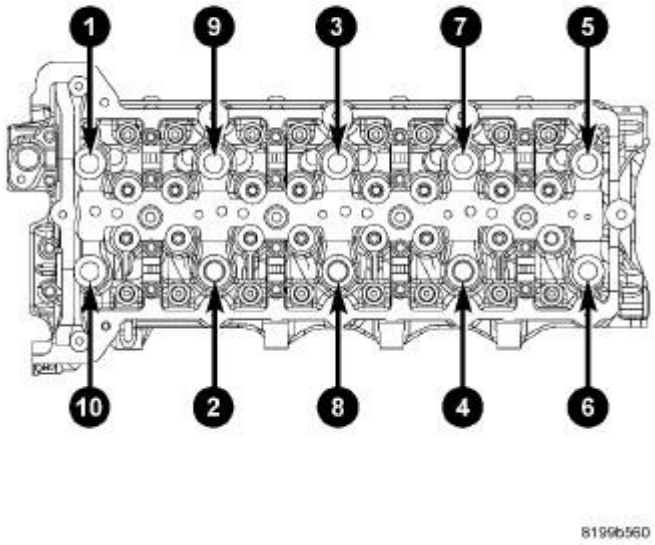

Fig. 58: Cylinder Head Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

NOTE: Always use new cylinder head bolts with washer whenever the existing bolts have been removed.

13. Install the cylinder head bolts.
    - Tighten the bolts to 30 N.m (22 ft. lbs.).
    - Repeat the pattern, turning the bolts an additional 85 degrees.
    - Repeat the pattern, turning the bolts an additional 85 degrees.
    - Repeat the pattern, turning the bolts an additional 85 degrees for a total of 255 degrees.

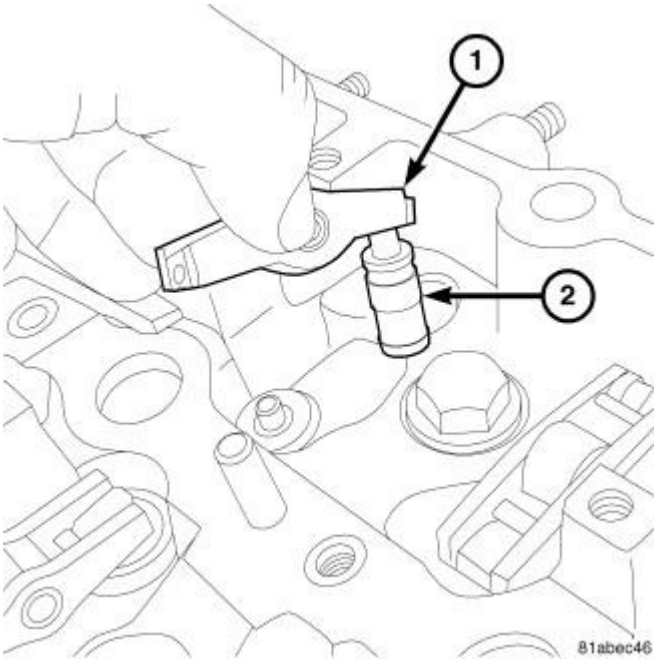

Fig. 59: Rocker Arms & Hydraulic Lifters
Courtesy of CHRYSLER LLC

14. Install the rocker arms (1) and hydraulic lifters (2). Make sure to return the lifters and arms to their original position.

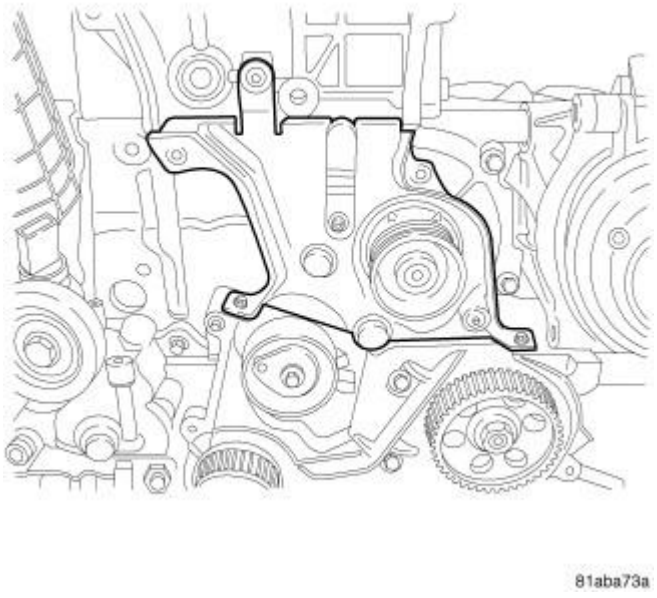

Fig. 60: Inner Front Cover
Courtesy of CHRYSLER LLC

15. Install the inner timing belt cover. Tighten bolts to 11 N.m (97 lbs. in.).
16. Install the camshafts. Refer to **CAMSHAFT, Engine , Installation**.

17. Install the exhaust manifold. Refer to **MANIFOLD, Exhaust , Installation**.
18. Install the intake manifold. Refer to **MANIFOLD, Intake , Installation**.
19. On 4x4 models, install the front axle. Refer to **Installation** .
20. Install the battery. Refer to **BATTERY , Installation** .
21. Start engine and check for leaks.

CAMSHAFT, ENGINE

Description

DESCRIPTION

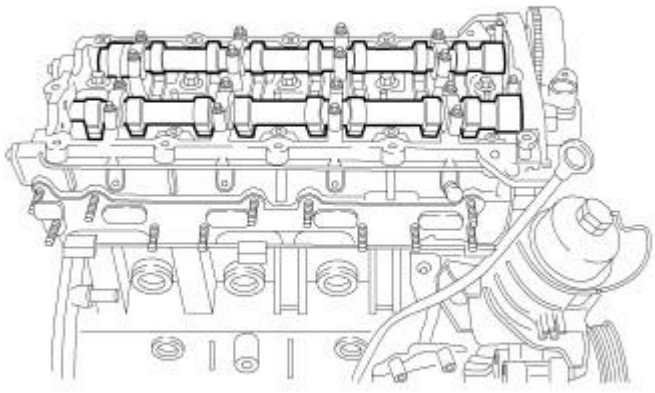

Fig. 61: Camshafts
Courtesy of CHRYSLER LLC

The camshafts are made of cast iron with eight machined lobes and four bearing journals.

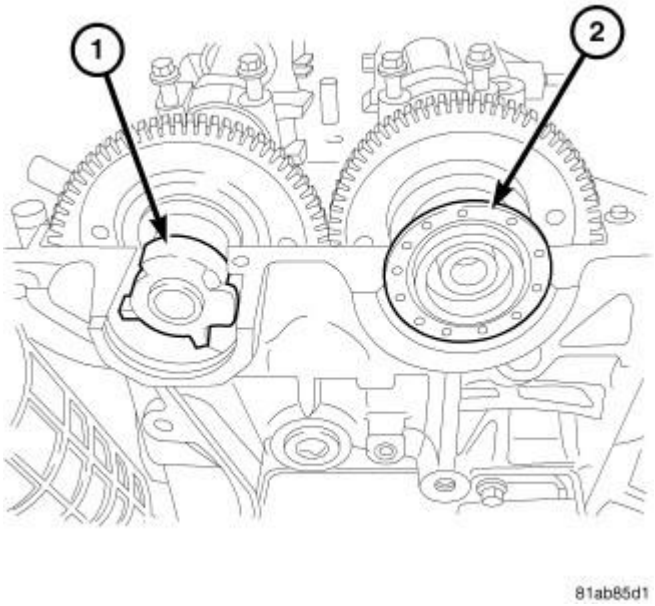

Fig. 62: Camshaft Oil Seal
Courtesy of CHRYSLER LLC

1. The exhaust camshaft (1) incorporates the CMP sensor reluctor wheel. The intake camshaft uses a camshaft seal (2).

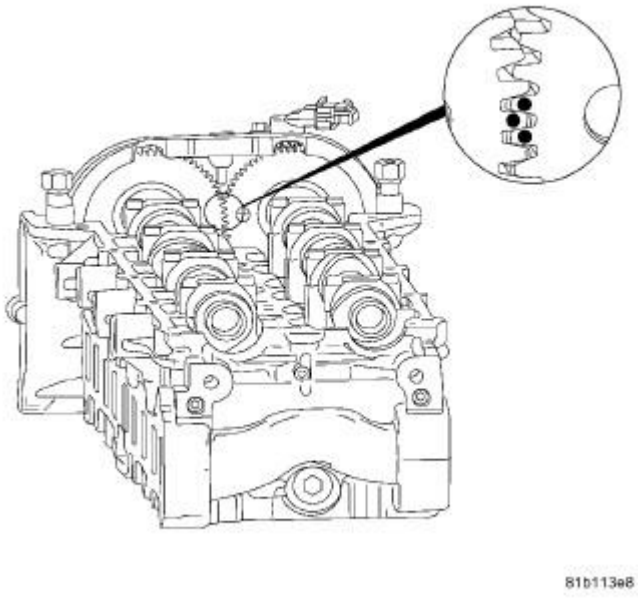

Fig. 63: Camshaft Timing Dots
Courtesy of CHRYSLER LLC

2. The dots on the back of the camshaft gears are for initial timing only. These dots are for timing the

camshafts to each other. To correctly set engine timing, the camshafts must be set to 90° ATDC. The camshaft locking tool (special tool #VM.9991, Alignment Tool, Camshaft Sprocket) is used to correctly set the camshafts to their proper location.

Removal

REMOVAL

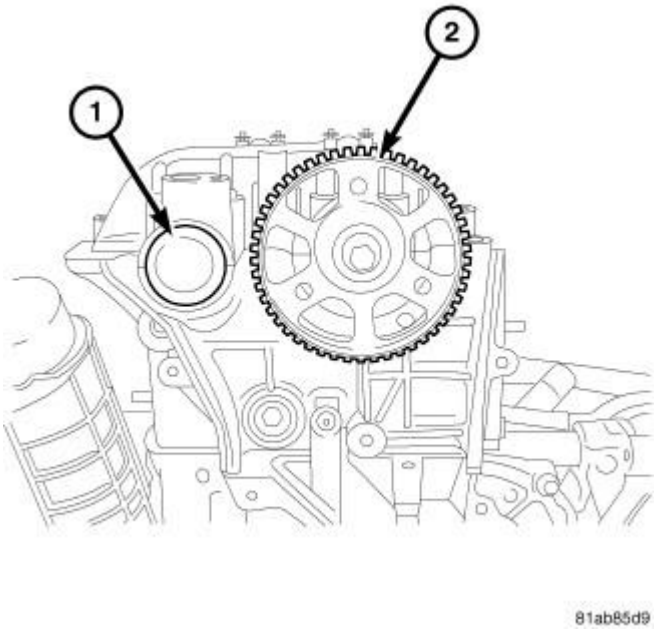

Fig. 64: Camshaft Timing Sprocket
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the intake camshaft sprocket (2). Refer to **SPROCKET(S), Timing Belt and Chain , Removal**.

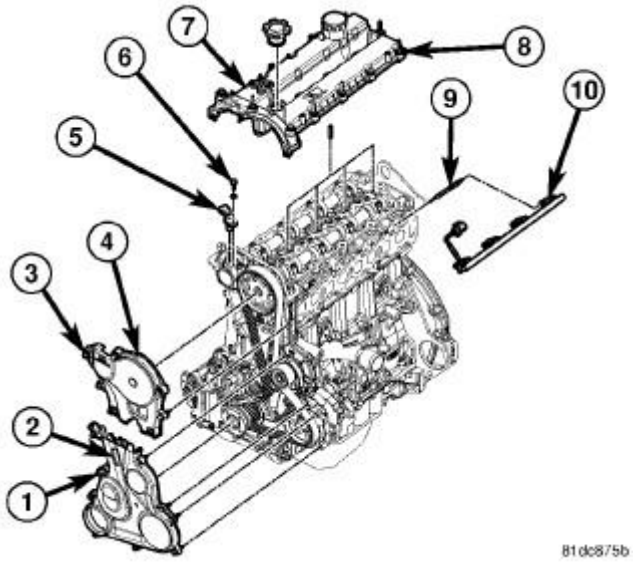

Fig. 65: Upper And Lower Front Covers
Courtesy of CHRYSLER LLC

3. Remove the cylinder head cover (7). Refer to **COVER(S), Cylinder Head , Removal**.

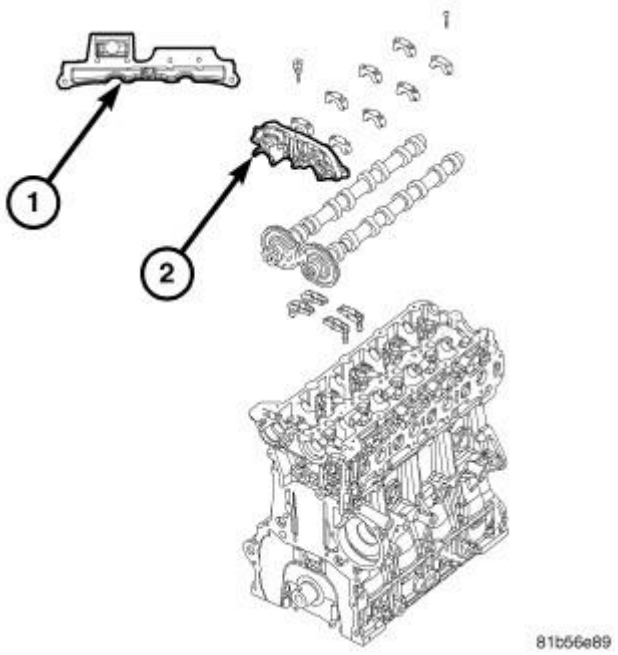

Fig. 66: Camshaft Cap RTV Location
Courtesy of CHRYSLER LLC

4. Remove the front camshaft bearing journal (2).

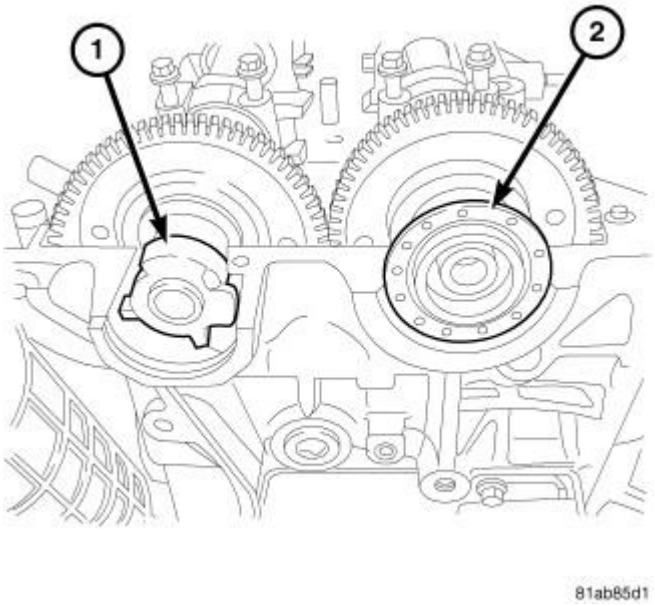

Fig. 67: Camshaft Oil Seal
Courtesy of CHRYSLER LLC

5. Remove the intake camshaft oil seal (2).

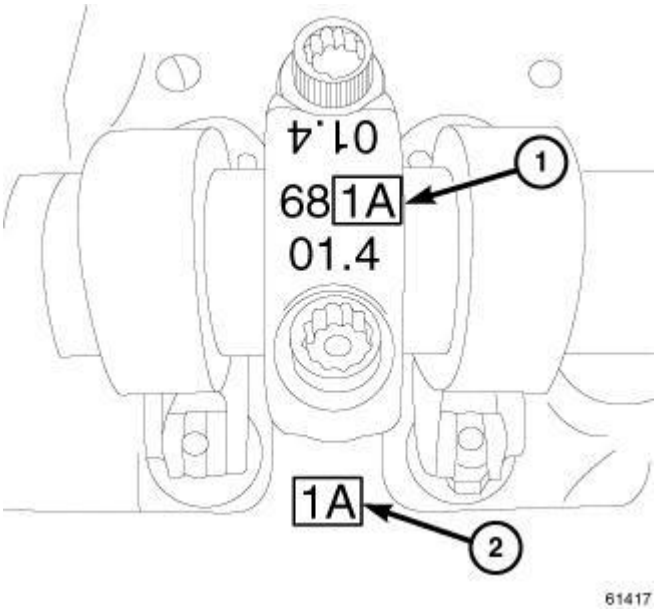

Fig. 68: Cam Cap 1
Courtesy of CHRYSLER LLC

NOTE: Observe the position marks on the cylinder head and camshaft cap as a reference to its original location. The illustration is an example of the camshaft markings.

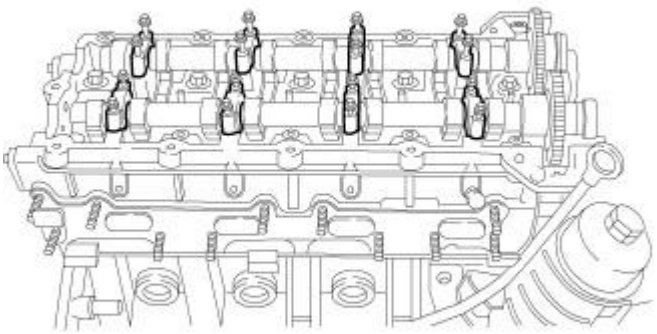

Fig. 69: Camshaft Caps
Courtesy of CHRYSLER LLC

NOTE: Intake and exhaust manifolds removed for clarity.

6. Using a circular pattern, remove bolts and the camshaft caps.
7. Remove the camshafts.

Installation

INSTALLATION

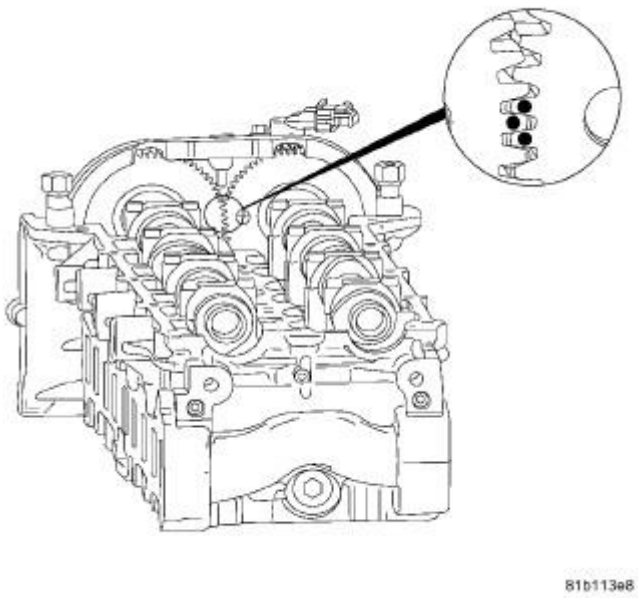

Fig. 70: Camshaft Timing Dots
Courtesy of CHRYSLER LLC

1. Lubricate the camshaft journals with Mopar® Engine Oil Supplement, or equivalent.

NOTE: The dots on the back of the camshaft gears are for initial timing only. These dots are for timing the camshafts to each other. To correctly set engine timing, the camshafts must be set to 90° ATDC. The camshaft locking tool is used to correctly set the camshafts to their proper location.

2. Make sure that the three small orientation dots marks on the back side of the camshaft gears are horizontal and facing each other.
3. Carefully install camshafts onto the camshaft journals.

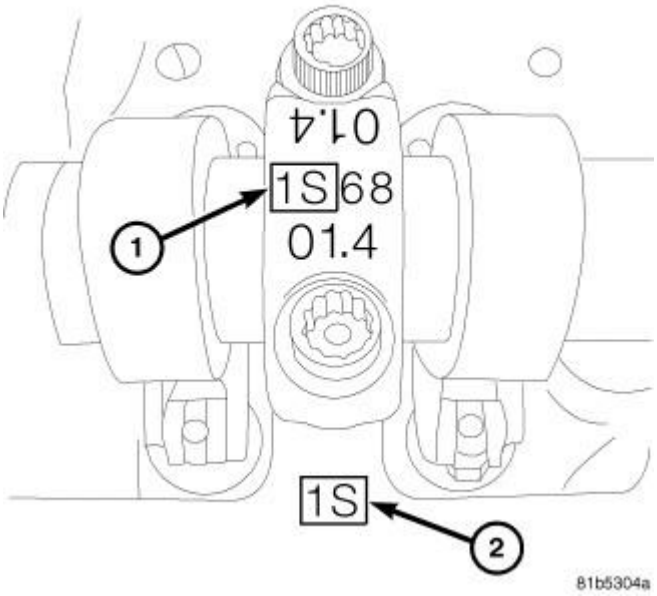

Fig. 71: Cam Cap 2
Courtesy of CHRYSLER LLC

4. The cylinder head and camshaft caps have markings to identify each cap to its correct location. In the illustration, 1S (1) is marked on the exhaust side camshaft cap and 1S (2) is the mark on the exhaust side of the cylinder head. It is critical that all of the camshaft caps are returned to their correct locations.

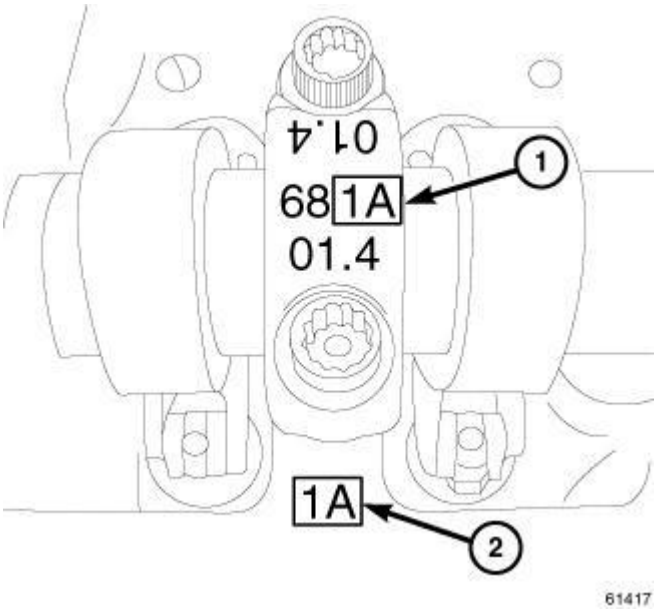

Fig. 72: Cam Cap 1
Courtesy of CHRYSLER LLC

5. The cylinder head and camshaft caps have markings to identify each cap to its correct location. In the illustration, 1A (1) is marked on the intake side camshaft cap and 1A (2) is the mark on the intake side of

the cylinder head. It is critical that all of the camshaft caps are returned to their correct locations.

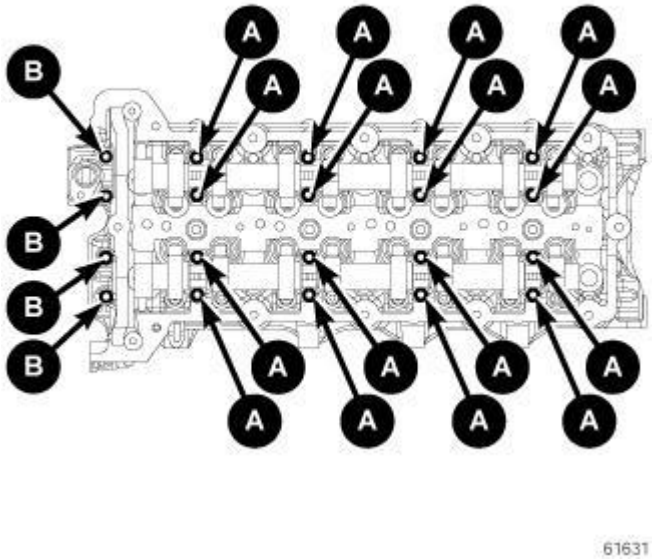

Fig. 73: Identifying Camshaft Bolts
Courtesy of CHRYSLER LLC

NOTE: Whenever the camshaft caps are removed, always replace the bolts.

6. The camshaft bolts have 2 different bolt sizes.
   - Bolts A are M6 35 mm.
   - Bolts B are M6 45 mm.

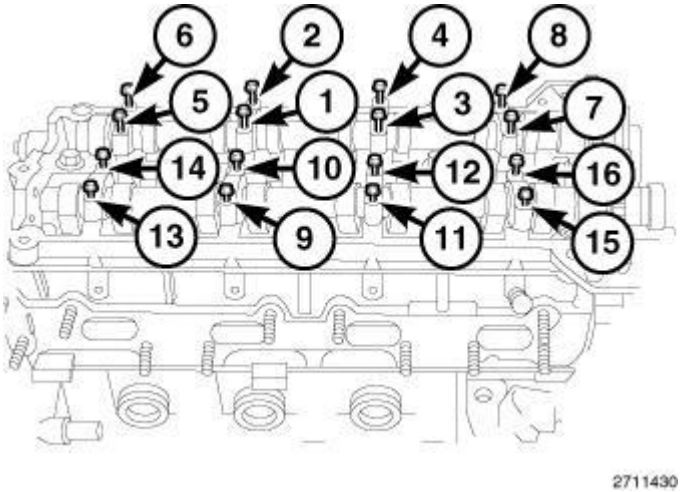

Fig. 74: Camshaft Tightening Sequence
Courtesy of CHRYSLER LLC

7. Using new bolts and the tightening sequence shown in illustration, install the camshaft bolts and tighten

bolts in one turn increments until finger tight.

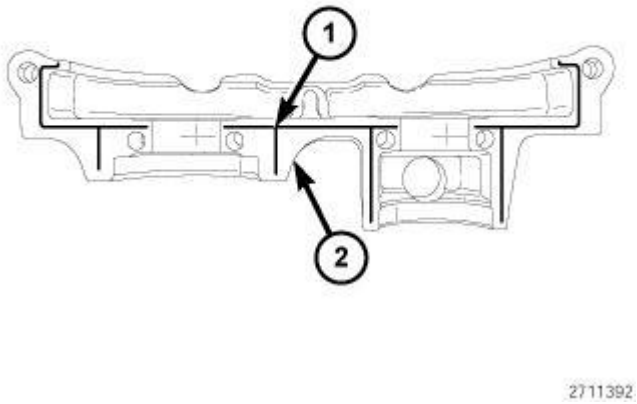

Fig. 75: Camshaft Cap RTV Location
Courtesy of CHRYSLER LLC

NOTE: Be careful not to get any Loctite® 510 onto the camshaft journal.

8. Apply a thin bead of Mopar® gasket maker (or equivalent) (1) to the front camshaft bearing journal (2) as illustrated.
9. Install the front camshaft bearing journal and tighten the new bolts finger tight.

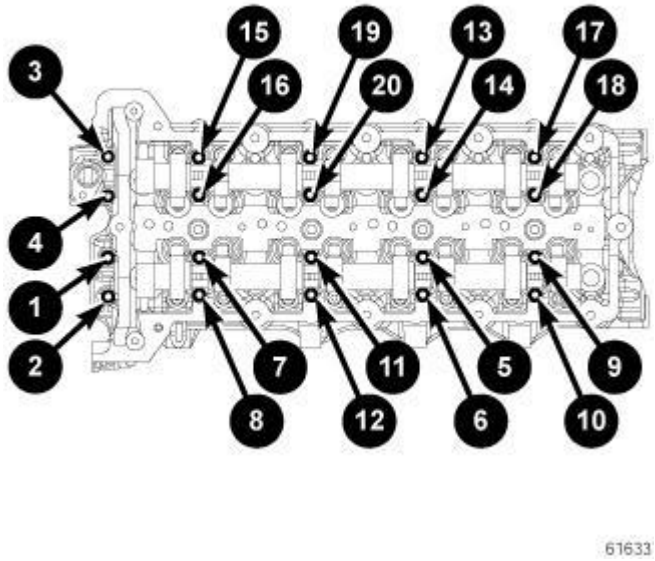

Fig. 76: Camshaft Cap Bolt Torque Sequence
Courtesy of CHRYSLER LLC

10. Using the sequence shown in illustration, tighten the camshaft cap bolts to 11 N.m (97 in. lbs.).

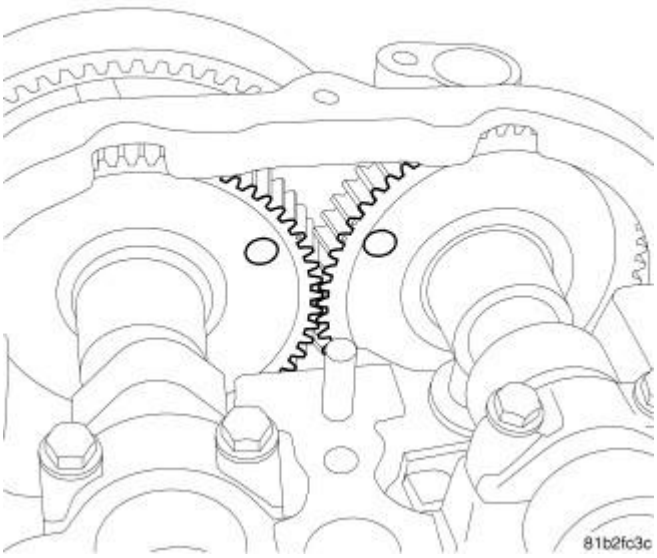

Fig. 77: Camshaft Marks At 90 Degrees ATDC
Courtesy of CHRYSLER LLC

11. Rotate the camshafts so that the camshaft locking tool (special tool #VM.9991, Alignment Tool, Camshaft Sprocket) fits into place.

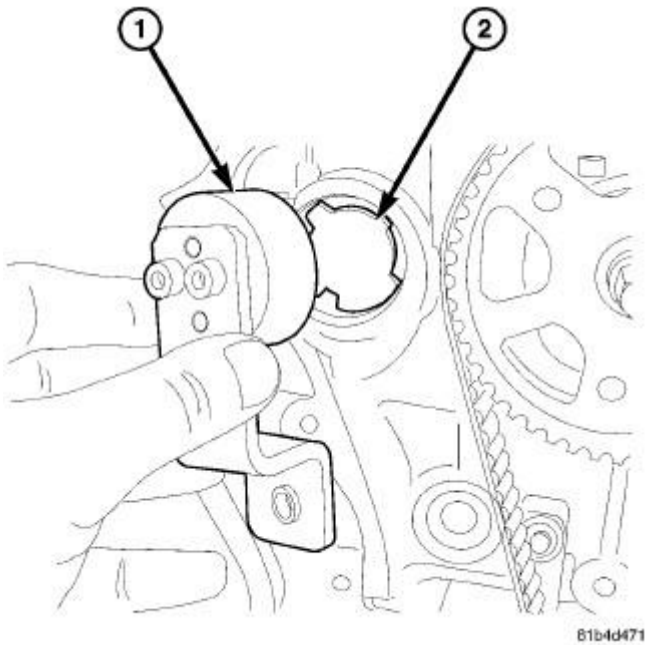

Fig. 78: Removing/Installing Camshaft Locking Tool

Courtesy of CHRYSLER LLC

12. Install the camshaft locking tool (special tool #VM.9991, Alignment Tool, Camshaft Sprocket) (1) onto the camshaft position sensor tone wheel (2).

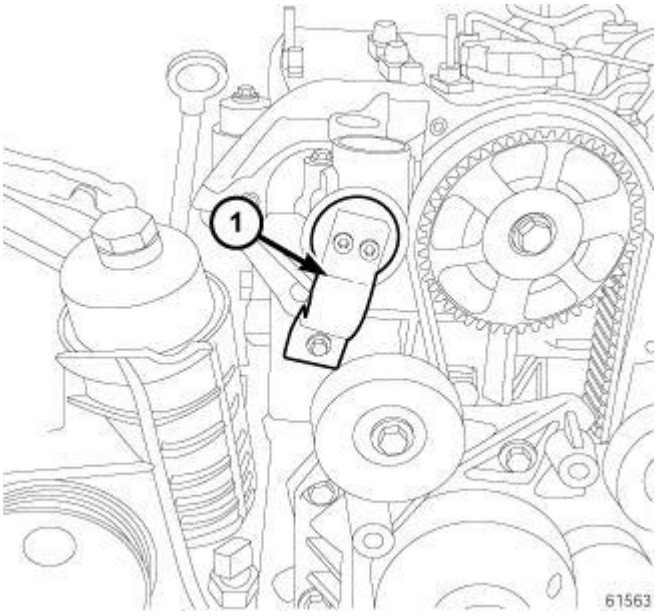

Fig. 79: Camshaft Locking Tool Installed
Courtesy of CHRYSLER LLC

13. When the camshaft locking tool (special tool #VM.9991, Alignment Tool, Camshaft Sprocket) is bolted in place, the camshafts are locked at 90° ATDC.

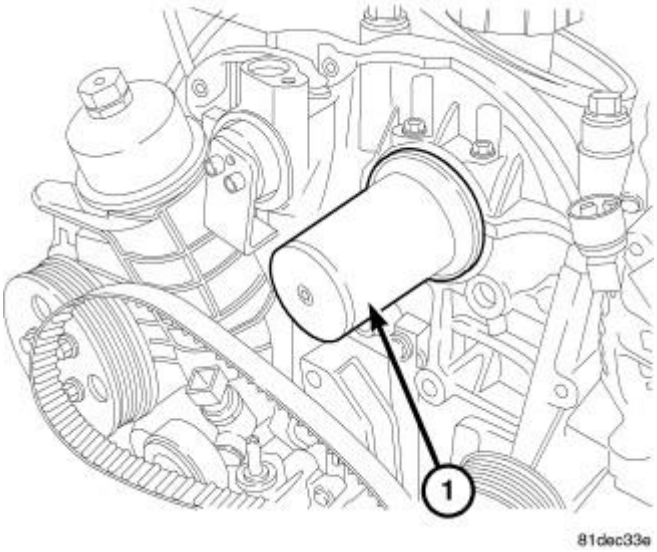

Fig. 80: Camshaft Oil Seal Installer
Courtesy of CHRYSLER LLC

14. Using the Seal Installer (special tool #9937-1, Installer, Seal) (1), install the intake camshaft oil seal.

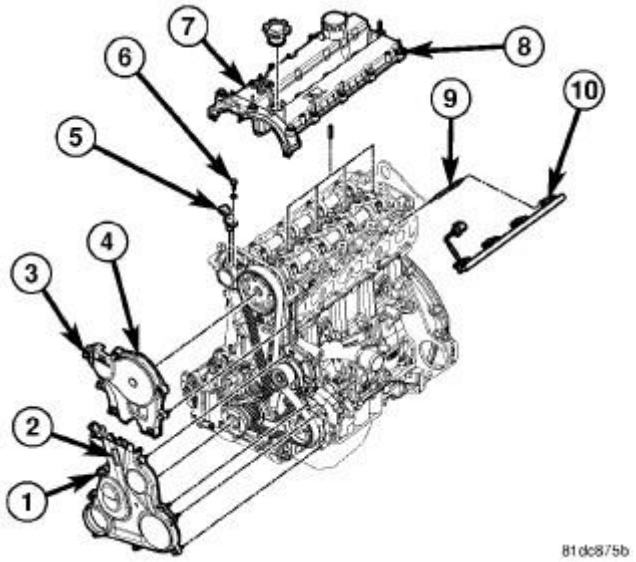

Fig. 81: Upper And Lower Front Covers
Courtesy of CHRYSLER LLC

15. Install the cylinder head cover (7). Refer to **COVER(S), Cylinder Head , Installation**.

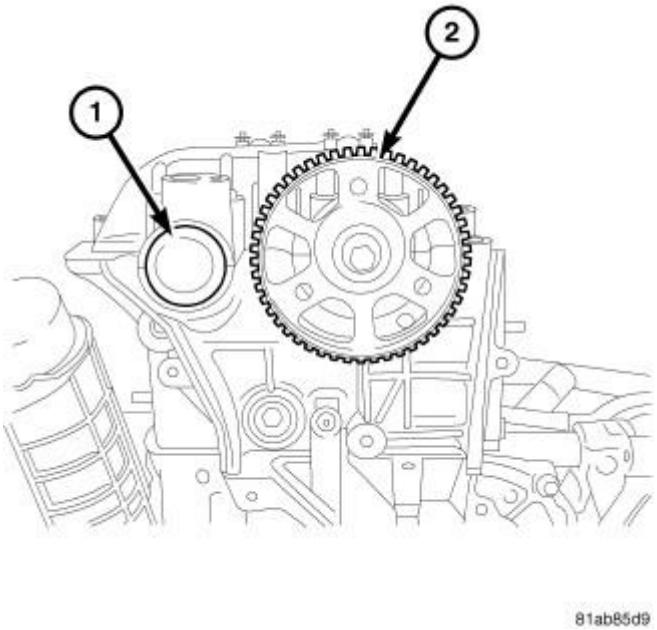

Fig. 82: Camshaft Timing Sprocket
Courtesy of CHRYSLER LLC

16. Install the intake camshaft sprocket (2). Refer to **SPROCKET(S), Timing Belt and Chain , Installation**.
17. Connect negative battery cable.

CHECKING CAMSHAFT ENDPLAY

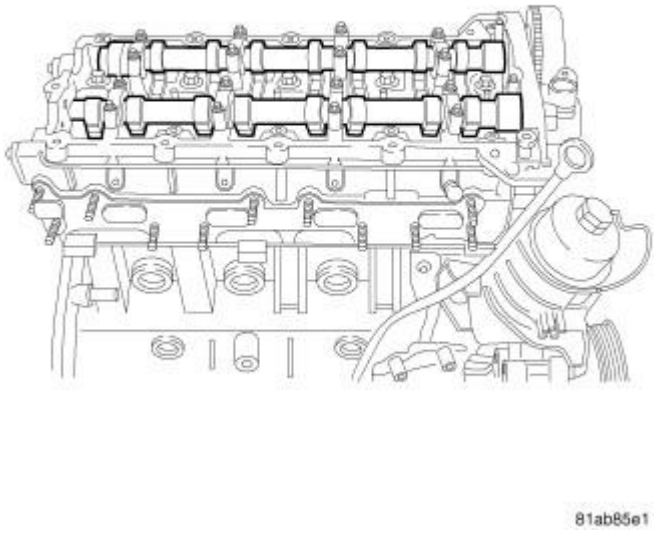

Fig. 83: Camshafts
Courtesy of CHRYSLER LLC

1. After camshafts are properly installed in cylinder head cover check end play of camshafts with a dial indicator. The end play should be between 0.10 mm - 0.55 mm.

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

2. Measure the camshaft end play with a dial indicator. The end play should be between 0.15 mm 0.35 mm (0.006 in - 0.014 in.).

COVER(S), CYLINDER HEAD

Description

DESCRIPTION

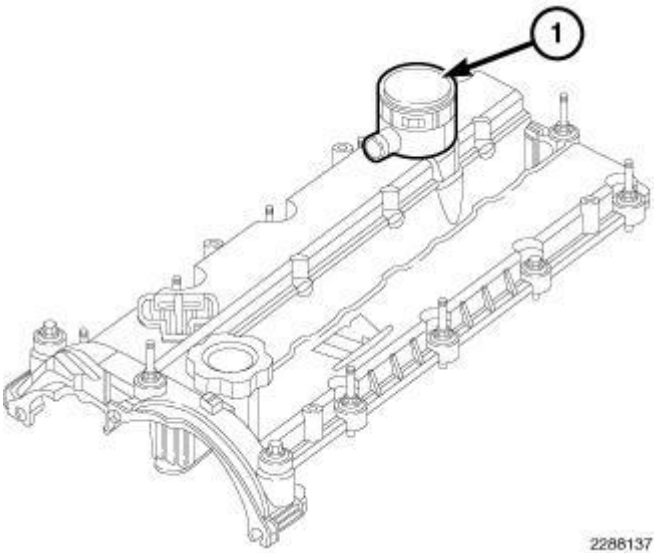

Fig. 84: Crankcase Ventilation (CCV) System
Courtesy of CHRYSLER LLC

The cylinder head cover is made of an injection molded composite. The cylinder head cover also incorporates a oil drain back hole for the crankcase ventilation (CCV) system (1).

The cylinder head cover gasket is not a serviceable item, if the gasket is found to be defective then a **new** cylinder head cover must be installed.

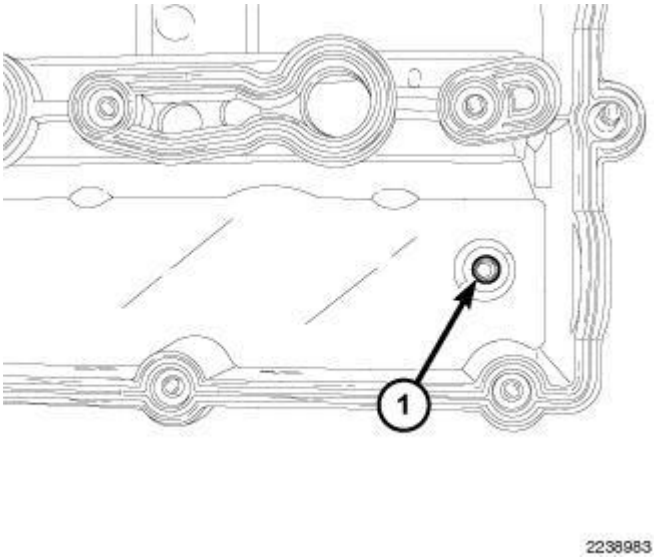

Fig. 85: Oil Drain Back Access Hole
Courtesy of CHRYSLER LLC

The cylinder head cover also incorporates a oil drain back hole (1) for the crankcase ventilation (CCV) system.

Removal

REMOVAL

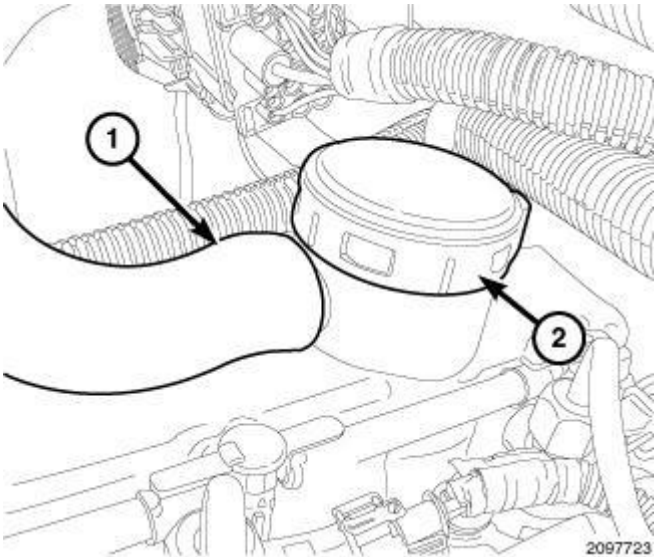

Fig. 86: Crankcase Vent Hose & Oil Separator
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove engine cover.
3. Remove the four retainers and the engine silencer.
4. Disconnect the crankcase vent hose (1) from the oil separator (2).
5. Remove the fuel Injectors. Refer to **INJECTOR(S), Fuel , Removal** .

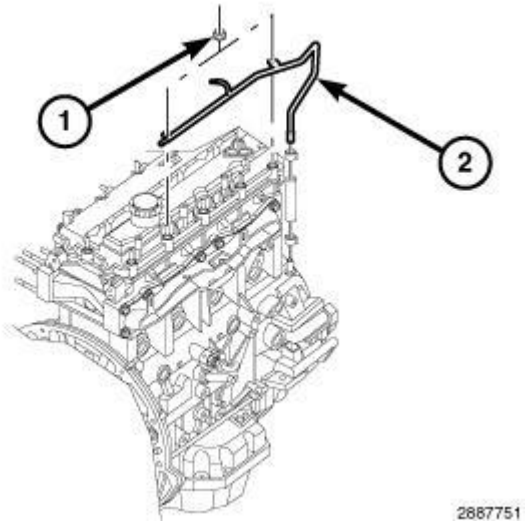

Fig. 87: Retaining Nuts & Vacuum Line
Courtesy of CHRYSLER LLC

6. Remove the retaining nuts (1) and position aside the vacuum line (2).

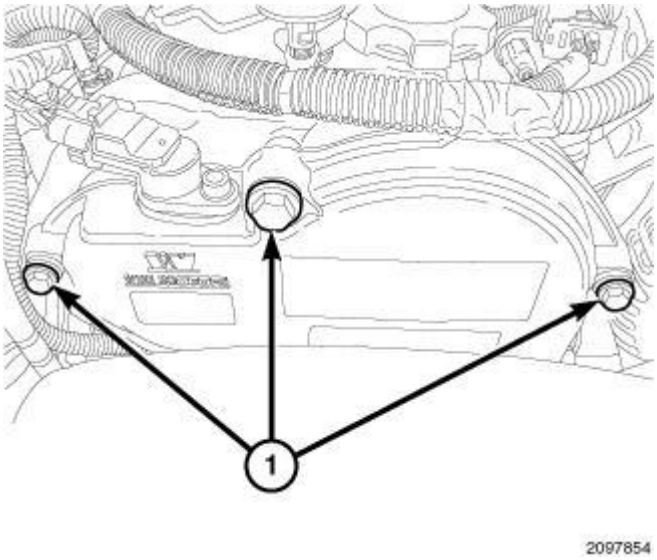

Fig. 88: Upper Front Timing Bolts
Courtesy of CHRYSLER LLC

NOTE: The upper cover bolts are incased in a collar which does not permit them to be removed.

7. Loosen the upper front timing cover bolts (1).

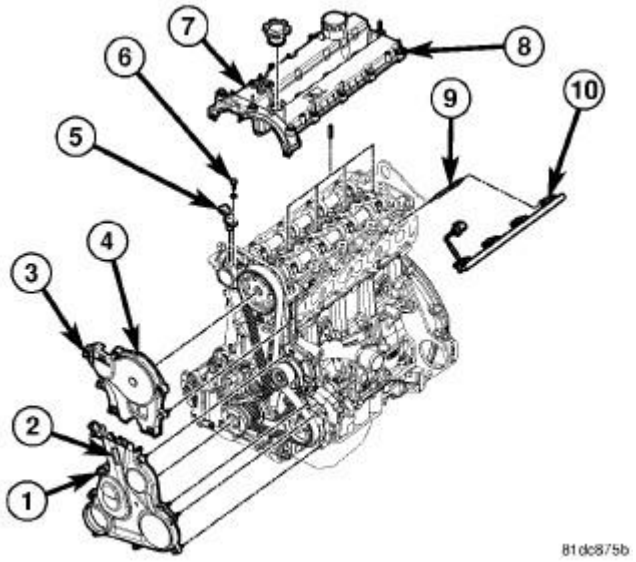

Fig. 89: Upper And Lower Front Covers
Courtesy of CHRYSLER LLC

8. Loosen the fasteners (8) and the cylinder head cover (7).

Installation

INSTALLATION

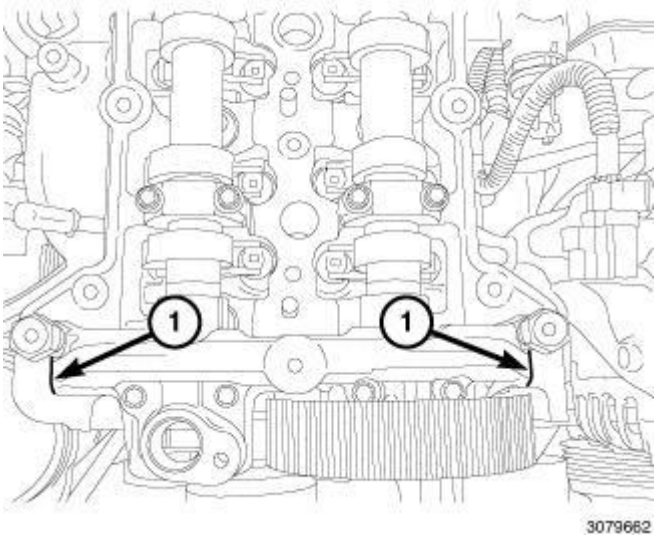

Fig. 90: Locating Application Marks Of Bead Of Mopar® Engine Sealant RTV
Courtesy of CHRYSLER LLC

NOTE: The cylinder head cover gasket is not serviceable, if the gasket is found to be defective then a new cylinder head cover must be installed.

1. Clean the sealing surfaces and inspect the gasket for damage and replace the cylinder head cover with a new one if the gasket is found to be defective.
2. Apply a 3 mm bead of Mopar® Engine Sealant RTV to the front camshaft bearing cap (1).

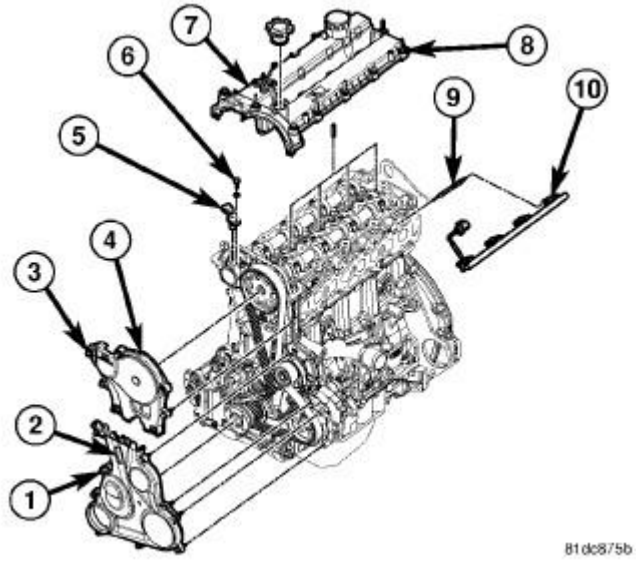

Fig. 91: Upper And Lower Front Covers
Courtesy of CHRYSLER LLC

3. Install the cylinder head cover (7). Tighten to 11 N.m (97 in. lbs.).

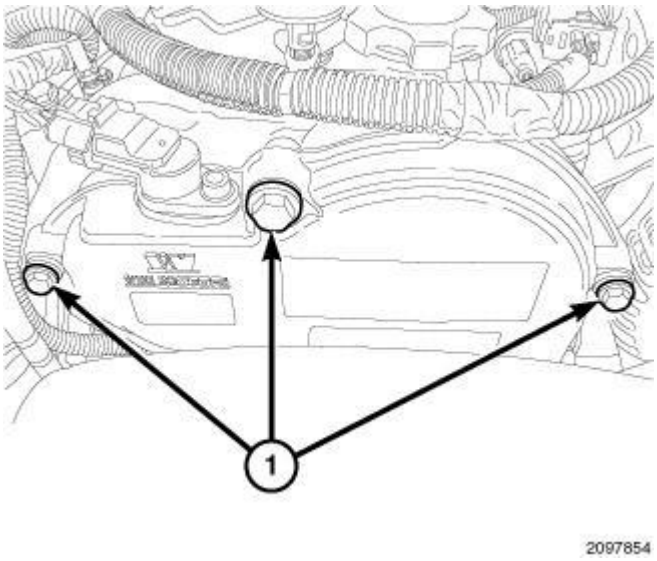

Fig. 92: Upper Front Timing Bolts
Courtesy of CHRYSLER LLC

4. Tighten the upper front timing cover bolts (1) to 8 N.m (71 in. lbs.).

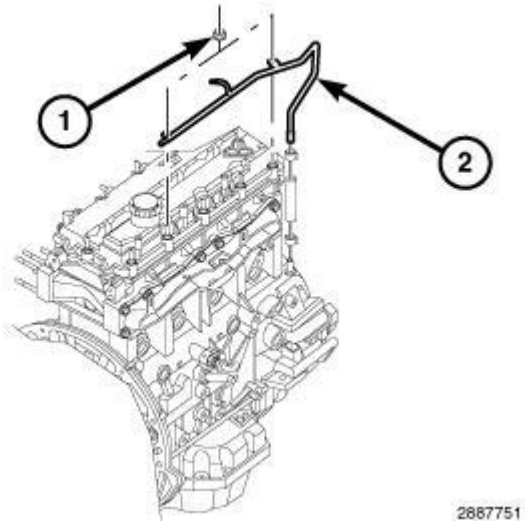

Fig. 93: Retaining Nuts & Vacuum Line
Courtesy of CHRYSLER LLC

5. Install the vacuum line (2). Tighten nuts (1) to 11 N.m (97 in. lbs.).

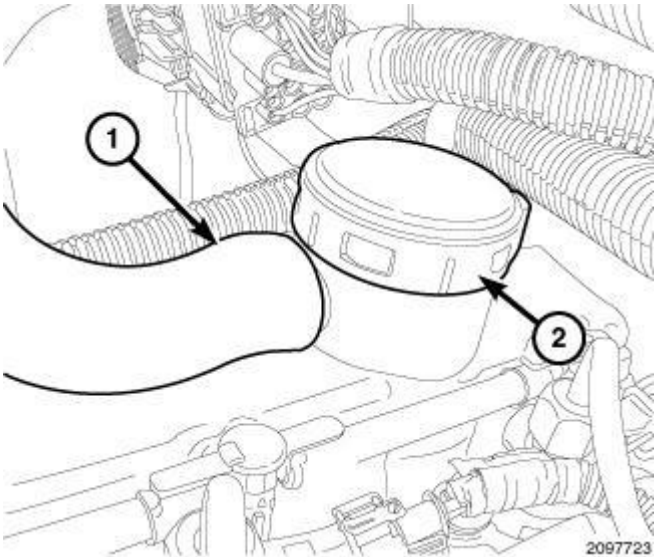

Fig. 94: Crankcase Vent Hose & Oil Separator
Courtesy of CHRYSLER LLC

6. Install the fuel injectors. Refer to **INJECTOR(S), Fuel , Installation** .
7. Connect the crankcase vent hose (1) to the oil separator (2).
8. Install the silencer and the four retainers.
9. Install the engine cover.
10. Connect the negative battery cable.

LIFTER(S), HYDRAULIC

Description

DESCRIPTION

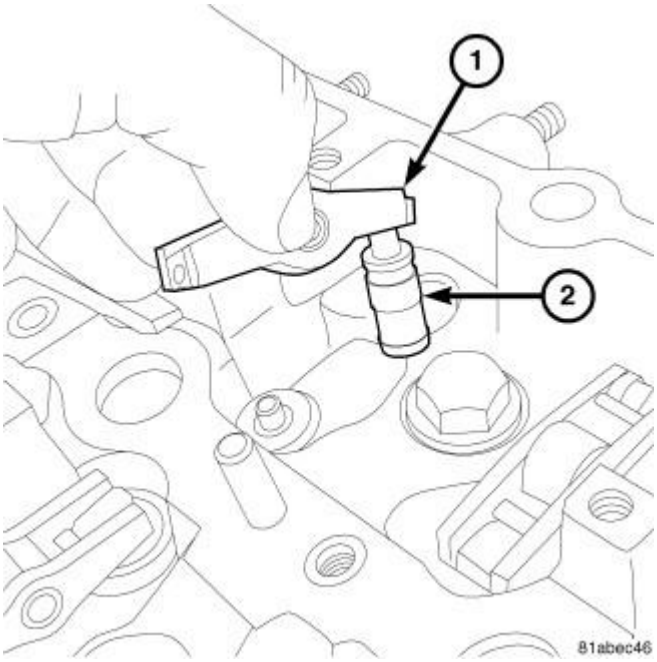

Fig. 95: Rocker Arms & Hydraulic Lifters
Courtesy of CHRYSLER LLC

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

Removal

REMOVAL

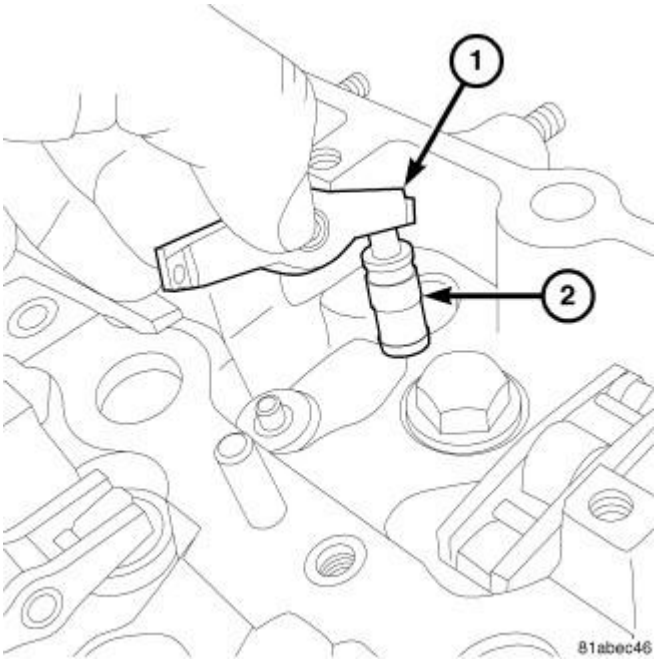

Fig. 96: Rocker Arms & Hydraulic Lifters

Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the camshafts. Refer to **CAMSHAFT, Engine , Removal**.

NOTE: Always return the hydraulic lifters to their original location in the cylinder head.

3. Remove the rocker arms (1) and hydraulic lifters (2).

Inspection

INSPECTION

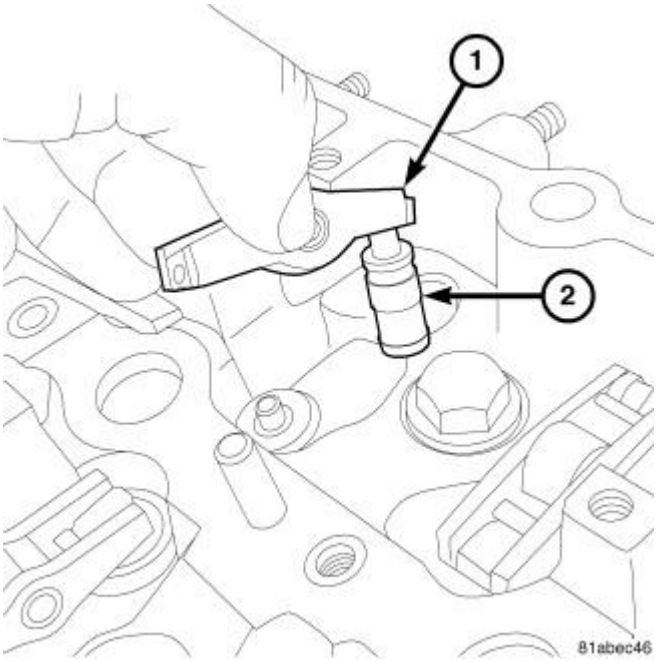

Fig. 97: Rocker Arms & Hydraulic Lifters
Courtesy of CHRYSLER LLC

Clean each lifter assembly (1) in cleaning solvent to remove all varnish and sludge deposits. Inspect for indications of scuffing on the side and base of each lifter body.

Installation

INSTALLATION

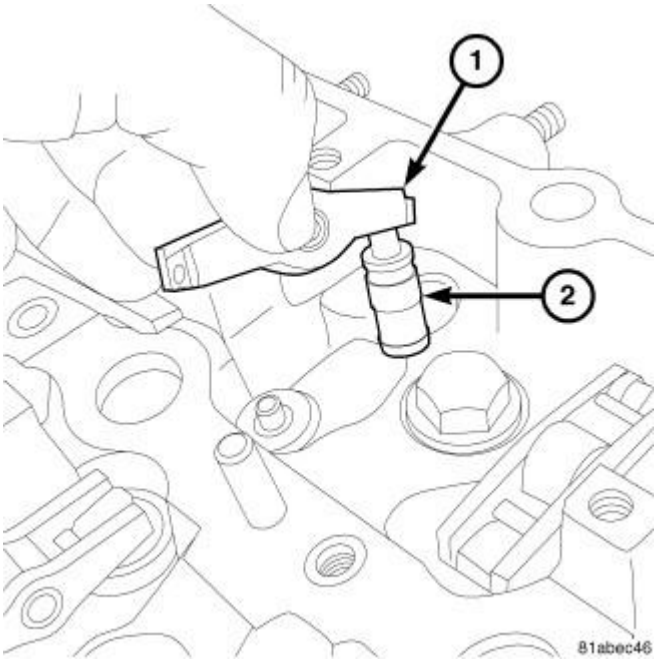

Fig. 98: Rocker Arms & Hydraulic Lifters
Courtesy of CHRYSLER LLC

1. Install the rocker arms (1) and hydraulic lifters (2) into their original locations.
2. Install the camshafts. Refer to **CAMSHAFT, Engine , Installation**.
3. Connect the negative battery cable.

ROCKER ARM, VALVE

Description

DESCRIPTION

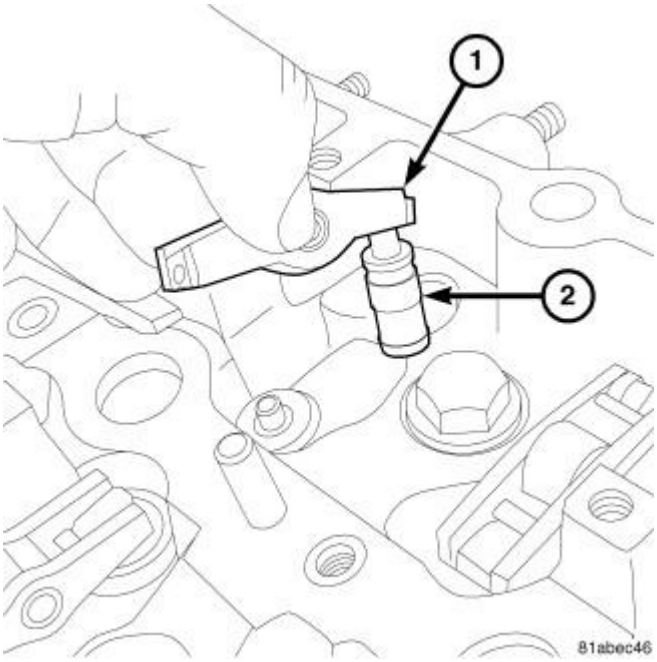

Fig. 99: Rocker Arms & Hydraulic Lifters
Courtesy of CHRYSLER LLC

The rocker arms (1) are made of stamped steel and serviced as an assembly along with the lifter.

The rocker arms (1) 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 (1). This pressure is then applied to the hydraulic lifter (2) which opens the valve.

Removal

REMOVAL

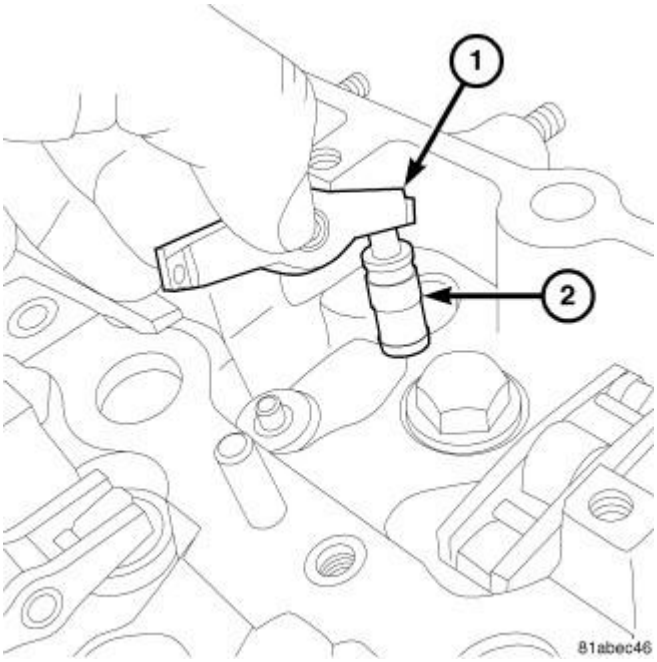

Fig. 100: Rocker Arms & Hydraulic Lifters
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the camshafts. Refer to **CAMSHAFT, Engine , Removal**.
3. Remove rocker arms (1) and lifters (2).

Installation

INSTALLATION

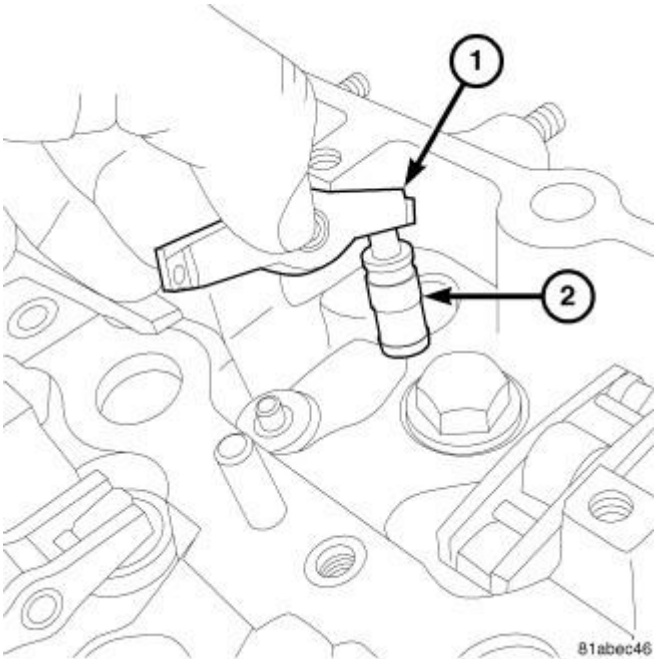

Fig. 101: Rocker Arms & Hydraulic Lifters
Courtesy of CHRYSLER LLC

1. Clean and inspect gasket sealing surfaces.
2. Lubricate lifter ball end of lifter(s), valve(s), and rocker arm roller(s) with Mopar® Engine Oil Supplement or equivalent.
3. Connect rocker arm(s) to lifter and reposition on valve(s).
4. Install the camshafts. Refer to **CAMSHAFT, Engine , Installation**.
5. Connect the negative battery cable.

SEAL(S), CAMSHAFT

Removal

REMOVAL

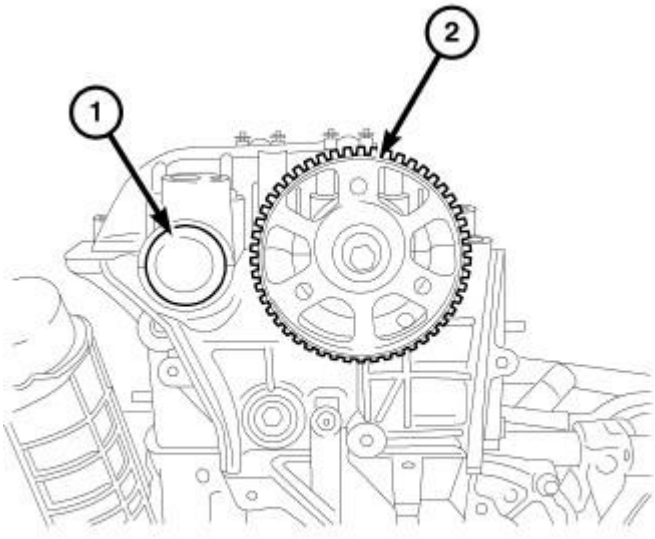

Fig. 102: Camshaft Timing Sprocket
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove the intake camshaft sprocket (2). Refer to **SPROCKET(S), Timing Belt and Chain , Removal**.

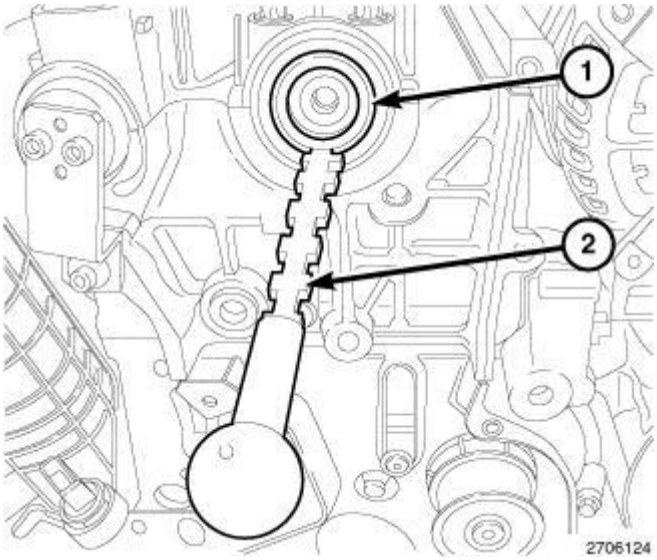

Fig. 103: Seal Remover & Seal
Courtesy of CHRYSLER LLC

3. Install the seal remover (special tool #VM.1058, Remover, Seal) (2) into seal (1) as illustrated.

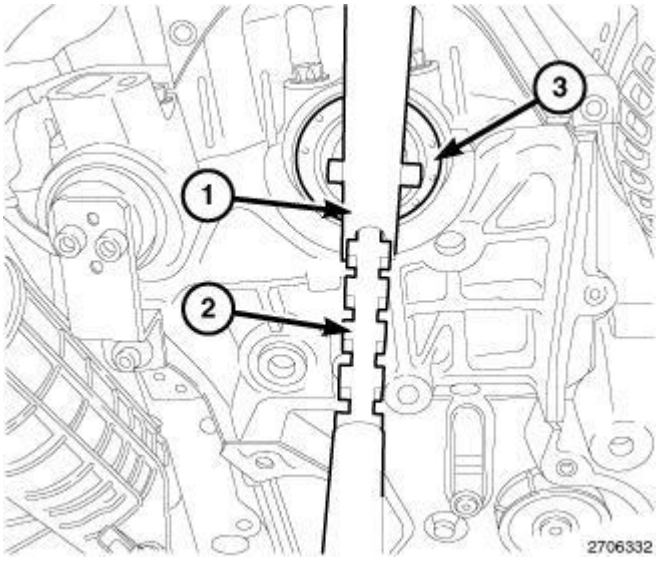

Fig. 104: Seal Remover Handle, Seal Remover & Intake Camshaft Oil Seal
Courtesy of CHRYSLER LLC

4. Position the Seal Remover handle (special tool #VM.1058, Remover, Seal) (1) onto Seal Remover (special tool #VM.1058, Remover, Seal) (2) and remove the intake camshaft oil seal (3).

Installation

INSTALLATION

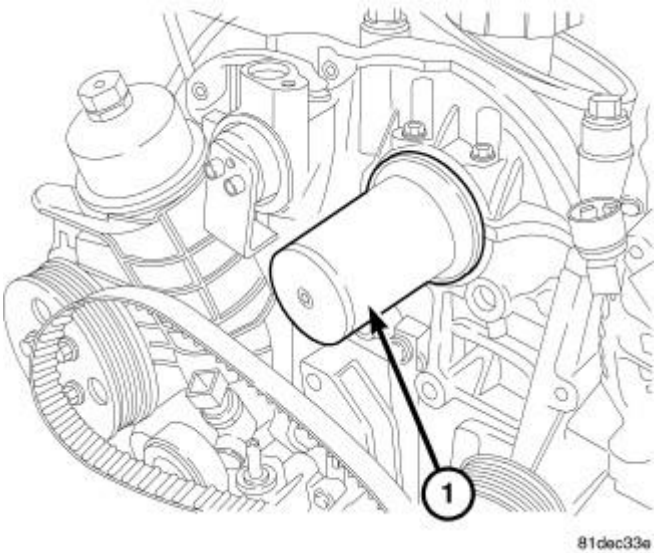

Fig. 105: Camshaft Oil Seal Installer
Courtesy of CHRYSLER LLC

1. Using the (special tool #9937-2, Guide, Seal) and the (special tool #9937-1, Installer, Seal) (1), install the intake camshaft oil seal.

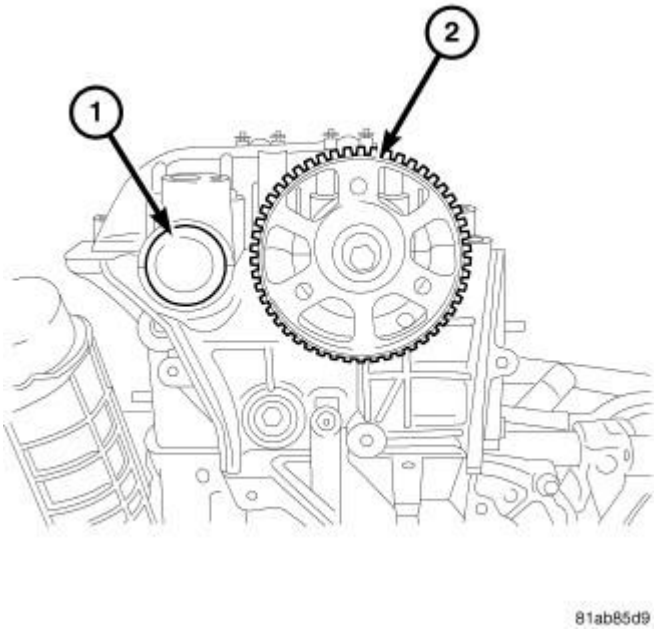

Fig. 106: Camshaft Timing Sprocket
Courtesy of CHRYSLER LLC

2. Install the camshaft sprocket (2). Refer to **SPROCKET(S), Timing Belt and Chain , Installation**.
3. Connect negative battery cable.

ENGINE BLOCK

DESCRIPTION

DESCRIPTION

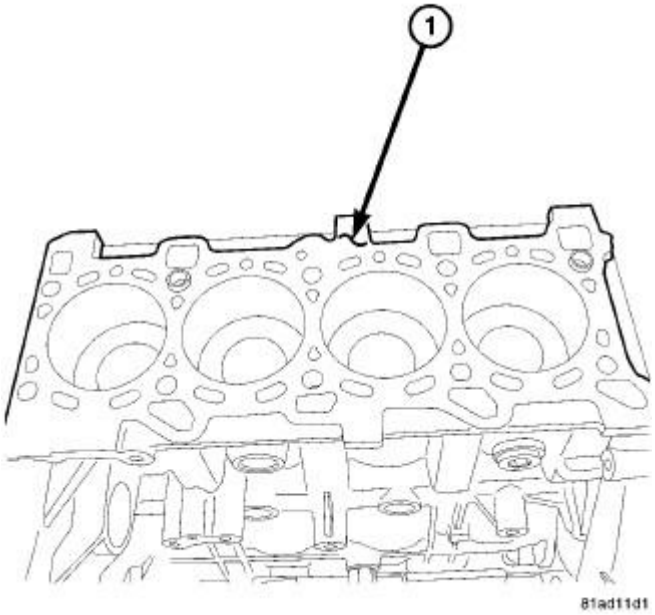

Fig. 107: Engine Block
Courtesy of CHRYSLER LLC

The 2.8L CRD Diesel engine uses a cast iron engine block. The cylinder block has increased stiffness that reduces structural flexing and a fractured connecting rod cap design that can not distort connecting rod cap fit.

STANDARD PROCEDURE

BEARING SELECTION CHARTS

Connecting Rod Bearings - Large End

Connecting Rod Journal Diameter - Connecting Rod Large End	Bearing Half	Connecting Rod Journal Diameter - Crankshaft			
		D	C	B	A
		53.929 - 53.936	53.936 - 53.942	53.942 - 53.948	53.948 - 53.955
A 57.563 - 57.568	Upper Bearing Shell	Blue	Blue	Red	Red
	Lower Bearing Shell	Yellow	Blue	Blue	Red

B 57.568 - 57.573	Upper Bearing Shell	Yellow	Blue	Blue	Red
	Lower Bearing Shell	Yellow	Yellow	Blue	Blue
C 57.573 - 57.578	Upper Bearing Shell	Yellow	Yellow	Blue	Blue
	Lower Bearing Shell	Green	Yellow	Yellow	Blue
D 57.578 - 57.583	Upper Bearing Shell	Green	Yellow	Yellow	Blue
	Lower Bearing Shell	Green	Green	Yellow	Yellow

Crankshaft Bearings

Cylinder Block Seat Diameter	Bearing Half	Crankshaft Main Journal Diameter			
		D	**C**	**B**	**A**
		64.974 - 64.981	**64.981 - 64.987**	**64.987 - 64.993**	**64.993 - 65.000**
A 69.000 - 69.005	Upper Bearing Shell	Blue	Blue	Red	Red
	Lower Bearing Shell	Yellow	Blue	Blue	Red
B 69.005 - 69.010	Upper Bearing Shell	Yellow	Blue	Blue	Red
	Lower Bearing Shell	Yellow	Yellow	Blue	Blue
C 69.010 - 69.015	Upper Bearing Shell	Yellow	Yellow	Blue	Blue
	Lower Bearing Shell	Green	Yellow	Yellow	Blue
	Upper Bearing	Green	Yellow	Yellow	Blue

D **69.015 - 69.020**	Shell				
	Lower Bearing Shell	Green	Green	Yellow	Yellow

COMPRESSION TEST

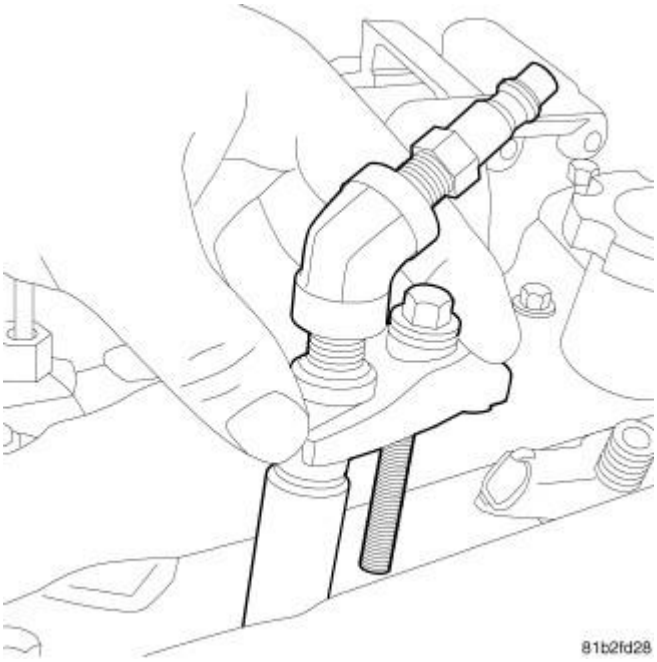

Fig. 108: Compression Tester
Courtesy of CHRYSLER LLC

1. Warm up engine to operating temperature (approximately 80 °C).
2. Shut off the engine.
3. Disable the low pressure fuel pump.
4. Remove the fuel injectors. Refer to **INJECTOR(S), Fuel , Removal** .
5. Crank engine several times with the starter to eliminate combustion residues in the cylinders.
6. Install the (special tool #VM.10010, Adapter, Compression Test) into injector hole of cylinder to be tested. Install injector retainer bolts and tighten.
7. Test compression pressure by cranking engine with starter for at least 8 revolutions.

Cylinder compression Difference Between Cylinders	**10 Bar (145 psi)**

8. Carry out test procedure at the remaining cylinders in the same way.
9. Remove the (special tool #VM.10010, Adapter, Compression Test) from cylinder head.
10. Install the fuel injectors. Refer to **INJECTOR(S), Fuel , Installation** .

BEARING(S), CRANKSHAFT, MAIN

Removal

REMOVAL

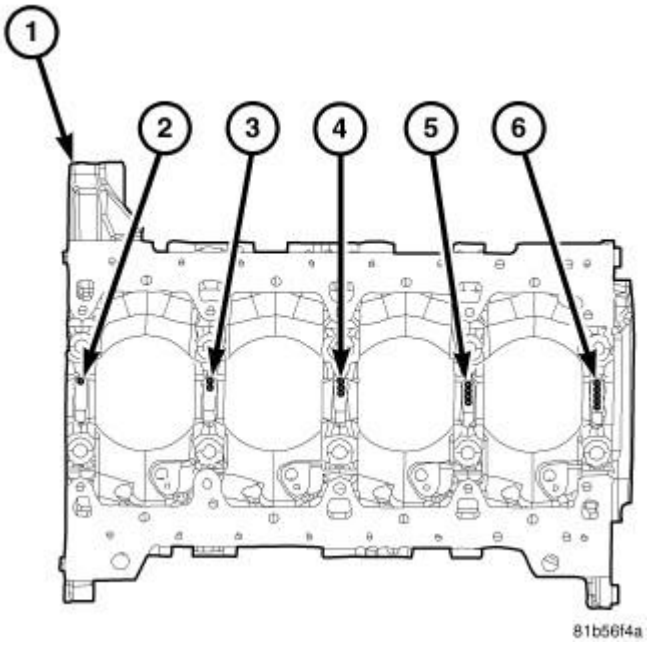

Fig. 109: Crankshaft Cap Location Marks
Courtesy of CHRYSLER LLC

NOTE: Bearing caps (2-6) are not interchangeable and are marked to ensure according to their locations (2-6) in the block (1). Upper and lower bearing halves are NOT interchangeable, and must be installed facing in the correct direction.

1. Remove the balance shaft assembly. Refer to **MODULE, Balance Shaft , Removal**.
2. Identify bearing cap locations (2-6) before removal.

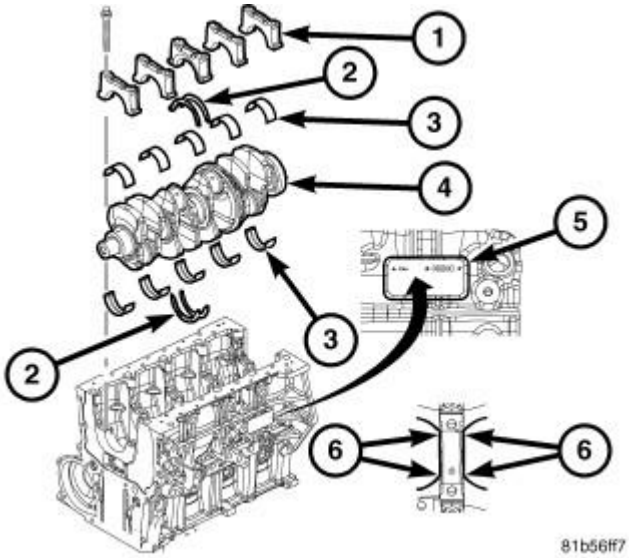

Fig. 110: Crankshaft Bearing Size Mark
Courtesy of CHRYSLER LLC

3. Remove the bearing caps (1) one at a time, and if possible, replace the crankshaft bearings (3) one at a time. Carefully rotate upper half of bearing from between the carrier and the crankshaft (4). If the upper half of the bearing does not easily slide out of position, the crankshaft must be removed for further inspection. Refer to **CRANKSHAFT , Removal**.

Installation

INSTALLATION

NOTE: The crankshaft cannot be machined, if badly worn or scored it must be replaced.

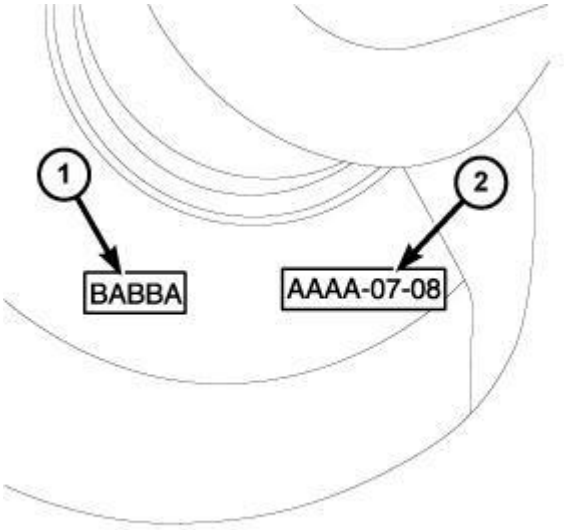

Fig. 111: Main Bearing Size Mark On Crank
Courtesy of CHRYSLER LLC

1. Each crankshaft journal has its own letter class (1) stamp on the crankshaft weight.

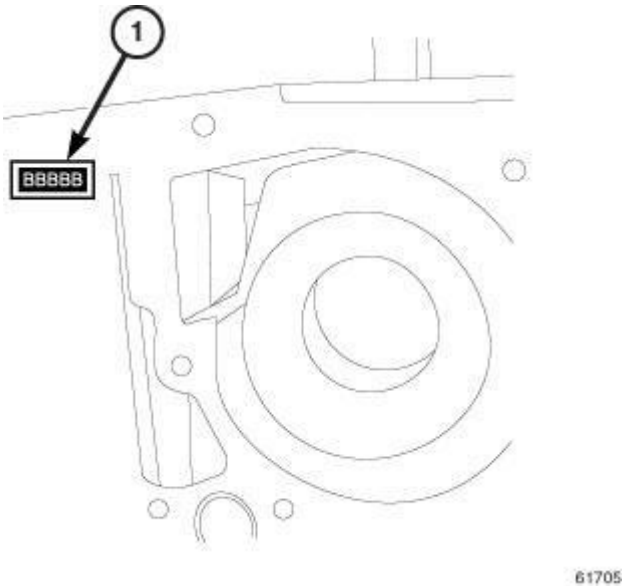

Fig. 112: Main Bearing Size Mark On Block
Courtesy of CHRYSLER LLC

2. Locate the engine block crankshaft journal letter class stamp on the engine block (1) besides the water pump seat.

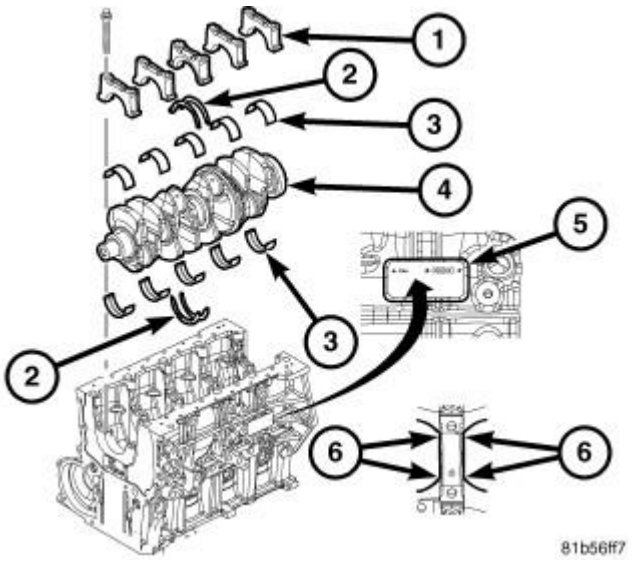

Fig. 113: Crankshaft Bearing Size Mark
Courtesy of CHRYSLER LLC

3. To determine the correct crankshaft journal size, each cylinder block seat diameter letter class must be matched with the crankshaft main journal diameter letter class. Both letter classes stamped on the cylinder

block as well as on the crankshaft weight are in a progressive order starting from the front of the engine. The first letter corresponds to the first cylinder, the second to the second, etc. Use the crankshaft bearing selection chart to determine the half shell color. Refer to **BEARING SELECTION CHARTS**.

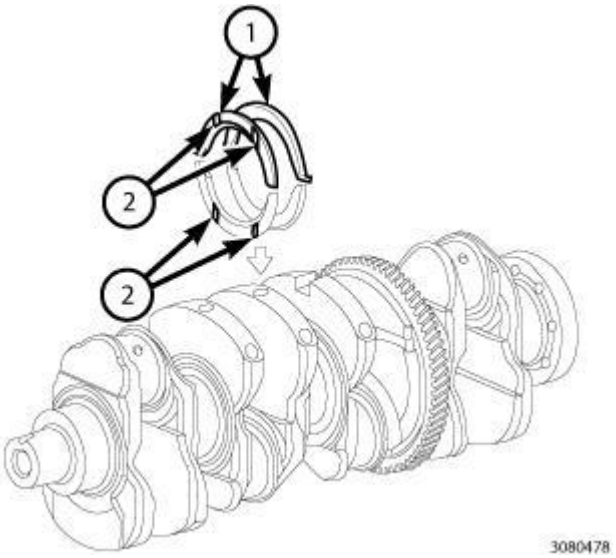

Fig. 114: Thrust Bearings & Oil Discharge Grooves Facing Toward Crankshaft
Courtesy of CHRYSLER LLC

4. When installing the thrust bearings (1) make sure the oil discharge groves (2) face towards the crankshaft.
5. If the crankshaft was removed to install the bearings, install the crankshaft. Refer to **CRANKSHAFT , Installation**.
6. Install the balance shaft assembly. Refer to **MODULE, Balance Shaft , Installation**.

BEARING(S), CONNECTING ROD

Removal

REMOVAL

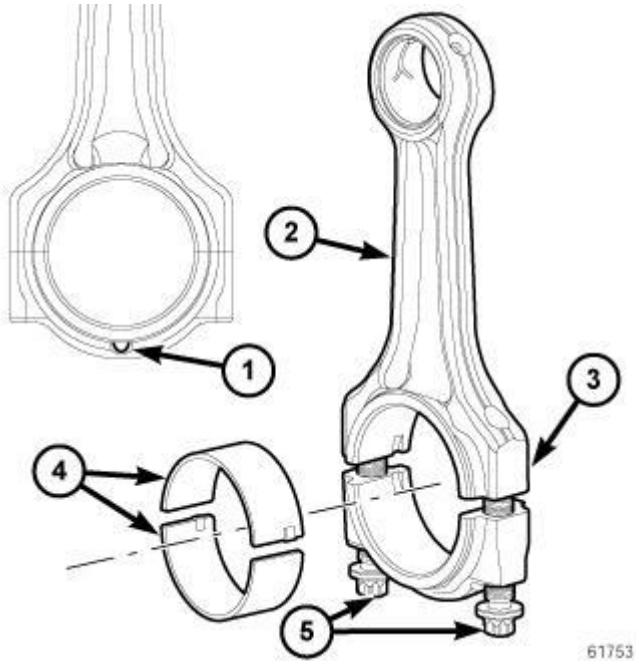

Fig. 115: Connecting Rod Identification
Courtesy of CHRYSLER LLC

1 - CONNECTING ROD PAWL
2 - CONNECTING ROD
3 - PAINTED CYLINDER IDENTIFIER
4 - CONNECTING ROD BEARINGS

1. Remove the balance shaft module. Refer to **MODULE, Balance Shaft , Removal**.
2. Remove the connecting rod bearing caps (1) one at a time and discard bolts (5).
3. Carefully remove the upper half and lower half of bearing (4) from the connecting rod (2).

Installation

INSTALLATION

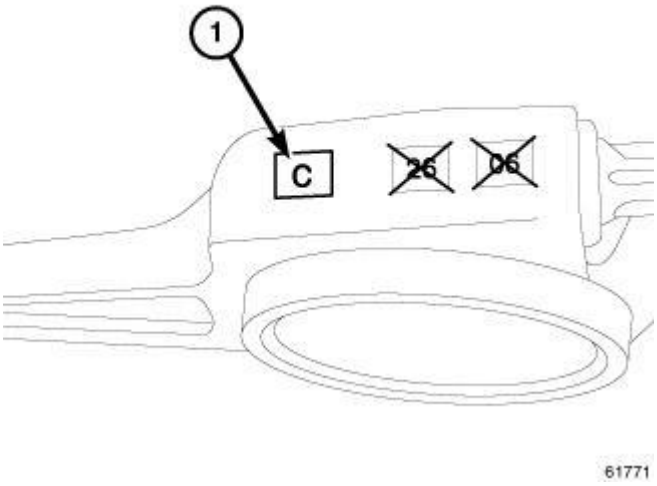

Fig. 116: Connecting Rod Size
Courtesy of CHRYSLER LLC

1. Each connecting rod has its own letter class (1) to a specific connecting rod journal diameter.

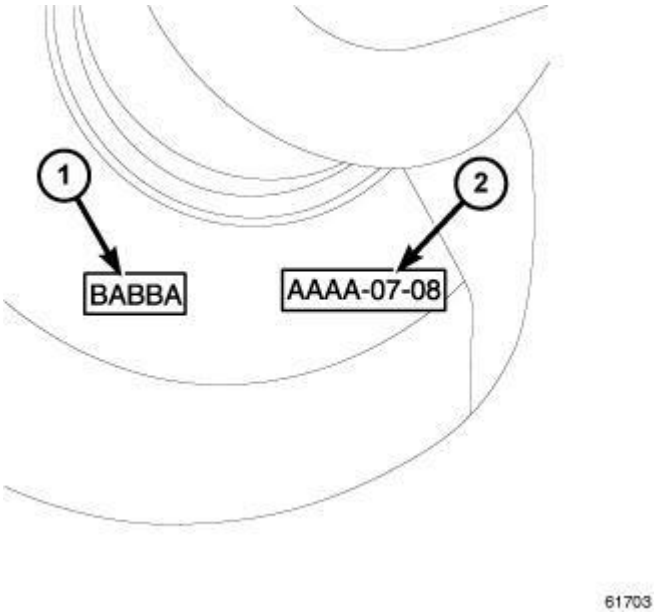

Fig. 117: Main Bearing Size Mark On Crank
Courtesy of CHRYSLER LLC

2. To determine the correct bearing size for each cylinder. Each connecting rod letter class must be matched with the crankshaft letter class (2) with the bearing selection chart to determine the correct bearing color for each cylinder. The letters stamped into the crankshaft (2) are in the same order as the cylinders. The first letter corresponds to the first cylinder, the second to the second, etc. See bearing selection chart. Refer to **BEARING SELECTION CHARTS**.

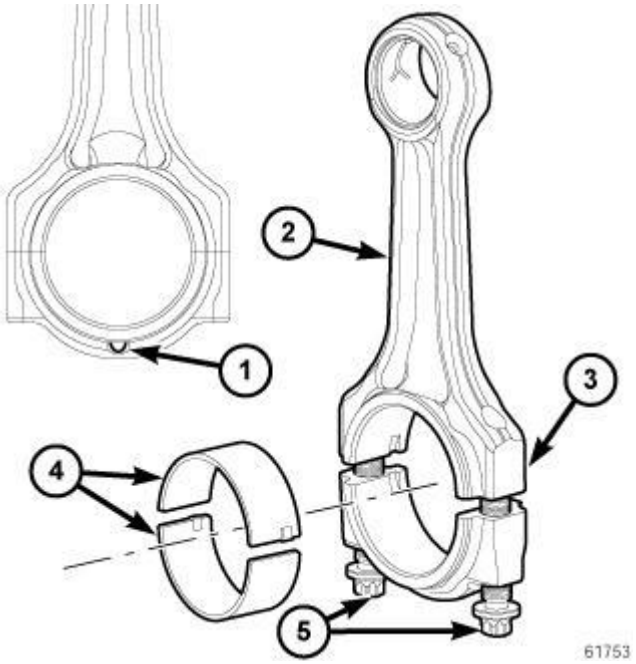

Fig. 118: Connecting Rod Identification
Courtesy of CHRYSLER LLC

1 - CONNECTING ROD PAWL
2 - CONNECTING ROD
3 - PAINTED CYLINDER IDENTIFIER
4 - CONNECTING ROD BEARINGS

CAUTION: Connecting rod bolts must be replaced when disassembled. When assembling the connecting rod (2), be sure that the connecting rod pawl (1) on each of the connecting rod caps is facing the rear (fly wheel) side of the engine.

NOTE: Do Not lubricate the new connecting rod bolts. They are already coated with a anti scuff treatment.

3. Assemble connecting rod bearings (4) and bearing caps to their respective connecting rods (2) ensuring that the serrations on the cap and reference marks are aligned.
4. Tighten the new connecting cap bolts to 10 N.m (88 in. lbs.).
5. Without loosening connecting rod bolts, tighten all bolts to 30 N.m (22 ft. lbs.).
6. Using a torque angle gauge, tighten each bolt an additional 40 degrees.
7. Using a torque wrench, recheck all rod bolt tightening to 88 N.m (65 ft. lbs).
8. Install the balance shaft module. Refer to **MODULE, Balance Shaft , Installation**.

COVER, ENGINE, FRONT

Description

DESCRIPTION

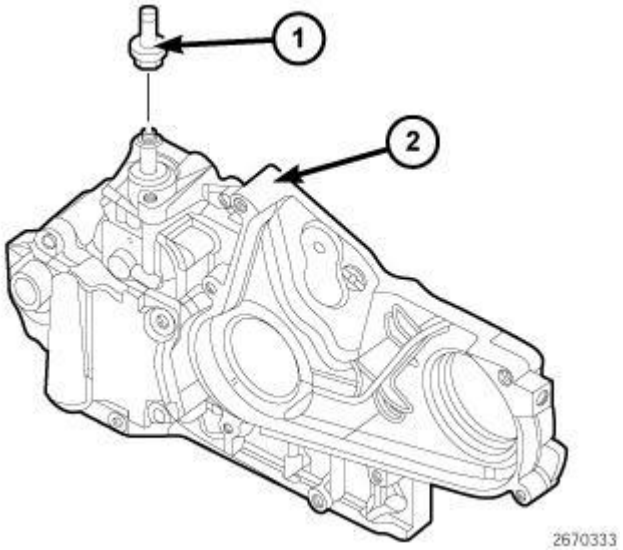

Fig. 119: Vacuum Pump Check Valve & Front Engine Cover
Courtesy of CHRYSLER LLC

The front engine cover (2) incorporates the engine oil pump and vacuum pump. Neither of these components are serviceable, but only as a whole assembly.

Removal

REMOVAL

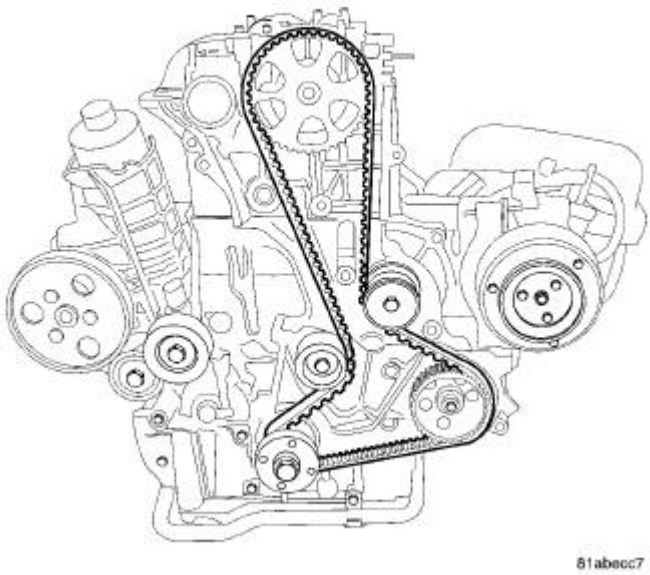

Fig. 120: Timing Belt
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Drain the cooling system. Refer to **Specifications** .
3. Remove cooling fan and fan drive viscous clutch assembly. Refer to **FAN, Cooling, Electric , Removal** .
4. Remove accessory drive belt. Refer to **BELT, Serpentine , Removal** .
5. Remove the timing belt. Refer to **SPROCKET(S), Timing Belt and Chain , Removal**.

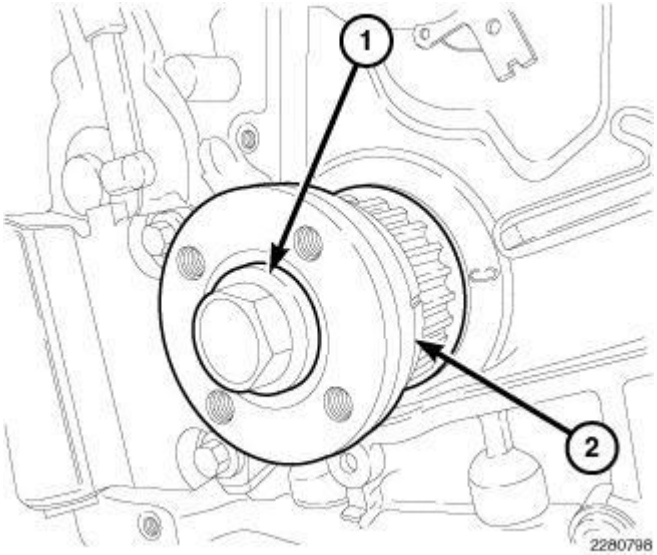

Fig. 121: Crankshaft Timing Belt Sprocket & Bolt
Courtesy of CHRYSLER LLC

NOTE: The crankshaft sprocket bolt is a left handed thread.

6. Remove bolt (1), and the crankshaft sprocket (2).

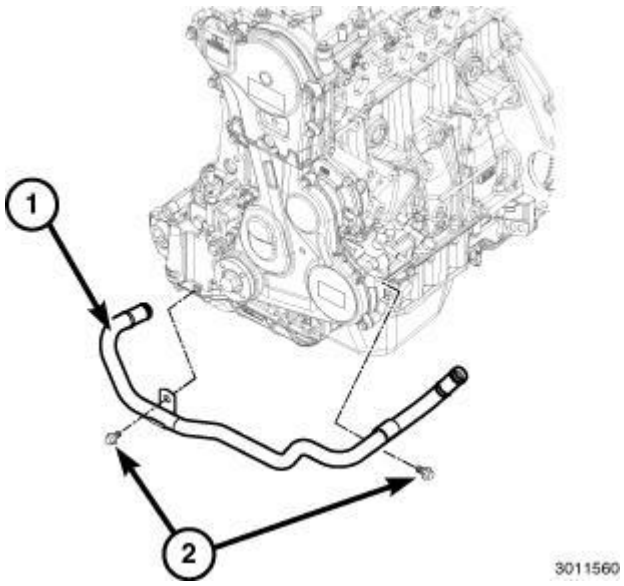

Fig. 122: Coolant Tube & Bolts
Courtesy of CHRYSLER LLC

7. Disconnect the coolant tube hose at oil cooler and by fuel injection pump.
8. Remove bolts (2) and the coolant tube (1).

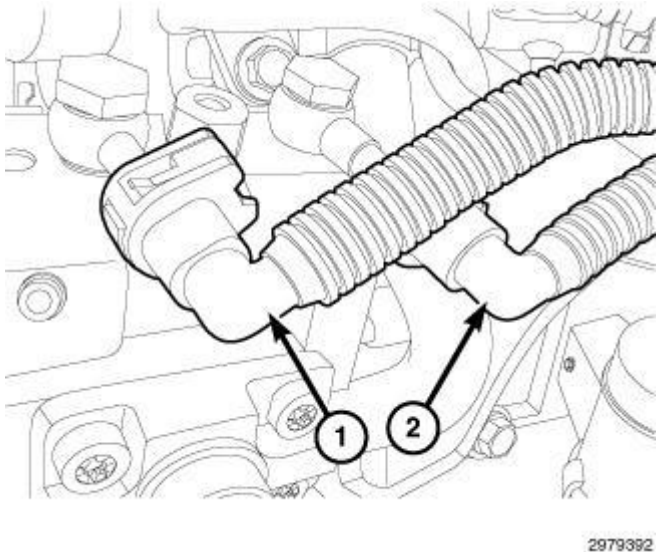

Fig. 123: Low Pressure Supply Line & Return Line
Courtesy of CHRYSLER LLC

9. Disconnect the low pressure supply (1) and return (2) lines at injection pump.

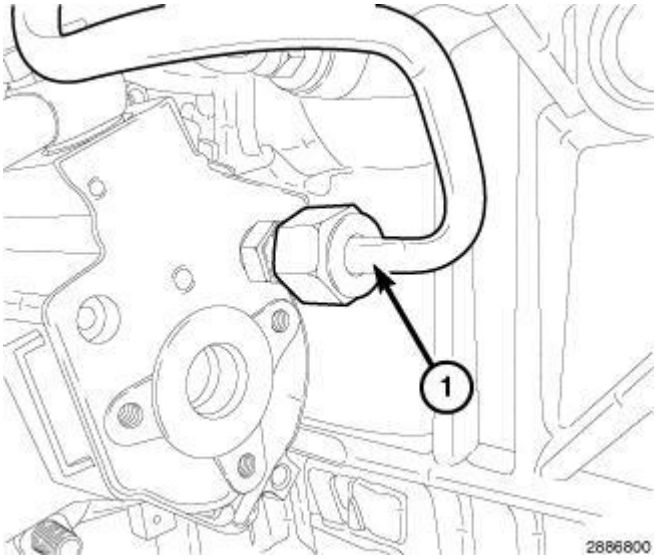

Fig. 124: High-Pressure Fuel Line
Courtesy of CHRYSLER LLC

10. Remove the fuel quantity solenoid. Refer to **SOLENOID, Fuel Quantity , Removal** .
11. Remove the high-pressure fuel tube (1) at rear of pump and fuel rail.

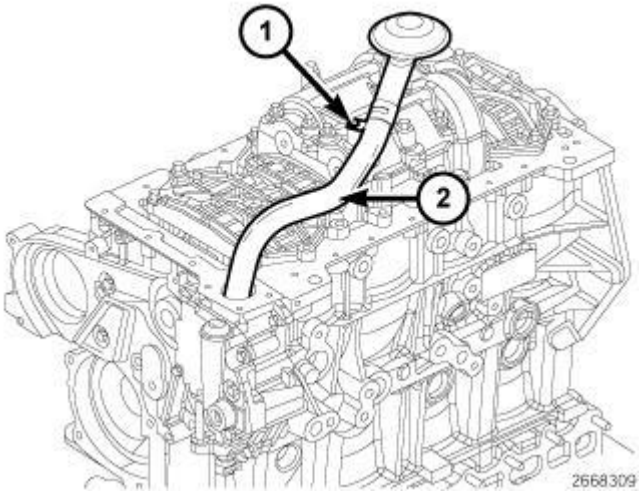

Fig. 125: Oil Pump Pickup Tube & Bolt
Courtesy of CHRYSLER LLC

12. Remove the oil pump pickup tube. Refer to **PICK-UP, Oil Pump , Removal**.

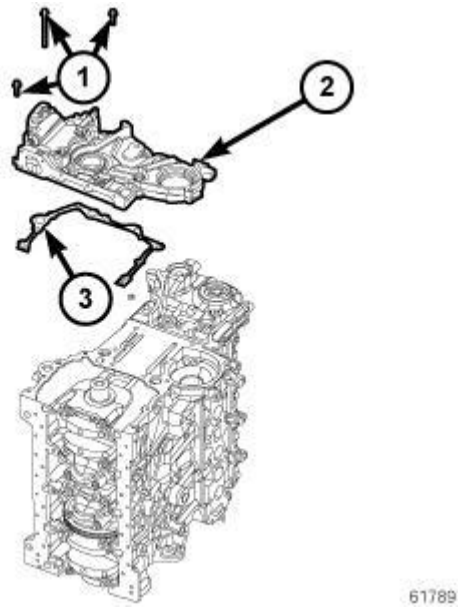

Fig. 126: Front Cover, Gasket & Bolts
Courtesy of CHRYSLER LLC

13. Disconnect the vacuum hose at vacuum pump.
14. Remove the eight bolts (1), and the front cover assembly (2).

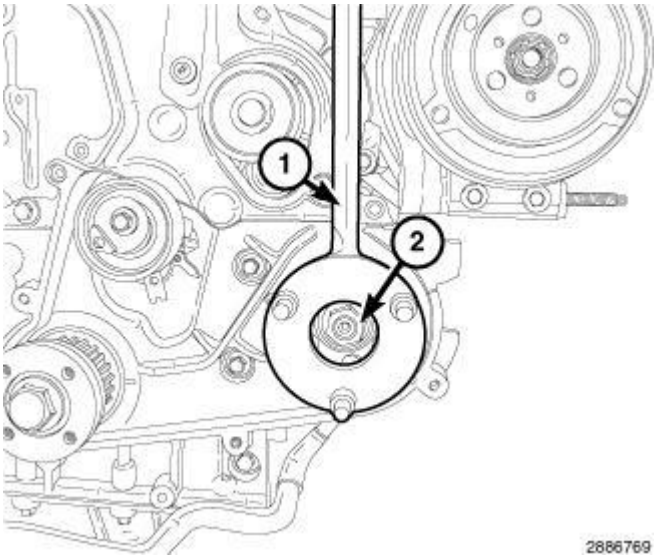

Fig. 127: Locking Tool & Injection Pump Sprocket Mounting Nut
Courtesy of CHRYSLER LLC

15. If necessary, using Locking Tool (special tool #VM.1055, Locking Tool) (1) remove the injection pump sprocket nut (2).
16. If necessary, Attach a typical 3-jaw Gear/Sprocket Puller (special tool #1023, Puller) and remove sprocket from pump.
17. If necessary, remove nuts and the injection fuel pump.

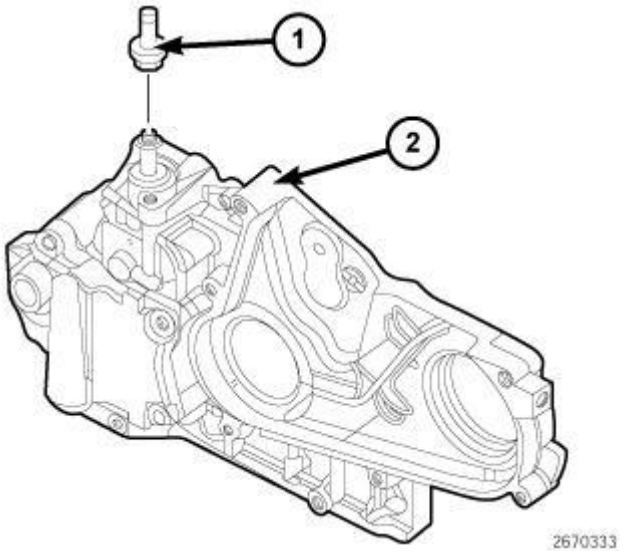

Fig. 128: Vacuum Pump Check Valve & Front Engine Cover
Courtesy of CHRYSLER LLC

18. If necessary, remove the vacuum pump check valve.

Installation

INSTALLATION

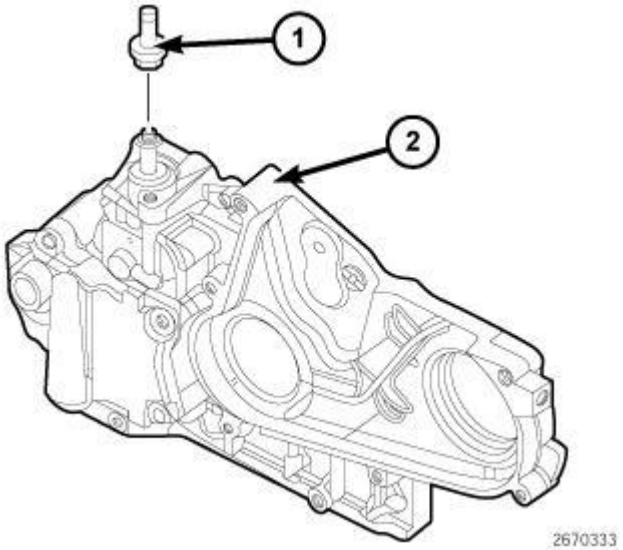

Fig. 129: Vacuum Pump Check Valve & Front Engine Cover
Courtesy of CHRYSLER LLC

1. Clean all gasket mating surfaces.
2. If necessary, install the front crankshaft oil seal.
3. If necessary, transfer the vacuum pump check valve (1) and securely tighten.

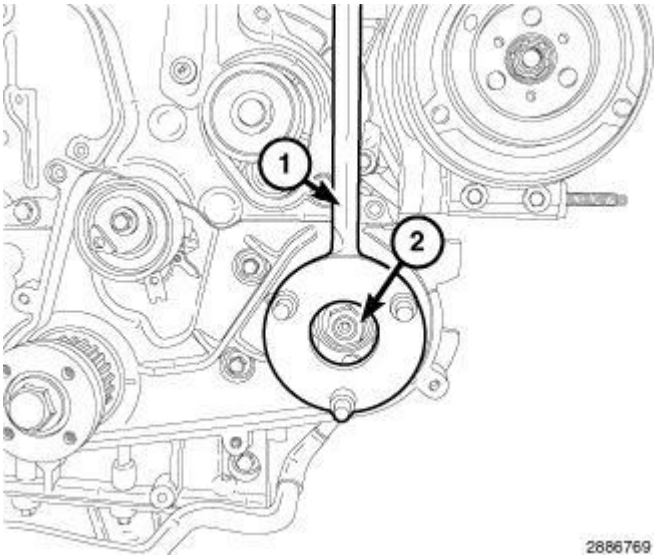

Fig. 130: Locking Tool & Injection Pump Sprocket Mounting Nut
Courtesy of CHRYSLER LLC

4. If necessary, install the high pressure fuel pump. Tighten nuts to 24 N.m (18 ft. lbs.).
5. If necessary, using Locking Tool (special tool #VM.1055, Locking Tool), install the high pressure fuel pump sprocket. Tighten nut (2) to 88 N.m (65 ft. lbs.).

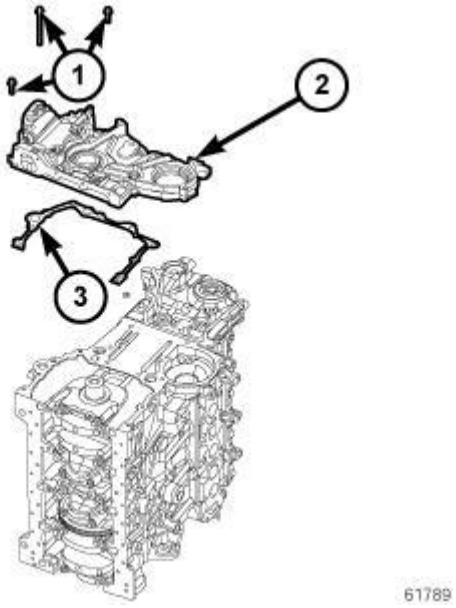

Fig. 131: Front Cover, Gasket & Bolts
Courtesy of CHRYSLER LLC

6. Install the front cover gasket (3).
7. Install the front cover assembly (2) and tighten the eight bolts (1) finger tight.

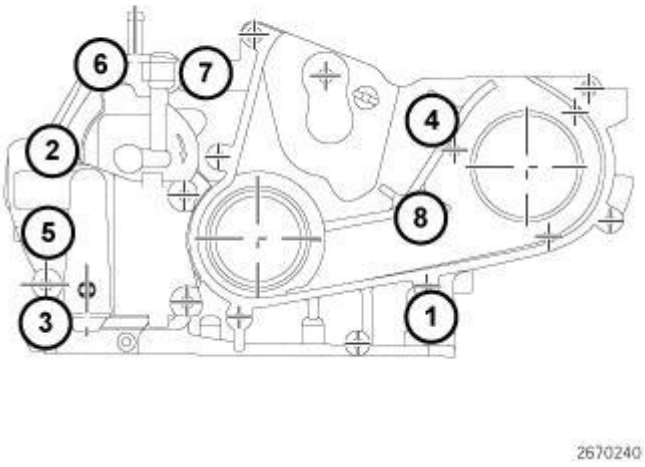

Fig. 132: Front Cover Assembly Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

8. Using the tightening sequence shown in illustration, tighten bolts to 33 N.m (24 ft. lbs.).

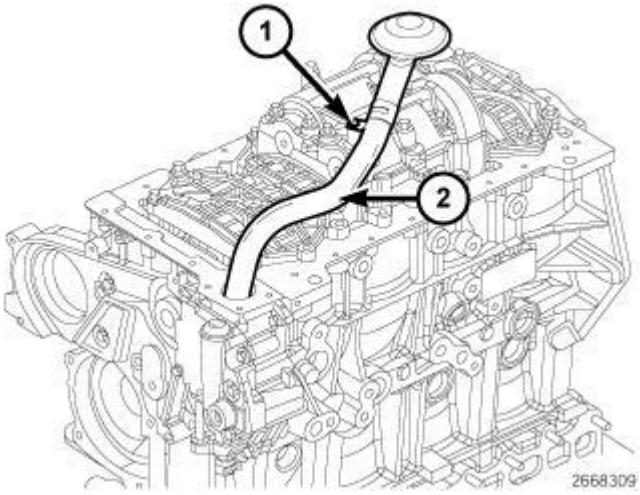

Fig. 133: Oil Pump Pickup Tube & Bolt
Courtesy of CHRYSLER LLC

9. Install the oil pump pickup tube. Refer to **PICK-UP, Oil Pump , Installation**.

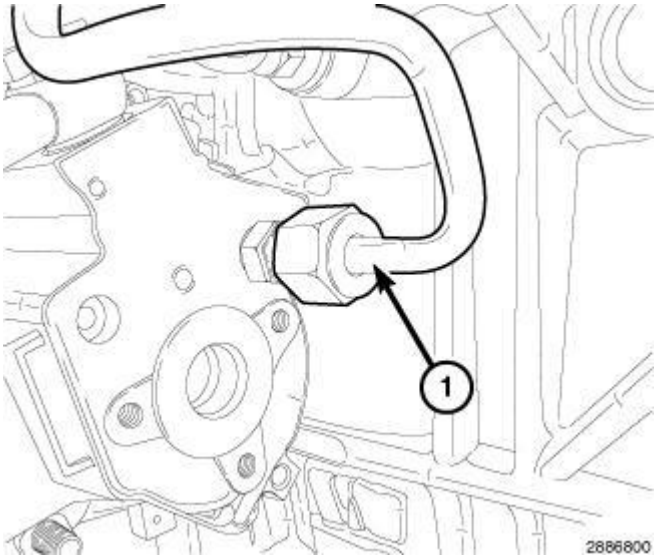

Fig. 134: High-Pressure Fuel Line
Courtesy of CHRYSLER LLC

10. Install the new high-pressure fuel tube (1) at rear of pump and fuel rail.
    - Tighten fuel tube nut at pump to 28 N.m (21 ft. lbs.).
    - Tighten fuel tube nut at fuel rail to 5 N.m (44 in. lbs) plus an additional 75 degrees turn.
11. Install the fuel quantity solenoid. Refer to **SOLENOID, Fuel Quantity , Installation** .

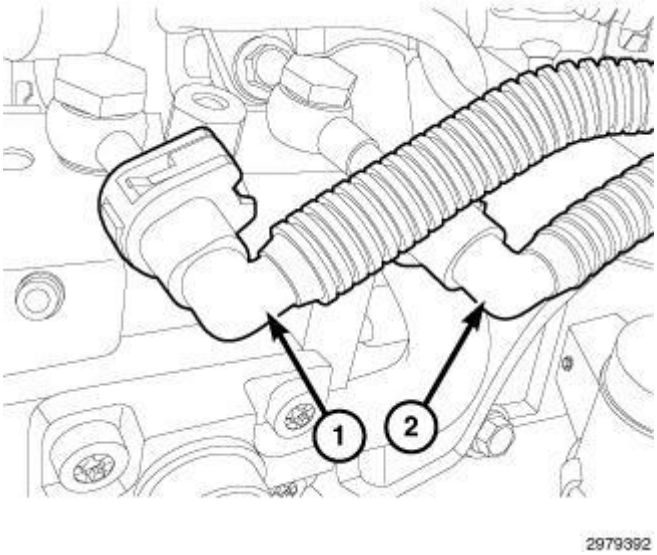

Fig. 135: Low Pressure Supply Line & Return Line
Courtesy of CHRYSLER LLC

12. Connect the low pressure supply (1) and return (2) lines at injection pump.

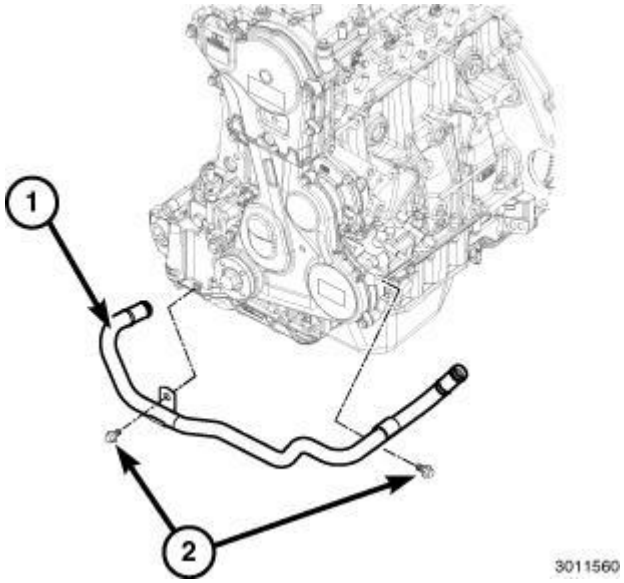

Fig. 136: Coolant Tube & Bolts
Courtesy of CHRYSLER LLC

13. Install the coolant tube (1). Tighten bolts (2) to 15 N.m (133 in. lbs.).
14. Connect the coolant tube hose at oil cooler and by fuel injection pump.

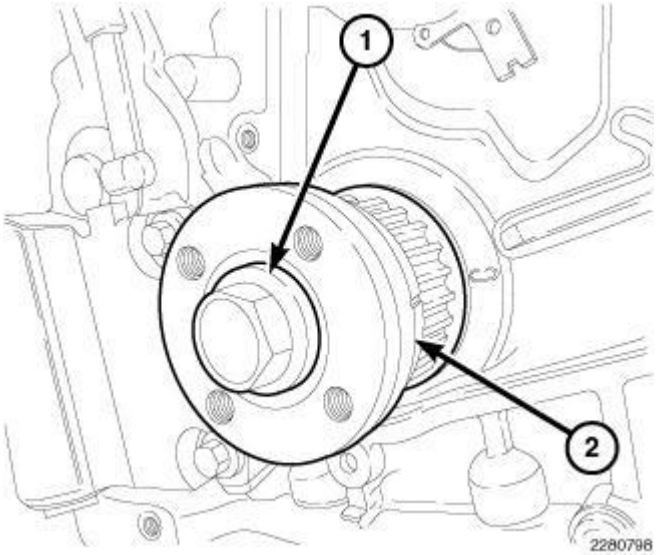

Fig. 137: Crankshaft Timing Belt Sprocket & Bolt
Courtesy of CHRYSLER LLC

NOTE: The crankshaft sprocket bolt is a left handed thread.

15. Install the crankshaft sprocket (2). Tighten bolt to 100 N.m (74 ft. lbs.) plus an additional 120 degrees turn.

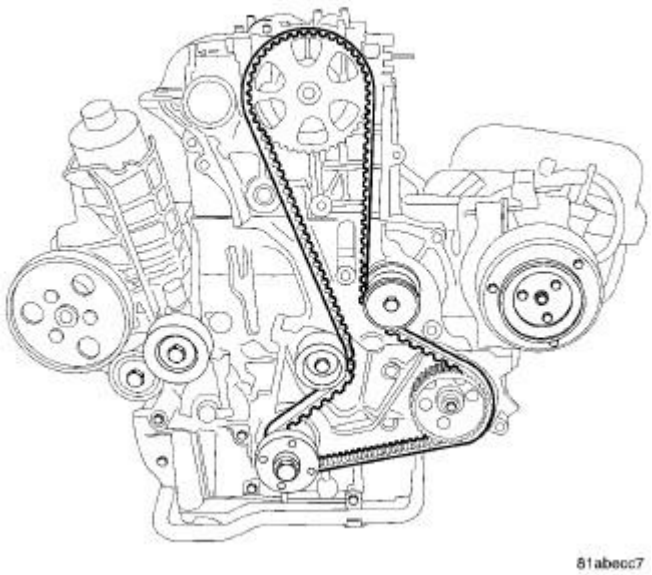

Fig. 138: Timing Belt
Courtesy of CHRYSLER LLC

16. Install the timing belt. Refer to **SPROCKET(S), Timing Belt and Chain , Removal**.
17. Install the accessory drive belt.
18. Install the cooling fan and fan drive viscous clutch assembly.
19. Fill the cooling system. Refer to **Standard Procedure** .
20. Connect the negative battery cable.

CRANKSHAFT

Description

DESCRIPTION

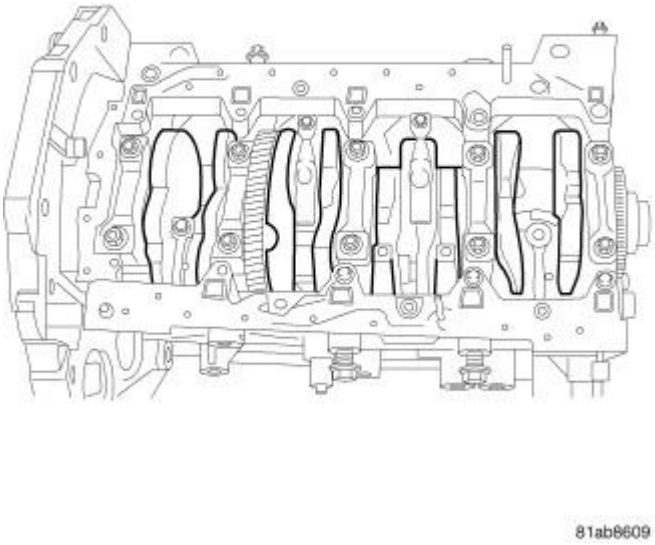

Fig. 139: Crankshaft
Courtesy of CHRYSLER LLC

The crankshaft for the 2.8L is a forged steel type design with five main bearing journals. The crankshaft is located at the bottom of the engine block.

Standard Procedure

STANDARD PROCEDURE

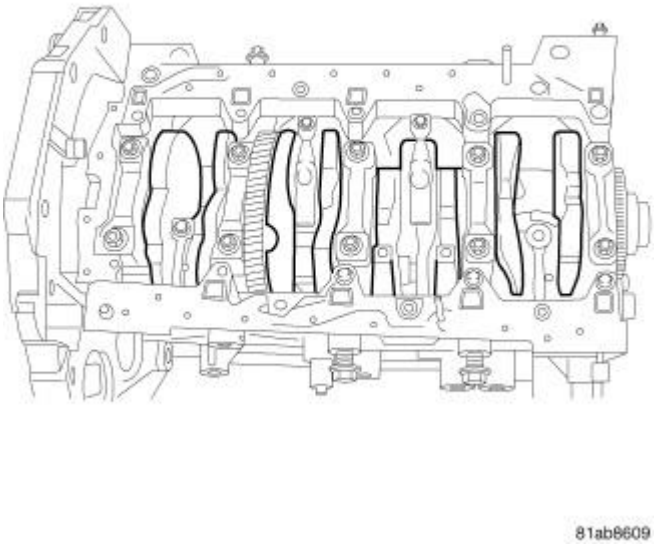

Fig. 140: Crankshaft

Courtesy of CHRYSLER LLC

1. Mount a (special tool #C-3339A, Set, Dial Indicator) to a stationary point at rear of engine. Locate the probe perpendicular against the flywheel.
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 and read dial indicator. For crankshaft end play clearances. Refer to **Engine - Specifications**.

Removal

REMOVAL

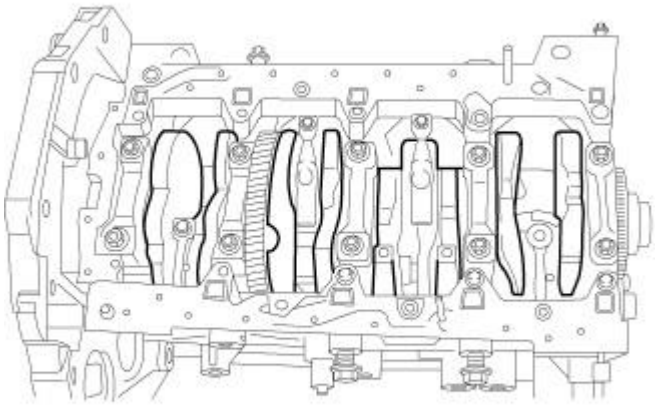

Fig. 141: Crankshaft
Courtesy of CHRYSLER LLC

1. Remove the balance shaft assembly. Refer to **MODULE, Balance Shaft , Removal**.
2. Remove the rear crankshaft oil seal carrier. Refer to **SEAL, Crankshaft Oil, Rear , Removal**.
3. Remove the front cover and front crank oil seal. Refer to **COVER, Engine, Front , Removal**.
4. Remove the bearing caps from the piston rods.
5. Remove the bearing caps from the crankshaft journals.
6. Remove the crankshaft.

Installation

INSTALLATION

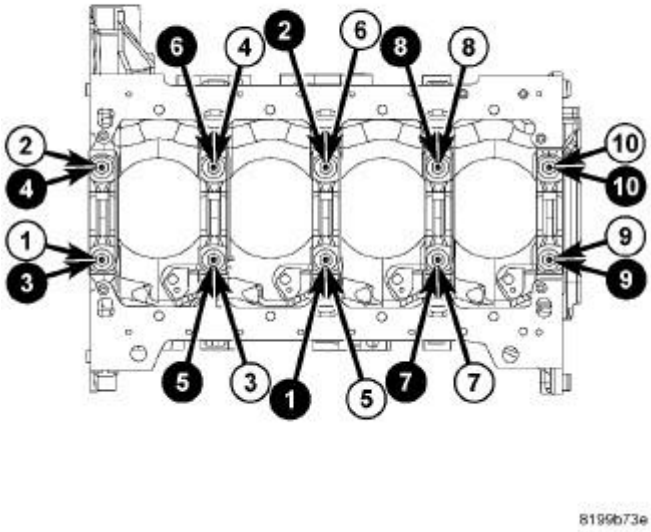

Fig. 142: Crankshaft Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

1. Use the crankshaft bearing selection chart for main bearing selection. Refer to **BEARING SELECTION CHARTS**.
2. Lubricate and install the crankshaft bearings. Make sure the thrust washer is not touching the engine block.
3. Install the crankshaft.

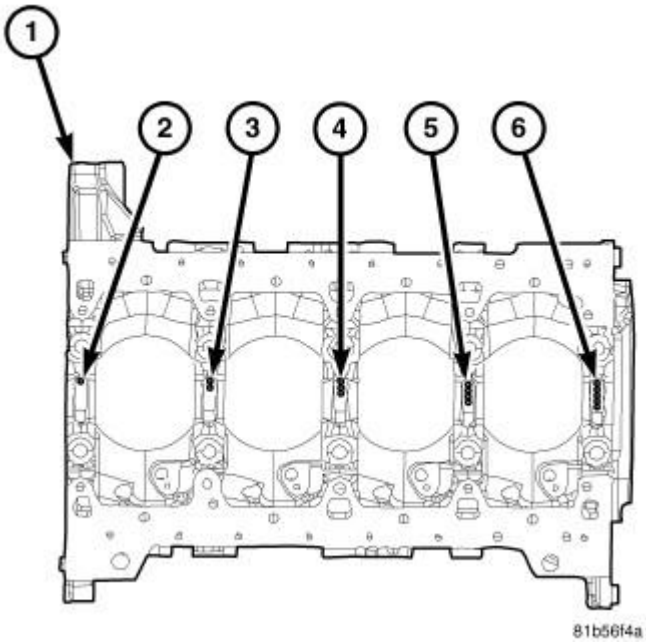

Fig. 143: Crankshaft Cap Location Marks
Courtesy of CHRYSLER LLC

4. Using new bolts, install the main bearing caps in the same location as they were removed. The notches on the top of the bearing caps indicate their proper position. The front cap has one notch, the next cap two, etc.
5. Using the black number bubbles in the torque pattern, tighten the crankshaft bolts to 50 N.m (36 ft. lbs.).
6. Using the white number bubbles in the torque pattern, Turn the bolts an additional 90°.
7. Measure the crankshaft end play. Crankshaft end play must be between 0.1 mm and 0.33 mm (0.004 in - 0.13 in).
8. Install the connecting rod bearings.
9. Install the connecting rods. Refer to **ROD, Piston and Connecting , Installation**.
10. Install the balance shaft assembly. Refer to **MODULE, Balance Shaft , Installation**.
11. Install the front main seal carrier. Refer to **SEAL, Crankshaft Oil, Front , Installation**.
12. Install the rear main seal carrier. Refer to **SEAL, Crankshaft Oil, Rear , Installation**.

DAMPER, VIBRATION

Removal

REMOVAL

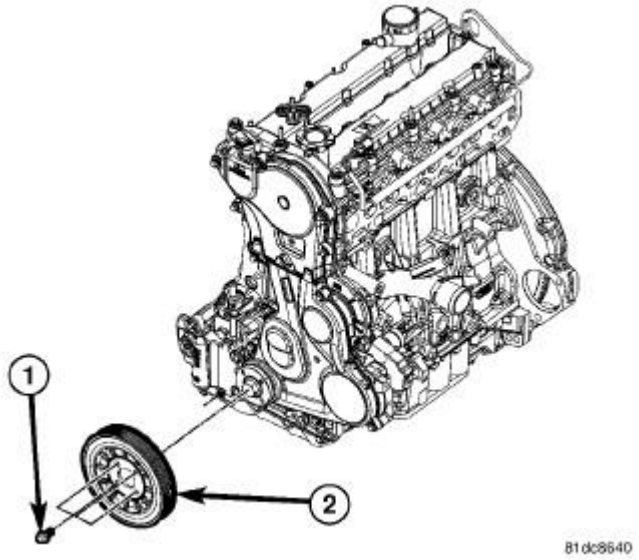

Fig. 144: Crankshaft Damper & Bolts
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Raise and support the vehicle.
3. Drain the engine coolant system.

4. Remove the air filter housing. Refer to **BODY, Air Cleaner , Removal**.
5. Remove the windshield washer reservoir.
6. Remove the viscous and electric cooling fans and shroud. Refer to **FAN, Cooling, Electric , Removal** .
7. Remove the accessory drive belt. Refer to **BELT, Serpentine , Removal** .
8. Remove the bolts (1) and the vibration damper (2).

Installation

INSTALLATION

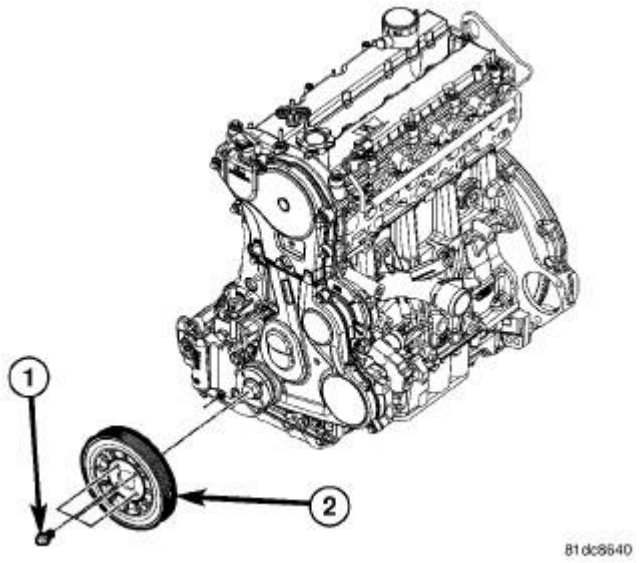

Fig. 145: Crankshaft Damper & Bolts
Courtesy of CHRYSLER LLC

1. Install the vibration damper (2).
2. Install the vibration damper bolts (1). Tighten to 32 N.m. (24 ft. lbs.).
3. Install accessory drive belt. Refer to **BELT, Serpentine , Installation** .
4. Install the electric and viscous cooling fans and shroud. Refer to **FAN, Cooling, Electric , Installation** .
5. Install the windshield washer reservoir.
6. Install the air filter housing. Refer to **BODY, Air Cleaner , Installation**.
7. Lower the vehicle.
8. Refill the engine coolant system.
9. Reconnect the negative battery cable.

FLEXPLATE

Removal

REMOVAL

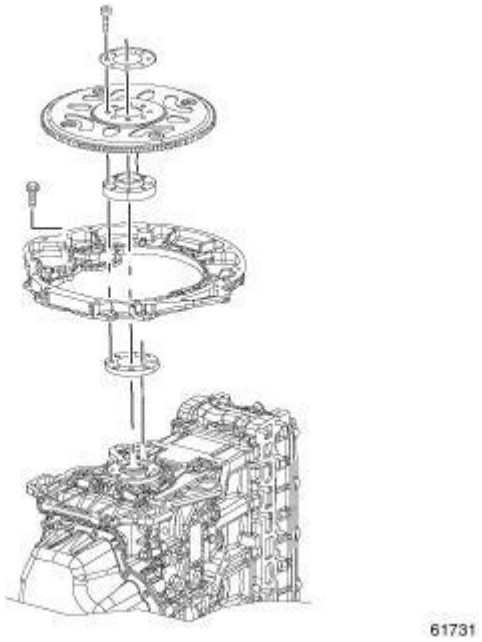

Fig. 146: Flywheel/Flex Plate Assembly
Courtesy of CHRYSLER LLC

1. Remove the transmission.
2. Paint mark the flex plate hub to flex plate relation.
3. Remove the 40 mm flex plate bolts (1) and flex plate (2).

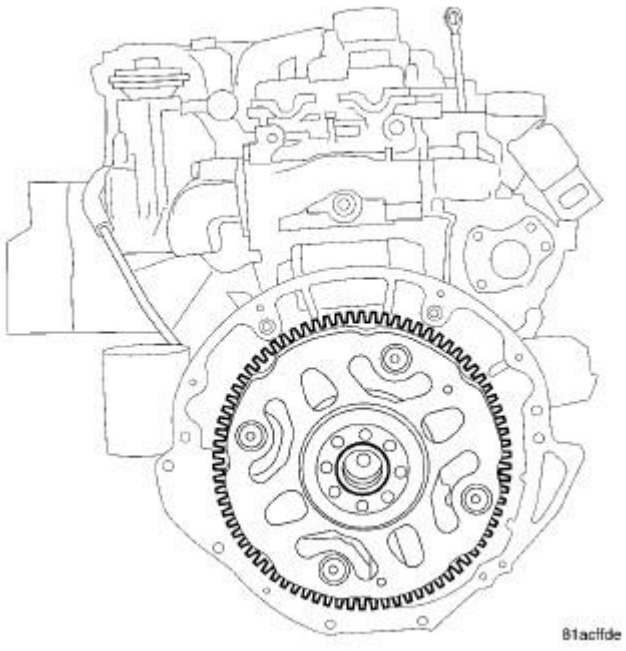

Fig. 147: Flex Plate
Courtesy of CHRYSLER LLC

4. Inspect flex plate (2) for damage.

Installation

INSTALLATION

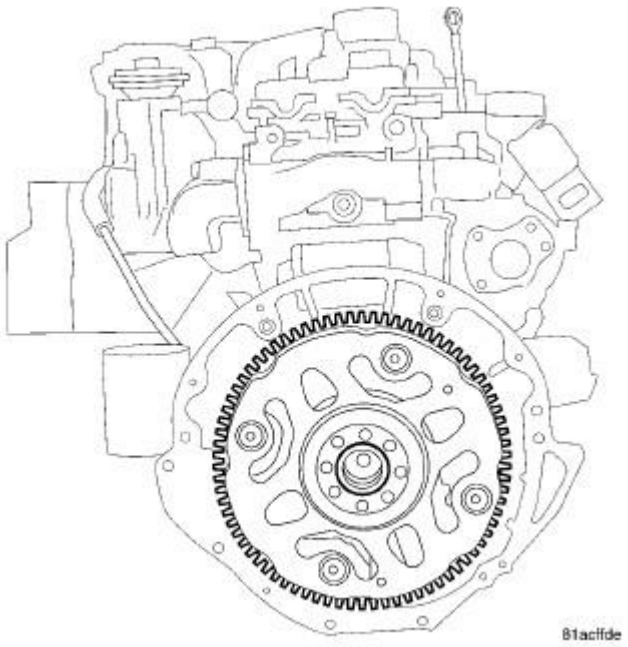

Fig. 148: Flex Plate
Courtesy of CHRYSLER LLC

NOTE: Always use new flex plate or flywheel bolts.

1. Install the flex plate/flywheel hub and hand tighten the fasteners.

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.

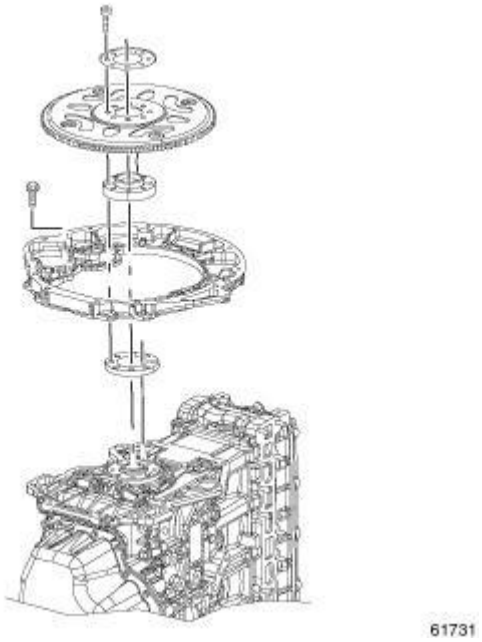

Fig. 149: Flywheel/Flex Plate Assembly
Courtesy of CHRYSLER LLC

2. Install the flex plate or flywheel bolts. Use a cross pattern to torque the bolts to 50 N.m (37 ft. lbs.).
3. Using a torque wrench fitted with a Torque Angle Gauge, (Goniometer), loosen one flex plate/flywheel bolt at a time and tighten to 25 N.m (19 ft. lbs.) plus angle in relation to bolt length.

Bolt Length	Torque Angle
40 mm	60°
50 mm	75°
60 mm	90°

4. Install the transmission.

MODULE, BALANCE SHAFT

Description

DESCRIPTION

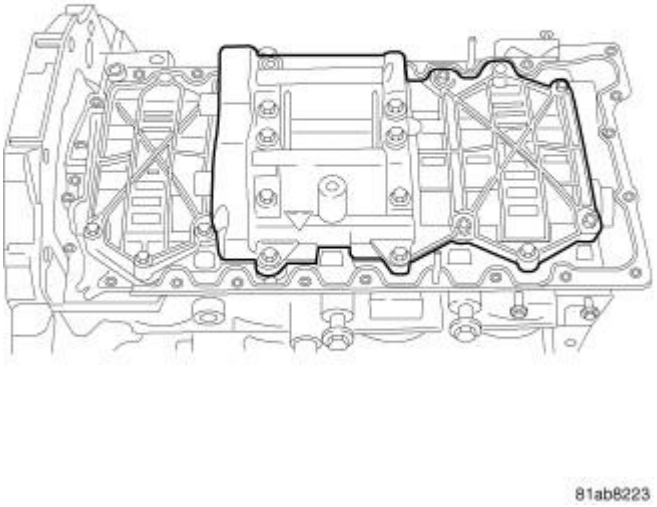

Fig. 150: Balance Shaft Module
Courtesy of CHRYSLER LLC

The balance shaft is gear-driven and is used to counteract engine vibration and roughness. The balance shaft assembly includes balancers on two shafts. It is only serviced as an assembly. Balance shafts must be timed to the crankshaft.

Removal

REMOVAL

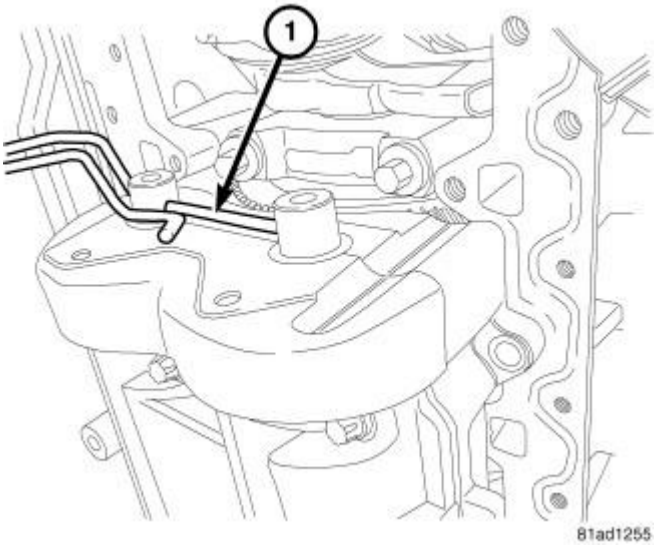

Fig. 151: Balance Shaft Timing Tool
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Lock the engine 90 degrees ATDC. Refer to **LOCKING ENGINE 90 DEGREES AFTER TDC**.
3. Remove the oil pickup tube. Refer to **PICK-UP, Oil Pump , Removal**.
4. Place a dowel rod through the holes in the balance shaft axles to keep the balance shafts in the correct position for reassembly.

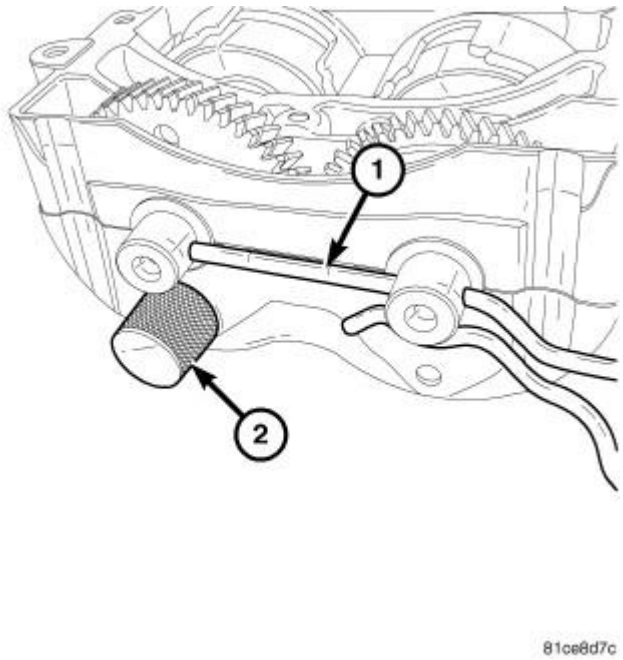

Fig. 152: Balance Shaft Tool Installed
Courtesy of CHRYSLER LLC

WARNING: The balance shaft pin must be installed before the balance shaft assembly is remove from the engine. The balance shaft pin must always remain in the balance shaft assembly while the assembly is removed from the engine. Do not remove the balance shaft pin until the balance shaft assembly is completely installed on the engine.

5. Insert the Balance Shaft Locking Pin (special tool #VM.10012, Balance Shaft Split Gear Align) (2) into the balance shaft assembly to lock the split gears together.

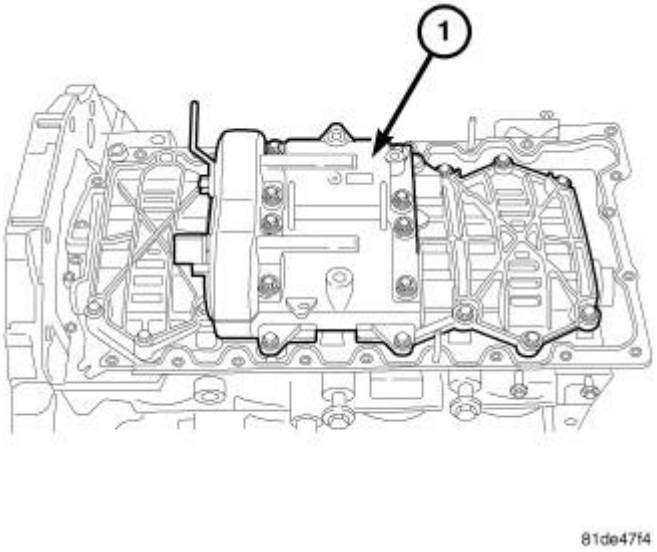

Fig. 153: Balance Shaft Housing
Courtesy of CHRYSLER LLC

6. Remove the balance shaft housing (1).

Installation

INSTALLATION

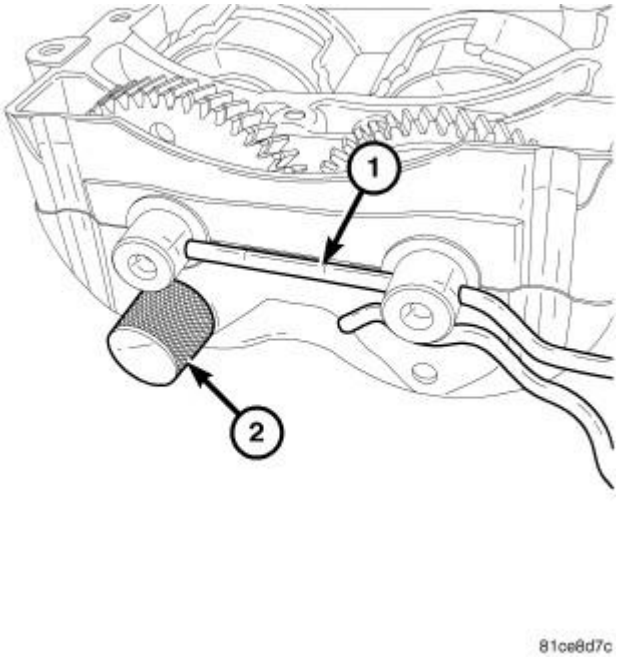

Fig. 154: Balance Shaft Tool Installed
Courtesy of CHRYSLER LLC

1. The balance shafts must remain aligned by the alignment dowel rod (1) and the Balance Shaft Locking Pin (special tool #VM.10012, Balance Shaft Split Gear Align) (2) must remain in the balance shaft

assembly until the assembly is completely installed to the engine.

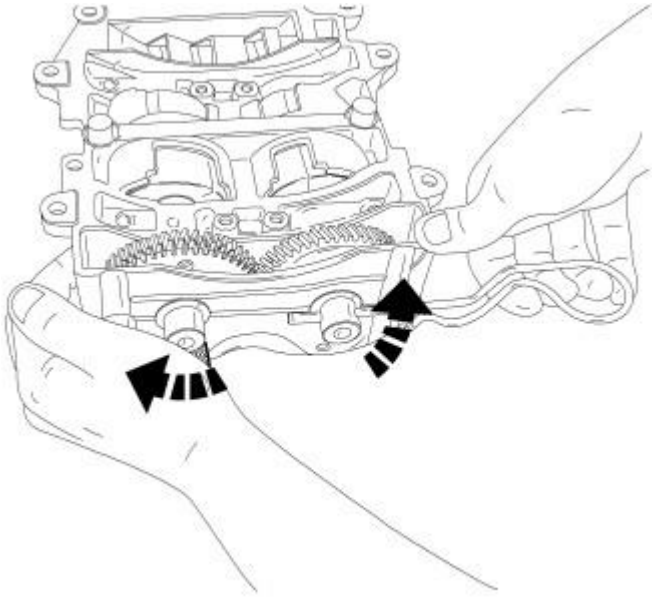

Fig. 155: Balance Shaft Tool Installation
Courtesy of CHRYSLER LLC

2. The balance shaft pin should never be removed from the balance shaft assembly when the balance shaft assembly is not installed in the engine. If the balance shaft was removed from the vehicle without the pin, or the pin was removed, use the dowel to load the spring while pressing the tool into place as shown in illustration.

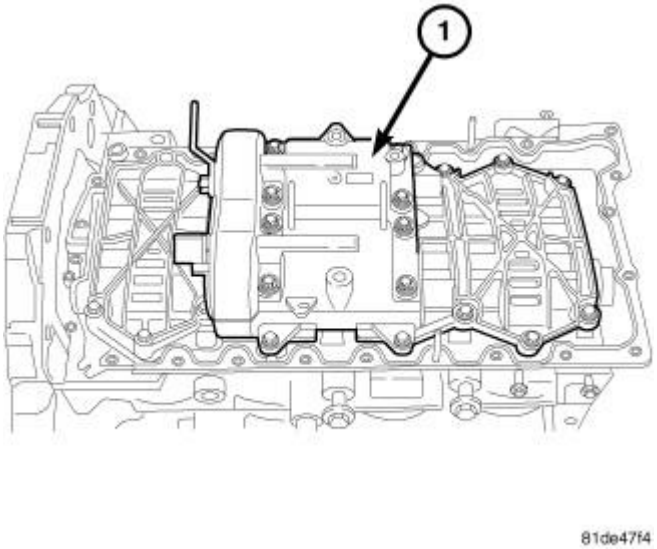

Fig. 156: Balance Shaft Housing
Courtesy of CHRYSLER LLC

3. Install the balance shaft housing (1).

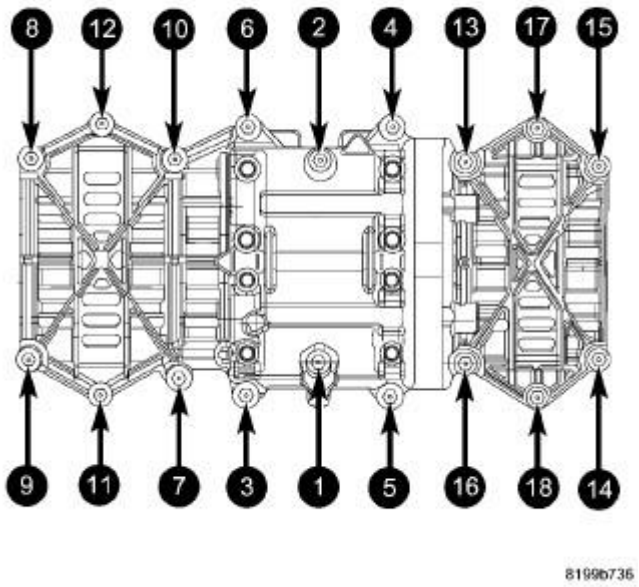

Fig. 157: Balance Shaft Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

4. Using the sequence shown in illustration, tighten the balance shaft bolts to 33 N.m (24 ft. lbs.).

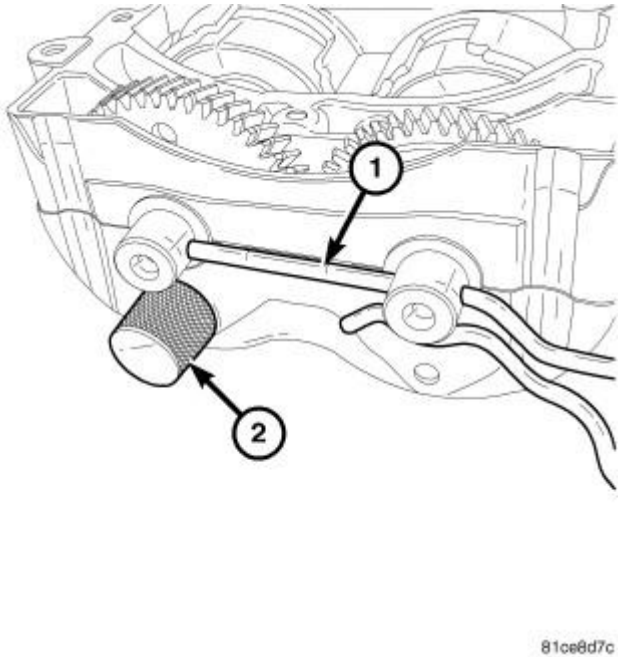

Fig. 158: Balance Shaft Tool Installed
Courtesy of CHRYSLER LLC

5. Remove Balance Shaft Locking Pin (special tool #VM.10012, Balance Shaft Split Gear Align) (2).

6. Remove the balance shaft assembly dowel rod (1).

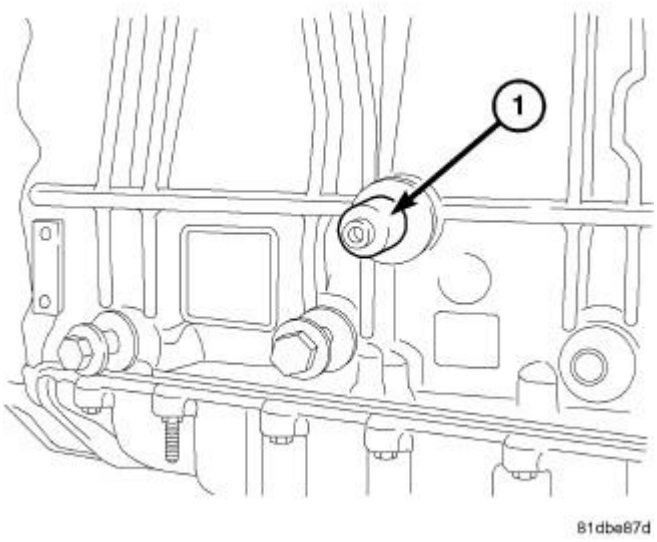

Fig. 159: Crankshaft Locking Tool
Courtesy of CHRYSLER LLC

7. Remove the Crankshaft Locking Tool (special tool #VM.9992, Adapter, 90 Degree ATDC) (1).

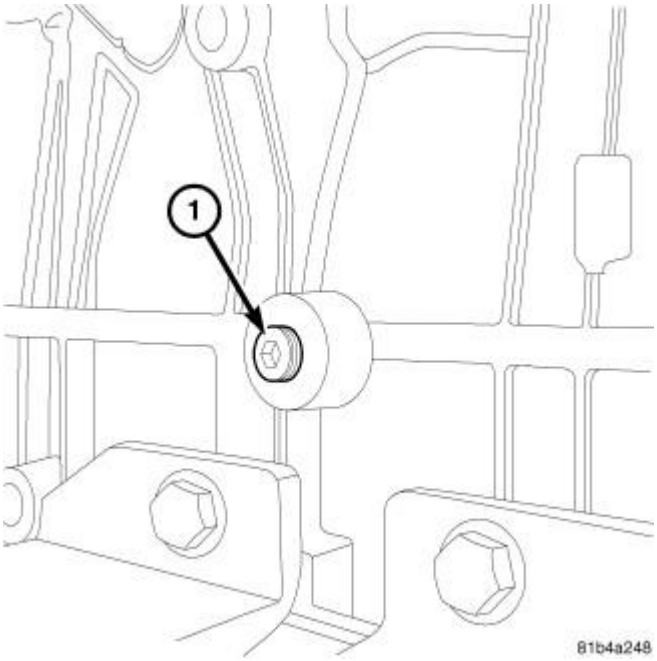

Fig. 160: Engine Block Plug
Courtesy of CHRYSLER LLC

8. Install the engine block plug (1). Tighten the engine block plug to 30 N.m (22 ft. lbs.).
9. Install the upper and lower timing cover. Refer to **COVER(S), Engine Timing , Removal**.
10. Install the oil pickup tube. Refer to **PICK-UP, Oil Pump , Installation**.

11. Fill the engine oil.
12. Connect the negative battery cable.

PLATE, TRANSMISSION ADAPTER

Description

DESCRIPTION

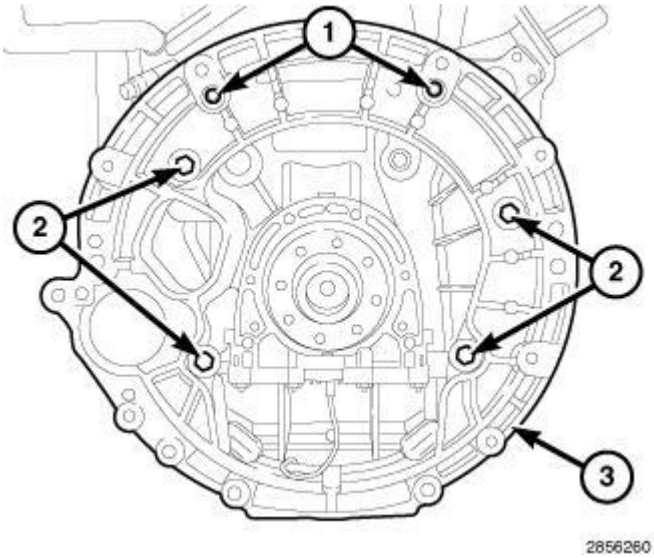

Fig. 161: Transmission Adapter Plate & Bolts
Courtesy of CHRYSLER LLC

The transmission plate adapter (3) is the component that allows the transmission to be bolted to the engine.

Removal

REMOVAL

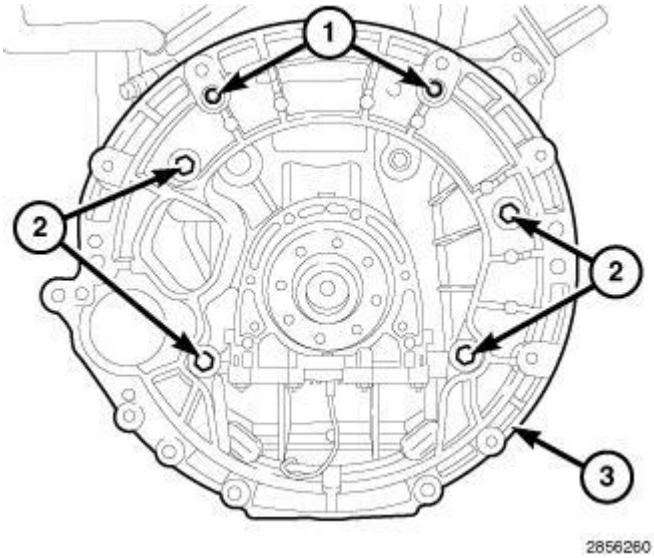

Fig. 162: Transmission Adapter Plate & Bolts
Courtesy of CHRYSLER LLC

1. Remove the flex plate. Refer to **FLEXPLATE , Removal**.
2. On manual transmission models, remove the flywheel. Refer to **FLYWHEEL , Removal** .

NOTE: Do not use any magnetic tools near the crankshaft sensor tone ring.

3. Remove bolts (1 and 2) and the transmission adapter plate (3).

Installation

INSTALLATION

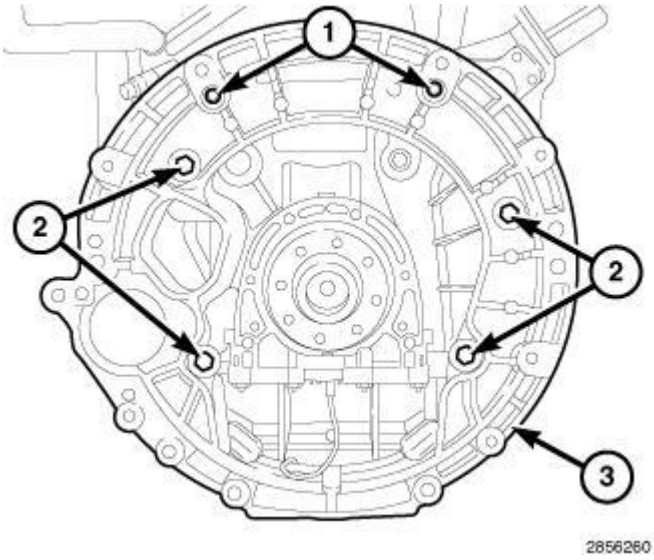

Fig. 163: Transmission Adapter Plate & Bolts
Courtesy of CHRYSLER LLC

NOTE: Do not use any magnetic tools near the crankshaft tone ring.

1. Install the transmission adapter plate (3). Tighten bolts (1 and 2) finger tight.
   - Tighten bolts (2) to 69 N.m (51 ft. lbs.).
   - Tighten bolts (1) to 79 N.m (58 ft. lbs.).
2. On manual transmission models, install the flywheel. Refer to **FLYWHEEL , Installation** .
3. Install the flex plate. Refer to **FLEXPLATE , Installation**.

PUMP, INTERNAL VACUUM

Description

DESCRIPTION

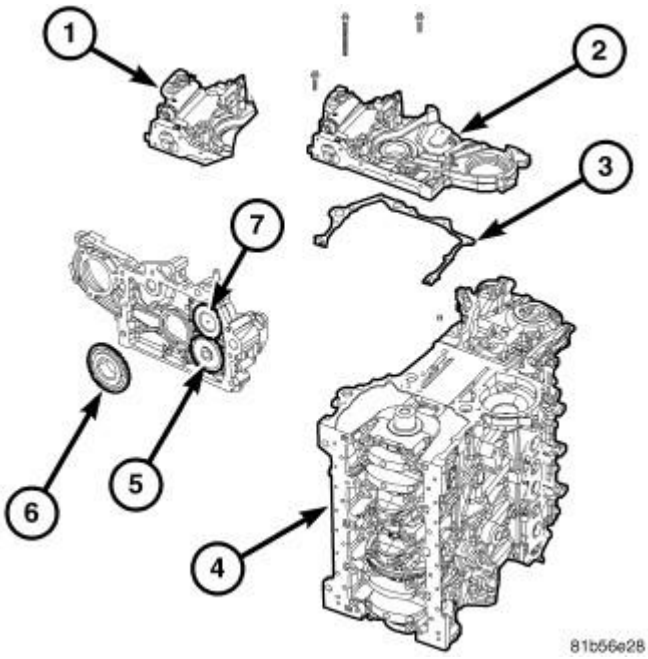

Fig. 164: Vacuum Pump And Oil Pump Assembly
Courtesy of CHRYSLER LLC

The diesel engine uses a internal vacuum pump (7). This vacuum pump (7) is mounted in the engine front cover (2). The vacuum pump is driven by a sprocket (6) on the crankshaft.

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. Refer to **PUMP, Internal Vacuum , Removal**.

Removal

REMOVAL

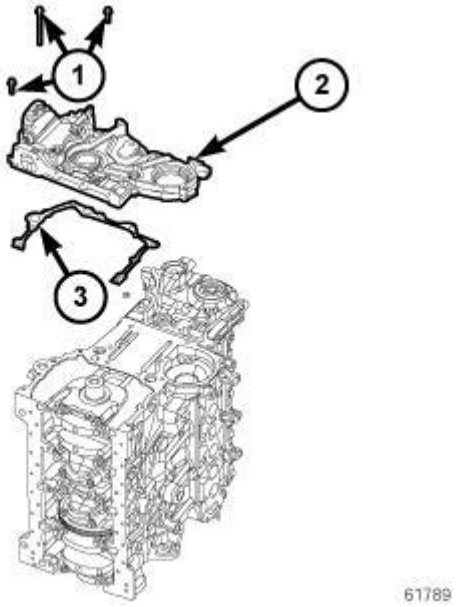

Fig. 165: Front Cover, Gasket & Bolts
Courtesy of CHRYSLER LLC

NOTE: The vacuum pump is not a serviceable item as it is part of the front cover. If diagnosis has directed you to replace the vacuum pump, then the front cover needs to be replaced.

1. Remove the front cover. Refer to **COVER, Engine, Front , Removal**.

Installation

INSTALLATION

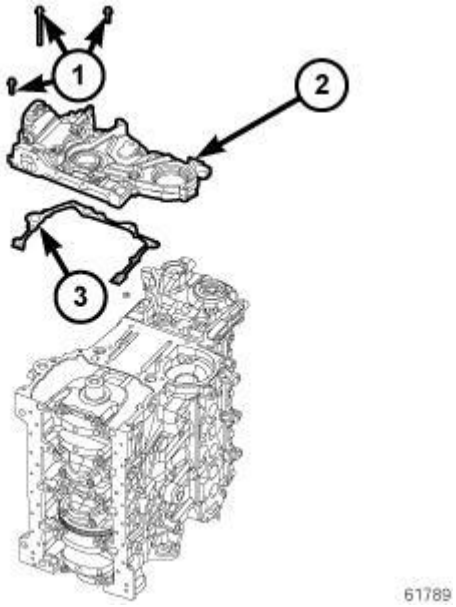

Fig. 166: Front Cover, Gasket & Bolts
Courtesy of CHRYSLER LLC

1. Install the front cover. Refer to **COVER, Engine, Front , Installation**.

ROD, PISTON AND CONNECTING

Description

DESCRIPTION

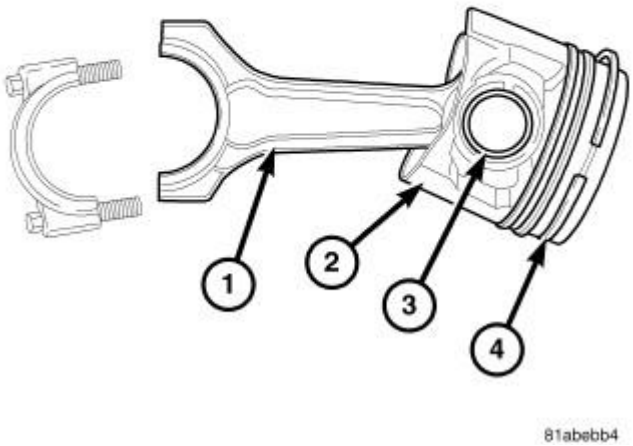

Fig. 167: Piston & Connecting Rod Assembly

Courtesy of CHRYSLER LLC

The pistons (2) are of a free floating design. Oil jets in the engine block lubricate and cool the piston and piston pin (3) assembly. The connecting rods (1) have a pressed in place wrist pin bushing which is lubricated by the oil jets. Connecting rod (7) and bearing caps have cracked mating surfaces and are not interchangeable.

Standard Procedure

STANDARD PROCEDURE - OVERSIZED CYLINDER BORE DIMENSIONS

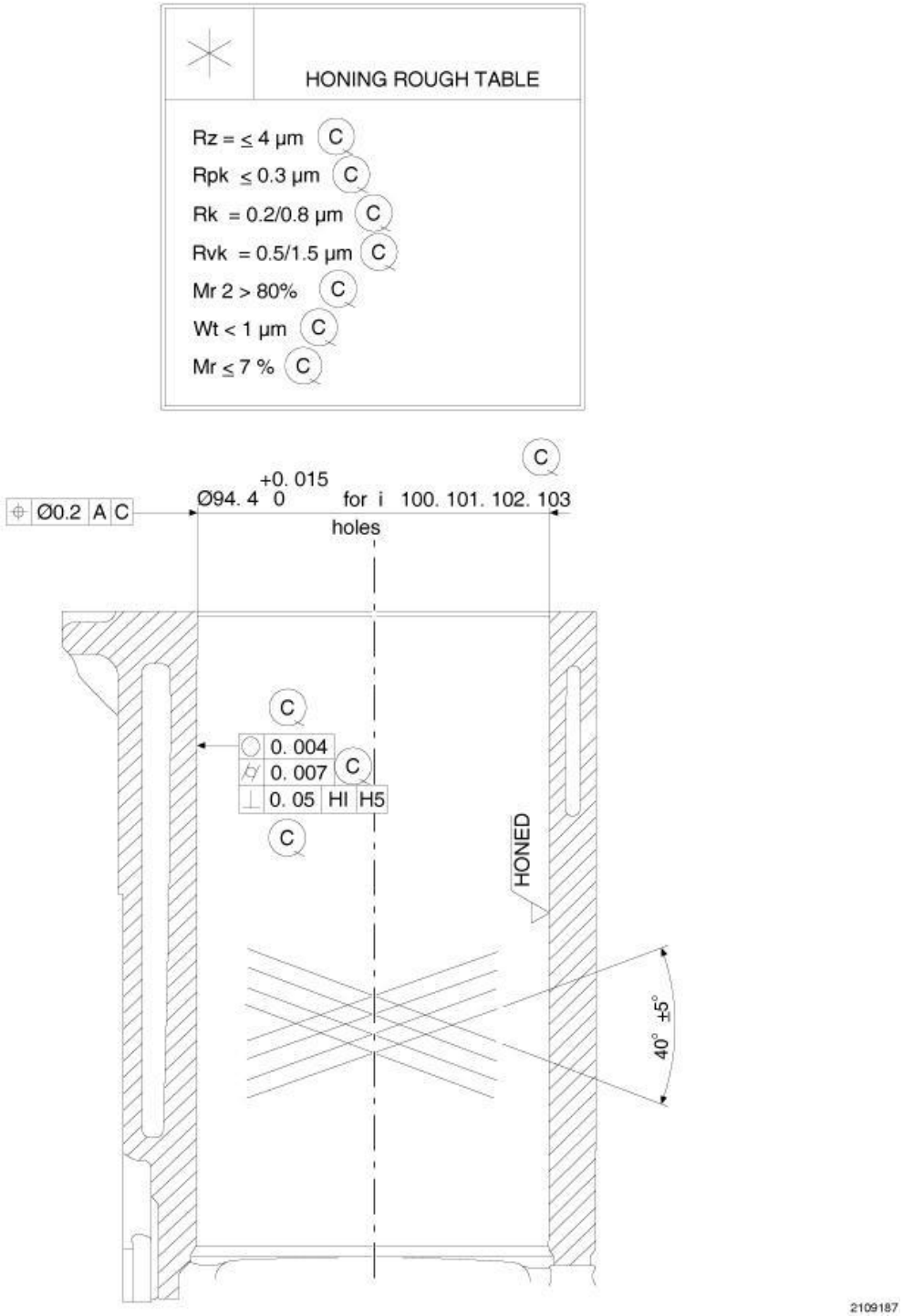

Fig. 168: Honing Rough Table
Courtesy of CHRYSLER LLC

Removal

REMOVAL

NOTE: Both the connecting rod and the connecting rod cap are paint marked to aid during assembly. Paint marks disappear after time. If the rod and the cap are not marked with paint, paint mark or scribe them before disassembly.

1. Disconnect negative battery cable.
2. Remove cylinder head. Refer to **Cylinder Head , Removal**.
3. Raise vehicle on hoist.
4. Remove balance shaft assembly. Refer to **MODULE, Balance Shaft , Removal**.
5. Remove the oil jets. Refer to **JET, Piston Oil Cooler , Removal**.
6. Remove top ridge of cylinder bores with a ridge reamer before removing pistons from cylinder block. **Be sure to keep top of pistons covered during this operation.**
7. Piston and connecting rods must be removed from top of cylinder block. Rotate crankshaft so that each connecting rod is centered in cylinder bore.

NOTE: Be careful not to nick or scratch crankshaft journals

8. After removal, install bearing cap on the mating rod and mark pistons with matching cylinder number when removed from engine block.

PISTON PIN - REMOVAL

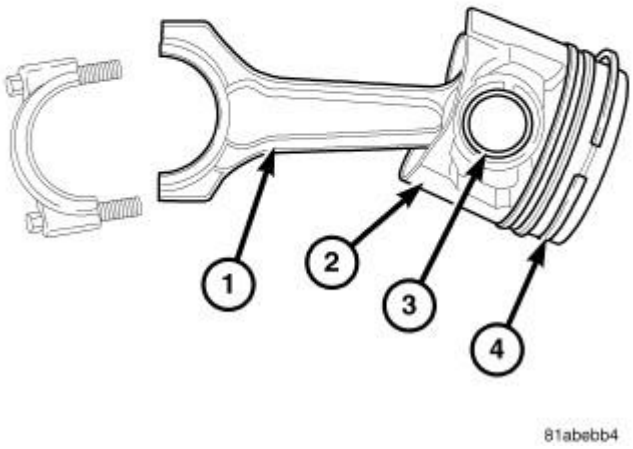

Fig. 169: Piston & Connecting Rod Assembly
Courtesy of CHRYSLER LLC

1. Secure connecting rods (1) in a soft jawed vice.
2. Remove 2 snap rings securing piston pin (3).
3. Push piston pin (3) out of piston (2) and connecting rod (1).

PISTON RING - REMOVAL

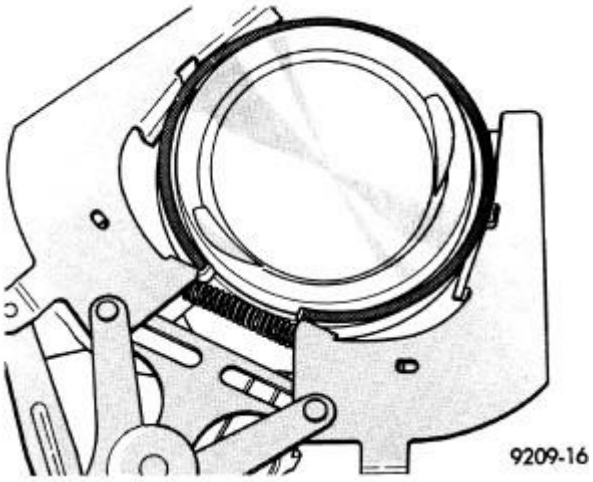

Fig. 170: Removing/Installing Piston Rings
Courtesy of CHRYSLER LLC

1. ID mark on face of top and second piston rings must point toward piston crown.
2. Using a suitable ring expander, remove top and second piston rings.
3. Remove upper oil ring side rail, lower oil ring side rail and then the oil expander from piston.
4. Carefully clean carbon from piston crowns, skirts and ring grooves ensuring the 4 oil holes in the oil control ring groove are clear.

Inspection

INSPECTION

PISTONS

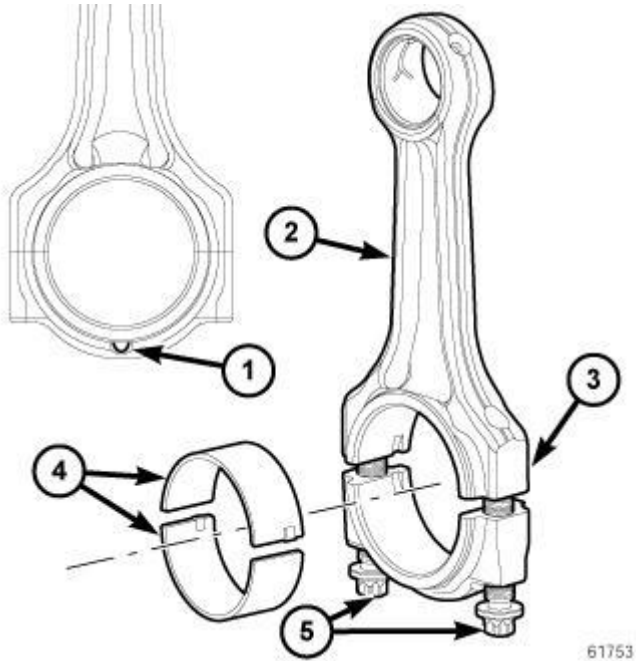

Fig. 171: Connecting Rod Identification
Courtesy of CHRYSLER LLC

1 - CONNECTING ROD PAWL
2 - CONNECTING ROD
3 - PAINTED CYLINDER IDENTIFIER
4 - CONNECTING ROD BEARINGS

1. Piston Diameter: Size: 91.912 - 91.928 mm (3.6185 - 3.6192 in.) Maximum wear limit.05 mm (.0019 in.).
2. Check piston pin bores in piston for roundness. Make 3 checks at 120° intervals. Maximum out of roundness.05 mm (.0019 in.).
3. The piston diameter should be measured approximately 15 mm (.590 in.) up from the base.
4. Skirt wear should not exceed 0.1 mm (.00039 in.).
5. The clearance between the cylinder liner and piston should not exceed 0.065-0.083 mm (.0025-.0032 in.).

CONNECTING RODS

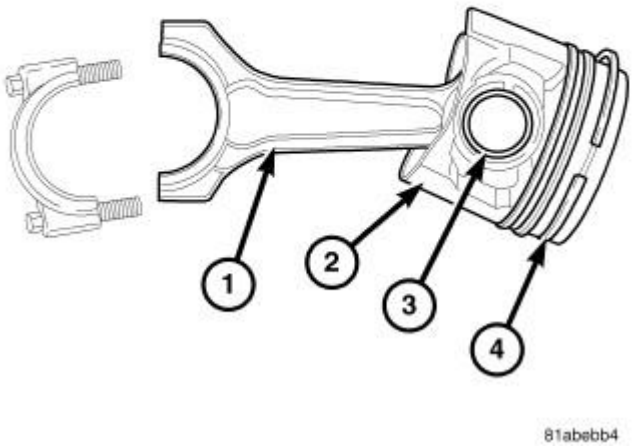

Fig. 172: Piston & Connecting Rod Assembly
Courtesy of CHRYSLER LLC

CAUTION: Connecting rod bolts must be replaced when disassembled. When assembling the connecting rod (2), be sure that the connecting rod pawl (1) on each of the connecting rod caps is facing the rear (fly wheel) side of the engine.

NOTE: Do Not lubricate the new connecting rod bolts. They are already coated with a anti scuff treatment.

1. Assemble connecting rod bearings (4) and bearing caps to their respective connecting rods (2) ensuring that the serrations on the cap and reference marks are aligned.
2. Tighten connecting cap bolts to 10 N.m (89 in. lbs.).
3. Without loosening connecting rod bolts, tighten all bolts to 30 N.m (22 ft. lbs.).
4. Using a torque angle gauge, tighten each bolt an additional 40°.
5. Recheck all bolt tightening with a torque wrench set to 88 N.m (65 ft. lbs.).
6. Check and record internal diameter of crank end of connecting rod (2).

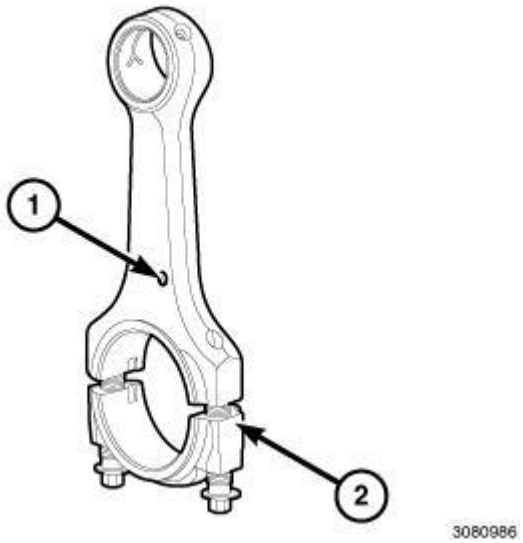

Fig. 173: Connecting Rod & Cap
Courtesy of CHRYSLER LLC

CAUTION: When changing connecting rods (2), DO NOT use a stamp to mark the cylinder location. Identify the connecting rods (2) and caps location using a paint marker. All four must have the same weight. Replacement connecting rods (2) will only be supplied in sets of four.

Connecting rods (2) are supplied in sets of four since they all must be of the same weight category. The weight of the connecting rod is identified by a paint mark (1) on the connecting rod.

PISTON PINS

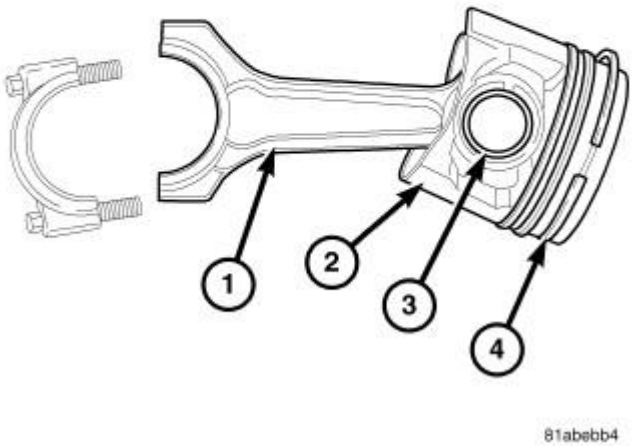

Fig. 174: Piston & Connecting Rod Assembly
Courtesy of CHRYSLER LLC

1. Measure the diameter of piston pin in the center and both ends. For specification. Refer to **Engine - Specifications**.

Installation

INSTALLATION

PISTON PIN - INSTALLATION

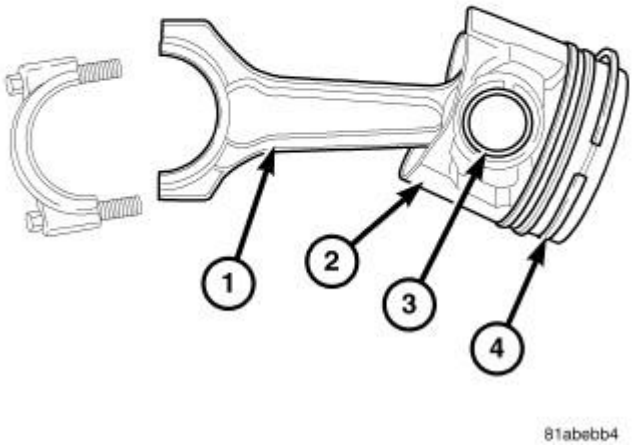

Fig. 175: Piston & Connecting Rod Assembly
Courtesy of CHRYSLER LLC

1. Secure connecting rod (1) in soft jawed vice.
2. Lubricate piston pin (3) and piston (2) with clean engine oil.
3. Position piston (2) on connecting rod (1).

CAUTION: Ensure arrow on piston crown and the bearing cap numbers on the connecting rod are on the opposite side.

4. Install piston pin (1).
5. Install snap ring in piston (2) to retain piston pin (3).
6. Remove connecting rod (1) from vice.

PISTON RINGS - INSTALLATION

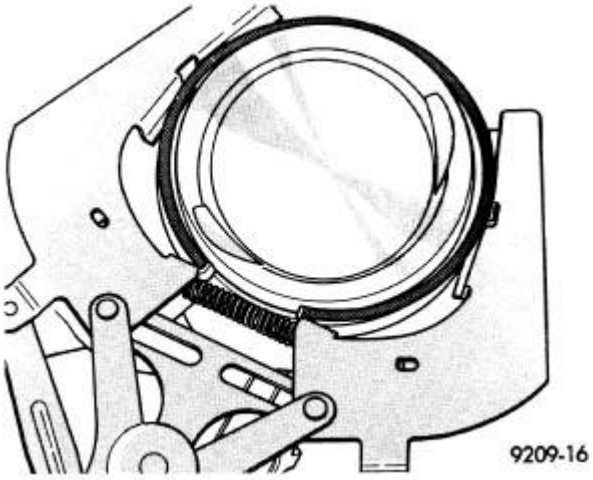

Fig. 176: Removing/Installing Piston Rings
Courtesy of CHRYSLER LLC

1. Install rings on the pistons using a suitable ring expander.

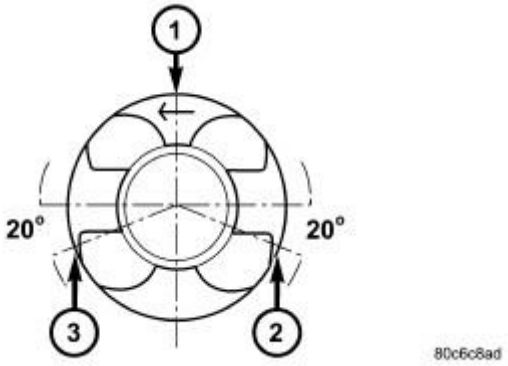

Fig. 177: Piston Ring Gap Location
Courtesy of CHRYSLER LLC

1 - SECOND COMPRESSION RING GAP POSITION
2 - OIL CONTROL RING GAP POSITION
3 - TOP COMPRESSION RING GAP POSITION

2. Top compression ring is tapered and chromium plated. The second ring is of the scraper type and must be installed with scraping edge facing bottom of the piston. The third is an oil control ring. Ring gaps must be positioned, before inserting piston into the liners, as follows.
3. Top ring gap must be positioned at the No. 3 position (looking at the piston crown from above).
4. Second piston ring gap should be positioned at the No. 1 position.
5. Oil control ring gap should be positioned at the No. 2 position.

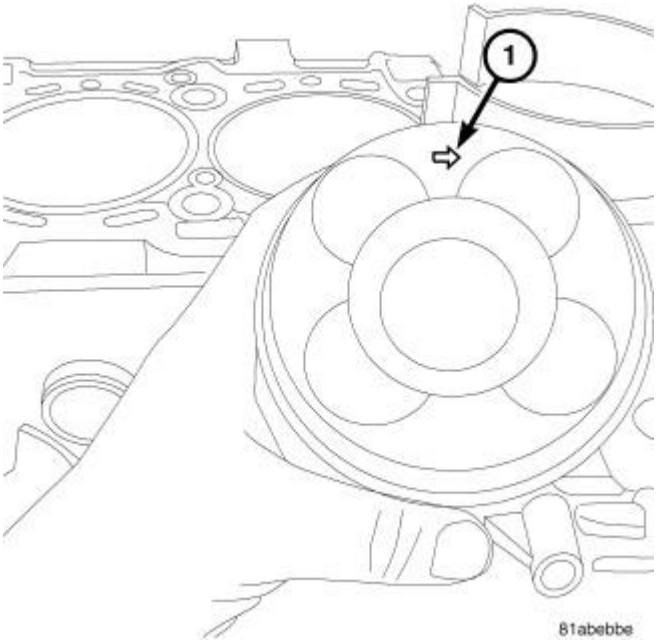

Fig. 178: Piston Direction
Courtesy of CHRYSLER LLC

6. When assembling pistons check that components are installed in the same position as before disassembly, determined by the numbers stamped on the crown of individual pistons. Engine cylinders are numbered starting from gear train end of the engine. **Face arrow on top of piston toward front of engine** . Therefore, the numbers stamped on connecting rod big end should face toward the injection pump side of engine.

INSTALLATION

1. Before installing pistons, and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap.
2. Before installing the piston ring compressor make sure the oil ring expander ends are butted together.
3. Immerse the piston head and rings in clean engine oil, slide the piston ring compressor over the piston and tighten. **Ensure position of rings does not change during this operation** .
4. Face arrow on piston towards front of engine.

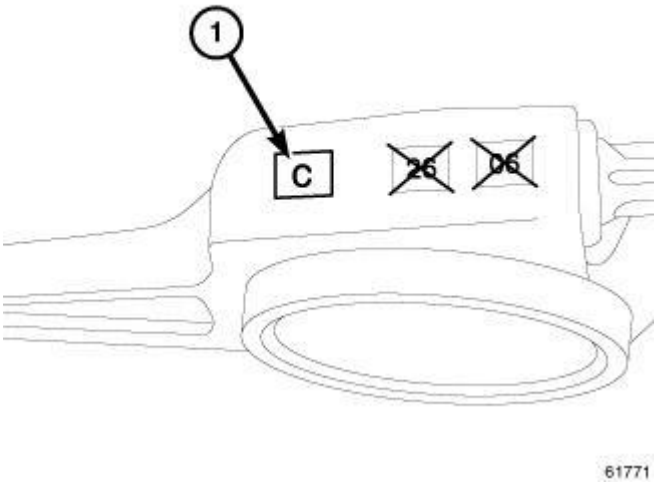

Fig. 179: Connecting Rod Size
Courtesy of CHRYSLER LLC

5. Each connecting rod has its own letter class (1) to a specific connecting rod journal diameter.

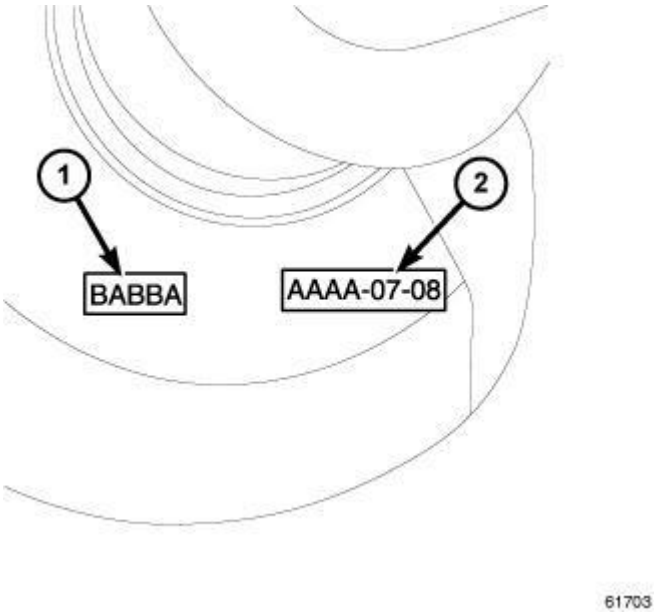

Fig. 180: Main Bearing Size Mark On Crank
Courtesy of CHRYSLER LLC

6. To determine the correct bearing size for each cylinder. Each connecting rod letter class must be matched with the crankshaft letter class (2) with the bearing selection chart to determine the correct bearing color for each cylinder. The letters stamped into the crankshaft (2) are in the same order as the cylinders. The first letter corresponds to the first cylinder, the second to the second, etc. See bearing selection chart. Refer to **BEARING SELECTION CHARTS**.

CAUTION: Care must be taken not to nick the crankshaft journal or cylinder bore when installing the pistons.

7. Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston into cylinder bore and guide rod over the crankshaft journal.
8. Guide the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal.

NOTE: The connecting rod bolts must be replaced every time they are loosened or removed.

9. Install connecting rod caps. Install new rod bolts and tighten to 10 N.m (88 in. lbs.). Tighten bolts to the next stage to 30 N.m (22 ft. lbs.) plus an additional 40°. Then with a torque wrench set to 88 N.m (65 ft. lbs.) make a tightening check.
10. Install the oil jets. Refer to **JET, Piston Oil Cooler , Installation**.
11. Install balance shaft assembly. Refer to **MODULE, Balance Shaft , Installation**.
12. Install cylinder head. Refer to **Cylinder Head , Installation**.
13. Connect negative battery cable.

SEAL, CRANKSHAFT OIL, FRONT

Removal

REMOVAL

1. Remove the crankshaft sprocket. Refer to **SPROCKET(S), Timing Belt and Chain , Removal**.

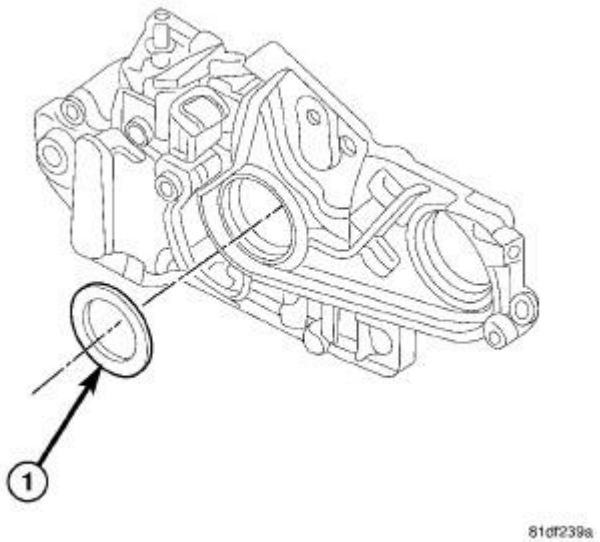

Fig. 181: Front Crankshaft Oil Seal
Courtesy of CHRYSLER LLC

NOTE: Do not gouge or scratch the surface of the crankshaft when removing the front crankshaft oil seal.

2. Remove the front crankshaft oil seal (1).

Installation

INSTALLATION

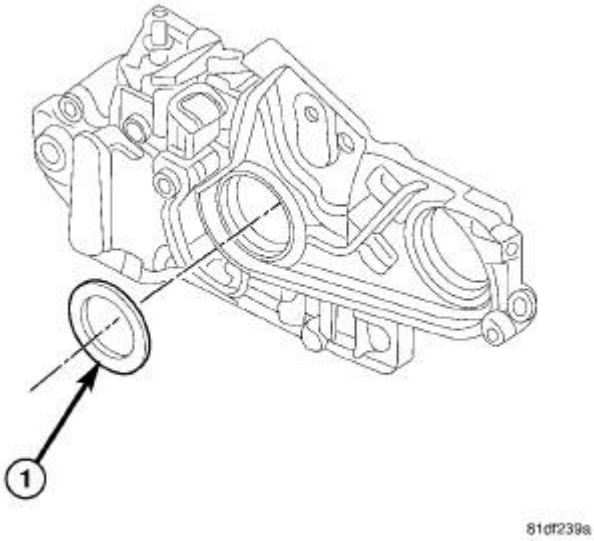

Fig. 182: Front Crankshaft Oil Seal
Courtesy of CHRYSLER LLC

NOTE: The lip of the front oil seal faces away from the engine on installation.

1. Position the front crankshaft oil seal (1) into the front cover.

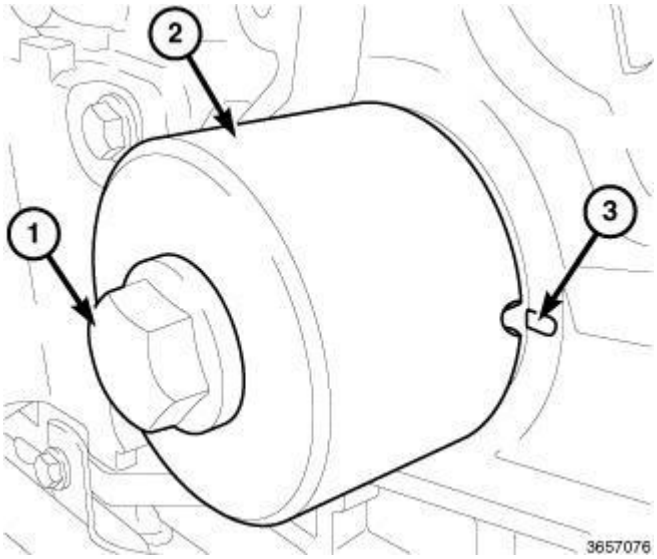

Fig. 183: Front Crankshaft Oil Seal Installer & Bolt
Courtesy of CHRYSLER LLC

NOTE: The crankshaft sprocket bolt is a left handed thread.

2. Using (special tool #VM.10335, Installer, Front Crankshaft Oil Seal) (2), install the front crankshaft oil seal using the vibration damper bolt (1) to draw the seal in place.
3. Remove bolt (1) and the (special tool #VM.10335, Installer, Front Crankshaft Oil Seal) (2).
4. Install the crankshaft sprocket. Refer to **SPROCKET(S), Timing Belt and Chain , Installation**.

SEAL, CRANKSHAFT OIL, REAR

Description

DESCRIPTION

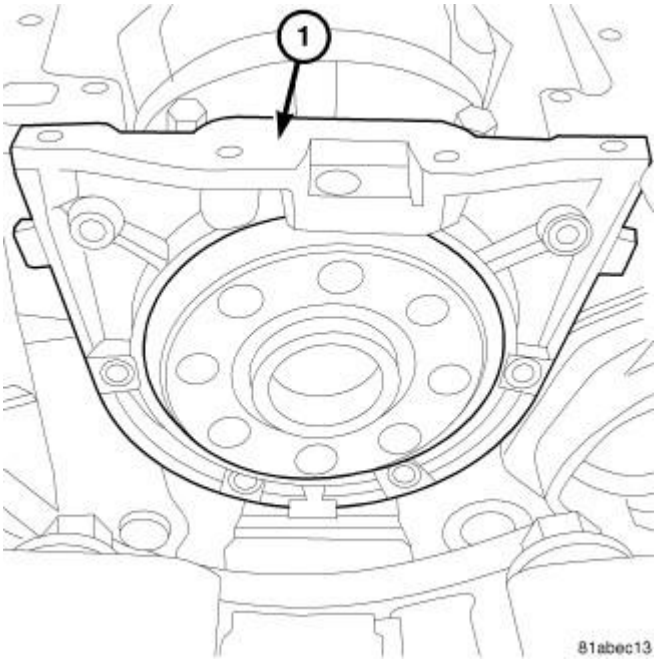

Fig. 184: Rear Crankshaft Seal & Rear Main Oil Seal Carrier
Courtesy of CHRYSLER LLC

The rear crankshaft seal consists of a seal and a seal carrier (1). The rear seal is inserted into the carrier. Once assembled the rear main seal assembly should not be separated to reduce the possibility of damage to the internal rear seal lip.

Removal

REMOVAL

NOTE: This procedure must be performed with either the engine or transmission removed from vehicle

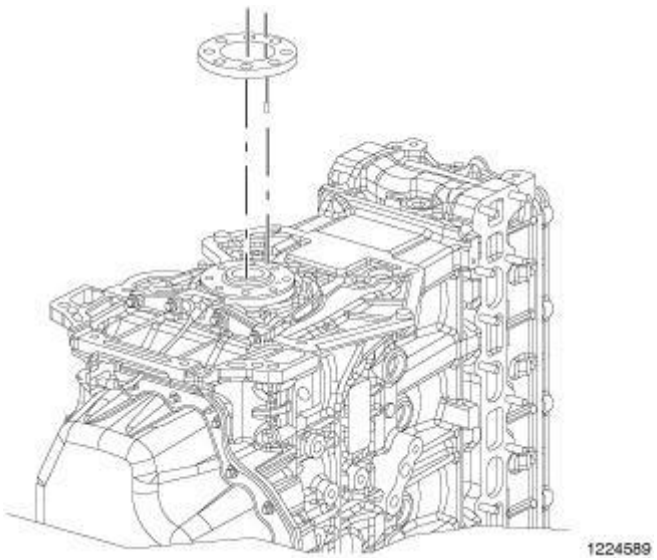

Fig. 185: Crankshaft Sensor Tone Wheel
Courtesy of CHRYSLER LLC

1. On automatic transmission vehicles, remove the flex plate. Refer to **FLEXPLATE , Removal**.
2. On manual transmission vehicles, remove the flywheel. Refer to **FLYWHEEL , Removal** .
3. Remove the Crankshaft Position (CKP) sensor from the rear of the engine block. Refer to **SENSOR, Crankshaft Position , Removal** .
4. Remove the upper oil pan. Refer to **PAN, Oil , Removal**.
5. Remove the crankshaft sensor tone wheel from the rear of the crankshaft.

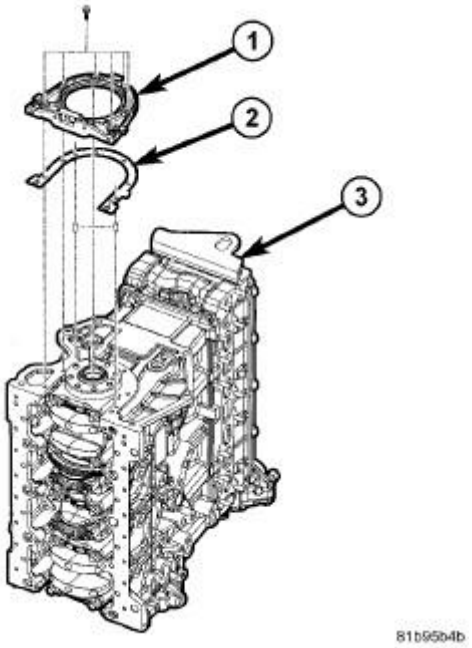

Fig. 186: Rear Oil Seal Carrier, Rear Oil Seal Carrier And Gasket & Engine Block
Courtesy of CHRYSLER LLC

6. Remove the bolts that secure the rear oil seal carrier (1) to the engine block (3).
7. Remove the rear oil seal carrier and gasket (2).
8. Remove the rear crankshaft oil seal from the rear oil seal carrier (1).

Installation

INSTALLATION

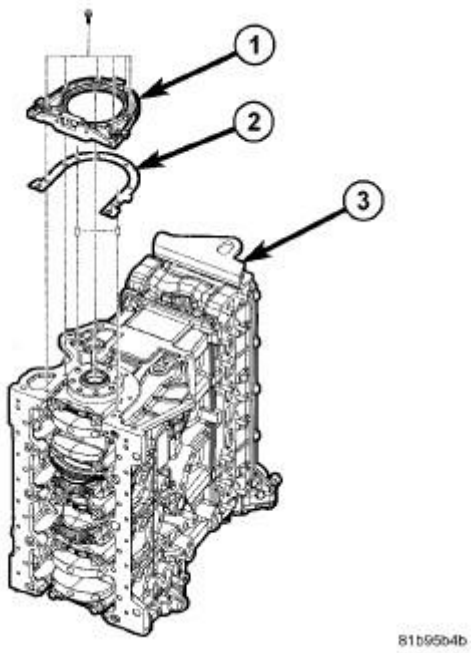

Fig. 187: Rear Oil Seal Carrier, Rear Oil Seal Carrier And Gasket & Engine Block
Courtesy of CHRYSLER LLC

1. Clean the rear crankshaft oil seal and seal carrier sealing surfaces.
2. Position the rear oil seal carrier gasket (2) onto the rear of the engine block (3).
3. Using Crankshaft Seal Installer (special tool #VM.9993, Installer, Crankshaft Rear Oil Seal), install rear crankshaft oil seal into the rear oil seal carrier (1).
4. Install the rear oil seal carrier onto the engine block.

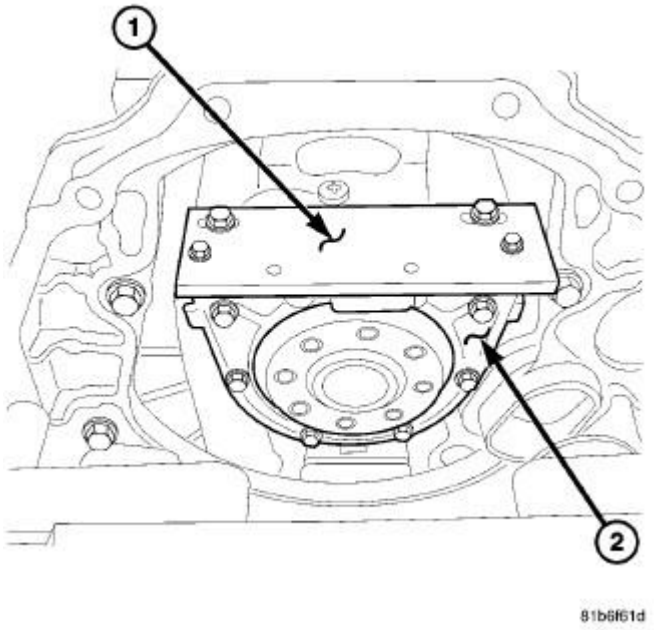

Fig. 188: Front And Rear Seal Tool Installed Onto Rear Oil Seal Carrier
Courtesy of CHRYSLER LLC

5. Loosely install the bolts that secure the rear oil seal carrier (2) to the engine block.
6. Using the Front and Rear Seal Tool (special tool #VM.9990, Tool, Front And Rear Seal) (1), to set the depth of the rear main seal (2).

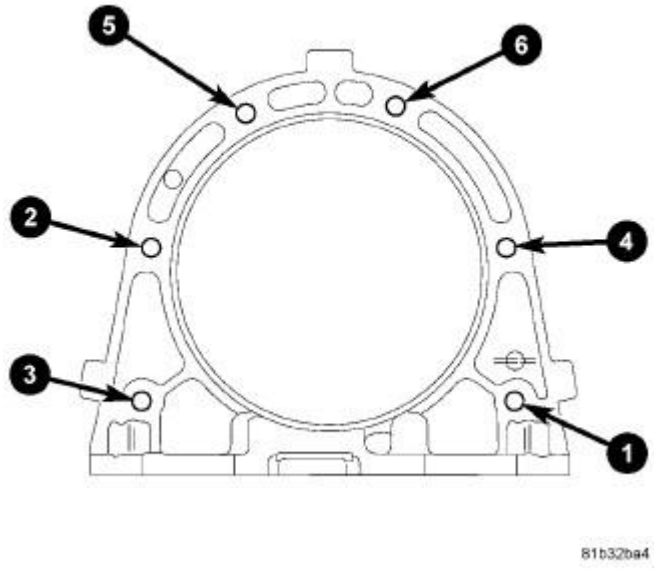

Fig. 189: Rear Cover Tightening Sequence

Courtesy of CHRYSLER LLC

7. Using the illustration shown, tighten the rear cover bolts to 15 N.m (133 in. lbs.).

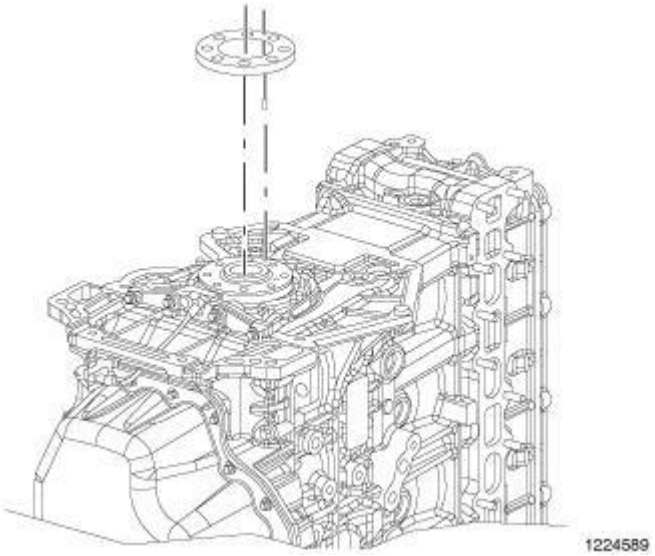

Fig. 190: Crankshaft Sensor Tone Wheel
Courtesy of CHRYSLER LLC

8. Install the upper oil pan. Refer to **PAN, Oil , Installation**.
9. Install the Crankshaft Position (CKP) sensor. Refer to **SENSOR, Crankshaft Position , Installation** .

NOTE: If equipped, manual transmission models with start/stop, there is a special tone wheel for this option that needs to be installed. (Refer to FLYWHEEL , Installation).

10. Install the crankshaft sensor tone wheel to the rear of the crankshaft.
11. On manual transmission models, install the flywheel. Refer to **FLYWHEEL , Installation** .
12. On automatic transmission vehicles, Install the flex plate. Refer to **FLEXPLATE , Installation**.

ENGINE MOUNTING

INSULATOR, ENGINE MOUNT, LEFT

Removal

REMOVAL

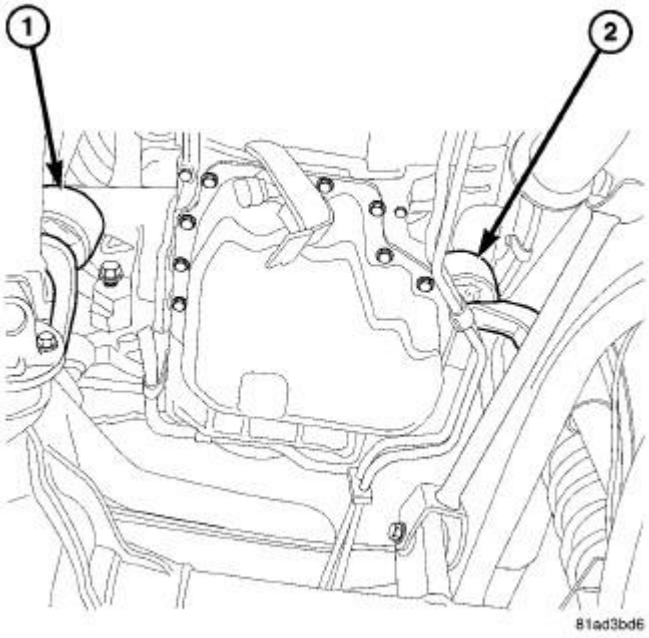

Fig. 191: Engine Mounts
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the engine cover.
3. Raise and support vehicle.
4. Remove the belly pan skid plate.
5. Remove the right hand and left hand lower engine mount nuts.
6. Remove the viscous fan and position aside. Refer to **FAN, Cooling, Electric , Removal** .
7. Install the Engine Support Fixture (special tool #6958, Wrench, Spanner) and raise the engine up.

NOTE: It is easier to remove the left engine mount from underneath vehicle.

8. Remove the upper nut and the engine mount.

Installation

INSTALLATION

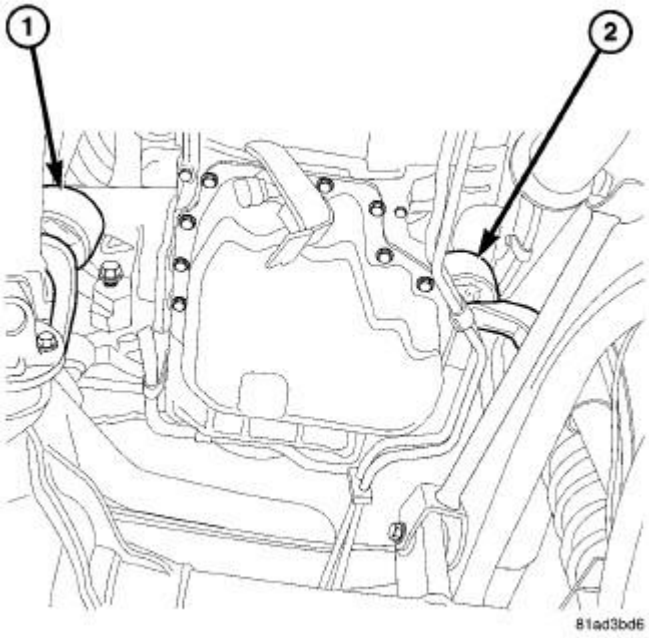

Fig. 192: Engine Mounts
Courtesy of CHRYSLER LLC

1. Position the left engine mount and hand tighten the retaining bolts.
2. Lower the engine and remove the Engine Support Fixture (special tool #6958, Wrench, Spanner).
3. Tighten the left upper engine mount nut to 54 N.m (40 ft. lbs.).
4. Tighten right hand and left hand engine mount nut to 54 N.m (40 ft. lbs.).
5. Install the belly pan skid plate.
6. Lower the vehicle.
7. Install the engine cover.
8. Connect the negative battery cable.

INSULATOR, ENGINE MOUNT, RIGHT

Removal

REMOVAL

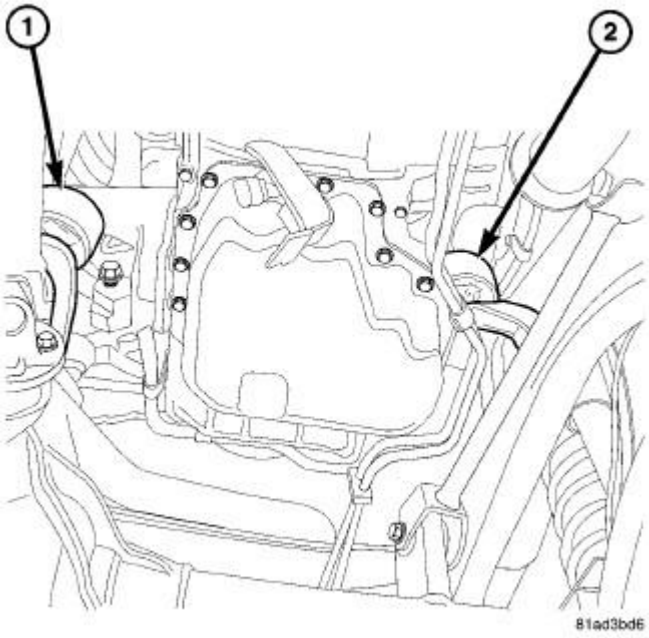

Fig. 193: Engine Mounts
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the engine cover.
3. Raise and support the vehicle.
4. Remove the belly pan skid plate.
5. Remove the right hand and left hand lower engine mount nuts.
6. Remove the viscous fan and position aside. Refer to **FAN, Cooling, Electric , Removal** .
7. Install the Engine Support Fixture (special tool #6958, Wrench, Spanner) and raise the engine up.

NOTE: It is easier to remove the right engine mount from up top.

8. Remove the nut and the engine mount.

Installation

INSTALLATION

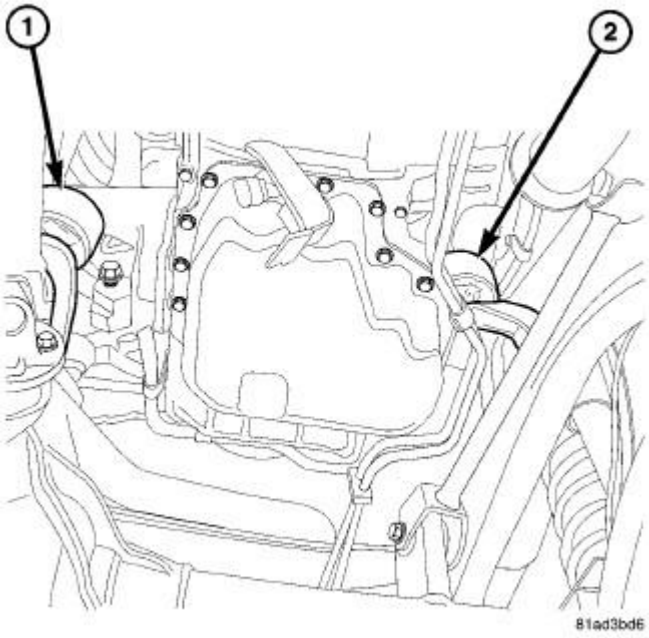

Fig. 194: Engine Mounts
Courtesy of CHRYSLER LLC

1. Position the right engine mount and hand tighten the retaining bolts.
2. Lower the engine and remove the Engine Support Fixture (special tool #6958, Wrench, Spanner).
3. Tighten the right upper engine mount nut to 54 N.m (40 ft. lbs.).
4. Tighten right hand and left hand engine mount nut to 54 N.m (40 ft. lbs.).
5. Install the belly pan skid plate.
6. Lower the vehicle.
7. Install the engine cover.
8. Connect the negative battery cable.

LUBRICATION

COOLER, OIL

Description

DESCRIPTION

Engine coolant is used to cool the engine oil. A plate-style external heat exchanger is located on the oil filter housing which is on the right side of the engine. A gasket seals the oil cooler to the oil filter housing. Replace the gasket whenever the oil cooler is removed or replaced. The oil is fed to the oil cooler through the oil filter housing.

Removal

REMOVAL

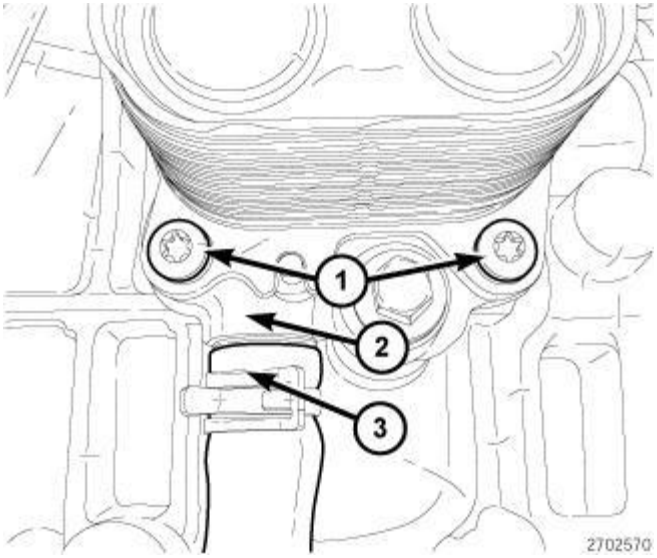

Fig. 195: Coolant Hose, Oil Cooler Housing & Bolts
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the belly pan.
3. Drain the cooling system. Refer to **Standard Procedure** .
4. Remove the coolant hose (3) at oil cooler housing (2).
5. Remove the two lower oil cooler bolts.

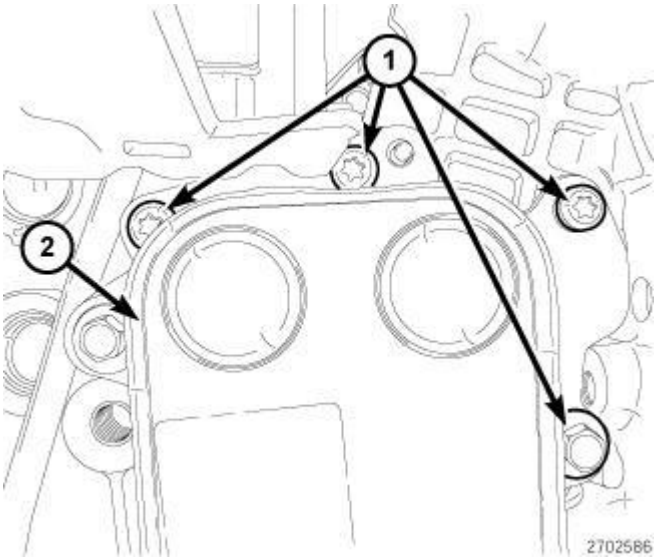

Fig. 196: Engine Oil Cooler & Bolts
Courtesy of CHRYSLER LLC

6. Remove the air cleaner body and turbocharger air inlet tube. Refer to **BODY, Air Cleaner , Removal**.

7. Remove the Charge Air Cooler (CAC) hose from (CAC).
8. Remove the (CAC) hose from turbocharger.
9. Drain the engine oil.
10. Remove the power steering pump. Refer to **Pump , Removal** .
11. Remove the four upper bolts (1) and the engine oil cooler (2).
12. Remove and discard the O-ring gasket.

Installation

INSTALLATION

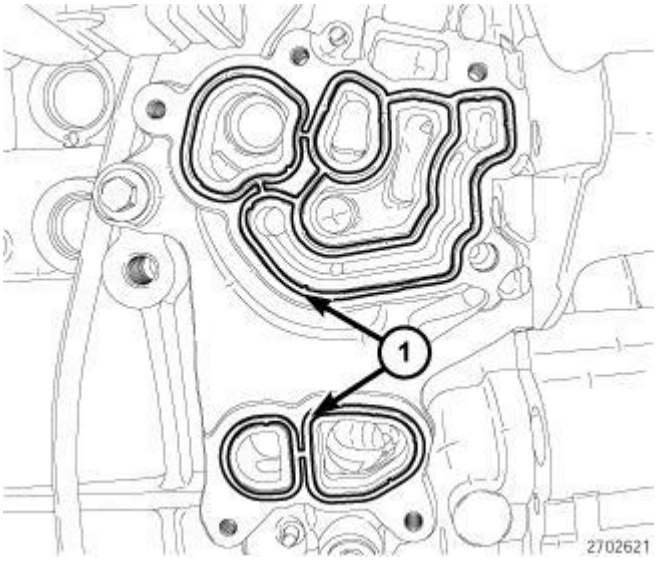

Fig. 197: O-Ring Gaskets
Courtesy of CHRYSLER LLC

1. Clean all gasket mating surfaces.
2. Install a new O-ring gaskets (1).

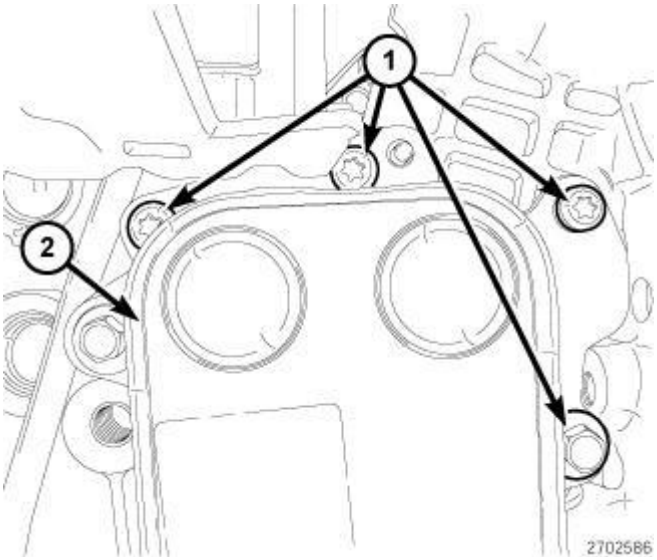

Fig. 198: Engine Oil Cooler & Bolts
Courtesy of CHRYSLER LLC

3. Install the oil cooler. Tighten bolts (1) to 12 N.m (106 in. lbs.).
4. Install the power steering pump. Refer to **Pump , Installation** .
5. Install the (CAC) hose from turbocharger.
6. Install the Charge Air Cooler (CAC) hose from (CAC).
7. Install the air cleaner body and turbocharger air inlet tube. Refer to **BODY, Air Cleaner , Installation**.

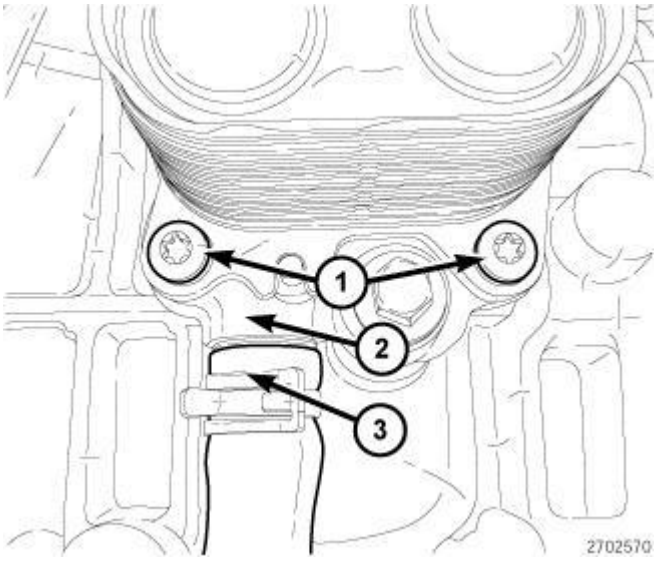

Fig. 199: Coolant Hose, Oil Cooler Housing & Bolts
Courtesy of CHRYSLER LLC

8. Install the two lower oil cooler bolts (1) and tighten to 12 N.m (106 in. lbs.).
9. Install the coolant hose (3) to oil cooler housing (2).
10. Fill the engine with recommended oil.

11. Fill the cooling system. Refer to **Standard Procedure** .
12. Install the belly pan.
13. Connect the negative battery cable.

FILTER, ENGINE OIL

Removal

REMOVAL

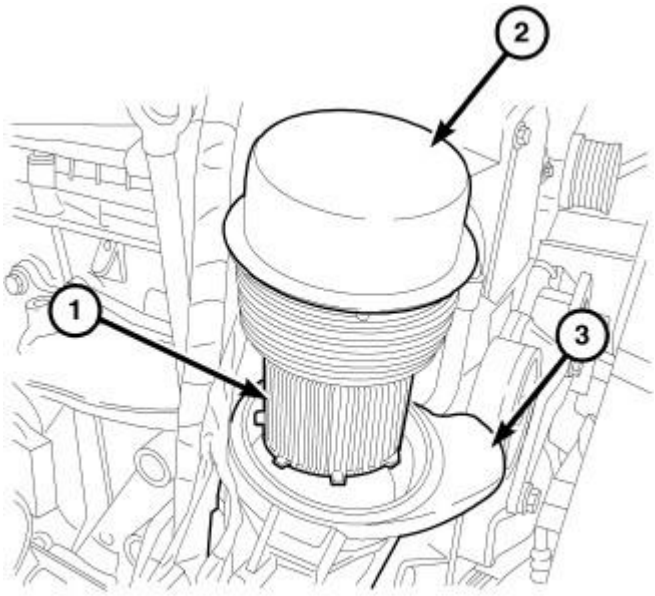

Fig. 200: Oil Filter, Oil Filter Housing Adapter & Oil Filter Housing
Courtesy of CHRYSLER LLC

1. Drain the engine oil.
2. Remove the oil filter housing adapter cap (2) and the oil filter (1).

Installation

INSTALLATION

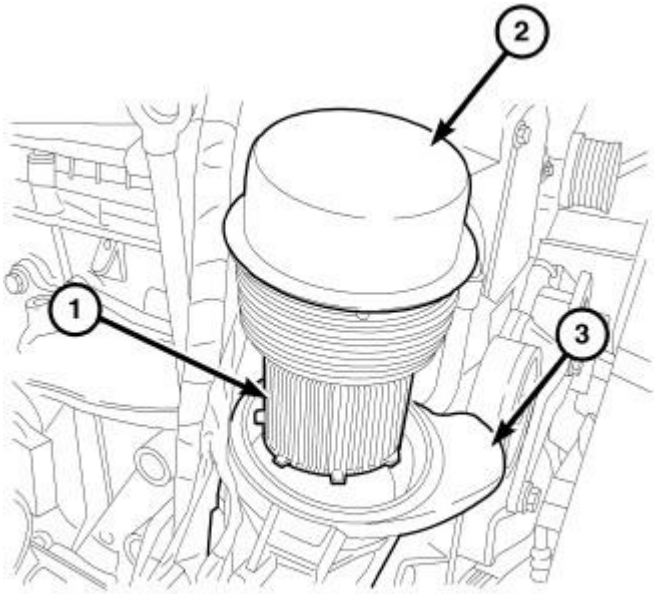

Fig. 201: Oil Filter, Oil Filter Housing Adapter & Oil Filter Housing
Courtesy of CHRYSLER LLC

1. Install the oil filter (1) and the oil filter housing adapter cap (2). Tighten adapter cap (2) to 25 N.m (18 ft. lbs.).
2. Fill the engine with recommended oil.

HOUSING, OIL FILTER

Description

DESCRIPTION

An oil filter housing adapter is used on this vehicle to relocate the oil filter for easier access when servicing.

Removal

REMOVAL

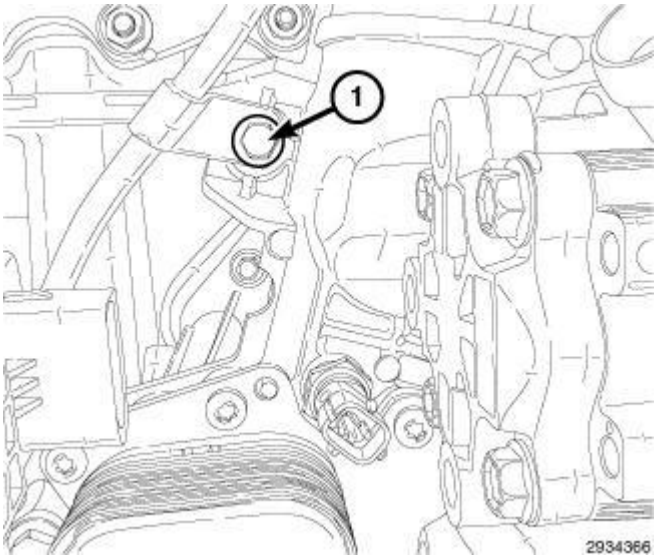

Fig. 202: Upper Oil Dipstick Bolt
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Raise and support the vehicle.
3. Remove the underbody skid plate.
4. Drain the cooling system. Refer to **Standard Procedure** .
5. Drain the engine oil.
6. Remove the air cleaner body and turbocharger air inlet tube. Refer to **BODY, Air Cleaner , Removal**.
7. Disconnect the oil temperature sensor harness connector.
8. Remove the upper oil dipstick bolt (1).

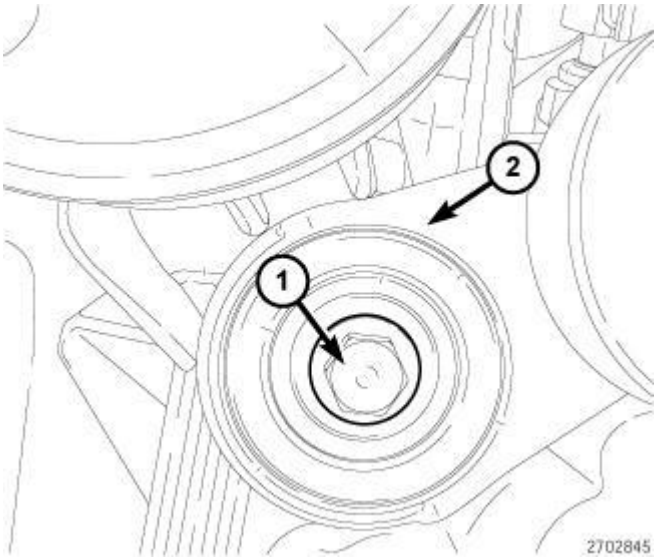

Fig. 203: Serpentine Belt Tensioner & Bolt
Courtesy of CHRYSLER LLC

9. Remove the serpentine belt. Refer to **BELT, Serpentine , Removal** .
10. Remove the power steering pump and position aside.
11. Remove bolt (1) and the serpentine belt tensioner (2).

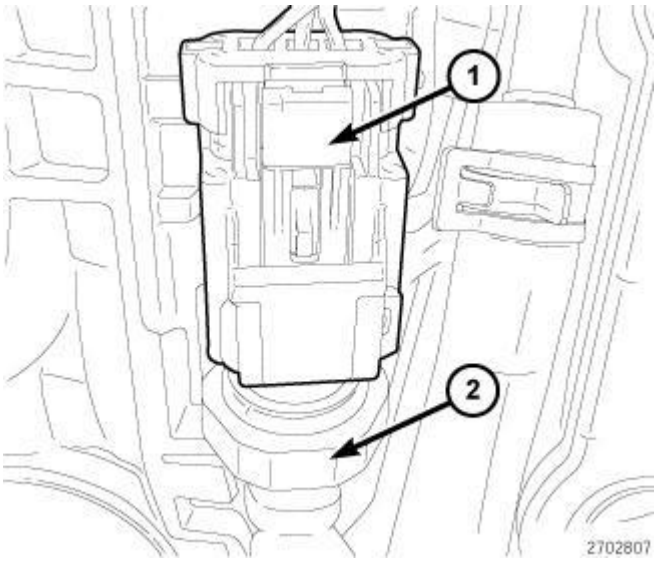

Fig. 204: Oil Pressure Switch & Harness Connector
Courtesy of CHRYSLER LLC

12. Disconnect the oil pressure sensor harness connector (1).

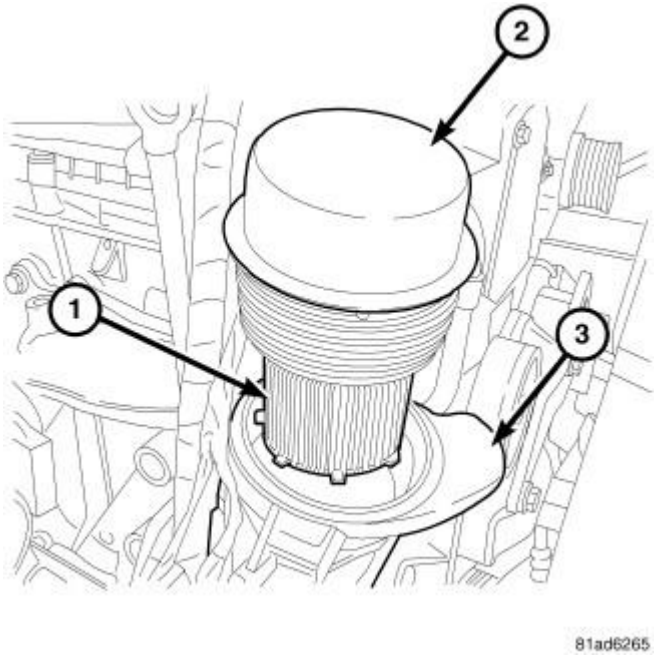

Fig. 205: Oil Filter, Oil Filter Housing Adapter & Oil Filter Housing
Courtesy of CHRYSLER LLC

13. Remove the oil filter housing adapter cap (2) and the oil filter (1).

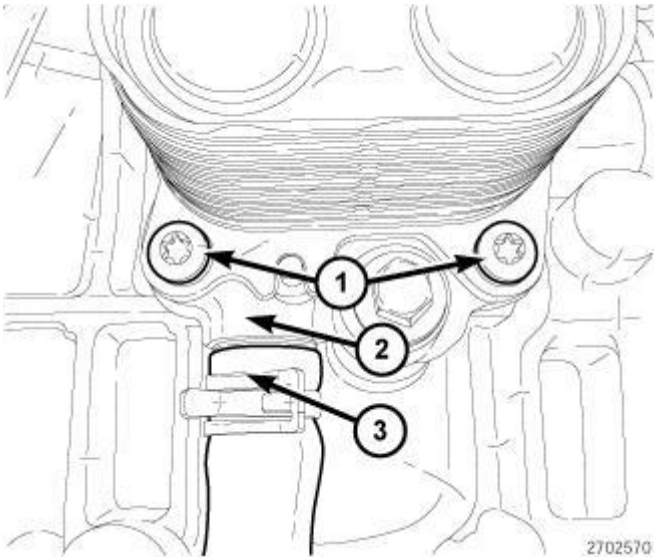

Fig. 206: Coolant Hose, Oil Cooler Housing & Bolts
Courtesy of CHRYSLER LLC

14. Remove the coolant hose (3) from oil filter housing adapter (2).

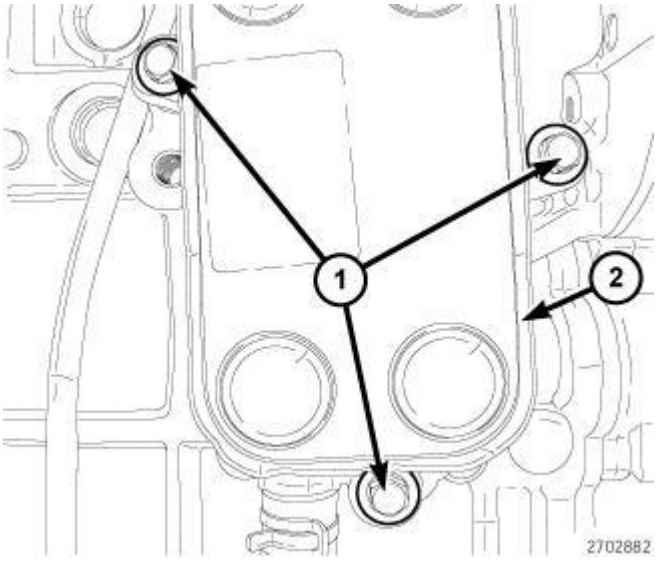

Fig. 207: Oil Filter Housing Adapter & Bolts
Courtesy of CHRYSLER LLC

15. Remove bolts (1) and the oil filter housing adapter (2).

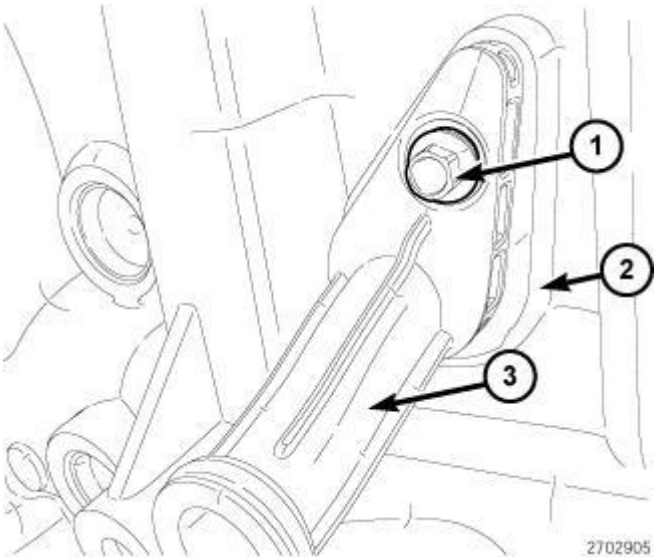

Fig. 208: Coolant Tube, Engine Block & Bolt
Courtesy of CHRYSLER LLC

16. Remove the tube and discard O-ring gasket.

Installation

INSTALLATION

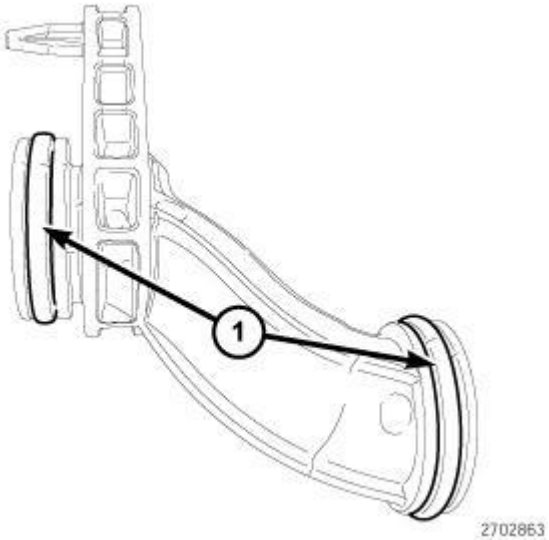

Fig. 209: Coolant Tube O-Ring Seals
Courtesy of CHRYSLER LLC

1. Install new O-ring seals (1) to coolant tube.

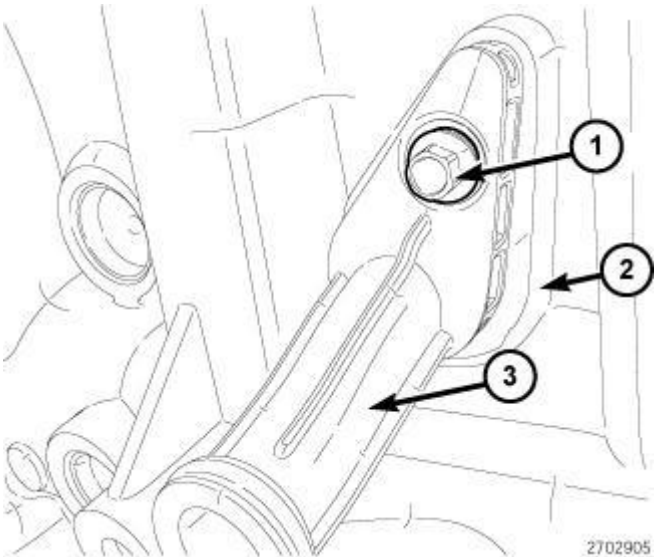

Fig. 210: Coolant Tube, Engine Block & Bolt
Courtesy of CHRYSLER LLC

2. Install coolant tube (3) into engine block (2). Tighten bolt (1) to 11 N.m (97 in. lbs.).

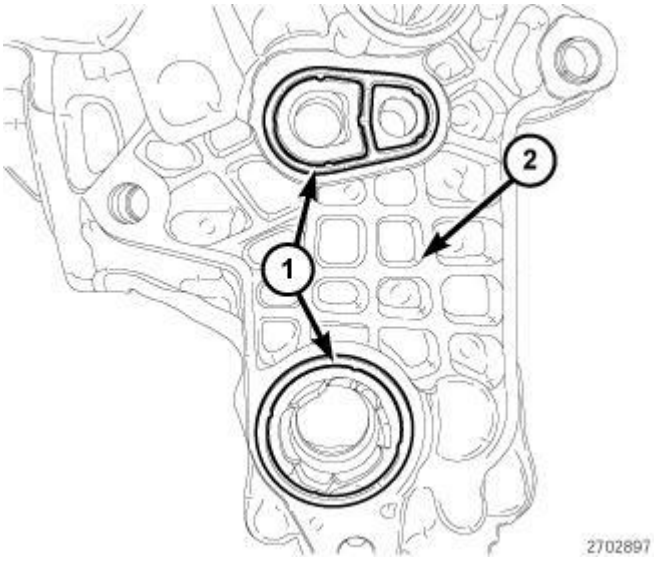

Fig. 211: O-Ring Seals & Oil Filter Housing
Courtesy of CHRYSLER LLC

3. Install new O-ring seals (1) to the oil filter housing (2) adapter.

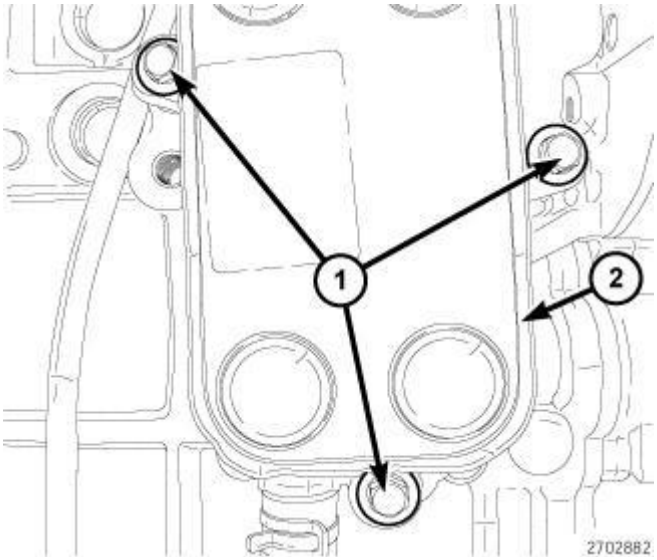

Fig. 212: Oil Filter Housing Adapter & Bolts
Courtesy of CHRYSLER LLC

4. Install the oil filter housing adapter (2). Tighten bolts (1) to 33 N.m (24 ft. lbs.).

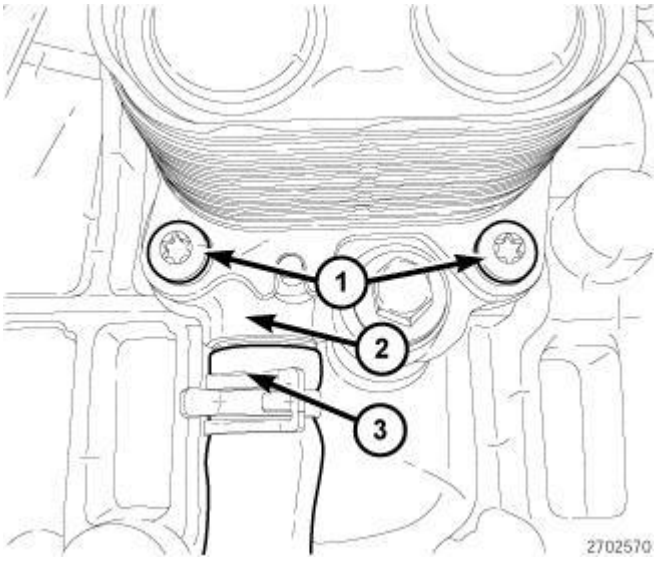

Fig. 213: Coolant Hose, Oil Cooler Housing & Bolts
Courtesy of CHRYSLER LLC

5. Install the coolant hose (3) to the oil filter housing adapter (2).

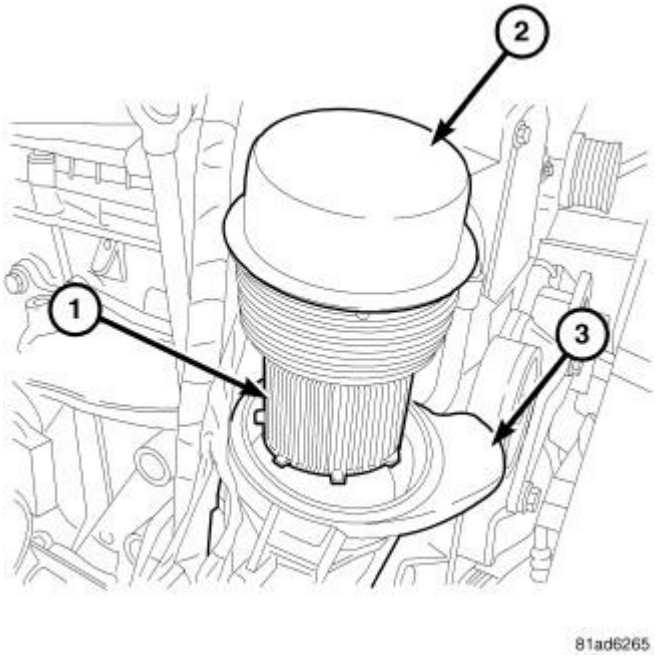

Fig. 214: Oil Filter, Oil Filter Housing Adapter & Oil Filter Housing
Courtesy of CHRYSLER LLC

6. Install the oil filter (1) and the oil filter housing adapter cap (2). Tighten to 25 N.m (18 ft. lbs.).

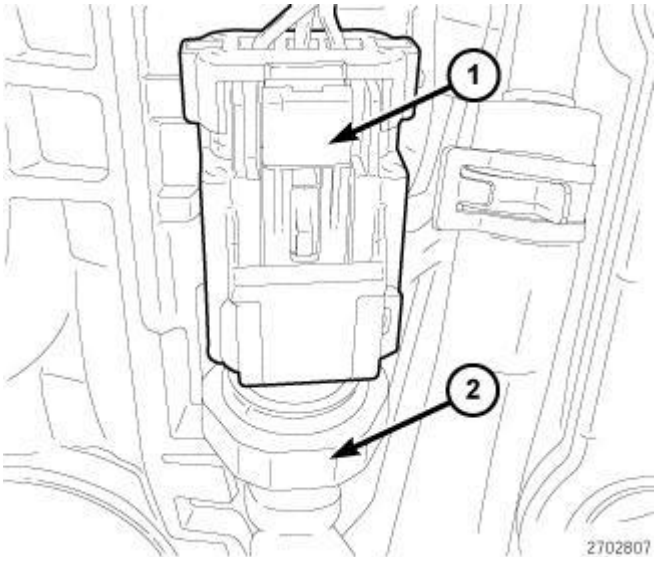

Fig. 215: Oil Pressure Switch & Harness Connector
Courtesy of CHRYSLER LLC

7. Connect the oil pressure switch harness connector (1).

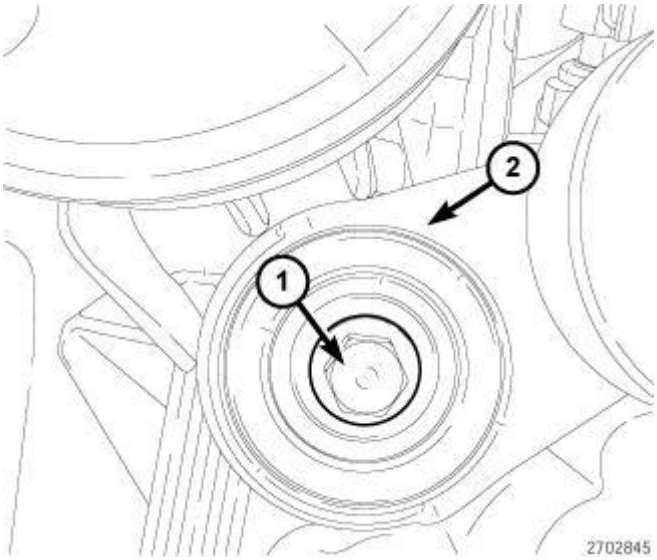

Fig. 216: Serpentine Belt Tensioner & Bolt
Courtesy of CHRYSLER LLC

8. Install the serpentine belt tensioner (2). Tighten bolt (1) to 45 N.m (33 ft. lbs.).
9. Install the power steering pump. Tighten bolts to 33 N.m (24 (ft. lbs.).
10. Install the serpentine belt. Refer to **BELT, Serpentine , Installation** .

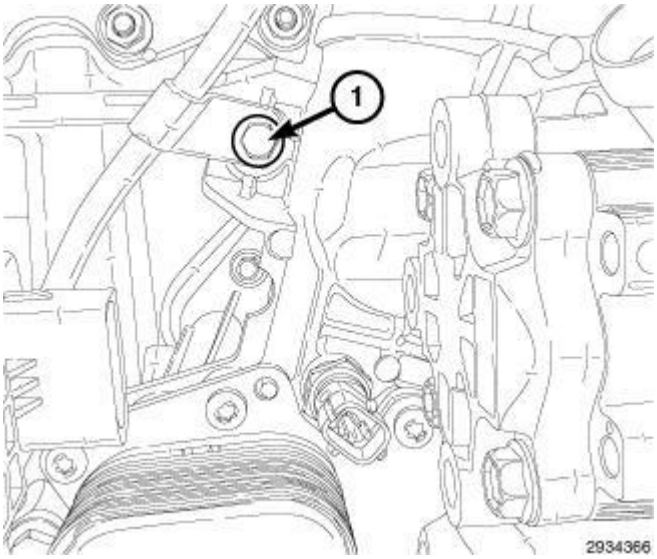

Fig. 217: Upper Oil Dipstick Bolt
Courtesy of CHRYSLER LLC

11. Install the upper oil dipstick bolt (1). Tighten bolt (1) to 33 N.m (24 ft. lbs.).
12. Connect the oil temperature sensor harness connector.
13. Install the turbocharger air inlet tube and air cleaner body. Refer to **BODY, Air Cleaner , Installation**.
14. Install the underbody skid plate.
15. Lower the vehicle.

16. Fill the engine with recommended oil.
17. Fill the cooling system. Refer to **Standard Procedure** .
18. Connect the negative battery cable.
19. Start the engine and check for leaks.

JET, PISTON OIL COOLER

Description

DESCRIPTION

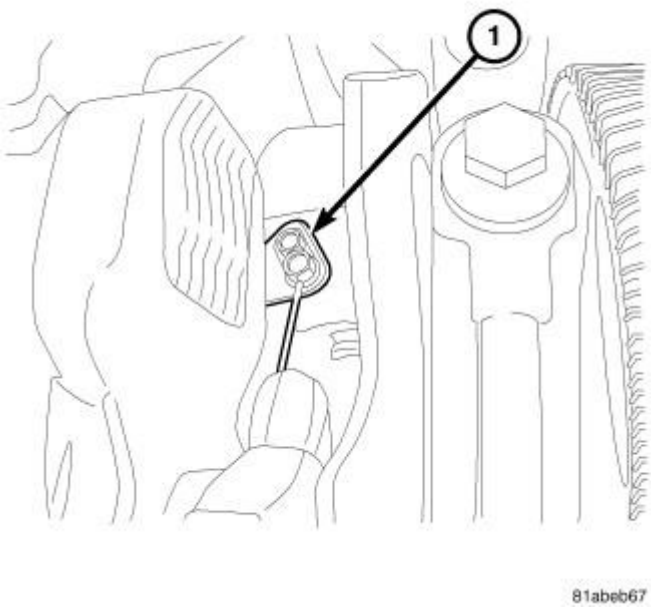

Fig. 218: Oil Jet
Courtesy of CHRYSLER LLC

There are four oil jets installed in the engine block. These oil jets are used to cool and lubricate the piston assemblies.

Removal

REMOVAL

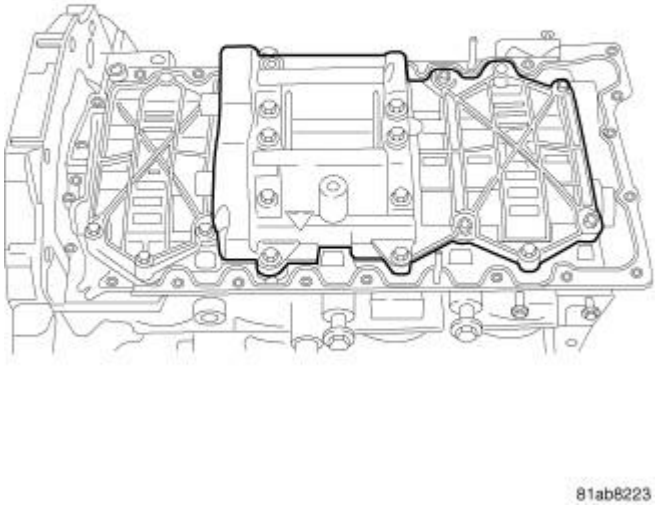

Fig. 219: Balance Shaft Module
Courtesy of CHRYSLER LLC

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.

NOTE: To prevent damage to the oil jets, remove the oil jets before removing the pistons.

1. Disconnect the negative battery cable.
2. Raise vehicle on hoist.
3. Remove the balance shaft assembly. Refer to **MODULE, Balance Shaft , Removal**.

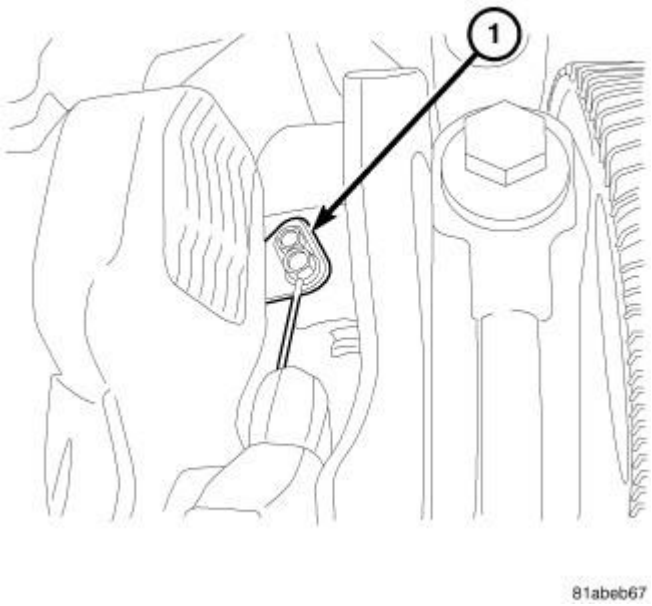

Fig. 220: Oil Jet
Courtesy of CHRYSLER LLC

4. Remove bolt and the oil jet (1).
5. Remove and discard O-ring seal.

Installation

INSTALLATION

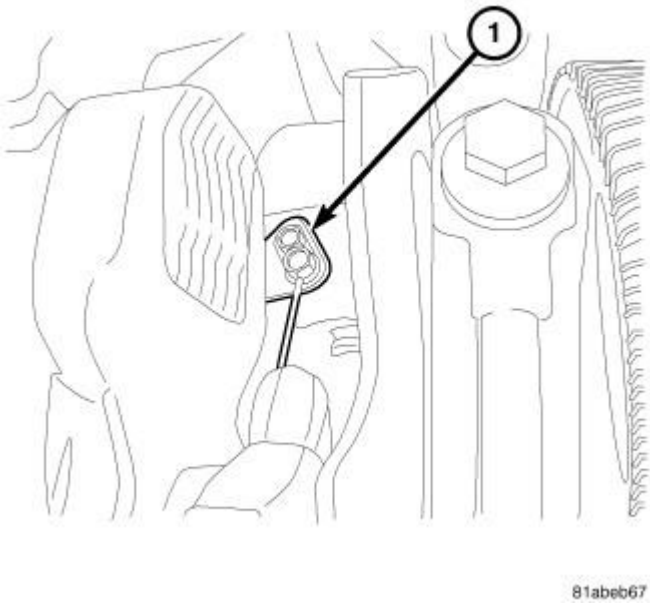

Fig. 221: Oil Jet

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 a new O-ring onto oil jet.
2. Lubricate O-ring on oil jet.
3. Install oil jet. Tighten bolt to 11 N.m (97 in. lbs.).

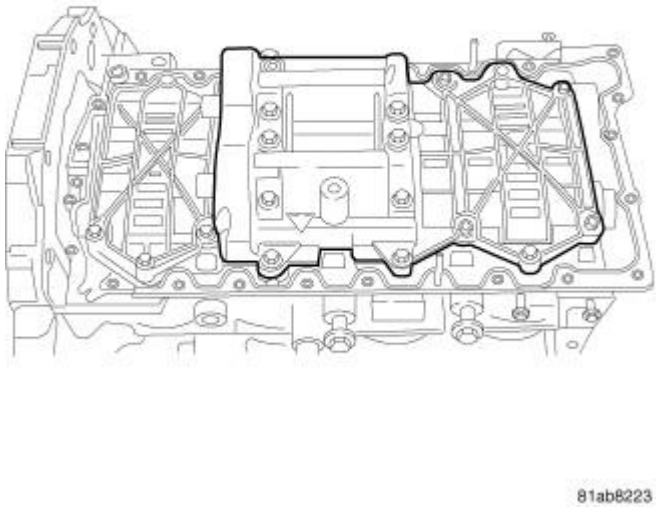

Fig. 222: Balance Shaft Module
Courtesy of CHRYSLER LLC

4. Install the balance shaft assembly. Refer to **MODULE, Balance Shaft , Installation**.
5. Lower vehicle on hoist
6. Connect the negative battery cable.

OIL

Description

DESCRIPTION

Refer to the Lube and Maintenance service information for oil specifications. Refer to **Capacities and Recommended Fluids , Specifications** .

PAN, OIL

Removal

UPPER OIL PAN

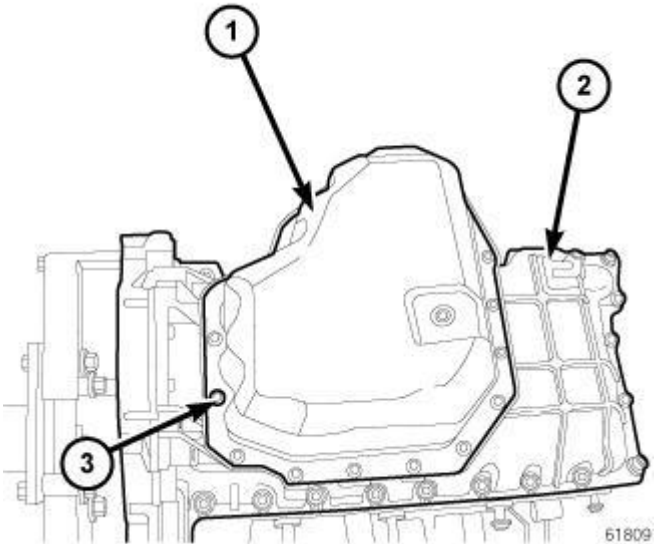

Fig. 223: Lower Oil Pan
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the lower oil pan. Refer to **PAN, Oil , Removal**.
3. Remove the Crankshaft Position Sensor (CKP). Refer to **SENSOR, Crankshaft Position , Removal** .
4. Remove bolt, and the oil dipstick tube from upper oil pan.

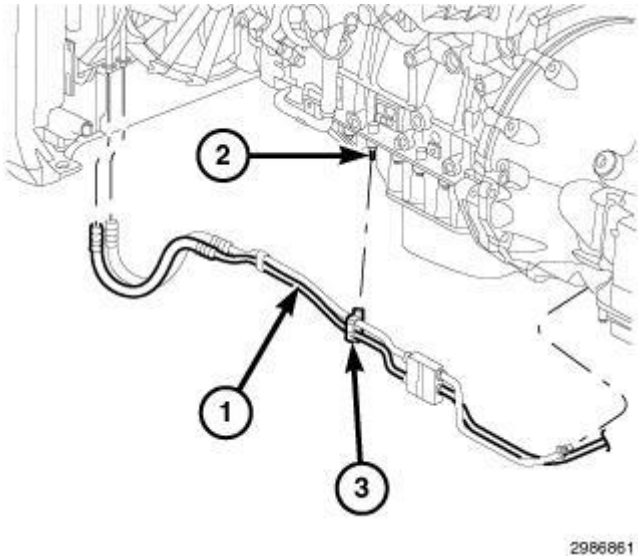

Fig. 224: Transmission Cooler Line, Oil Pan Stud & Clip
Courtesy of CHRYSLER LLC

NOTE: The plastic clip that secures the transmission oil cooler lines to oil pan

stud/bolt is a one time use clip that need to be replace each time the line is removed.

5. On automatic transmission models, remove the transmission cooler line (1) from oil pan stud (2) and discard clip (3).

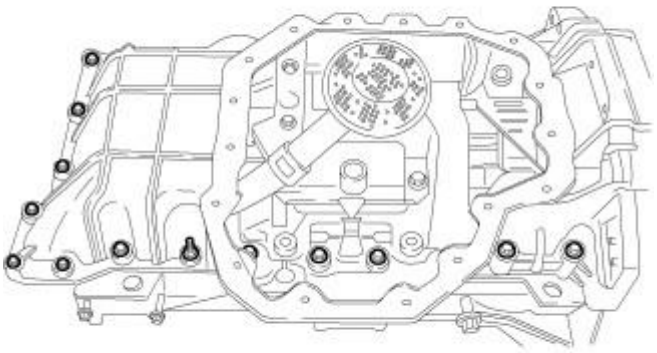

Fig. 225: Upper Oil Pan Bolts
Courtesy of CHRYSLER LLC

6. Remove bolts, and the upper oil pan.
7. Remove and discard gasket.

LOWER OIL PAN

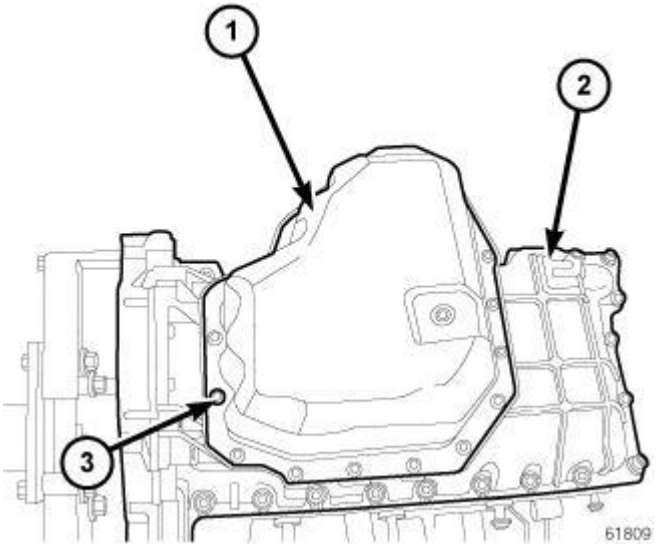

Fig. 226: Lower Oil Pan
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the engine cover.
3. Remove the air cleaner body. Refer to **BODY, Air Cleaner , Removal**.
4. Remove the upper dipstick bolt.
5. On 4x4 models, remove the front axle. Refer to **Removal** .
6. Remove the right lower engine mount nut.
7. Remove the left lower engine mount nut.
8. Drain the engine oil.
9. Using a new copper sealing washer, install and tighten the oil drain plug to 54 N.m (40 ft. lbs.).
10. Remove the viscous fan. Refer to **FAN, Cooling, Electric , Removal** .
11. Install the Engine Support Fixture (special tool #8534B, Fixture, Driveline Support) and raise up the engine.
12. Remove bolts (3) and the lower oil pan (1).
13. Remove and discard the oil pan gasket.

Installation

UPPER OIL PAN

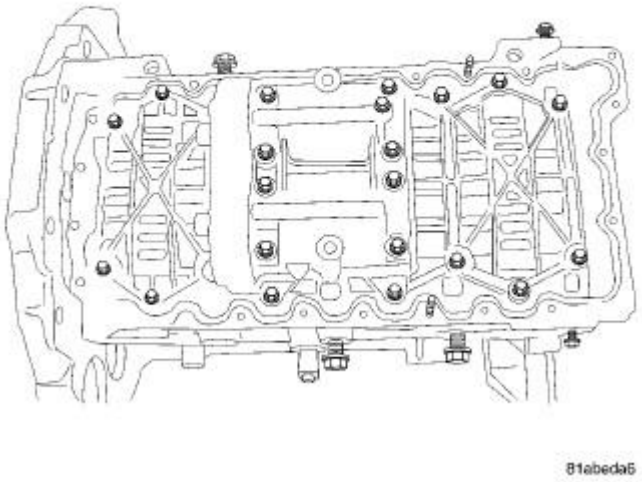

Fig. 227: Upper Oil Pan Bolts
Courtesy of CHRYSLER LLC

1. Clean the oil pan and engine block gasket surfaces.

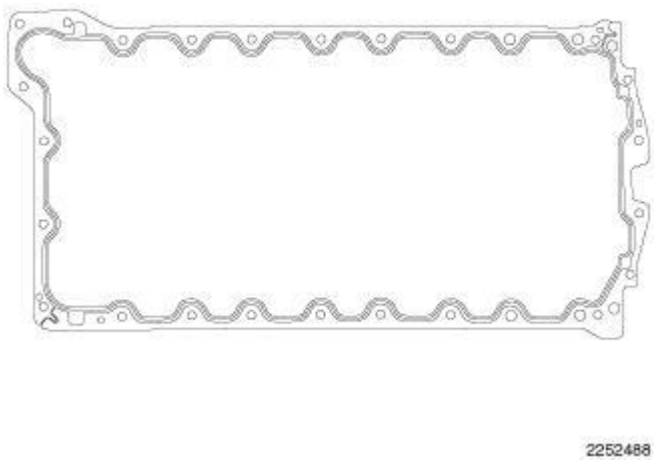

Fig. 228: Upper Oil Pan Gasket
Courtesy of CHRYSLER LLC

2. Install the upper oil pan gasket.

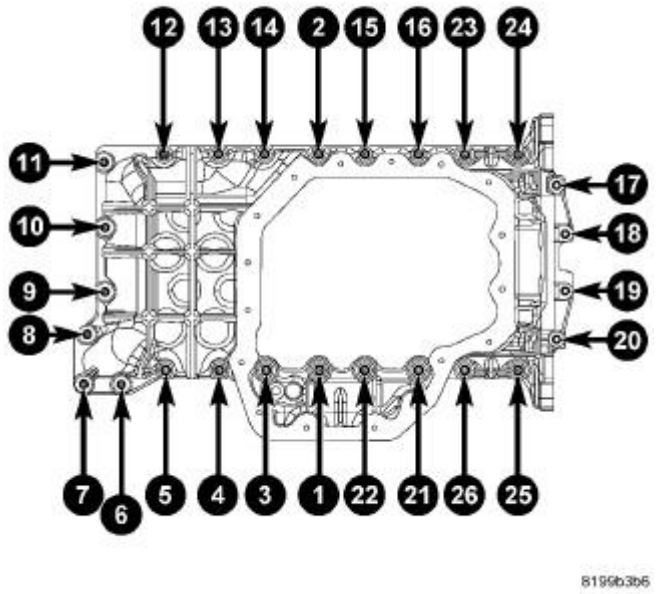

Fig. 229: Upper Oil Pan Bolts Tightening Sequence
Courtesy of CHRYSLER LLC

3. Install the upper oil pan bolts in positions one and two, then follow the sequence illustrated for the remaining bolts. Once all of the bolts are installed, tighten the M6 bolts to 15 N.m (133 in. lbs.) and M8 bolts to 32 N.m (23 ft. lbs.).
4. Loosen all of the upper oil pan bolts and studs by 90 degrees and retighten the M6 bolts to 15 N.m (133 in. lbs.) and M8 bolts to 32 N.m (23 ft. lbs.).

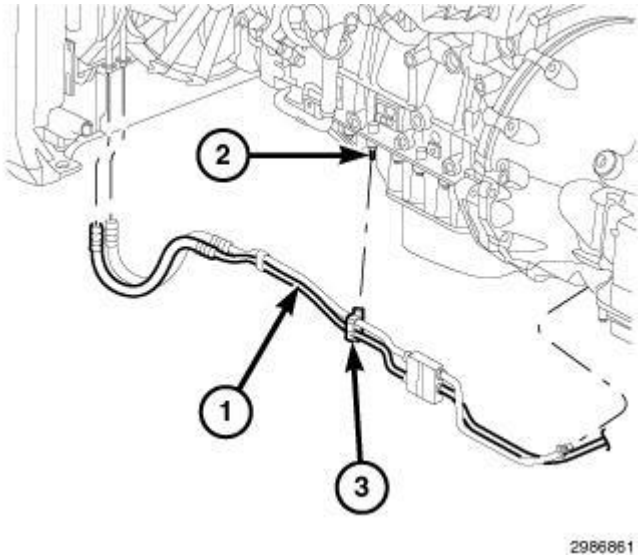

Fig. 230: Transmission Cooler Line, Oil Pan Stud & Clip
Courtesy of CHRYSLER LLC

NOTE: The plastic clip that secures the transmission oil cooler lines to oil pan stud/bolt is a one time use clip that need to be replace each time the line is removed.

5. On automatic transmission models, install the transmission cooler line (1) to the oil pan stud (2) using a new clip (3).

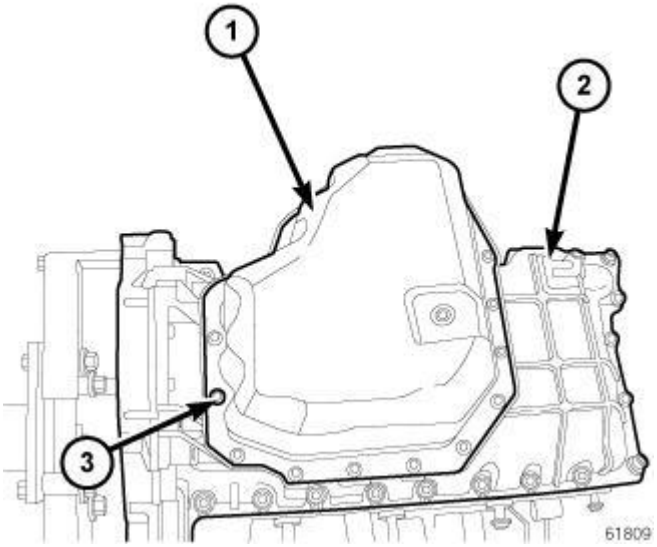

Fig. 231: Lower Oil Pan
Courtesy of CHRYSLER LLC

6. Install the oil dip stick. Tighten lower bolt to 11 N.m (97 in. lbs.).
7. Install the Crankshaft Position (CKP) sensor. Refer to **SENSOR, Crankshaft Position , Installation** .
8. Install the lower oil pan. Refer to **PAN, Oil , Installation**.
9. Refill engine with recommended oil.
10. Connect negative battery cable.
11. Start engine and check for leaks.

LOWER OIL PAN

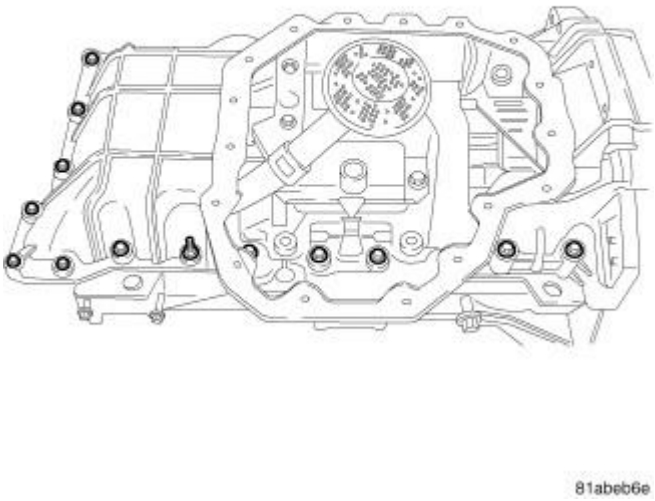

Fig. 232: Upper Oil Pan Bolts
Courtesy of CHRYSLER LLC

1. Clean the lower oil pan gasket sealing surfaces.

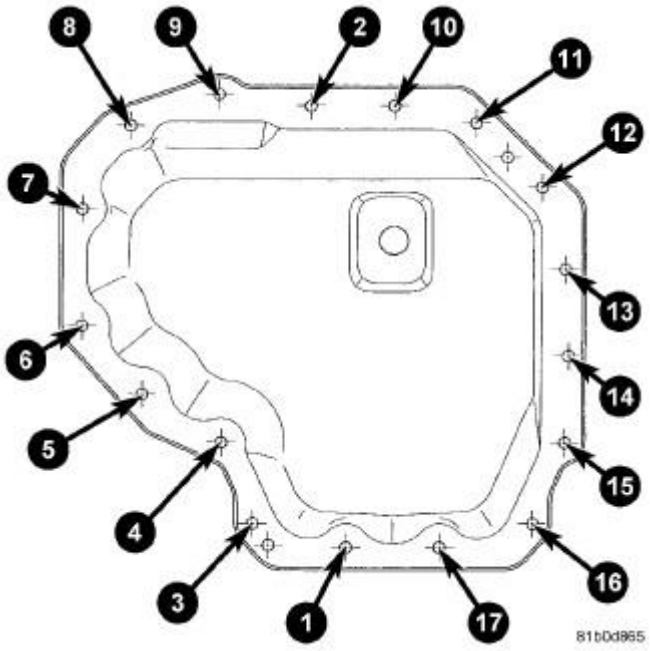

Fig. 233: Lower Oil Pan Bolts Tightening Sequence
Courtesy of CHRYSLER LLC

2. Using a new gasket, position the lower oil pan and install No. one and No. two bolts into the lower oil pan, then follow the sequence for the remaining bolts.

3. Using the sequence shown in illustration, tighten bolts in to 15 N.m (133 in. lbs.).
4. Loosen the oil pan bolts 90 degrees.
5. Using the sequence shown in illustration, tighten the oil pan bolts in to 15 N.m (133 in. lbs.).
6. Lower the engine and remove the Engine Support Fixture (special tool #8534B, Fixture, Driveline Support).
7. Install the viscous fan. Refer to **FAN, Cooling, Electric , Installation** .
8. Install the bolt to the left engine nut. Tighten nut to 54 N.m (40 ft. lbs.).
9. Install the bolt to the right engine nut. Tighten nut to 54 N.m (40 ft. lbs.).
10. On 4x4 models, Install the front axle. Refer to **Installation** .
11. Install the upper dipstick bolt. Tighten bolt to 11 N.m (97 in. lbs.).
12. Install the air cleaner body. Refer to **BODY, Air Cleaner , Installation**.
13. Fill the engine with recommended oil to proper level. Refer to **Capacities and Recommended Fluids , Specifications** .
14. Install the engine cover.
15. Connect the negative battery cable.
16. Start engine and check for leaks.

PICK-UP, OIL PUMP

Removal

Removal

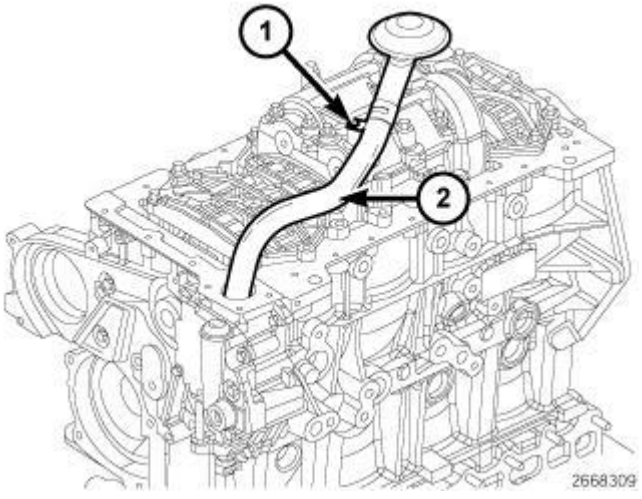

Fig. 234: Oil Pump Pickup Tube & Bolt
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the upper oil pan Refer to **PAN, Oil , Removal**.

3. Remove bolt (1) and the oil pump pickup tube (2) from engine block.
4. Remove and discard O-rings.

Installation

Installation

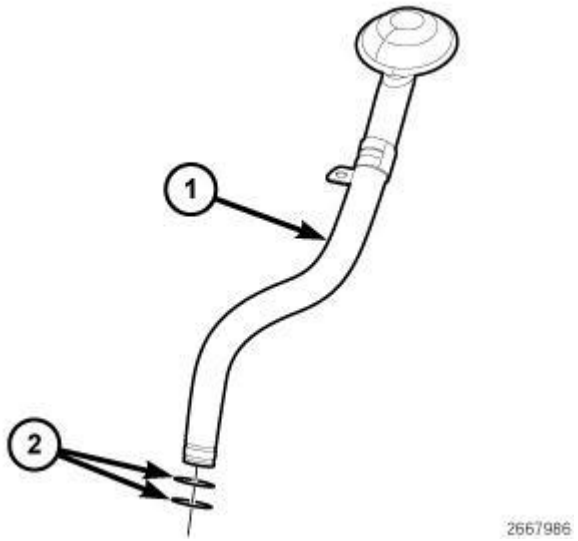

Fig. 235: Oil Pickup Tube & O-Rings
Courtesy of CHRYSLER LLC

1. Lubricate and install two new O-rings (2) on oil pickup tube (1).

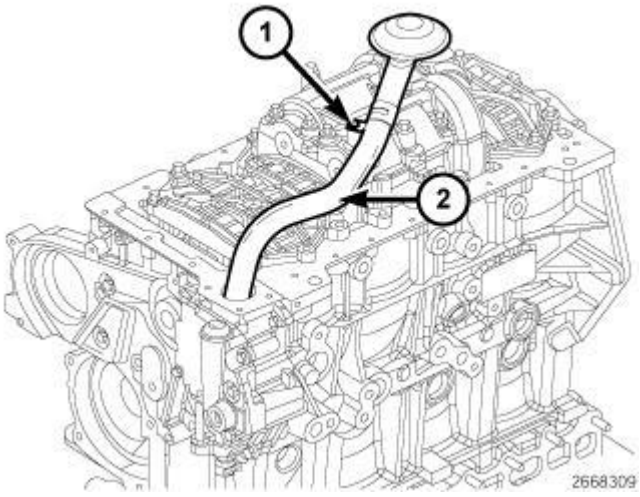

Fig. 236: Oil Pump Pickup Tube & Bolt
Courtesy of CHRYSLER LLC

2. Install the oil pickup tube into engine block. Tighten bolt to 15 N.m. (133 in. lbs.).

3. Install the upper oil pan. Refer to **PAN, Oil , Installation**.
4. Connect the negative battery cable.

PUMP, ENGINE OIL

Removal

REMOVAL

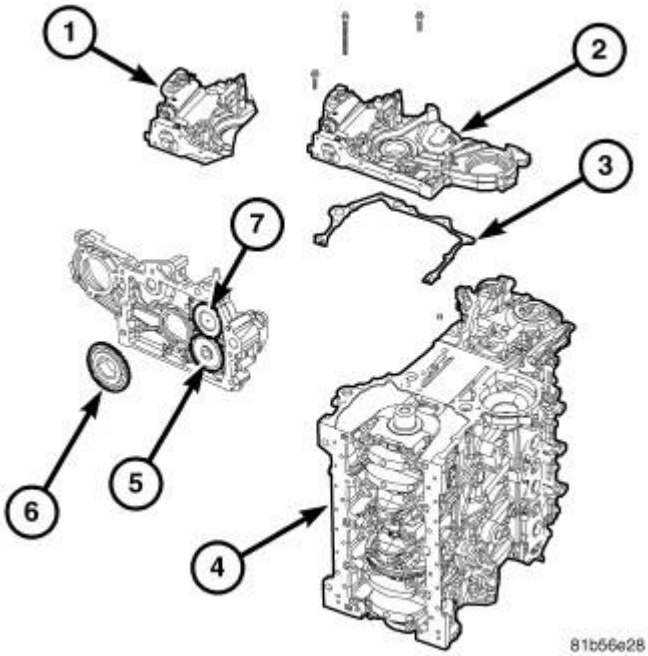

Fig. 237: Vacuum Pump And Oil Pump Assembly
Courtesy of CHRYSLER LLC

NOTE: The oil pump is not a serviceable part. If oil pump failure has occurred or diagnosis led you to replace the oil pump, then the front cover will have to be replaced.

1. Disconnect the negative battery cable.
2. Remove the front cover. Refer to **COVER, Engine, Front , Removal**.

Installation

INSTALLATION

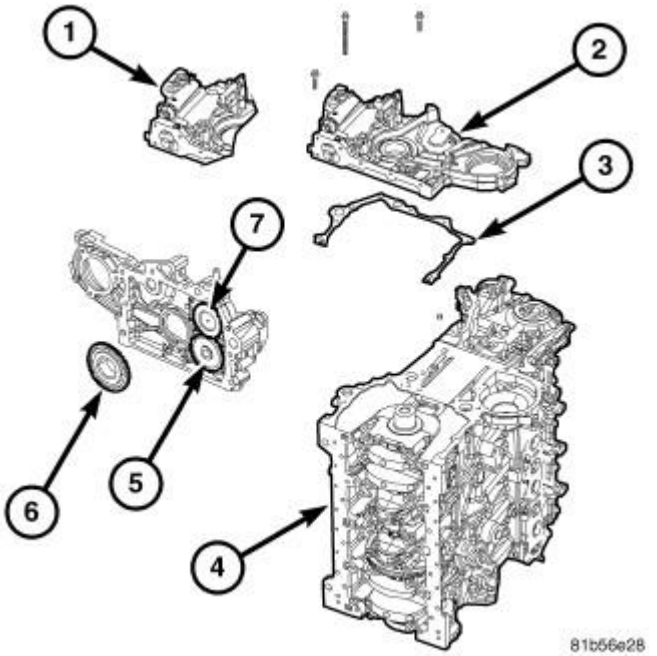

Fig. 238: Vacuum Pump And Oil Pump Assembly
Courtesy of CHRYSLER LLC

1. Clean the gasket surfaces and sealing areas.
2. Lubricate oil pump rotor with engine oil.
3. Install front cover assembly. Refer to **COVER, Engine, Front , Installation**.
4. Connect the negative battery cable.

SENSOR, OIL PRESSURE

Description

DESCRIPTION

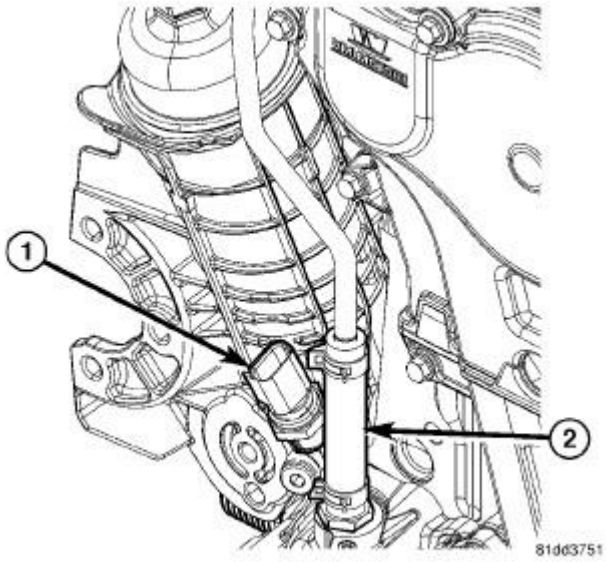

Fig. 239: Oil Pressure Sending Unit
Courtesy of CHRYSLER LLC

The oil pressure sending unit uses three circuits. They are:

- A signal circuit to the ECM.
- A sensor ground circuit through the ECM.
- A 5 volt reference circuit from the ECM.

The oil pressure sending unit returns a voltage signal back to the ECM relating oil pressure. Ground for the sensor is supplied by the ECM.

The oil pressure switch (1) is located on the right side of the engine block. The switch screws into the engines main oil gallery.

Removal

REMOVAL

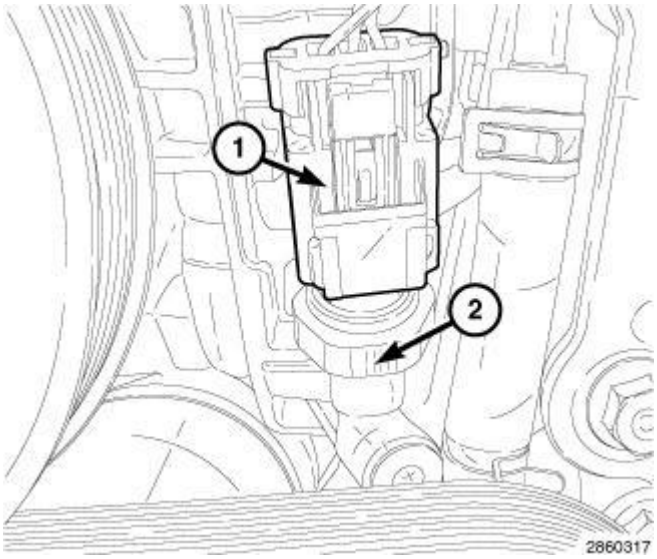

Fig. 240: Oil Pressure Switch Harness Connector & Oil Pressure Switch
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Disconnect the oil pressure switch harness connector (1).
3. Remove the oil pressure switch (2).

Installation

INSTALLATION

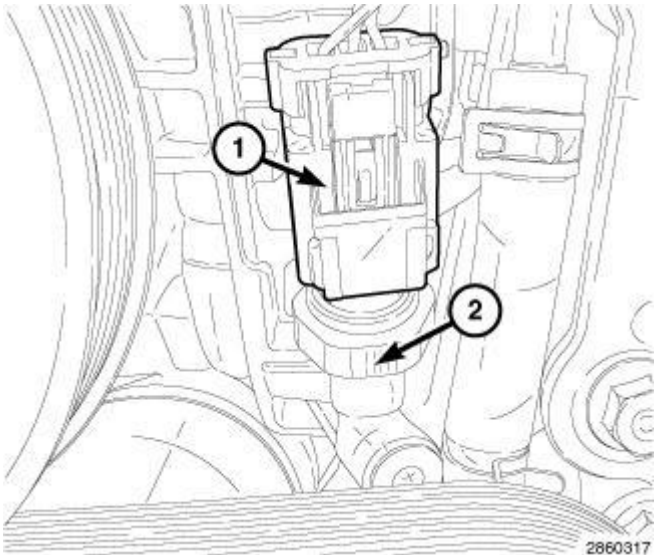

Fig. 241: Oil Pressure Switch Harness Connector & Oil Pressure Switch
Courtesy of CHRYSLER LLC

1. Install the oil pressure switch (2). Tighten to 20 N.m (177 in. lbs.).
2. Connect the oil pressure switch harness connector (1).

3. Connect the negative battery cable.
4. Start engine and check for oil leaks.

SENSOR, OIL TEMPERATURE

Description

DESCRIPTION

The oil temperature sensor is located on the oil filter housing next to the engine oil cooler.

Removal

REMOVAL

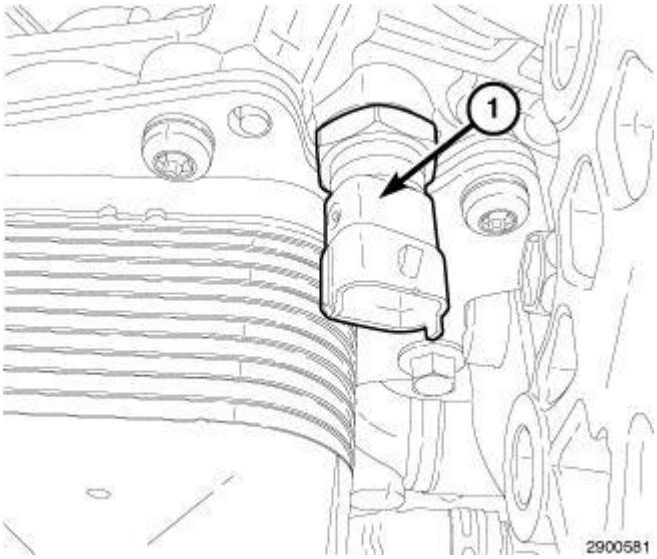

Fig. 242: Oil Temperature Sensor
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Disconnect the oil temperature sensor harness connector.
3. Remove the oil temperature sensor (1).

Installation

INSTALLATION

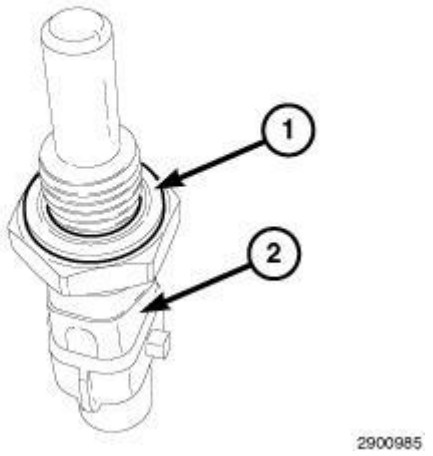

Fig. 243: Temperature Sensor & Sealing Washer
Courtesy of CHRYSLER LLC

1. Using a new sealing washer (1) , install the temperature sensor (2). Tighten to 20 N.m (177 in. lbs.).
2. Connect the temperature sensor harness connector
3. Connect the negative battery cable.
4. Start engine and check for oil leaks.

SEPARATOR, OIL

Removal

REMOVAL

1. Disconnect the negative battery cable.
2. Remove engine cover.
3. Remove the four retainers and the engine silencer.
4. Remove the cylinder head cover. Refer to **COVER(S), Cylinder Head , Removal**.

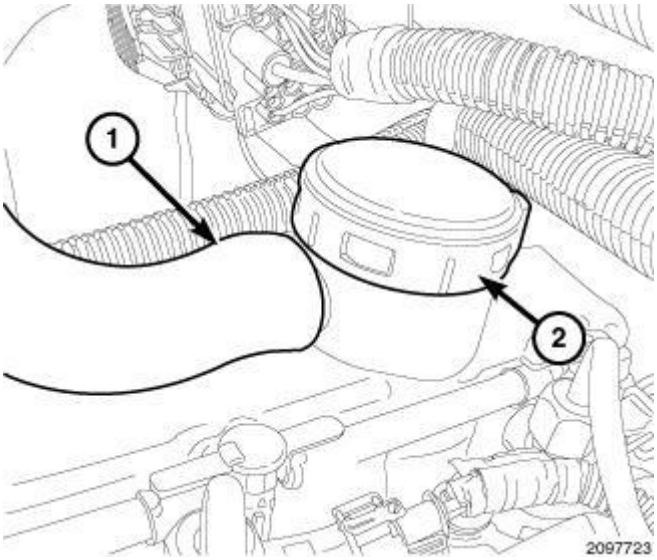

Fig. 244: Crankcase Vent Hose & Oil Separator
Courtesy of CHRYSLER LLC

5. Remove the oil separator cover (2).

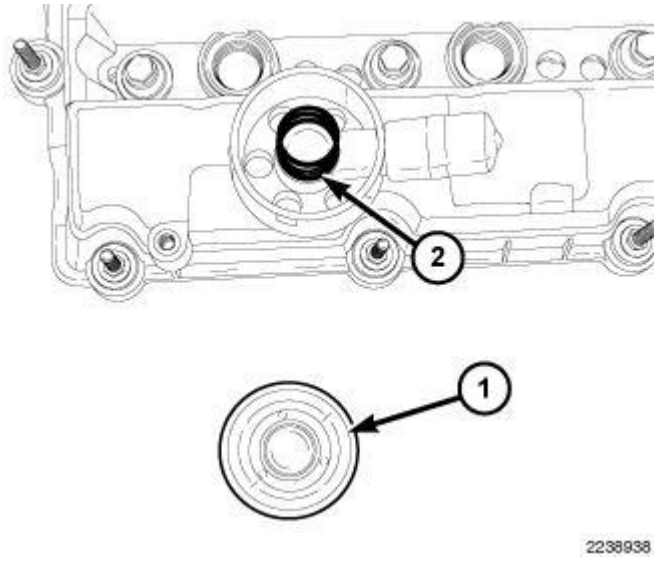

Fig. 245: Diaphragm & Diaphragm Spring
Courtesy of CHRYSLER LLC

6. Remove diaphragm (1) and the diaphragm spring (2).

Installation

INSTALLATION

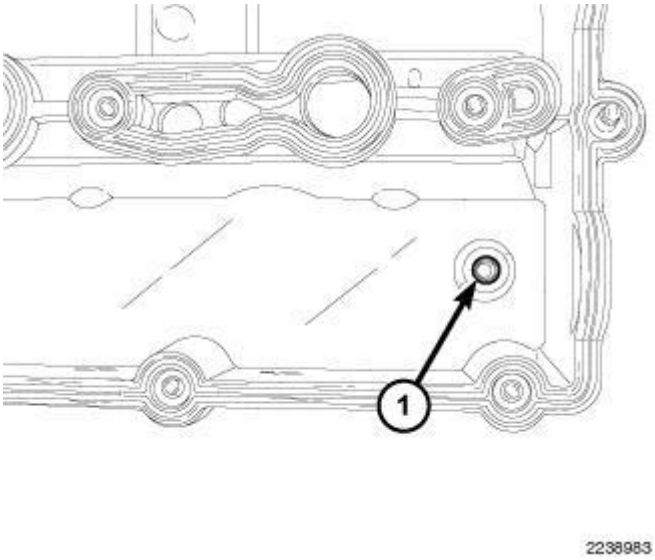

Fig. 246: Oil Drain Back Access Hole
Courtesy of CHRYSLER LLC

1. Inspect the oil drain back access hole (1) in the cylinder head cover to assure that it is free of obstruction.

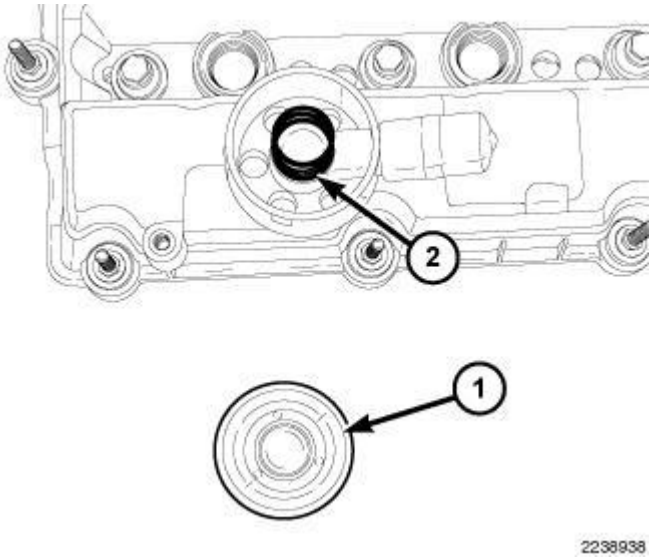

Fig. 247: Diaphragm & Diaphragm Spring
Courtesy of CHRYSLER LLC

2. Lubricate the oil separator O-ring with clean engine oil.
3. Install the diaphragm spring (2) and the diaphragm (1).

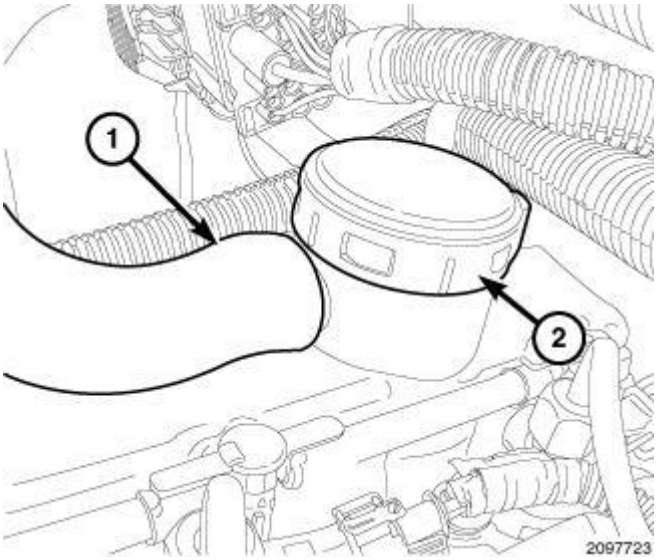

Fig. 248: Crankcase Vent Hose & Oil Separator
Courtesy of CHRYSLER LLC

4. Carefully position and push down on the oil separator (2) to seat.
5. Install the cylinder head cover. Refer to **COVER(S), Cylinder Head , Installation**.
6. Install the silencer and the four retainers.
7. Install the engine cover.
8. Connect negative battery cable.

VALVE, OIL PRESSURE RELIEF

Description

DESCRIPTION

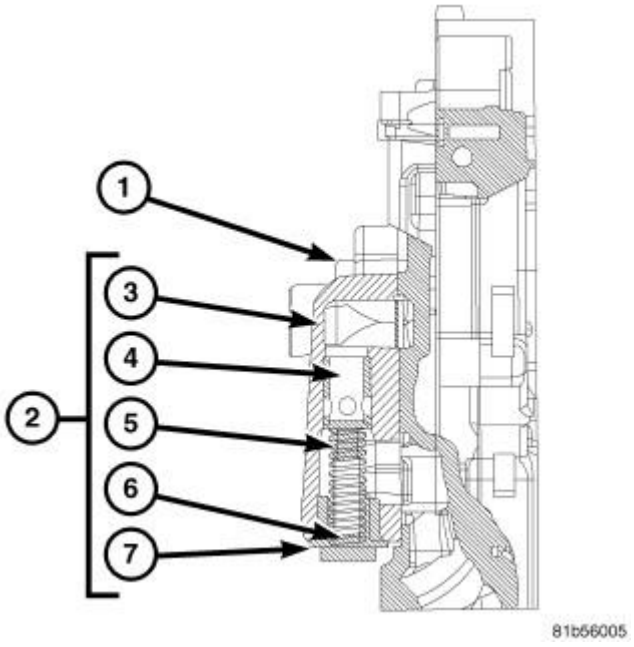

Fig. 249: Oil Pressure Relief Valve Components
Courtesy of CHRYSLER LLC

The oil pressure relief valve is build into the front cover (1). The oil pressure relief valve assembly (2) consists of several components. The plunger (4) is held in place by the spring (5). The plug (6) keeps the plug and spring in place, and the o-ring (7) prevents oil from leaking past the plug (6).

In the case of excessively high oil pressure, the oil pressure on the piston (4) overcomes the spring (5) pressure and the piston is forced off its seat. When the piston is forced off its seat, a drain back passage is opened and the excess oil pressure is vented back into the crankcase.

MANIFOLDS

MANIFOLD, EXHAUST

Removal

REMOVAL

1. Disconnect the negative battery cable.
2. Remove the engine cover.
3. Remove the four retainers and the engine silencer.

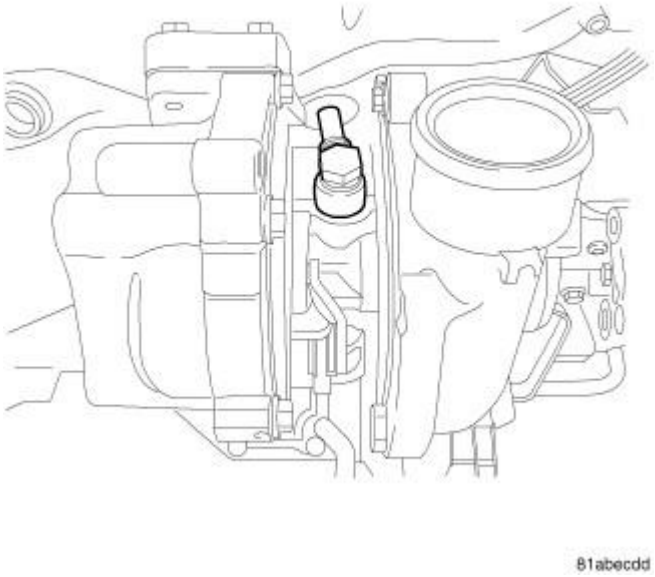

Fig. 250: Turbocharger Feed Line
Courtesy of CHRYSLER LLC

4. Remove the turbocharger. Refer to **Turbocharger System , Removal**.

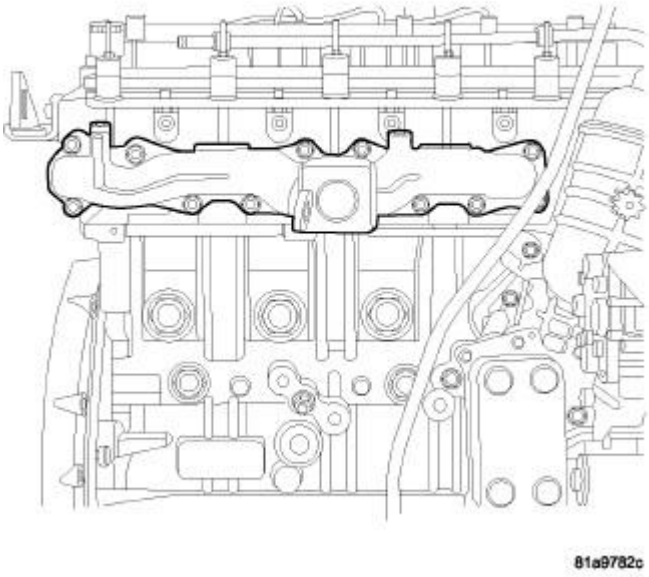

Fig. 251: Exhaust Manifold
Courtesy of CHRYSLER LLC

5. Remove nuts and the exhaust manifold.

6. Remove and discard the exhaust manifold gasket.

Installation

INSTALLATION

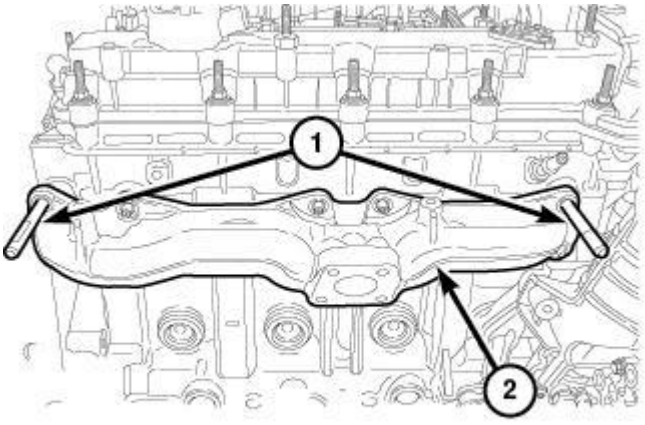

Fig. 252: Exhaust Manifold Alignment Tools & Exhaust Manifold
Courtesy of CHRYSLER LLC

1. Clean and inspect the gasket surface of the exhaust manifold and cylinder head.
2. Install a new exhaust manifold gasket.
3. Install the (special tool #VM.10334, Tool, Exhaust Manifold Alignment) (1).
4. Install the exhaust manifold (2) and tighten nuts finger tight.
5. Remove the (special tool #VM.10334, Tool, Exhaust Manifold Alignment) (1). Install and tighten nuts finger tight.

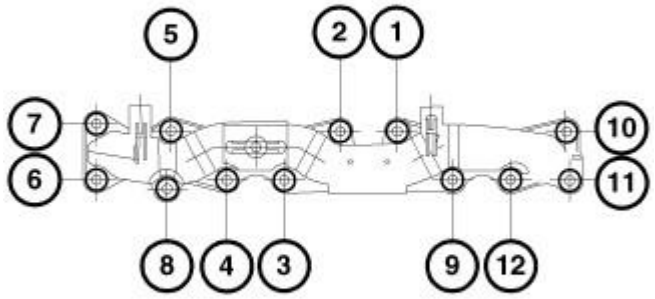

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Fig. 253: Exhaust Manifold Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

6. Using the sequence shown in illustration, Tighten the exhaust manifold nuts to 36 N.m (27 ft. lbs.).
7. Repeat the same tightening procedure again.

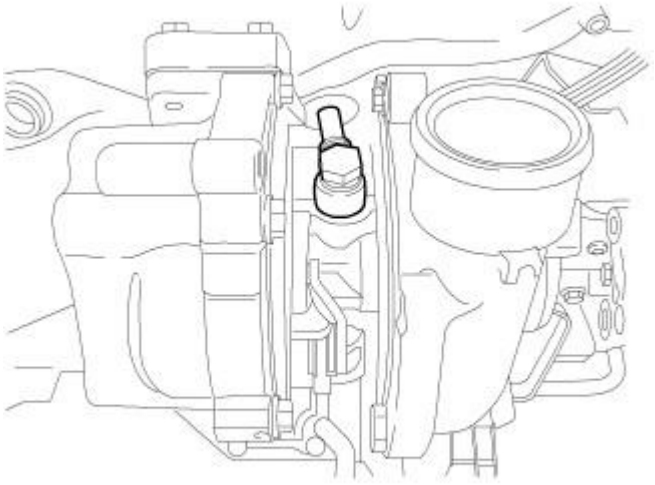

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Fig. 254: Turbocharger Feed Line
Courtesy of CHRYSLER LLC

8. Install the turbocharger. Refer to **Turbocharger System , Installation**.

9. Install the inlet air tube to the turbocharger.
10. Install the air cleaner body. Refer to **BODY, Air Cleaner , Installation**.
11. Install the engine silencer and securely tighten retainers.
12. Install the engine cover.
13. Connect the negative battery cable.

MANIFOLD, INTAKE

Removal

REMOVAL

1. Disconnect the negative and positive battery cable.
2. Remove the battery.
3. Remove the engine cover.
4. Remove four retainers and the engine silencer.
5. Drain the coolant. Refer to **Standard Procedure** .
6. Remove lower radiator hose clip at fan shroud.
7. On 4x4 models, remove the front axle. Refer to **Removal** .
8. Remove the starter. Refer to **STARTER , Removal** .
9. Remove bolt and position aside the ground and starter harness cables.
10. Disconnect upper radiator hose from thermostat housing.
11. Remove the EGR cooler. Refer to **COOLER, EGR, 2.8L Diesel [ENS] , Removal** .
12. Remove the EGR airflow control valve. Refer to **VALVE, Exhaust Gas Recirculation (EGR) Airflow Control , Removal** .
13. Remove the Charge Air Cooler (CAC) hose.
14. Remove nut and the A/C suction line support bracket to valve cover.
15. Remove the wire harness loom clip from front of valve cover.

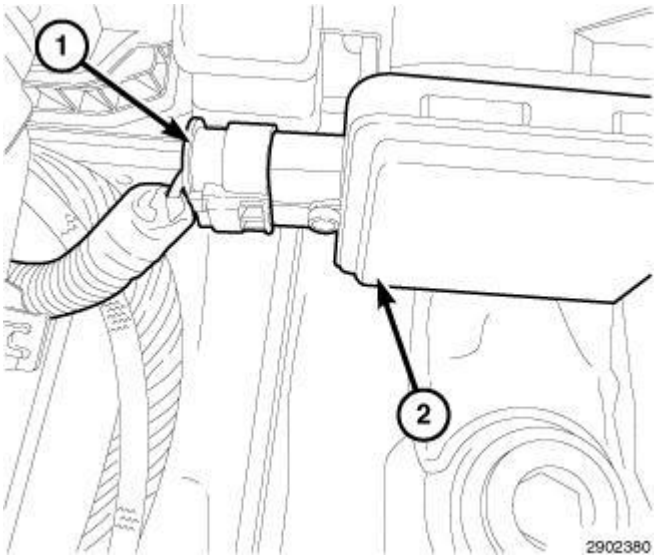

Fig. 255: Tuning Valve Harness Connector
Courtesy of CHRYSLER LLC

16. Disconnect the tuning valve harness connector (1).

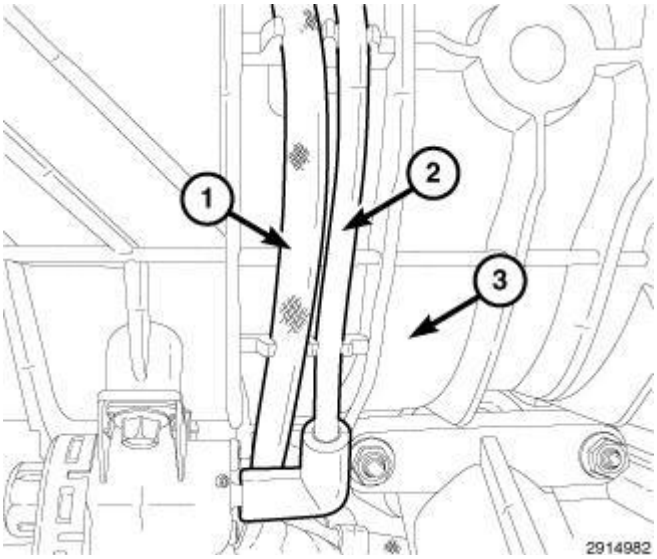

Fig. 256: Fuel Injector Return Line, Vacuum Line & Intake Manifold
Courtesy of CHRYSLER LLC

17. Disconnect the fuel injector return line (1) from intake manifold (3).
18. Disconnect the vacuum line (2) from vacuum solenoid and intake manifold (3).

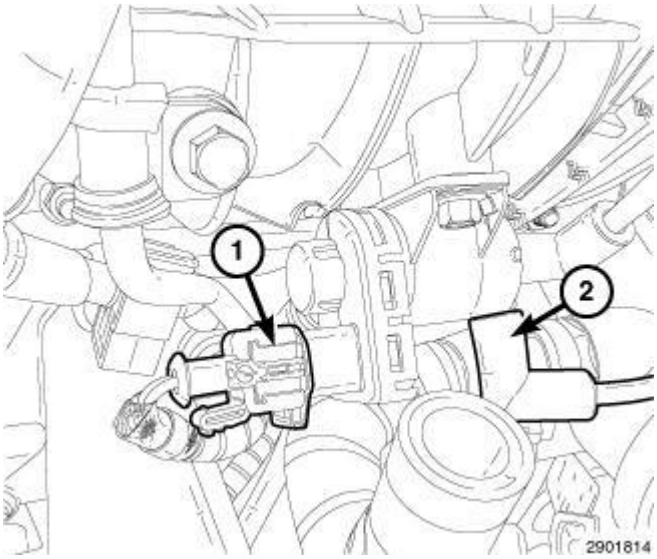

Fig. 257: Vacuum Solenoid Harness Connector
Courtesy of CHRYSLER LLC

19. Disconnect the vacuum solenoid harness connector (1).

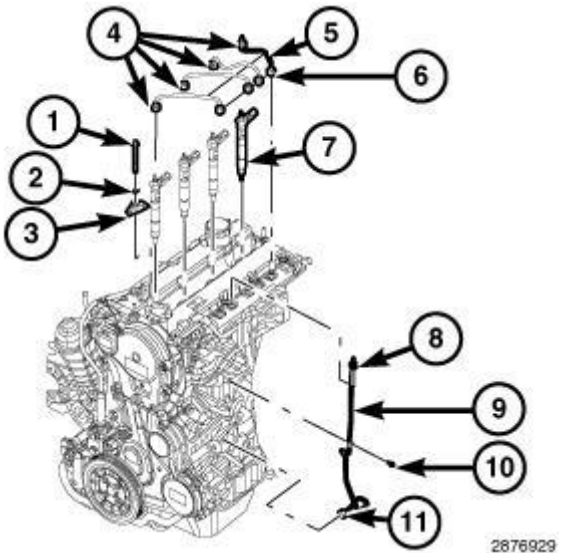

Fig. 258: Fuel Rail & Fuel Injector Components
Courtesy of CHRYSLER LLC

NOTE: High pressure fuel lines must be replaced with new lines any time they are removed. Also, protective caps should be installed on the fuel injector any time the lines are removed.

20. Remove the fuel tubes. Refer to **TUBE(S), Fuel , Removal** .

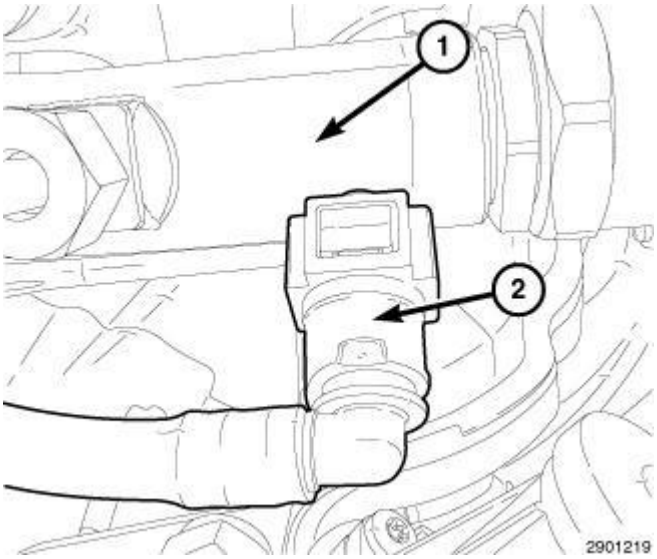

Fig. 259: Fuel Return & Fuel Rail
Courtesy of CHRYSLER LLC

21. Disconnect the fuel return line (2) from fuel rail (1).

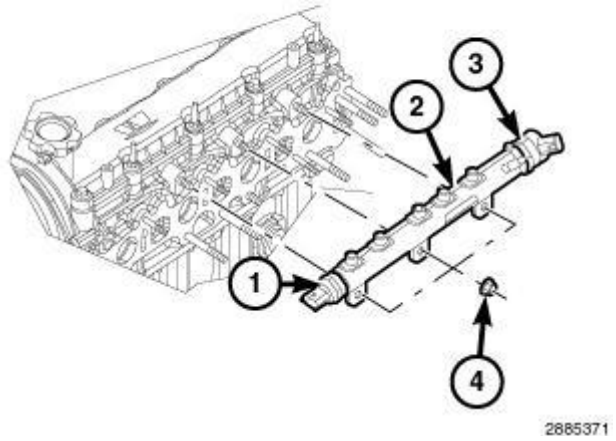

Fig. 260: Fuel Rail Pressure Sensor, Fuel Rail, Pressure Solenoid & Nuts
Courtesy of CHRYSLER LLC

22. Disconnect the fuel rail pressure sensor (1) and pressure solenoid (3).
23. Remove nuts (4) the fuel rail (2).

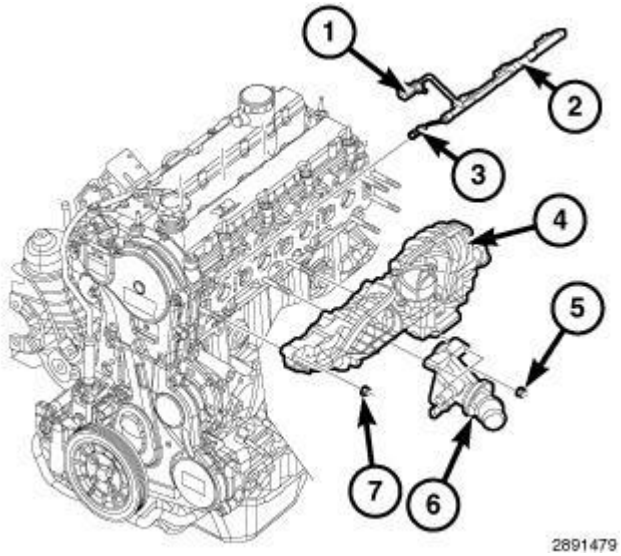

Fig. 261: Glow Plug Wire Harness Clip, Wire Harness, Glow Plugs, Intake Manifold, Thermostat Housing & Bolts
Courtesy of CHRYSLER LLC

24. Remove the glow plug wire harness clip (1) from generator mounting bracket.
25. Disconnect glow plugs (3) and remove the wire harness (2).
26. Remove nuts (5) and the (6).
27. Remove nuts (7) and the intake manifold (4).
28. Remove the intake manifold gasket.

Installation

INSTALLATION

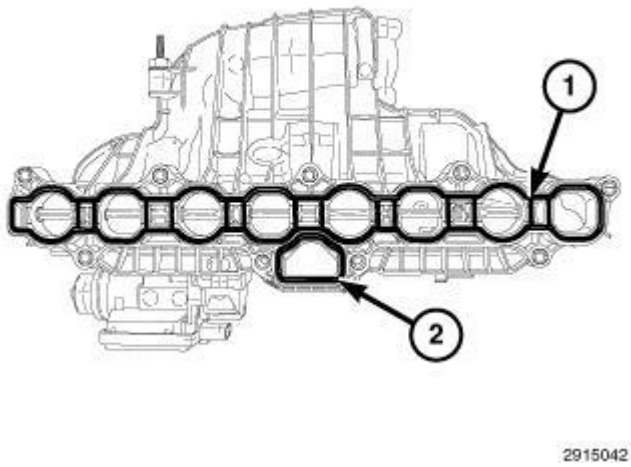

Fig. 262: Intake Manifold Gasket & Water Jacket Gasket
Courtesy of CHRYSLER LLC

1. Clean and inspect the gasket surface area of the intake manifold and the cylinder head.
2. Install a new intake manifold gasket (1) and water jacket gasket (2).

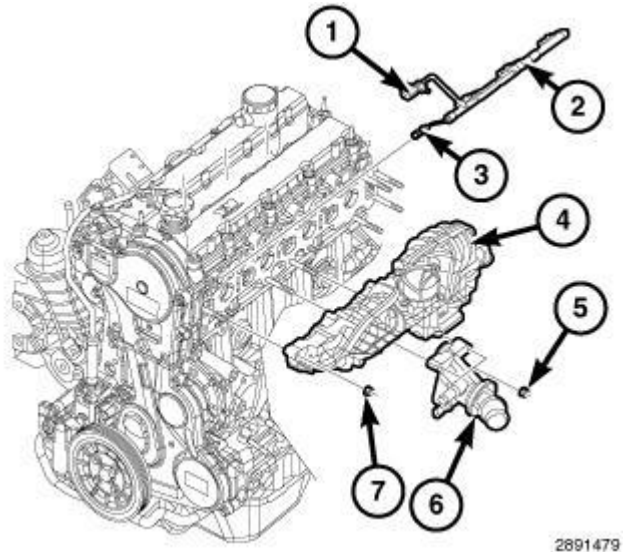

Fig. 263: Glow Plug Wire Harness Clip, Wire Harness, Glow Plugs, Intake Manifold, Thermostat Housing & Bolts
Courtesy of CHRYSLER LLC

3. Install the intake manifold (4) and thermostat housing (6).

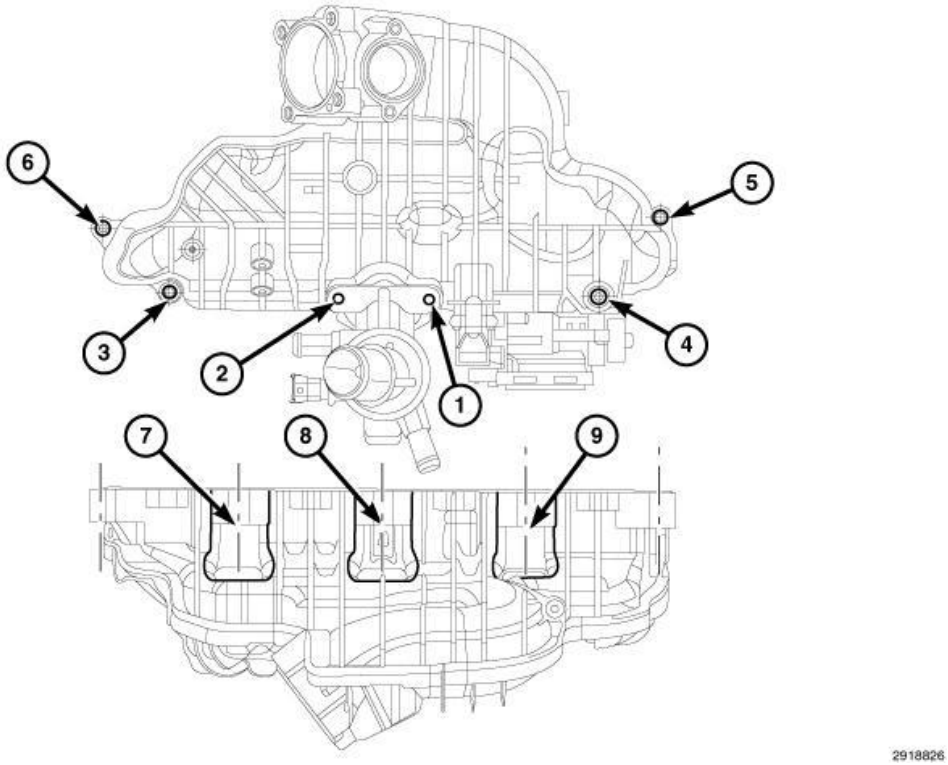

Fig. 264: Intake Manifold Retaining Nuts Tightening Sequence

Courtesy of CHRYSLER LLC

4. Install the intake manifold retaining nuts. Using the tightening sequence shown in illustration, tighten nuts 5, 1, 2, 6 to 5 N.m (44 in. lbs.).
5. Using the tightening sequence shown in illustration, tighten nuts 1 through 9 to 12 N.m (106 in. lbs.).

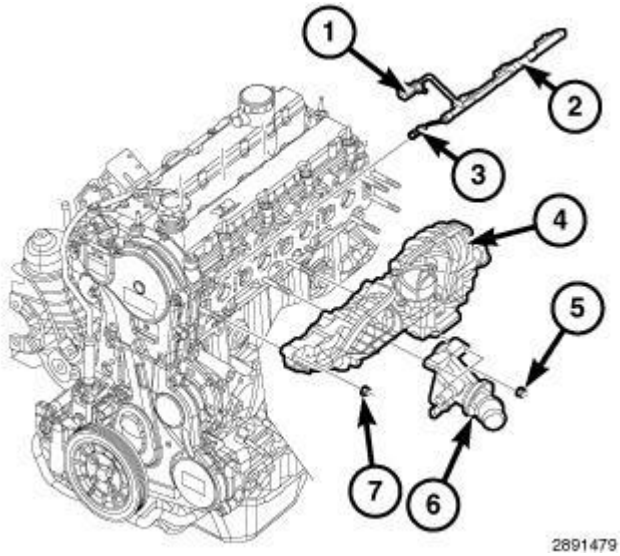

Fig. 265: Glow Plug Wire Harness Clip, Wire Harness, Glow Plugs, Intake Manifold, Thermostat Housing & Bolts
Courtesy of CHRYSLER LLC

6. Position the wire harness (2) and connect glow plugs (3).
7. Install the glow plug wire harness clip (1) to the generator mounting bracket.

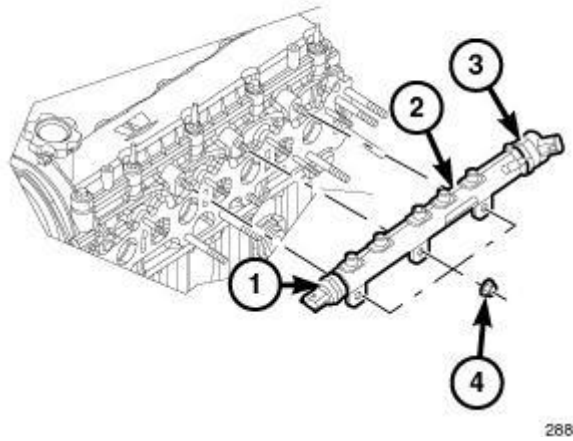

Fig. 266: Fuel Rail Pressure Sensor, Fuel Rail, Pressure Solenoid & Nuts
Courtesy of CHRYSLER LLC

8. Install the fuel rail (2). Tighten nuts (4) to 24 N.m (18 ft. lbs.).
9. Connect the fuel rail pressure sensor (1) and pressure solenoid (3).

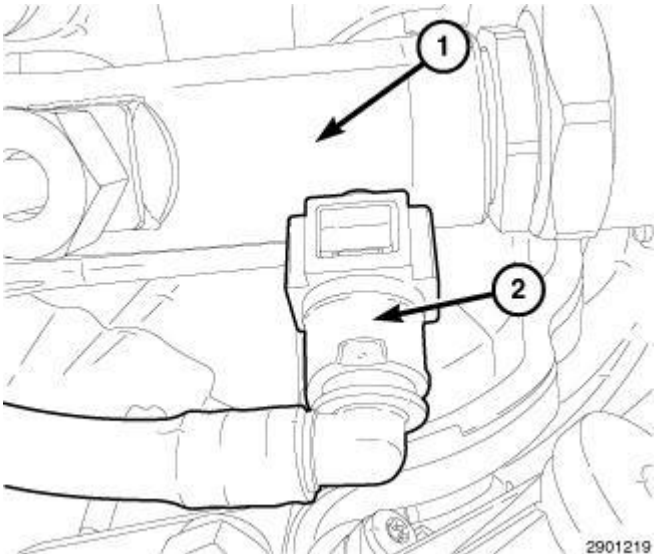

Fig. 267: Fuel Return & Fuel Rail
Courtesy of CHRYSLER LLC

10. Connect the fuel return line (2) onto fuel rail (1).

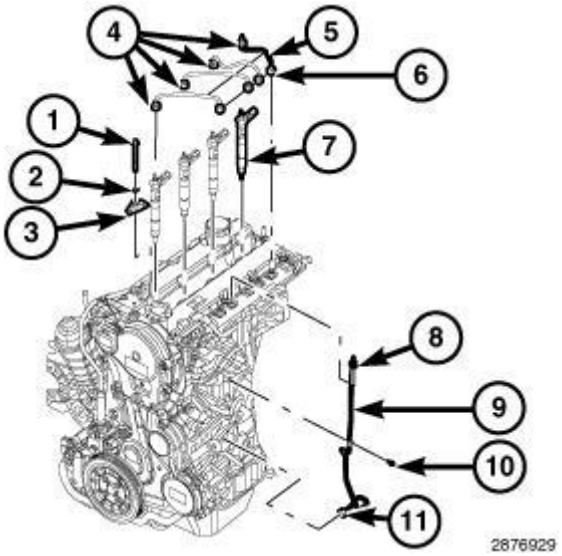

Fig. 268: Fuel Rail & Fuel Injector Components
Courtesy of CHRYSLER LLC

NOTE: High pressure fuel lines must be replaced with new lines any time they are removed. Also, protective caps should be installed on the fuel injector any time the lines are removed.

11. Install the fuel tubes. Refer to **TUBE(S), Fuel , Installation** .

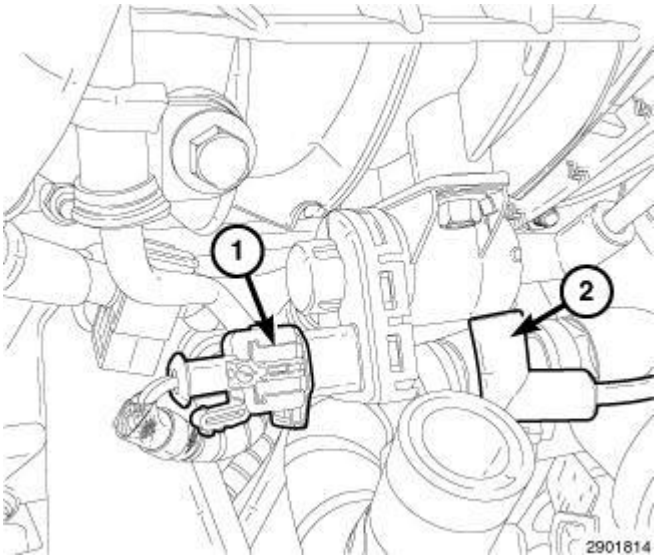

Fig. 269: Vacuum Solenoid Harness Connector
Courtesy of CHRYSLER LLC

12. Connect the vacuum solenoid harness connector (1).

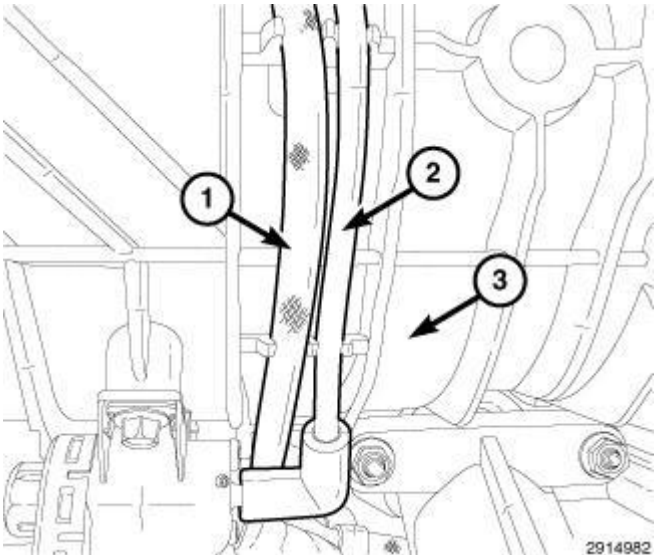

Fig. 270: Fuel Injector Return Line, Vacuum Line & Intake Manifold
Courtesy of CHRYSLER LLC

13. Connect the vacuum line (2) to the vacuum solenoid and intake manifold (3)
14. Connect the fuel injector return line (1) to the intake manifold (3).

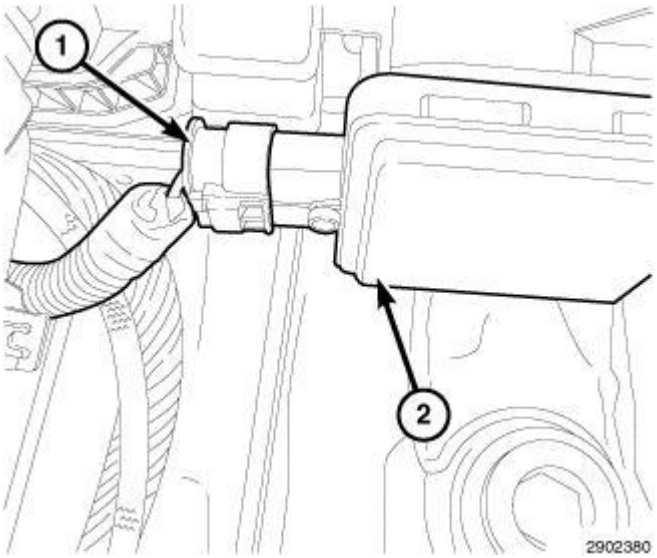

Fig. 271: Tuning Valve Harness Connector
Courtesy of CHRYSLER LLC

15. Connect the tuning valve harness connector (1).
16. Install the wire harness loom clip to front of valve cover.
17. Install the A/C suction line support bracket to valve cover and securely tighten nut.
18. Install the Charge Air Cooler (CAC) hose.
19. Install the EGR airflow control valve. Refer to **VALVE, Exhaust Gas Recirculation (EGR) Airflow Control , Installation** .
20. Install the EGR cooler. Refer to **COOLER, EGR, 2.8L Diesel [ENS] , Installation** .
21. Connect upper radiator hose from thermostat housing.
22. Position the ground and starter harness cables and tighten bolt.
23. Install the starter. Refer to **STARTER , Installation** .
24. On 4x4 models, Install the front axle. Refer to **Installation** .
25. Install the lower radiator hose clip to fan shroud.
26. Fill the coolant. Refer to **Standard Procedure** .
27. Install the engine silencer and the four retainers.
28. Install the engine cover.
29. Install the battery
30. Connect the positive and negative battery cable.

TURBOCHARGER SYSTEM

DESCRIPTION

DESCRIPTION

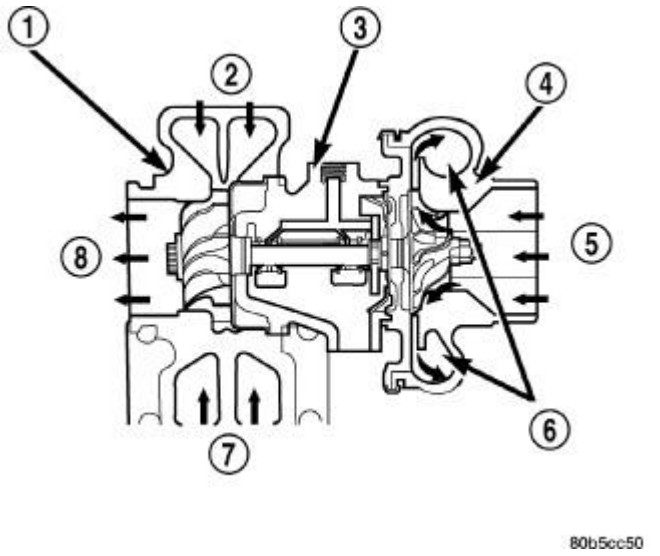

Fig. 272: Turbocharger Operation
Courtesy of CHRYSLER LLC

1 - TURBINE SECTION
2 - EXHAUST GAS
3 - BEARING HOUSING
4 - COMPRESSOR SECTION
5 - INLET AIR
6 - COMPRESSED AIR TO ENGINE
7 - EXHAUST GAS
8 - EXHAUST GAS TO EXHAUST PIPE

CAUTION: The turbocharger is a performance part and must not be tampered with. The wastegate bracket is an integral part of the turbocharger. Tampering with the wastegate components can reduce durability by increasing cylinder pressure and thermal loading due to incorrect inlet and exhaust manifold pressure. Poor fuel economy and failure to meet regulatory emissions laws may result. Increasing the turbocharger boost WILL NOT increase engine power.

The turbocharger is an exhaust-driven supercharger which increases the pressure and density of the air entering the engine through the charge air cooler. With the increase of air entering the engine, more fuel can be injected into the cylinders, which creates more power during combustion.

The turbocharger assembly consists of four (5) major component systems Refer to**Fig. 272**.

- Turbine section
- Compressor section
- Bearing housing
- Variable veins

- Actuator

OPERATION

OPERATION

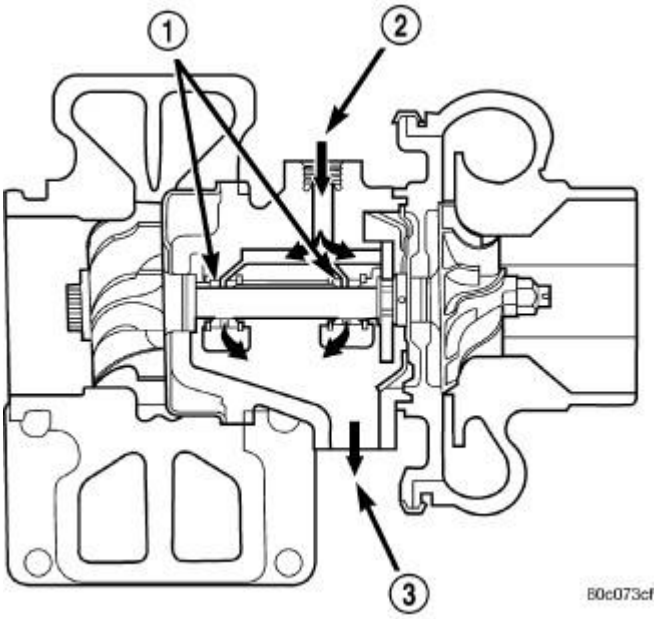

Fig. 273: Turbocharger Oil Supply & Drain
Courtesy of CHRYSLER LLC

1 - BEARINGS
2 - OIL SUPPLY (FROM ENGINE BLOCK)
3 - OIL RETURN (TO OIL PAN)

Exhaust gas pressure and energy drive the turbine, which in turn drives a centrifugal compressor that compresses the inlet air, and forces the air into the engine through the charge air cooler and plumbing. Since heat is a by-product of this compression, the air must pass through a charge air cooler to cool the incoming air and maintain power and efficiency.

Increasing air flow to the engine provides:

- Improved engine performance
- Lower exhaust smoke density
- Improved operating economy
- Altitude compensation
- Noise reduction.

The turbocharger is lubricated by engine oil that is pressurized, cooled, and filtered. The oil is delivered to the turbocharger by a supply line (2) that is tapped into the engine block. The oil travels into the bearing housing,

where it lubricates the shaft (1) and bearings. Refer to **Fig. 273**. A return pipe (3) at the bottom of the bearing housing, routes the engine oil back to the crankcase.

The most common turbocharger failure is bearing failure related to repeated hot shutdowns with inadequate "cool-down" periods. A sudden engine shut down after prolonged operation will result in the transfer of heat from the turbine section of the turbocharger to the bearing housing. This causes the oil to overheat and break down, which causes bearing and shaft damage the next time the vehicle is started.

Letting the engine idle after extended operation allows the turbine housing to cool to normal operating temperature. The following chart should be used as a guide in determining the amount of engine idle time required to sufficiently cool down the turbocharger before shut down, depending upon the type of driving and the amount of cargo.

TURBOCHARGER "COOL DOWN" CHART			
Driving Condition	**Load**	**Turbocharger Temperature**	**Idle Time (in minutes) Before Shut Down**
Stop AND Go	Empty	Cool	Less than 1
Stop AND Go	Medium	Warm	1
Highway Speeds	Medium	Warm	2
City Traffic	Max. GCWR	Warm	3
Highway Speeds	Max. GCWR	Warm	4
Uphill Grade	Max. GCWR	Hot	5

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - TURBOCHARGER BOOST PRESSURE

Low turbocharger boost pressure can cause poor engine performance and driveability concerns. The following procedure will test the turbocharger boost pressure.

Causes of low boost pressure include the following:

- Restricted air inlet system
- Leak in charge air cooler system
- Restricted/high pressure drop across charge air cooler
- Damaged turbocharger compressor wheel housing
- Turbocharger wastegate stuck open
- Excessive exhaust restriction

Causes of excessively high boost pressure include:

- Turbocharger wastegate stuck closed
- Turbocharger wastegate signal line leaking or damaged
- Damaged wastegate command valve O-rings

- Wastegate command valve mechanically stuck in actuated position

Several Diagnostic Trouble Codes (DTCs) can be set that will indicate high or low system boost levels. There is a DTC for circuit faults relating to the electronically controlled wastegate command valve.

for diagnosing of low or high boost pressure due to leaks. Refer to **COOLER and HOSES, Charge Air , Diagnosis and Testing**.

REMOVAL

REMOVAL

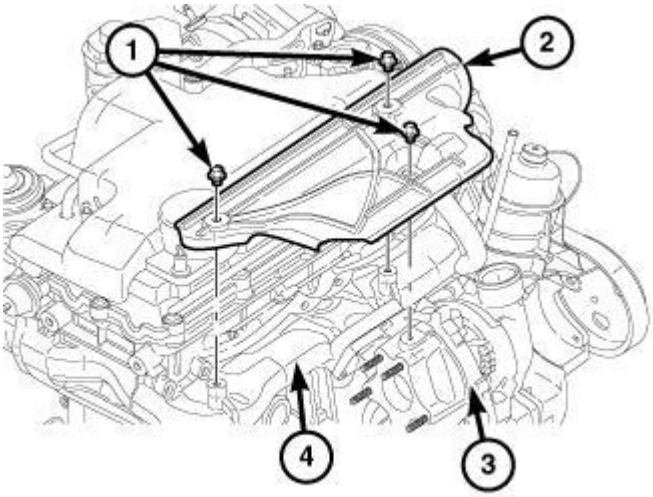

Fig. 274: Exhaust Manifold Heat Shield, Turbocharger, Exhaust Manifold & Fasteners
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove the upper heat shield (2) that covers the exhaust manifold (4) and the turbocharger (3).

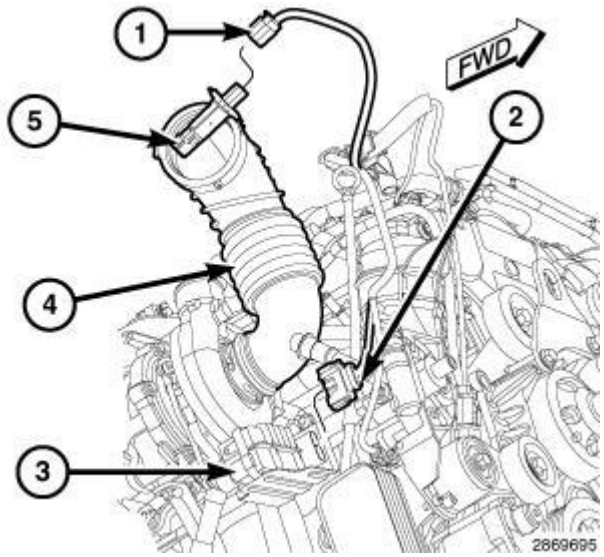

Fig. 275: Air Pressure Sensor Connector, Turbocharger Variable Vane Control Module Connector & Turbocharger Air Inlet Tube
Courtesy of CHRYSLER LLC

3. Remove coolant recovery pressure container. Refer to **BOTTLE, Coolant Recovery , Removal** .
4. Remove the Inlet air pressure sensor (5) wiring harness connector (1).
5. Remove air cleaner assembly. Refer to **BODY, Air Cleaner , Removal**.
6. Remove charge air cooler inlet hose (4) from turbocharger. Refer to **COOLER and HOSES, Charge Air , Removal**.

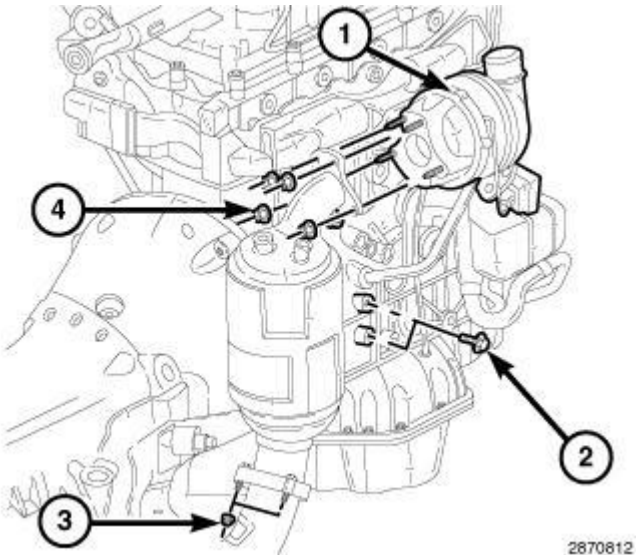

Fig. 276: Turbocharger & Catalytic Converter Fasteners
Courtesy of CHRYSLER LLC

7. Remove the catalytic converter nuts (4) from the turbocharger (1).
8. Remove the catalytic converter support bracket bolts (2).

9. Remove the catalytic converter from the turbocharger and position aside. Discard gasket.

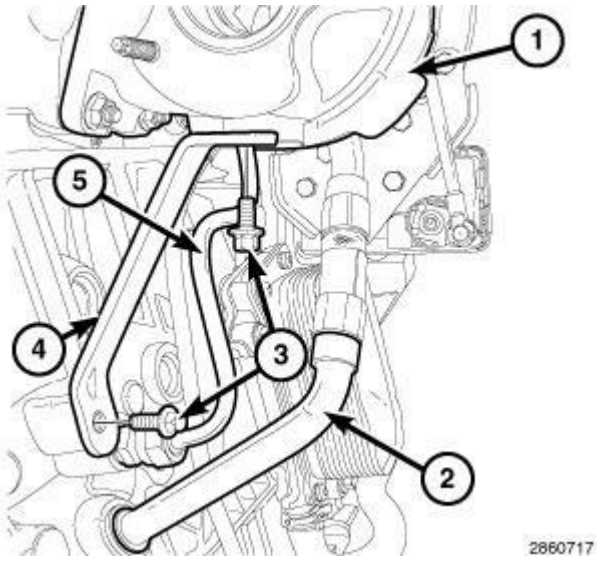

Fig. 277: Turbocharger, Oil Return Line, Oil Supply Line, Turbocharger Support Bracket & Bolts
Courtesy of CHRYSLER LLC

10. Remove the turbocharger support bracket (4).
11. Position a clean container under the turbocharger to collect oil.
12. Remove turbocharger oil return line (2) at the turbocharger.
13. Remove the oil supply line (5) pressure fitting at the engine block.

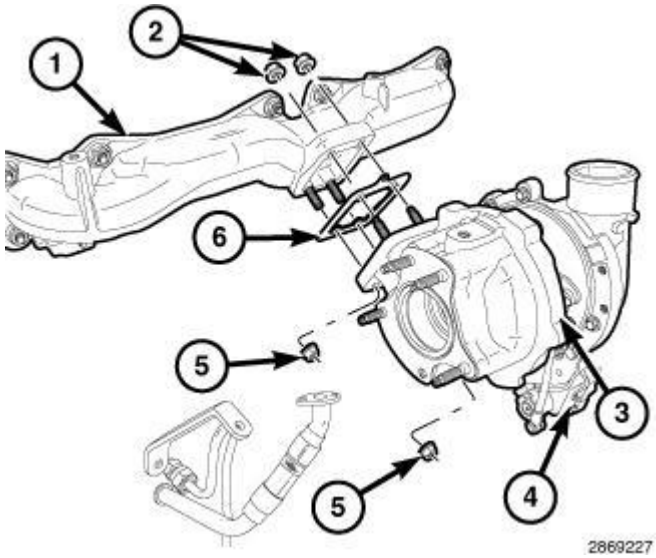

Fig. 278: Exhaust Manifold, Turbocharger, Gasket & Fasteners
Courtesy of CHRYSLER LLC

14. Remove the lower turbocharger to exhaust manifold retaining nuts (5).
15. Remove turbocharger to exhaust manifold upper retaining nuts (2) and separate turbocharger (3) from

exhaust manifold (1).

16. Discard the turbocharger to exhaust manifold gasket (6).
17. Remove the turbocharger oil supply line (2) from the turbocharger (3).

CLEANING

CLEANING

All old gaskets should be inspected for any tears or signs of prior leakage. If any gaskets show such indications, they should be replaced with new gaskets. All gasket mating surfaces must be cleaned of old gasket material to produce a smooth and dirt free sealing surface for the new gasket.

INSTALLATION

INSTALLATION

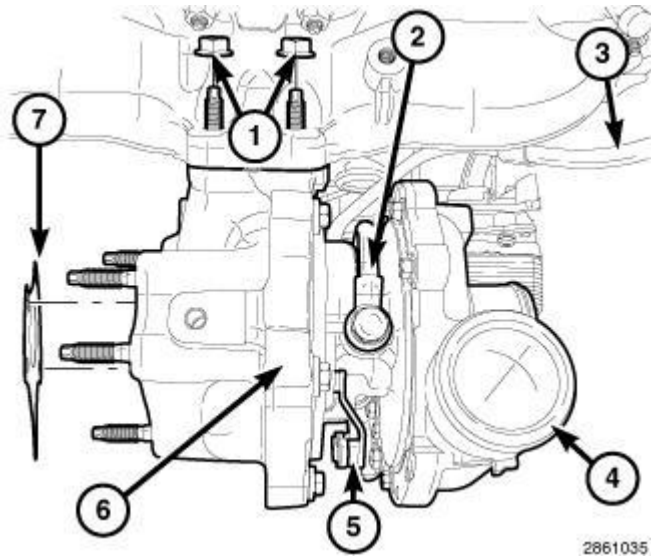

Fig. 279: Turbocharger, Oil Feed Line, Gasket, Banjo Fitting & Fasteners
Courtesy of CHRYSLER LLC

1. Install turbocharger oil feed line (2) to the turbocharger (6). Tighten banjo fitting to 24 N.m (18 ft.lbs.).

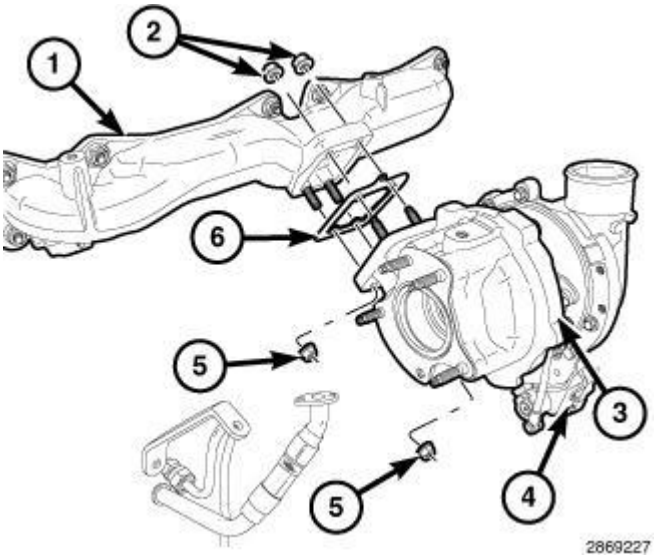

Fig. 280: Exhaust Manifold, Turbocharger, Gasket & Fasteners
Courtesy of CHRYSLER LLC

2. Position turbocharger (3) to exhaust manifold (1) with new gasket (7). Hand tighten the upper retaining nuts (2).
3. Install the lower retaining nuts (5) for the turbocharger. Tighten upper (2) and lower retaining nuts in a crisscross pattern to 32 N.m (24 ft.lbs.).

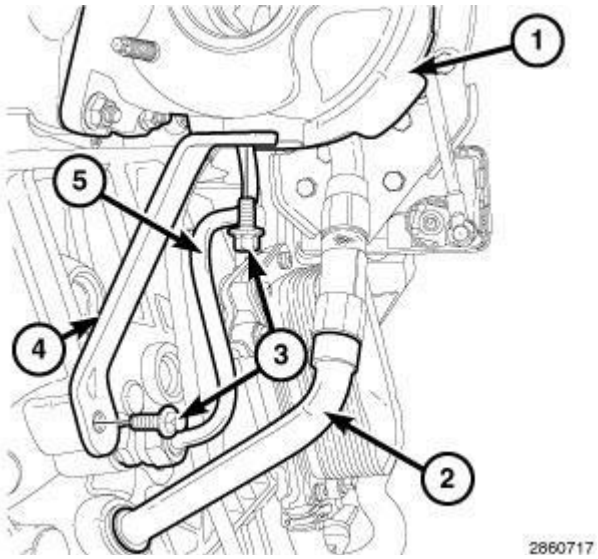

Fig. 281: Turbocharger, Oil Return Line, Oil Supply Line, Turbocharger Support Bracket & Bolts
Courtesy of CHRYSLER LLC

4. Install the oil supply line (5) to the engine block. Tighten pressure fitting to 32 N.m (24 ft.lbs.).
5. Install the oil return line (2) to the turbocharger. Tighten bolts to 15 N.m (133 in.lbs.).
6. Install the turbocharger support bracket (4). Tighten bolts (3) to 32 N.m (24 ft.lbs.).

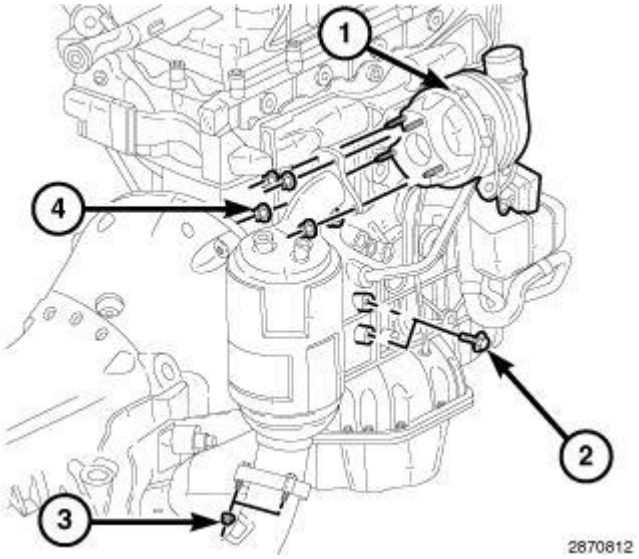

Fig. 282: Turbocharger & Catalytic Converter Fasteners
Courtesy of CHRYSLER LLC

7. Install the catalytic converter mounting nuts (4) to the turbocharger (1). Tighten nuts to 32 N.m (24 ft.lbs.).
8. Install the catalytic converter support bracket bolts (2). Tighten bolts (3) to 20 N.m (180 in.lbs.).

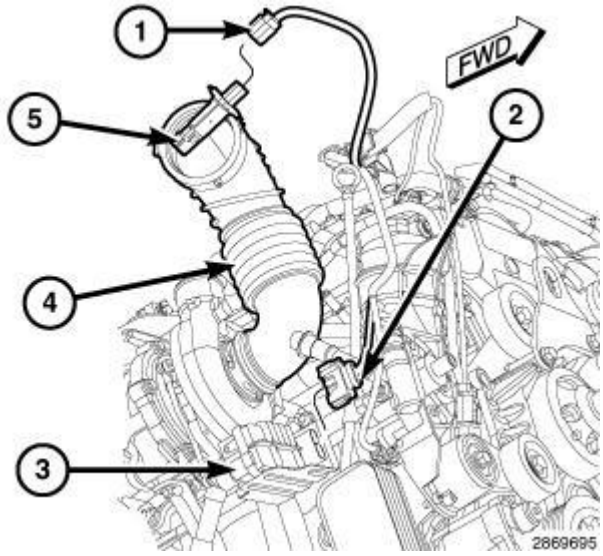

Fig. 283: Air Pressure Sensor Connector, Turbocharger Variable Vane Control Module Connector & Turbocharger Air Inlet Tube
Courtesy of CHRYSLER LLC

9. Connect air outlet hose to turbocharger.
10. Connect the turbocharger variable vane control module connector (2).
11. Install the air pressure sensor connector (1).
12. Install the turbocharger air inlet tube (4). Refer to **BODY, Air Cleaner , Installation**.

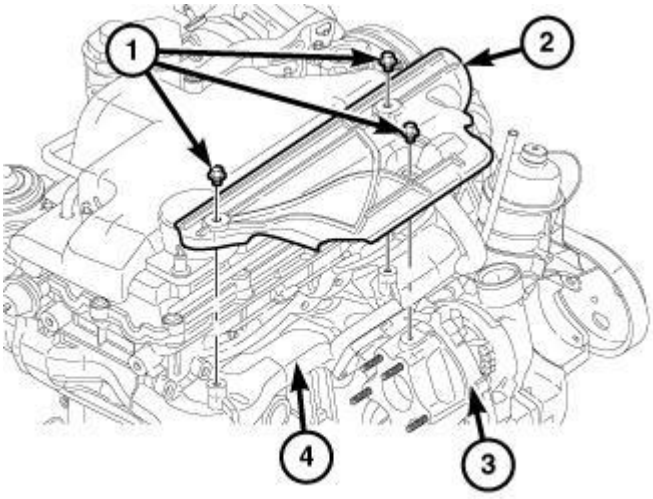

Fig. 284: Exhaust Manifold Heat Shield, Turbocharger, Exhaust Manifold & Fasteners
Courtesy of CHRYSLER LLC

13. Install exhaust manifold heat shield (2). Tighten retaining bolts to 24 N.m (18 ft.lbs.).
14. Install coolant recovery pressure container. Refer to **BOTTLE, Coolant Recovery , Installation** .
15. Refill cooling system Refer to **Standard Procedure** .
16. Connect charge air cooler inlet hose at turbocharger.
17. Install air cleaner assembly. Refer to **BODY, Air Cleaner , Installation**.
18. Connect negative battery cable.

COOLER AND HOSES, CHARGE AIR

Diagnosis and Testing

DIAGNOSIS AND TESTING - CHARGE AIR COOLER SYSTEM - LEAKS

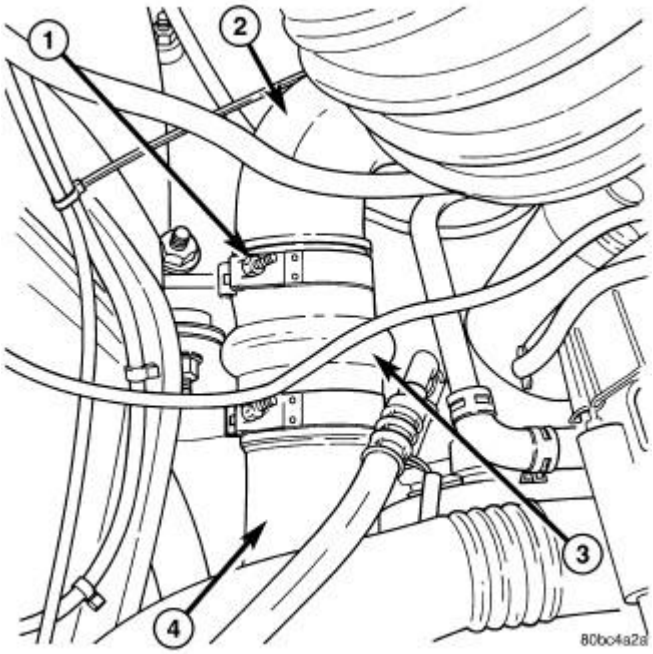

Fig. 285: Clamp, Turbocharger, Air Duct Rubber Sleeve & Air Inlet Duct
Courtesy of CHRYSLER LLC

1 - CLAMP
2 - TURBOCHARGER
3 - AIR DUCT RUBBER SLEEVE
4 - AIR INLET DUCT

Low turbocharger boost pressure and low engine performance can be caused by leaks in the charge air cooler or plumbing. Fuel staining on the exhaust manifold can also be an indication that there are leaks in the air system. The following procedure outlines how to check for leaks in the charge air cooler system.

This procedure can also be used to check for leaks in the wastegate signal line or the wastegate canister.

1. Loosen clamp (1) and remove air inlet hose (3) from turbocharger.
2. Insert Special Tool (special tool #9022, Test Plug) Adapter into the turbocharger inlet. Tighten tool clamp to 8 N.m (72 in. lbs.).

CAUTION: Do not apply more than 138 kPa (20 psi) air pressure to the charge air cooler system; severe damage to the charge air cooler system may occur.

3. Connect a regulated air supply to air fitting on Tool (special tool #9022, Test Plug) Adapter. Set air pressure to a maximum of 138 kPa (20 psi).
4. Using soapy water check the rubber sleeves, charge air cooler and intake manifold for leaks.
5. Using soapy water check for leaks at the wastegate signal line, wastegate canister and wastegate

command valve.

Removal

INLET HOSE

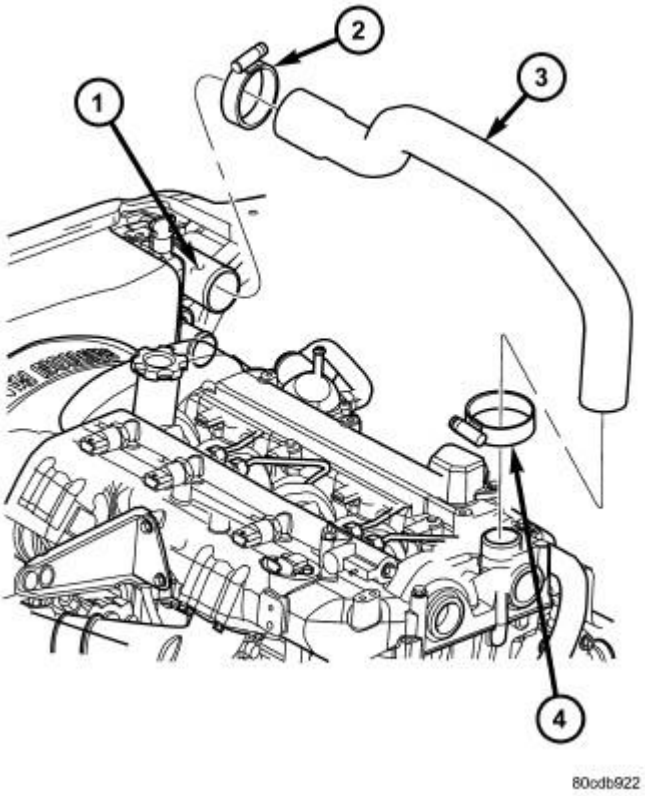

Fig. 286: Charge Air Cooler, Hose Clamp, Charge Air Cooler Inlet Hose & Hose Clamp
Courtesy of CHRYSLER LLC

1 - CHARGE AIR COOLER
2 - HOSE CLAMP
3 - CHARGE AIR COOLER INLET HOSE
4 - HOSE CLAMP

1. Open and support hood of vehicle.
2. Loosen hose clamps (2, 4) at both ends of charge air cooler (CAC) inlet hose (3).
3. Remove CAC inlet hose (3) from turbocharger and CAC.

OUTLET HOSE

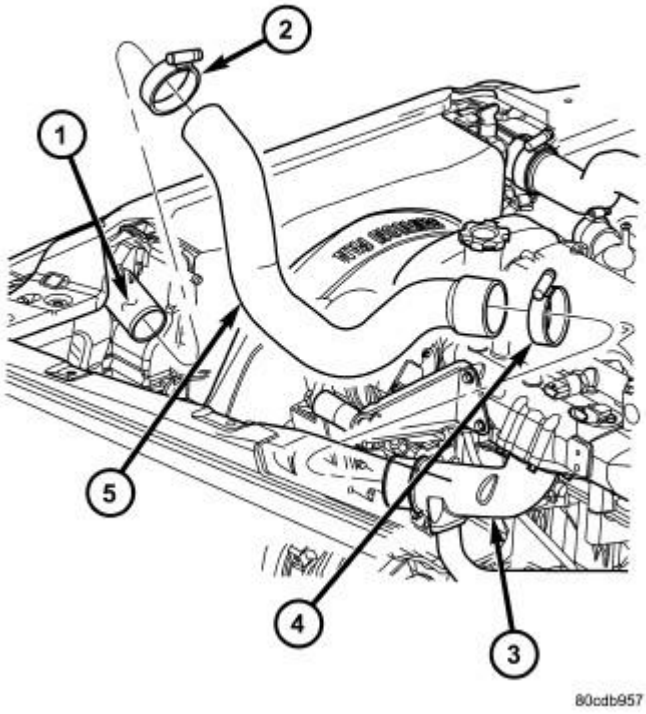

Fig. 287: Charge Air Cooler, Hose Clamp, Intake Manifold Inlet, Hose Clamp & Charge Air Cooler Outlet Hose
Courtesy of CHRYSLER LLC

1 - CHARGE AIR COOLER
2 - HOSE CLAMP
3 - INTAKE MANIFOLD INLET
4 - HOSE CLAMP
5 - CHARGE AIR COOLER OUTLET HOSE

1. Raise and support hood on vehicle.
2. Loosen hose clamps (2, 4) at both ends of charge air cooler (CAC) outlet hose (5). Refer to **Fig. 287**.
3. Remove hose (5) from CAC and intake manifold inlet. Refer to **Fig. 287**.

Installation

INLET HOSE

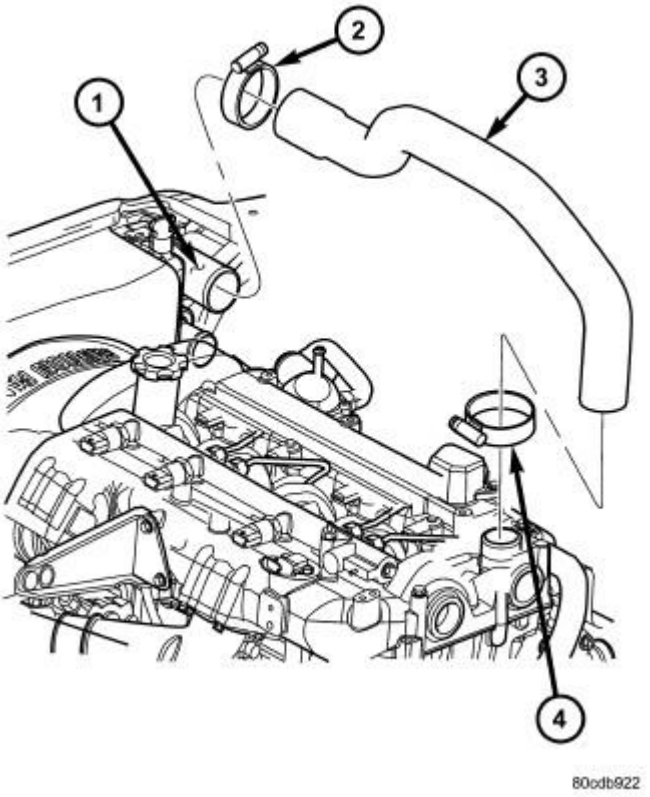

Fig. 288: Charge Air Cooler, Hose Clamp, Charge Air Cooler Inlet Hose & Hose Clamp
Courtesy of CHRYSLER LLC

1 - CHARGE AIR COOLER
2 - HOSE CLAMP
3 - CHARGE AIR COOLER INLET HOSE
4 - HOSE CLAMP

1. Install charge air cooler (CAC) inlet hose (3) on turbocharger and CAC.
2. Tighten hose clamps (1, 4).
3. Close hood.

OUTLET HOSE

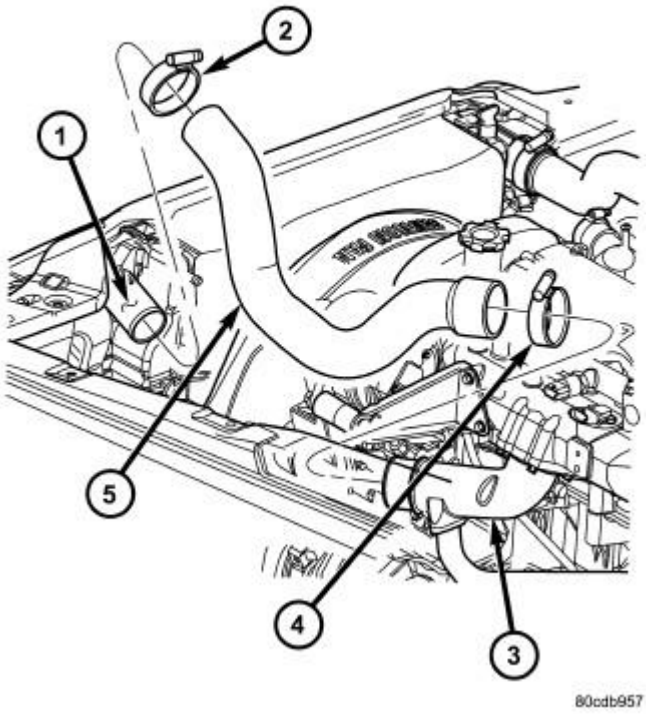

Fig. 289: Charge Air Cooler, Hose Clamp, Intake Manifold Inlet, Hose Clamp & Charge Air Cooler Outlet Hose
Courtesy of CHRYSLER LLC

1 - CHARGE AIR COOLER
2 - HOSE CLAMP
3 - INTAKE MANIFOLD INLET
4 - HOSE CLAMP
5 - CHARGE AIR COOLER OUTLET HOSE

1. Install charge air cooler (CAC) outlet hose (5) on CAC and intake manifold inlet.
2. Tighten both hose clamps (2, 4) on CAC outlet hose.
3. Close hood.

VALVE TIMING

STANDARD PROCEDURE

LOCKING ENGINE 90 DEGREES AFTER TDC

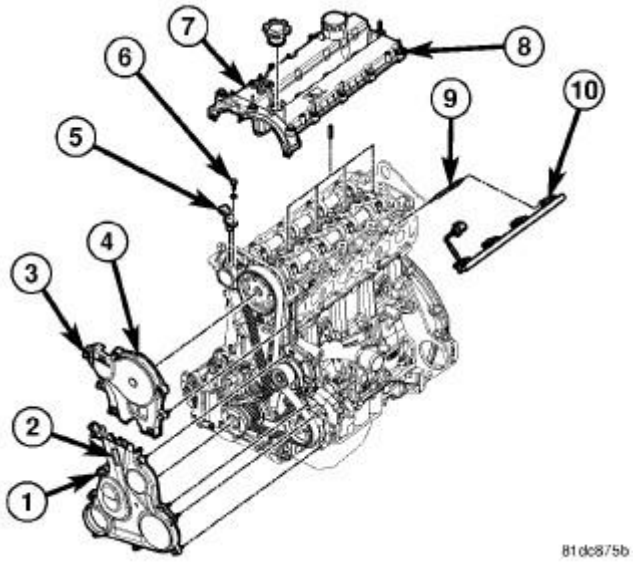

Fig. 290: Upper And Lower Front Covers
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove the upper (4) and lower (2) timing belt covers. Refer to **COVER(S), Engine Timing , Removal**.

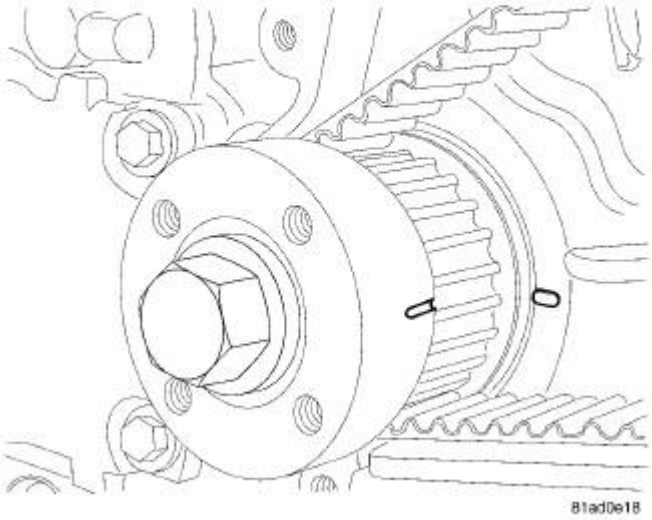

Fig. 291: Crankshaft Timing Marks
Courtesy of CHRYSLER LLC

3. Rotate the engine until the 90° ATDC marks on the crankshaft timing belt drive sprocket and front cover are aligned.

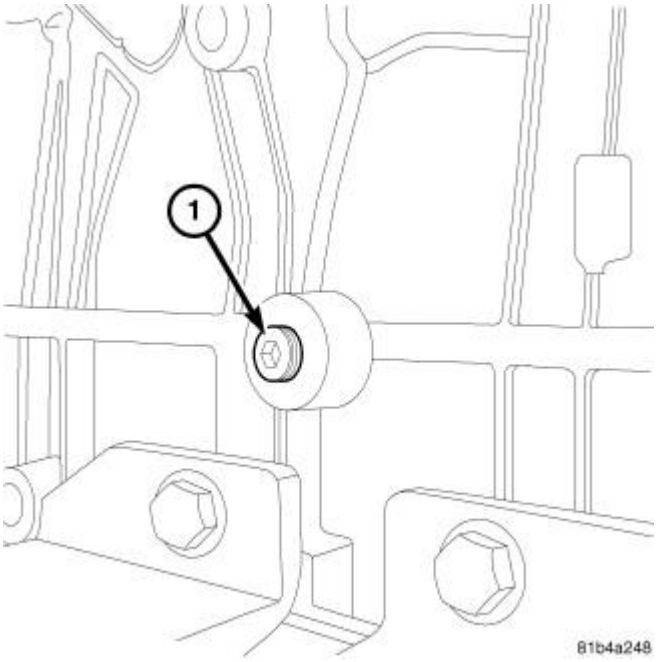

Fig. 292: Engine Block Plug
Courtesy of CHRYSLER LLC

4. Remove the engine block plug (1).

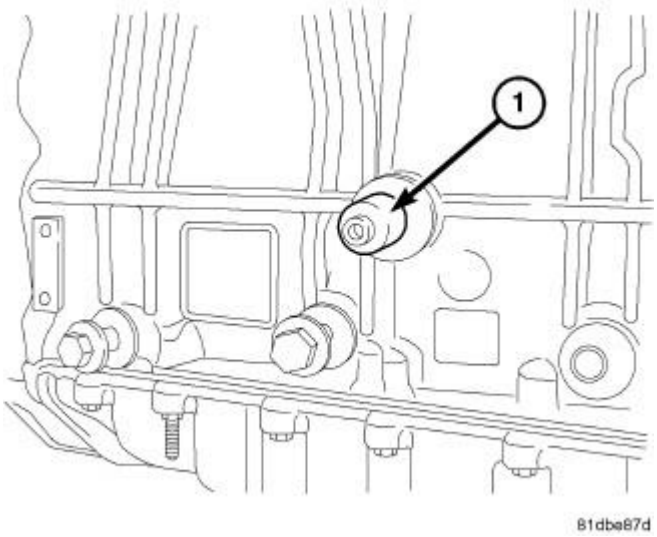

Fig. 293: Crankshaft Locking Tool
Courtesy of CHRYSLER LLC

5. Install the Crankshaft Locking Tool (special tool #VM.9992, Adapter, 90 Degree ATDC) into the high pressure pump side of the engine block. Make sure that the outer portion of the tool threads into the block and the bolt threads into the crankshaft. If the bolt does not thread into the crankshaft, the crankshaft is not at 90° ATDC. If necessary, realign the 90° ATDC marks on the crankshaft timing belt drive sprocket and timing belt cover.

Camshaft Timing Procedure

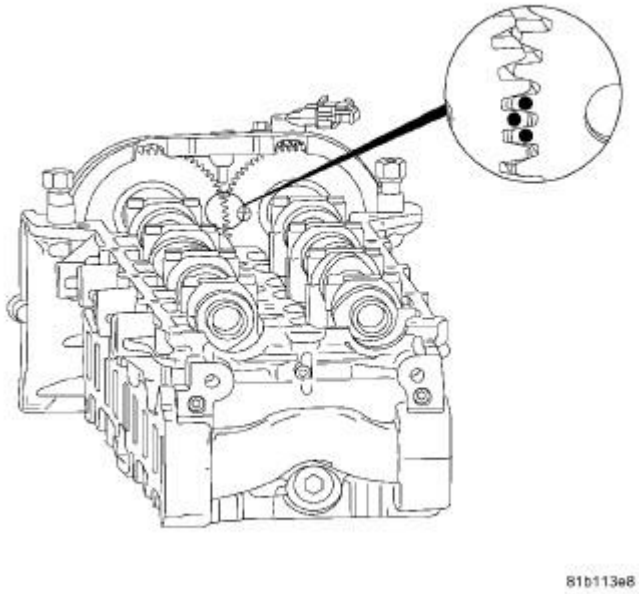

Fig. 294: Camshaft Timing Dots
Courtesy of CHRYSLER LLC

NOTE: In order to validate camshaft timing, the cylinder head cover and timing belt should already have been removed.

CAUTION: The camshaft dots time the camshafts to each other. Later in the procedure we will rotate the camshafts so they are timed to the crankshaft.

1. Line up the camshaft dots.

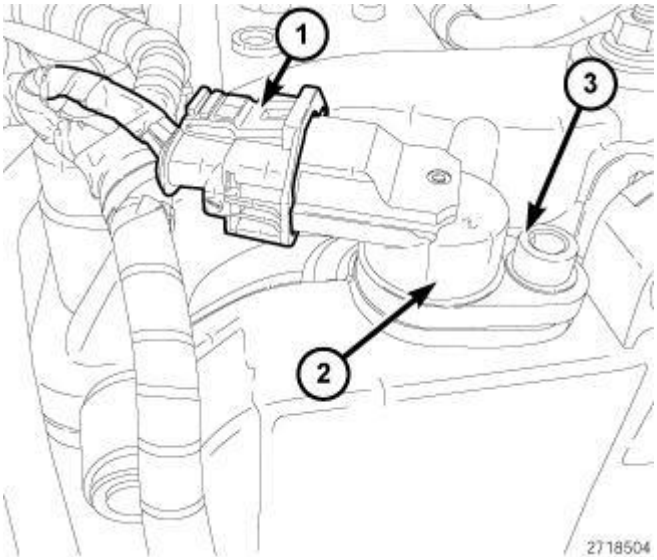

Fig. 295: Camshaft Position Sensor Harness Connector, Sensor & Bolt
Courtesy of CHRYSLER LLC

2. Disconnect the camshaft position sensor harness connector (1).
3. Remove bolt (3) and the camshaft position sensor (2).

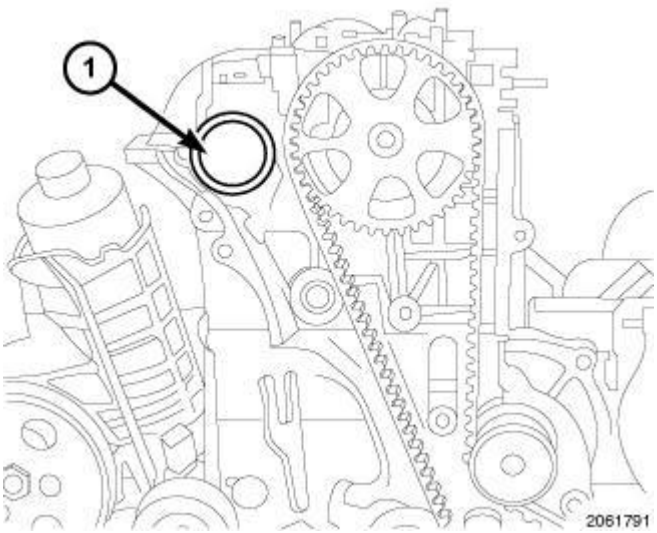

Fig. 296: Exhaust Camshaft Oil Seal
Courtesy of CHRYSLER LLC

4. Remove the exhaust camshaft oil seal (1) to expose the camshaft reluctor.

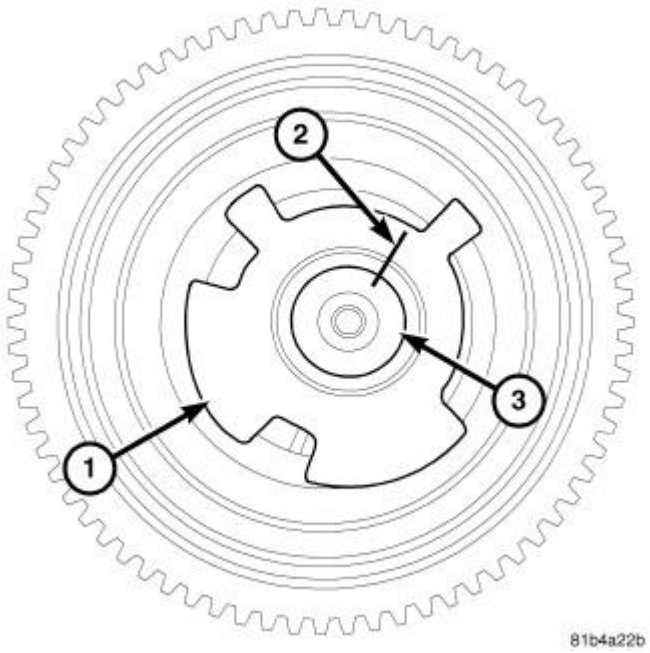

Fig. 297: Marking CMP Sensor Reluctor Wheel & Exhaust Camshaft
Courtesy of CHRYSLER LLC

5. Mark the camshaft tone wheel with a paint marker.

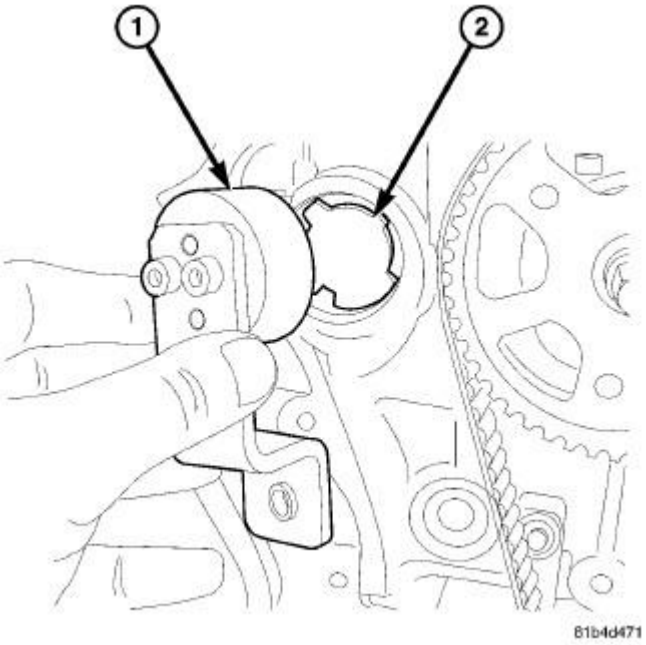

Fig. 298: Installing Camshaft Lock Tool
Courtesy of CHRYSLER LLC

CAUTION: Do not rotate the camshaft using the camshaft locking tool. The tone

wheel may spin on the camshaft. If the tone wheel is rotated on the camshaft, the camshaft must be replaced.

6. Rotate the camshafts until the Camshaft Locking Tool (special tool #VM.9991, Alignment Tool, Camshaft Sprocket) can be installed.
7. Install Camshaft Locking tool (special tool #VM.9991, Alignment Tool, Camshaft Sprocket).

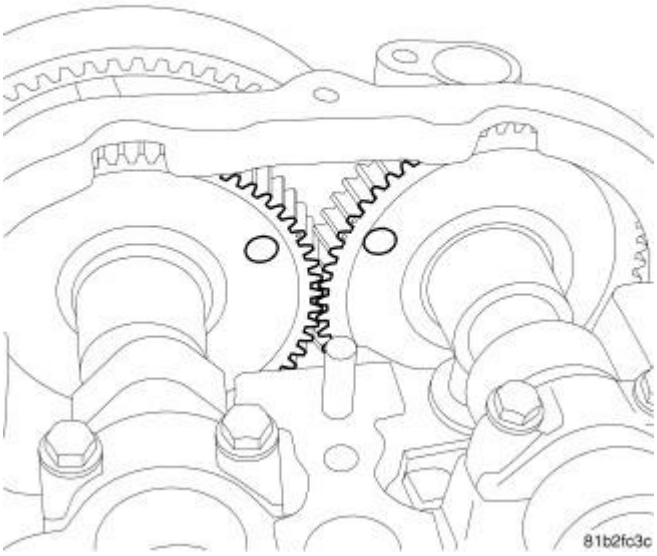

Fig. 299: Camshaft Marks At 90 Degrees ATDC
Courtesy of CHRYSLER LLC

8. Verify the camshafts are set correctly at 90° ATDC as illustrated.

BELT, TIMING

Removal

REMOVAL

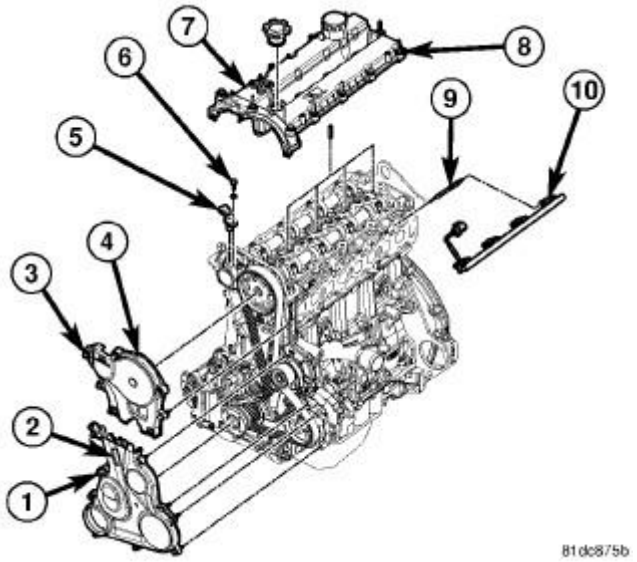

Fig. 300: Upper And Lower Front Covers
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the upper (4) and lower (2) timing belt cover. Refer to **COVER(S), Engine Timing , Removal**.

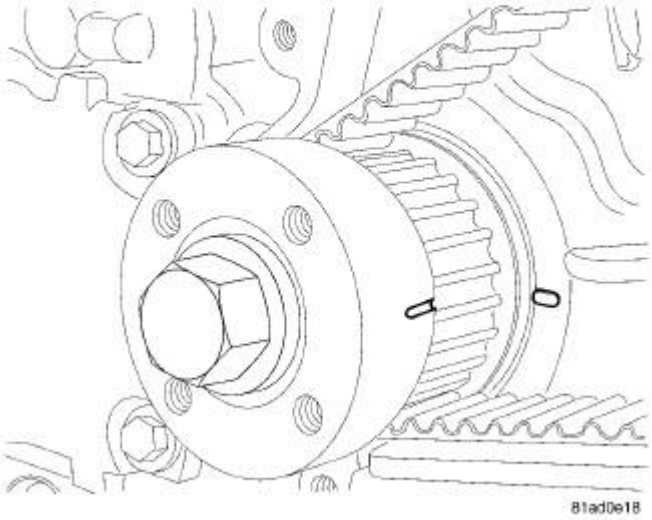

Fig. 301: Crankshaft Timing Marks
Courtesy of CHRYSLER LLC

3. Rotate the engine until the crankshaft 90° ATDC marks on the crankshaft timing belt drive sprocket and timing cover are aligned.

4. Remove the skid plate.

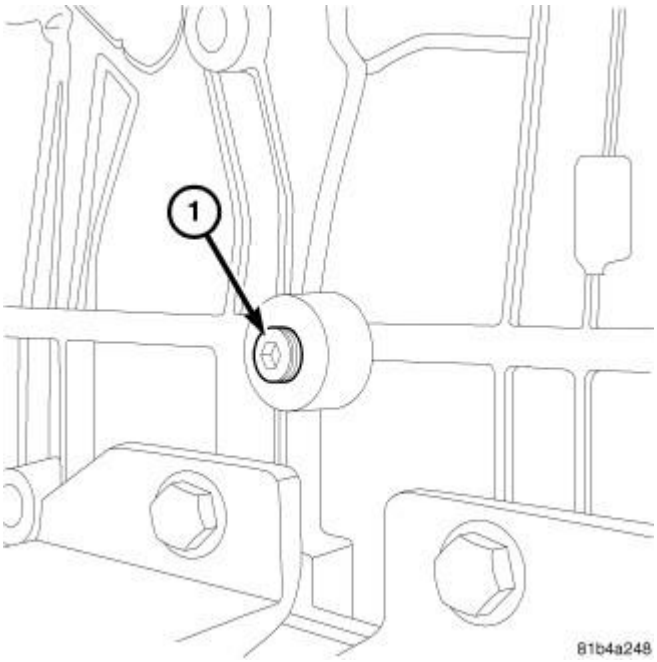

Fig. 302: Engine Block Plug
Courtesy of CHRYSLER LLC

5. Remove the engine block plug (1).

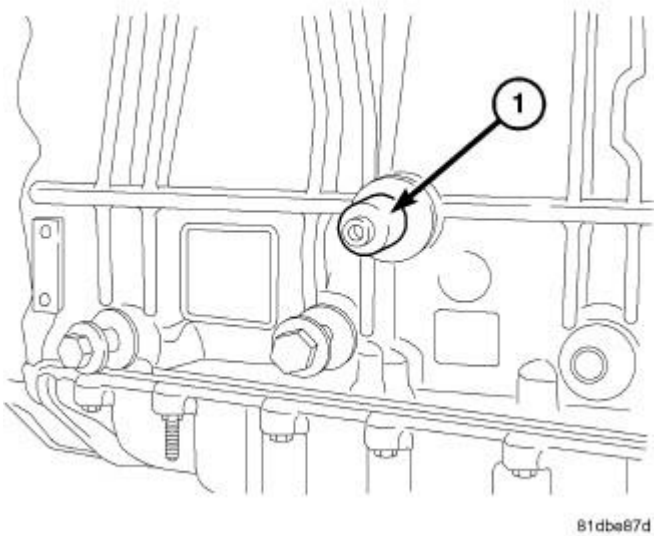

Fig. 303: Crankshaft Locking Tool
Courtesy of CHRYSLER LLC

6. Install the Crankshaft Locking Tool (special tool #VM.9992, Adapter, 90 Degree ATDC) (1).

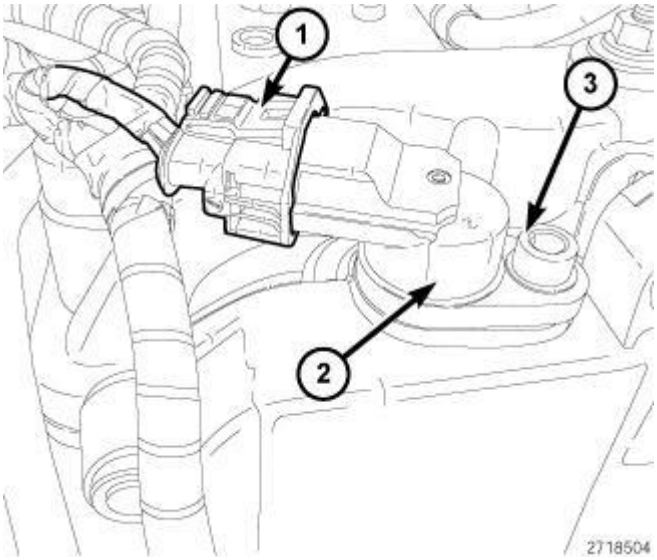

Fig. 304: Camshaft Position Sensor Harness Connector, Sensor & Bolt
Courtesy of CHRYSLER LLC

7. Disconnect the Camshaft Position Sensor (CMP) harness connector (1).
8. Remove bolt (3) the CMP sensor (2).

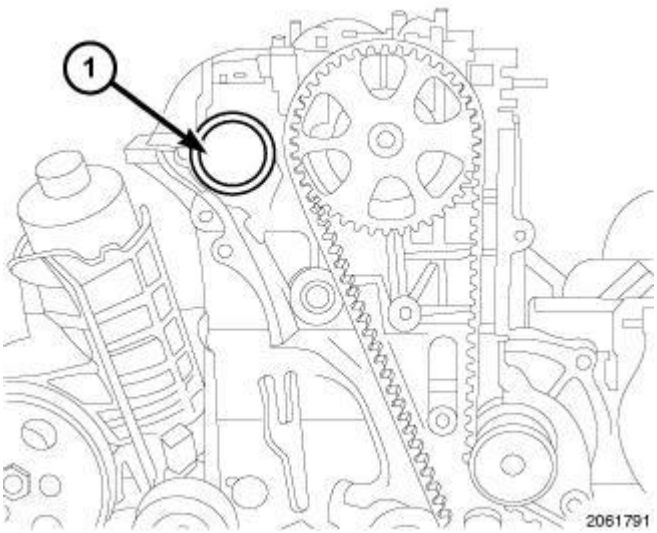

Fig. 305: Exhaust Camshaft Oil Seal
Courtesy of CHRYSLER LLC

9. Remove the exhaust camshaft oil seal (1) to expose the camshaft reluctor.

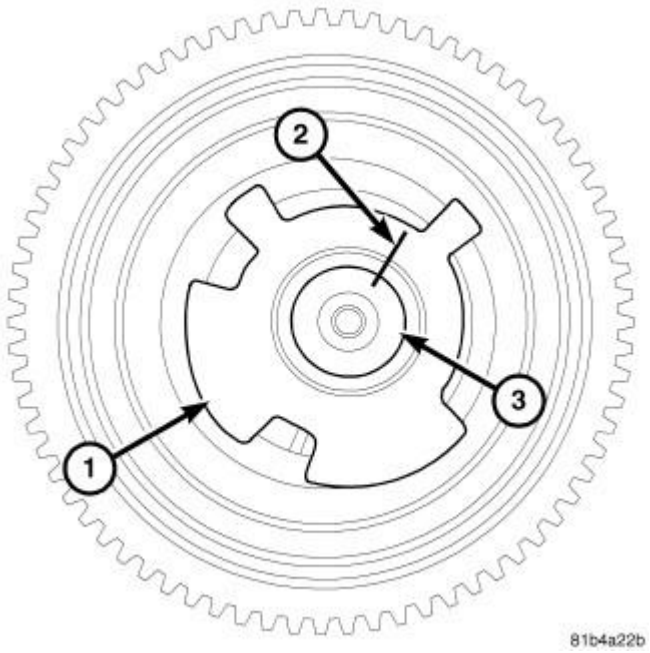

Fig. 306: Marking CMP Sensor Reluctor Wheel & Exhaust Camshaft
Courtesy of CHRYSLER LLC

10. Use a paint pen to mark the location (2) of the reluctor wheel (1) on the camshaft (2).

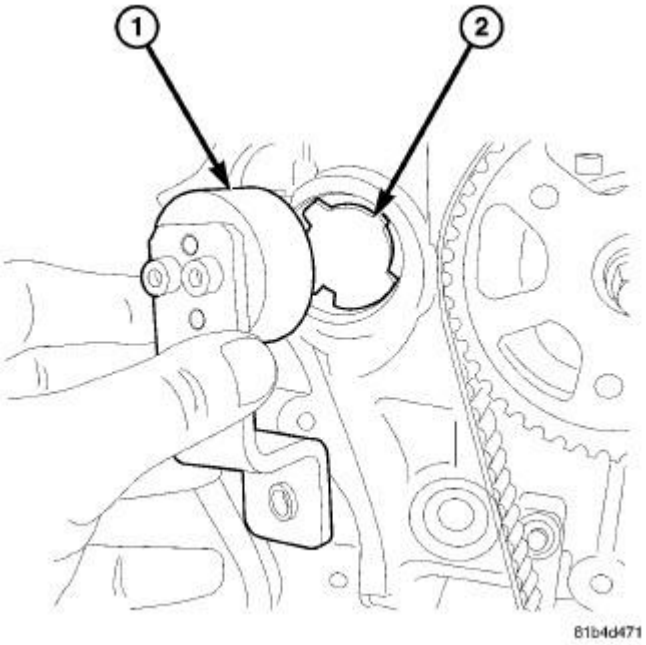

Fig. 307: Removing/Installing Camshaft Locking Tool
Courtesy of CHRYSLER LLC

11. Install the Camshaft Locking Tool (special tool #VM.9991, Alignment Tool, Camshaft Sprocket) (1).

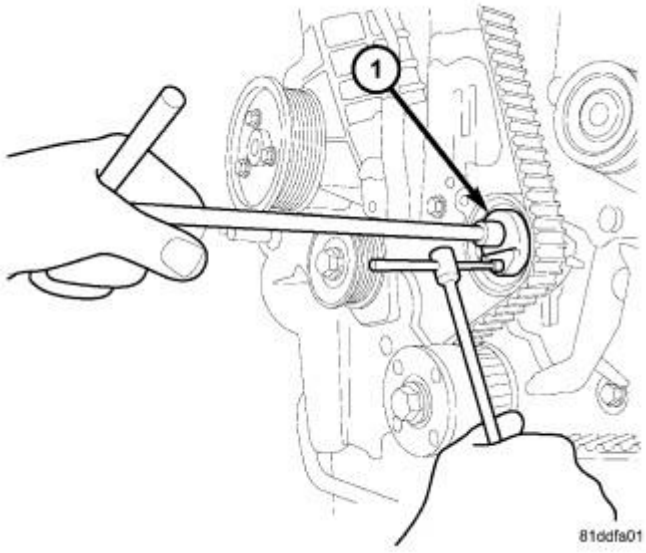

Fig. 308: Tighten/Loosen Timing Belt Tensioner Bolt
Courtesy of CHRYSLER LLC

12. Loosen the timing belt tensioner bolt (1), and remove the timing belt.

Installation

INSTALLATION

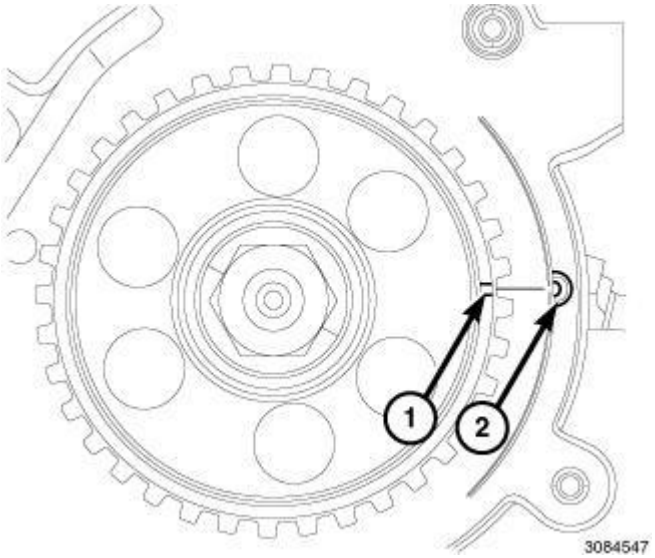

Fig. 309: Fuel Injection Pump Timing Marks
Courtesy of CHRYSLER LLC

1. Align the high pressure fuel pump sprocket timing mark (1) with the timing mark (2) on the block.

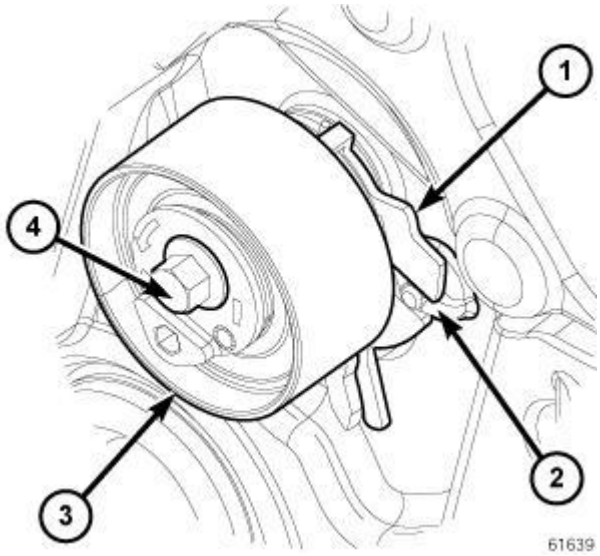

Fig. 310: Timing Belt Tensioner Alignment Plate, Engine Cover Boss & Bolt
Courtesy of CHRYSLER LLC

2. Verify that the bolt (4) is finger tight and tensioner alignment plate (1) is aligned with the boss (2) on the engine cover.

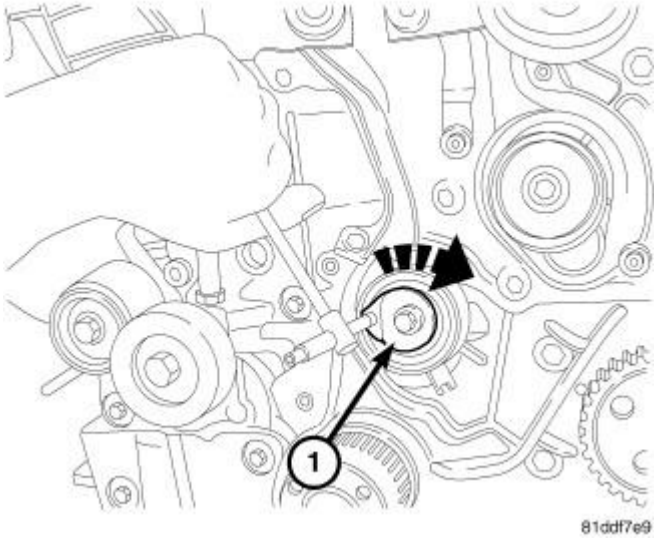

Fig. 311: Unloading Tension To Install Timing Belt
Courtesy of CHRYSLER LLC

3. Turn the timing belt tensioner (1) clockwise to unload the tensioner enough for the timing belt to be installed.

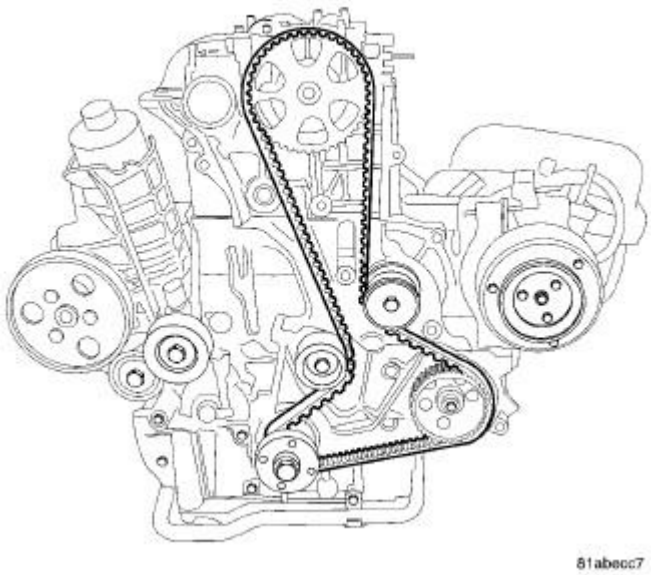

Fig. 312: Timing Belt
Courtesy of CHRYSLER LLC

NOTE: DO NOT remove the timing belt from the package until it is going to be installed. DO NOT expose timing belt to oil, grease or water contamination. DO NOT crimp belt at a sharp angle. DO NOT clean belt, pulleys or tensioner with solvent. Check that pulleys and bearings are not seized or damaged before installing belt.

4. Install the timing belt on the components in the following order:
   - Crankshaft sprocket (1)
   - High pressure fuel pump (2)
   - Water pump pulley (3)
   - Intake camshaft pulley (4)
   - Timing belt tensioner (5).

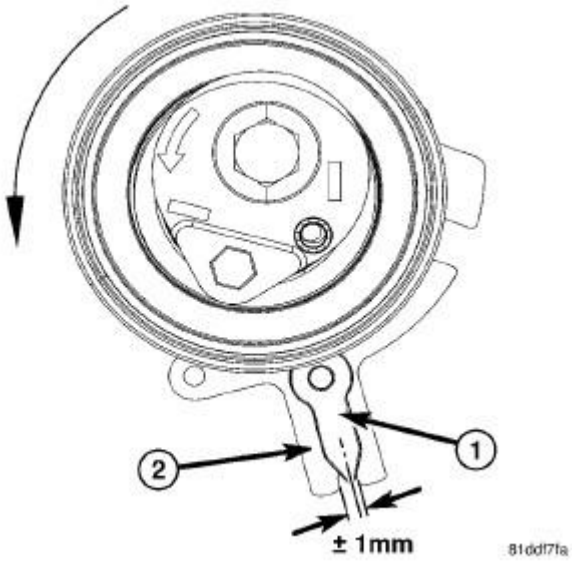

Fig. 313: Tensioner Indicator & Tensioner Gage Slot
Courtesy of CHRYSLER LLC

NOTE: Turning the belt tensioner counter clockwise moves the pointer in a clockwise direction. Also, if the tensioner bolt is too loose this will cause the tensioner alignment slot to jump off the alignment boss on timing cover.

5. Adjust timing belt tensioner by lining up the load indicator arrow (1) to the center of the tensioner load gage (2) as illustrated.

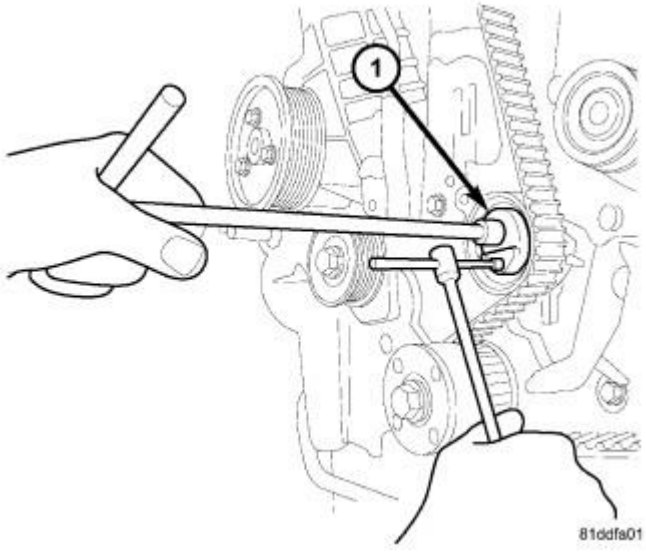

Fig. 314: Tighten/Loosen Timing Belt Tensioner Bolt
Courtesy of CHRYSLER LLC

6. Tighten the timing belt tensioner bolt (1) to 28 N.m (21 ft. lbs.).

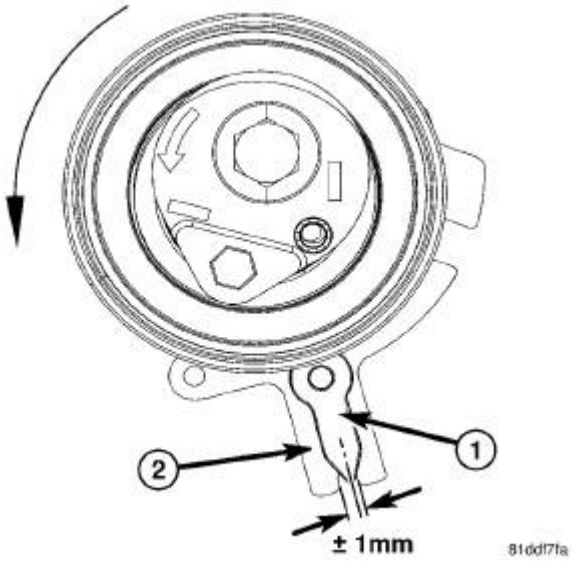

Fig. 315: Tensioner Indicator & Tensioner Gage Slot
Courtesy of CHRYSLER LLC

7. Verify the tensioner load indicator (1) is still centered in the tensioner load gage (2). If the indicator is not centered in the gage as shown in illustration. Refer to **TENSIONER, Engine Timing , Adjustments**.

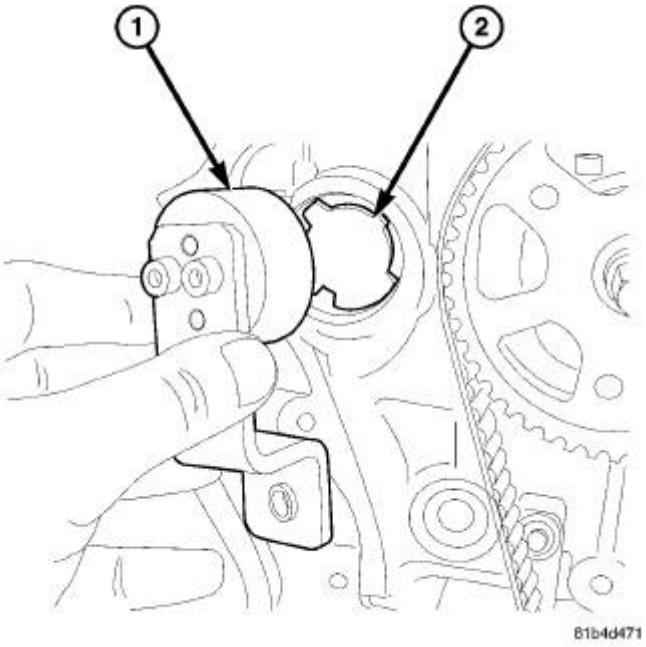

Fig. 316: Removing/Installing Camshaft Locking Tool
Courtesy of CHRYSLER LLC

8. Remove the Camshaft Locking Tool (special tool #VM.9991, Alignment Tool, Camshaft Sprocket) (1).

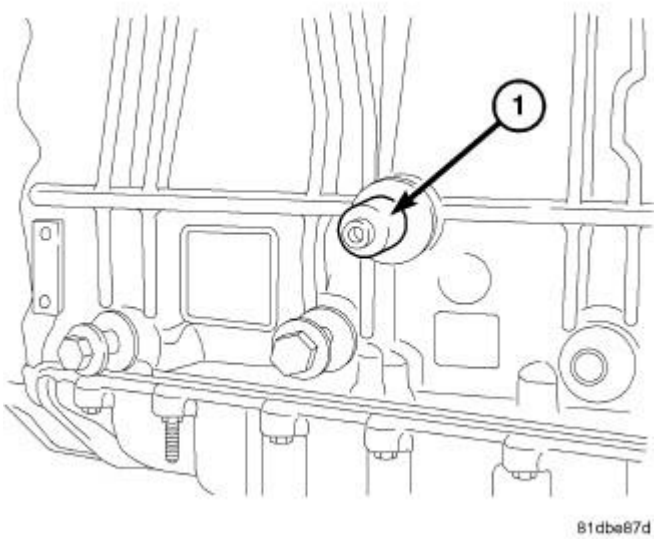

Fig. 317: Crankshaft Locking Tool
Courtesy of CHRYSLER LLC

9. Remove the Crankshaft Locking Tool (special tool #VM.9992, Adapter, 90 Degree ATDC) (1).

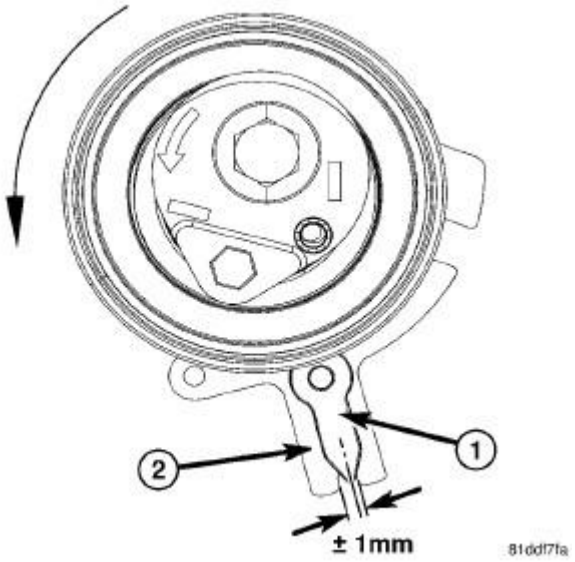

Fig. 318: Tensioner Indicator & Tensioner Gage Slot
Courtesy of CHRYSLER LLC

NOTE: In order to rotate the engine, the Camshaft Locking Tool (special tool #VM.9991, Alignment Tool, Camshaft Sprocket) and the Crankshaft Locking Tool (special tool #VM.9992, Adapter, 90 Degree ATDC) need to be removed.

10. Rotate engine 2 complete revolutions and then recheck tensioner alignment. Verify that the tension indicator (1) is centered in the slot on the tensioner gage (2) slot as shown in illustration. Readjust tensioner alignment is necessary.

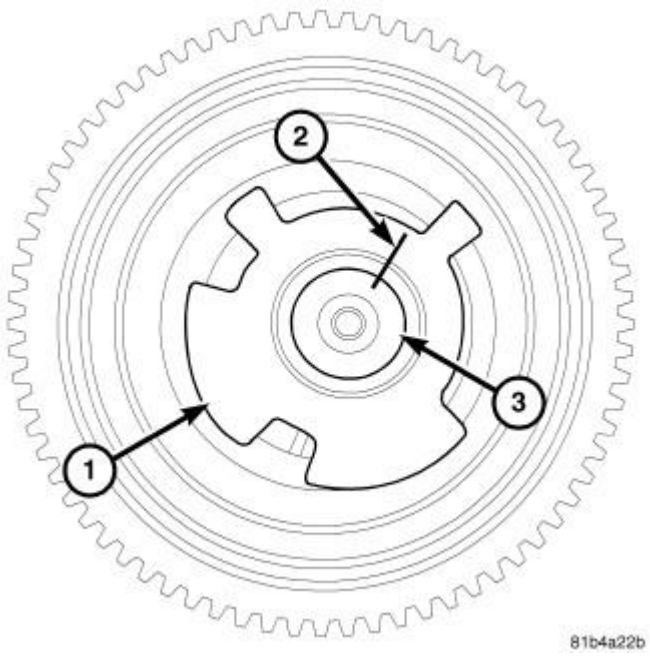

Fig. 319: Marking CMP Sensor Reluctor Wheel & Exhaust Camshaft
Courtesy of CHRYSLER LLC

11. Verify that the reluctor wheel (1) has not moved on the camshaft. If the witness marks are not aligned, the reluctor wheel (1) has spun on the camshaft (3) during the assembly process, and the exhaust camshaft must be replaced.

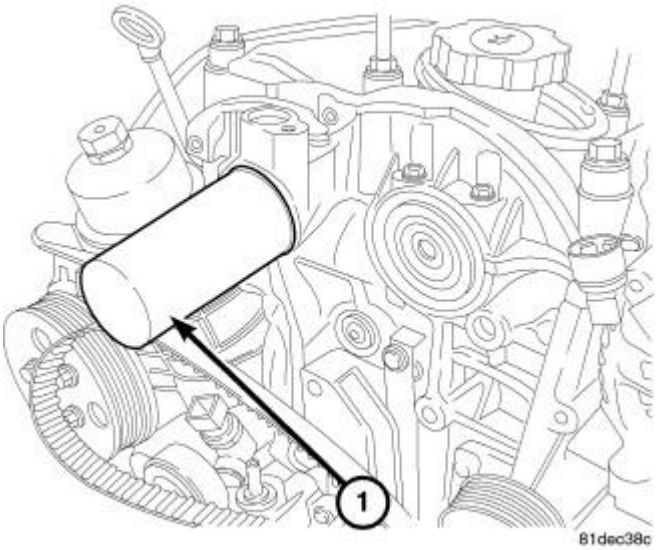

Fig. 320: Exhaust Camshaft Cap Installer
Courtesy of CHRYSLER LLC

12. Using Seal Installer (special tool #VM.1057, Installer, Seal) (1), install the exhaust camshaft cap.

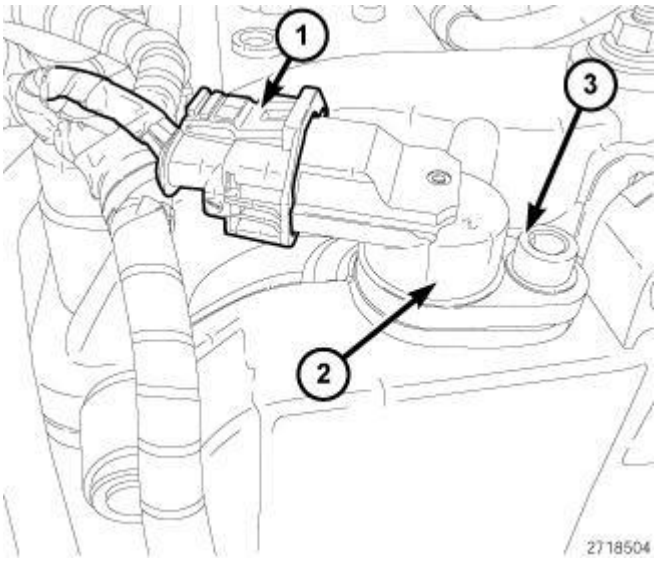

Fig. 321: Camshaft Position Sensor Harness Connector, Sensor & Bolt
Courtesy of CHRYSLER LLC

13. Install the Camshaft Position Sensor CMP sensor (2). Tighten bolt (3) to 11 N.m (97 in. lbs.).
14. Connect the (CMP) harness connector (1).

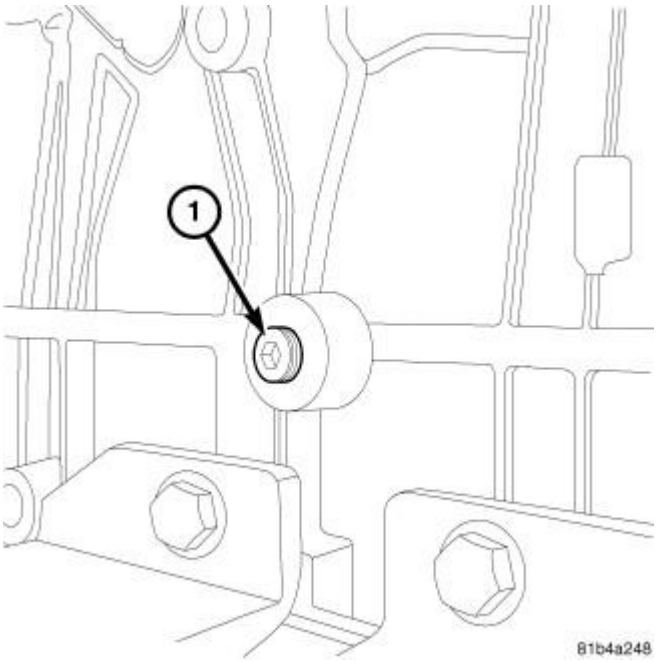

Fig. 322: Engine Block Plug
Courtesy of CHRYSLER LLC

15. Install the engine block plug (1). Tighten the engine block plug to 30 N.m (22 ft. lbs.).
16. Install the skid plate.

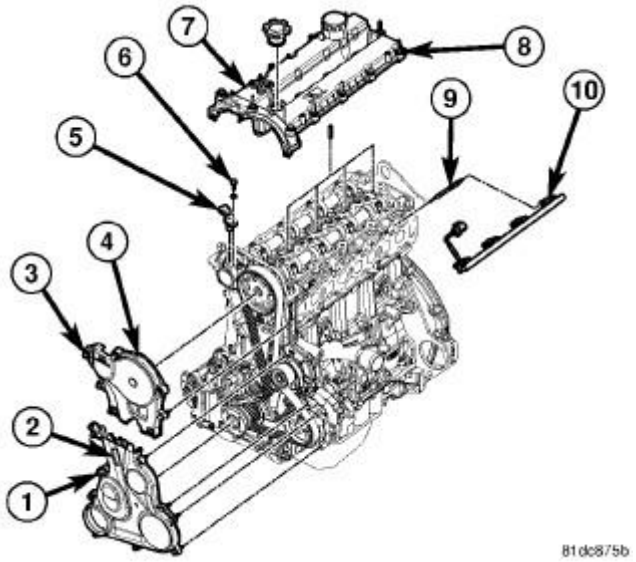

Fig. 323: Upper And Lower Front Covers
Courtesy of CHRYSLER LLC

17. Install the upper (4) and lower (2) timing belt cover. Refer to **COVER(S), Engine Timing , Installation**.
18. Connect the negative battery cable.

COVER(S), ENGINE TIMING

Removal

TIMING BELT INNER COVER

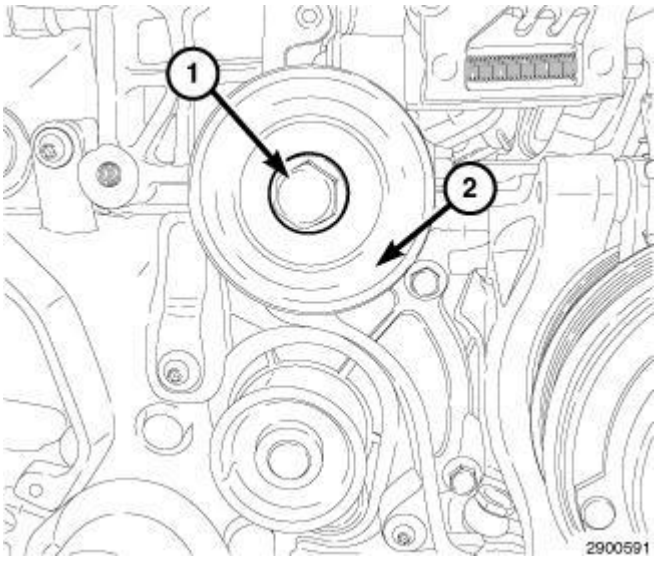

Fig. 324: Idler Pulley & Bolt
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to **SPROCKET(S), Timing Belt and Chain , Removal**.
3. Remove bolt (1) and the Idler pulley (2).

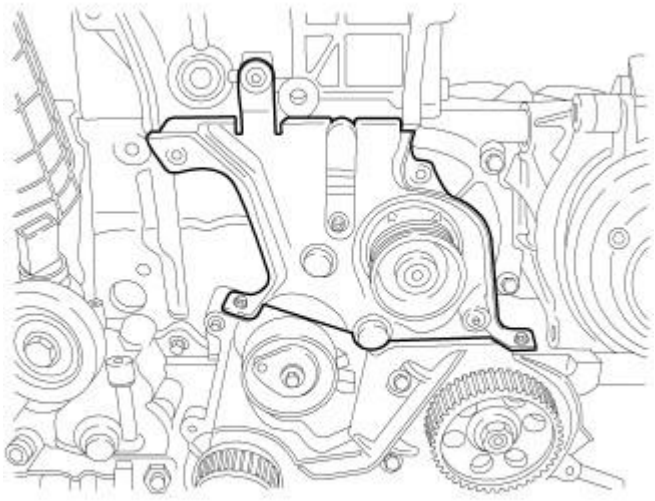

Fig. 325: Inner Front Cover
Courtesy of CHRYSLER LLC

4. Remove bolt and the inner front belt cover.

UPPER AND LOWER TIMING BELT OUTER COVERS

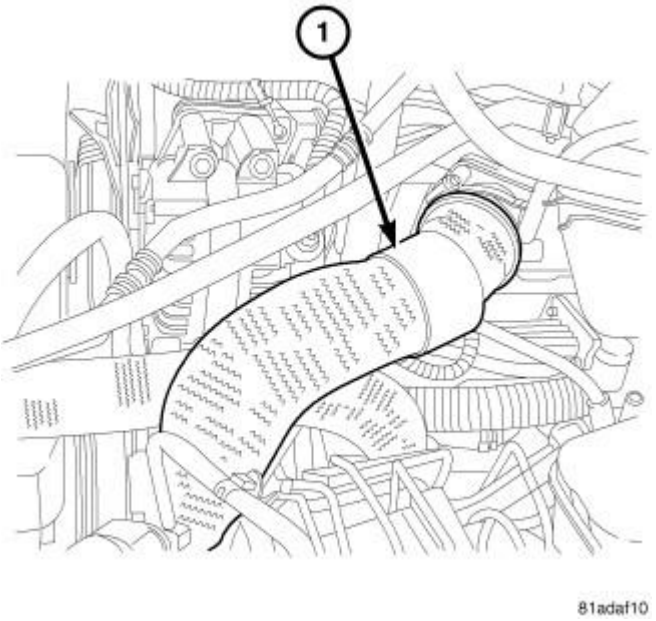

Fig. 326: Charge Outlet Hose
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove the engine cover.
3. Remove the four retainers and the engine silencer.
4. Remove the air cleaner body. Refer to **BODY, Air Cleaner , Removal**.
5. Drain the engine cooling system. Refer to **Standard Procedure** .
6. Remove lower radiator hose clip at fan shroud.
7. Remove the charge outlet hose from EGR air flow control valve.
8. Remove the three wire harness retainers.
9. Remove the windshield washer reservoir and engine coolant recovery bottle. Refer to **BOTTLE, Coolant Recovery , Removal** .
10. Remove the Charge Air Cooler (CAC) outlet hose at (CAC).
11. Remove the upper radiator hose at radiator.
12. Remove the A/C discharge line clip at fan shroud.
13. Disconnect the cooling fan harness connector.
14. Remove the viscous fan assembly. Refer to **FAN, Cooling, Electric , Removal** .

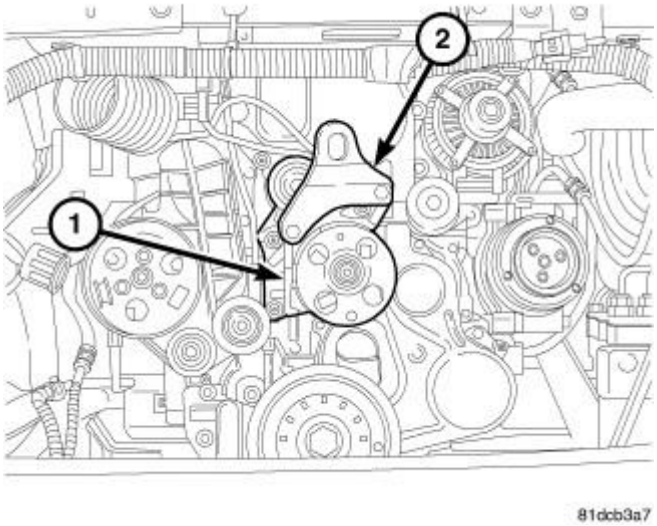

Fig. 327: Idler Pulley Assembly & Front Engine Lifting Bracket
Courtesy of CHRYSLER LLC

15. Remove the serpentine belt. Refer to **BELT, Serpentine , Removal** .
16. Remove bolts and the front engine lifting bracket (2).
17. Remove bolts and the fan drive and idler pulley assembly.

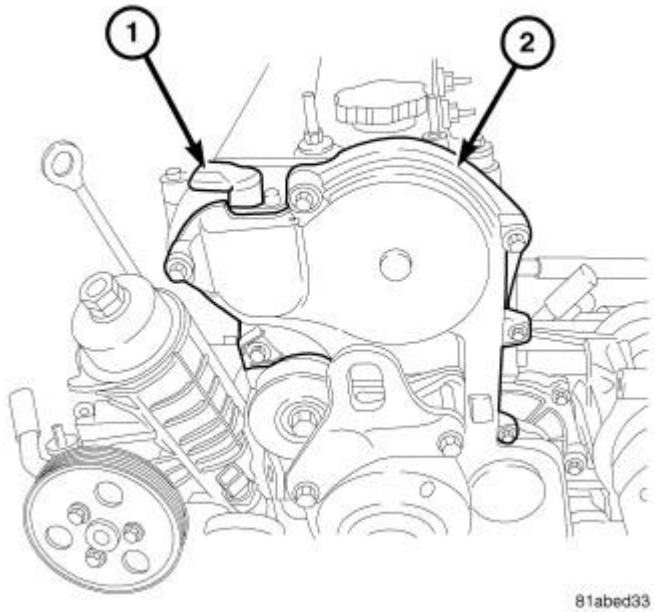

Fig. 328: Upper Front Cover & Lifting Bracket
Courtesy of CHRYSLER LLC

18. Remove the upper front cover (2).

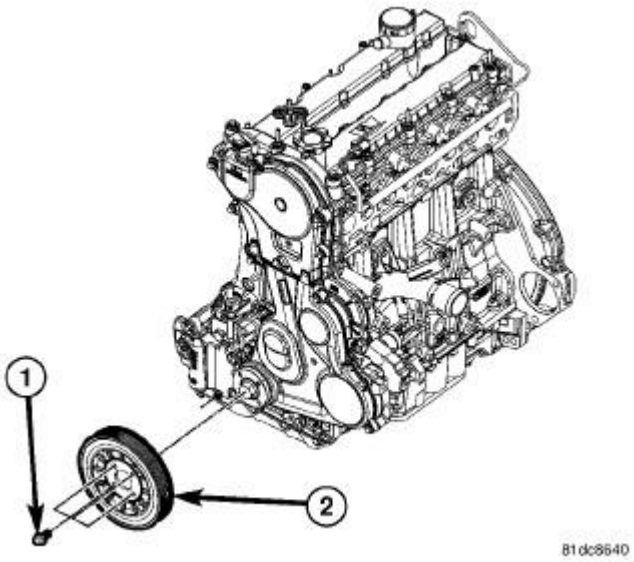

Fig. 329: Crankshaft Damper & Bolt
Courtesy of CHRYSLER LLC

19. Remove the bolts (1) and the crankshaft damper (2).

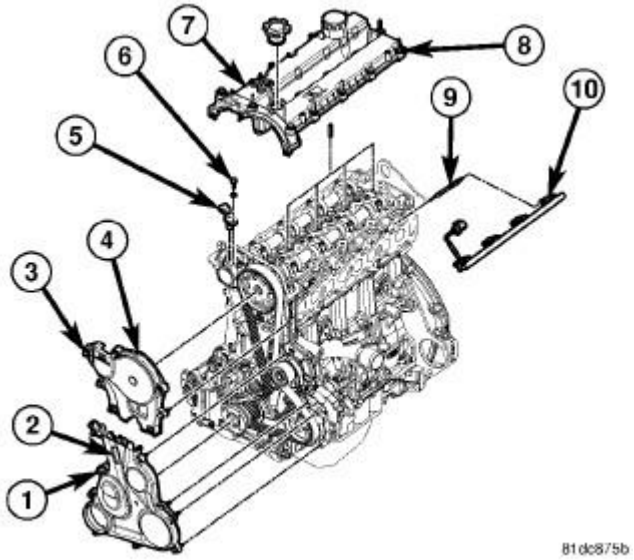

Fig. 330: Upper And Lower Front Covers
Courtesy of CHRYSLER LLC

20. Remove the lower front cover (2).

Installation

TIMING BELT INNER COVER

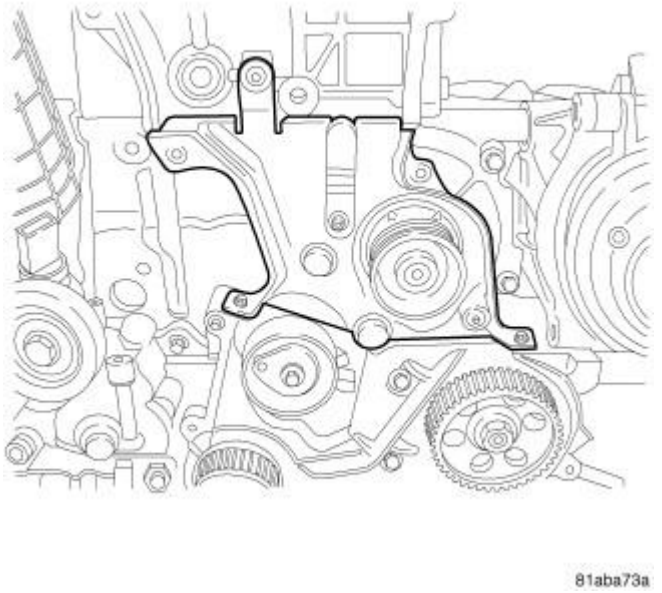

Fig. 331: Inner Front Cover
Courtesy of CHRYSLER LLC

1. Install the inner front cover. Tighten the bolts to 11 N.m (97 in. lbs.).

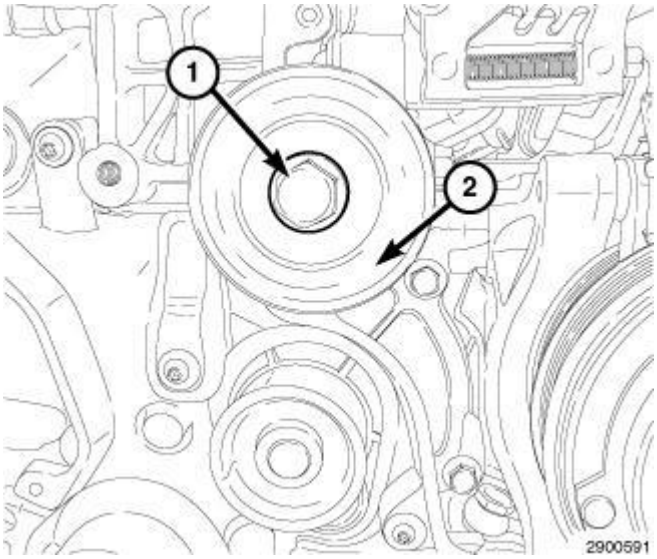

Fig. 332: Idler Pulley & Bolt
Courtesy of CHRYSLER LLC

2. Install the idler pulley (2). Tighten bolt (1) to 45 N.m (33 ft. lbs.).
3. Install the timing belt. Refer to **SPROCKET(S), Timing Belt and Chain , Installation**.
4. Connect the negative battery cable.

UPPER AND LOWER OUTER TIMING BELT COVERS

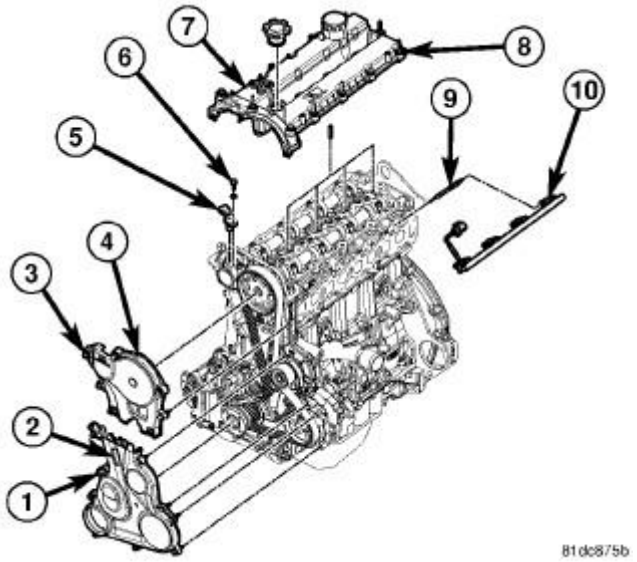

Fig. 333: Upper And Lower Front Covers
Courtesy of CHRYSLER LLC

1. Install the lower front cover (2). Tighten the bolts to 8 N.m (71 in. lbs.).

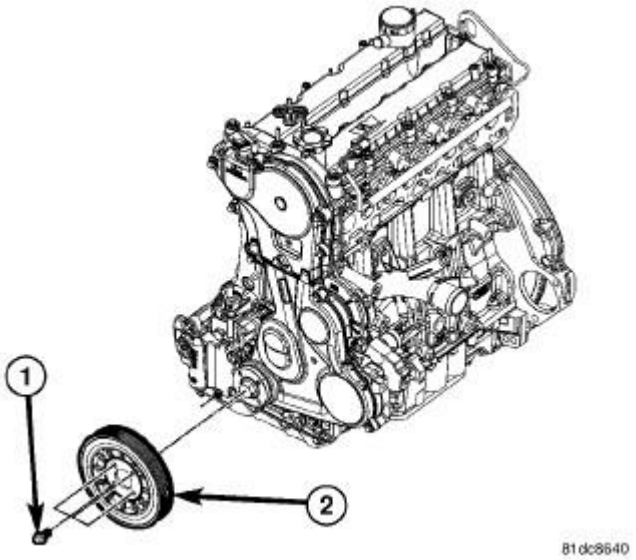

Fig. 334: Crankshaft Damper & Bolt
Courtesy of CHRYSLER LLC

2. Install the crankshaft damper (2). Tighten the bolts (1) to 32 N.m (23 in. lbs.).

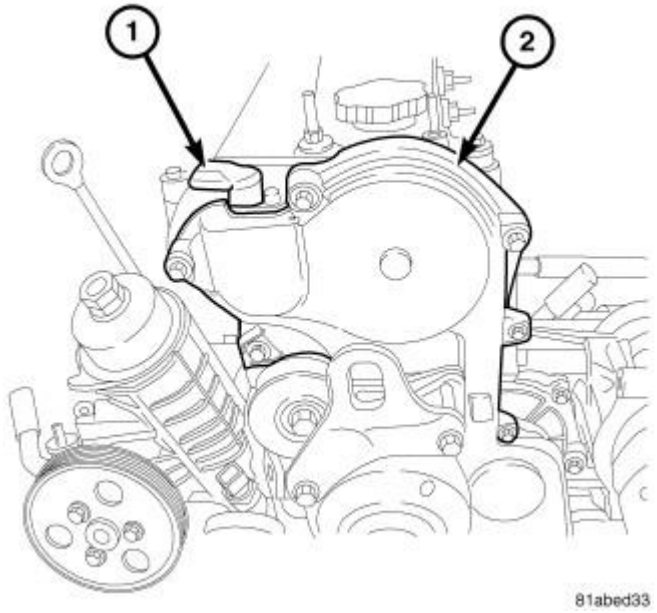

Fig. 335: Upper Front Cover & Lifting Bracket
Courtesy of CHRYSLER LLC

3. Install the upper front cover (2). Tighten the bolts to 8 N.m (71 in. lbs.).

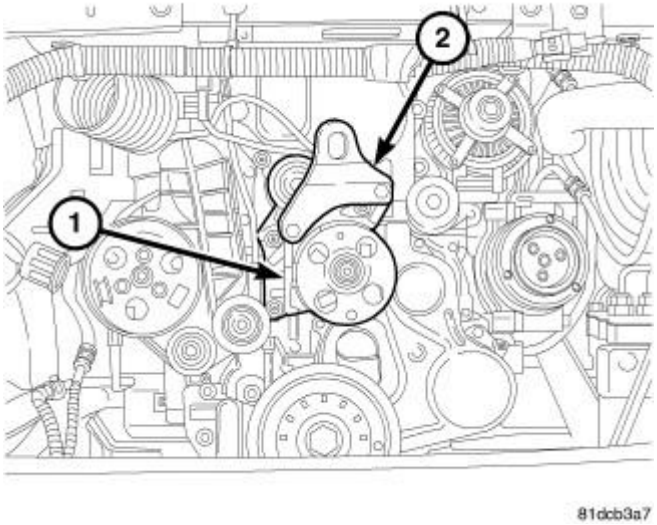

Fig. 336: Idler Pulley Assembly & Front Engine Lifting Bracket
Courtesy of CHRYSLER LLC

4. Install the accessory drive idler pulley bracket. Tighten bolts to 45 N.m (33 ft. lbs.).
5. Install the front engine lift bracket (2). Tighten bolts to 45 N.m (33 ft. lbs.).
6. Install the serpentine belt. Refer to **BELT, Serpentine , Installation** .
7. Install the viscous fan assembly. Refer to **FAN, Cooling, Electric , Installation** .
8. Connect the fan harness connector.

9. Install the A/C discharge line clip to fan shroud.
10. Install the upper radiator hose to radiator.
11. Install the Charge Air Cooler (CAC) outlet hose to (CAC).
12. Install the windshield washer reservoir and engine coolant recovery bottle. Refer to **BOTTLE, Coolant Recovery , Installation** .
13. Install the three wire harness retainers.

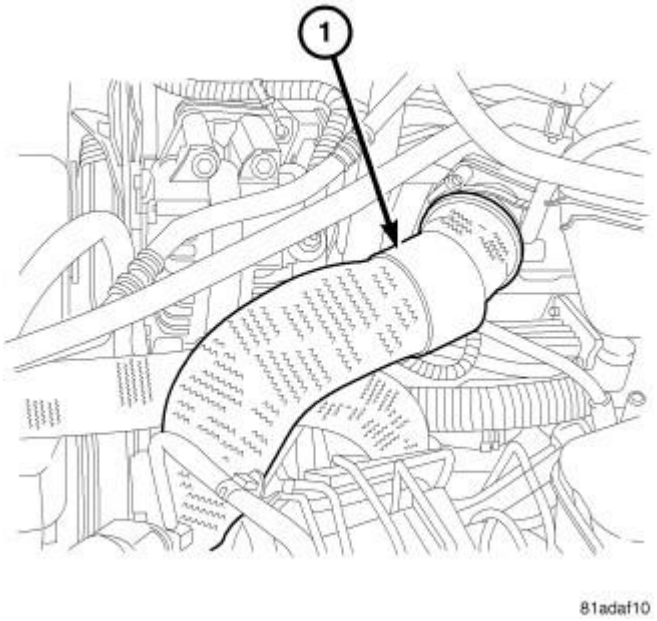

Fig. 337: Charge Outlet Hose
Courtesy of CHRYSLER LLC

14. Install the charge outlet hose to EGR air flow control valve.
15. Install lower radiator hose clip to fan shroud.
16. Fill the engine cooling system. Refer to **Standard Procedure** .
17. Install the air cleaner body. Refer to **BODY, Air Cleaner , Installation**.
18. Install the engine silencer and securely tighten fasteners.
19. Install the engine cover.
20. Connect the negative battery cable.

SPROCKET(S), TIMING BELT AND CHAIN

Removal

CAMSHAFT SPROCKET

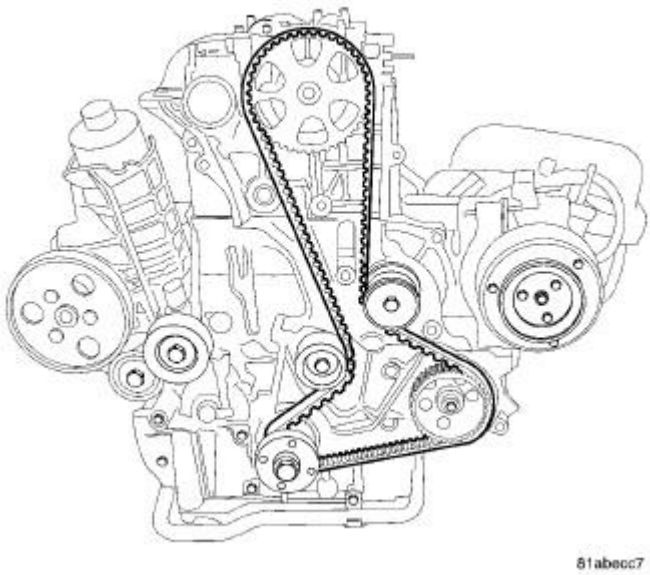

Fig. 338: Timing Belt
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the timing belt. Refer to **BELT, Timing , Removal**.

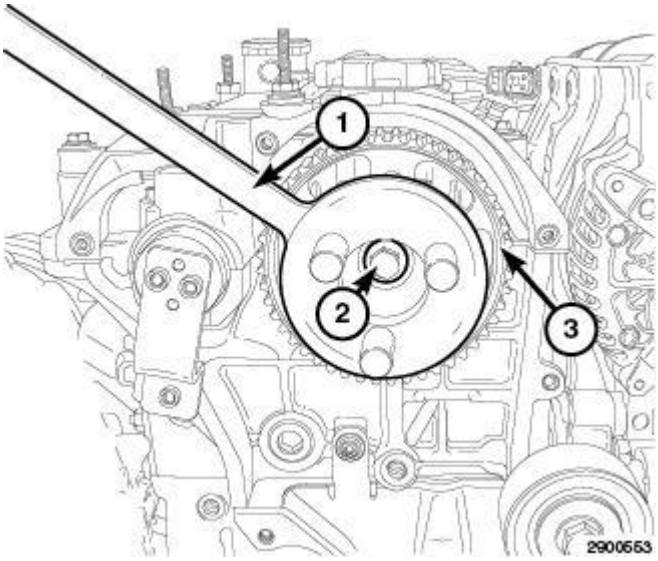

Fig. 339: Locking Tool, Camshaft Sprocket & Bolt
Courtesy of CHRYSLER LLC

3. Using the Locking tool (special tool #VM.1055, Locking Tool) (1) to hold the intake camshaft sprocket, remove the bolt (2).

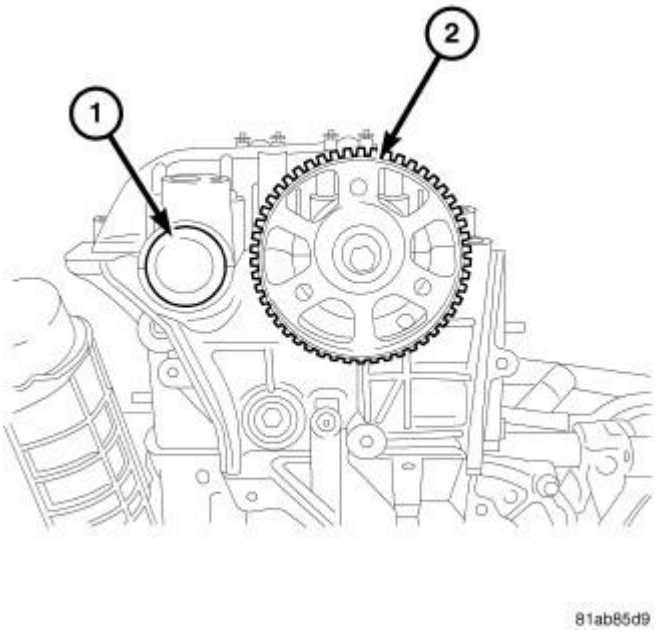

Fig. 340: Camshaft Timing Sprocket
Courtesy of CHRYSLER LLC

4. Remove the intake camshaft sprocket (2).

CRANKSHAFT SPROCKET

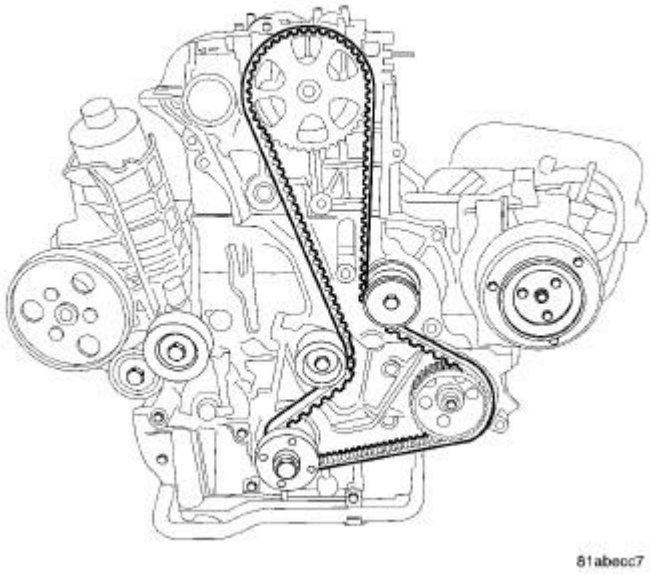

Fig. 341: Timing Belt
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove the timing belt. Refer to **BELT, Timing , Removal**.

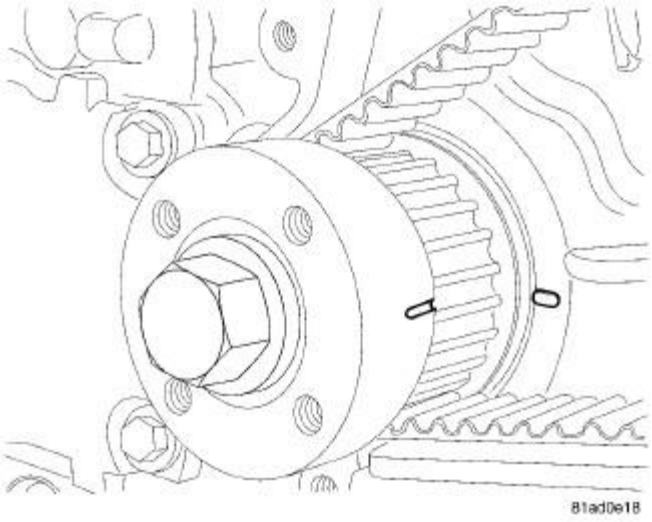

Fig. 342: Crankshaft Timing Marks
Courtesy of CHRYSLER LLC

NOTE: The crankshaft sprocket bolt is a left handed thread.

3. Remove bolt and the crankshaft sprocket.

Installation

CAMSHAFT SPROCKET

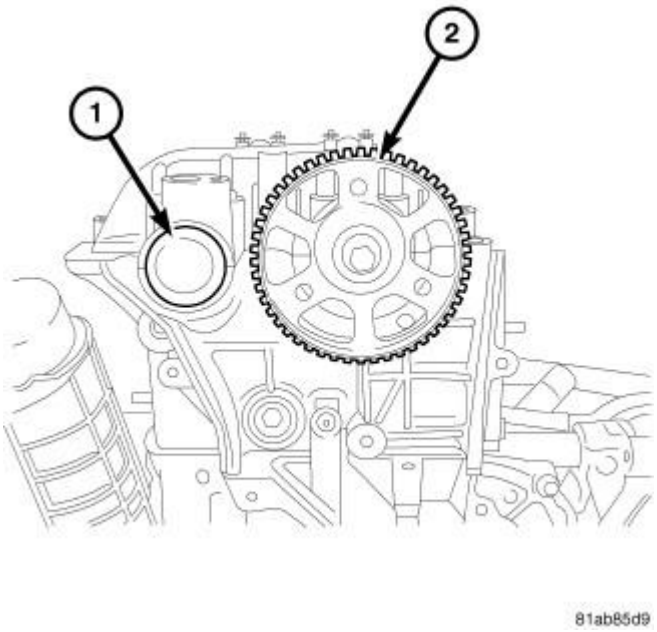

Fig. 343: Camshaft Timing Sprocket
Courtesy of CHRYSLER LLC

1. Install the camshaft sprocket (2) and tighten bolt finger tight.

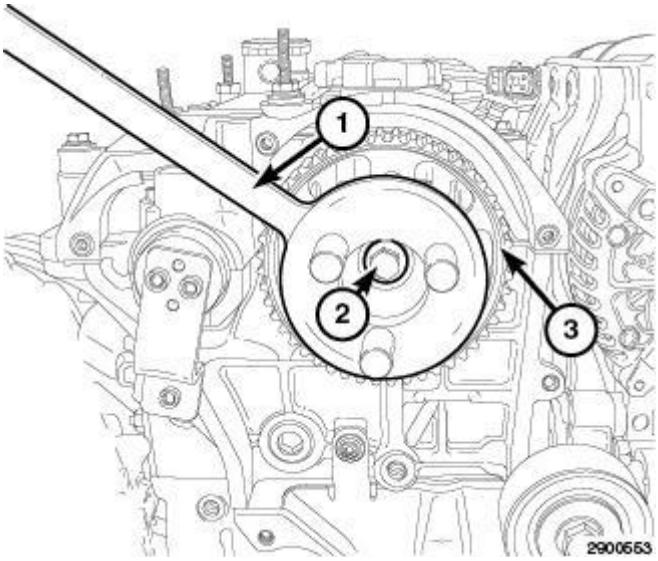

Fig. 344: Locking Tool, Camshaft Sprocket & Bolt
Courtesy of CHRYSLER LLC

2. Using the Locking Tool (special tool #VM.1055, Locking Tool) (1) to hold the camshaft sprocket, tighten bolt (2) to 64 N.m (47 ft. lbs.).
3. Install the timing belt. Refer to **SPROCKET(S), Timing Belt and Chain , Installation**.
4. Connect negative battery cable.

CRANKSHAFT SPROCKET

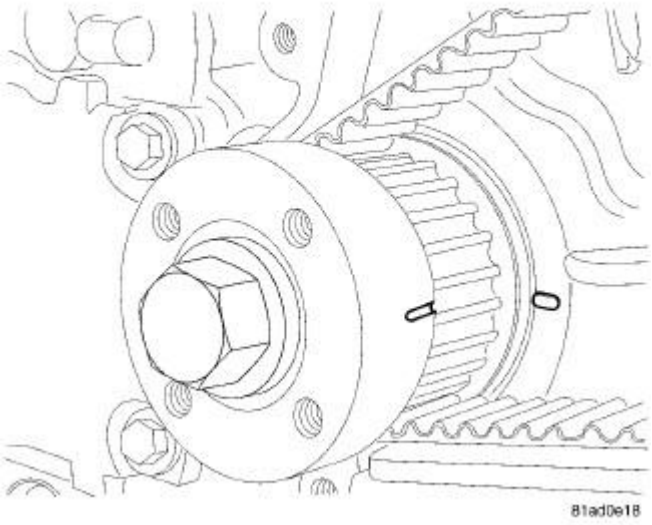

Fig. 345: Crankshaft Timing Marks
Courtesy of CHRYSLER LLC

NOTE: The crankshaft sprocket bolt is a left handed thread.

1. Install the crankshaft sprocket. Tighten bolt to 100 N.m (74 ft. lbs.) plus an additional 120 degrees.

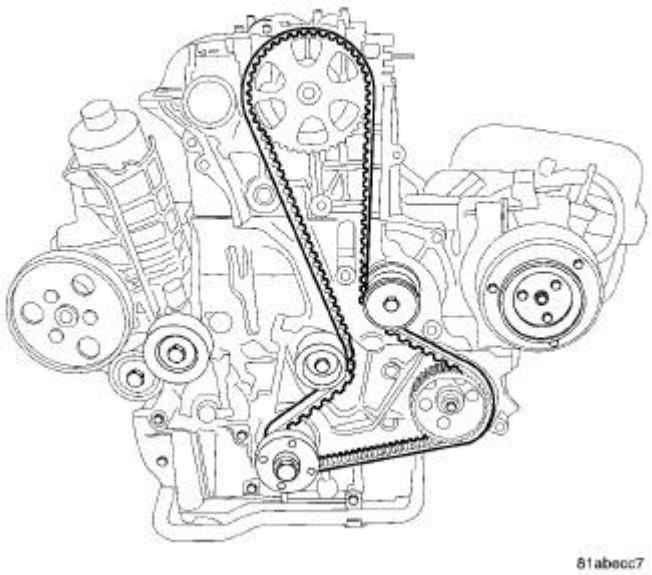

Fig. 346: Timing Belt
Courtesy of CHRYSLER LLC

2. Install the timing belt. Refer to **BELT, Timing , Installation**.
3. Connect the negative battery cable.

TENSIONER, ENGINE TIMING

Adjustments

ADJUSTMENTS

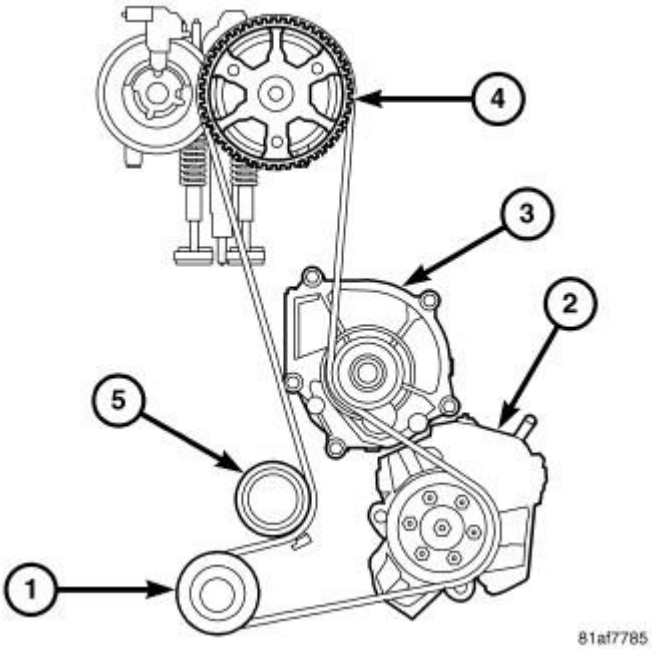

Fig. 347: Timing Belt Routing
Courtesy of CHRYSLER LLC

1. With the upper and lower front covers removed and the timing belt installed, loosen timing belt tensioner.

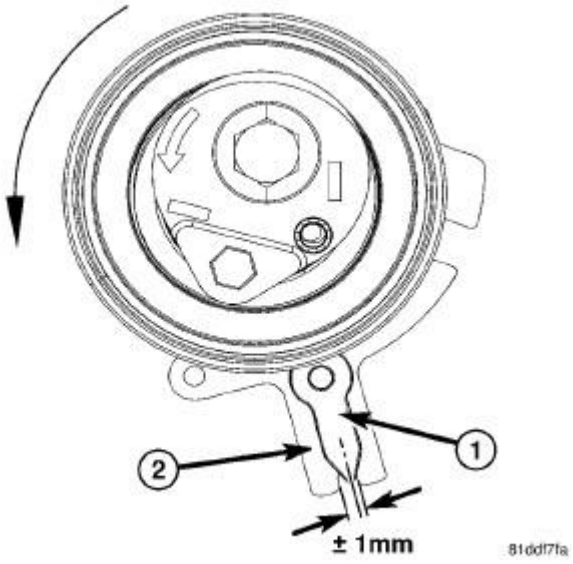

Fig. 348: Tensioner Indicator & Tensioner Gage Slot
Courtesy of CHRYSLER LLC

NOTE: Turning the belt tensioner counter clockwise moves the pointer in a clockwise direction. Also, if the tensioner bolt is too loose this will cause the tensioner alignment slot to jump off the alignment boss on timing cover.

2. Adjust timing belt tensioner by lining up the load indicator arrow (1) to the center of the tensioner load gage (2) as illustrated. Tighten the timing belt tensioner bolt to 28 N.m (21 ft. lbs.).

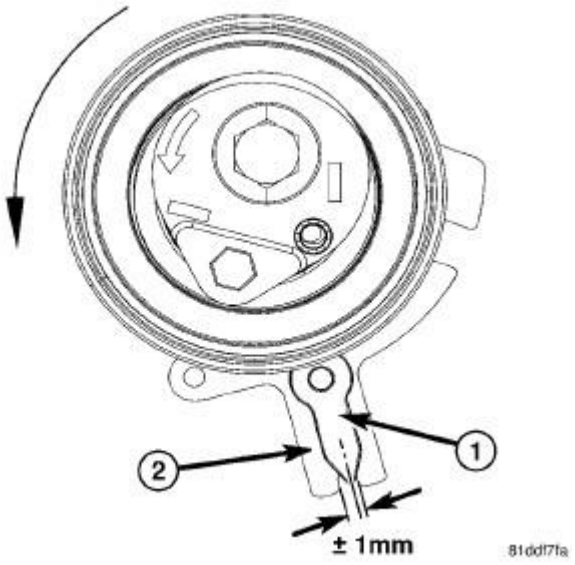

Fig. 349: Tensioner Indicator & Tensioner Gage Slot
Courtesy of CHRYSLER LLC

3. Rotate engine 2 complete revolutions and then recheck tensioner alignment. Verify that the tension indicator (1) is centered in the slot on the tensioner gage (2) slot as shown in illustration. Readjust tensioner alignment as necessary.

Removal

REMOVAL

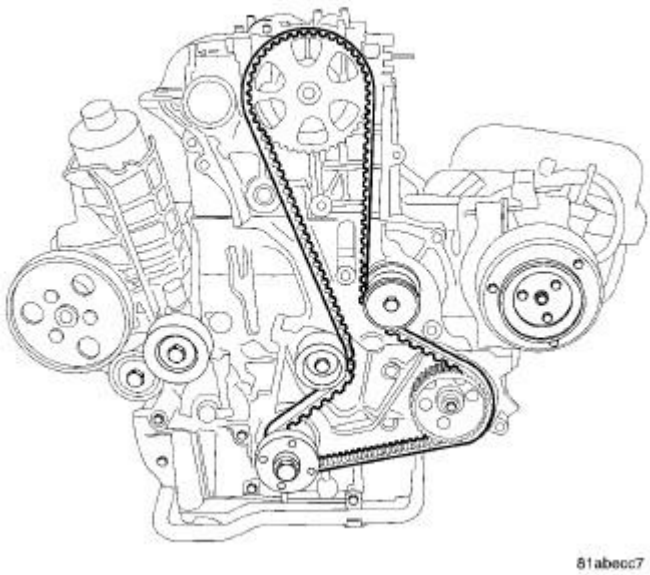

Fig. 350: Timing Belt
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove the timing. Refer to **BELT, Timing , Removal**.

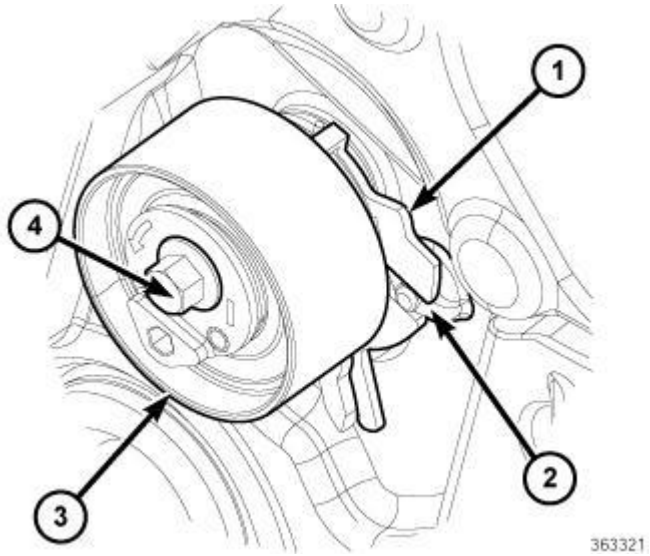

Fig. 351: Tensioner Alignment Plate, Boss, Timing Belt Tensioner & Bolt
Courtesy of CHRYSLER LLC

3. Remove bolt (4), and timing belt tensioner (3).

Installation

INSTALLATION

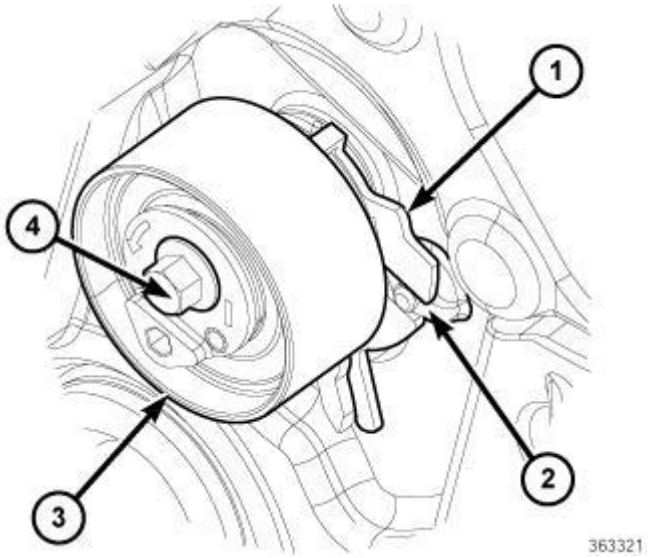

Fig. 352: Tensioner Alignment Plate, Boss, Timing Belt Tensioner & Bolt
Courtesy of CHRYSLER LLC

1. Install the timing belt tensioner (3). Do not tighten bolt (4) at this time. Verify that the slot in the tensioner alignment plate (1) is aligned with the boss (2) in the rear timing belt cover.

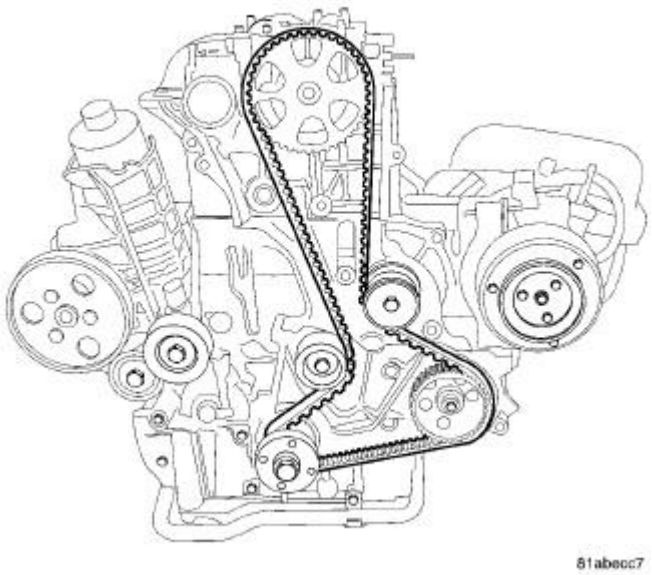

Fig. 353: Timing Belt
Courtesy of CHRYSLER LLC

2. If the timing belt. Refer to **BELT, Timing , Installation**.

3. Connect the negative battery cable.

AIR INTAKE SYSTEM

BODY, AIR CLEANER

Removal

REMOVAL

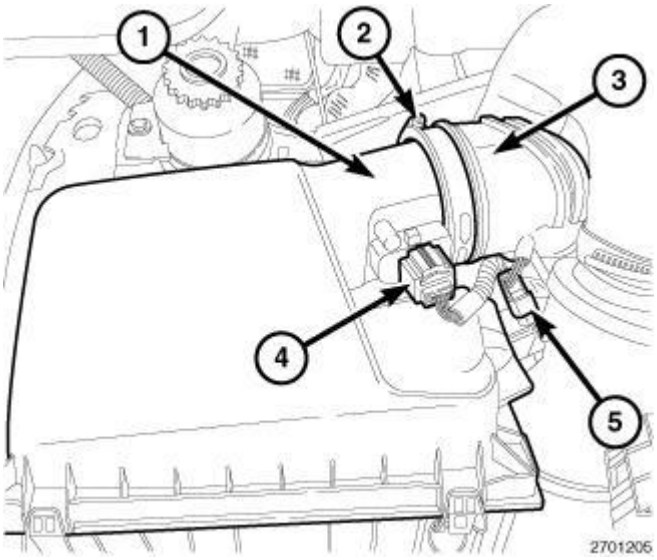

Fig. 354: Air Cleaner Housing, Worm Clamp, Air Cleaner Outlet Tube, MAF Sensor & IAT Sensor
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Loosen worm clamp (2) and remove the air cleaner outlet tube (3) from air cleaner housing (1).
3. Disconnect the IAT sensor (5).
4. Release the lock tab and disconnect the MAF sensor (4).
5. To remove the air cleaner assembly, first lift up on air cleaner body to release the three tabs; then disconnect the inlet tube from housing and remove the air cleaner body.

Turbocharger Air Inlet Tube

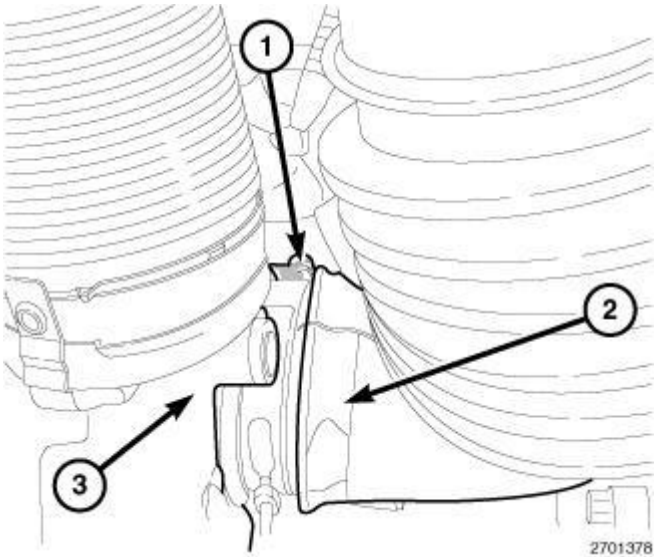

Fig. 355: Worm Clamp, Turbocharger Air Inlet Tube & Turbocharger
Courtesy of CHRYSLER LLC

NOTE: Air Cleaner assembly should already have been removed.

1. Loosen worm clamp (1) and remove the turbocharger air inlet tube (2) from turbocharger (3).

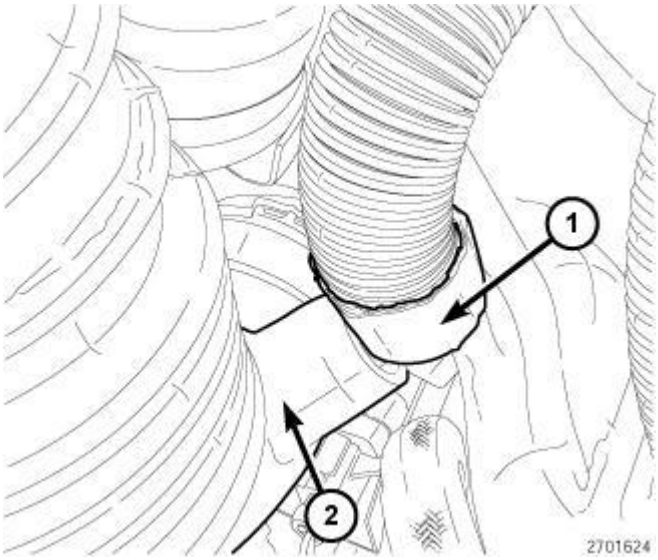

Fig. 356: Oil Separator Hose & Turbocharger Air Inlet Tube
Courtesy of CHRYSLER LLC

2. Disconnect the oil separator hose from turbocharger air inlet tube.

Installation

INSTALLATION

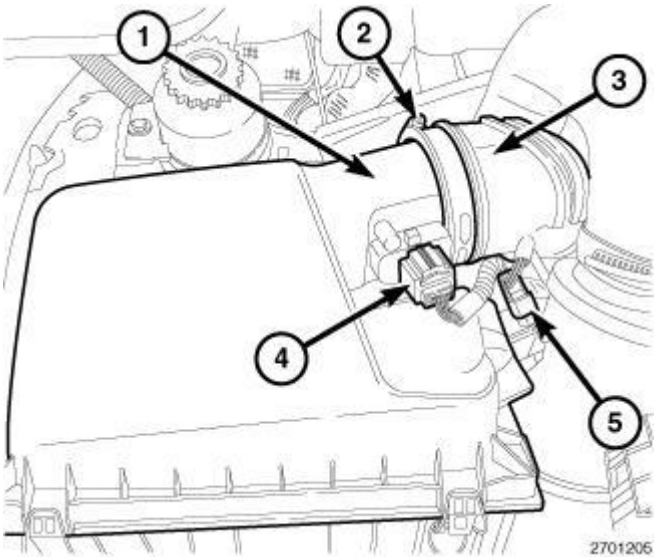

Fig. 357: Air Cleaner Housing, Worm Clamp, Air Cleaner Outlet Tube, MAF Sensor & IAT Sensor
Courtesy of CHRYSLER LLC

1. Connect the inlet tube and install the air cleaner body and push down to lock the three tabs in place.
2. Connect the MAF sensor (4).
3. Connect the IAT sensor (5).
4. Install the air cleaner outlet tube (3) and tighten the worm clamp (2).
5. Connect the negative battery cable.

Turbocharger Air Inlet Tube

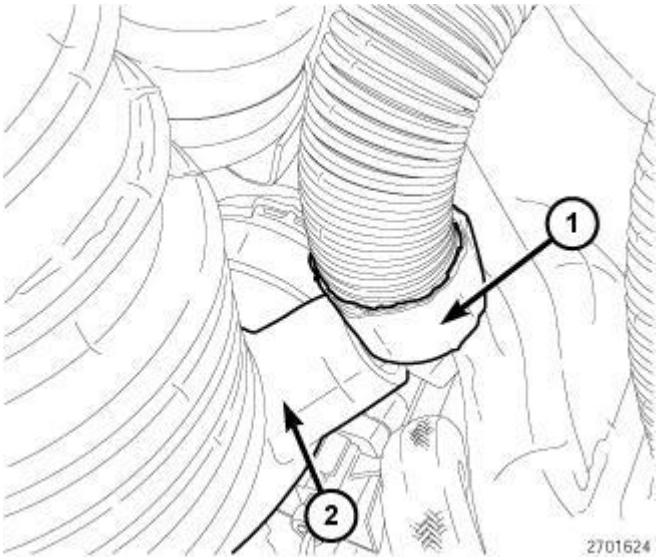

Fig. 358: Oil Separator Hose & Turbocharger Air Inlet Tube
Courtesy of CHRYSLER LLC

1. Connect the oil separator hose from turbocharger air inlet tube.

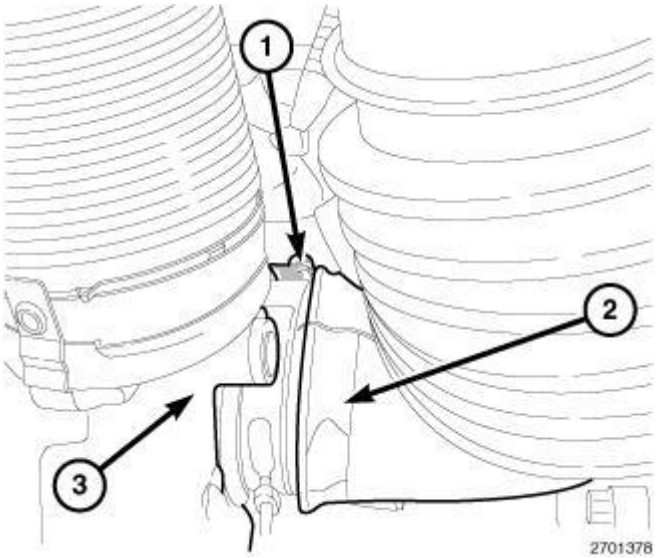

Fig. 359: Worm Clamp, Turbocharger Air Inlet Tube & Turbocharger
Courtesy of CHRYSLER LLC

NOTE: Air Cleaner assembly should already have been removed.

2. Install the turbocharger air inlet tube (2) to the turbocharger (3) and securely tighten worm clamp (1).

AIR CLEANER

Removal

REMOVAL

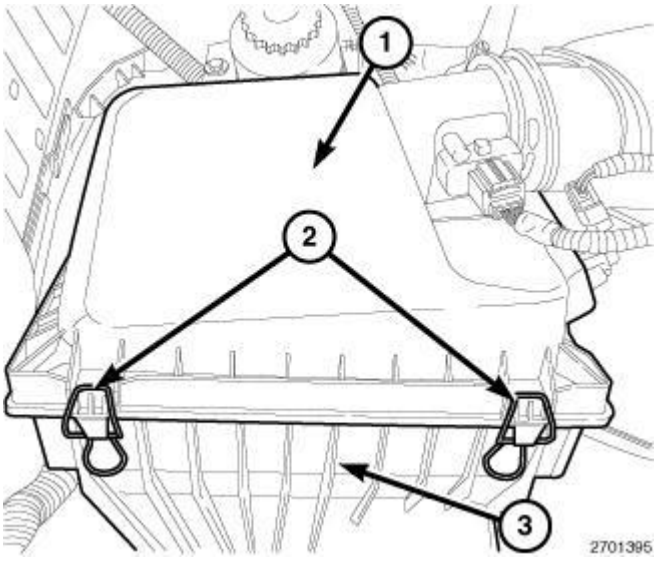

Fig. 360: Identifying Air Cleaner Housing & Clips
Courtesy of CHRYSLER LLC

1. Unlatch clips (2) from top of air cleaner housing (1) and lift housing cover up for removal.

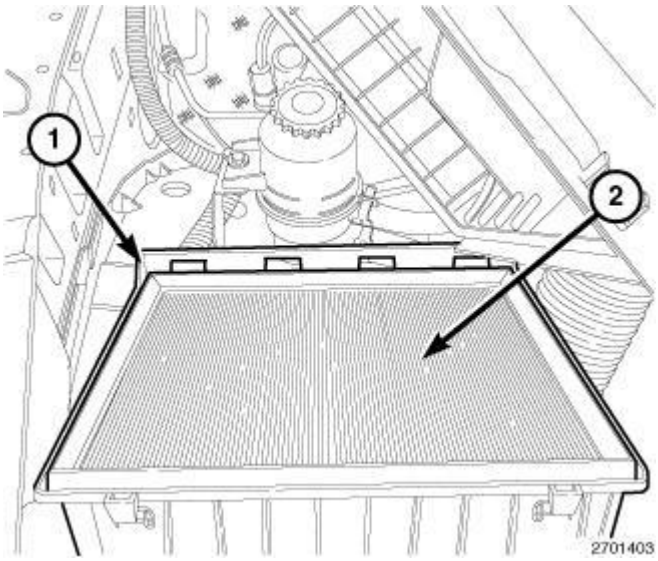

Fig. 361: Air Cleaner Housing & Air Cleaner Filter
Courtesy of CHRYSLER LLC

2. Remove the air cleaner filter (2) from air cleaner housing (1).

Installation

INSTALLATION

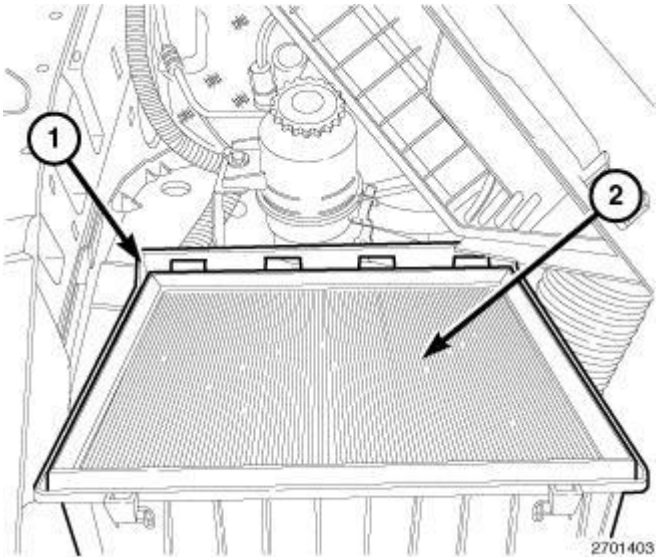

Fig. 362: Air Cleaner Housing & Air Cleaner Filter
Courtesy of CHRYSLER LLC

1. Clean out the inside of air cleaner housing (1).
2. Install the new filter element (2) into air cleaner housing (1).

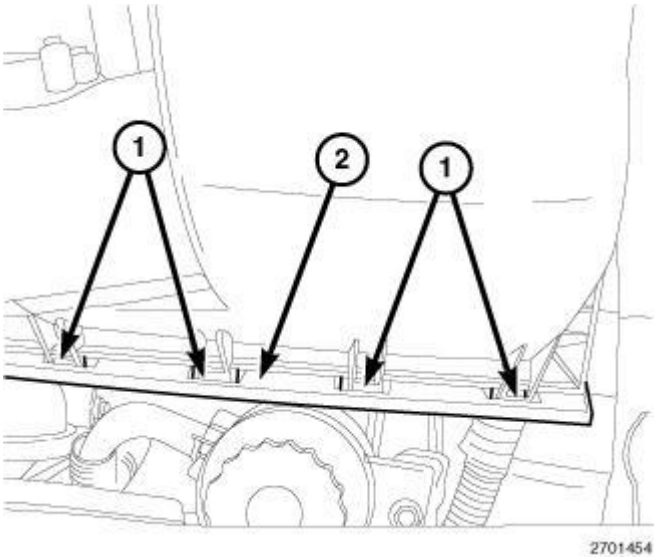

Fig. 363: Air Cleaner Cover Alignment Tabs
Courtesy of CHRYSLER LLC

3. Position the air cleaner cover alignment tabs into housing slots and make sure the air cleaner cover is properly seated.

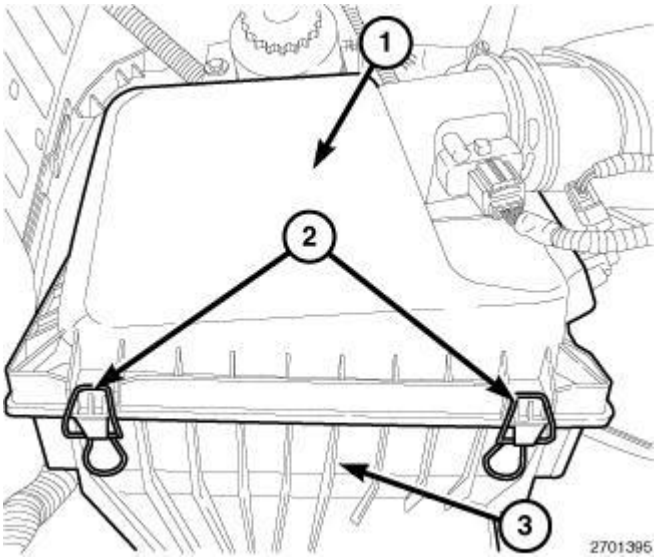

Fig. 364: Identifying Air Cleaner Housing & Clips
Courtesy of CHRYSLER LLC

4. Latch the clips (2) to the clamp air cleaner cover (1).

