2009 ENGINE

2.8L Diesel - Service Information - Nitro

STANDARD PROCEDURE

ENGINE GASKET SURFACE PREPARATION

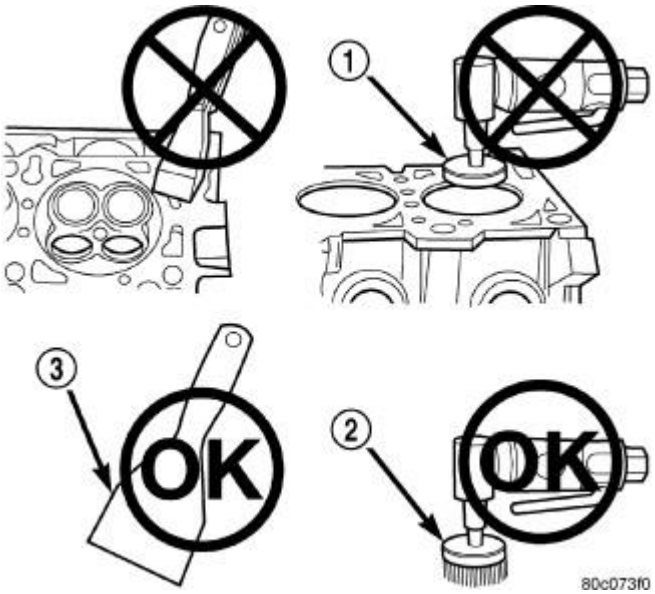

Fig. 1: Proper Tool Usage For Surface Preparation
Courtesy of CHRYSLER LLC

1 - ABRASIVE PAD 2 - 3M ROLOC™ BRISTLE DISC 3 - PLASTIC/WOOD SCRAPER

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

Never use the following to clean gasket surfaces:

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

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.
- Drill motor with 3M Roloc™ Bristle Disc (white or yellow).

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

DESCRIPTION

DESCRIPTION

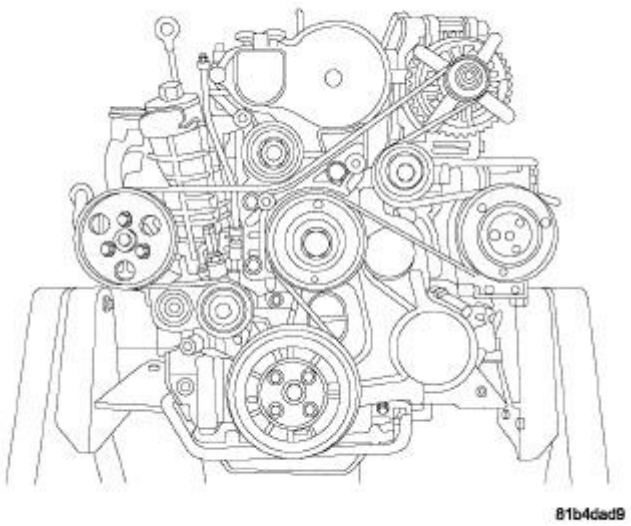

Fig. 2: 2.8L ENGINE
Courtesy of CHRYSLER LLC

The 2.8L (2776 cc) 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.

REMOVAL

ENGINE

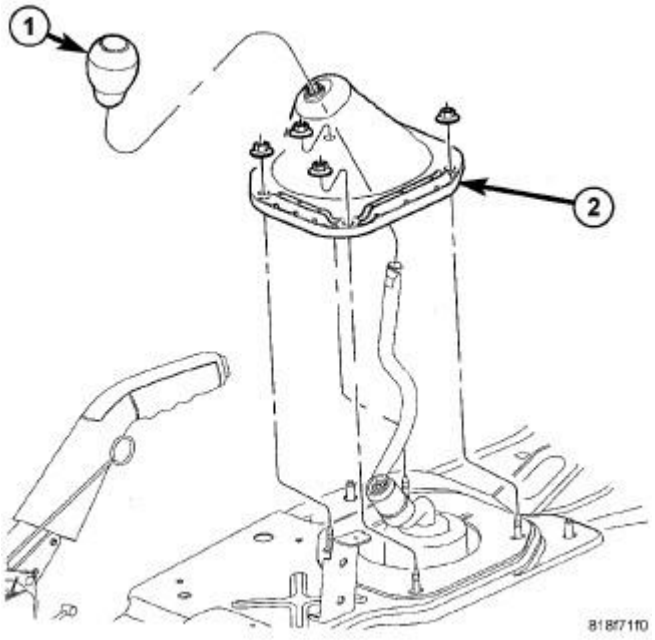

Fig. 3: SHIFT KNOB
Courtesy of CHRYSLER LLC

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

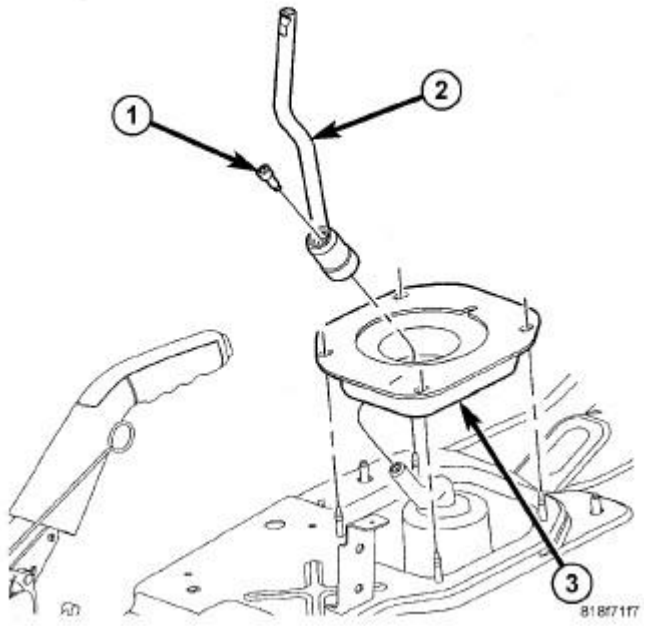

Fig. 4: SHIFTER INNER BOOT
Courtesy of CHRYSLER LLC

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 **Heating and Air Conditioning/Plumbing - Standard Procedure** .
7. Remove the engine skid plate.
8. Remove the lower air deflector from the radiator.
9. Drain the coolant. Refer to **Cooling - Standard Procedure** .
10. Drain the engine oil.

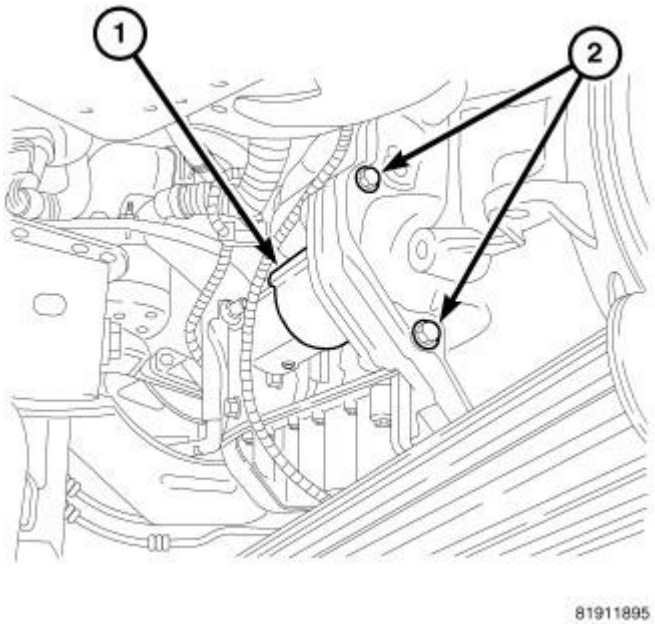

Fig. 5: STARTER MOUNTING 2.8L DIESEL
Courtesy of CHRYSLER LLC

11. Remove the starter. Refer to **Electrical/Starting/STARTER - Removal** .
12. Remove the ground cable from engine block and position aside the harness.
13. Remove lower radiator hose clip at fan shroud.

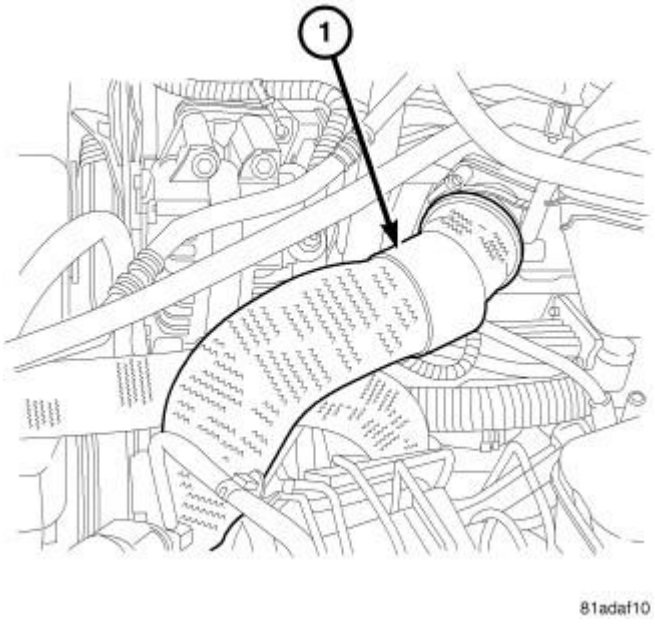

Fig. 6: Charge Outlet Hose
Courtesy of CHRYSLER LLC

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

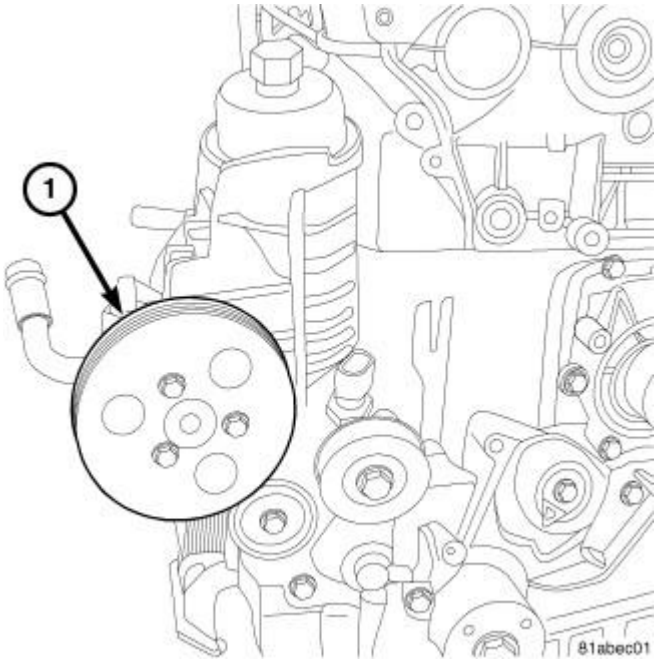

Fig. 7: POWER STEERING PUMP PULLEY
Courtesy of CHRYSLER LLC

27. Remove the power steering pump. Refer to **Steering/Pump - Removal** .

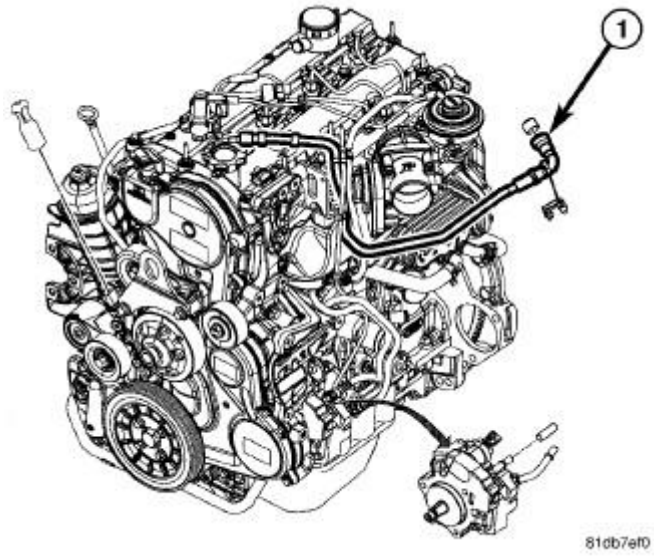

Fig. 8: FUEL RAIL RETURN LINE
Courtesy of CHRYSLER LLC

28. Disconnect the fuel supply and return lines.
29. Disconnect the fuel rail fuel return line (1).

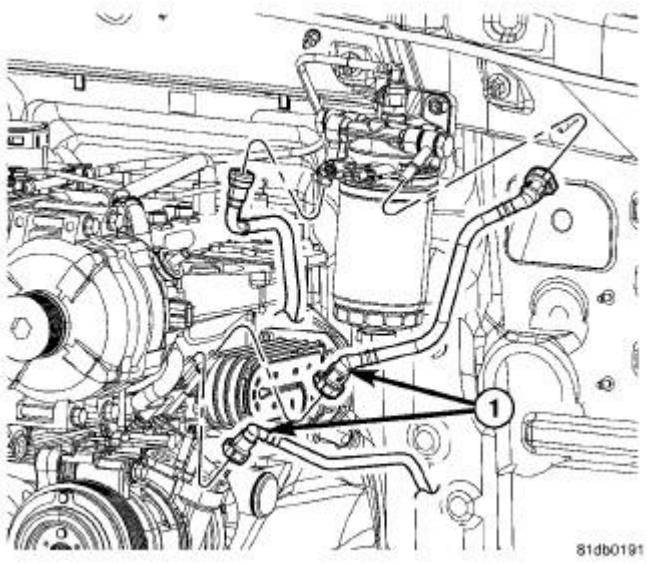

Fig. 9: FUEL BLOCK
Courtesy of CHRYSLER LLC

30. Remove the fuel filter/water separator. Refer to **Fuel System/Fuel Delivery/SEPARATOR and FILTER, Fuel and Water - Removal** .
31. Disconnect the brake booster vacuum hose.
32. Disconnect the heater core coolant hoses from heater core.

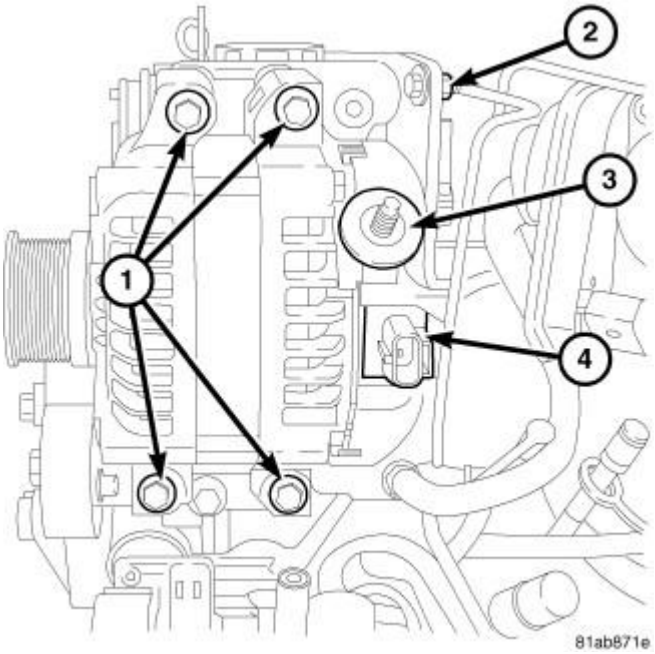

Fig. 10: GENERATOR
Courtesy of CHRYSLER LLC

33. Remove the generator. Refer to **Electrical/Charging/GENERATOR - Removal** .

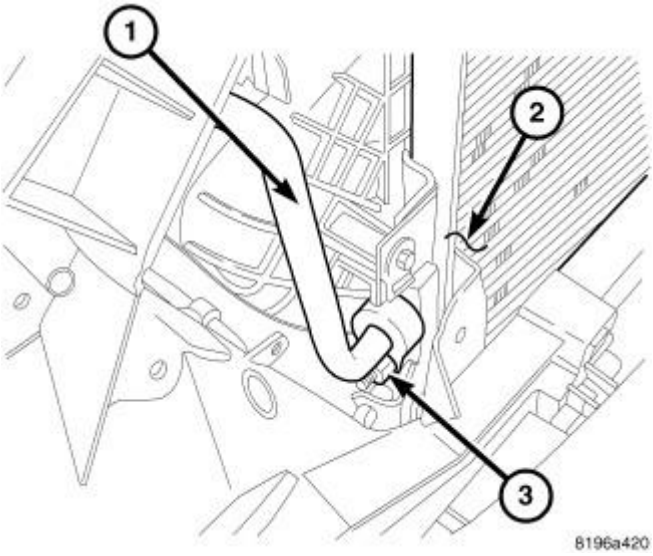

Fig. 11: Identifying Discharge Line To Condenser Diesel
Courtesy of CHRYSLER LLC

34. Remove nut (3) and the A/C line (1) at the condenser (2).
35. Install tape or plugs to the discharge line and condenser.
36. Remove nut securing wire harness to suction line.

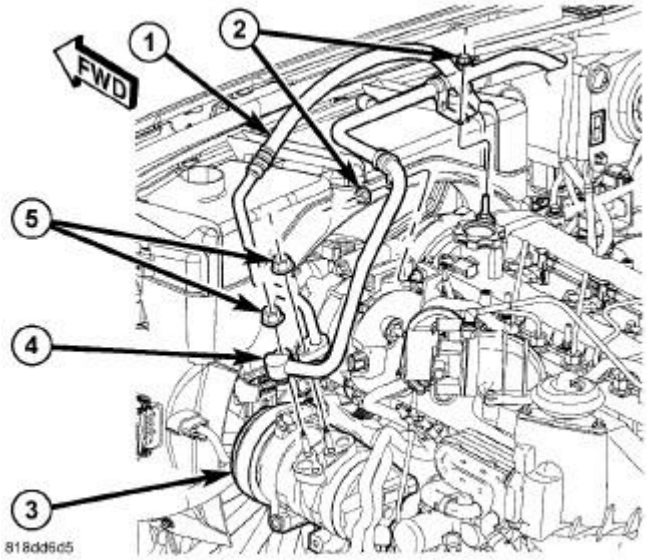

Fig. 12: Identifying Refrigerant Lines To Compressor
Courtesy of CHRYSLER LLC

37. Depending on model year, remove the one or two nuts (2) that secure the A/C suction line to the top of the engine.
38. Remove the nut (5) that secures the A/C suction line (4) to the A/C compressor (3).
39. Remove and discard O-ring, gaskets and install protective caps.

40. Disconnect the A/C compressor harness connector.
41. Remove bolts and the A/C compressor (3).

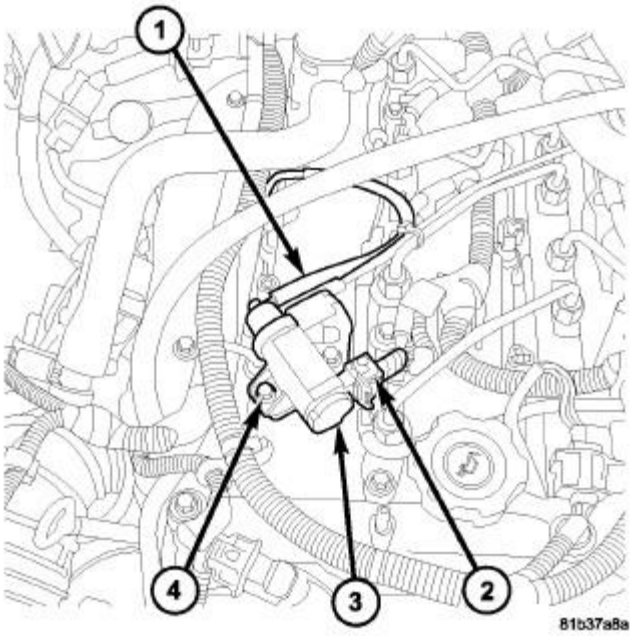

Fig. 13: Identifying EGR solenoid
Courtesy of CHRYSLER LLC

42. Disconnect the EGR vacuum solenoid harness connector (2).

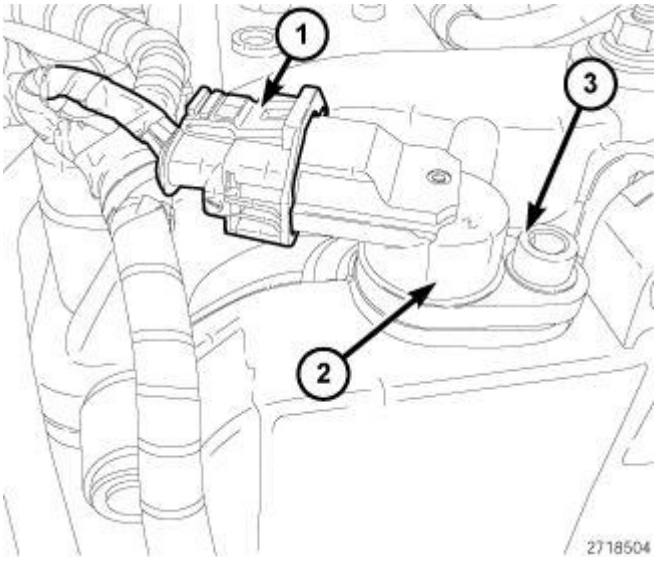

Fig. 14: CAMSHAFT POSITION SENSOR HARNESS CONNECTOR
Courtesy of CHRYSLER LLC

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

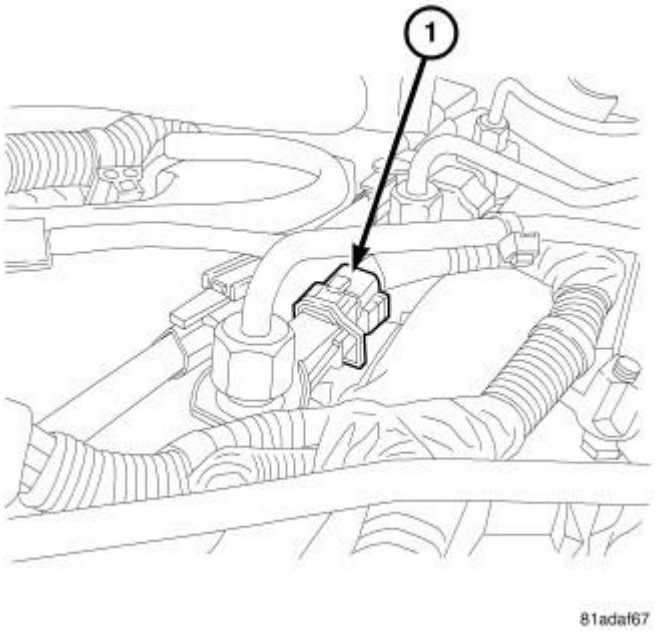

Fig. 15: INJECTOR CONNECTOR
Courtesy of CHRYSLER LLC

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

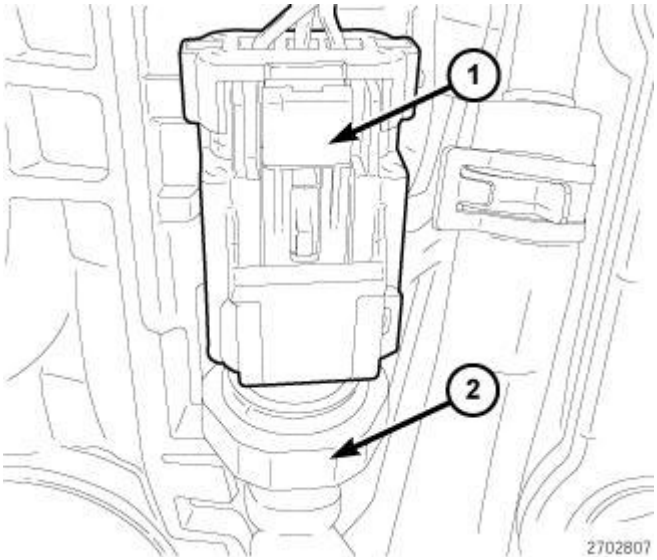

Fig. 16: OIL PRESSURE SWITCH
Courtesy of CHRYSLER LLC

45. Disconnect the oil pressure switch.

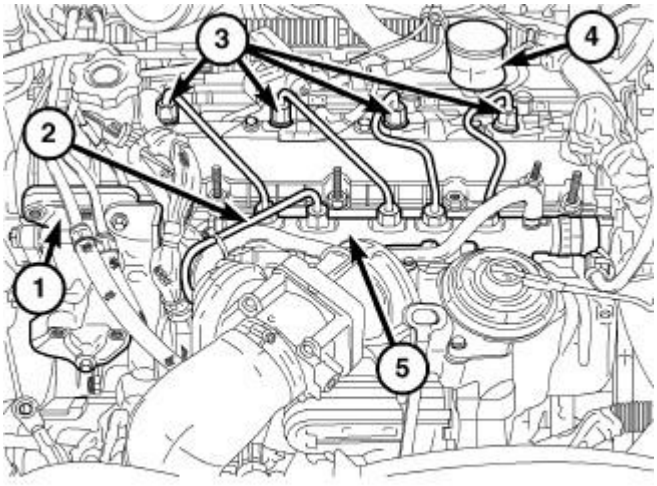

Fig. 17: FUEL RAIL
Courtesy of CHRYSLER LLC

46. Disconnect the fuel pressure sensor harness connector.
47. Disconnect the fuel pressure regulator harness connector.

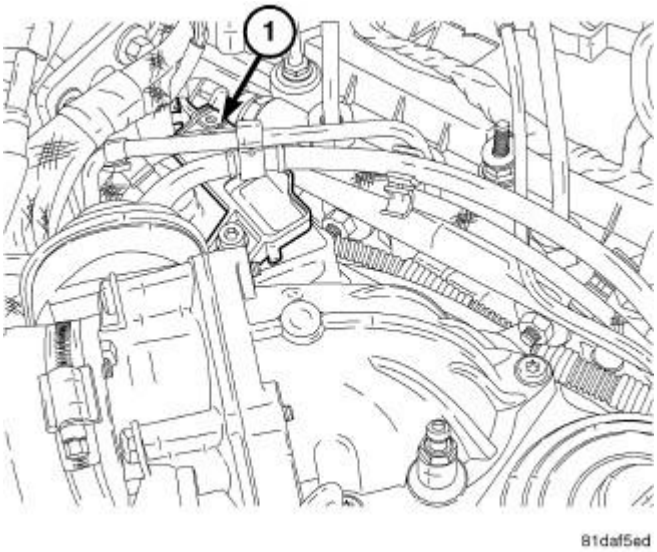

Fig. 18: IAT/BPS SENSOR
Courtesy of CHRYSLER LLC

48. Disconnect the turbocharger actuator harness connector.
49. Disconnect the A/C pressure transducer harness connector.
50. Disconnect the EGR airflow control valve solenoid harness connector.
51. Disconnect the IAT/BPS harness connector (1).
52. Disconnect the fuel quantity solenoid harness connector.
53. Position aside the engine wiring harness.

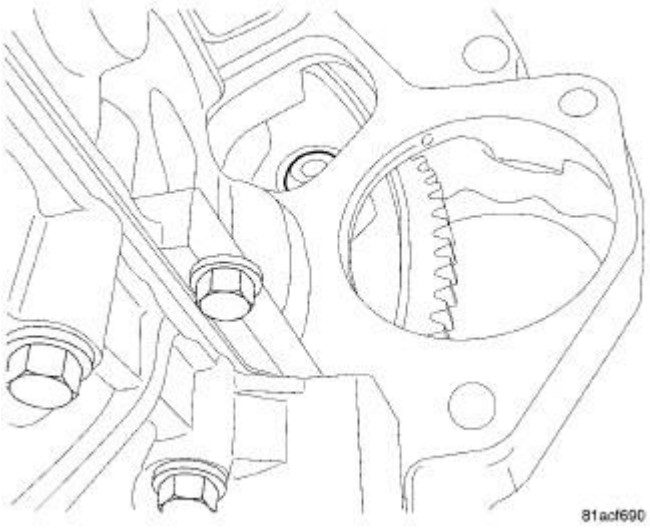

Fig. 19: FLEX PLATE BOLTS
Courtesy of CHRYSLER LLC

54. Remove the Crankshaft Position Sensor (CKP). Refer to **Fuel System/Fuel Injection/SENSOR, Crankshaft Position - Removal** .
55. Remove the torque converter to flex plate bolts.
56. Remove the transmission fill tube.
57. On manual transmission models, remove the manual transmission. Refer to **Transmission and Transfer Case/Manual - Removal** .

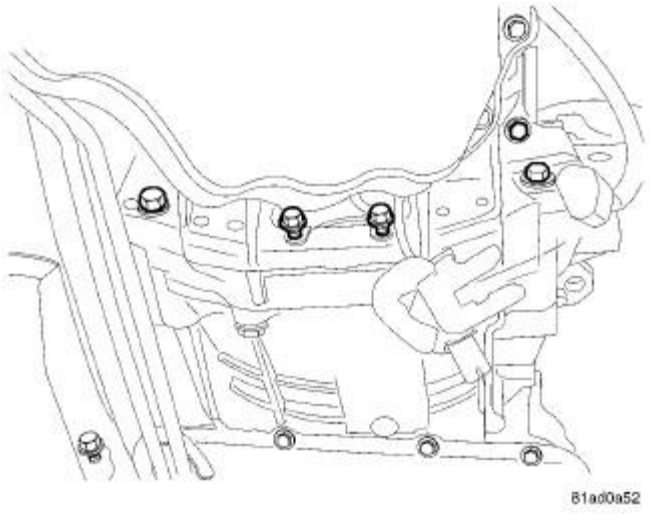

Fig. 20: BELL HOUSING BOLTS
Courtesy of CHRYSLER LLC

58. Remove the transmission to engine bolts.
59. Remove the transmission line bracket at the oil pan.
60. Remove the catalytic converter. Refer to **Exhaust System/CONVERTER, Catalytic - Removal** .

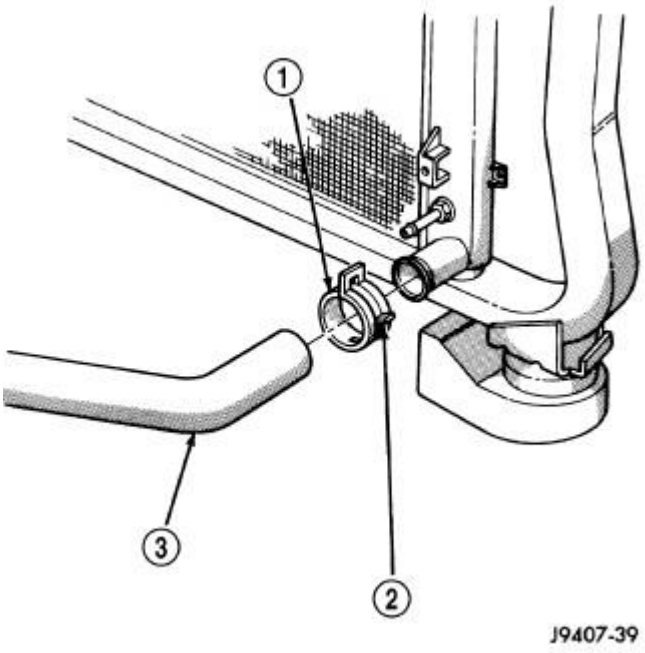

Fig. 21: Removing/Installing Lower Radiator Hose
Courtesy of CHRYSLER LLC

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

61. Remove the upper radiator hose at thermostat housing.
62. Remove the lower radiator hose (2).

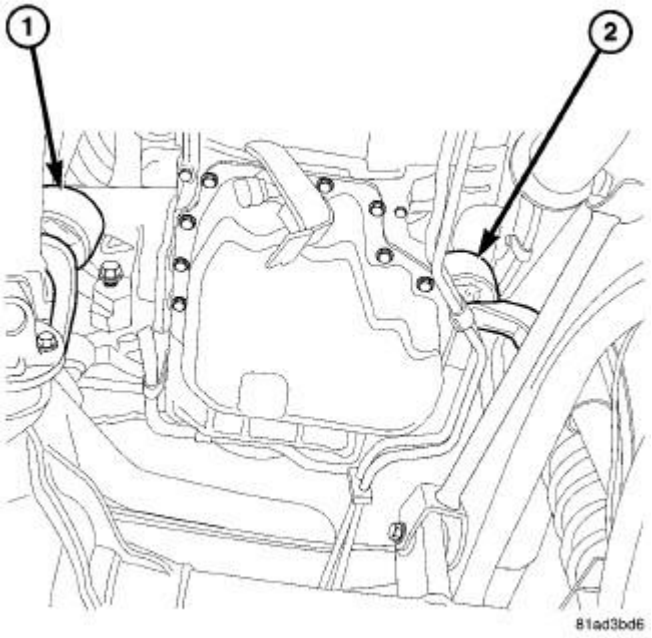

Fig. 22: ENGINE MOUNTS
Courtesy of CHRYSLER LLC

63. Remove the left engine mount nut.
64. Remove the right engine mount nut.

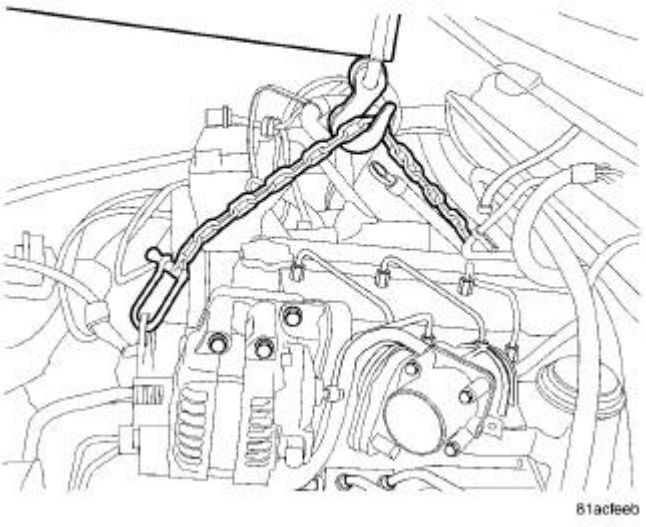

Fig. 23: ENGINE LIFT
Courtesy of CHRYSLER LLC

65. Install a suitable engine lifting device.
66. Remove the engine.

INSTALLATION

ENGINE

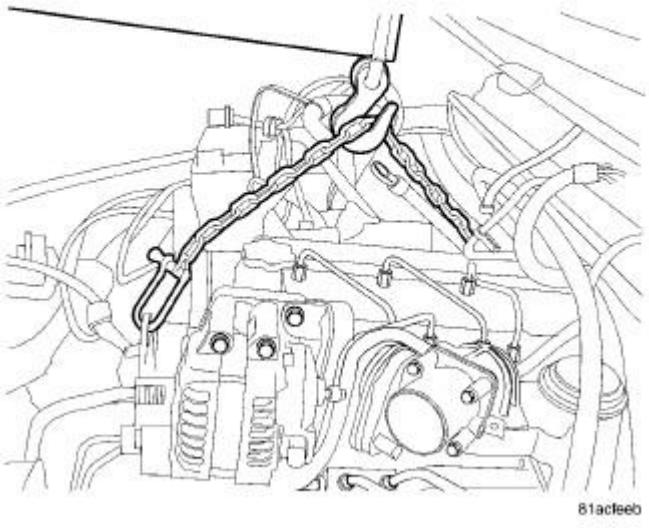

Fig. 24: ENGINE LIFT
Courtesy of CHRYSLER LLC

1. Install the engine.
2. Remove the engine lift.

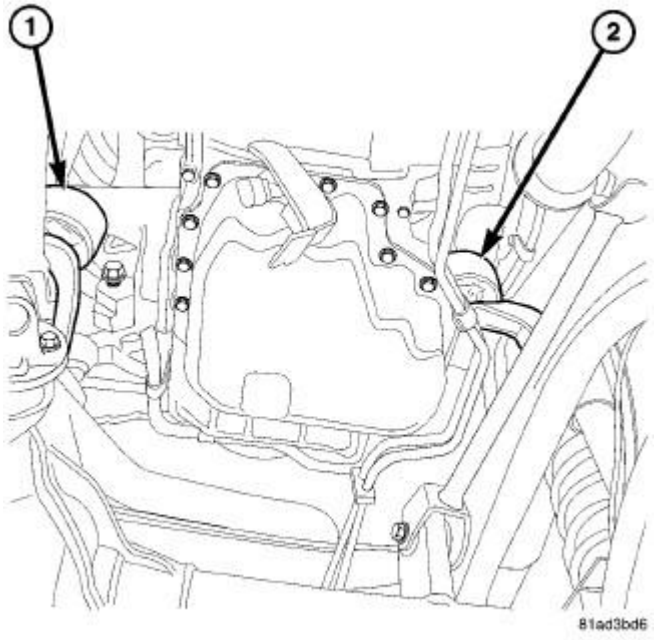

Fig. 25: ENGINE MOUNTS
Courtesy of CHRYSLER LLC

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.).

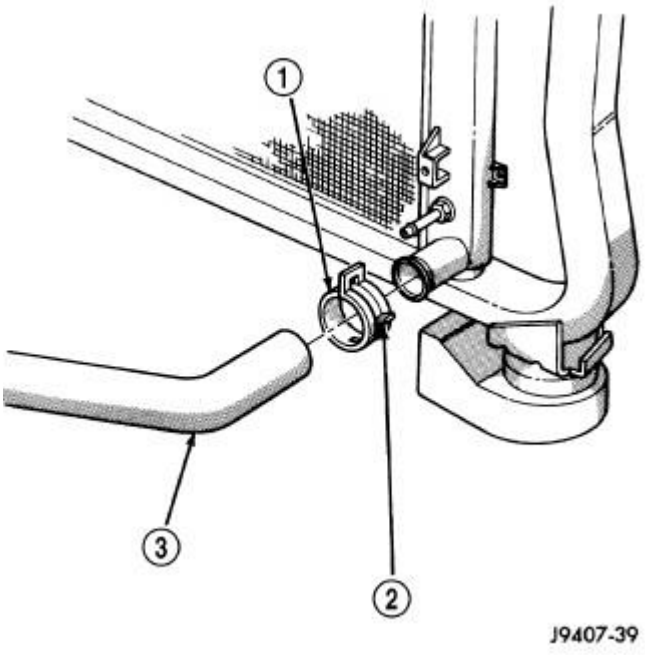

Fig. 26: Removing/Installing Lower Radiator Hose
Courtesy of CHRYSLER LLC

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.

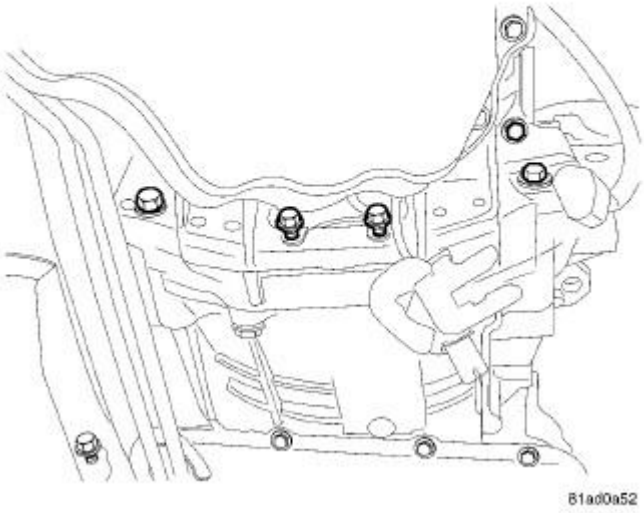

Fig. 27: BELL HOUSING BOLTS
Courtesy of CHRYSLER LLC

7. Install the catalytic converter to engine bolts. Refer to **Exhaust System/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.).

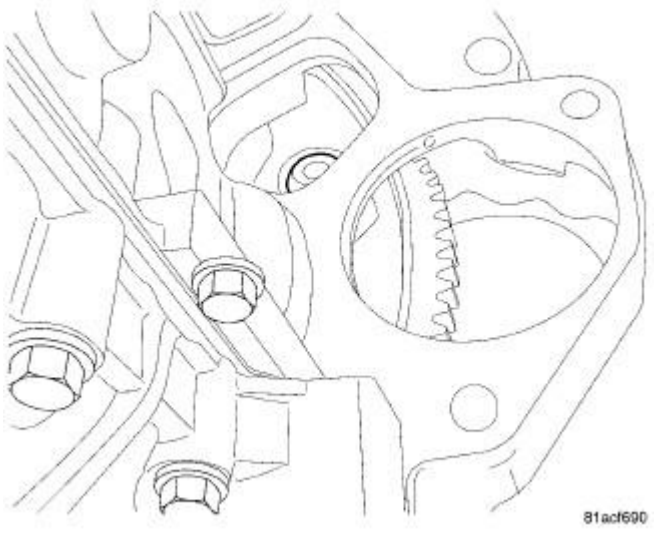

Fig. 28: FLEX PLATE BOLTS
Courtesy of CHRYSLER LLC

10. On manual transmission models, install the manual transmission. Refer to **Transmission and Transfer Case/Manual - 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 **Fuel System/Fuel Injection/SENSOR, Crankshaft Position - Installation** .

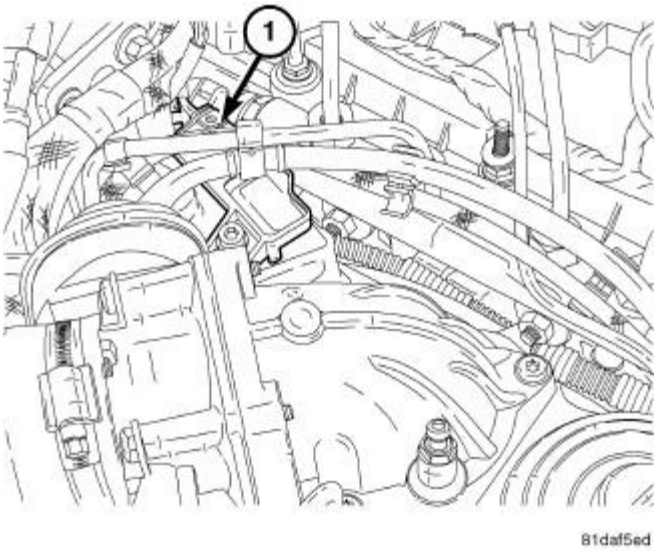

Fig. 29: IAT/BPS SENSOR
Courtesy of CHRYSLER LLC

14. Position the engine wiring harness.

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

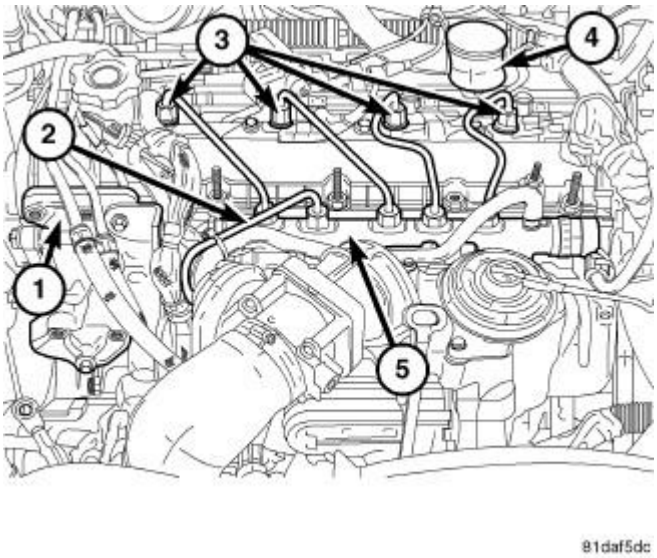

Fig. 30: FUEL RAIL
Courtesy of CHRYSLER LLC

20. Connect the fuel pressure regulator harness connector.
21. Connect the fuel pressure sensor harness connector.

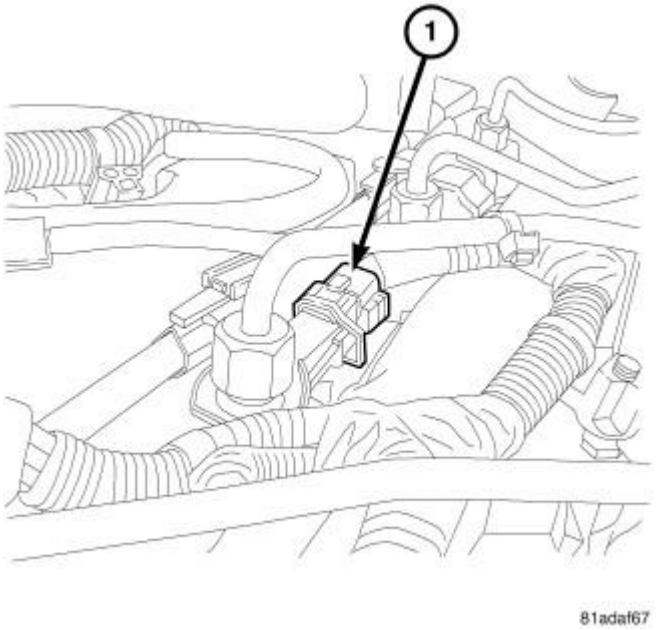

Fig. 31: INJECTOR CONNECTOR
Courtesy of CHRYSLER LLC

22. Disconnect the oil pressure switch.
23. Disconnect the fuel injector connectors.

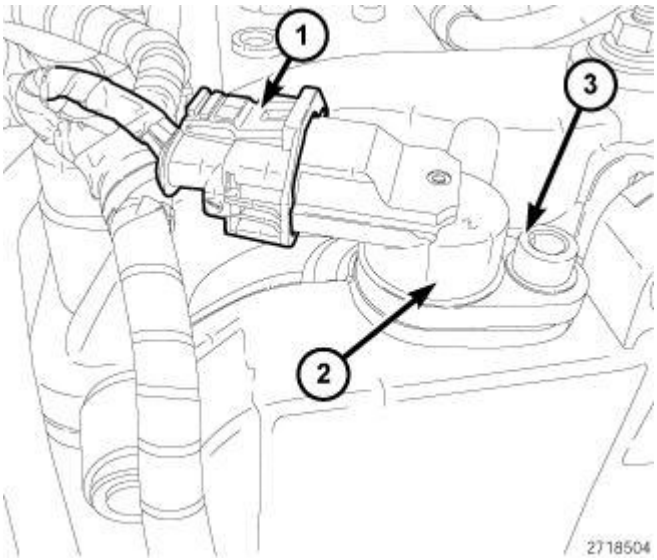

Fig. 32: CAMSHAFT POSITION SENSOR HARNESS CONNECTOR
Courtesy of CHRYSLER LLC

24. Connect the camshaft position sensor harness connector (1).

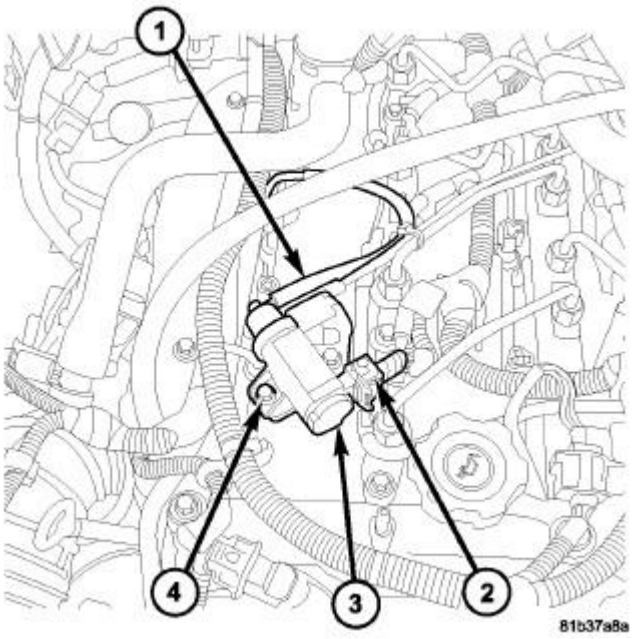

Fig. 33: Identifying EGR solenoid

Courtesy of CHRYSLER LLC

25. Connect the EGR vacuum solenoid harness connector (2).

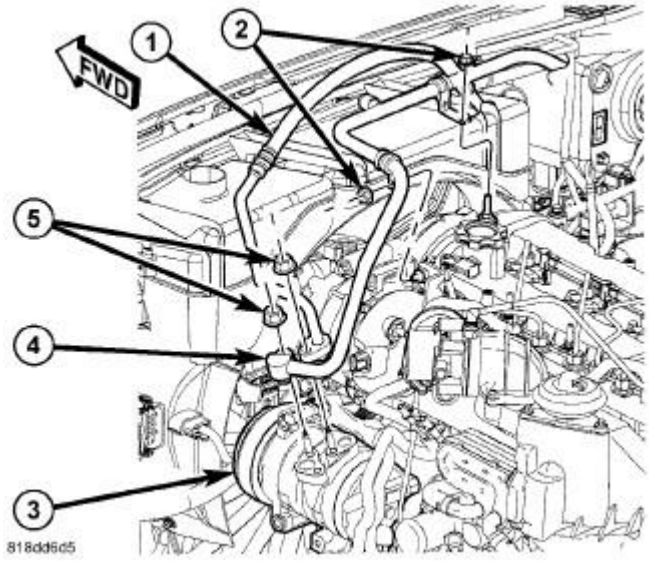

Fig. 34: Identifying Refrigerant Lines To Compressor
Courtesy of CHRYSLER LLC

26. Install the A/C compressor. Tighten the bolts to 32 N.m (24 ft. lbs.).
27. Connect the A/C compressor harness connector.
28. Remove the tape or plugs from the opened refrigerant line fittings and the compressor ports.
29. 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.
30. Connect the A/C suction line (4) and A/C discharge line (1) to the A/C compressor (3).
31. 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.).
32. 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.).

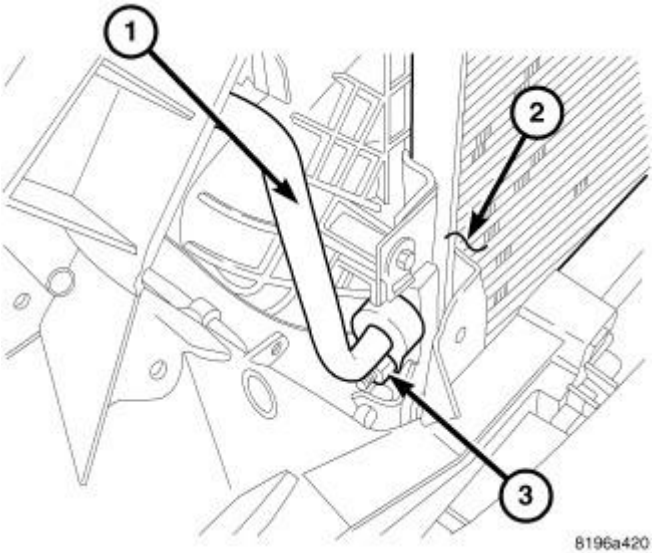

Fig. 35: Identifying Discharge Line To Condenser Diesel
Courtesy of CHRYSLER LLC

33. Remove the tape or plugs from the discharge line and condenser.
34. 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.

35. Position the A/C discharge line (1) into the engine compartment and connect it to the A/C condenser (2).
36. 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.).
37. Install the nut securing wire harness to suction line.

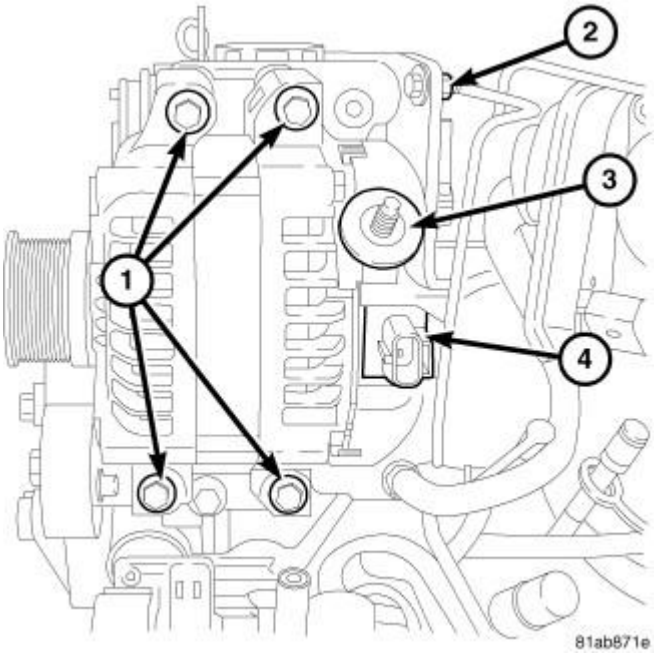

Fig. 36: GENERATOR
Courtesy of CHRYSLER LLC

38. Install the generator. Refer to **Electrical/Charging/GENERATOR - Installation** .

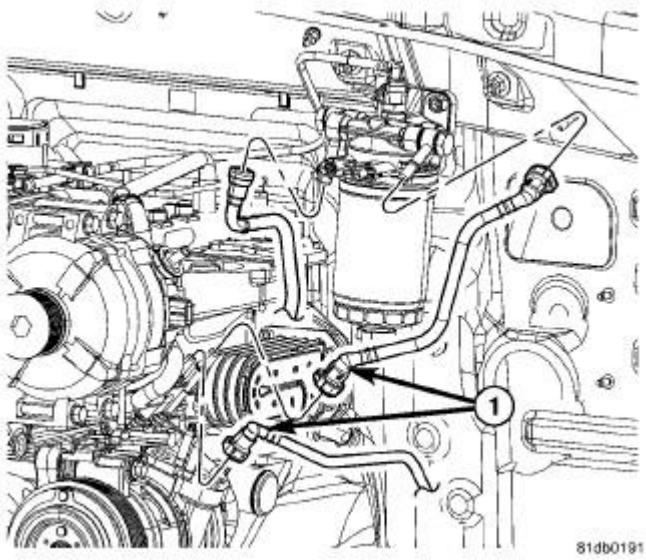

Fig. 37: FUEL BLOCK
Courtesy of CHRYSLER LLC

39. Connect the heater core coolant hoses to heater core.
40. Connect the brake booster vacuum hose.
41. Install the fuel filter/water separator. Refer to **Fuel System/Fuel Delivery/SEPARATOR and FILTER, Fuel and Water - Installation** .

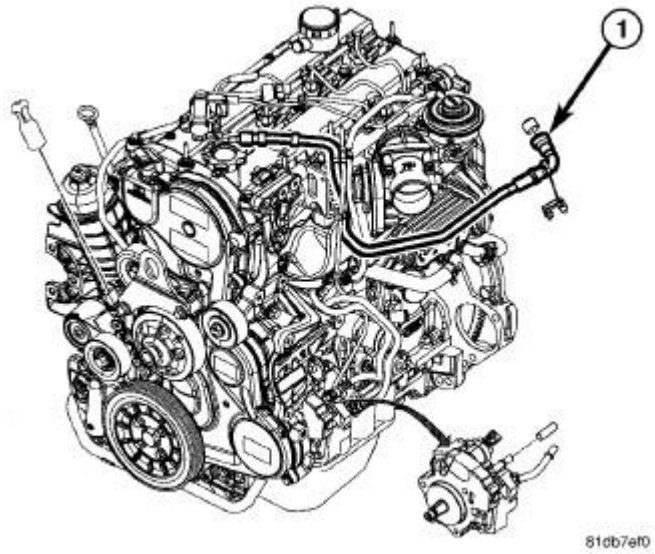

Fig. 38: FUEL RAIL RETURN LINE
Courtesy of CHRYSLER LLC

42. Connect the fuel rail fuel return line (1).
43. Install the fuel supply and return lines.

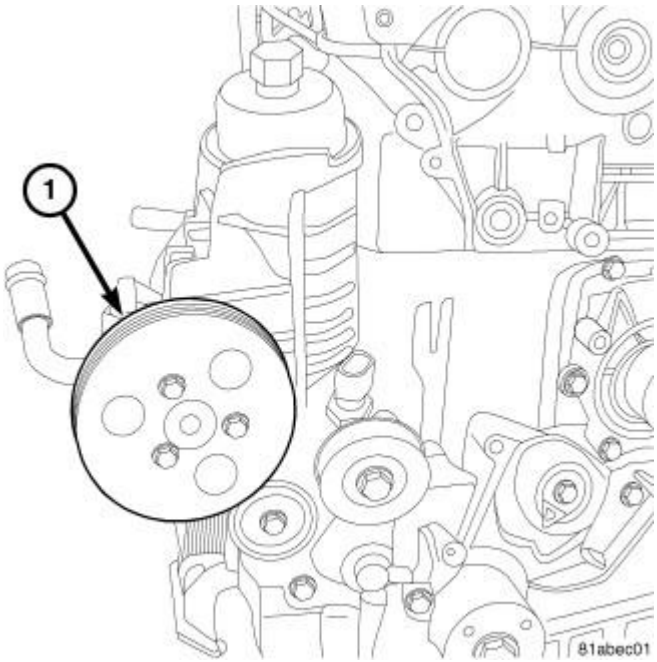

Fig. 39: POWER STEERING PUMP PULLEY
Courtesy of CHRYSLER LLC

44. Install the power steering pump. Refer to **Steering/Pump - Installation** .

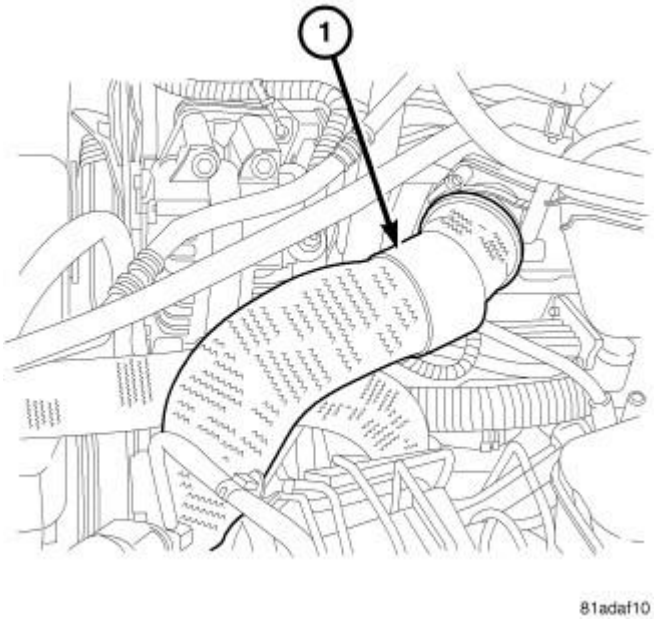

Fig. 40: Charge Outlet Hose
Courtesy of CHRYSLER LLC

45. Install the coolant recovery bottle. Refer to **Cooling/Engine/BOTTLE, Coolant Recovery - Installation** .
46. Install the viscous fan assembly. Refer to **Cooling/Engine/FAN, Cooling - Installation** .
47. Connect the fan harness connector.
48. Install the serpentine belt. Refer to **Cooling/Accessory Drive/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 at (CAC).
52. Install the windshield washer reservoir (Refer to **RESERVOIR, WINDSHIELD WASHER**).
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. See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.
57. Install the charge outlet hose (1) to EGR air flow control valve.

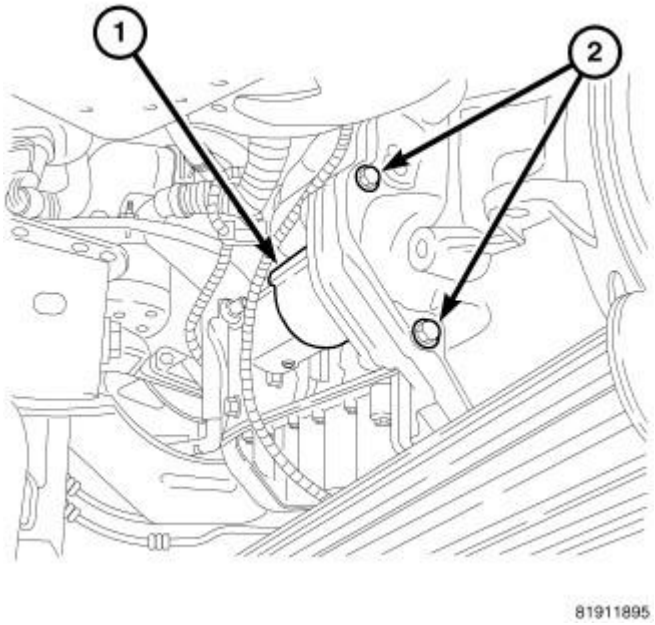

Fig. 41: STARTER MOUNTING 2.8L DIESEL
Courtesy of CHRYSLER LLC

58. Install the lower radiator hose clip to fan shroud.
59. Install the ground cable to engine block.
60. Install the starter. Refer to **Electrical/Starting/STARTER - Installation** .
61. Install the lower air deflector to the radiator.
62. Install the engine skid plate.
63. Evacuate the refrigerant system. Refer to **Heating and Air Conditioning/Plumbing - Standard Procedure** .
64. Charge the refrigerant system. Refer to **Heating and Air Conditioning/Plumbing - Standard Procedure** .
65. Fill the cooling system. Refer to **Cooling - 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.

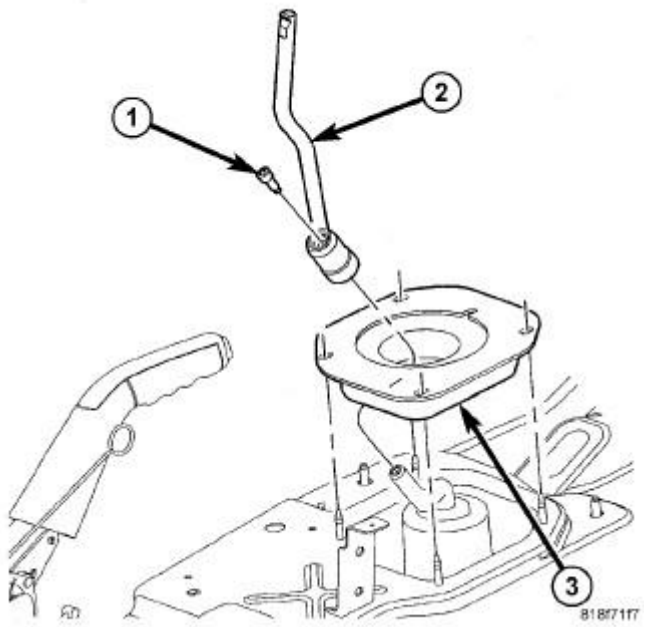

Fig. 42: SHIFTIER INNER BOOT
Courtesy of CHRYSLER LLC

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

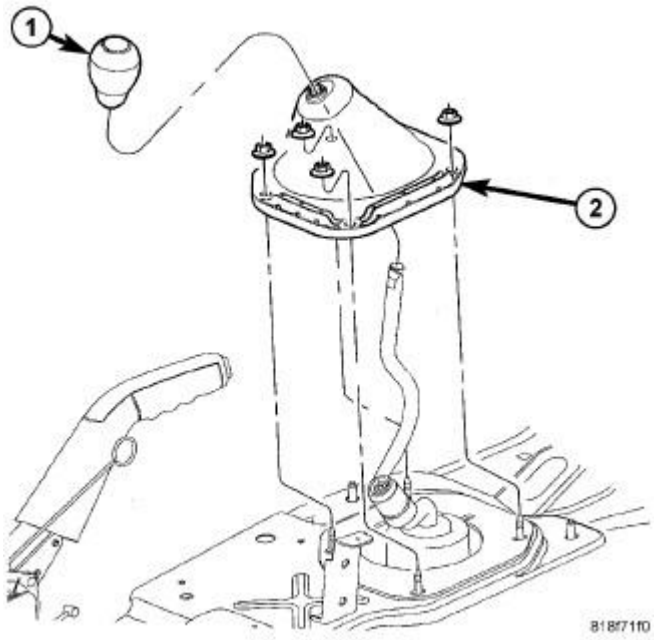

Fig. 43: SHIFT KNOB
Courtesy of CHRYSLER LLC

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

SPECIFICATIONS

SPECIFICATIONS

SPECIFICATIONS

2.8L Engine Specifications	
Engine	2.8L JK/KA/KK
Engine Type	2.8L - 16 Valves
Displacement	2777 cc
Bore	94.00
Stroke	100.05
Power (VGT) JK - KA - KK	130 kW (177CV) @ 3800 RPM
Torque (ATX) JK	460 Nm @ 2000 RPM
Torque (MTX) JK	410 Nm @ 2000 - 2800 RPM
Cylinders	4 In line
Injection Order	1-3-4-2
Compression Ratio	17.0:1
Vacuum at idle	680 mm/HG (27.5 In/HG)
Idle Speed (ATX)	760 +/- 50 RPM
Idle Speed (MTX)	875 +/- 50 RPM
Maximum RPM in Gear	4500 RPM
Maximum RPM in neutral	ATX 2800 MTX 3500
Belt tension	Automatic Belt Tensioner
Thermostat opening	80°C +/- 2°C
Generator Rating	Denso 12V-180A
Emissions Level	EU4
Block configuration/Material	Open/Cast Iron
Cylinder Head	Dual Overhead Cam
Timing System	Belt
Fuel System	CP3.2+ 1,600 bar Fuel Pump, Piezo Injectors
Fuel Supply	Electric Fuel Pump In the Fuel Tank
Electronic Control Unit	EDC 16
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 (pneumatic) 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	Aluminum, with Cast-in EGR passages, intake mixer, vacuum actuated EGR valve, electric intake throttle and a U-type EGR cooler
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

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 (0.013 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 **Engine/Engine Block/BEARING(S), Crankshaft - Standard Procedure** .	
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	CRS 3.0 - 1600 Bar
High Pressure Pump	CP3.2+
ECU	EDC16CP31
Injectors	Piezo CRI 3.0
Glow Plugs	
Make/Type	Bosch/GLP2
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	80°C (176°F)
Pressure Cap Setting	1.2 Bar
Engine Oil	
Specification Refer to **Vehicle Quick Reference/Capacities and Recommended Fluids - Description** .	
Coolant	
Specification. Refer to **Vehicle Quick Reference/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 CLEARANCE	0.700-0.800	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 THICKNESS	1.30	0.0512
PISTON CLEARANCE	0.700-0.800	0.0276 -0.0315

TORQUE

ENGINE BLOCK

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Air Temp/Pressure sensor	12	-	106
Balance Shaft	33	24	-
Connecting Rod Caps	See **Engine/Engine Block/ROD, Piston and Connecting - Installation**.		
Dipstick Tube (block)	11	-	97
Dipstick Tube (sump)	11	-	97
Engine Block Plug	30	22	-
Engine Mount Bolts	54	40	-
Fuel Quantity Solenoid	11	-	97
Fuel Rail Sensor	35	26	-
Lower Oil Pan	See **Engine/Lubrication/PAN, Oil - Installation**.		
Main Bearing Caps	See **Engine/Engine Block/CRANKSHAFT - Installation**.		
Oil Cooler Coolant Line	33	24	-
Oil Drain Plug	54	40	-
Oil Filter Cap	25	18	-
Oil Jet	11	-	97
Oil Pickup Tube	15	-	133
Oil Pressure Sensor	14	-	124
Transmission adapter bolts (Allen Head)	69	51	-
Transmission adapter bolts (hex head)	69	51	-
Upper Oil Pan (M6 bolt)	15	-	133
Upper Oil Pan (M8 bolt)	32	24	-

CYLINDER HEAD

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Camshaft Cap	11	-	97
Camshaft Sprocket	80	59	-
Cylinder Head Bolt	See **Engine/Cylinder Head - Installation**.		
Cylinder Head Cover	11	-	97
EGR Throttle Assembly	11	-	97
Exhaust Manifold	36	27	-
Front Camshaft Journal	11	-	97
Fuel injector	33	24	-
Fuel Injector Fuel Lines at Fuel Rail	5 + 75°	-	44 + 75°
Fuel Injector lines at the	28	20	-

injector			
Fuel Rail	24	18	-
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	25	18	-
Vacuum Tube	11	-	97

FRONT ENGINE

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Accessory Belt Tensioner Bolt	45	33	-
Accessory Drive Idler Pulley Bolt	45	33	-
Camshaft Position Sensor	11	-	97
Crankshaft Pulley	32	24	-
Crankshaft Sprocket	100 + 120°	74 + 120°	-
Front Cover	33	24	-
Front Engine Lifting Bracket	45	33	-
Fuel Quantity Solenoid	11	-	97
Fuel Rail Sensor	35	26	-
Inner Front Cover	11	-	97
Outer Front Cover (lower)	11	-	97
Outer Front Cover (upper)	11	-	97
Timing Belt Tensioner	28	21	-
TVA Valve	13	-	115
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)	See **Engine/Engine Block/FLEXPLATE - Installation**.		
Flywheel (MTX)	See **Engine/Engine Block/FLEXPLATE - Installation**.		
Rear Cover	15	-	133
Rear Lifting Bracket	45	33	-

Trans Adapter Plate (Allen bolts)	79	58	-
Trans Adapter Plate (hex bolt)	45	33	-

ACCESSORY DRIVE

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
A/C Compressor	32	24	-
A/C Compressor Bracket	45	33	-
EGR Cooler	15	-	133
EGR Valve	15	-	133
Generator Bracket	45	33	-
Generator	33	24	-
High Pressure Fuel Pump Bolts	24	18	-
High Pressure Fuel Pump Sprocket Nut	88	65	-
Oil Cooler Feed Line	11	-	97
Oil Cooler Housing	32	24	-
Power Steering Pump	33	24	-
Power Steering Pump Pulley	33	24	-
Turbocharger	32	24	-
Turbocharger Adapter (oil feed line to engine block connection)	54	40	-
Turbocharger Brace	32	24	-
Turbocharger Oil Feed Line at the Engine Block	32	24	-
Turbocharger Oil Feed Line at the Turbocharger	24	18	-
Turbocharger Oil Return Line	15	-	133

SPECIAL TOOLS

SPECIAL TOOLS

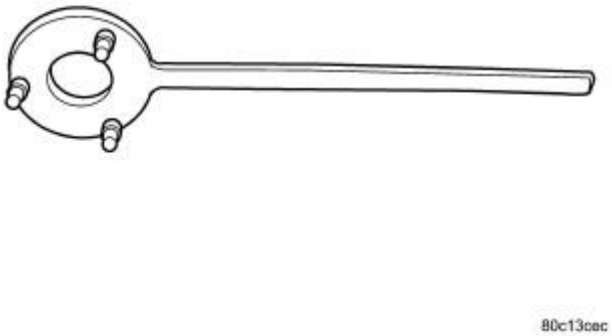

Fig. 44: LOCKING TOOL - VM.1055
Courtesy of CHRYSLER LLC

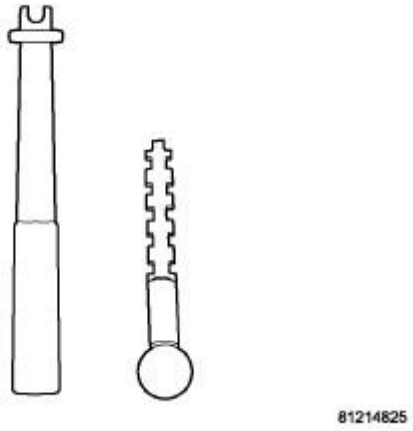

Fig. 45: REMOVER, SEAL - VM.1058
Courtesy of CHRYSLER LLC

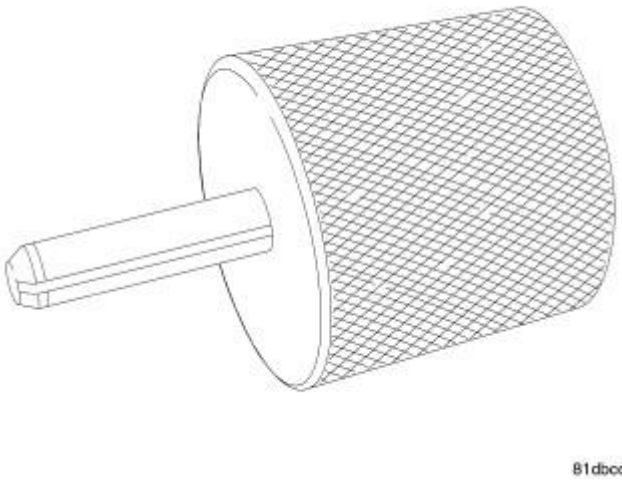

Fig. 46: BALANCE SHAFT LOCK PIN - VM.10012
Courtesy of CHRYSLER LLC

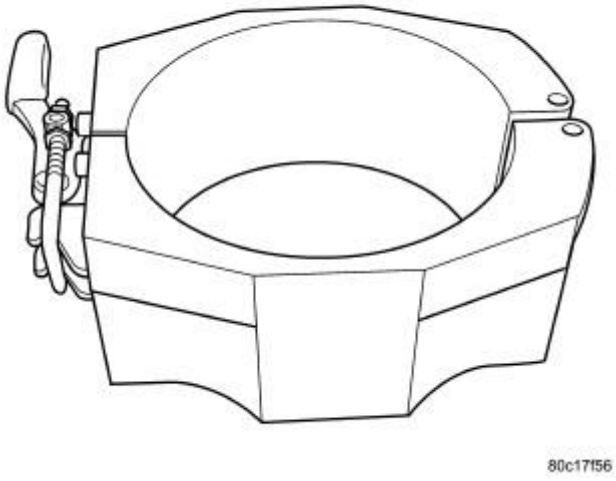

Fig. 47: 2.8L PISTON INSTALLER - VM.1082
Courtesy of CHRYSLER LLC

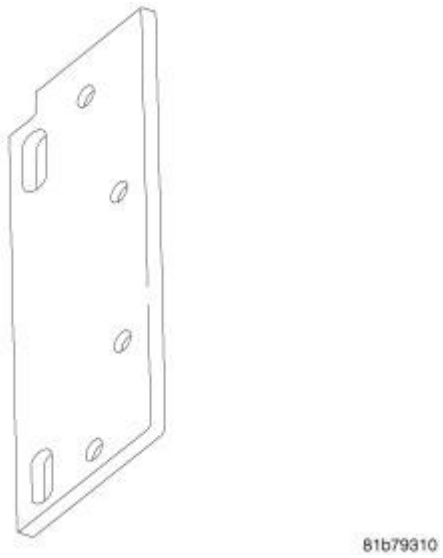

Fig. 48: FRONT AND REAR SEAL TOOL - VM.9990
Courtesy of CHRYSLER LLC

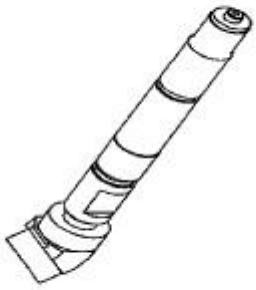

Fig. 49: ADAPTER, COMPRESSION TEST - VM.1072A
Courtesy of CHRYSLER LLC

Fig. 50: INSTALLER/GUIDE SEAL - VM.9937
Courtesy of CHRYSLER LLC

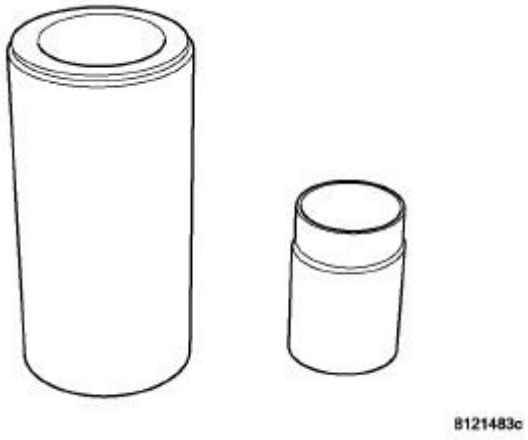

Fig. 51: INSTALLER, SEAL - VM.1057
Courtesy of CHRYSLER LLC

Fig. 52: CAMSHAFT TIMING TOOL - VM.9991
Courtesy of CHRYSLER LLC

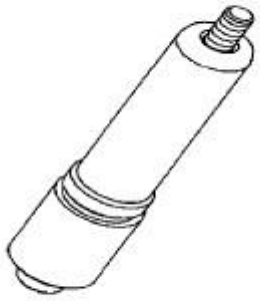

Fig. 53: CRANKSHAFT LOCKING TOOL - VM.9992
Courtesy of CHRYSLER LLC

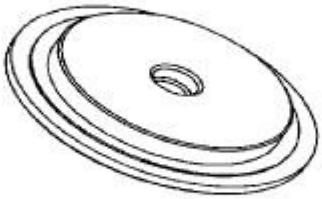

Fig. 54: CRANKSHAFT SEAL INSTALLER - VM.9993
Courtesy of CHRYSLER LLC

CYLINDER HEAD

DESCRIPTION

DESCRIPTION

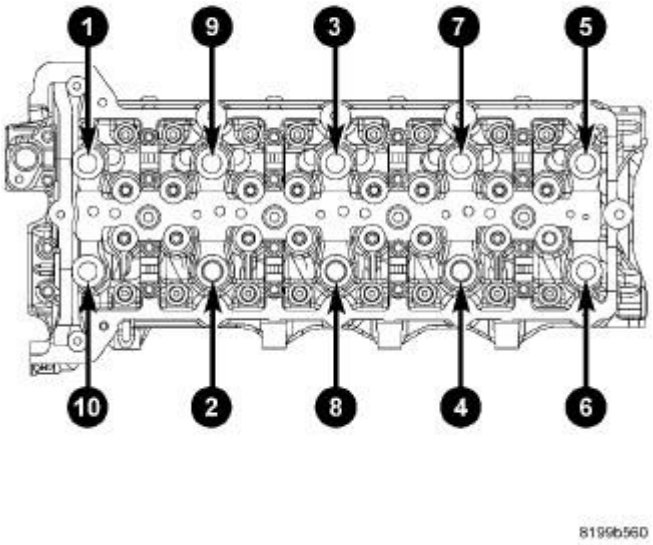

Fig. 55: CYLINDER HEAD TORQUE
Courtesy of CHRYSLER LLC

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

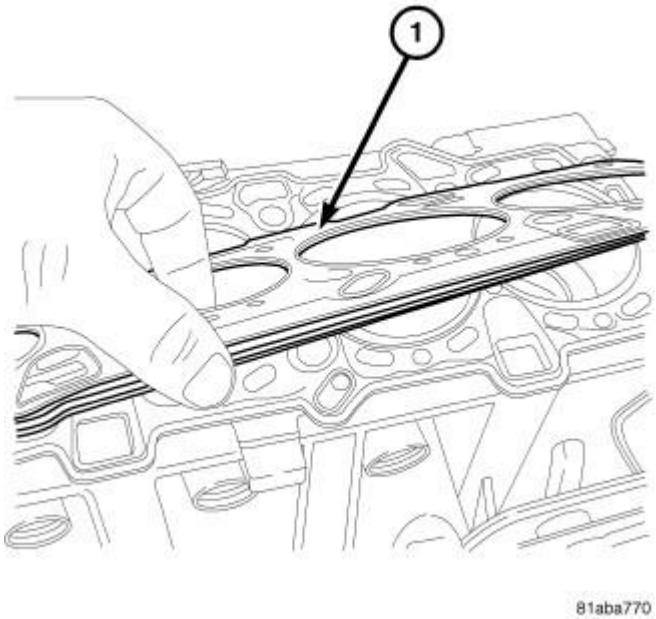

Fig. 56: MLS GASKET
Courtesy of CHRYSLER LLC

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

STANDARD PROCEDURE

VALVE SEALS - IN VEHICLE

1. Disconnect the negative battery cable.
2. Remove the intake manifold/cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.

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

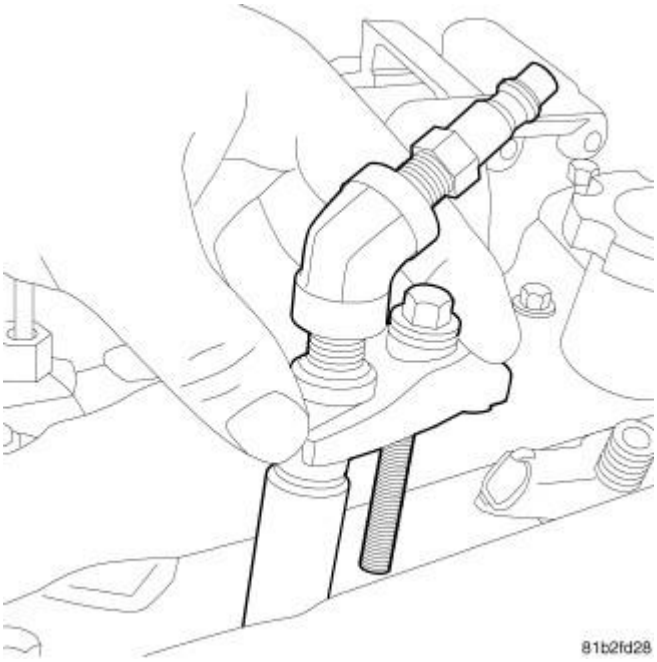

Fig. 57: COMPRESSION TESTER
Courtesy of CHRYSLER LLC

3. Position the rocker arms aside. See **Engine/Cylinder Head/ROCKER ARM, Valve - Removal**.
4. Install special tool VM.1072A, compression tester adaptor into the injector hole and retain with an injector hold down (2) bolt.
5. Prepare special tool MD998772A (1) for usage by inverting the tool to cylinder head holding screws so that the thread size matches the cylinder head.
6. Install special tool MD998772A (1) onto cylinder head and using adaptor MD998772A-15 (2), place the adaptor over the valve spring.
7. Connect a regulated air supply (3) to VM.1072A (4), and pressurize the cylinder.
8. Place shop towels around the working area of the cylinder head to prevent valve locks from accidently entering the engine.

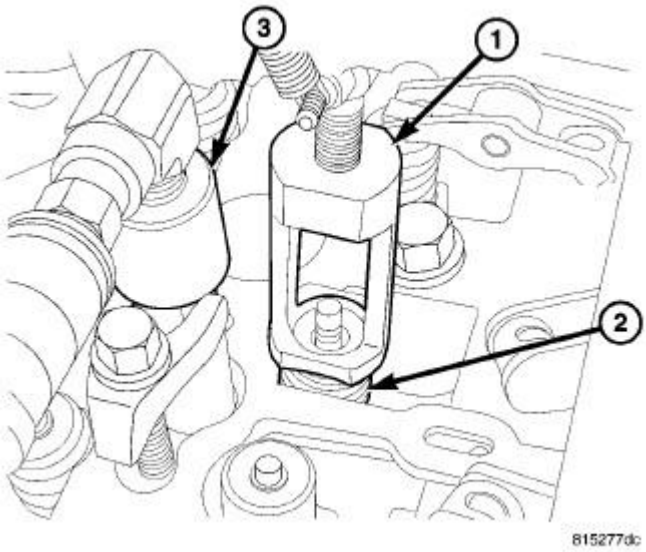

Fig. 58: MD998772A-15 ADAPTOR
Courtesy of CHRYSLER LLC

1 - MD998772A-15 ADAPTOR 2 - VALVE SPRING 3 - VM.1072A COMPRESSION TESTER ADAPTOR

9. Using adaptor MD998772A-15 (1), collapse the valve spring (2) and remove the locks.
10. Remove the valve spring (2) assembly.

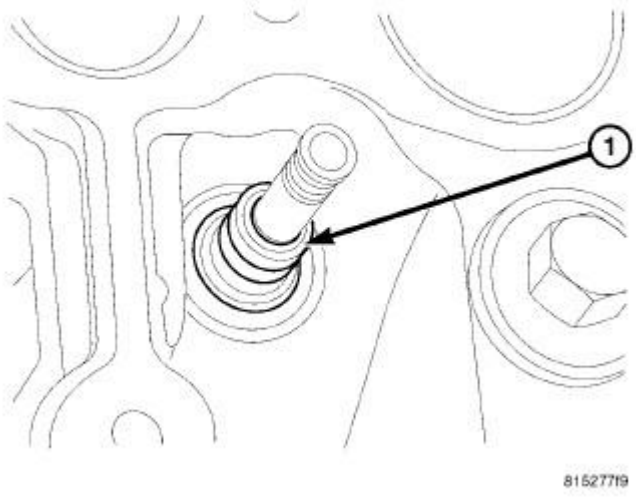

Fig. 59: VALVE SEAL
Courtesy of CHRYSLER LLC

1 - VALVE SEAL

11. Remove the valve seal.
12. Repeat this procedure for all cylinders.

VALVE SERVICE

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

DISASSEMBLY

1. Remove the engine cylinder head from the cylinder block. See **Engine/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

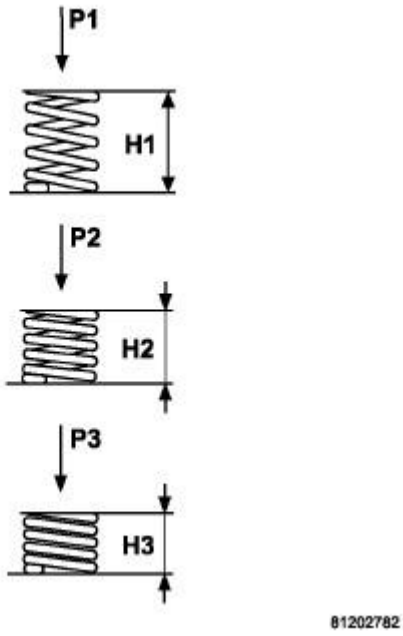

Fig. 60: VALVE SPRING CHART

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 .

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

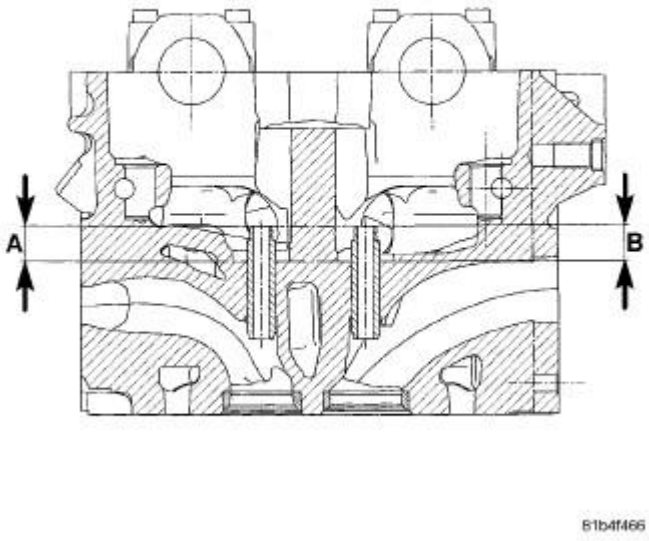

Fig. 61: VALVE HEIGHT
Courtesy of CHRYSLER LLC

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 **Electrical/Battery System/BATTERY - Removal** .
2. On 4x4 models, remove the front axle. Refer to **Differential and Driveline/Front Axle - 186FIA - Removal** .
3. Remove the intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Removal**.
4. Remove the exhaust manifold. See **Engine/Manifolds/MANIFOLD, Exhaust - Removal**.
5. Remove the camshafts. See **Engine/Cylinder Head/CAMSHAFT, Engine - Removal**.

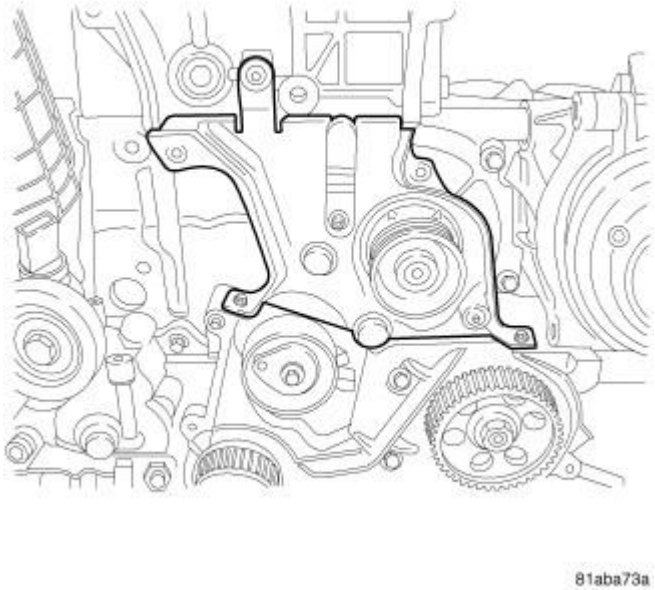

Fig. 62: INNER FRONT COVER
Courtesy of CHRYSLER LLC

6. Remove the inner timing belt cover.

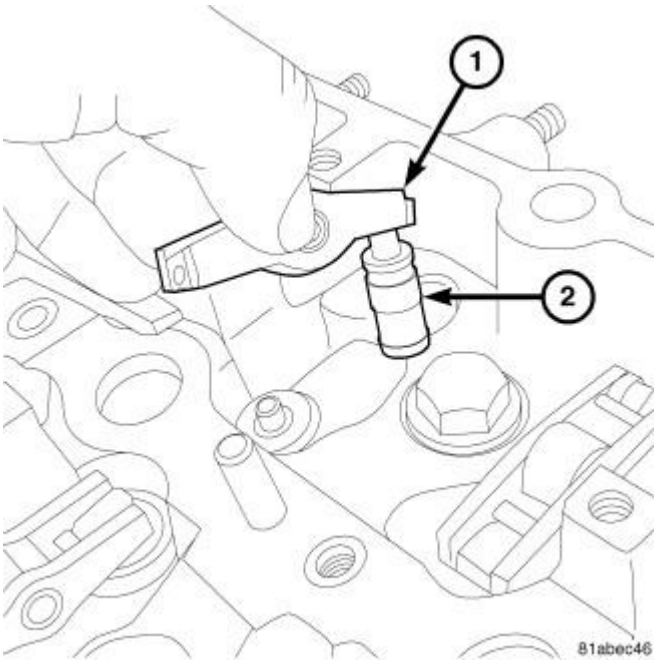

Fig. 63: ROCKER ARM AND LIFTER ASSEMBLY
Courtesy of CHRYSLER LLC

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

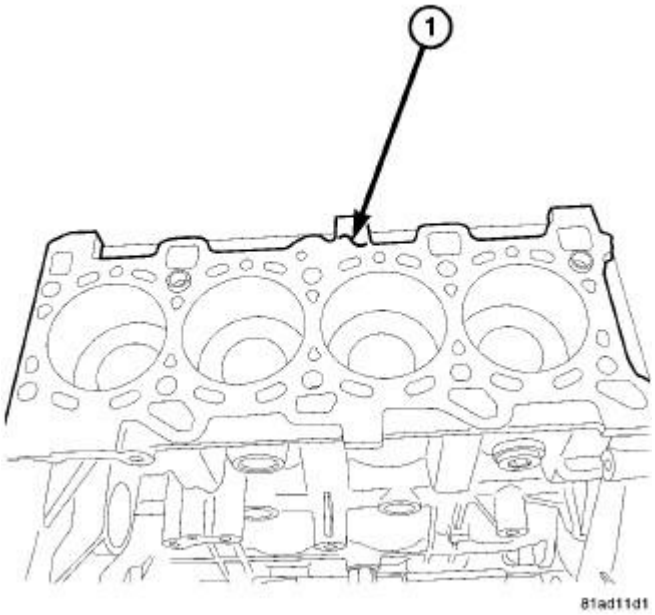

Fig. 64: ENGINE BLOCK
Courtesy of CHRYSLER LLC

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. See **Engine - Standard Procedure**.

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

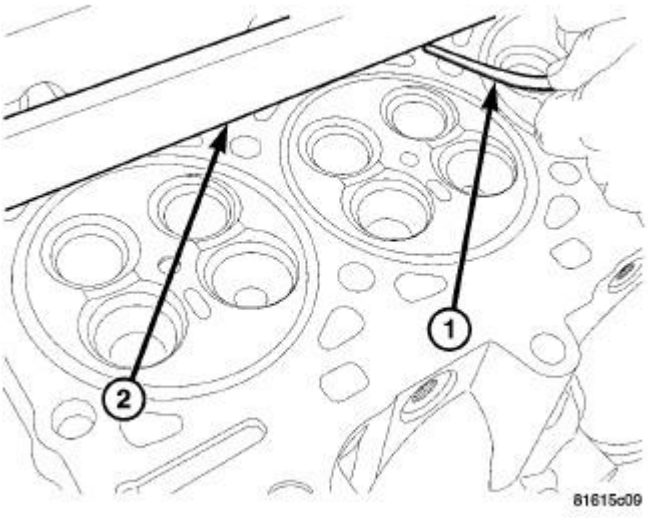

Fig. 65: CYLINDER HEAD FLATNESS - 1
Courtesy of CHRYSLER LLC

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 0.075 mm (0.003 in.).

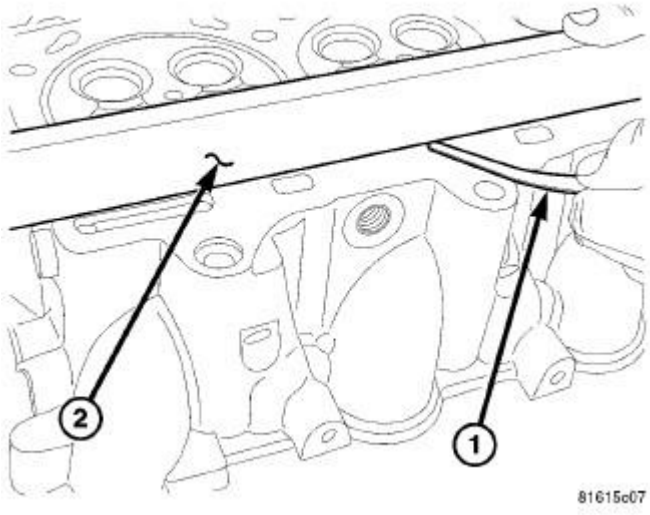

Fig. 66: CYLINDER HEAD FLATNESS - 2
Courtesy of CHRYSLER LLC

1 - FEELER GAUGE 2 - STEEL STRAIGHT EDGE

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

INSTALLATION

INSTALLATION

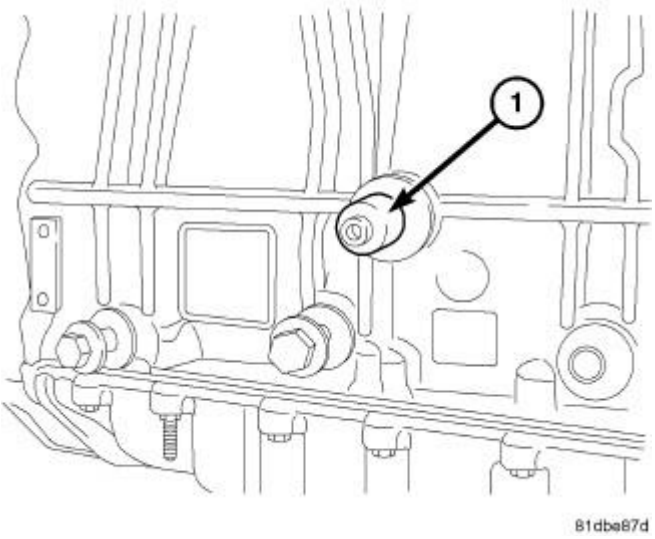

Fig. 67: CRANKSHAFT LOCKING TOOL
Courtesy of CHRYSLER LLC

1. Remove the crankshaft locking tool.

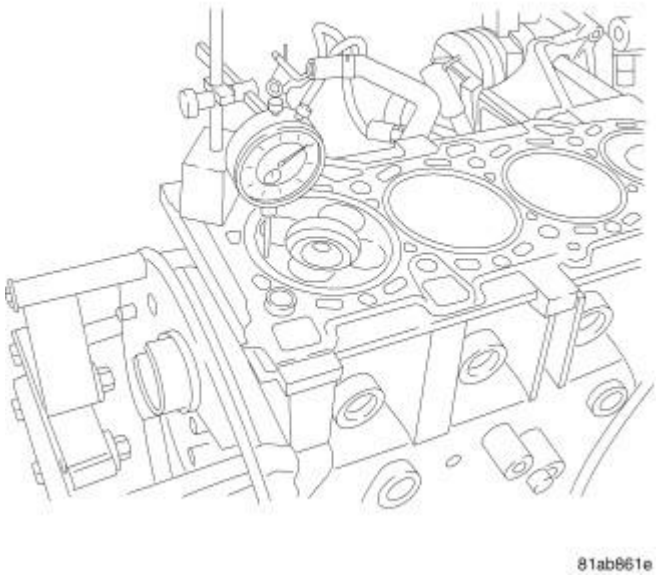

Fig. 68: DECK HEIGHT
Courtesy of CHRYSLER LLC

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

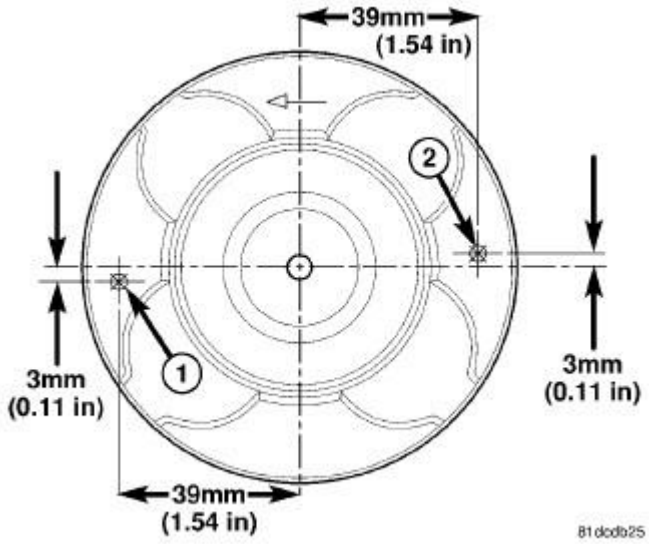

Fig. 69: PISTON PROTRUSION MEASUREMENT
Courtesy of CHRYSLER LLC

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 THICKNESS	1.30	0.0512
PISTON CLEARANCE	0.700 - 0.800	0.0276 - 0.0315

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

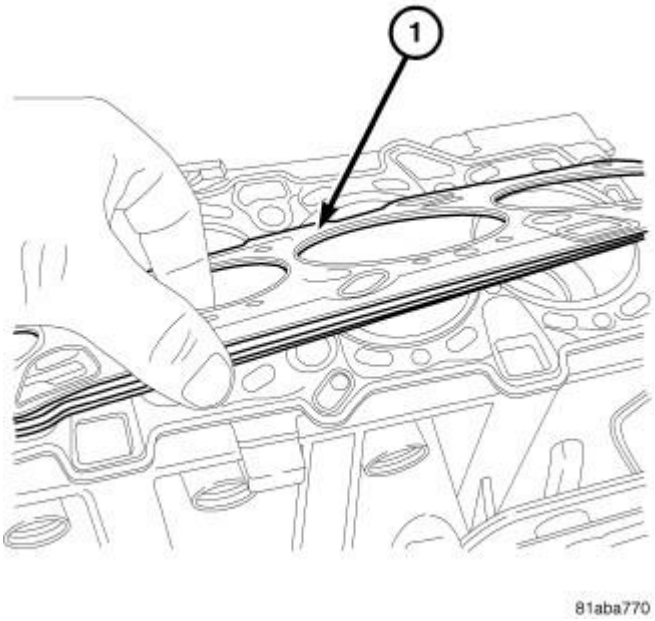

Fig. 70: MLS GASKET
Courtesy of CHRYSLER LLC

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

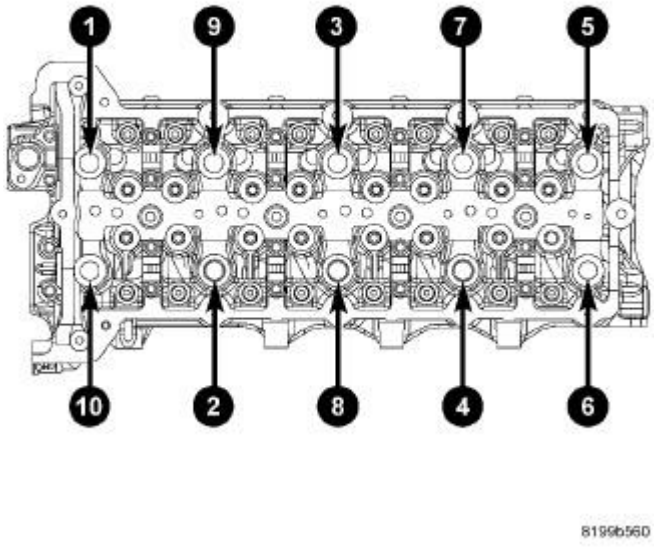

Fig. 71: CYLINDER HEAD TORQUE
Courtesy of CHRYSLER LLC

NOTE: Always use new cylinder head bolts 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.

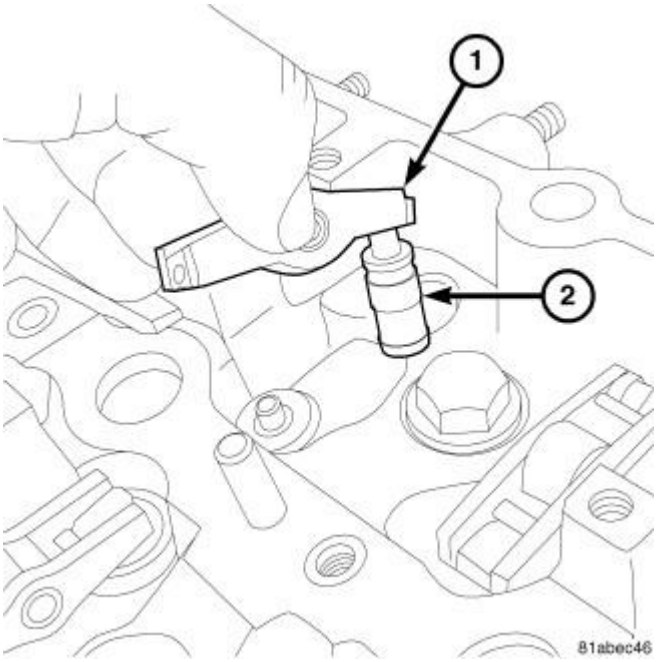

Fig. 72: ROCKER ARM AND LIFTER ASSEMBLY
Courtesy of CHRYSLER LLC

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

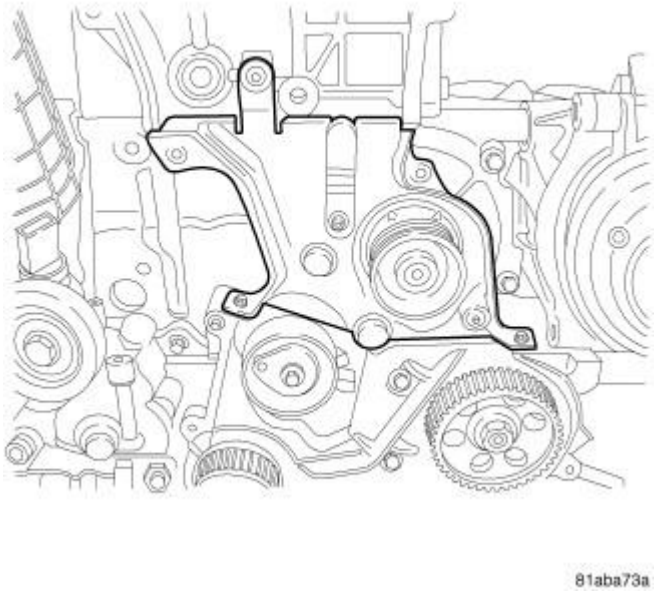

Fig. 73: INNER FRONT COVER
Courtesy of CHRYSLER LLC

15. Install the inner timing belt cover. Tighten bolts to 11 N.m (97 lbs. in.).
16. Install the camshafts. See **Engine/Cylinder Head/CAMSHAFT, Engine - Installation**.
17. Install the exhaust manifold. See **Engine/Manifolds/MANIFOLD, Exhaust - Installation**.
18. Install the intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Installation**.
19. Install the battery. Refer to **Electrical/Battery System/BATTERY - Installation** .
20. Start engine and check for leaks.

CAMSHAFT, ENGINE

Description

DESCRIPTION

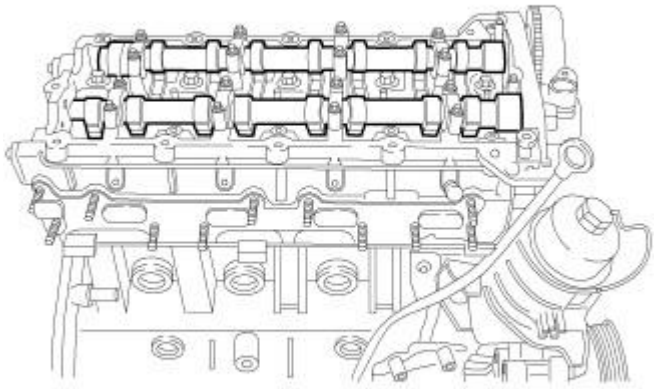

Fig. 74: CAMSHAFTS
Courtesy of CHRYSLER LLC

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

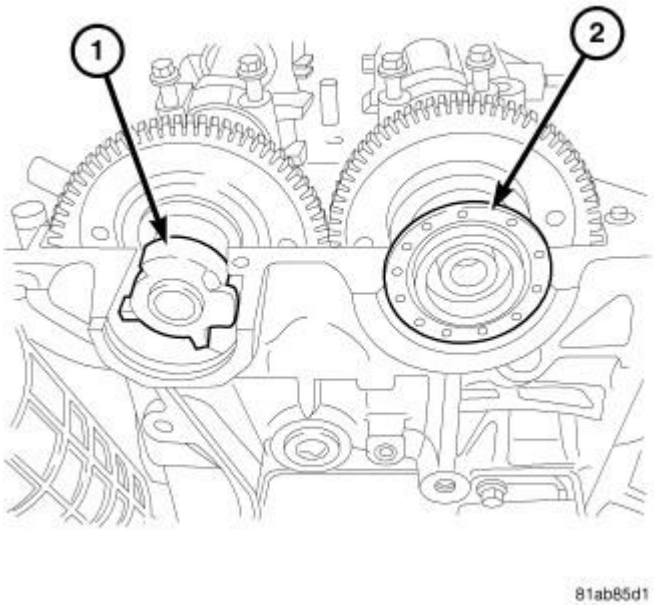

Fig. 75: CAMSHAFT OIL SEAL
Courtesy of CHRYSLER LLC

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

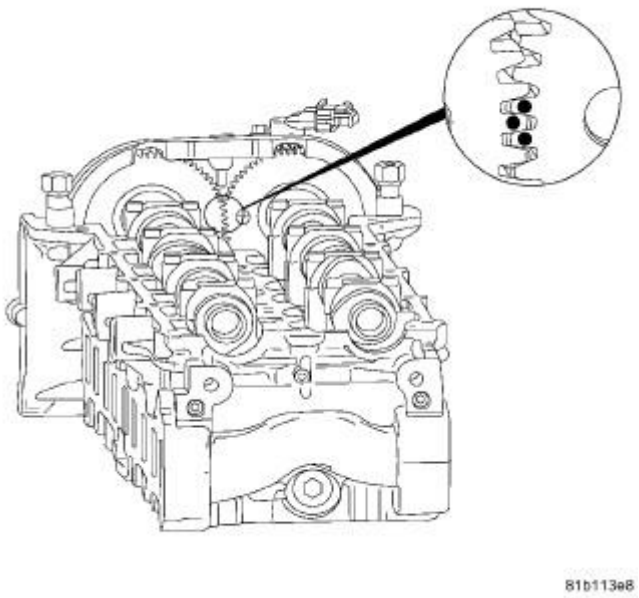

Fig. 76: CAMSHAFT TIMING DOTS
Courtesy of CHRYSLER LLC

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 VM. 9991 is used to correctly set the camshafts to their proper location.

Removal

REMOVAL

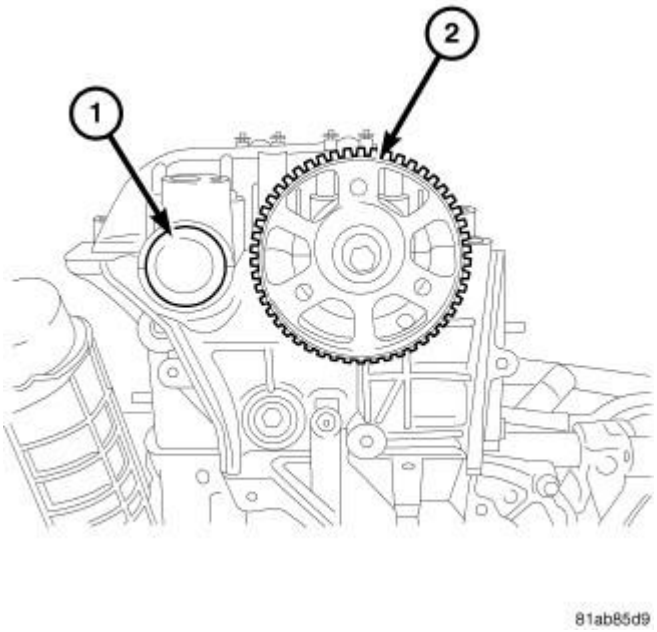

Fig. 77: Intake Camshaft Sprocket
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the intake camshaft sprocket (2). See **Engine/Valve Timing/SPROCKET(S), Timing Belt and Chain - Removal**.

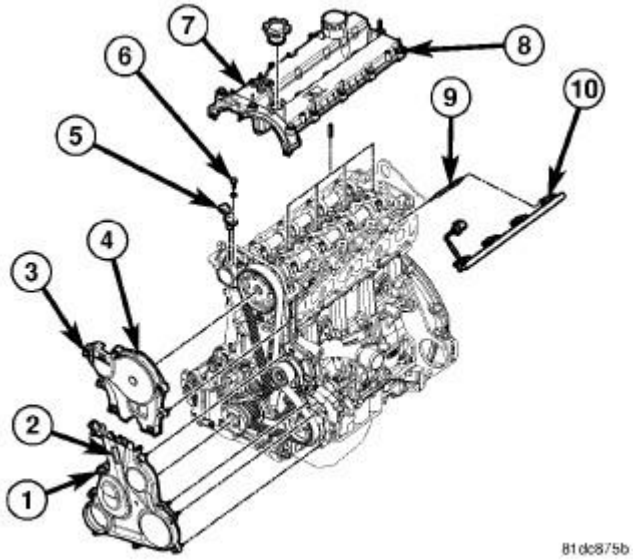

Fig. 78: CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

3. Remove the cylinder head cover (7). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.

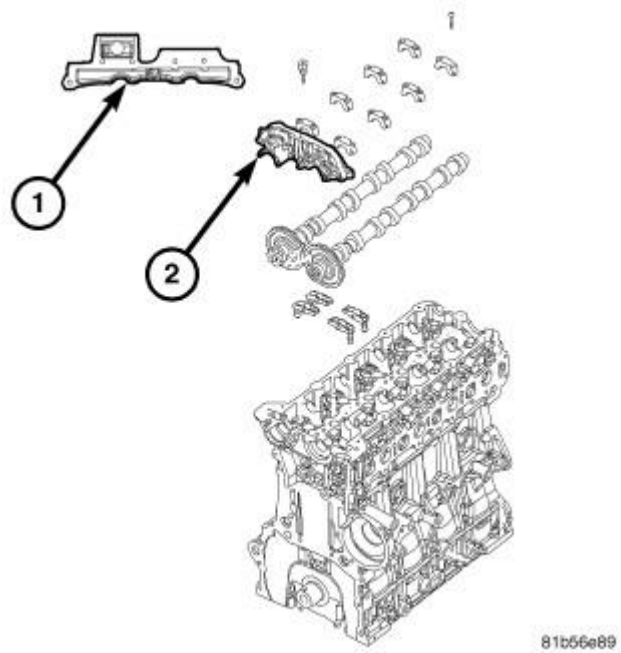

Fig. 79: CAMSHAFT CAP RTV LOCATION
Courtesy of CHRYSLER LLC

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

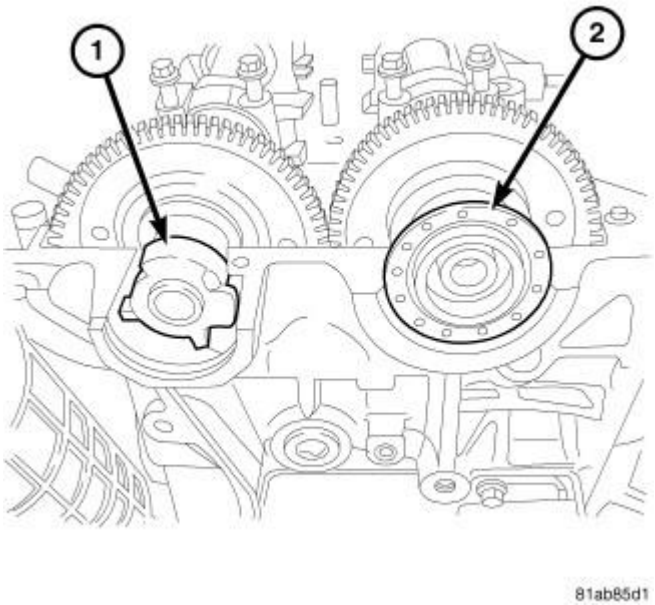

Fig. 80: CAMSHAFT OIL SEAL
Courtesy of CHRYSLER LLC

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

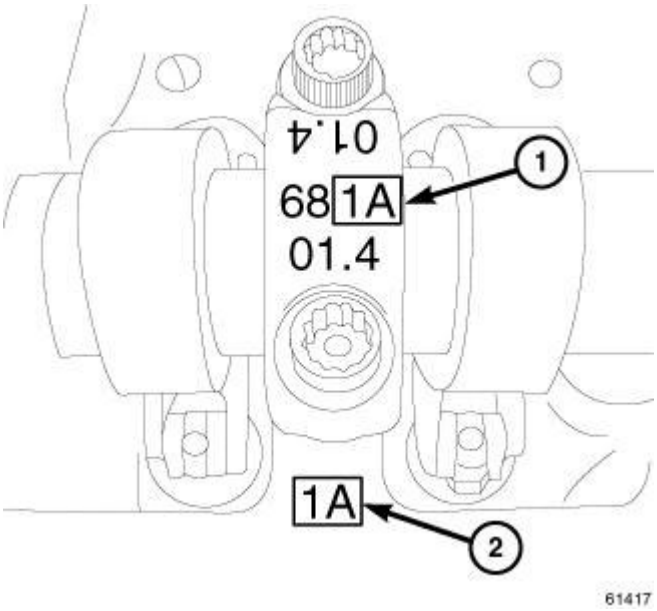

Fig. 81: Identifying Camshaft Cap & Cylinder Head (Intake Side) Markings
Courtesy of CHRYSLER LLC

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.

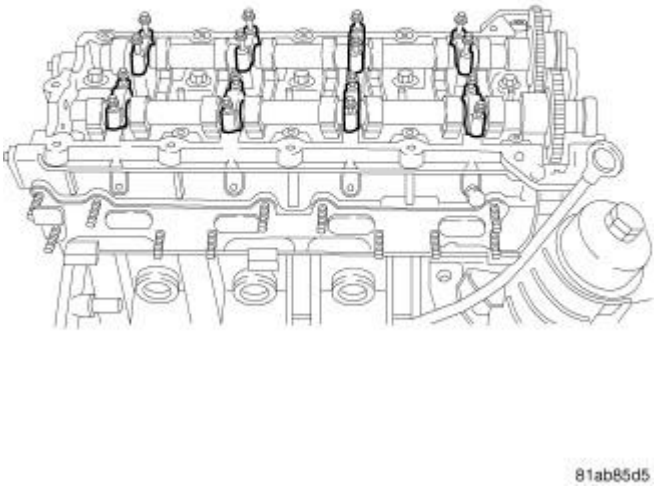

Fig. 82: CAMSHAFT REMOVAL
Courtesy of CHRYSLER LLC

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

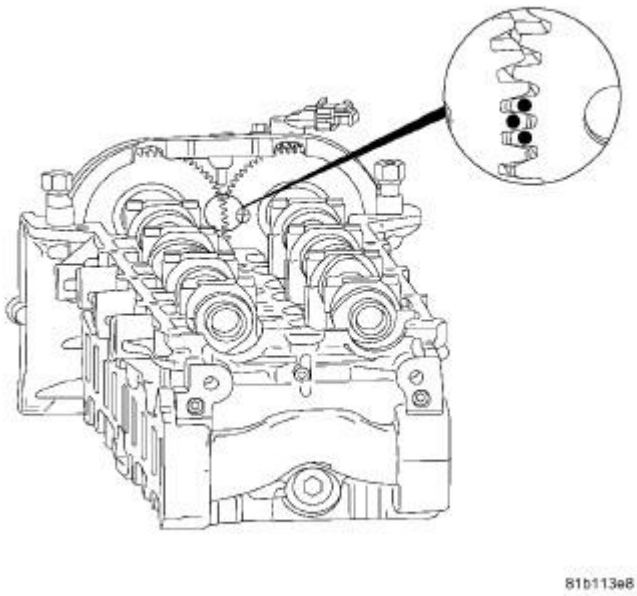

Fig. 83: CAMSHAFT TIMING DOTS
Courtesy of CHRYSLER LLC

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.

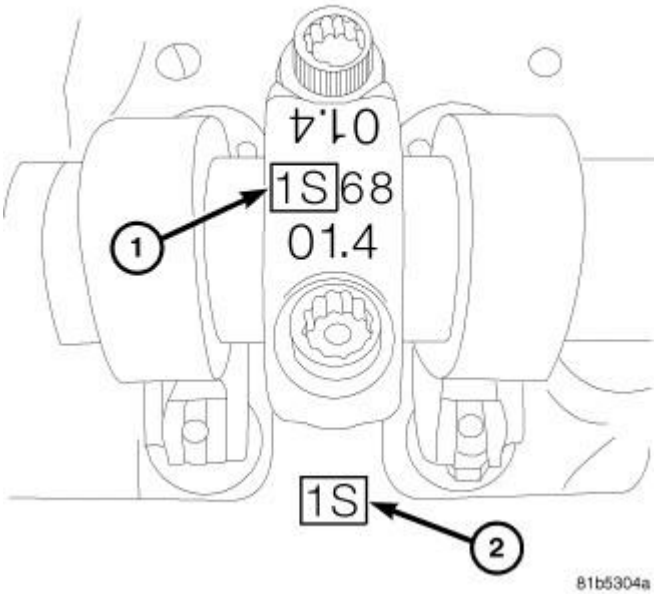

Fig. 84: Identifying Camshaft Cap & Cylinder Head (Exhaust Side) Markings
Courtesy of CHRYSLER LLC

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.

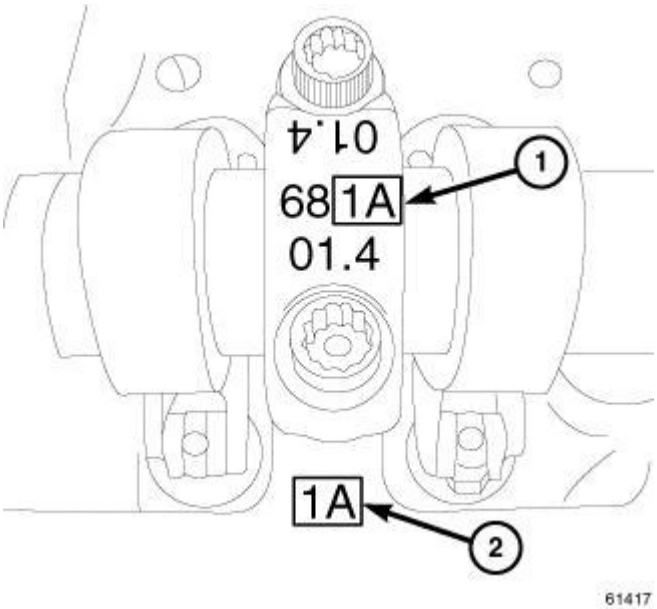

Fig. 85: Identifying Camshaft Cap & Cylinder Head (Intake Side) Markings
Courtesy of CHRYSLER LLC

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.

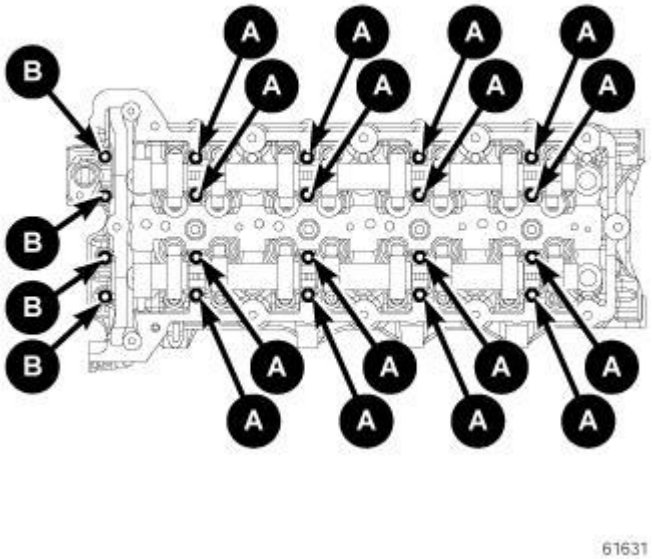

Fig. 86: Identifying Camshaft Bolts
Courtesy of CHRYSLER LLC

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.

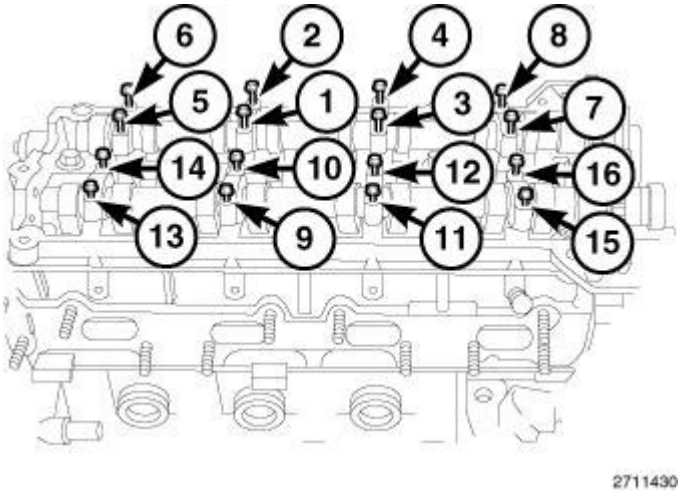

Fig. 87: Identifying Camshaft Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

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.

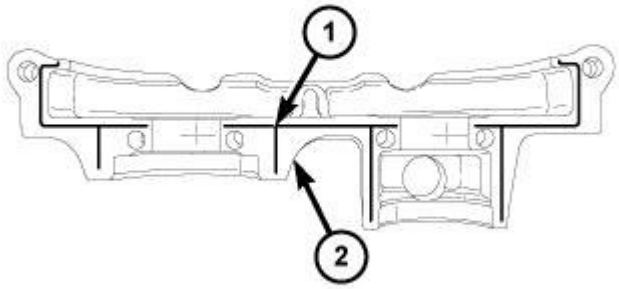

Fig. 88: FRONT CAMSHAFT BEARING JOURNAL
Courtesy of CHRYSLER LLC

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.

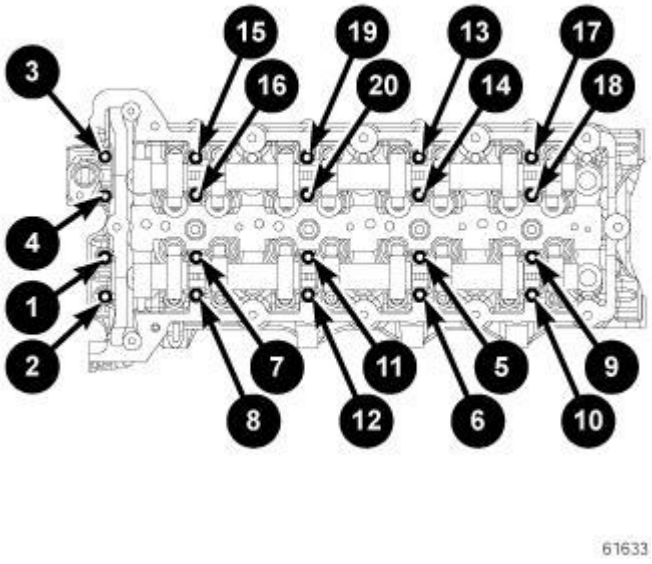

Fig. 89: Camshaft Cap Bolt Torque Sequence
Courtesy of CHRYSLER LLC

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

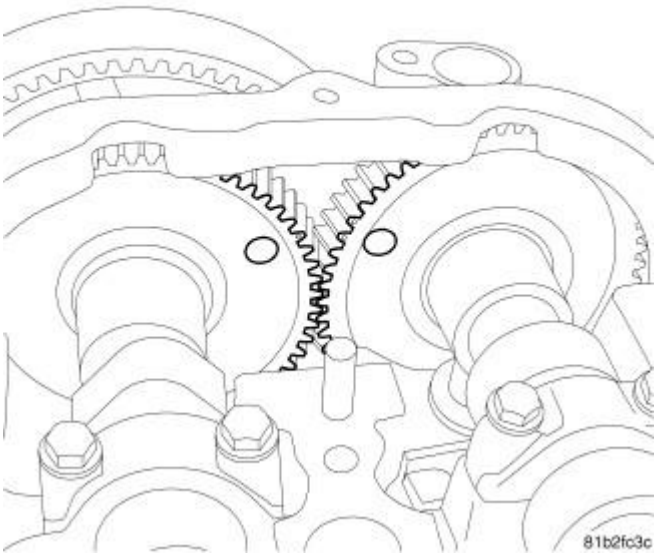

Fig. 90: CAMSHAFT MARKS AT 90° ATDC
Courtesy of CHRYSLER LLC

11. Rotate the camshafts so that the camshaft locking tool VM. 9991 fits into place.

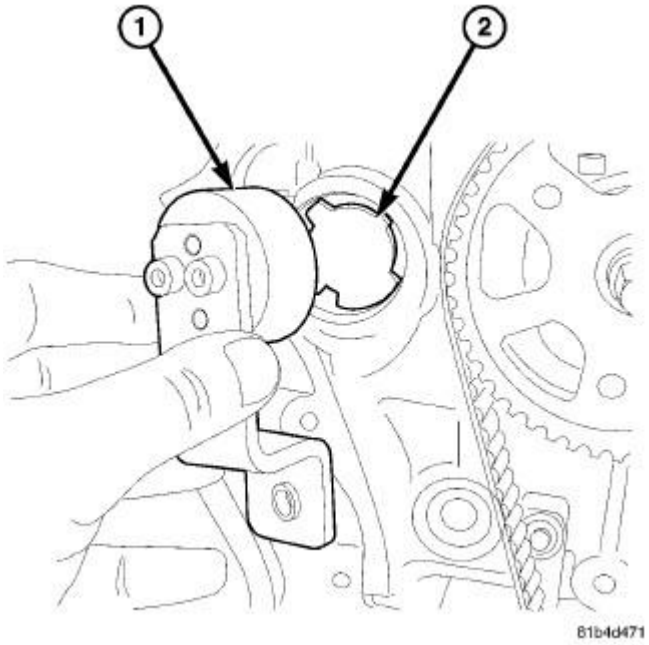

Fig. 91: INSTALLING CAMSHAFT LOCK TOOL
Courtesy of CHRYSLER LLC

12. Install the camshaft locking tool VM. 9991 (1) onto the camshaft position sensor tone wheel (2).

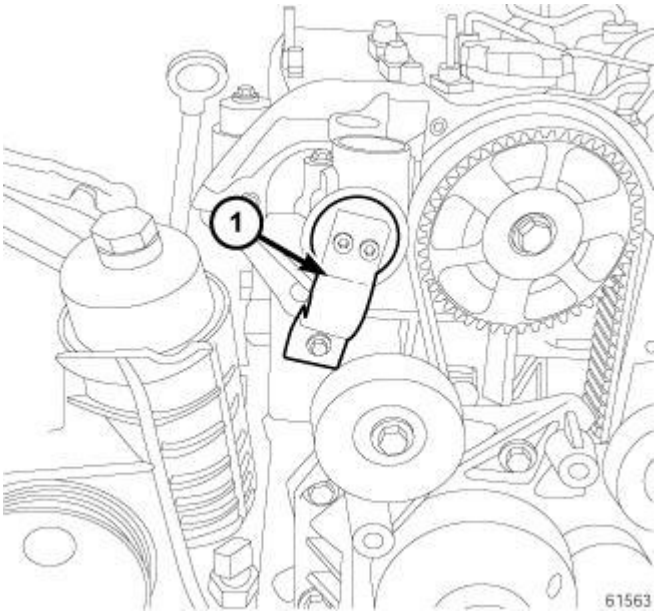

Fig. 92: CAMSHAFT LOCKING TOOL INSTALLED
Courtesy of CHRYSLER LLC

13. When the camshaft locking tool VM. 9991 is bolted in place, the camshafts are locked at 90° ATDC.

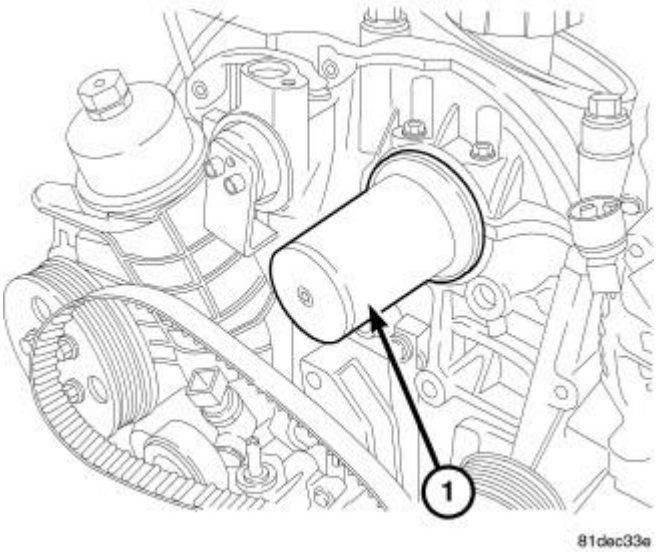

Fig. 93: CAMSHAFT OIL SEAL INSTALLATION
Courtesy of CHRYSLER LLC

14. Using the seal installer 9937-1 (1), install the intake camshaft oil seal.

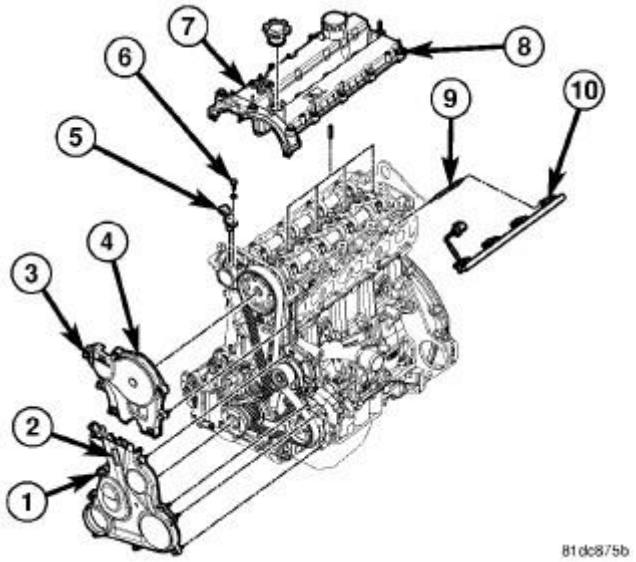

Fig. 94: CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

15. Install the cylinder head cover (7). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.

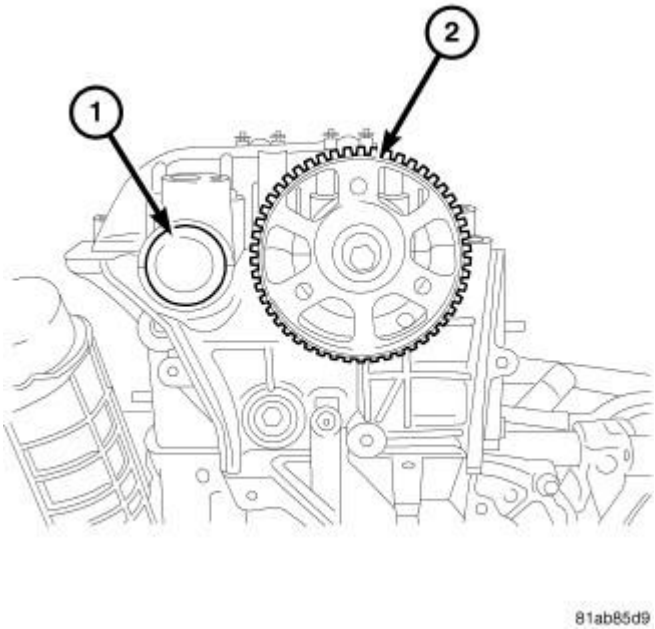

Fig. 95: Intake Camshaft Sprocket
Courtesy of CHRYSLER LLC

16. Install the intake camshaft sprocket (2). See **Engine/Valve Timing/SPROCKET(S), Timing Belt and Chain - Installation**.
17. Connect negative battery cable.

CHECKING CAMSHAFT ENDPLAY

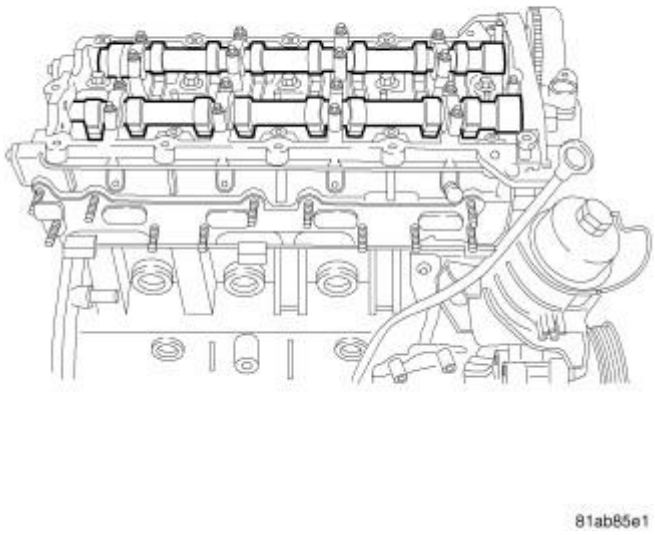

Fig. 96: CAMSHAFTS
Courtesy of CHRYSLER LLC

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 - 0.0138 in.).

COVER(S), CYLINDER HEAD

Description

DESCRIPTION

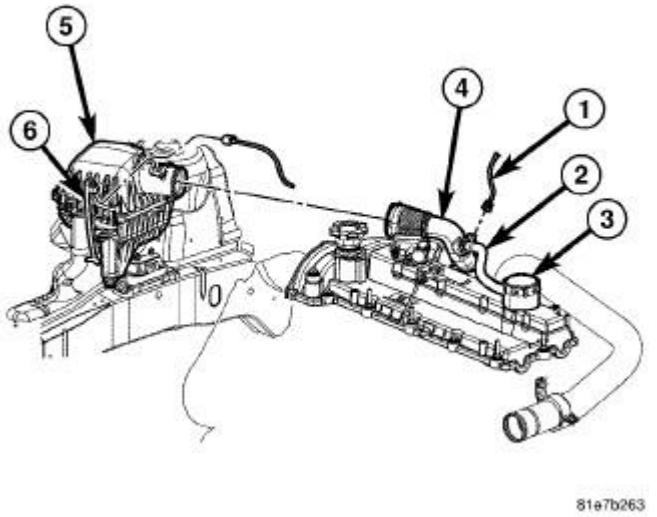

Fig. 97: CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

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 (2) and (3).

Removal

REMOVAL

1. Disconnect the negative battery cable.

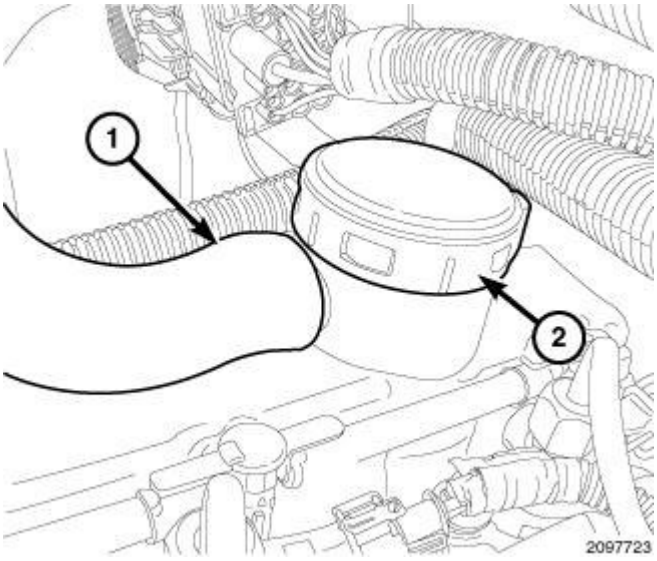

Fig. 98: CRANKCASE VENT HOSE & OIL SEPARATOR
Courtesy of CHRYSLER LLC

2. Disconnect the crankcase vent hose (1) from the oil separator (2).

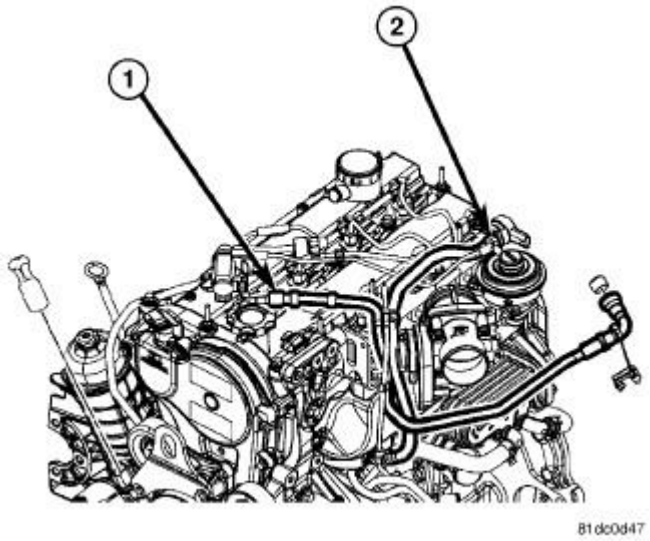

Fig. 99: FUEL RETURN LINES-TOP
Courtesy of CHRYSLER LLC

3. Disconnect the fuel injector return line (1) from the fuel injectors.
4. Disconnect the vacuum line from the EGR solenoid to EGR valve (2).
5. Disconnect the EGR solenoid electrical connector.

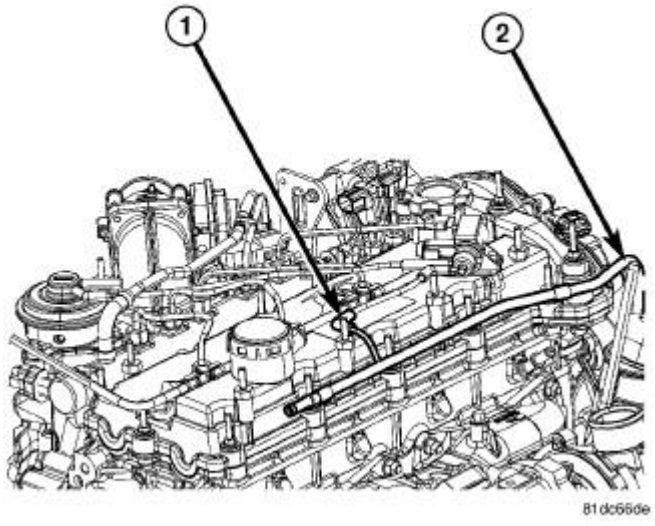

Fig. 100: VACUUM SUPPLY TUBE
Courtesy of CHRYSLER LLC

6. Disconnect the vacuum line (1) to the EGR solenoid.

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

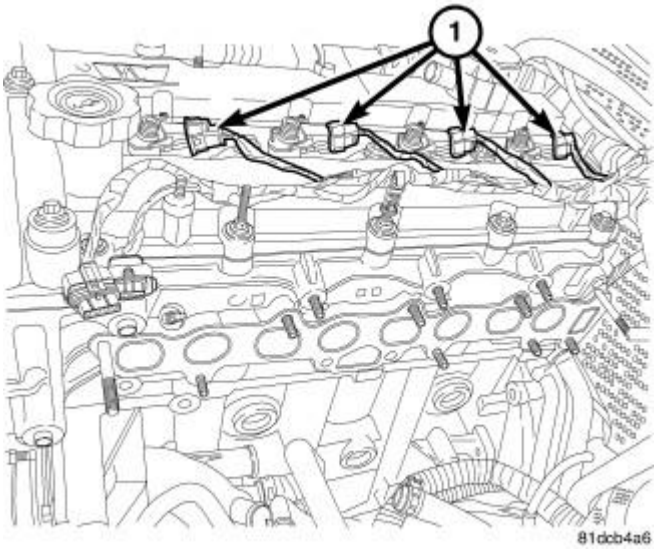

Fig. 101: FUEL INJECTORS
Courtesy of CHRYSLER LLC

8. Disconnect the fuel injector harness connectors from the fuel injectors (1).

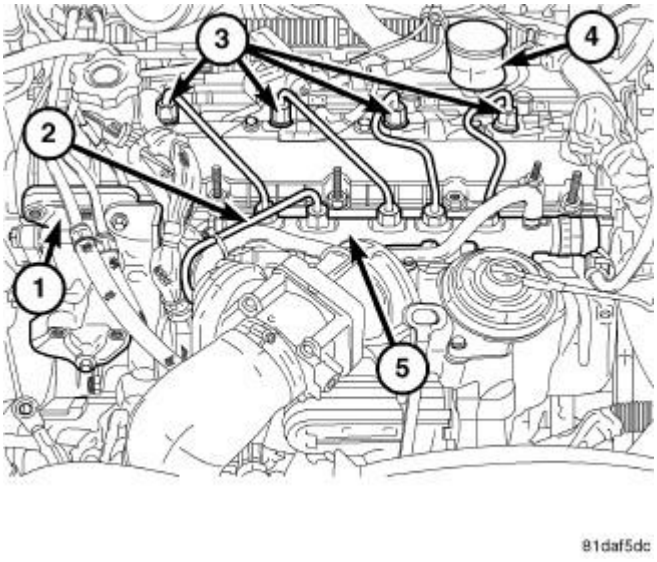

Fig. 102: FUEL RAIL
Courtesy of CHRYSLER LLC

9. If necessary, loosen the fuel rail nuts.
10. Remove the fuel injector fuel lines (3) from the fuel injectors and the fuel rail. Install protective caps onto the fuel injector.

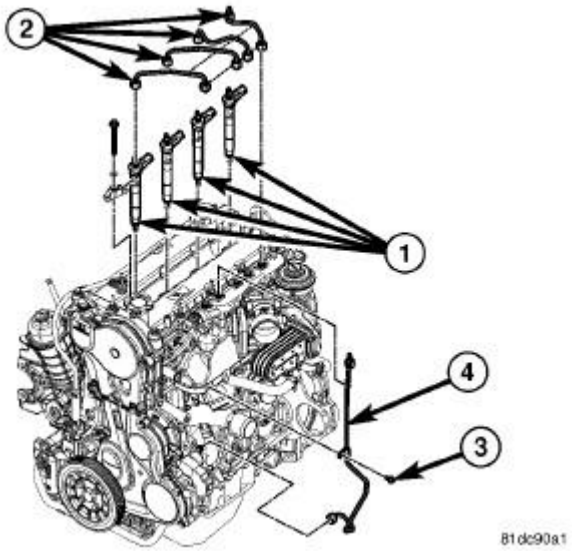

Fig. 103: DIESEL FUEL INJECTORS
Courtesy of CHRYSLER LLC

11. Remove the fuel injectors (1).

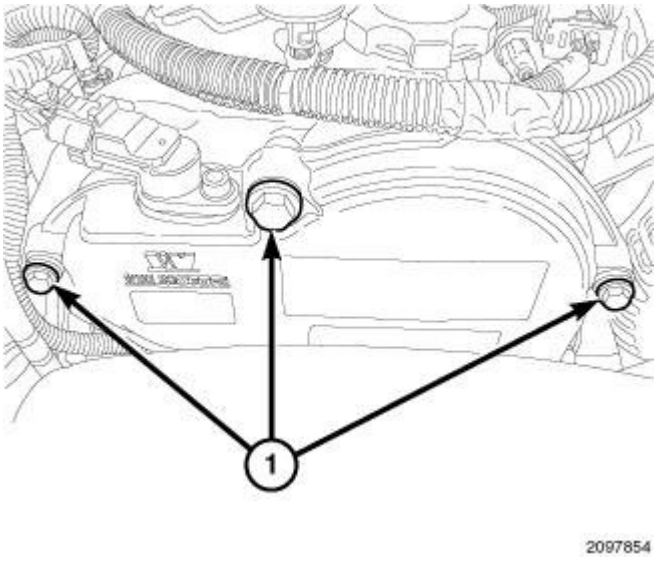

Fig. 104: UPPER COVER BOLTS
Courtesy of CHRYSLER LLC

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

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

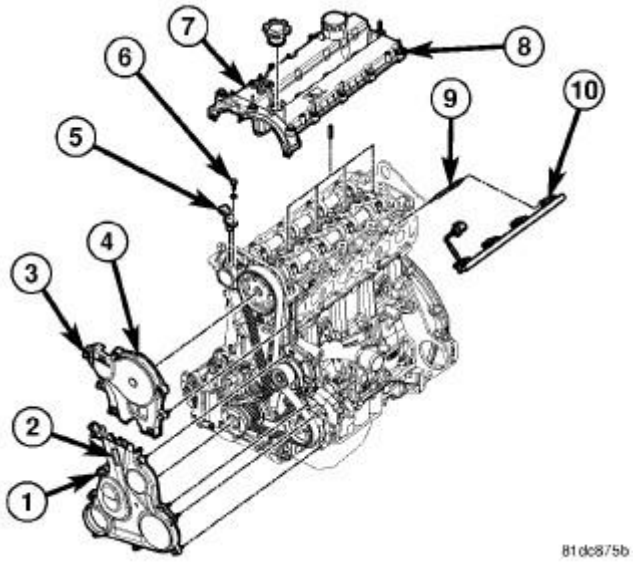

Fig. 105: CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

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

Installation

INSTALLATION

1. Clean and inspect the gasket surface of the cylinder head and the cylinder head cover gasket. Replace cylinder cover gasket if necessary.

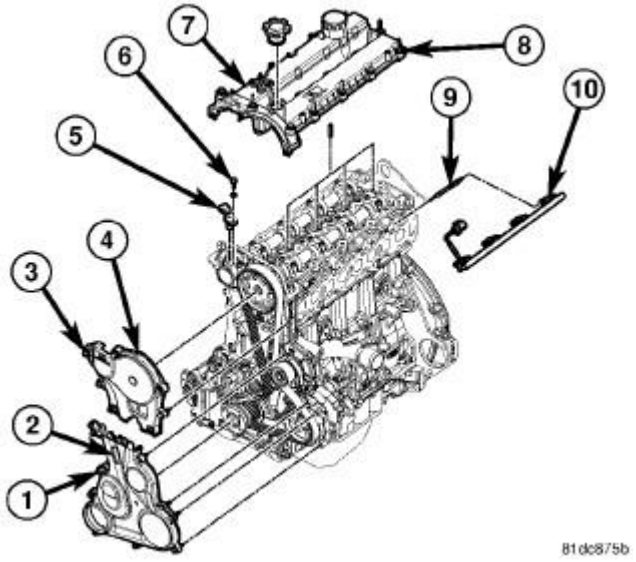

Fig. 106: CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

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

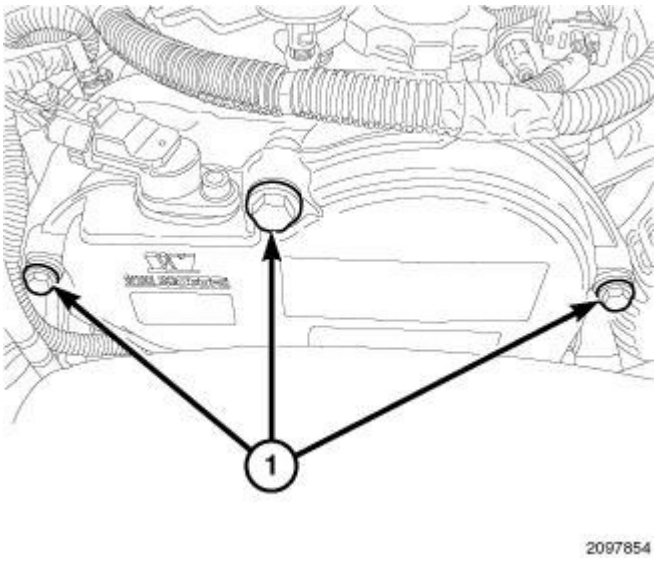

Fig. 107: UPPER COVER BOLTS
Courtesy of CHRYSLER LLC

3. Tighten the upper front timing cover bolts (1) to 11 N.m (97 in. lbs.).

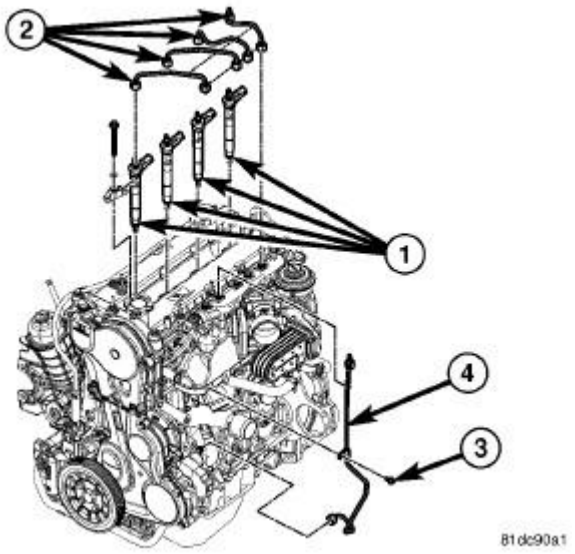

Fig. 108: DIESEL FUEL INJECTORS
Courtesy of CHRYSLER LLC

4. Install fuel injectors, washer, and injector retainer claw.
5. Install the injector clamp bolts. Tighten injector clamp bolts to 33 N.m (24 ft. lbs.).

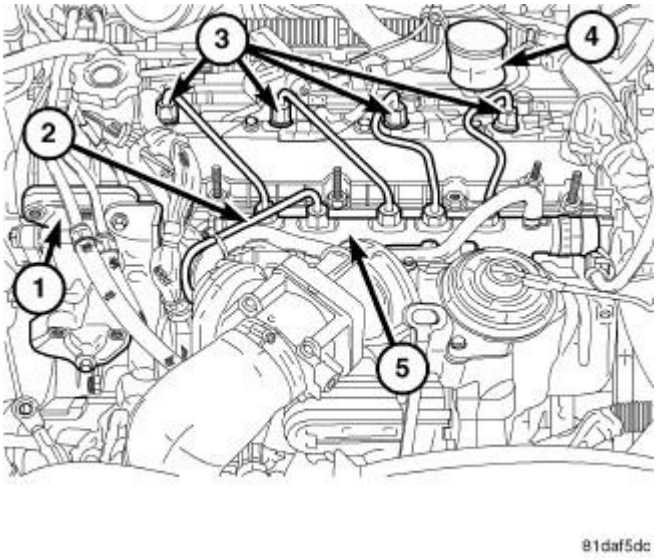

Fig. 109: FUEL RAIL
Courtesy of CHRYSLER LLC

6. Remove the protective caps and loosely install the high pressure fuel lines (3) onto the fuel injectors and the fuel rail.
7. If necessary, tighten the fuel rail nuts to 24 N.m (18 ft. lbs.).
8. Tighten the fuel lines (3) at the fuel injector to 28 N.m (20 ft. lbs.).
9. Tighten the fuel lines from the injectors to the fuel rail to 5 N.m (44 in. lbs.), plus an additional 75°.

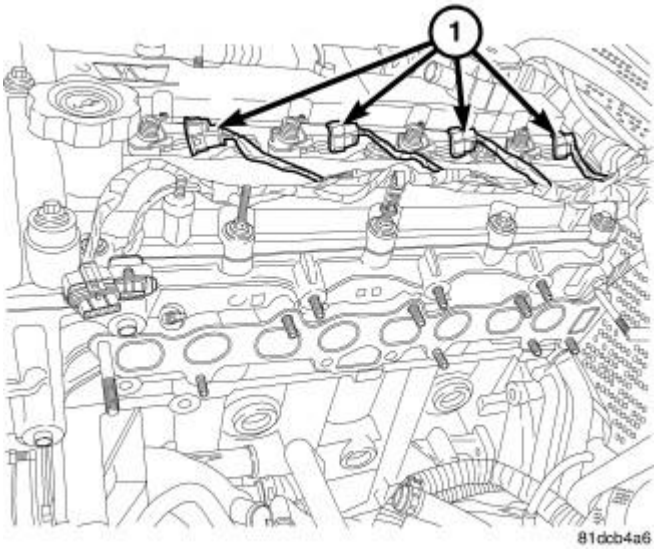

Fig. 110: FUEL INJECTORS
Courtesy of CHRYSLER LLC

10. Connect the fuel injector harness connectors (1) to the fuel injector.

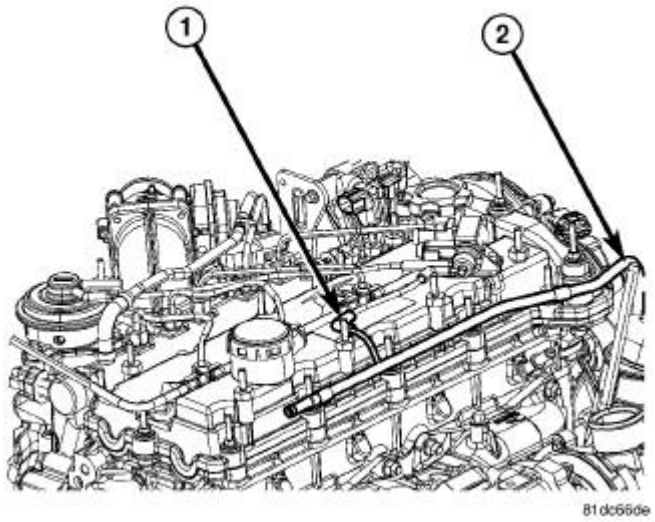

Fig. 111: VACUUM SUPPLY TUBE
Courtesy of CHRYSLER LLC

11. Install the vacuum line (2) and tighten the retaining nuts.
12. Connect the vacuum line (1) to the EGR solenoid.

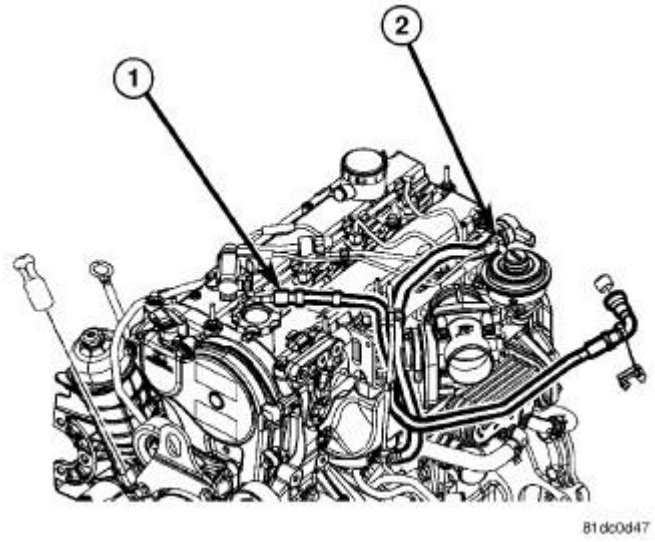

Fig. 112: FUEL RETURN LINES-TOP
Courtesy of CHRYSLER LLC

13. Connect the EGR solenoid electrical connector.
14. Connect the vacuum line from the EGR solenoid to EGR valve (2).
15. Connect the fuel injector return lines (1) to the fuel injectors.

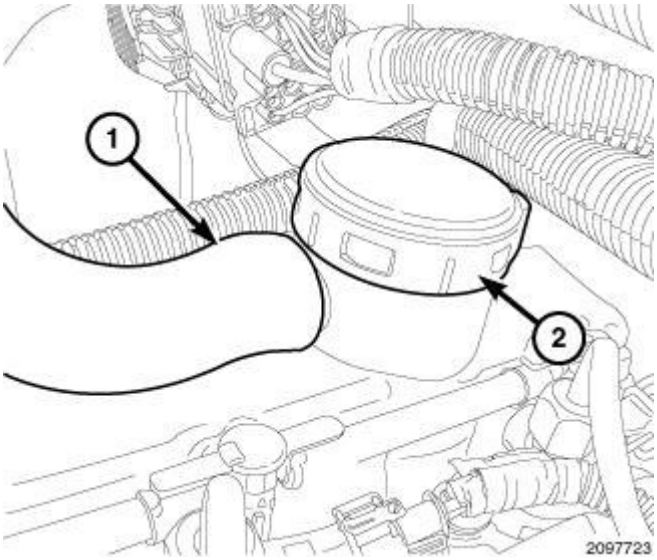

Fig. 113: CRANKCASE VENT HOSE & OIL SEPARATOR
Courtesy of CHRYSLER LLC

16. Connect the crankcase vent hose (1) to the oil separator (2).
17. Connect the negative battery cable.

LIFTER(S), HYDRAULIC

Description

DESCRIPTION

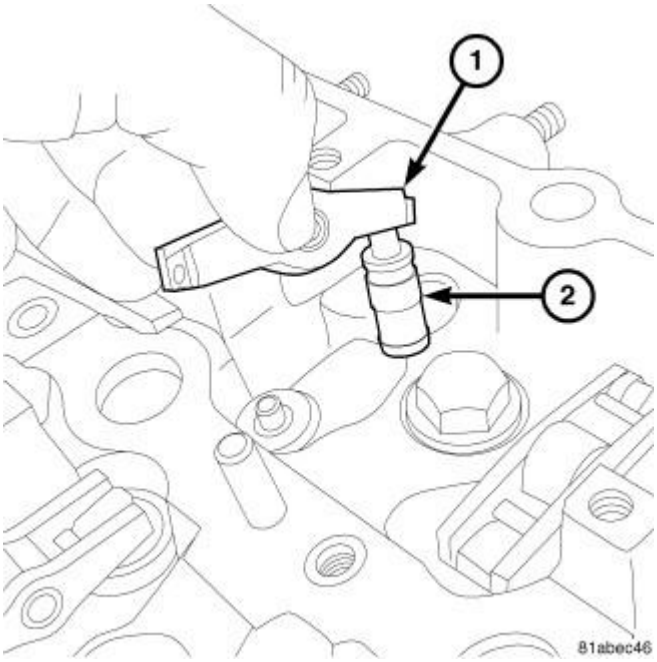

Fig. 114: ROCKER ARM AND LIFTER ASSEMBLY
Courtesy of CHRYSLER LLC

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

Removal

REMOVAL

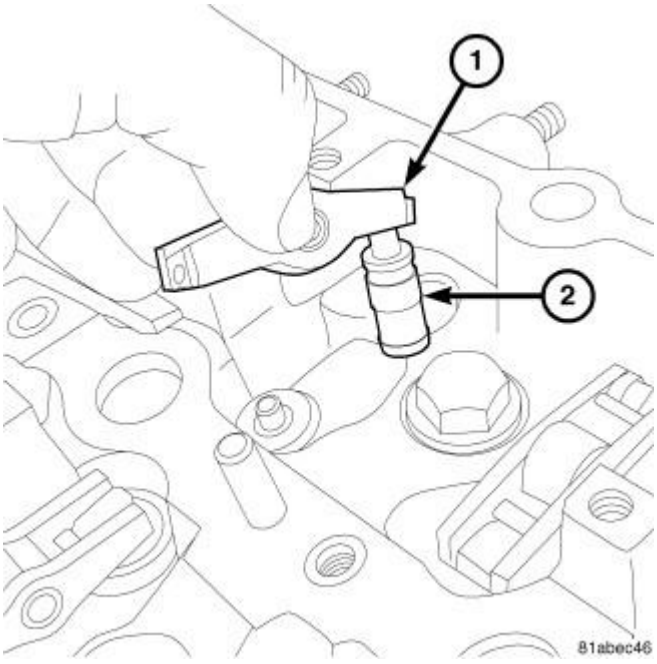

Fig. 115: ROCKER ARM AND LIFTER ASSEMBLY
Courtesy of CHRYSLER LLC

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

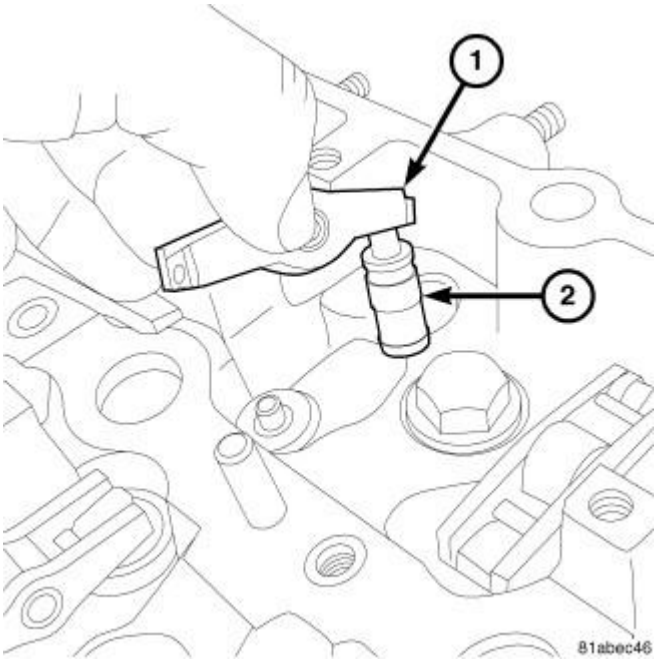

Fig. 116: ROCKER ARM AND LIFTER ASSEMBLY
Courtesy of CHRYSLER LLC

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

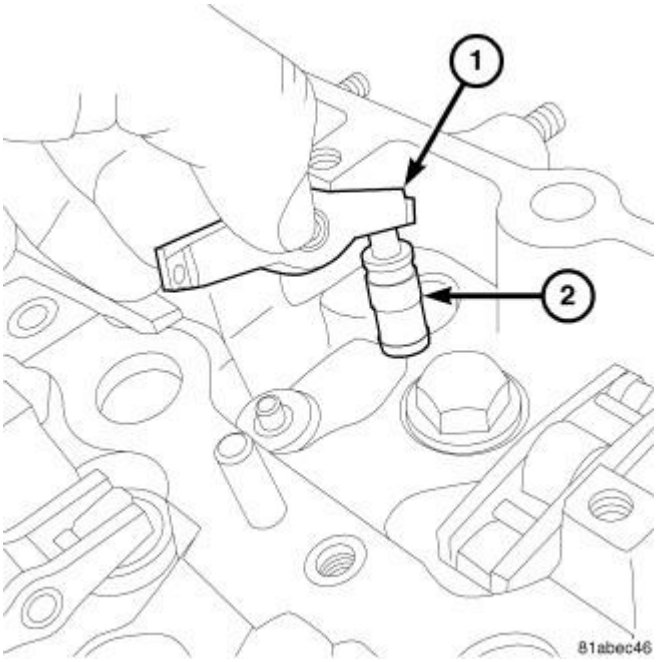

Fig. 117: ROCKER ARM AND LIFTER ASSEMBLY

Courtesy of CHRYSLER LLC

1. Install the rocker arms (1) and hydraulic lifters (2) into their original locations.
2. Install the camshafts. See **Engine/Cylinder Head/CAMSHAFT, Engine - Removal**.

ROCKER ARM, VALVE

Description

DESCRIPTION

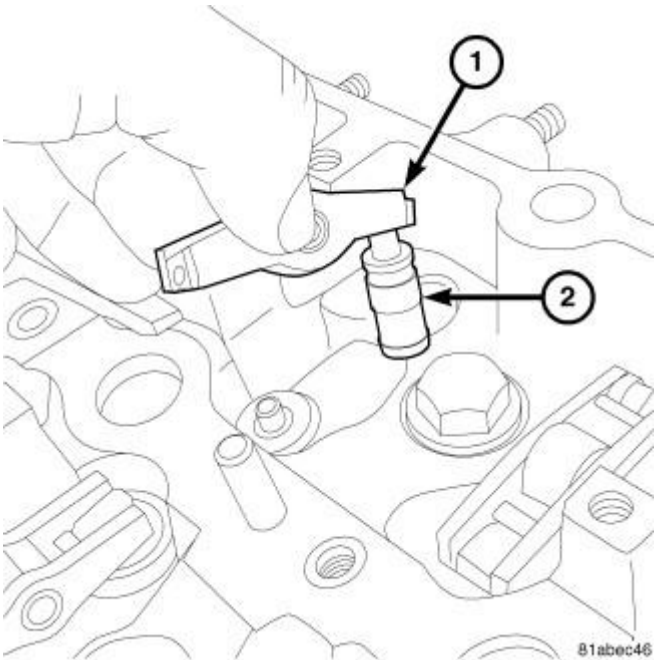

Fig. 118: ROCKER ARM AND LIFTER ASSEMBLY
Courtesy of CHRYSLER LLC

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

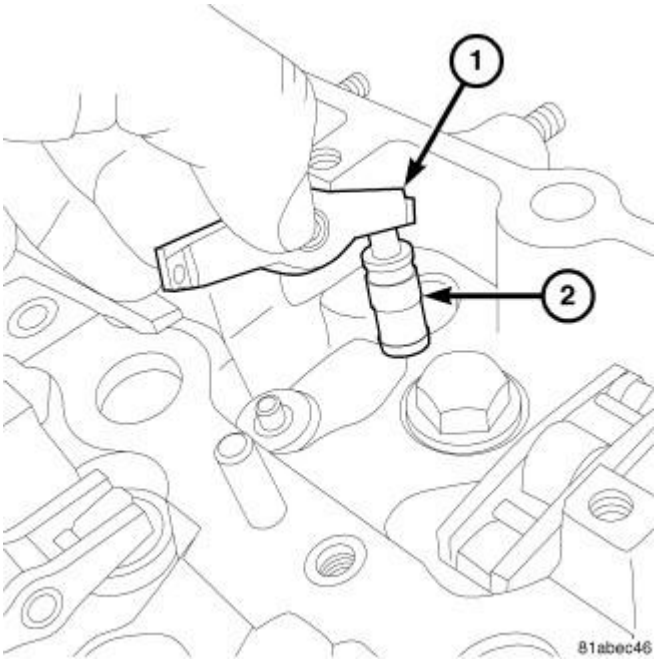

Fig. 119: ROCKER ARM AND LIFTER ASSEMBLY
Courtesy of CHRYSLER LLC

CAUTION: Before removing the cylinder head cover/intake manifold (2) the engine must rotated to 90° after TDC to assure proper alignment of the engine timing components. Failure to do so could result in valve and/or piston damage during reassembly. See Engine/Valve Timing - Standard Procedure.

1. Disconnect negative battery cable.
2. Rotate the crankshaft to 90 degrees ATDC. See **Engine/Valve Timing - Standard Procedure**.
3. Remove the camshafts. See **Engine/Cylinder Head/CAMSHAFT, Engine - Removal**.
4. Remove rocker arms (1) and lifters (2).

Installation

INSTALLATION

1. Clean and inspect gasket sealing surfaces.

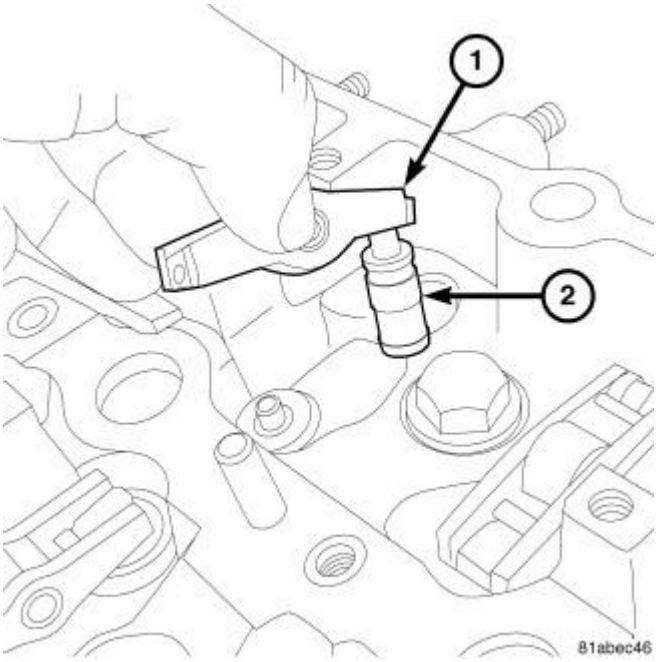

Fig. 120: ROCKER ARM AND LIFTER ASSEMBLY
Courtesy of CHRYSLER LLC

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. See **Engine/Cylinder Head/CAMSHAFT, Engine - Installation**.
5. Connect negative battery cable.

SEAL(S), CAMSHAFT

Removal

REMOVAL

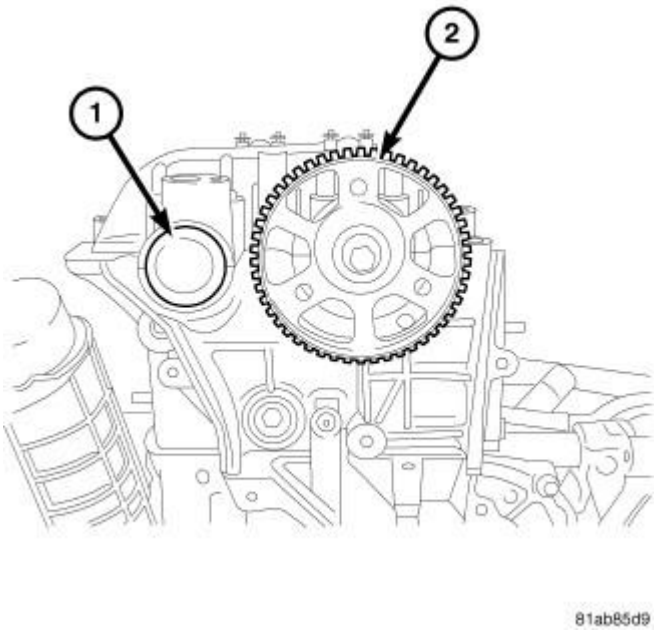

Fig. 121: Intake Camshaft Sprocket
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove the intake camshaft sprocket (2). See **Engine/Valve Timing/SPROCKET(S), Timing Belt and Chain - Removal**.

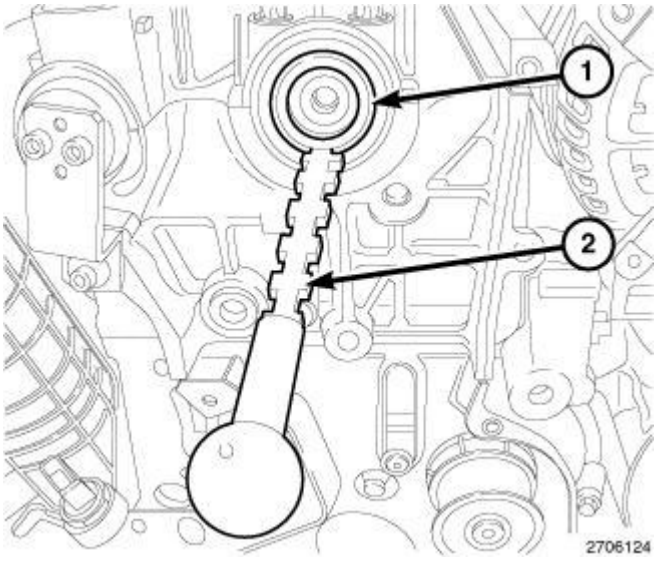

Fig. 122: SEAL REMOVER & SEAL
Courtesy of CHRYSLER LLC

3. Install the seal remover VM. 1058 (2) into seal (1) as illustrated.

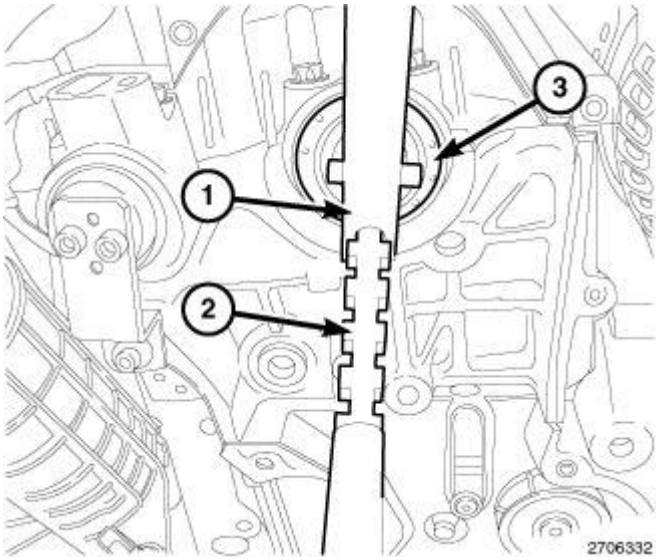

Fig. 123: IDENTIFYING SEAL REMOVER HANDLE, SEAL REMOVER & INTAKE CAMSHAFT OIL SEAL
Courtesy of CHRYSLER LLC

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

Installation

INSTALLATION

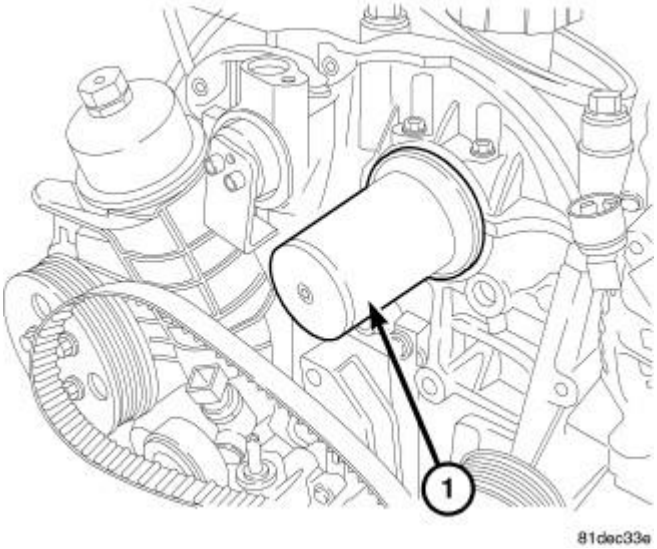

Fig. 124: CAMSHAFT OIL SEAL INSTALLATION
Courtesy of CHRYSLER LLC

1. Using Seal Installer 9973-1 and 9973-2 (1), install the intake camshaft oil seal.

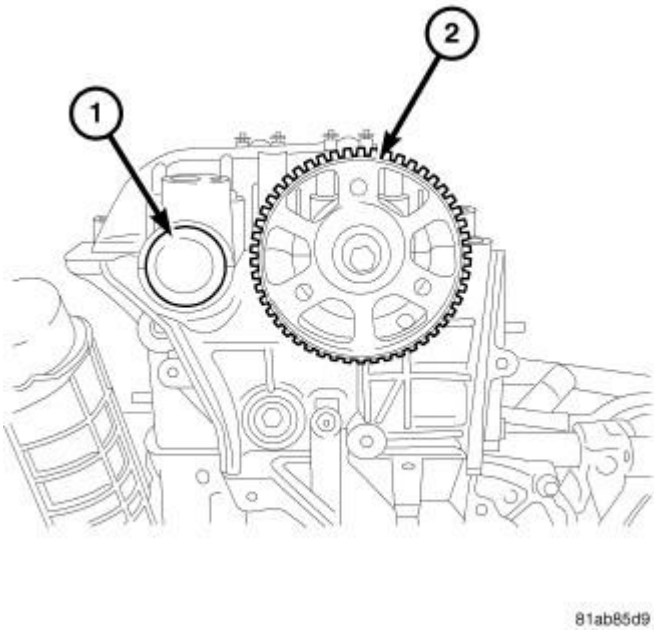

Fig. 125: Intake Camshaft Sprocket
Courtesy of CHRYSLER LLC

2. Install the camshaft sprocket (2). See **Engine/Valve Timing/SPROCKET(S), Timing Belt and Chain - Installation**.
3. Connect negative battery cable.

ENGINE BLOCK

DESCRIPTION

DESCRIPTION

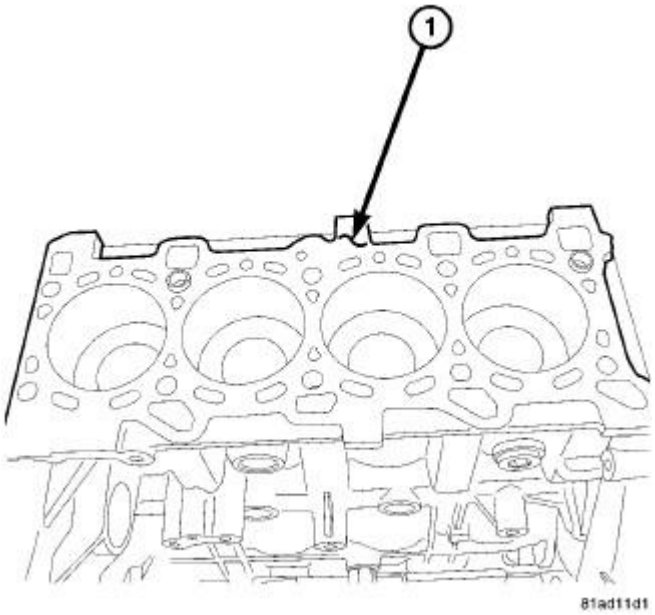

Fig. 126: ENGINE BLOCK
Courtesy of CHRYSLER LLC

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 57.563 - 57.568	Upper Bearing Shell	Yellow	Blue	Blue	Red
	Lower Bearing Shell	Yellow	Yellow	Blue	Blue
-					

C 57.563 - 57.568	Upper Bearing Shell	Yellow	Yellow	Blue	Blue
	Lower Bearing Shell	Green	Yellow	Yellow	Blue
-					
D 57.563 - 57.568	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 - 64.000**
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
-					
D 69.015 - 69.020	Upper Bearing Shell	Green	Yellow	Yellow	Blue
	Lower Bearing Shell	Green	Green	Yellow	Yellow

STANDARD PROCEDURE - COMPRESSION TEST

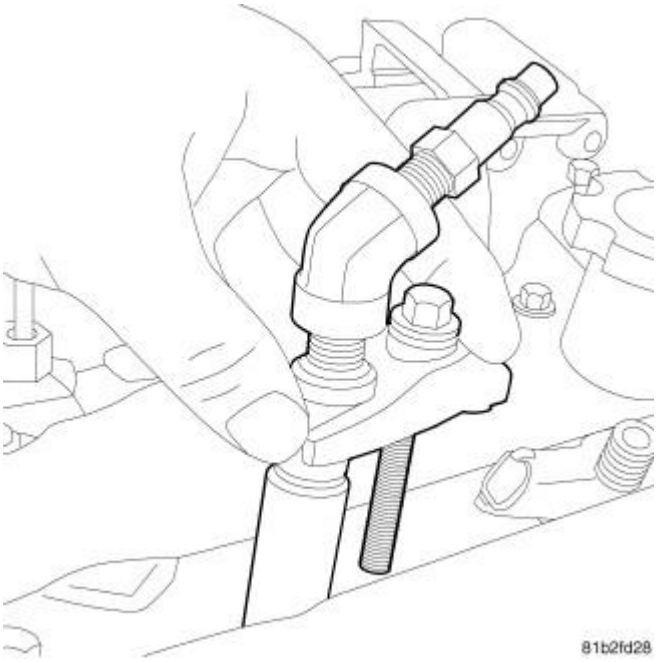

Fig. 127: COMPRESSION TESTER
Courtesy of CHRYSLER LLC

1. Warm up engine to operating temperature (approximately 80 °C).
2. Shut off engine
3. Remove engine cover
4. Disconnect fuel feed and return lines from the fuel filter
5. Operate a vacuum pump connected to the return line until no more fuel comes out
6. Remove injectors
7. Crank engine several times with the starter to eliminate combustion residues in the cylinders
8. Insert compression test adapter p/n 10010 into injector hole of cylinder to be tested. Install injector retainer bolts and tighten.
9. Test compression pressure by cranking engine with starter for at least 8 revolutions.

Cylinder compression Difference Between Cylinders	**10 Bar (44 psi)**

10. Carry out test procedure at the remaining cylinders in the same way.
11. Remove adapter from cylinder head.
12. Install injectors with new high pressure pipe
13. Install engine cover

BEARING(S), CONNECTING ROD

Removal

REMOVAL

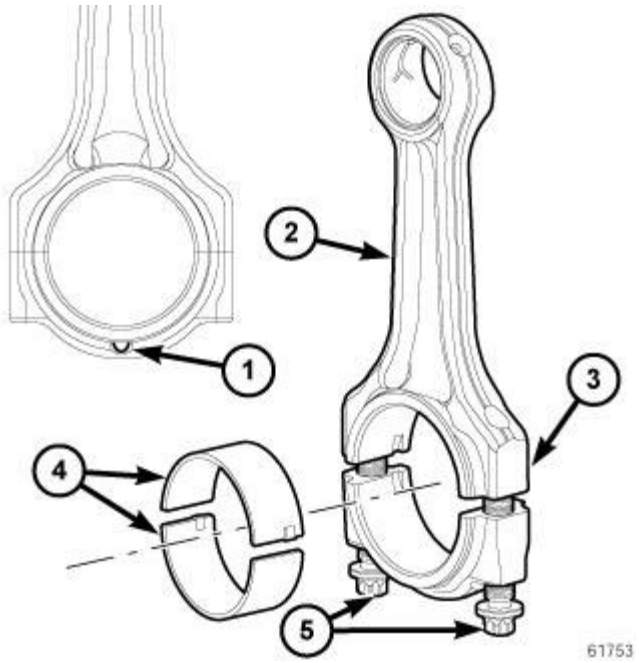

Fig. 128: CONNECTING ROD IDENTIFICATION
Courtesy of CHRYSLER LLC

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

1. Remove the balance shaft module. See **Engine/Engine Block/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

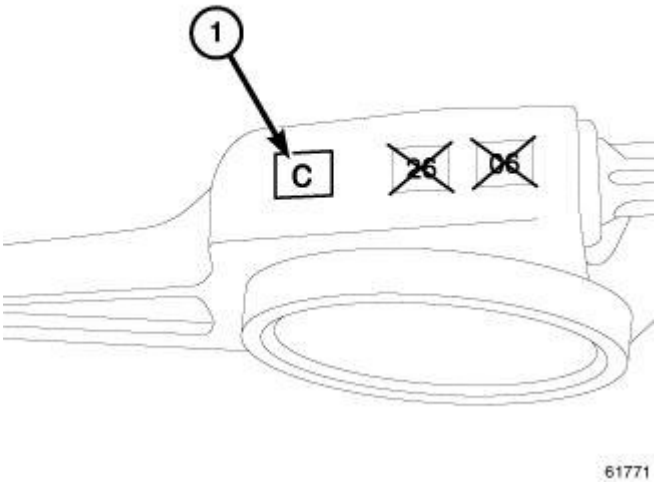

Fig. 129: CONNECTING ROD SIZE
Courtesy of CHRYSLER LLC

1. The connecting rod bearing size (1) is stamped on the connecting rod.

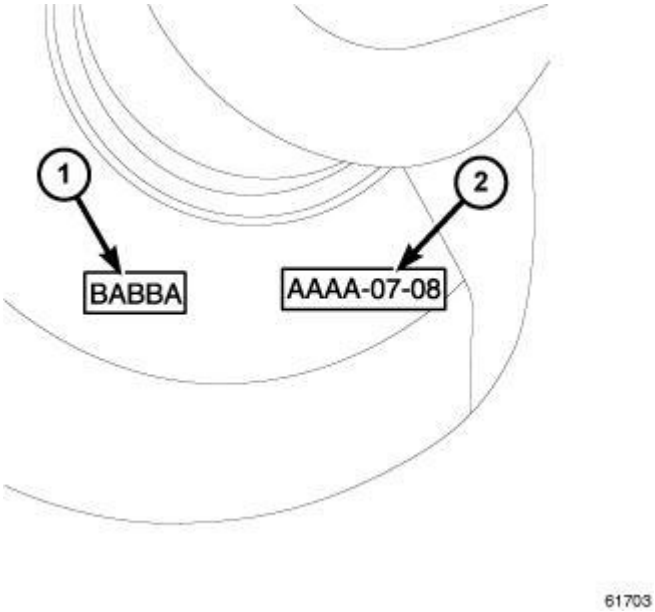

Fig. 130: MAIN BEARING SIZE MARK ON CRANK
Courtesy of CHRYSLER LLC

2. Compare the crankshaft connecting rod journal diameter (2) with the bearing selection chart to determine the correct bearing size 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 **Engine/Engine Block - Standard Procedure**.

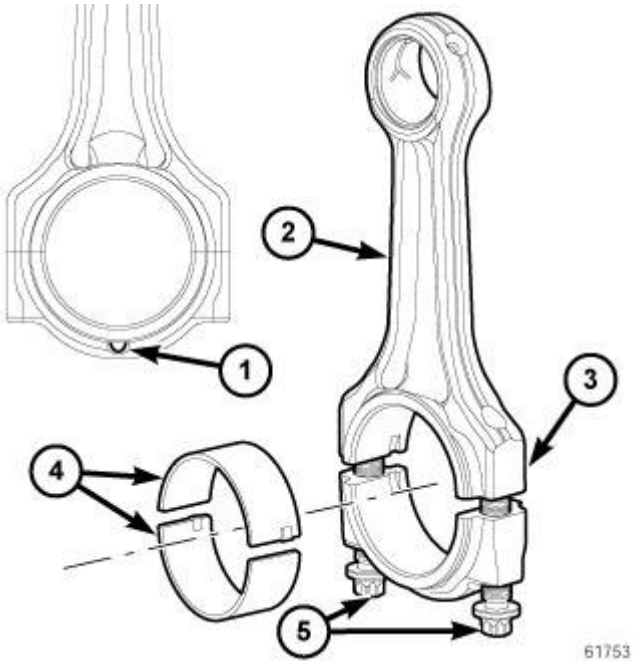

Fig. 131: CONNECTING ROD IDENTIFICATION
Courtesy of CHRYSLER LLC

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

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).

BEARING(S), CRANKSHAFT, MAIN

Removal

REMOVAL

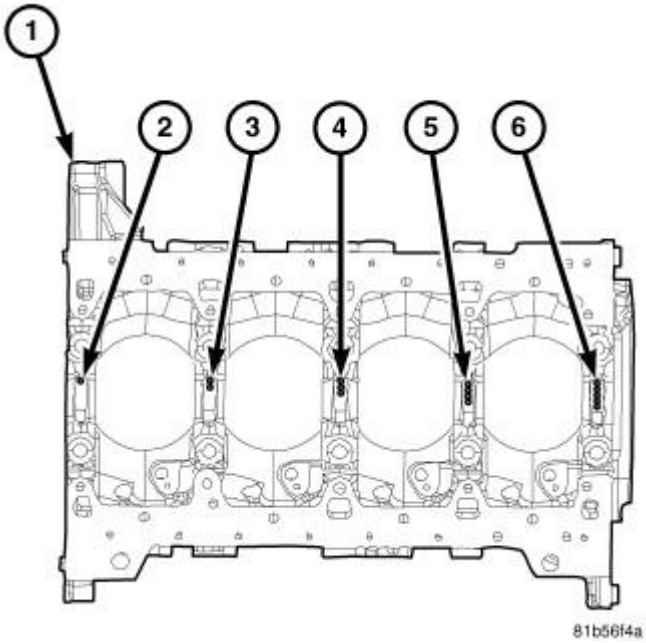

Fig. 132: CRANKSHAFT CAP LOCATION MARKS
Courtesy of CHRYSLER LLC

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 oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.
2. Remove the balance shaft assembly. See **Engine/Engine Block/MODULE, Balance Shaft - Removal**.
3. Identify bearing cap locations (2-6) before removal.

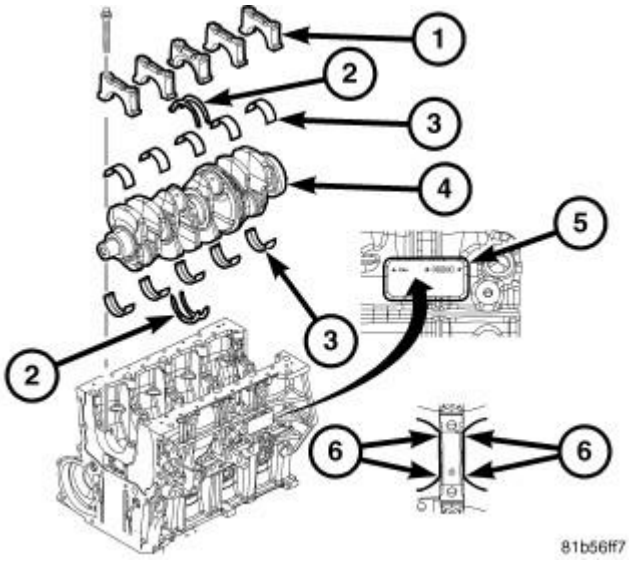

Fig. 133: CRANKSHAFT BEARING SIZE MARK
Courtesy of CHRYSLER LLC

4. 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. See **Engine/Engine Block/CRANKSHAFT - Removal**.

Installation

INSTALLATION

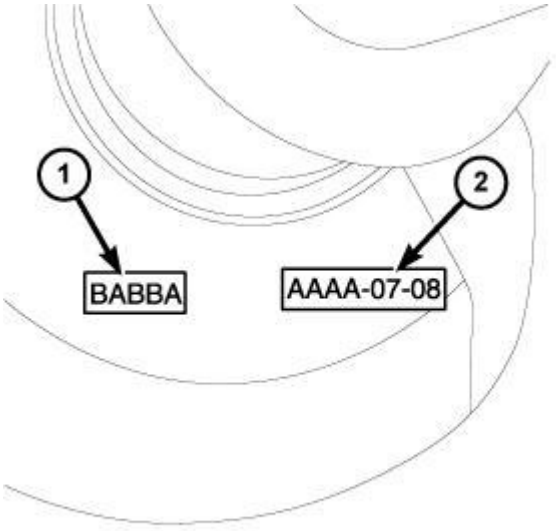

Fig. 134: MAIN BEARING SIZE MARK ON CRANK
Courtesy of CHRYSLER LLC

1. Locate the crankshaft journal size (1) stamp on the crankshaft weight.

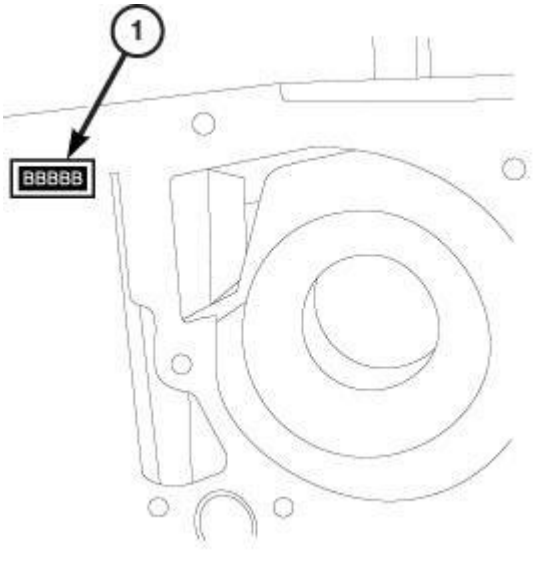

Fig. 135: MAIN BEARING SIZE MARK ON BLOCK
Courtesy of CHRYSLER LLC

2. Locate the engine block crankshaft journal size stamp on the engine block (1).

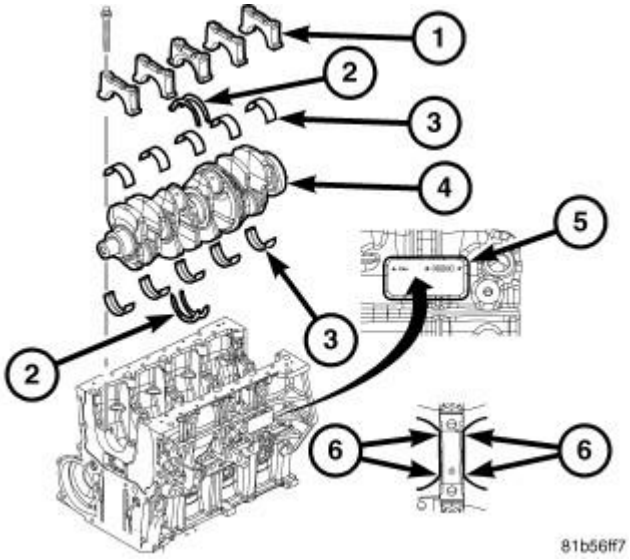

Fig. 136: CRANKSHAFT BEARING SIZE MARK
Courtesy of CHRYSLER LLC

3. Use the crankshaft stamp and engine block stamp to select the correct crankshaft bearing sizes from the bearing chart. The letters stamped into the block are in the same order as the cylinders (5). The first letter corresponds to the first cylinder, the second to the second, etc. See **Engine/Engine Block - Standard Procedure**.
4. If the crankshaft was removed to install the bearings, install the crankshaft. See **Engine/Engine Block/CRANKSHAFT - Installation**.
5. Install the balance shaft assembly. See **Engine/Engine Block/MODULE, Balance Shaft - Installation**.

6. Install the oil pan.

COVER, ENGINE, FRONT

Description

DESCRIPTION

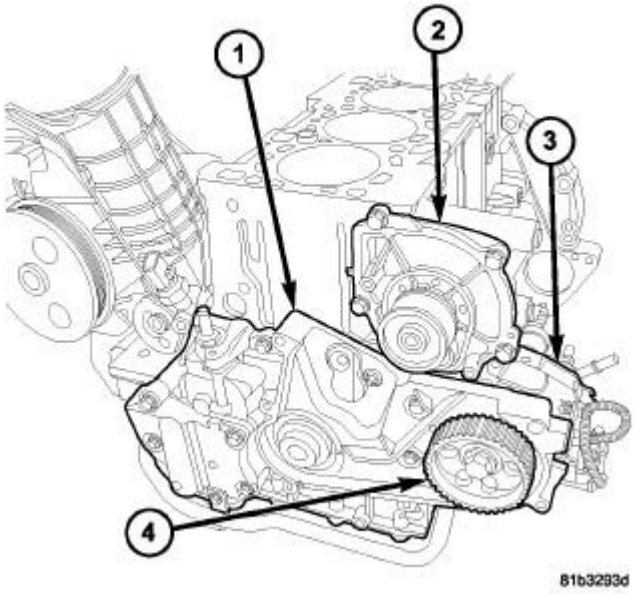

Fig. 137: OIL PUMP COVER ASSEMBLY
Courtesy of CHRYSLER LLC

The oil pump cover assembly on this engine is an aluminum cover that incorporates the oil pump.

Removal

REMOVAL

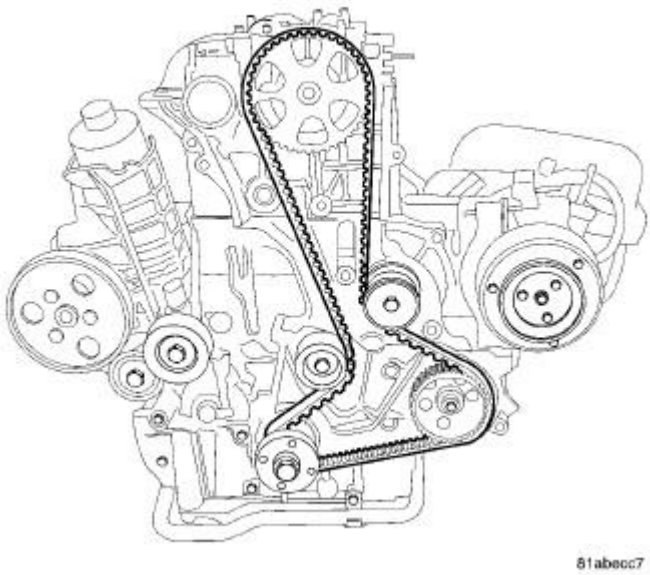

Fig. 138: TIMING BELT
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove cooling fan and fan drive viscous clutch assembly. Refer to **Cooling/Engine/FAN, Cooling - Removal** .
3. Remove accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal** .
4. Remove the timing belt. See **Engine/Valve Timing/SPROCKET(S), Timing Belt and Chain - Removal**.

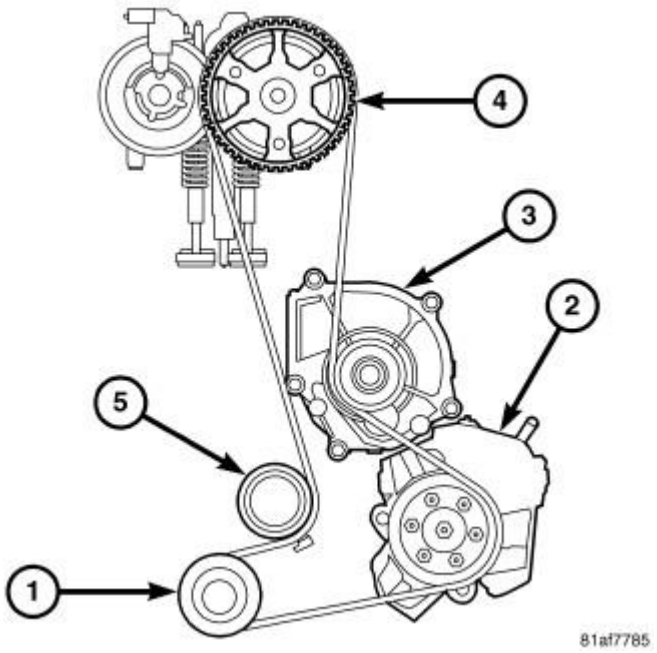

Fig. 139: TIMING BELT TENSIONER
Courtesy of CHRYSLER LLC

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

5. Remove the crankshaft sprocket (1).

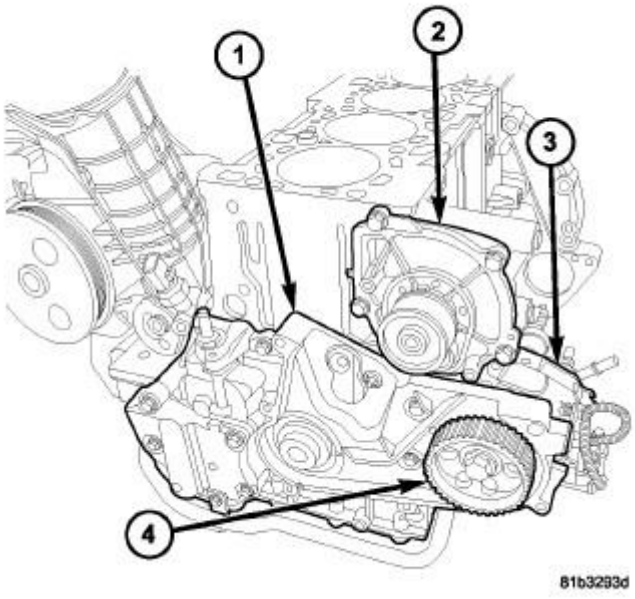

Fig. 140: OIL PUMP COVER ASSEMBLY
Courtesy of CHRYSLER LLC

6. Remove the high pressure fuel pump (4) sprocket.
7. Remove the oil pump cover assembly (1).

Installation

INSTALLATION

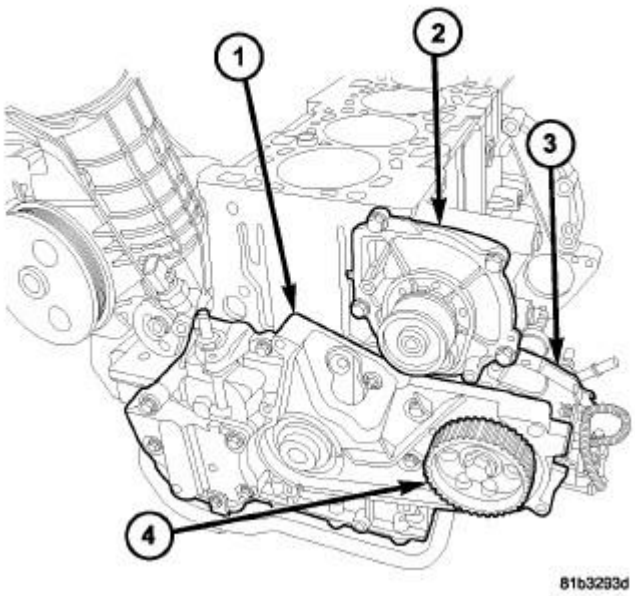

Fig. 141: OIL PUMP COVER ASSEMBLY
Courtesy of CHRYSLER LLC

1. Install the oil pump gasket.
2. Install the oil pump cover assembly (1).

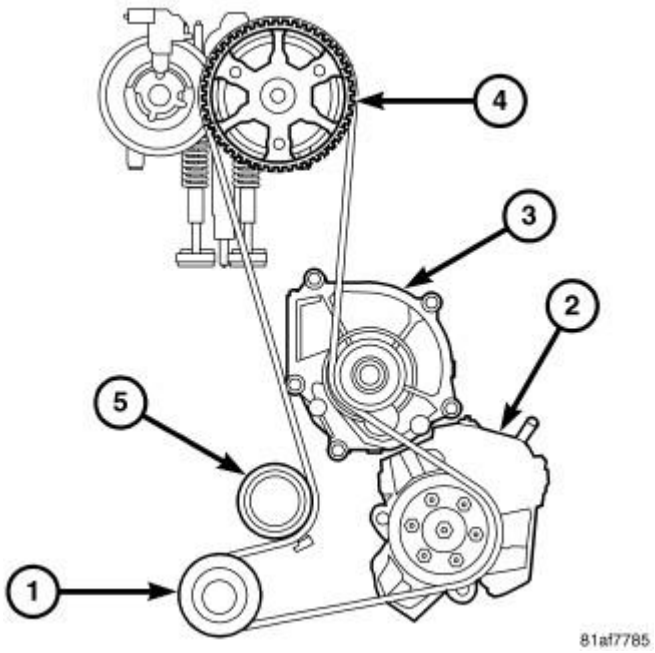

Fig. 142: TIMING BELT TENSIONER
Courtesy of CHRYSLER LLC

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

3. Install the crankshaft sprocket (1).
4. Install the high pressure pump (4) sprocket.

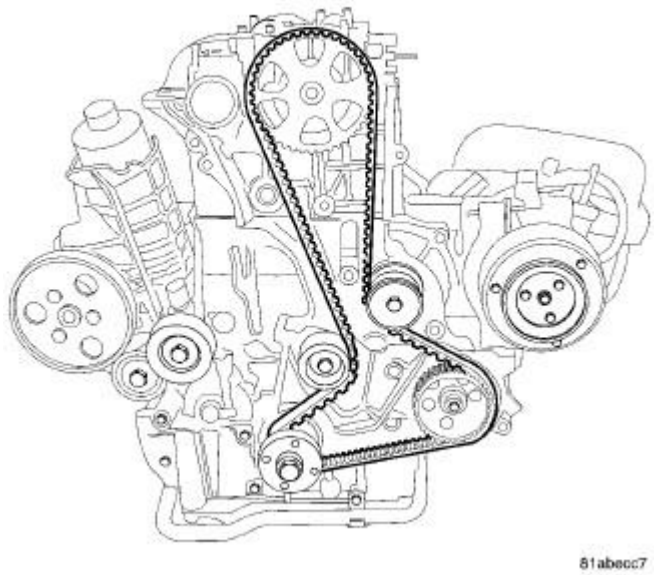

Fig. 143: TIMING BELT

Courtesy of CHRYSLER LLC

5. Install the timing belt. See **Engine/Valve Timing/SPROCKET(S), Timing Belt and Chain - Removal**.
6. Install the cooling fan and fan drive viscous clutch assembly.
7. Install the accessory drive belt.
8. Connect negative battery cable.

CRANKSHAFT

Description

DESCRIPTION

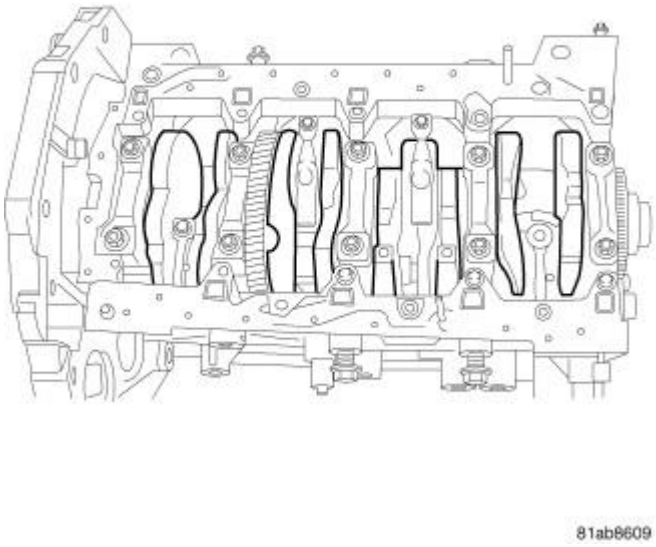

Fig. 144: CRANKSHAFT
Courtesy of CHRYSLER LLC

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

CHECKING CRANKSHAFT END PLAY

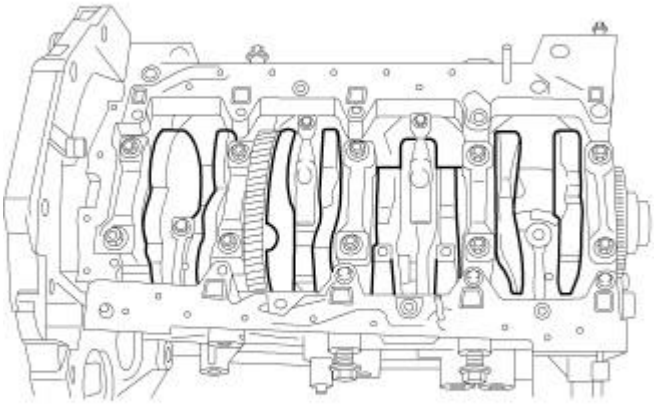

Fig. 145: CRANKSHAFT
Courtesy of CHRYSLER LLC

1. Mount a 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, see **Engine - Specifications**.

Removal

REMOVAL

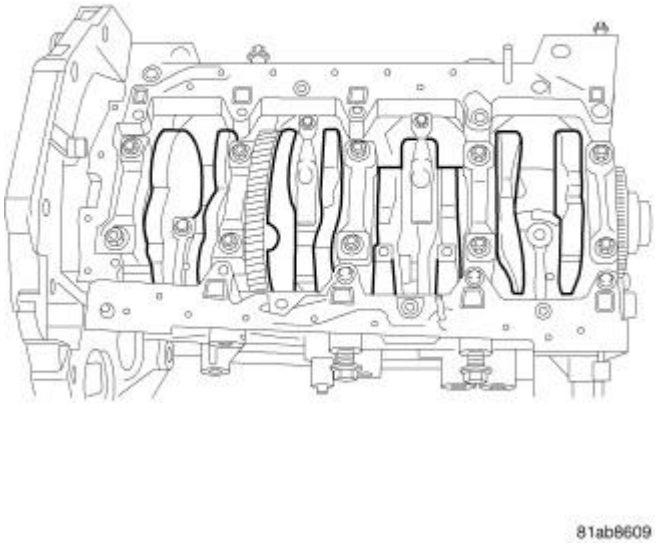

Fig. 146: CRANKSHAFT
Courtesy of CHRYSLER LLC

1. Remove the lower oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.
2. Remove the upper oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.
3. Remove the balance shaft assembly. See **Engine/Engine Block/MODULE, Balance Shaft - Removal**.
4. Remove the rear crankshaft oil seal carrier. See **Engine/Engine Block/SEAL, Crankshaft Oil - Removal**.
5. Remove the front cover and front crank oil seal. See **Engine/Engine Block/COVER, Engine - Removal**.
6. Remove the bearing caps from the piston rods.
7. Remove the bearing caps from the crankshaft journals.
8. Remove the crankshaft.

Installation

INSTALLATION

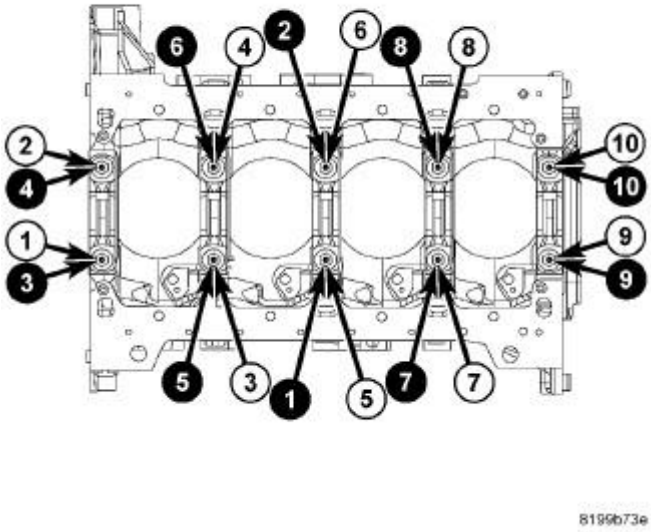

Fig. 147: CRANKSHAFT TORQUE SEQUENCE
Courtesy of CHRYSLER LLC

1. Use the crankshaft bearing selection chart for main bearing selection. Refer to **Engine/Engine Block/BEARING(S), Crankshaft - Standard Procedure** .
2. Lubricate and install the crankshaft bearings. Make sure the thrust washer is not touching the engine block.
3. Install the crankshaft.

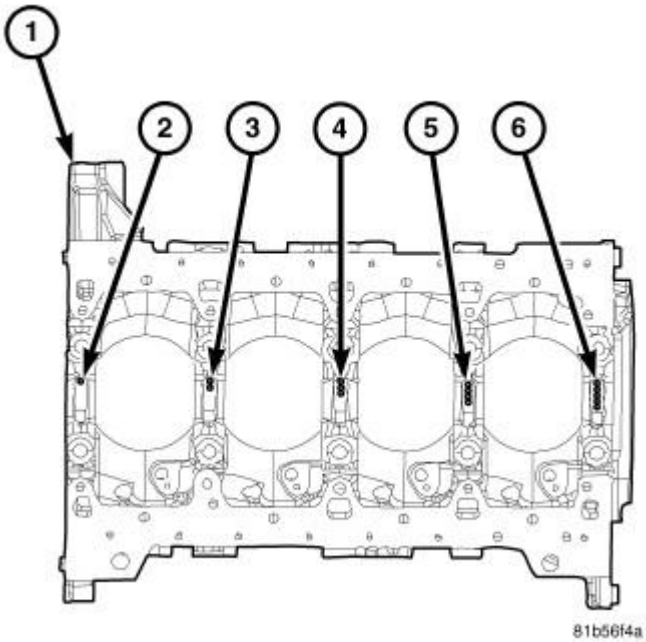

Fig. 148: CRANKSHAFT CAP LOCATION MARKS
Courtesy of CHRYSLER LLC

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. See **Engine/Engine Block/ROD, Piston and Connecting - Installation**.
10. Install the balance shaft assembly. See **Engine/Engine Block/MODULE, Balance Shaft - Installation**.
11. Install the upper oil pan. See **Engine/Lubrication/PAN, Oil - Installation**.
12. Install the lower oil pan. See **Engine/Lubrication/PAN, Oil - Installation**.
13. Install the front main seal carrier. See **Engine/Engine Block/SEAL, Crankshaft Oil - Installation**.
14. Install the rear main seal carrier. See **Engine/Engine Block/SEAL, Crankshaft Oil - Installation**.

DAMPER, VIBRATION

Removal

REMOVAL

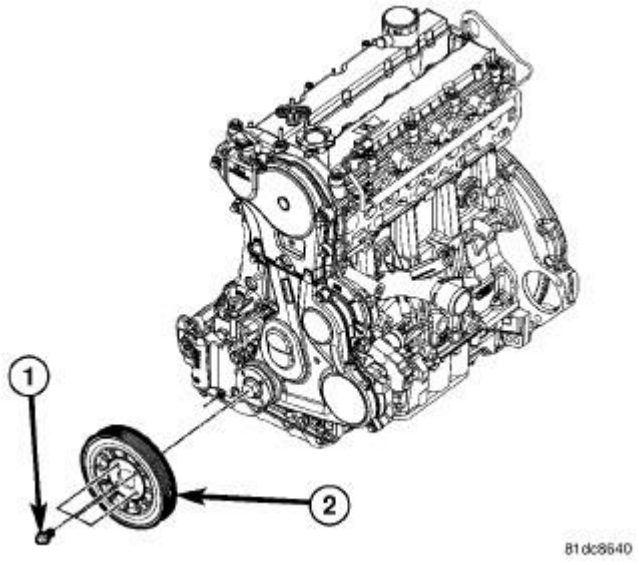

Fig. 149: CRANKSHAFT DAMPER
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.

2. Raise and support the vehicle.
3. Drain the engine coolant system.
4. Remove the air filter housing. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.
5. Remove the windshield washer reservoir.
6. Remove the viscous and electric cooling fans and shroud. Refer to **Cooling/Engine/FAN, Cooling - Removal** .
7. Remove the accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal** .
8. Remove the bolts (1) and the vibration damper (2).

Installation

INSTALLATION

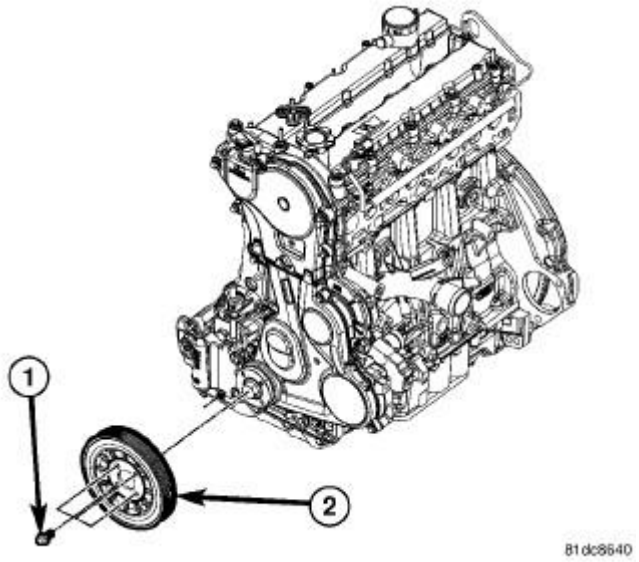

Fig. 150: CRANKSHAFT DAMPER
Courtesy of CHRYSLER LLC

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 **Cooling/Accessory Drive/BELT, Serpentine - Installation** .
4. Install the electric and viscous cooling fans and shroud. Refer to **Cooling/Engine/FAN, Cooling - Installation** .
5. Install the windshield washer reservoir.
6. Install the air filter housing. See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.
7. Lower the vehicle.
8. Refill the engine coolant system.
9. Reconnect the negative battery cable.

FLEXPLATE

Removal

REMOVAL

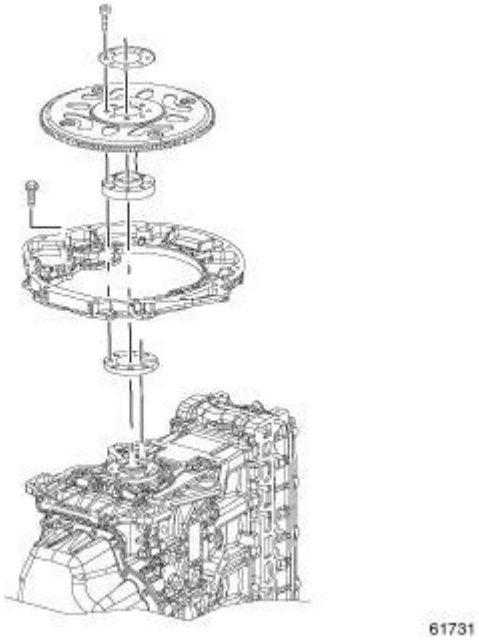

Fig. 151: FLYWHEEL AND FLEX PLATE
Courtesy of CHRYSLER LLC

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).

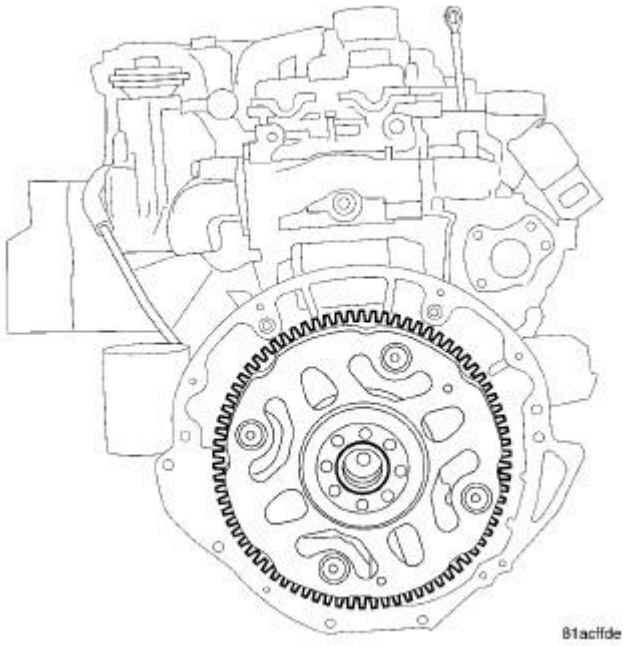

Fig. 152: FLEX PLATE - INSTALLED
Courtesy of CHRYSLER LLC

4. Inspect flex plate (2) for damage.

Installation

INSTALLATION

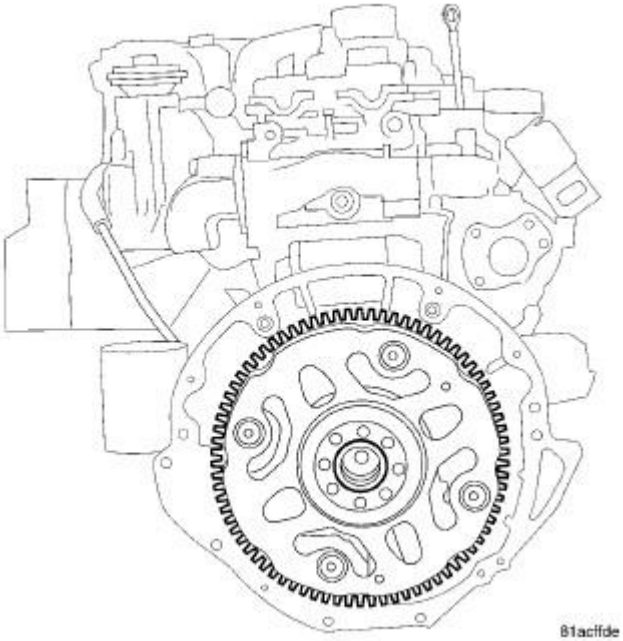

Fig. 153: FLEX PLATE - INSTALLED
Courtesy of CHRYSLER LLC

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.

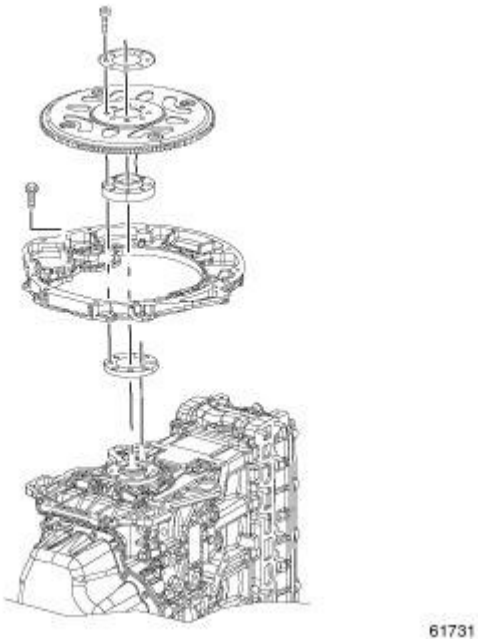

Fig. 154: FLYWHEEL AND FLEX PLATE
Courtesy of CHRYSLER LLC

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

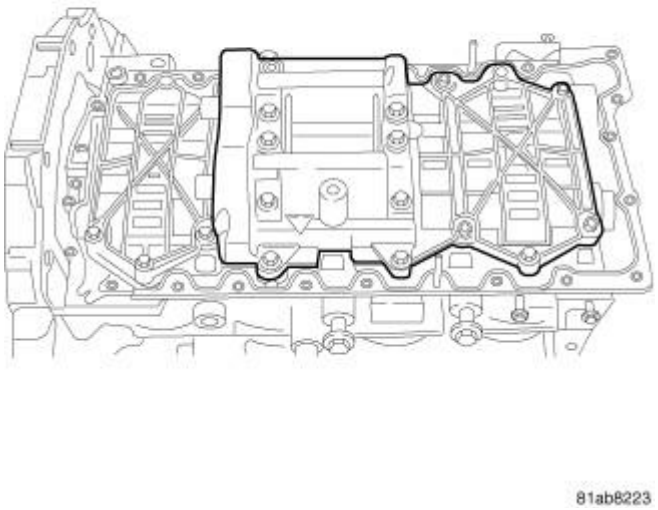

Fig. 155: BALANCE SHAFT
Courtesy of CHRYSLER LLC

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

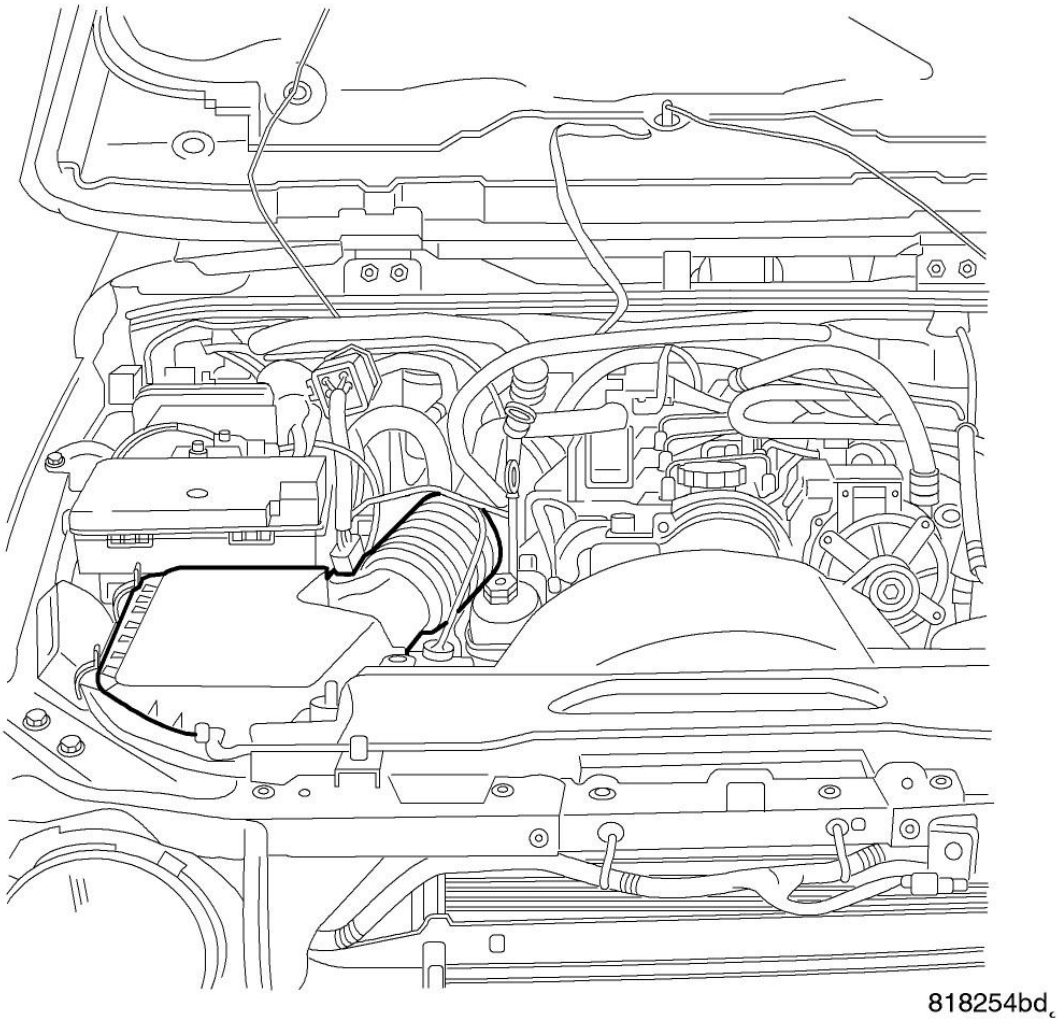

Fig. 156: ENGINE COMPARTMENT
Courtesy of CHRYSLER LLC

1. Disconnect the battery.
2. Drain the engine oil.

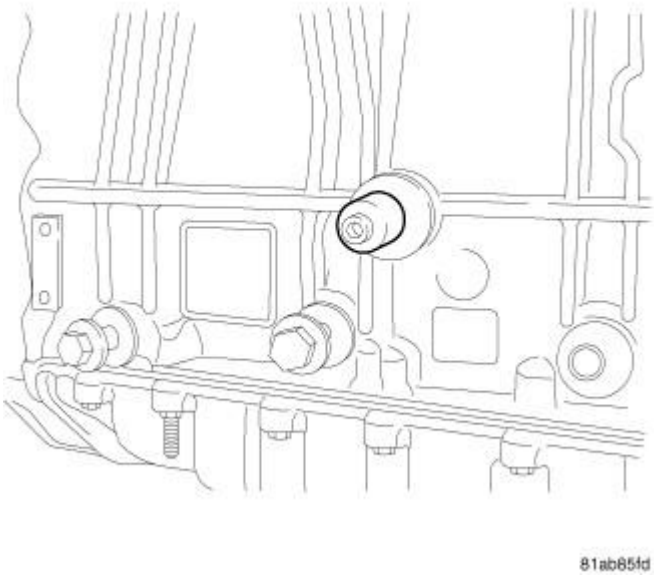

Fig. 157: CRANKSHAFT LOCKING TOOL
Courtesy of CHRYSLER LLC

3. Install the TDC locking tool.

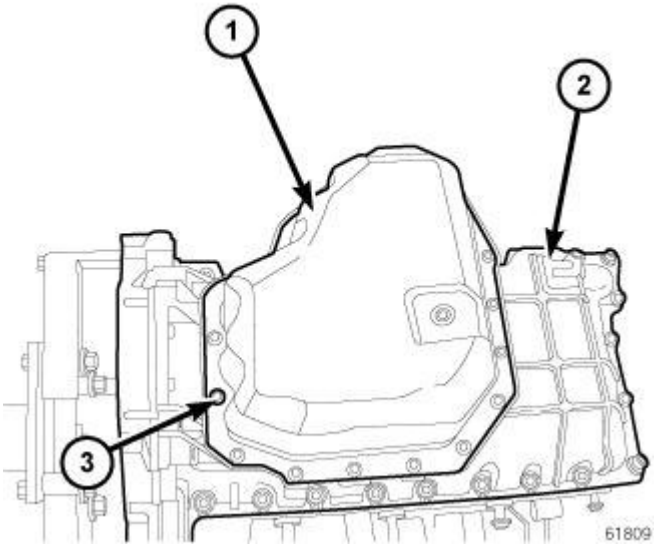

Fig. 158: LOWER OIL PAN
Courtesy of CHRYSLER LLC

4. Remove the lower oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.

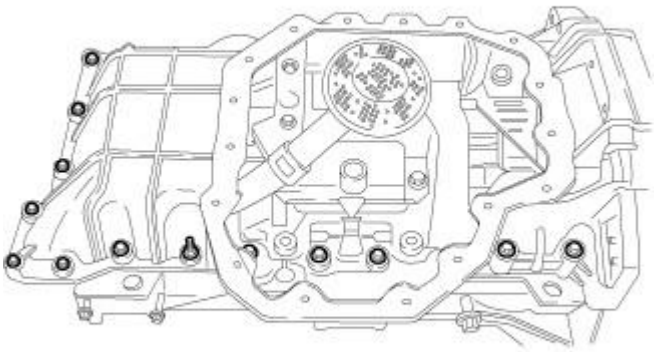

Fig. 159: OIL PICKUP TUBE
Courtesy of CHRYSLER LLC

5. Remove the upper oil pan.
6. Remove the oil pickup tube.

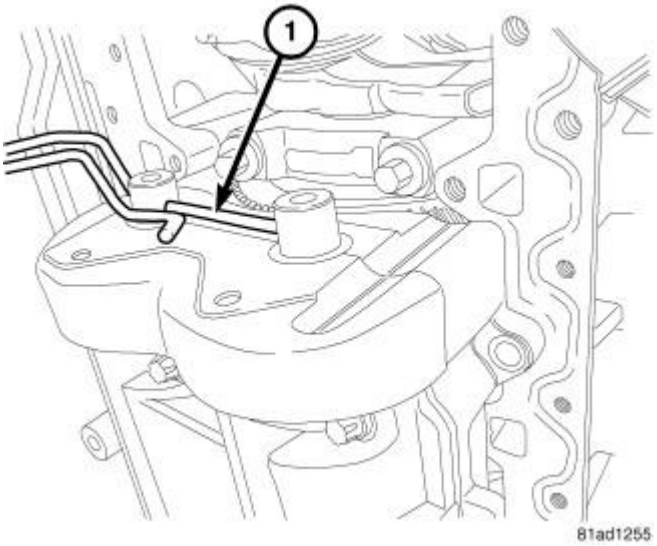

Fig. 160: BALANCE SHAFT TIMING TOOL
Courtesy of CHRYSLER LLC

7. Place a dowel rod through the holes in the balance shaft axles to keep the balance shafts in the correct position for reassembly.

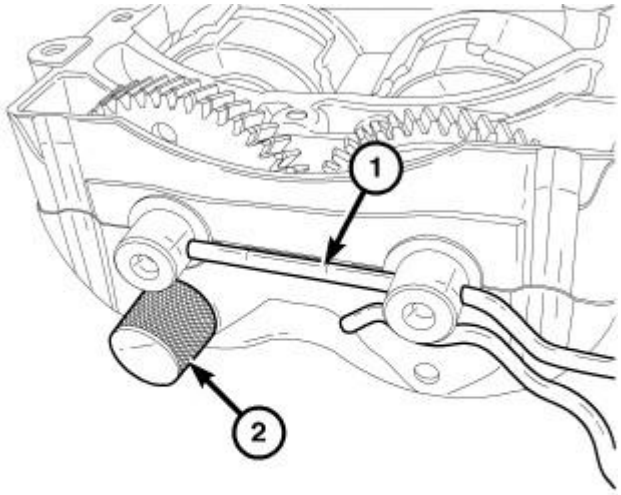

Fig. 161: BALANCE SHAFT TOOL INSTALLED
Courtesy of CHRYSLER LLC

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.

8. Insert the balance shaft locking pin (2) into the balance shaft assembly to lock the split gears together.

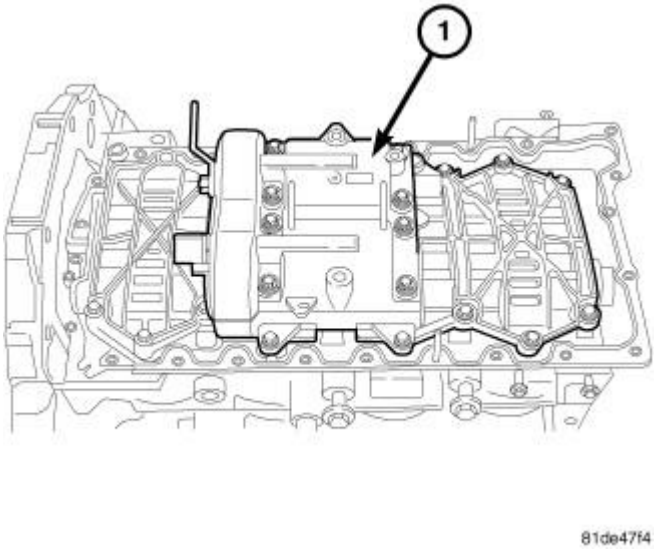

Fig. 162: BALANCE SHAFT
Courtesy of CHRYSLER LLC

9. Remove the balance shaft housing (1).

Installation

INSTALLATION

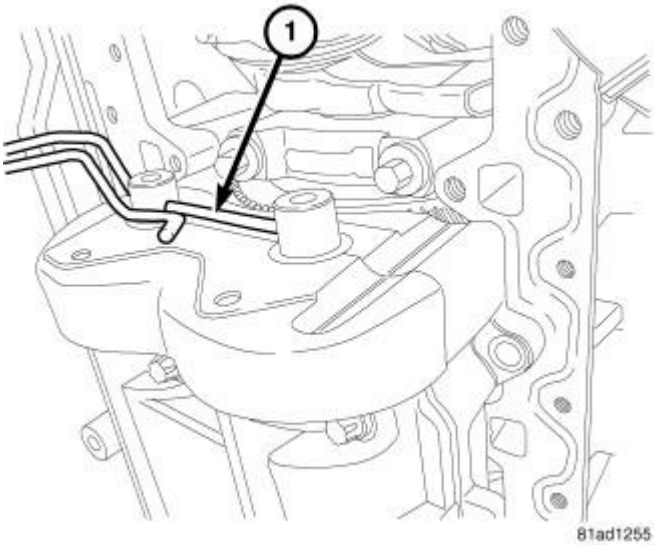

Fig. 163: BALANCE SHAFT TIMING TOOL
Courtesy of CHRYSLER LLC

1. The balance shafts must remain aligned by the alignment dowel and the balance shaft pin must remain in the balance shaft assembly until the assembly is completely installed to the engine.

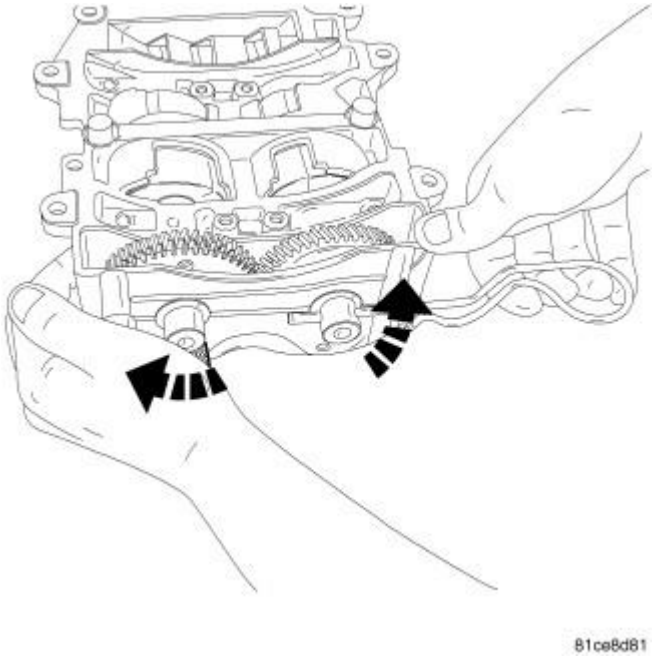

Fig. 164: BALANCE SHAFT TOOL INSTALLATION
Courtesy of CHRYSLER LLC

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.

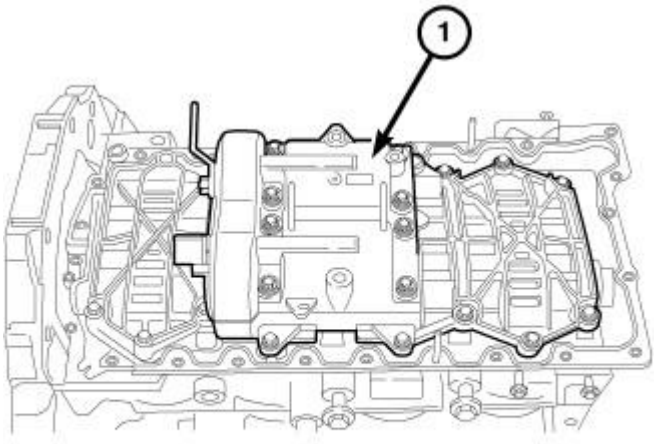

Fig. 165: BALANCE SHAFT
Courtesy of CHRYSLER LLC

3. Install the balance shaft housing (1).

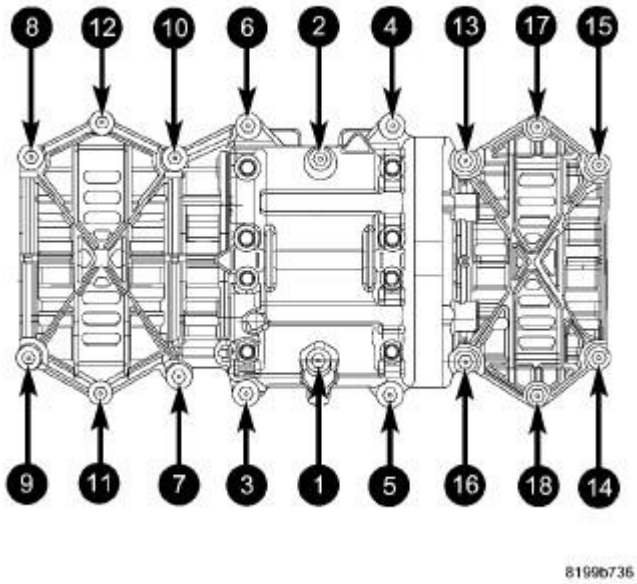

Fig. 166: BALANCE SHAFT HOUSING TORQUE SEQUENCE
Courtesy of CHRYSLER LLC

4. Use torque sequence in the graphic to torque the balance shaft bolts to 33 Nm (24 lbs. ft.).
5. Remove the balance shaft assembly dowel and the balance shaft pin.

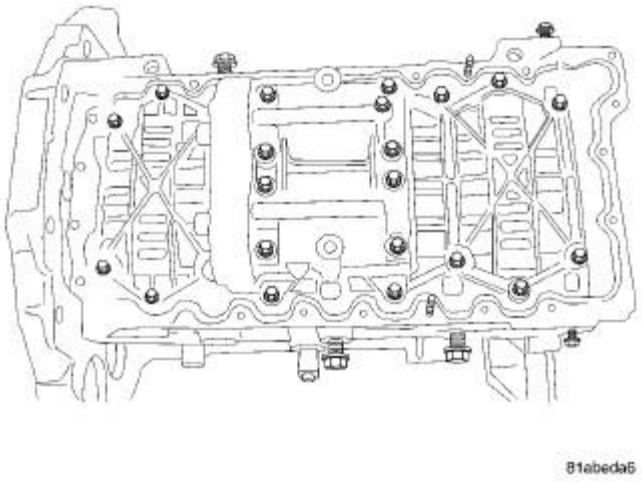

Fig. 167: Engine Block Gasket Surface
Courtesy of CHRYSLER LLC

6. Install the upper oil pan gasket.

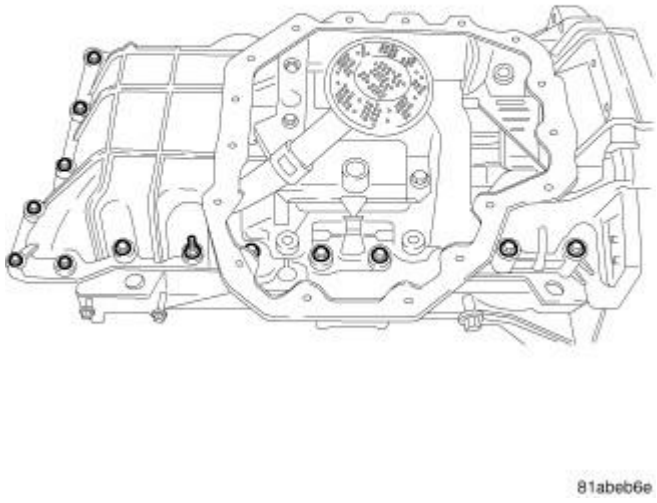

Fig. 168: OIL PICKUP TUBE

Courtesy of CHRYSLER LLC

7. Install the oil pickup tube.
8. Install the upper oil pan.

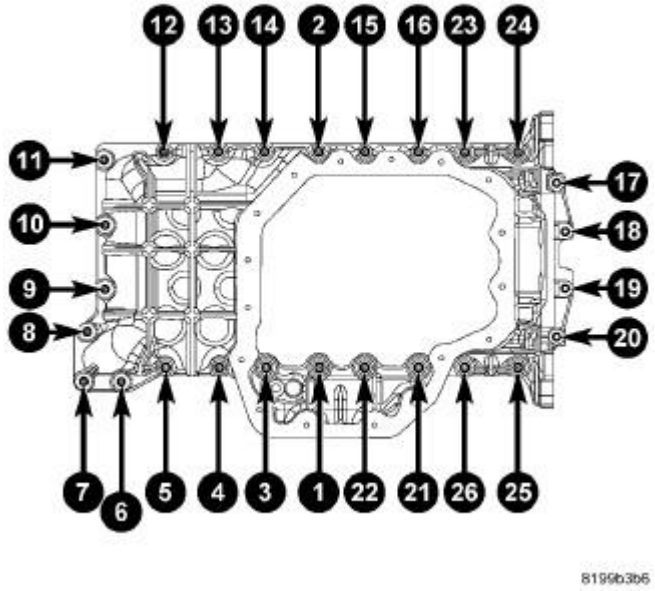

Fig. 169: OIL SUMP TORQUE SEQUENCE
Courtesy of CHRYSLER LLC

9. Use the illustrated torque sequence and torque the M6 bolts to 15 Nm (132 lbs. in.).
10. 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 Nm (133 lbs. in.) and M8 bolts to 32 Nm (23 lbs ft.).
11. Loosen all of the upper oil pan bolts and studs by 90 degrees and retighten the M6 bolts to 15 Nm (133 lbs. in.) and M8 bolts to 32 Nm (23 lbs ft.).

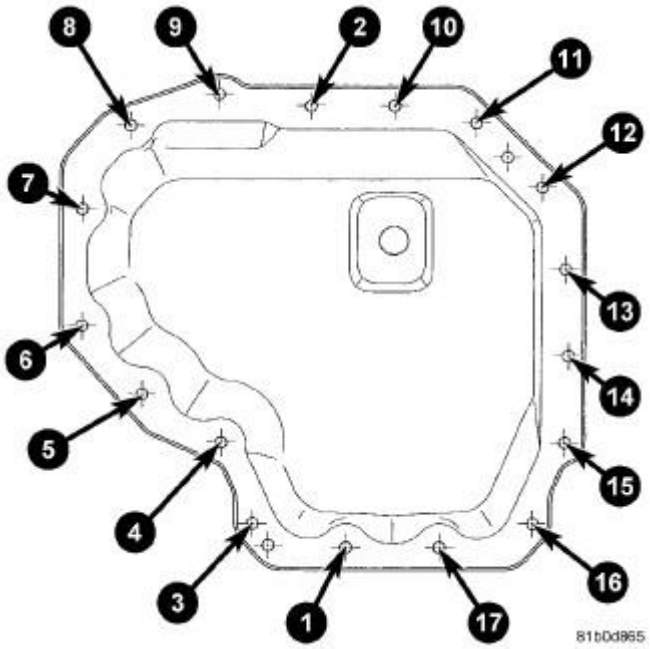

Fig. 170: LOWER OIL PAN TORQUE SEQUENCE
Courtesy of CHRYSLER LLC

12. Install bolts 1 and 2 into the lower oil pan and torque to 15 Nm (133 lbs. in.).
13. Install the remaining bolts in the sequence illustrated.
14. Torque the oil pan bolts in sequence to 15 Nm (133 lbs. in.).
15. Loosen each bolt 90° and use the illustrated sequence to torque the bolts to 15 Nm (133 lbs. in.).

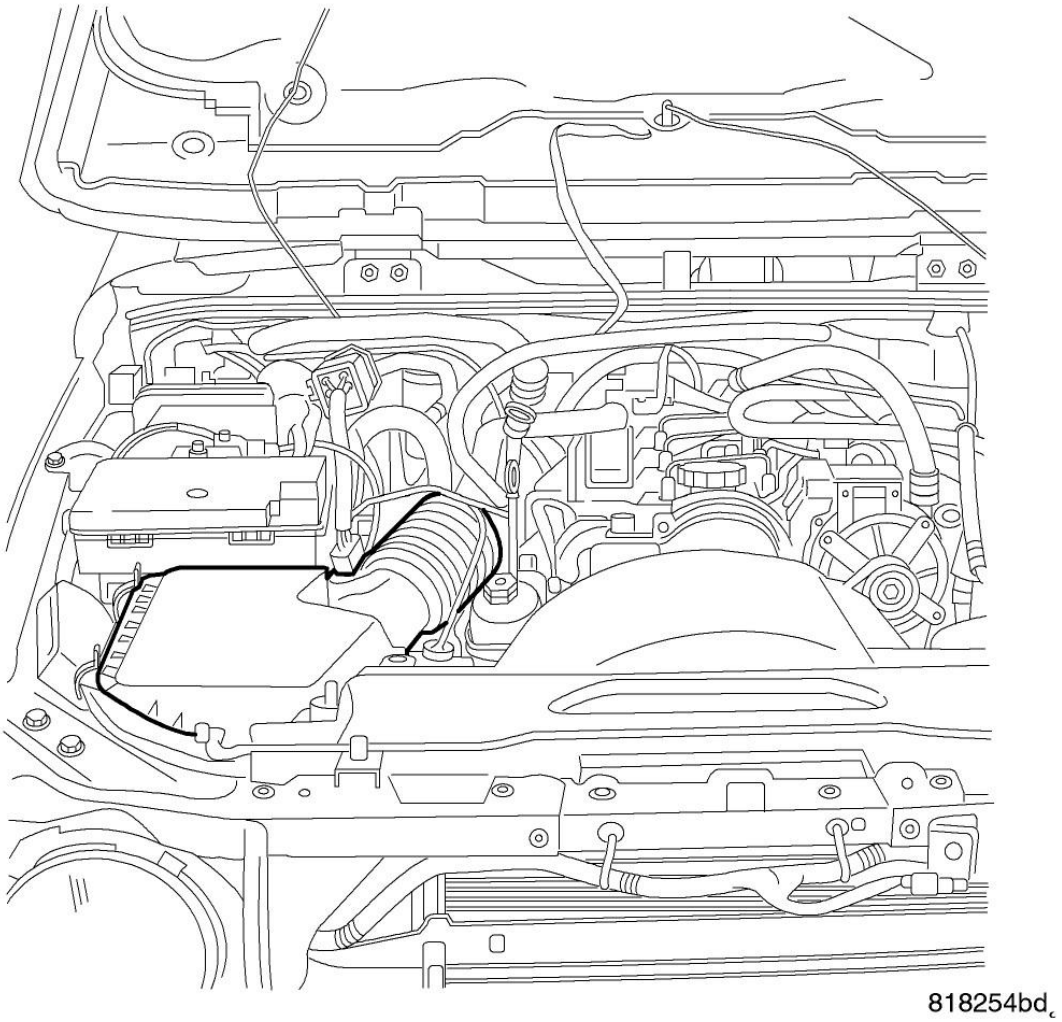

Fig. 171: ENGINE COMPARTMENT
Courtesy of CHRYSLER LLC

16. Fill the engine oil.
17. Remove the TDC locking tool.
18. Reconnect the battery.

PLATE, TRANSMISSION ADAPTER

Description

DESCRIPTION

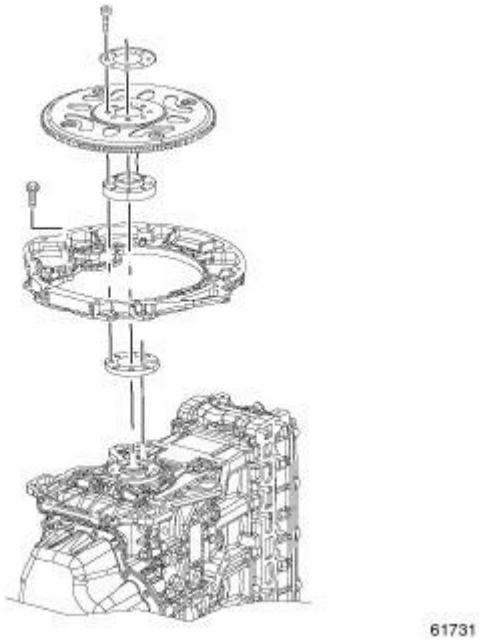

Fig. 172: FLYWHEEL AND FLEX PLATE
Courtesy of CHRYSLER LLC

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

Removal

REMOVAL

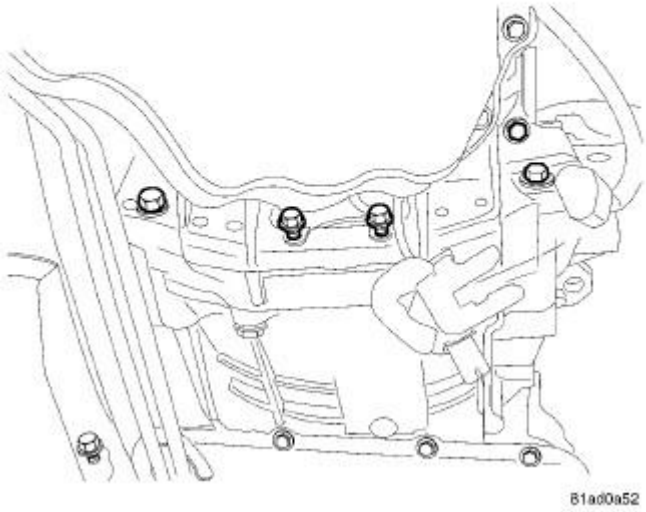

Fig. 173: BELL HOUSING BOLTS

Courtesy of CHRYSLER LLC

1. Remove the transmission from the vehicle.

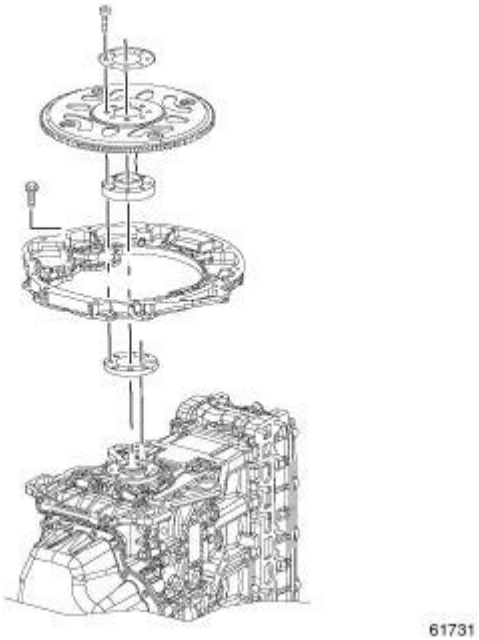

Fig. 174: FLYWHEEL AND FLEX PLATE
Courtesy of CHRYSLER LLC

2. Remove the flex plate or flywheel.

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

3. Remove the flex plate adapter bolts.

Installation

INSTALLATION

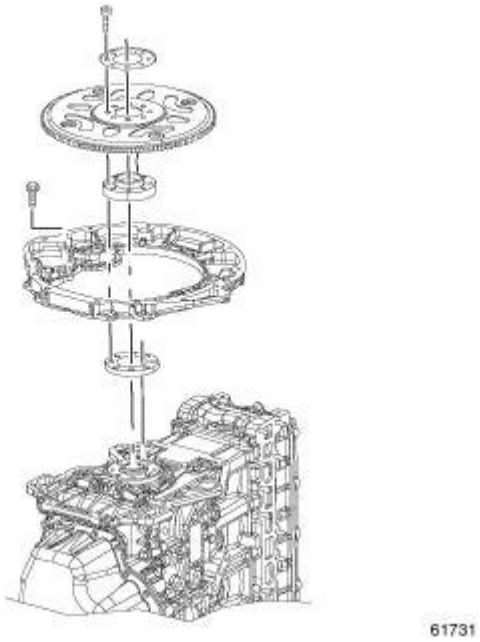

Fig. 175: FLYWHEEL AND FLEX PLATE
Courtesy of CHRYSLER LLC

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

1. Install the flex plate adapter.
2. Install the flex plate adapter hex head bolts and tighten to 45 N.m (33 ft. lbs.)
3. Install the flex plate torx head bolts and tighten to 78 N.m (58 ft. lbs.)
4. Install the flex plate or flywheel. See **Engine/Engine Block/FLEXPLATE - Installation**.

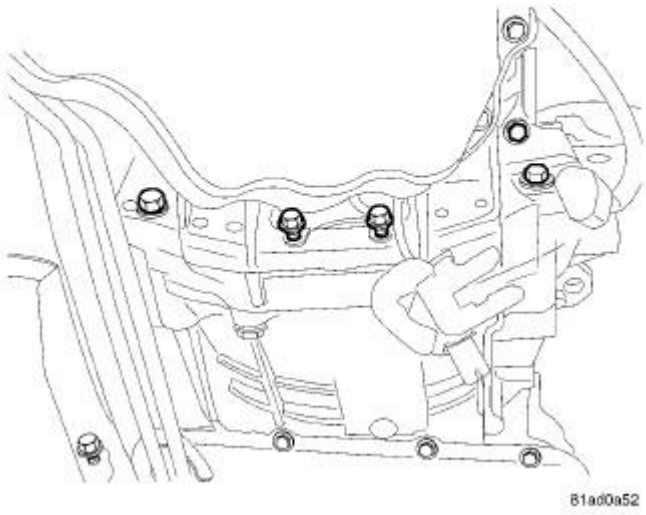

Fig. 176: BELL HOUSING BOLTS
Courtesy of CHRYSLER LLC

5. Install the transmission.

PUMP, INTERNAL VACUUM

Description

DESCRIPTION

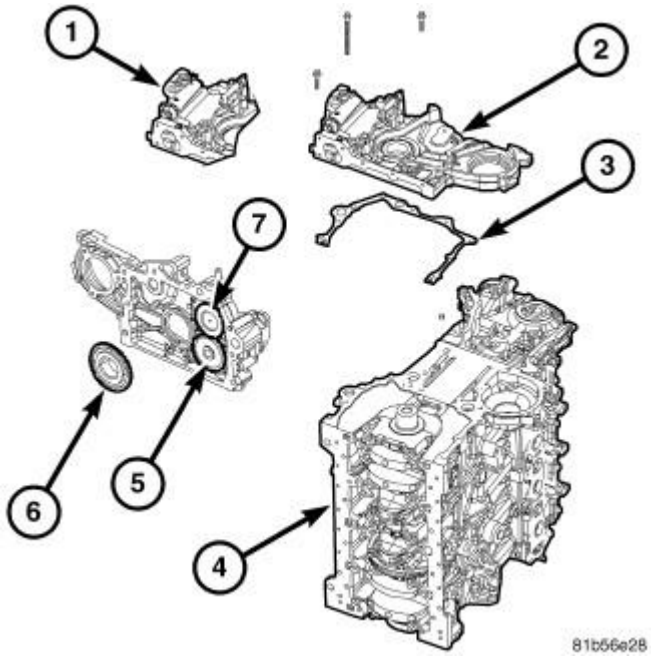

Fig. 177: VACUUM PUMP AND OIL PUMP
Courtesy of CHRYSLER LLC

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.

Removal

REMOVAL

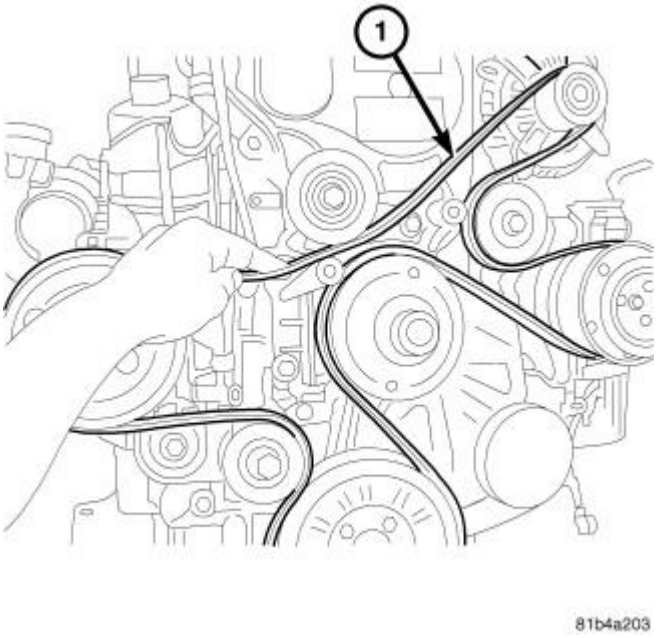

Fig. 178: ACCESSORY DRIVE BELT REMOVED

Courtesy of CHRYSLER LLC

1. Remove the cooling fan module.
2. Remove the accessory drive belt.

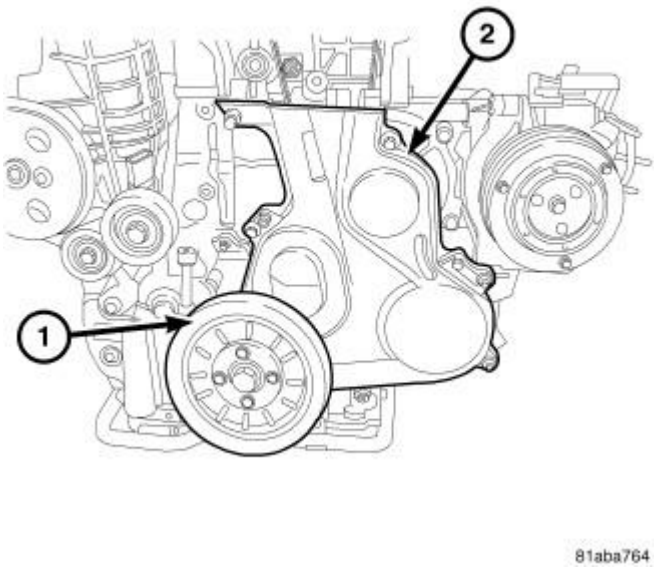

Fig. 179: LOWER FRONT COVER
Courtesy of CHRYSLER LLC

3. Remove the four crankshaft damper (1) bolts and remove the crankshaft damper.

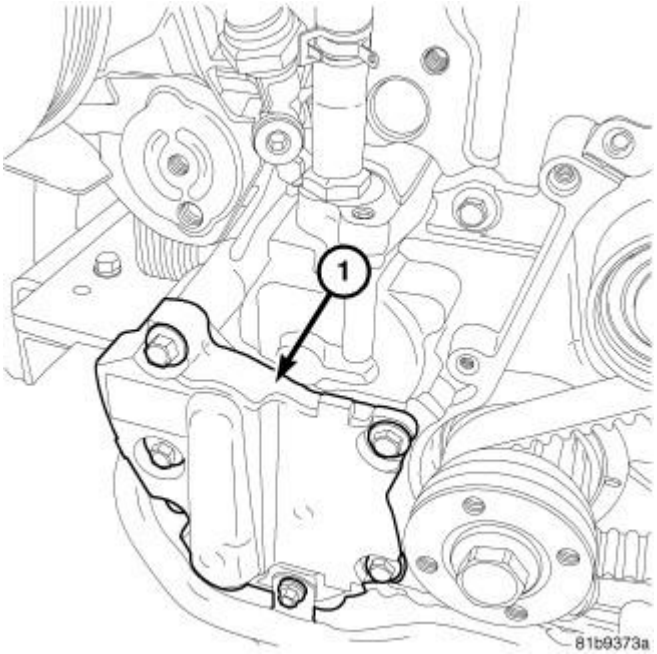

Fig. 180: VACUUM PUMP COVER

Courtesy of CHRYSLER LLC

4. Remove the oil pressure relief front cover (1) bolts.

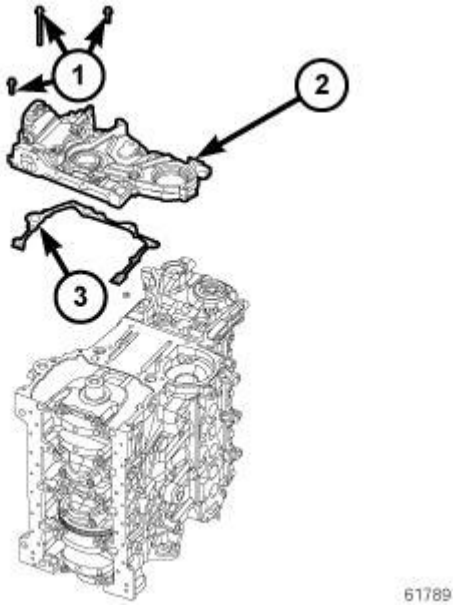

Fig. 181: FRONT COVER AND GASKET
Courtesy of CHRYSLER LLC

5. Remove the front cover. See **Engine/Engine Block/COVER, Engine - Removal**.
6. Remove the vacuum pump from the front cover.

Installation

INSTALLATION

1. Install the vacuum pump into the front cover.
2. Install the special tool 9990 Front Cover Align Tool (1).
3. Install the front cover to the engine block (1). See **Engine/Engine Block/COVER, Engine - Installation**.

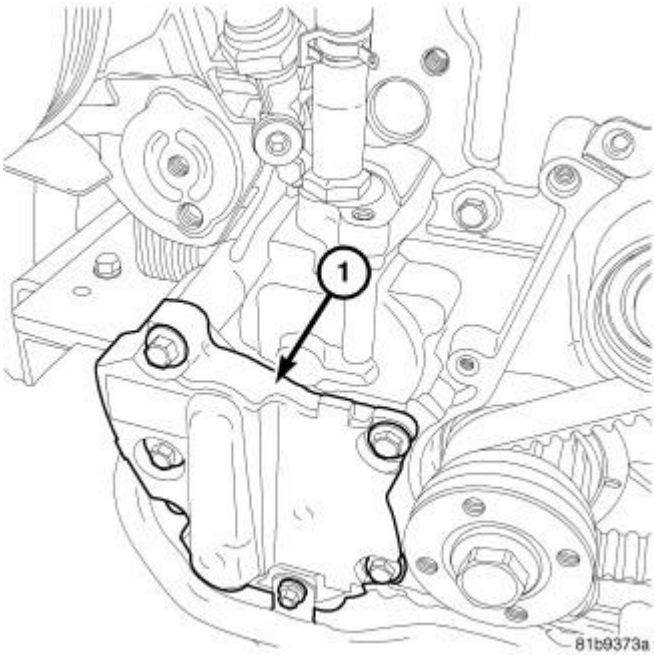

Fig. 182: VACUUM PUMP COVER
Courtesy of CHRYSLER LLC

4. Install the oil pressure relief valve cover (1).
5. Install the oil pressure relief valve cover bolts and tighten to 32 Nm (23 lbs. ft.).

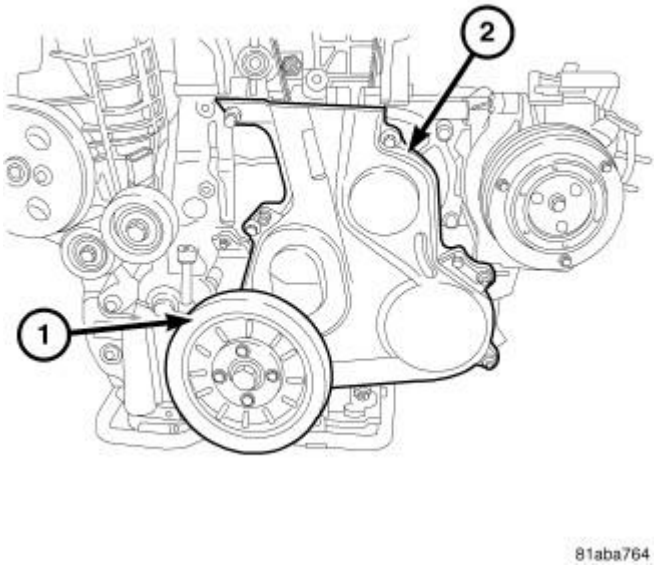

Fig. 183: LOWER FRONT COVER
Courtesy of CHRYSLER LLC

6. Install the crankshaft damper.

7. Install and torque the crankshaft damper bolts to 32 Nm (23 lbs. ft.).

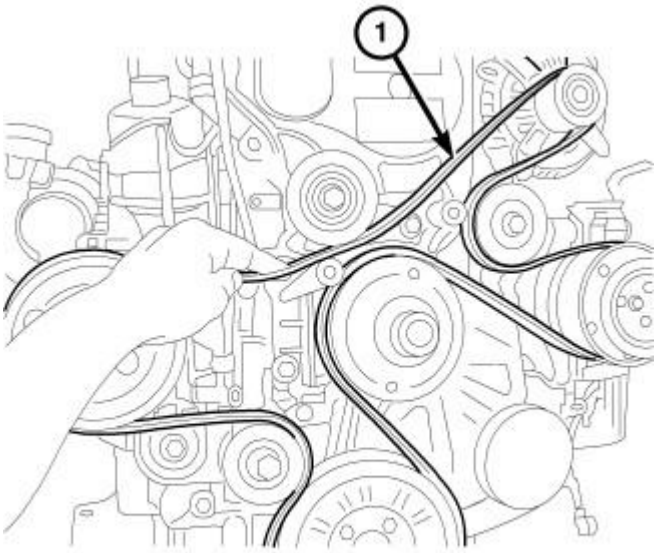

Fig. 184: ACCESSORY DRIVE BELT REMOVED
Courtesy of CHRYSLER LLC

8. Install the accessory drive belt.
9. Install the cooling fan module.

ROD, PISTON AND CONNECTING

Description

DESCRIPTION

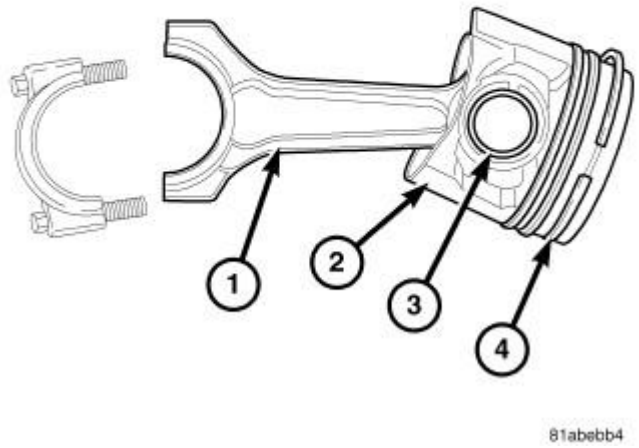

Fig. 185: PISTON AND CONNECTING ROD
Courtesy of CHRYSLER LLC

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

PISTON RING FITTING

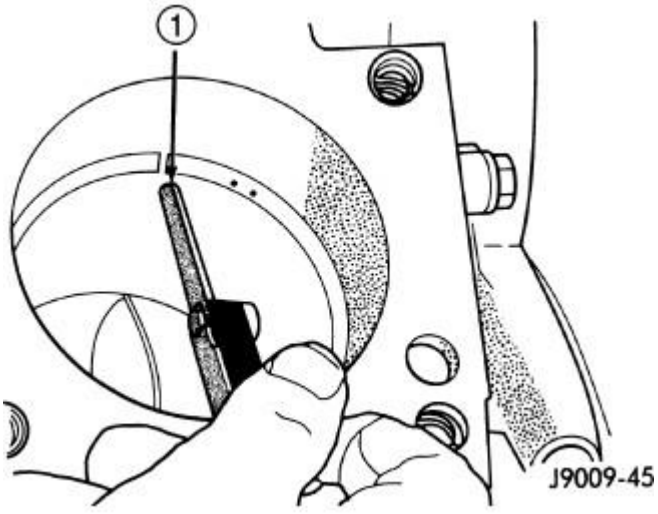

Fig. 186: RING END GAP MEASUREMENT
Courtesy of CHRYSLER LLC

1 - FEELER GAUGE

1. Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 12 mm (0.50 in.) from bottom of cylinder bore . Check gap with feeler gauge. Top compression ring gap .30 to .45 mm (.0118 to .0177 in.). Second compression ring gap .30 to .45 mm (.0118 to .0177 in.). Oil control ring gap .25 to .50 mm (.0098 to .0196 in.).
2. If ring gaps exceed dimension given, new rings or cylinder liners must be fitted. Keep piston rings in piston sets.

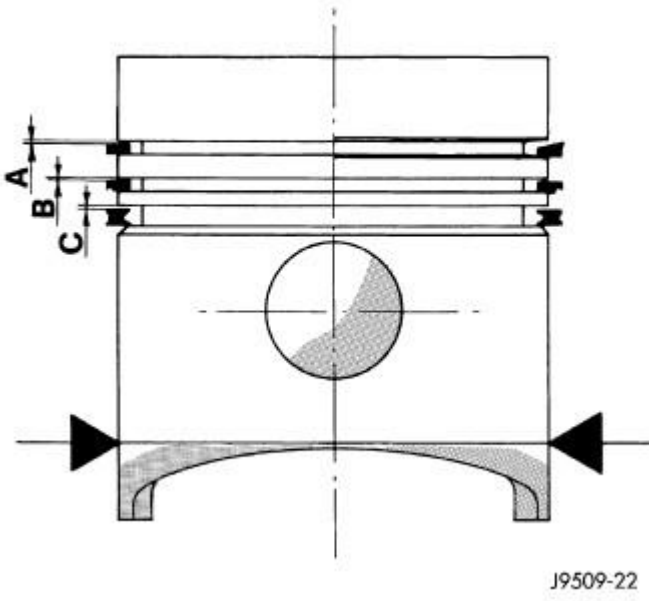

Fig. 187: PISTON RING TO GROOVE CLEARANCE
Courtesy of CHRYSLER LLC

3. Check piston ring to groove clearance . Top compression ring gap .080 to .130 mm (.0031 to .0051 in.). Second compression ring gap .070 to .110 mm (.0027 to .0043 in.). Oil control ring gap .040 to .080 mm (.0015 to .0031 in.).

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. See **Engine/Cylinder Head - Removal**.
3. Raise vehicle on hoist.
4. Remove the lower oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.

5. Remove upper oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.
6. Remove the oil jets. See **Engine/Lubrication/JET, Piston Oil Cooler - Removal**.
7. Remove balance shaft assembly. See **Engine/Engine Block/MODULE, Balance Shaft - Removal**.
8. 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.**
9. 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

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

PISTON PIN - REMOVAL

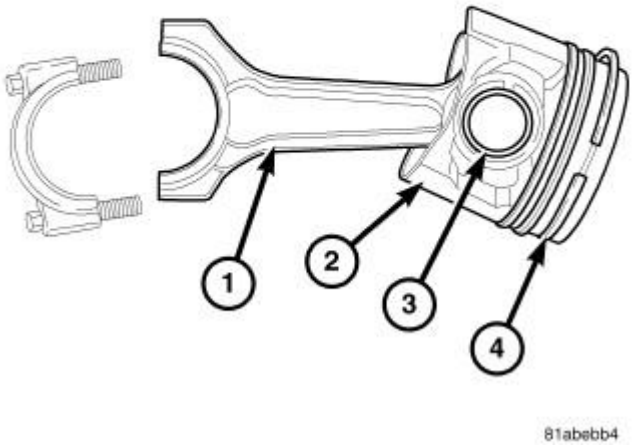

Fig. 188: PISTON AND CONNECTING ROD
Courtesy of CHRYSLER LLC

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

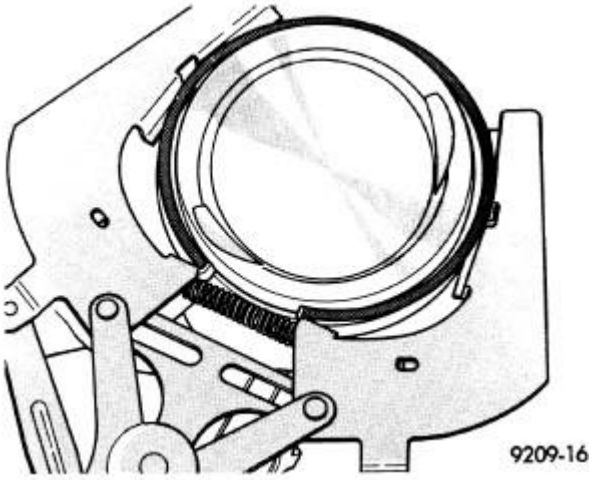

Fig. 189: PISTON RINGS - REMOVAL/INSTALLATION
Courtesy of CHRYSLER LLC

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

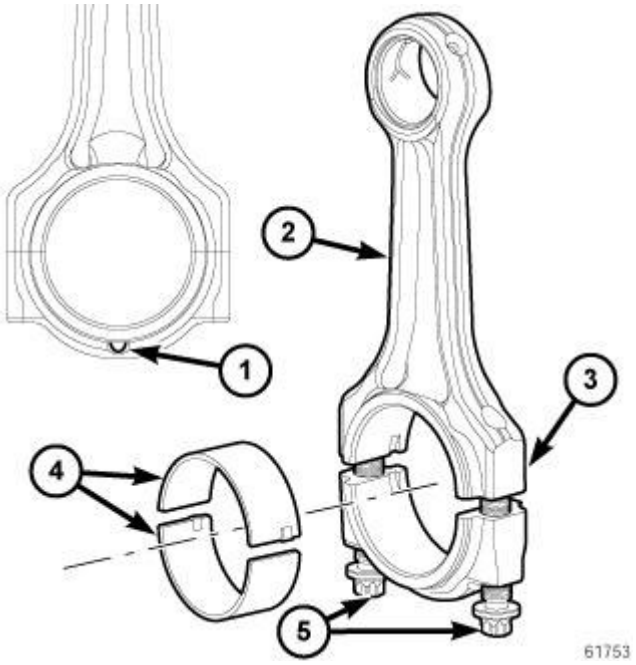

Fig. 190: CONNECTING ROD IDENTIFICATION
Courtesy of CHRYSLER LLC

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

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

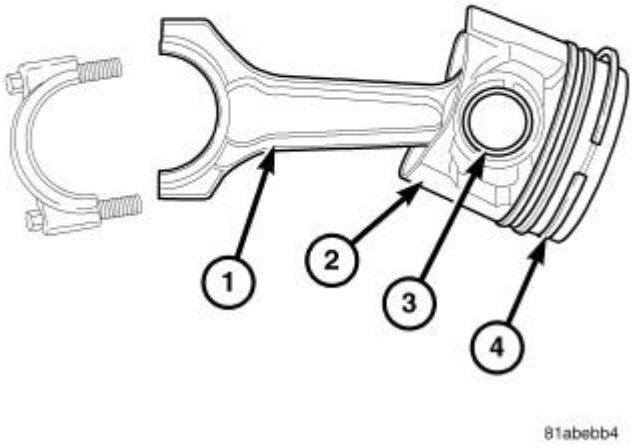

Fig. 191: PISTON AND CONNECTING ROD
Courtesy of CHRYSLER LLC

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 (88 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).

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 and the same number. 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. Max allowable weight difference is 5 gr.

PISTON PINS

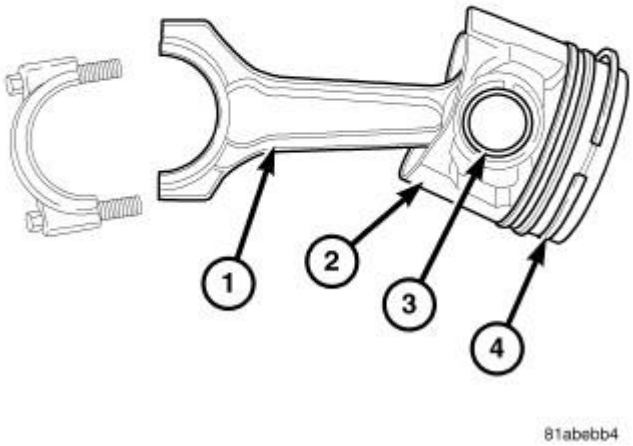

Fig. 192: PISTON AND CONNECTING ROD
Courtesy of CHRYSLER LLC

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

Installation

INSTALLATION

PISTON PIN INSTALLATION

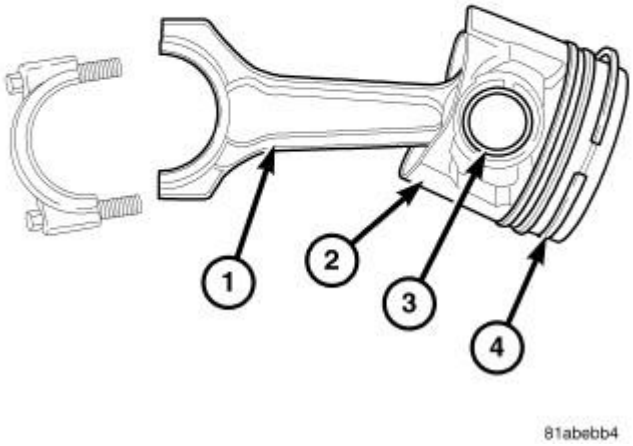

Fig. 193: PISTON AND CONNECTING ROD
Courtesy of CHRYSLER LLC

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

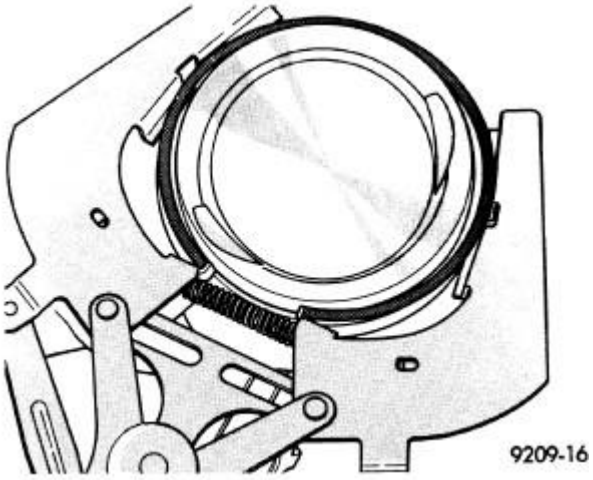

Fig. 194: PISTON RINGS - REMOVAL/INSTALLATION
Courtesy of CHRYSLER LLC

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

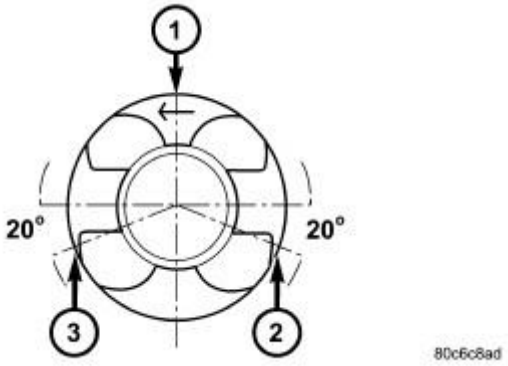

Fig. 195: PISTON RING GAP LOCATION
Courtesy of CHRYSLER LLC

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 #3 position (looking at the piston crown from above).
4. Second piston ring gap should be positioned at the #1 position.
5. Oil control ring gap should be positioned at the #2 position.

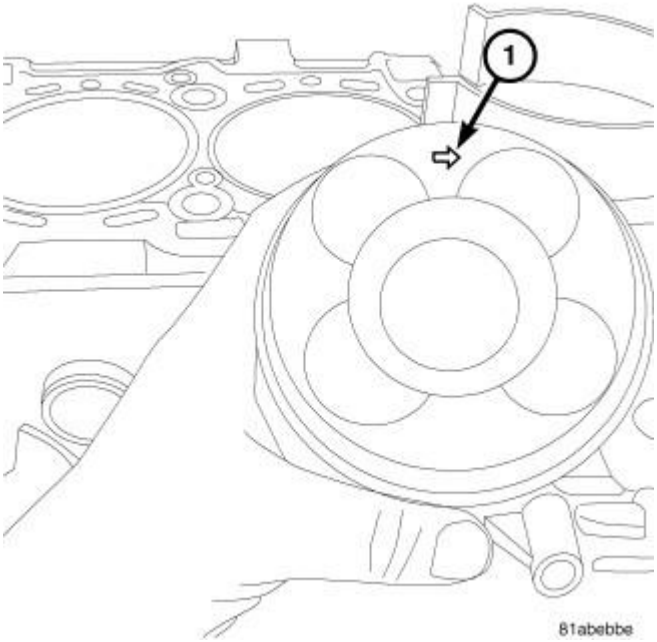

Fig. 196: PISTON DIRECTION
Courtesy of CHRYSLER LLC

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. To insert piston into cylinder use a ring compressor as shown in illustration.

INSTALLATION

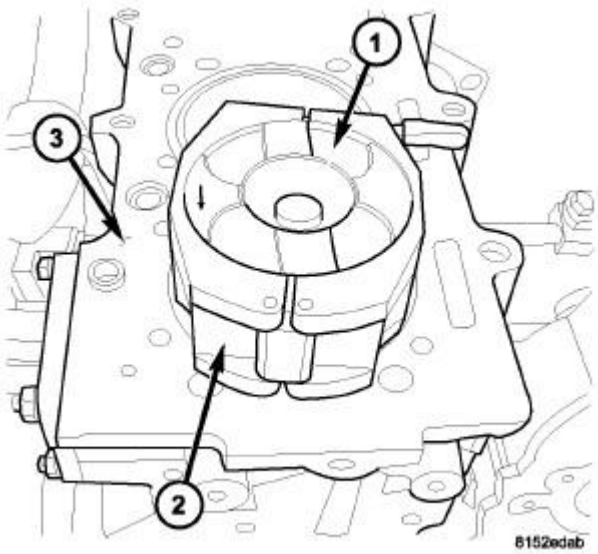

Fig. 197: PISTON INSTALLATION
Courtesy of CHRYSLER LLC

1 - PISTON 2 - PISTON RING COMPRESSOR 3 - ENGINE BLOCK

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 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.

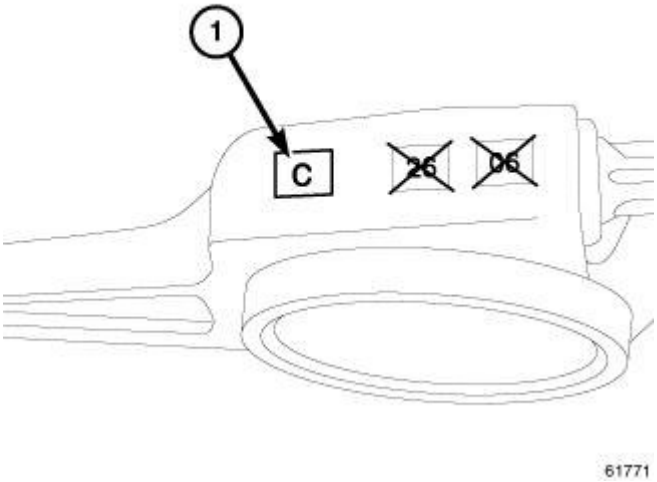

Fig. 198: CONNECTING ROD SIZE
Courtesy of CHRYSLER LLC

5. The connecting rod bearing size (1) is stamped on the connecting rod.

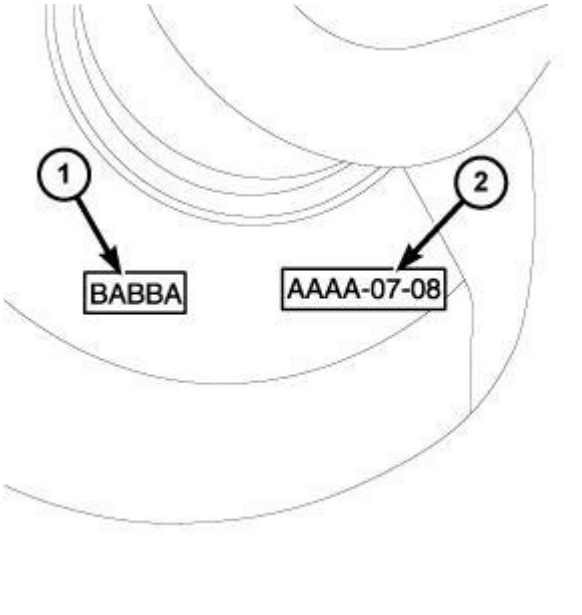

Fig. 199: MAIN BEARING SIZE MARK ON CRANK
Courtesy of CHRYSLER LLC

6. Compare the crankshaft connecting rod journal diameter (2) with the bearing selection chart to determine the correct bearing size 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 **Engine/Engine Block - Standard Procedure**.

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 rod bolts and tighten to 10 N.m (88 in. lbs.). Tighten bolts the next stage to 30 N.m (22 ft. lbs.) plus 40°. Then with a torque wrench set to 88 N.m (65 ft. lbs.), make a tightening check.
10. Install the oil jets. See **Engine/Lubrication/JET, Piston Oil Cooler - Installation**.
11. Install cylinder head. See **Engine/Cylinder Head - Installation**.
12. Install balance shaft assembly. See **Engine/Engine Block/MODULE, Balance Shaft - Installation**.
13. Install upper oil pan. See **Engine/Lubrication/PAN, Oil - Installation**.
14. Install the lower oil pan. See **Engine/Lubrication/PAN, Oil - Installation**.
15. Connect negative battery cable.

SEAL, CRANKSHAFT OIL, FRONT

Removal

REMOVAL

1. Remove the timing belt. See **Engine/Valve Timing/SPROCKET(S), Timing Belt and Chain - Removal**.
2. Remove the crankshaft sprocket. See **Engine/Valve Timing/SPROCKET(S), Timing Belt and Chain - Removal**.

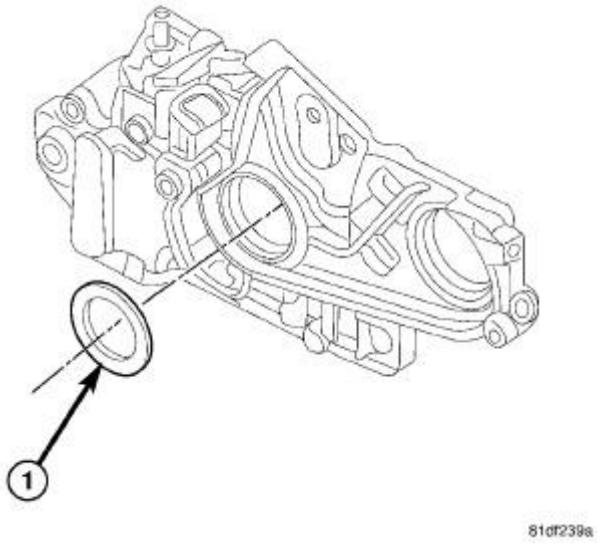

Fig. 200: FRONT CRANKSHAFT SEAL
Courtesy of CHRYSLER LLC

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

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

Installation

INSTALLATION

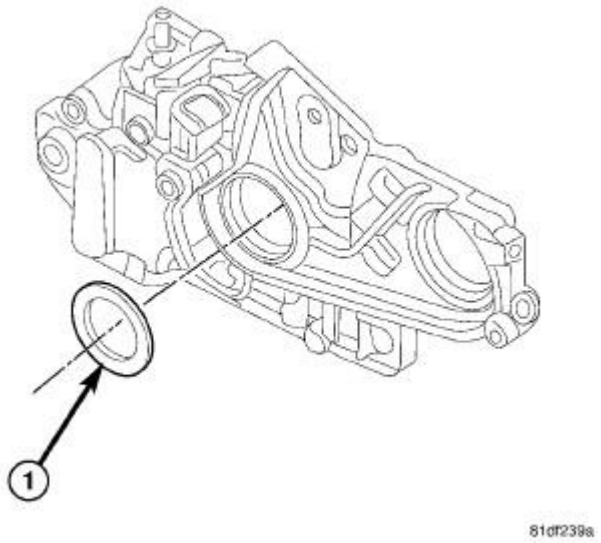

Fig. 201: FRONT CRANKSHAFT SEAL
Courtesy of CHRYSLER LLC

1. Use the 9937 seal installer to install the front crankshaft oil seal (1) into the rear timing belt cover.
2. Install the crankshaft sprocket. See **Engine/Valve Timing/SPROCKET(S), Timing Belt and Chain - Installation**.
3. Install the timing belt. See **Engine/Valve Timing/SPROCKET(S), Timing Belt and Chain - Installation**.

SEAL, CRANKSHAFT OIL, REAR

Description

DESCRIPTION

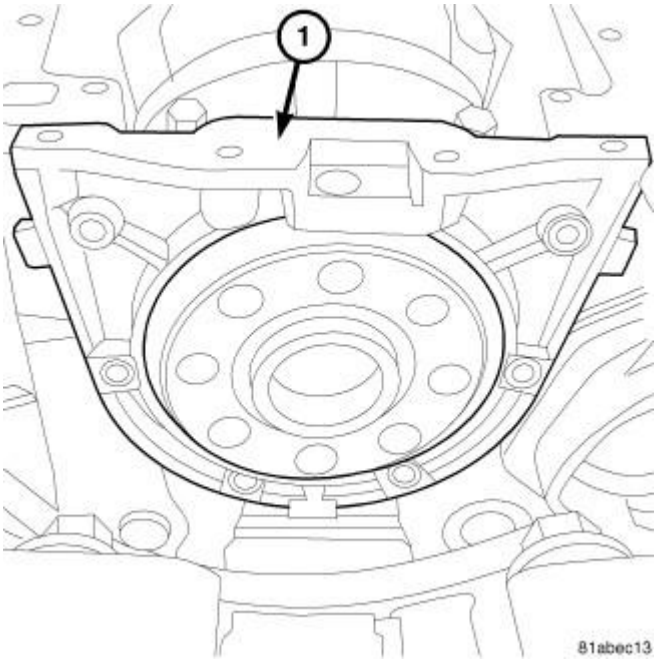

Fig. 202: REAR MAIN SEAL
Courtesy of CHRYSLER LLC

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

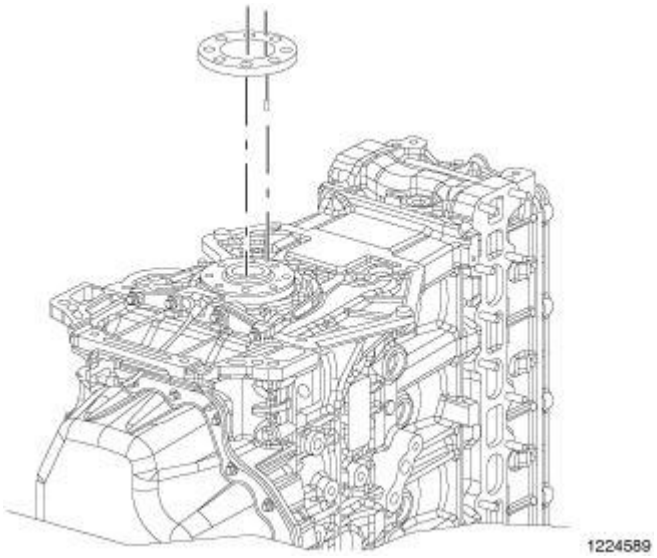

Fig. 203: FLYWHEEL & CRANKSHAFT
Courtesy of CHRYSLER LLC

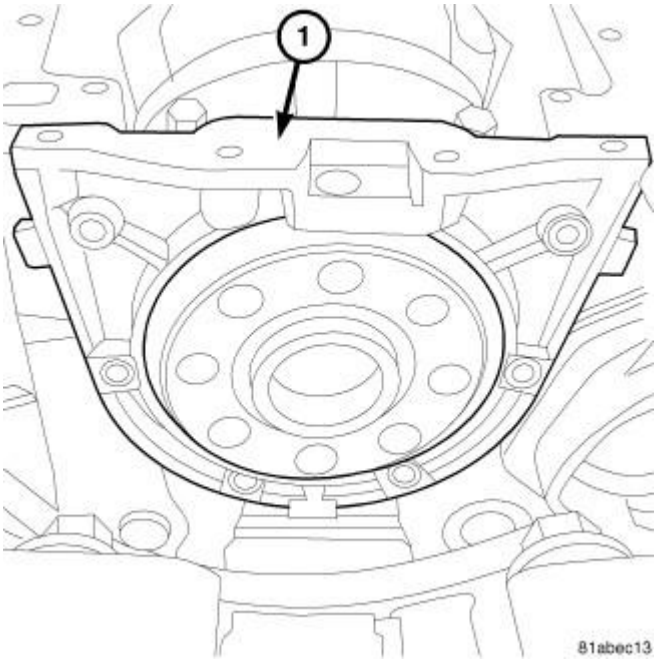

Fig. 204: REAR MAIN SEAL
Courtesy of CHRYSLER LLC

This must be done with either the engine or transmission removed from vehicle.

1. Remove flywheel assembly.
2. Remove the crankshaft sensor tone wheel before removing the rear main oil seal.
3. Pry out old crankshaft oil seal.

Installation

INSTALLATION

1. Make sure the rear main seal sealing surfaces are free of oil and debris.

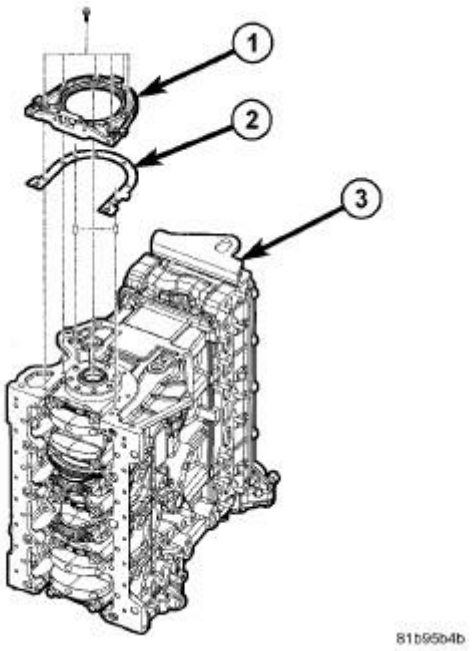

Fig. 205: REAR MAIN SEAL GASKET
Courtesy of CHRYSLER LLC

2. Position the rear main seal carrier gasket (2) onto the rear of the engine block (3).
3. Using special tool VM. 9993, install rear crankshaft oil seal into the rear main seal carrier (1).
4. Using special tool VM 9993 install the rear main seal carrier onto the engine block (3).

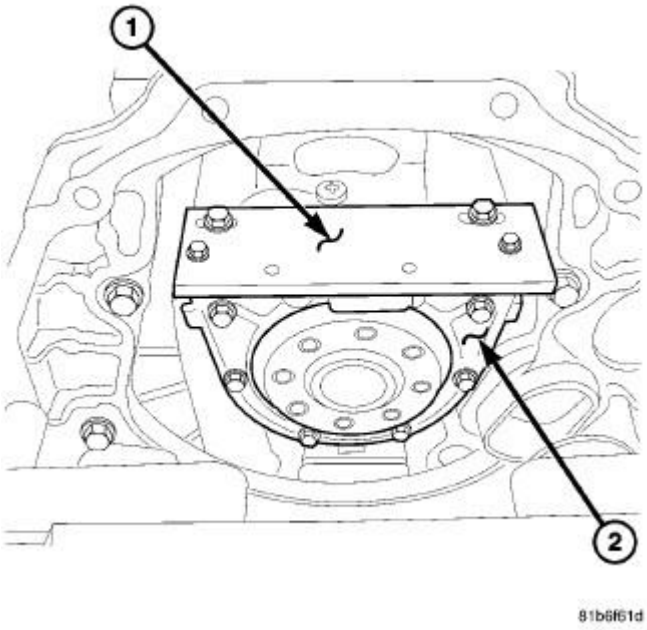

Fig. 206: REAR SEAL TOOL INSTALLED

Courtesy of CHRYSLER LLC

5. Loosely install the bolts that secure the rear oil seal carrier (2) to the engine block.
6. Use special tool VM9990 (1) to set the depth of the rear main seal (2).

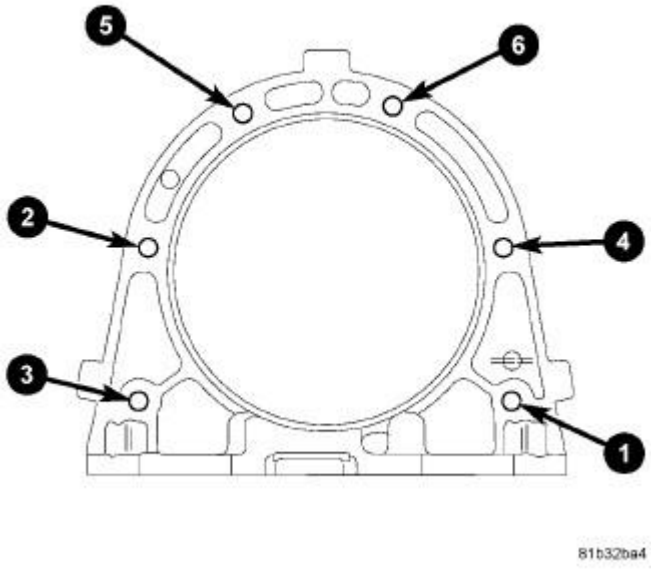

Fig. 207: REAR COVER TORQUE
Courtesy of CHRYSLER LLC

7. Use the illustrated pattern to tighten the rear cover bolts to 15 Nm (133 lbs. in.).
8. Make sure the crankshaft sensor tone wheel is positioned correctly on the crankshaft.
9. Install the upper and lower oil pan. See **Engine/Lubrication/PAN, Oil - Installation**.
10. Install the Crankshaft Position Sensor (CKP). Refer to **Fuel System/Fuel Injection/SENSOR, Crankshaft Position - Installation** .
11. Install the crankshaft sensor tone wheel from the rear of the crankshaft.
12. Install the flywheel. See **Engine/Engine Block/FLEXPLATE - Installation**.
13. Install engine or transmission in vehicle.

ENGINE MOUNTING

INSULATOR, ENGINE MOUNT, LEFT

Removal

REMOVAL - LEFT MOUNT

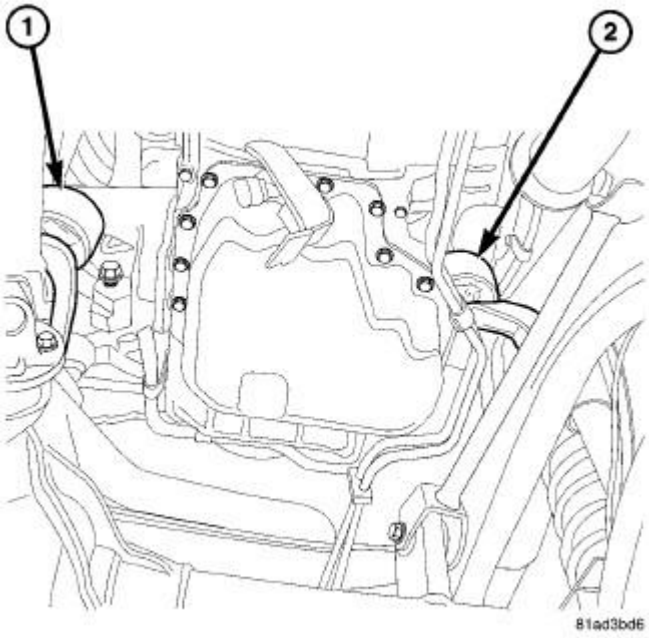

Fig. 208: ENGINE MOUNTS
Courtesy of CHRYSLER LLC

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 **Cooling/Engine/FAN, Cooling - Removal** .
7. Install the Engine Support Fixture 6958 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 LEFT MOUNT

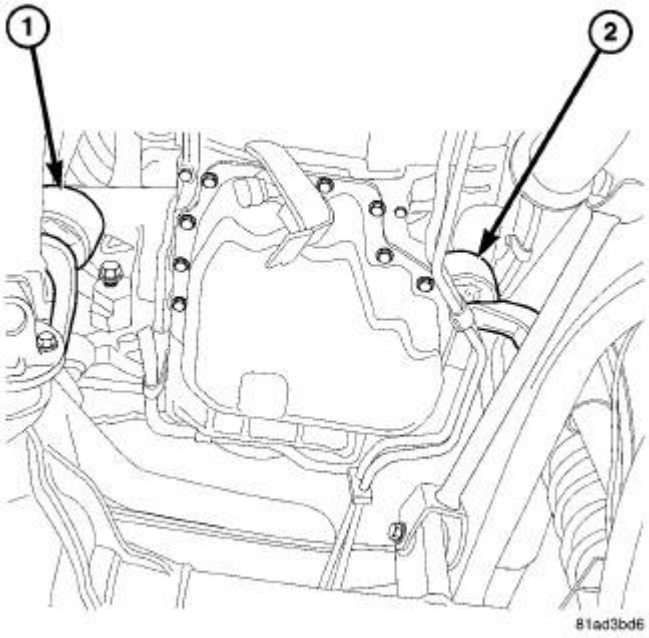

Fig. 209: ENGINE MOUNTS
Courtesy of CHRYSLER LLC

1. Position the left engine mount and hand tighten the retaining bolts.
2. Lower the engine and remove the Engine Support Fixture 6958.
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 - RIGHT MOUNT

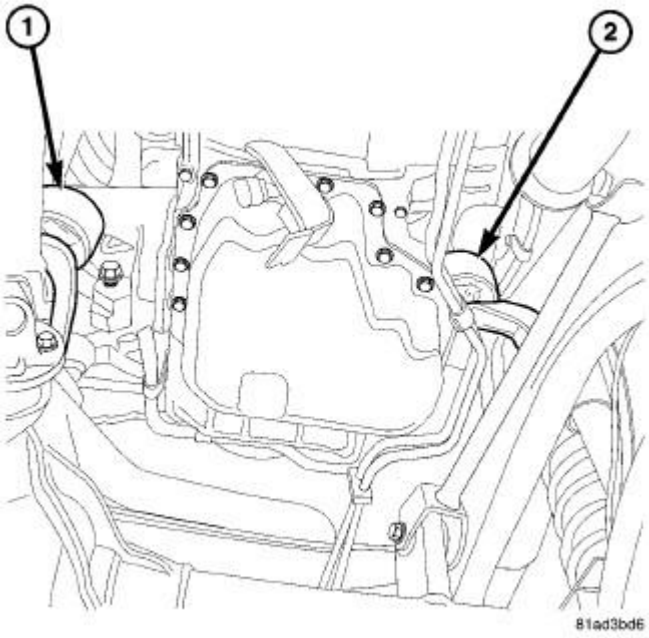

Fig. 210: ENGINE MOUNTS
Courtesy of CHRYSLER LLC

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 **Cooling/Engine/FAN, Cooling - Removal** .
7. Install the Engine Support Fixture 6958 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 - RIGHT MOUNT

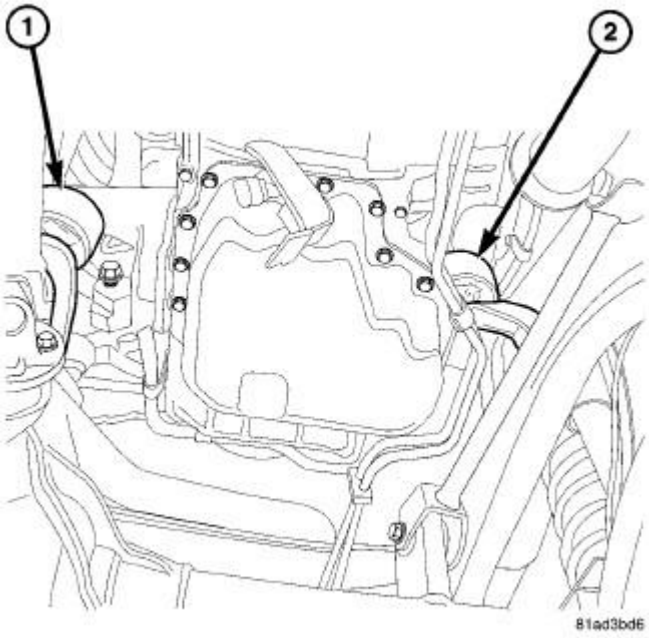

Fig. 211: ENGINE MOUNTS
Courtesy of CHRYSLER LLC

1. Position the right engine mount and hand tighten the retaining bolts.
2. Lower the engine and remove the Engine Support Fixture 6958.
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

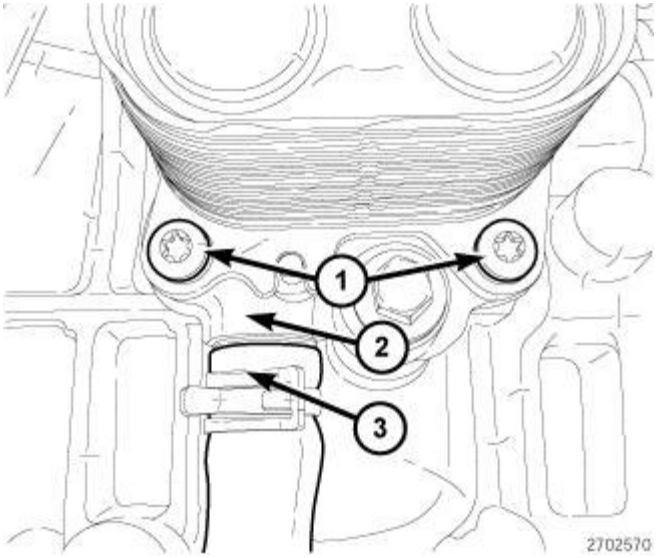

Fig. 212: COOLANT HOSE & OIL COOLER HOUSING
Courtesy of CHRYSLER LLC

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

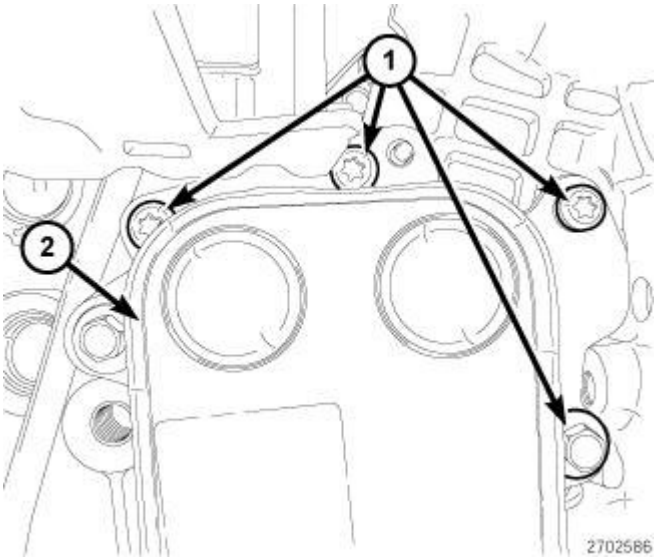

Fig. 213: ENGINE OIL COOLER & BOLTS
Courtesy of CHRYSLER LLC

6. Remove the air cleaner body and turbocharger air inlet tube. See **Engine/Air Intake System/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 **Steering/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

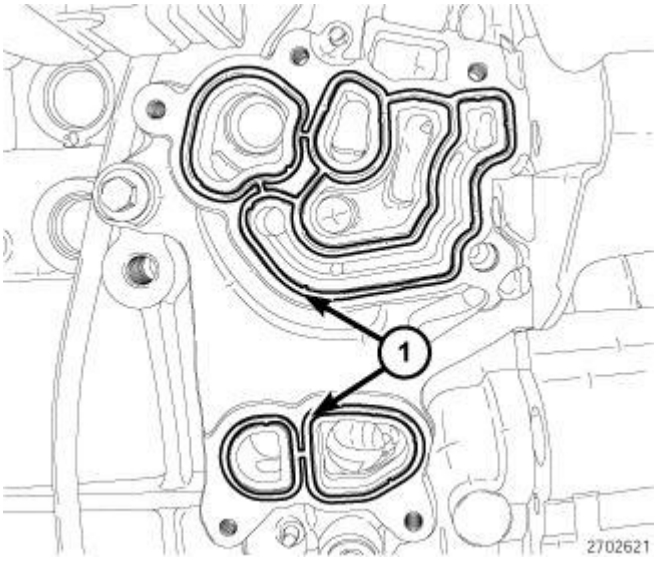

Fig. 214: O-RING GASKETS
Courtesy of CHRYSLER LLC

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

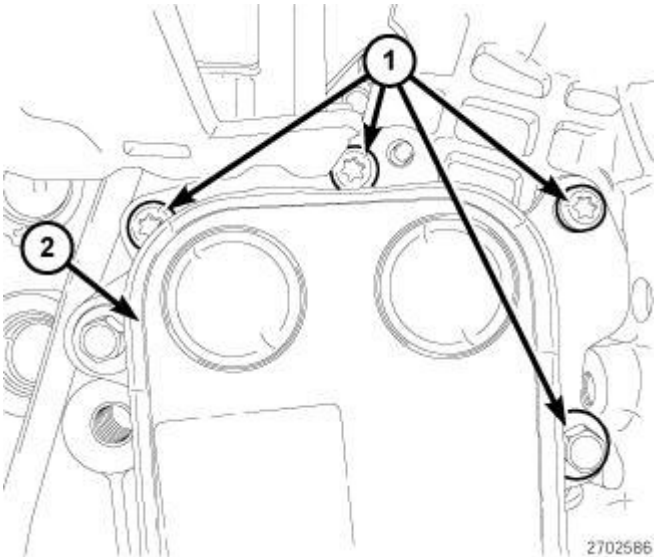

Fig. 215: ENGINE OIL COOLER & BOLTS
Courtesy of CHRYSLER LLC

3. Install the oil cooler. Tighten bolts (1) to 12 N.m (106 in. lbs.).
4. Install the power steering pump. Refer to **Steering/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. See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.

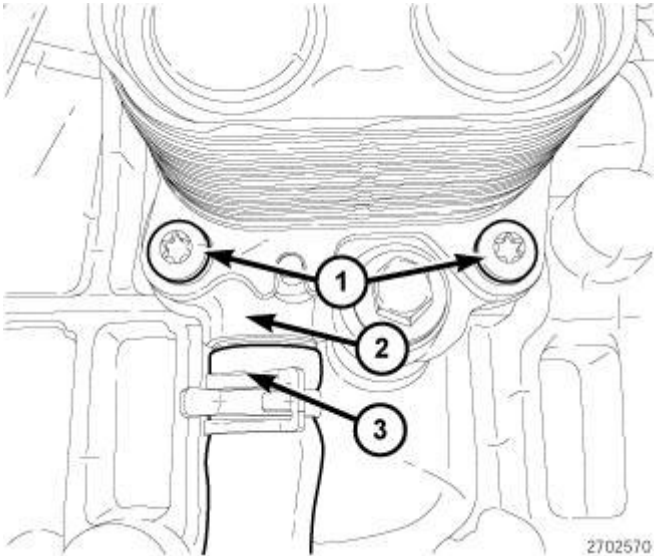

Fig. 216: COOLANT HOSE & OIL COOLER HOUSING
Courtesy of CHRYSLER LLC

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 **Cooling - Standard Procedure** .
12. Install the belly pan.
13. Connect the negative battery cable.

FILTER, ENGINE OIL

Removal

REMOVAL

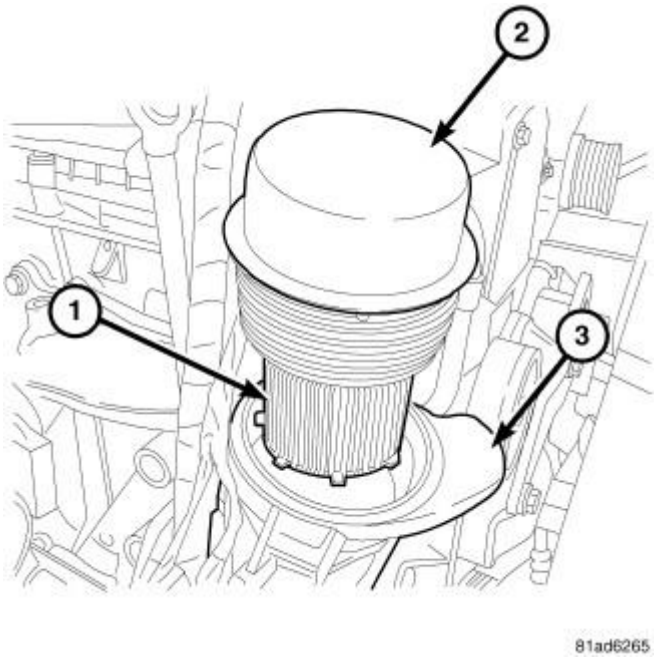

Fig. 217: OIL FILTER ADAPTER
Courtesy of CHRYSLER LLC

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

Installation

INSTALLATION

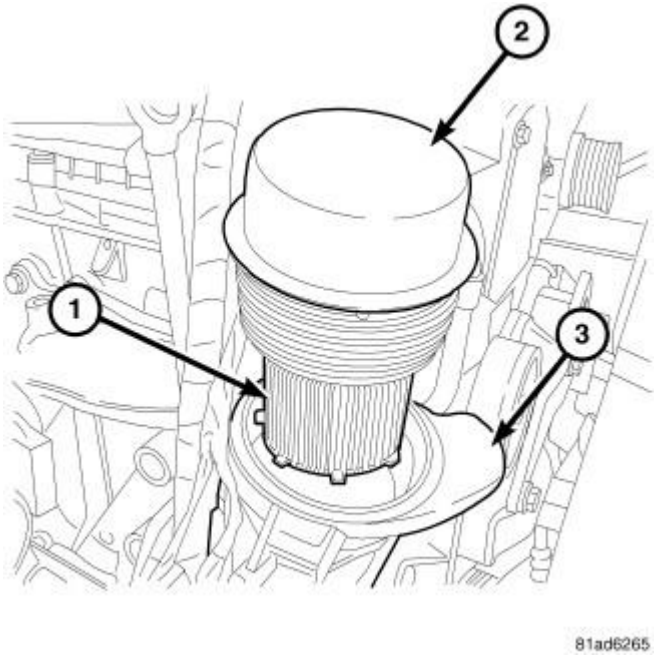

Fig. 218: OIL FILTER ADAPTER
Courtesy of CHRYSLER LLC

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

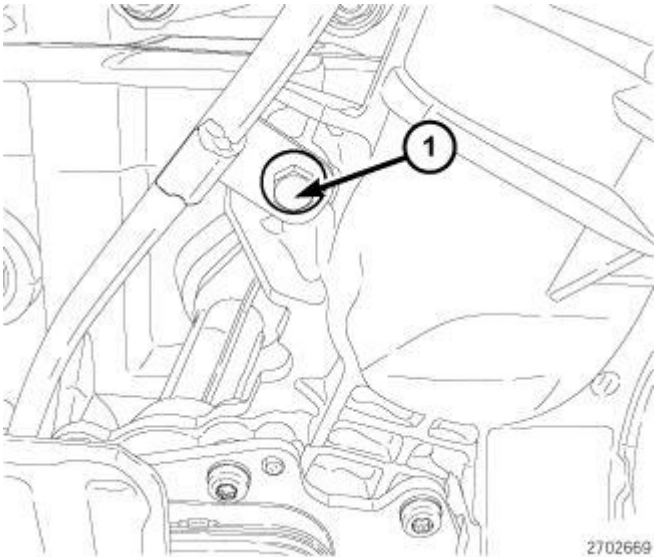

Fig. 219: UPPER OIL DIPSTICK BOLT
Courtesy of CHRYSLER LLC

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 **Cooling - Standard Procedure** .
5. Drain the engine oil.
6. Remove the air cleaner body and turbocharger air inlet tube. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.
7. Remove the upper oil dipstick bolt (1).

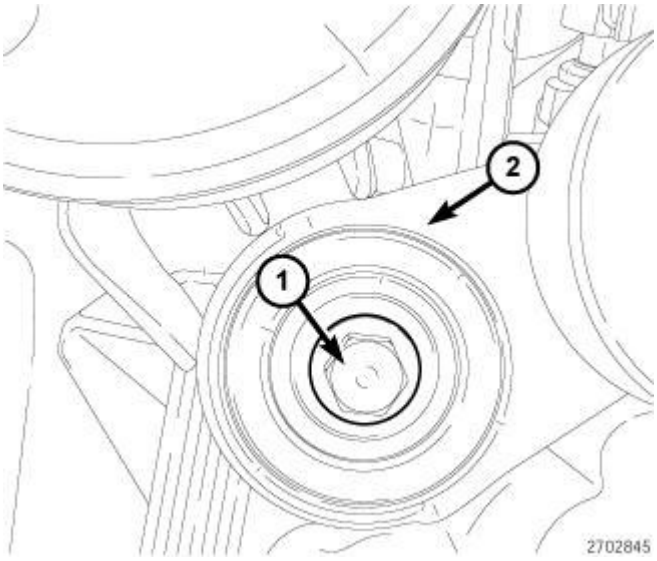

Fig. 220: SERPENTINE BELT TENSIONER & BOLT
Courtesy of CHRYSLER LLC

8. Remove the serpentine belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal** .
9. Remove the power steering pump and position aside.
10. Remove bolt (1) and the serpentine belt tensioner (2).

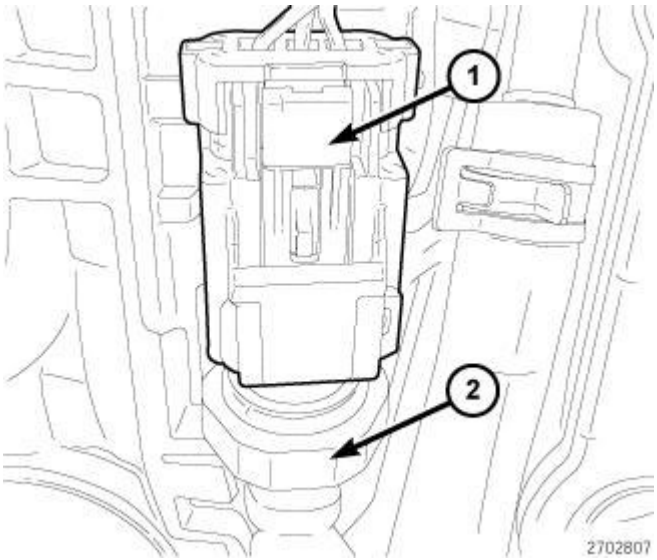

Fig. 221: OIL PRESSURE SWITCH
Courtesy of CHRYSLER LLC

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

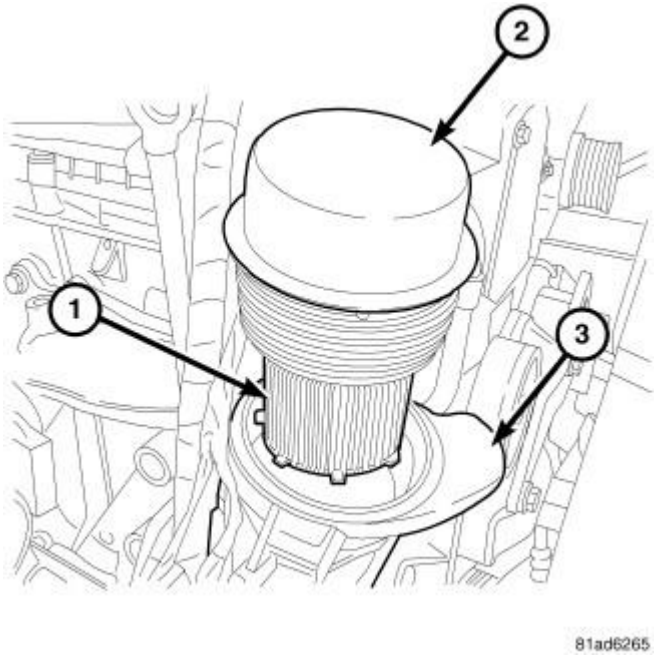

Fig. 222: OIL FILTER ADAPTER
Courtesy of CHRYSLER LLC

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

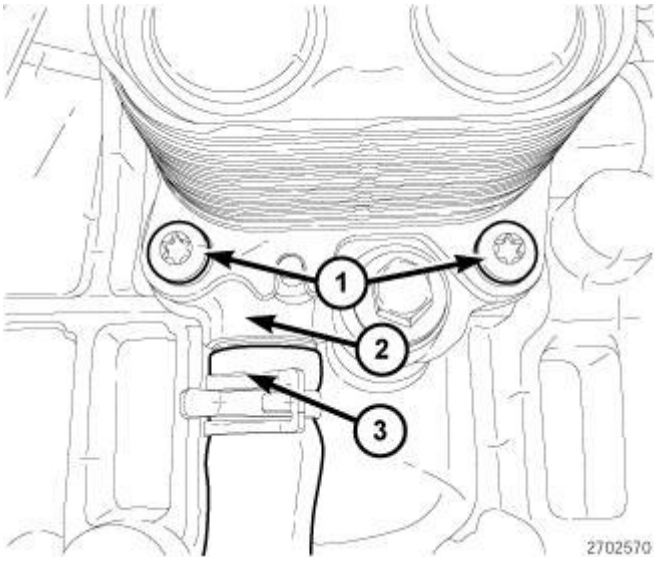

Fig. 223: COOLANT HOSE & OIL COOLER HOUSING
Courtesy of CHRYSLER LLC

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

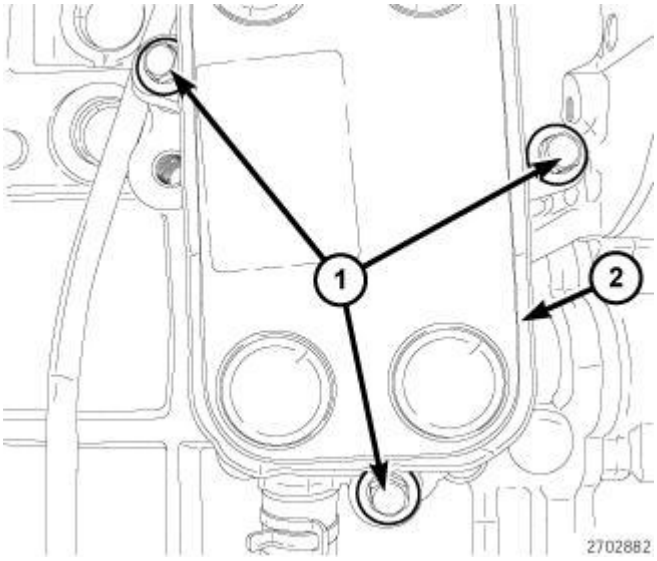

Fig. 224: OIL FILTER HOUSING ADAPTER & BOLTS
Courtesy of CHRYSLER LLC

14. Remove bolts (1) and the oil filter housing adapter (2).
15. Remove the tube and discard O-ring gasket.

Installation

INSTALLATION

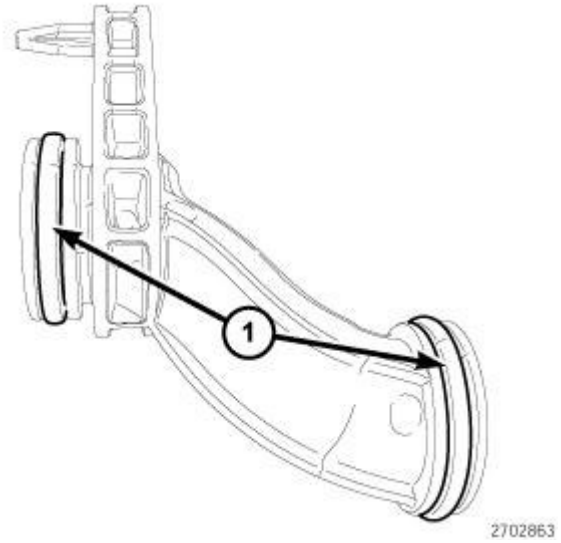

Fig. 225: IDENTIFYING O-RING SEALS
Courtesy of CHRYSLER LLC

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

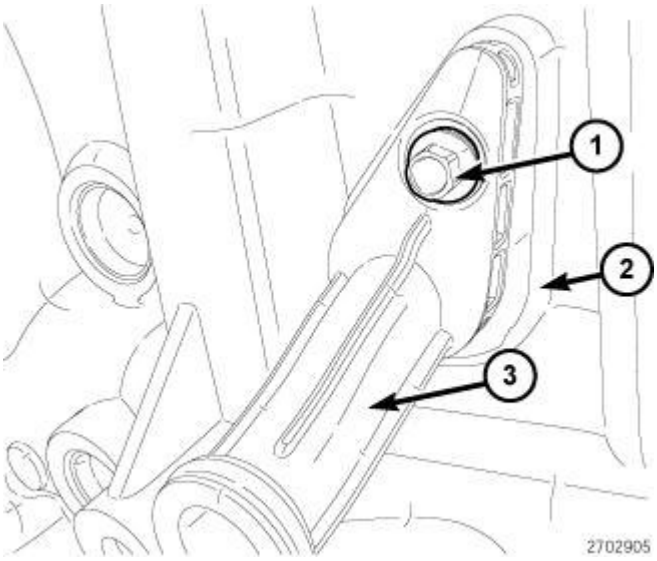

Fig. 226: IDENTIFYING COOLANT TUBE, ENGINE BLOCK & BOLT
Courtesy of CHRYSLER LLC

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

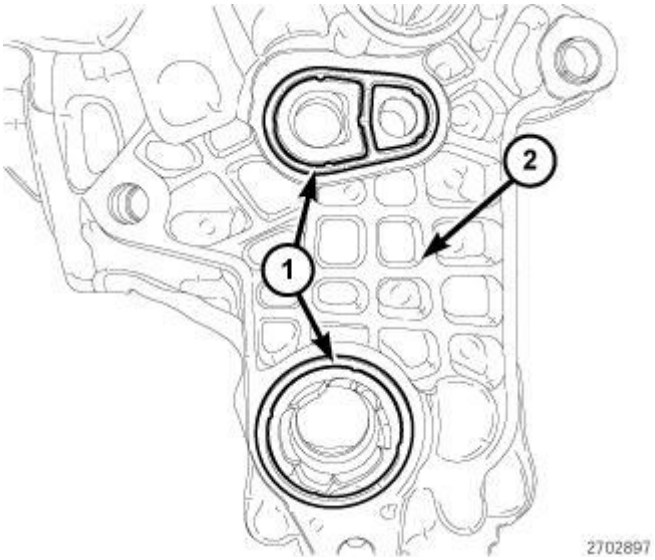

Fig. 227: O-RING SEALS & OIL FILTER HOUSING
Courtesy of CHRYSLER LLC

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

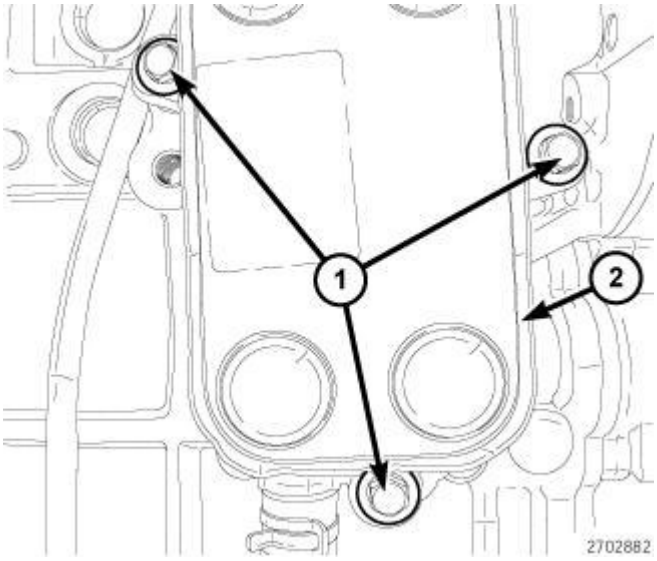

Fig. 228: OIL FILTER HOUSING ADAPTER & BOLTS
Courtesy of CHRYSLER LLC

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

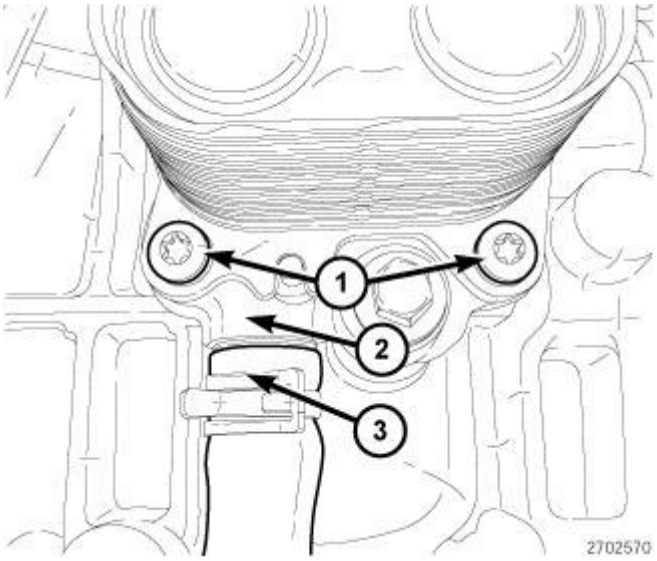

Fig. 229: COOLANT HOSE & OIL COOLER HOUSING
Courtesy of CHRYSLER LLC

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

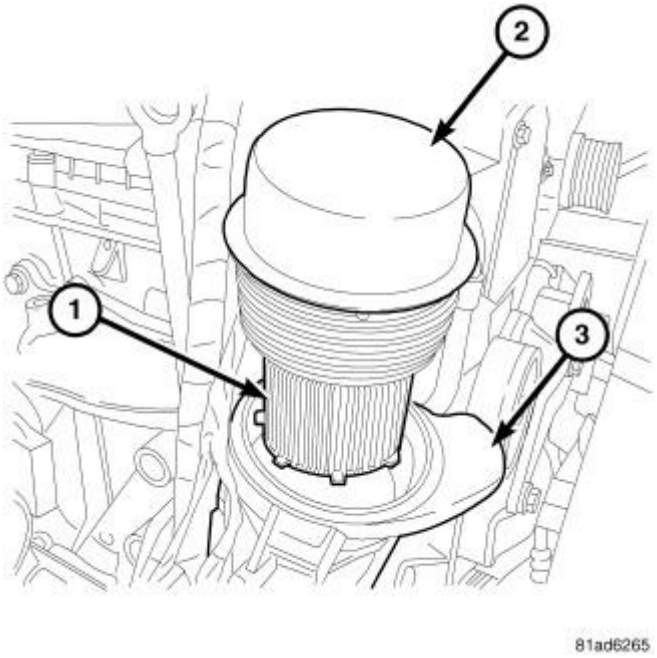

Fig. 230: OIL FILTER ADAPTER
Courtesy of CHRYSLER LLC

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

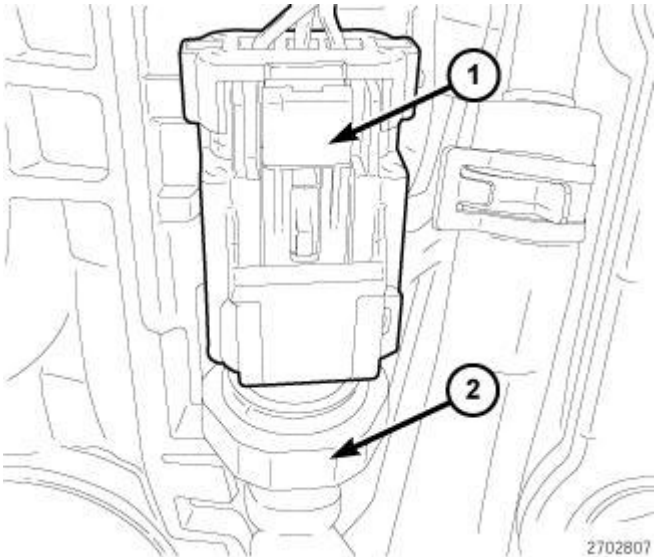

Fig. 231: OIL PRESSURE SWITCH
Courtesy of CHRYSLER LLC

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

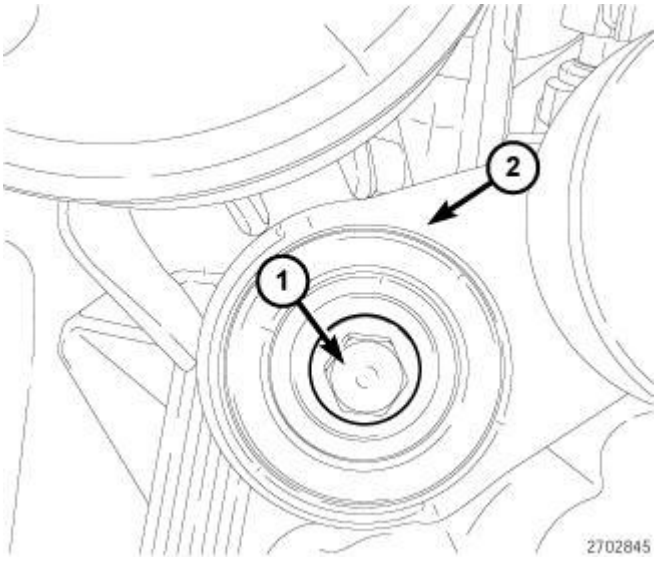

Fig. 232: SERPENTINE BELT TENSIONER & BOLT
Courtesy of CHRYSLER LLC

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 **Cooling/Accessory Drive/BELT, Serpentine - Installation** .

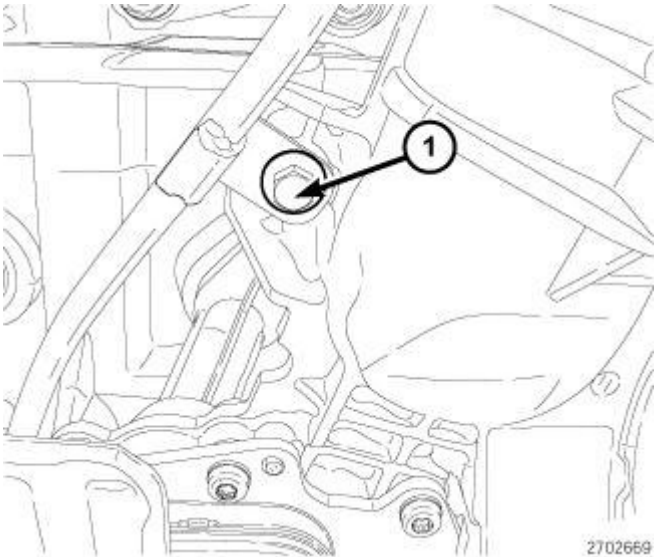

Fig. 233: UPPER OIL DIPSTICK BOLT
Courtesy of CHRYSLER LLC

11. Install the upper oil dipstick bolt (1). Tighten bolt (1) to 33 N.m (24 ft. lbs.).
12. Install the turbocharger air inlet tube and air cleaner body. See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.
13. Install the underbody skid plate.
14. Lower the vehicle.
15. Fill the engine with recommended oil.
16. Fill the cooling system. Refer to **Cooling - Standard Procedure** .
17. Connect the negative battery cable.
18. Start the engine and check for leaks.

JET, PISTON OIL COOLER

Description

DESCRIPTION

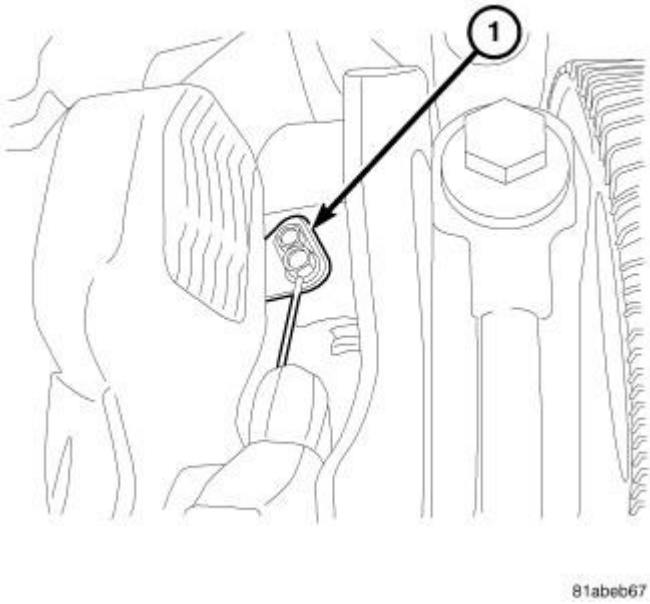

Fig. 234: OIL JET
Courtesy of CHRYSLER LLC

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

Removal

REMOVAL

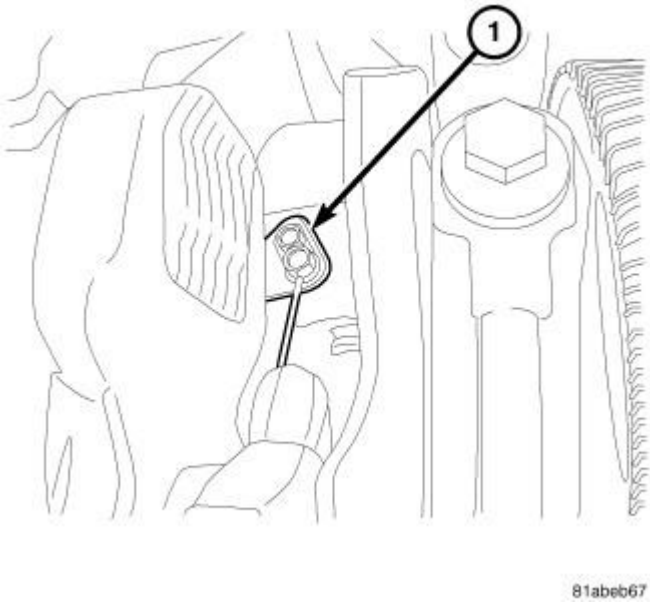

Fig. 235: OIL JET

Courtesy of CHRYSLER LLC

CAUTION: Use caution when removing and installing oil jets. Damage to oil jet nozzle could cause severe engine damage. Care must be taken not to damage the crankshaft tone ring when removing cylinder number four oil jet.

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

1. Disconnect negative battery cable.
2. Raise vehicle on hoist.
3. Remove the lower oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.
4. Remove the oil pickup tube.
5. Remove the upper oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.
6. Remove the balance shaft assembly. See **Engine/Engine Block/MODULE, Balance Shaft - Removal**.
7. Remove the oil jet.

Installation

INSTALLATION

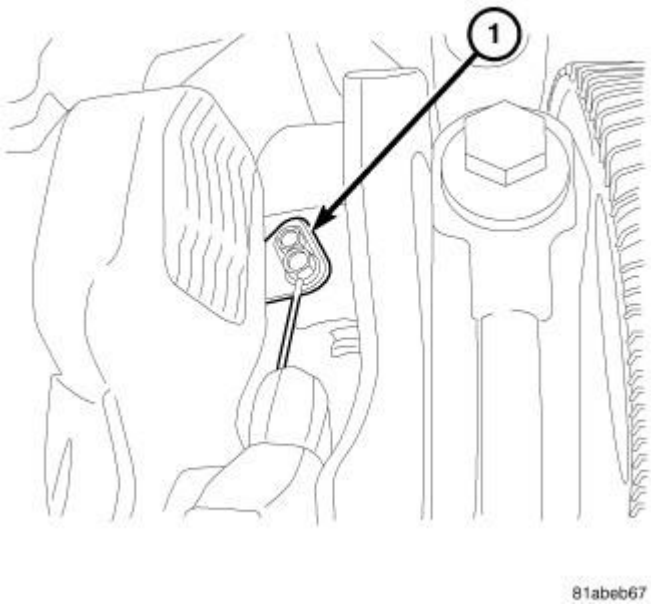

Fig. 236: OIL JET
Courtesy of CHRYSLER LLC

CAUTION: Use caution when removing and installing oil jets. Damage to oil jet nozzle could cause severe engine damage.

1. Lubricate o-ring on oil jet.
2. Install oil jet retaining bolt. Tighten bolt to 10.8 N.m (96 in. lbs.).

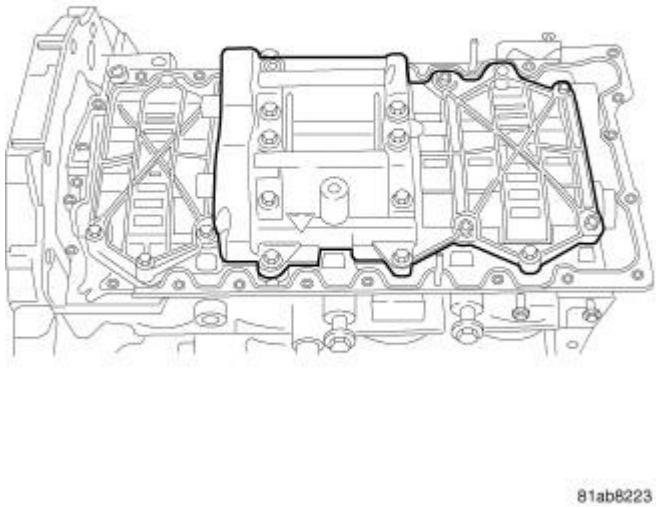

Fig. 237: BALANCE SHAFT
Courtesy of CHRYSLER LLC

3. Install the balance shaft assembly. See **Engine/Engine Block/MODULE, Balance Shaft - Installation**.

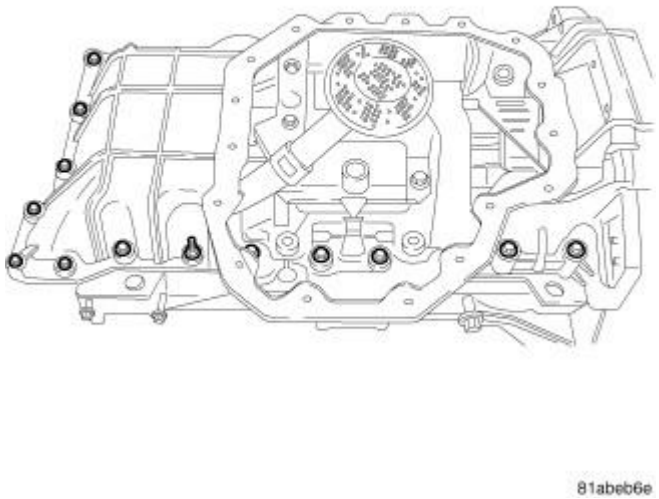

Fig. 238: OIL PICKUP TUBE
Courtesy of CHRYSLER LLC

4. Lubricate the oil pickup tube o-ring before installation.
5. Install the oil pickup tube and tighten the bolt to 15 N.m (12 lbs. ft).

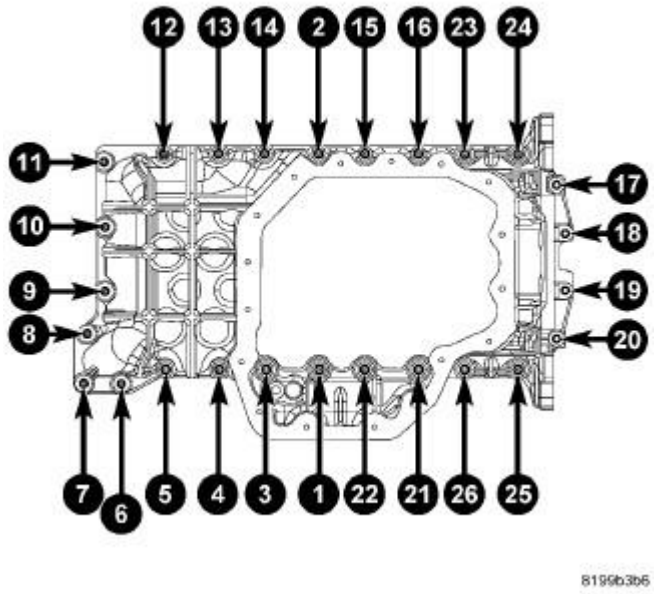

Fig. 239: OIL SUMP TORQUE SEQUENCE
Courtesy of CHRYSLER LLC

6. Install the upper oil pan gasket.
7. 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 Nm (133 lbs. in.) and M8 bolts to 32 Nm (23 lbs ft.).

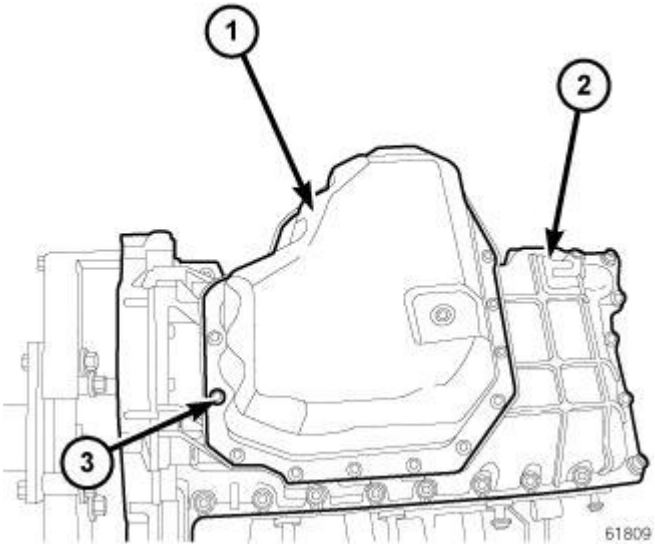

Fig. 240: LOWER OIL PAN
Courtesy of CHRYSLER LLC

8. Install the lower oil pan gasket.

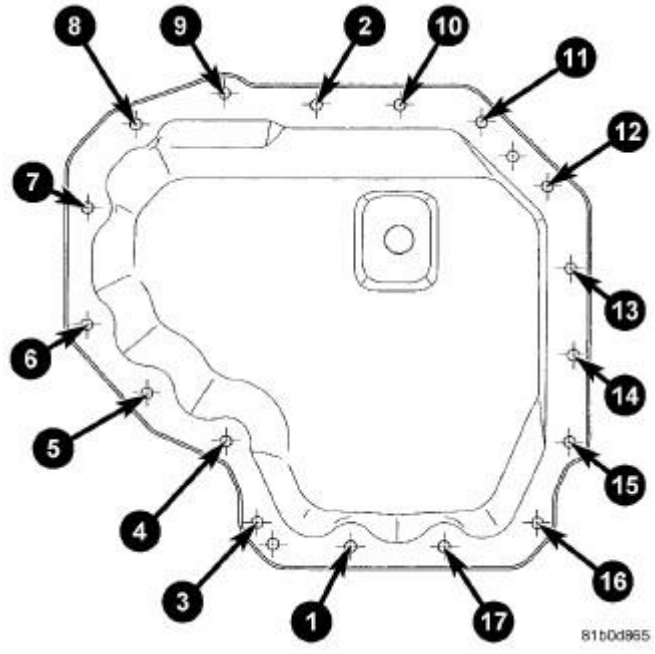

Fig. 241: LOWER OIL PAN TORQUE SEQUENCE
Courtesy of CHRYSLER LLC

9. Install bolts one and two into the lower oil pan, then follow the sequence for the remaining bolts.
10. Tighten the oil pan bolts in sequence to 15 N.m (133 lbs. in.).

11. Turn each bolt an additional 90°.
12. Refill engine oil to proper level.

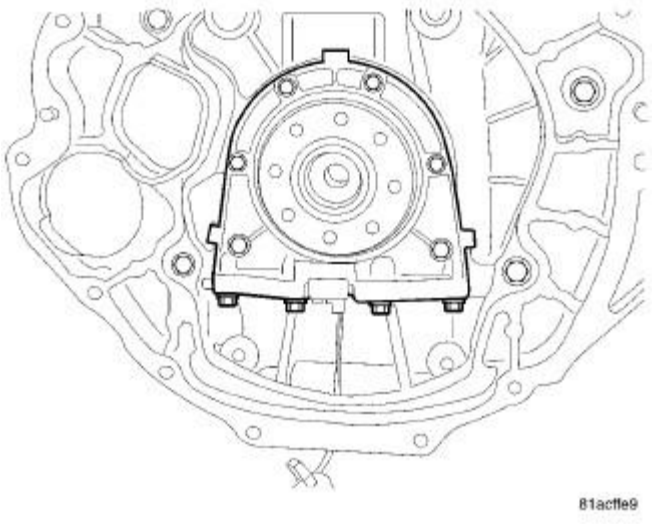

Fig. 242: REAM MAIN SEAL AND OIL PAN BOLTS
Courtesy of CHRYSLER LLC

13. Connect the crankshaft position sensor (CKP).
14. Connect negative battery cable.

OIL

Description

DESCRIPTION

Refer to the Lube and Maintenance service information for oil specifications. Refer to **Vehicle Quick Reference/Capacities and Recommended Fluids - Specifications** .

PAN, OIL

Removal

UPPER OIL PAN

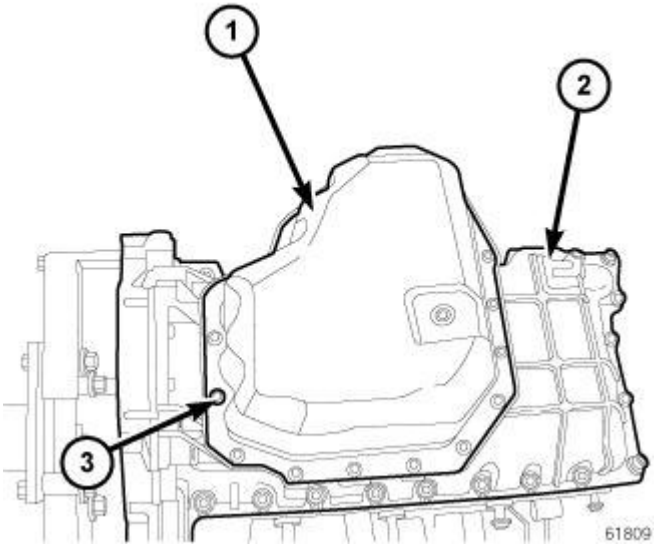

Fig. 243: LOWER OIL PAN
Courtesy of CHRYSLER LLC

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

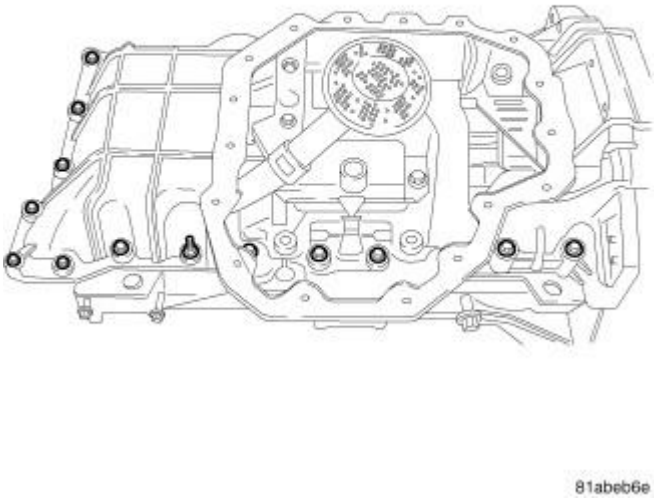

Fig. 244: OIL PICKUP TUBE
Courtesy of CHRYSLER LLC

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

LOWER OIL PAN

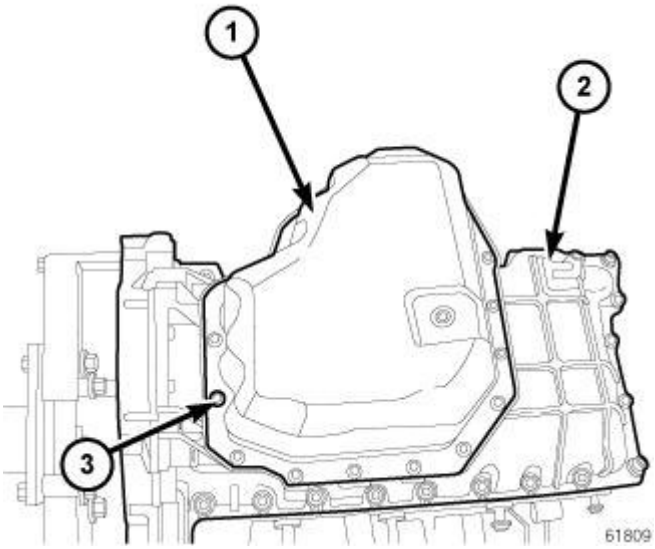

Fig. 245: LOWER OIL PAN
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the engine cover.
3. Remove the air cleaner body. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.
4. Remove the upper dipstick bolt.
5. On 4x4 models, remove the front axle. Refer to **Differential and Driveline/Front Axle - 186FIA - Removal** .
6. Remove the right lower engine mount nut.
7. Remove the left lower engine mount nut.
8. Drain the engine oil.
9. Remove the viscous fan. Refer to **Cooling/Engine/FAN, Cooling - Removal** .
10. Install the Engine Support Fixture 8534B and raise up the engine.
11. Remove bolts (3) and the lower oil pan (1).
12. Remove the oil pan gasket.

Installation

UPPER OIL PAN

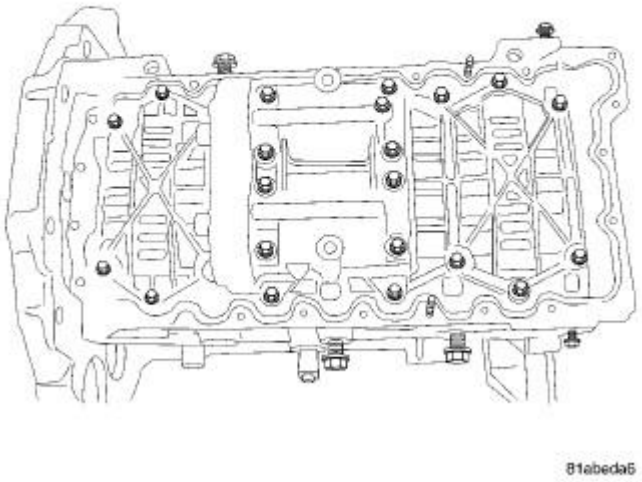

Fig. 246: Engine Block Gasket Surface
Courtesy of CHRYSLER LLC

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

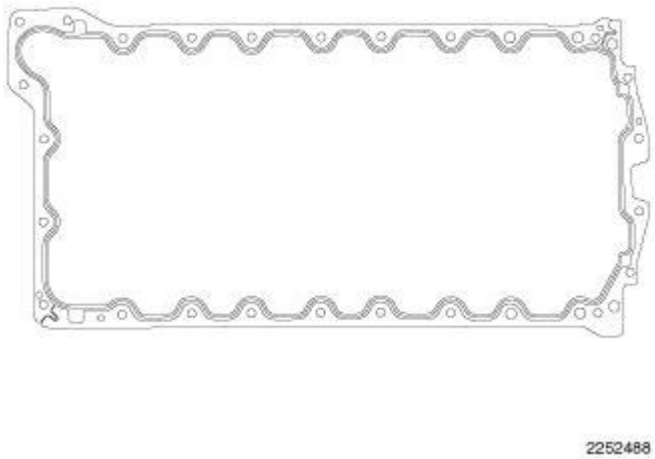

Fig. 247: Oil Pan Gasket Surface
Courtesy of CHRYSLER LLC

2. Install the upper oil pan gasket.

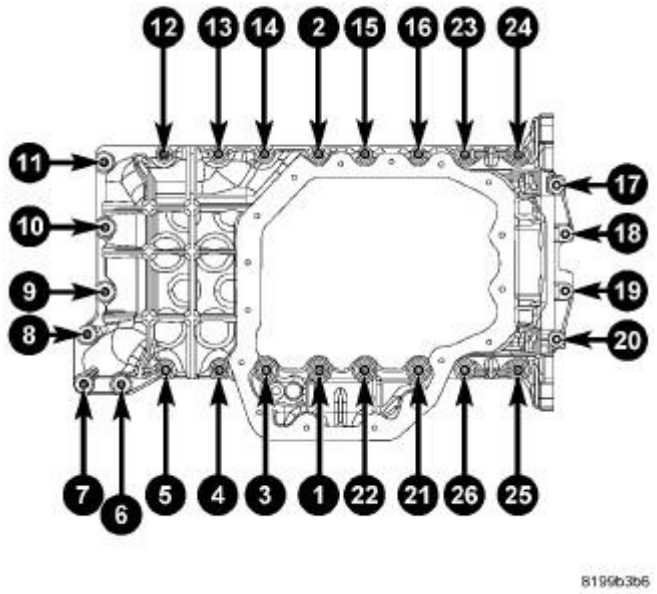

Fig. 248: OIL SUMP TORQUE SEQUENCE
Courtesy of CHRYSLER LLC

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.).
5. Install the oil dip stick. Tighten lower bolt to 11 N.m (97 in. lbs.).
6. Install the Crankshaft Position (CKP) sensor. Refer to **Fuel System/Fuel Injection/SENSOR, Crankshaft Position - Installation** .

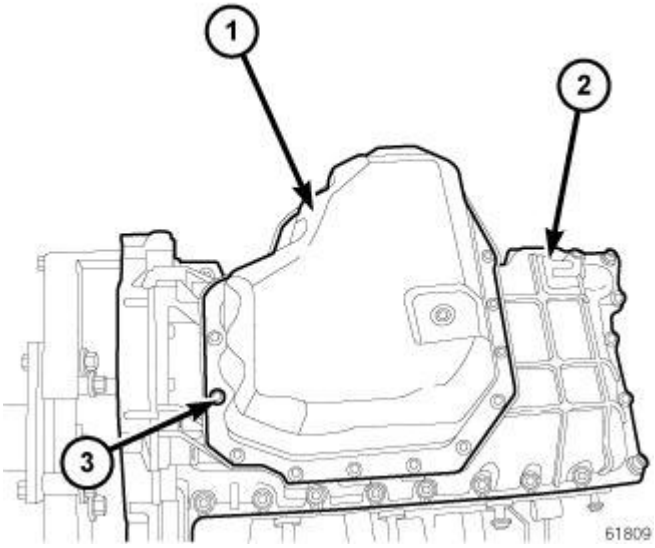

Fig. 249: LOWER OIL PAN
Courtesy of CHRYSLER LLC

7. Install the lower oil pan. See **Engine/Lubrication/PAN, Oil - Installation**.
8. Refill engine with recommended oil.
9. Connect negative battery cable.
10. Start engine and check for leaks.

LOWER OIL PAN

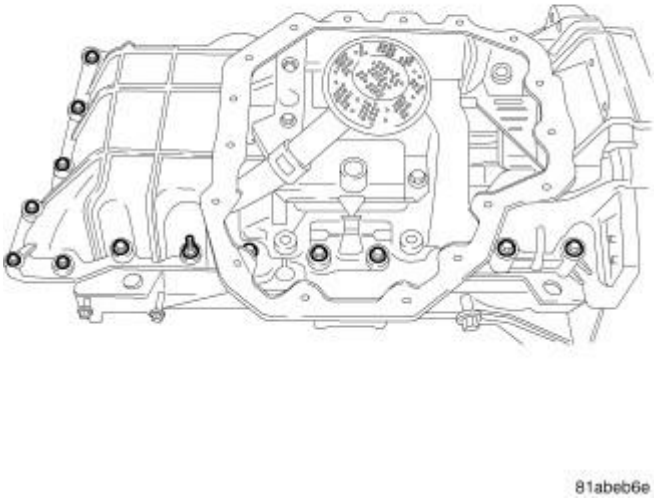

Fig. 250: OIL PICKUP TUBE
Courtesy of CHRYSLER LLC

1. Clean the lower oil pan gasket sealing surfaces.

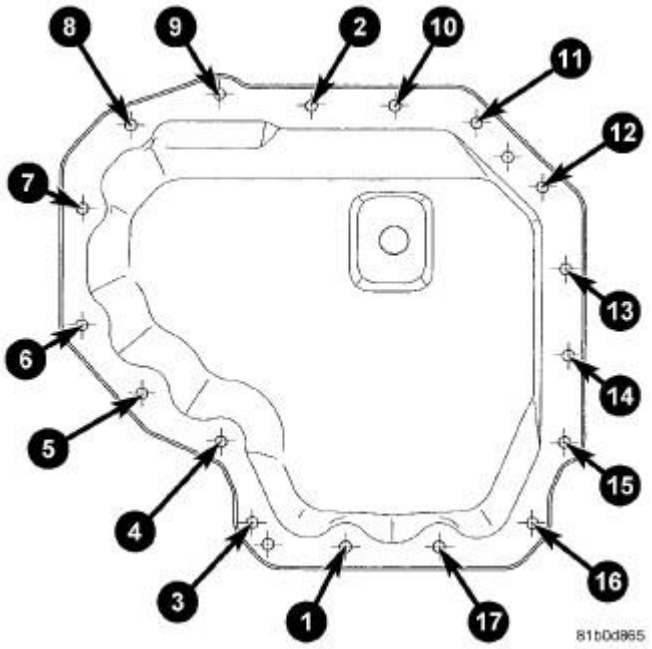

Fig. 251: LOWER OIL PAN TORQUE SEQUENCE
Courtesy of CHRYSLER LLC

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 8534B.
7. Install the viscous fan. Refer to **Cooling/Engine/FAN, Cooling - 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 **Differential and Driveline/Front Axle - 186FIA - Installation** .
11. Install the upper dipstick bolt. Tighten bolt to 11 N.m (97 in. lbs.).
12. Install the air cleaner body. See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.
13. Refill engine oil to proper level.
14. Install the engine cover.
15. Connect the negative battery cable.
16. Start engine and check for leaks.

PICK-UP, OIL PUMP

Removal

Removal

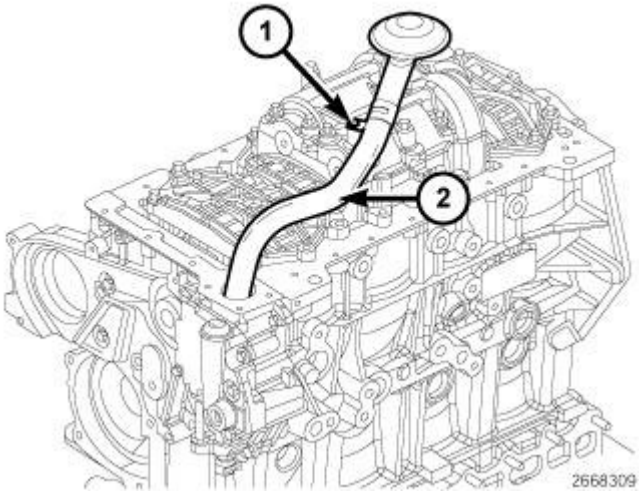

Fig. 252: Oil Pump Pickup Tube & Bolt
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the upper oil pan. See **Engine/Lubrication/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

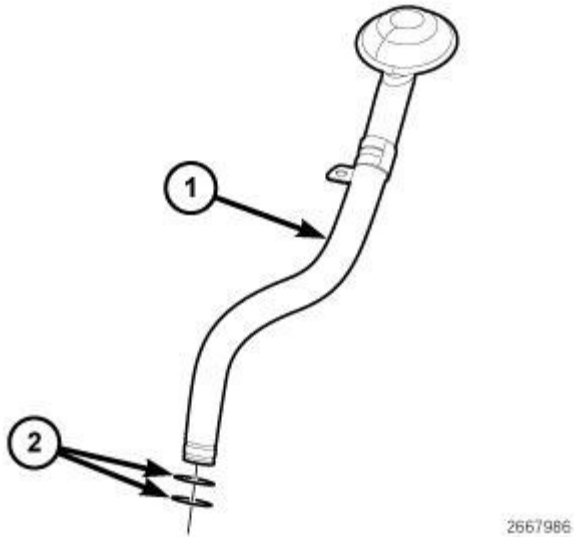

Fig. 253: OIL PICKUP TUBE & O-RINGS
Courtesy of CHRYSLER LLC

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

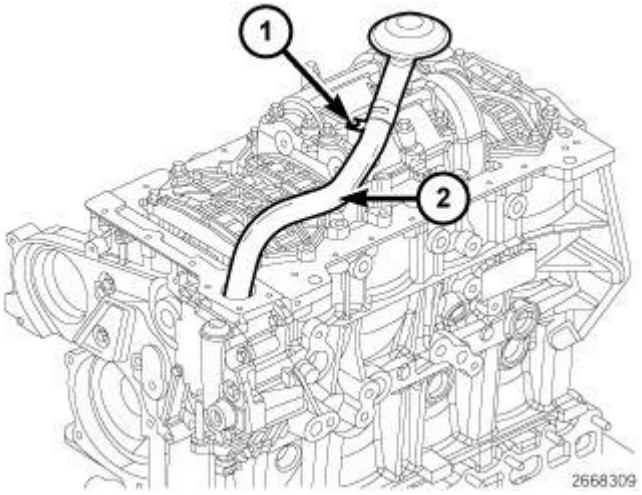

Fig. 254: Oil Pump Pickup Tube & Bolt
Courtesy of CHRYSLER LLC

2. Install the oil pickup tube into engine block. Tighten bolt to 15 N.m (133 in. lbs.).
3. Install the upper oil pan. See **Engine/Lubrication/PAN, Oil - Installation**.
4. Connect the negative battery cable.

PUMP, ENGINE OIL

Removal

OIL PUMP PICKUP TUBE

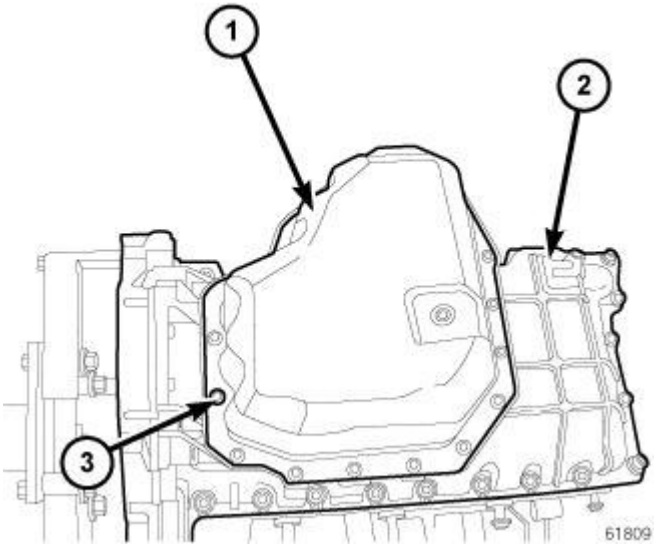

Fig. 255: LOWER OIL PAN
Courtesy of CHRYSLER LLC

1. Drain the oil.
2. Disconnect negative battery cable. Refer to **Electrical/Battery System/BATTERY - Removal** .
3. Raise vehicle on hoist.
4. Remove the lower oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.

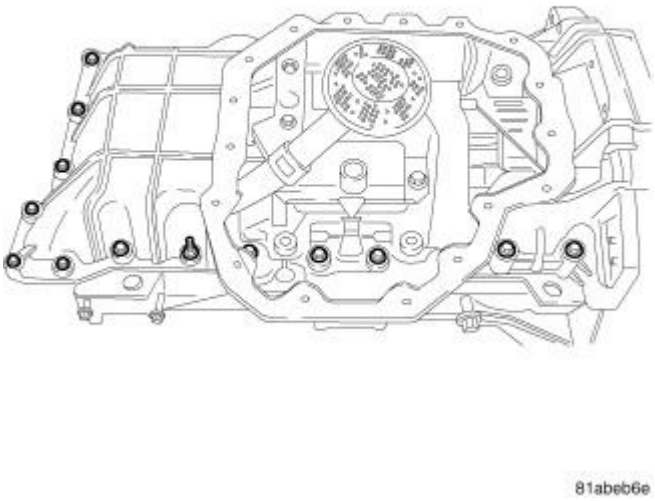

Fig. 256: OIL PICKUP TUBE
Courtesy of CHRYSLER LLC

5. Remove the upper oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.
6. Remove oil pump pickup tube retaining bolt and pull pickup tube from engine block. Discard O-rings.

OIL PUMP

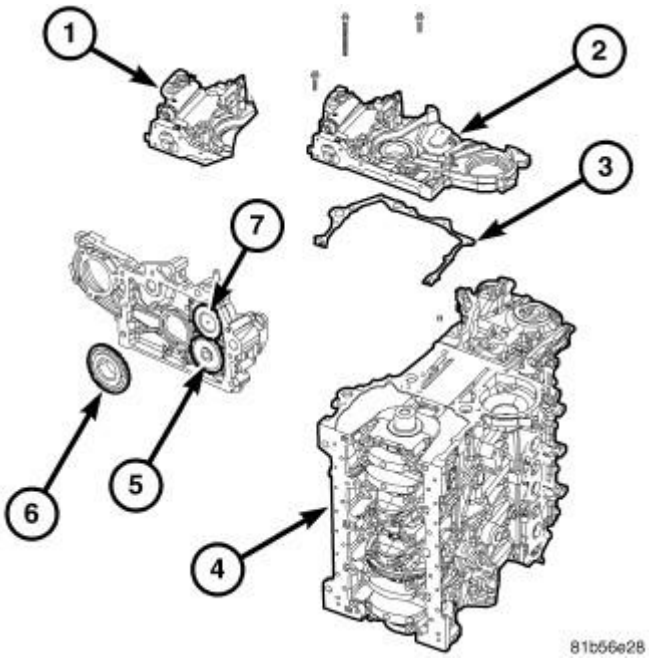

Fig. 257: VACUUM PUMP AND OIL PUMP
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove cooling fan and fan drive viscous clutch assembly. Refer to **Cooling/Engine/FAN, Cooling - Removal** .
3. Remove the front cover. See **Engine/Engine Block/COVER, Engine - Removal**.
4. Remove the oil pump (5) from the front cover (2).

Installation

OIL PUMP PICKUP TUBE

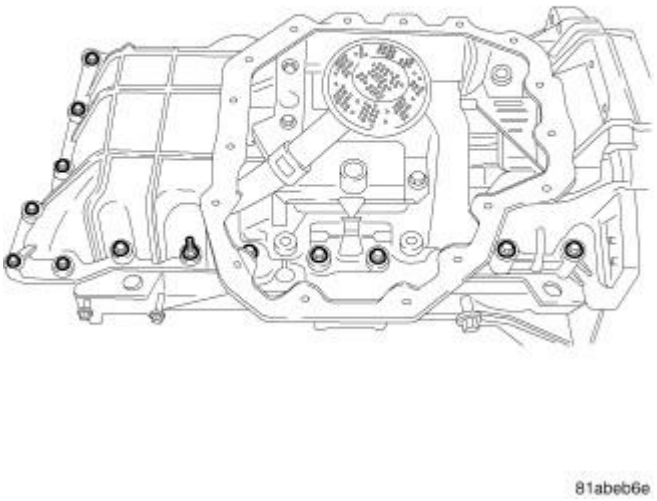

Fig. 258: OIL PICKUP TUBE
Courtesy of CHRYSLER LLC

1. Lubricate o-ring on oil pump pickup tube with engine oil.
2. Install pickup tube in engine block and install retaining bolt. Torque bolt to 32.4 N.m (24 ft. lbs.). .
3. Install the upper oil pan. See **Engine/Lubrication/PAN, Oil - Installation**.

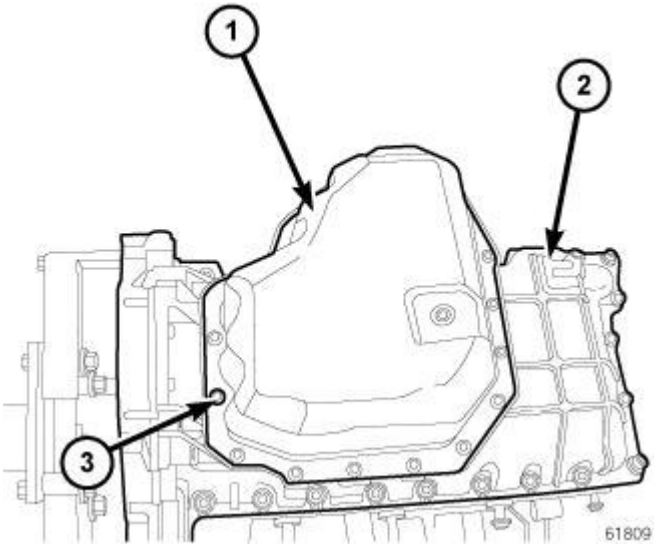

Fig. 259: LOWER OIL PAN
Courtesy of CHRYSLER LLC

4. Install the lower oil pan. See **Engine/Lubrication/PAN, Oil - Installation**.

5. Refill engine oil to proper level.
6. Connect negative battery cable. Refer to **Electrical/Battery System/BATTERY - Installation** .

OIL PUMP

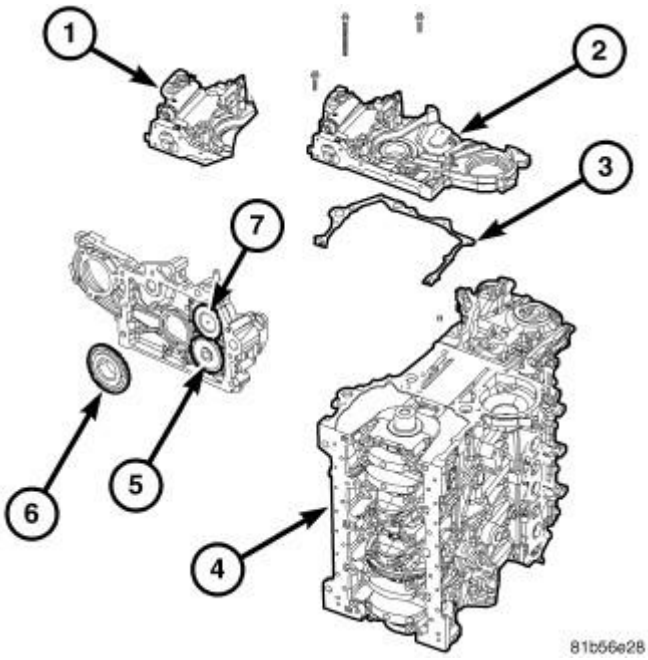

Fig. 260: VACUUM PUMP AND OIL PUMP
Courtesy of CHRYSLER LLC

1. Make sure that the gasket surfaces are free of oil and debris.
2. Lubricate oil pump rotor with engine oil.
3. Install the oil pump gasket.
4. Install front cover assembly. See **Engine/Engine Block/COVER, Engine - Installation**.

SENSOR, OIL PRESSURE

Description

DESCRIPTION

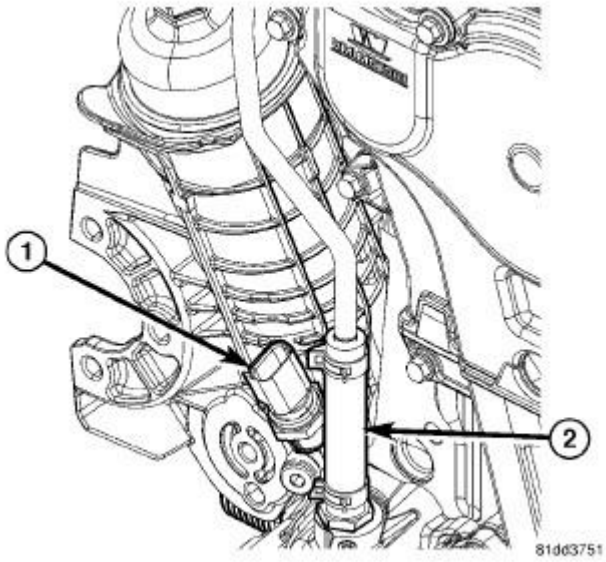

Fig. 261: OIL PRESSURE SENDING UNIT
Courtesy of CHRYSLER LLC

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.

SEPARATOR, OIL

Removal

REMOVAL

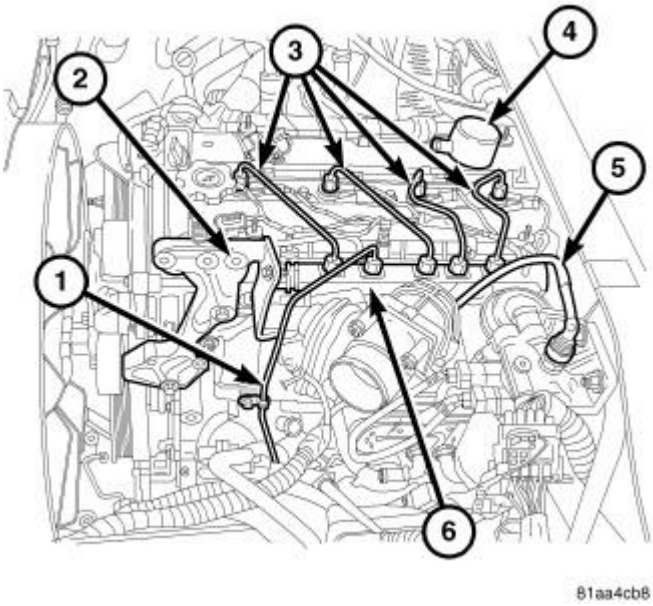

Fig. 262: FUEL RAIL
Courtesy of CHRYSLER LLC

1. Remove the engine cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.

NOTE: Inspect the oil drain back access hole in the intake manifold/cylinder head cover to assure that it is free of obstruction.

2. Remove the oil separator fasteners and oil separator (4).

Installation

INSTALLATION

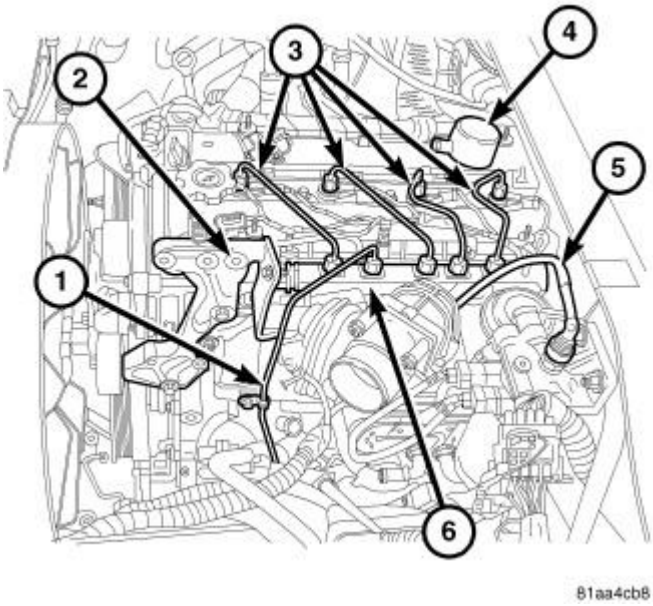

Fig. 263: FUEL RAIL
Courtesy of CHRYSLER LLC

NOTE: Inspect the oil drain back access hole in the intake manifold/cylinder head cover to assure that it is free of obstruction.

1. Lubricate the oil separator o-rings with clean engine oil.
2. Carefully position and push down on the oil separator to seat.
3. Install the oil separator retaining fasteners. Tighten fasteners to 10.8 N.m (96 lbs. in.).
4. Install the camshaft cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.

VALVE, OIL PRESSURE RELIEF

Description

DESCRIPTION

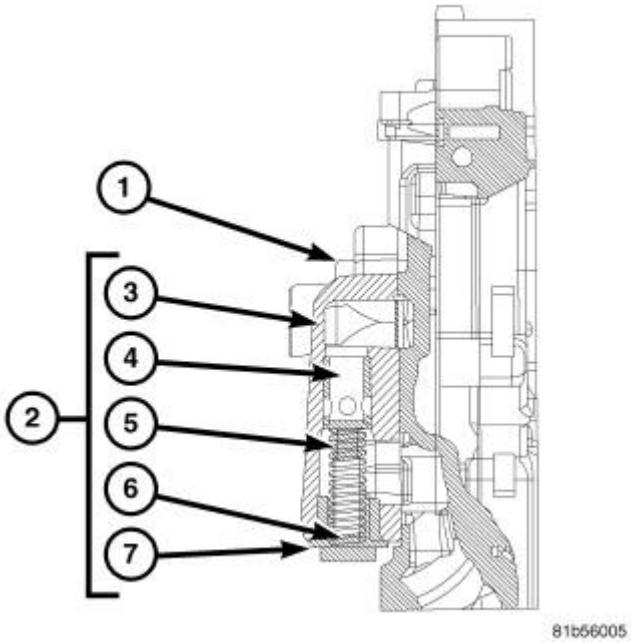

Fig. 264: FRONT COVER COMPONENTS
Courtesy of CHRYSLER LLC

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

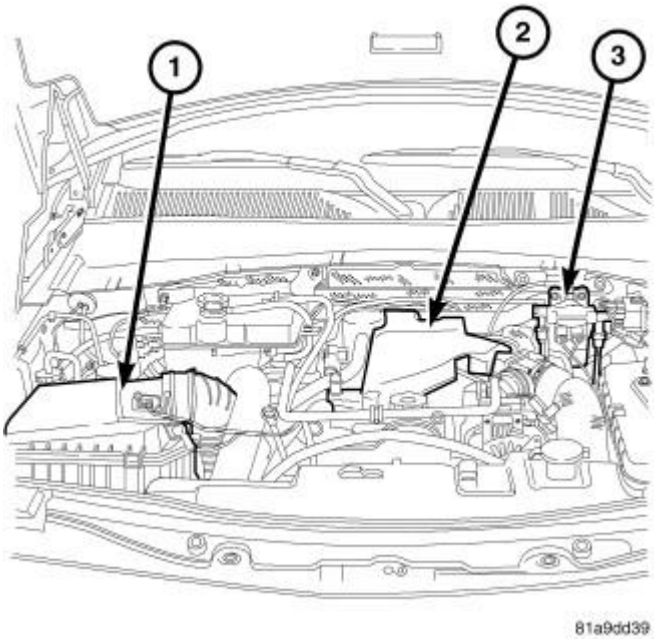

Fig. 265: ENGINE COVER
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the engine cover.
3. Remove the four retainers and the engine silencer.
4. Remove the air cleaner body. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.
5. Remove the inlet air tube from the turbocharger.

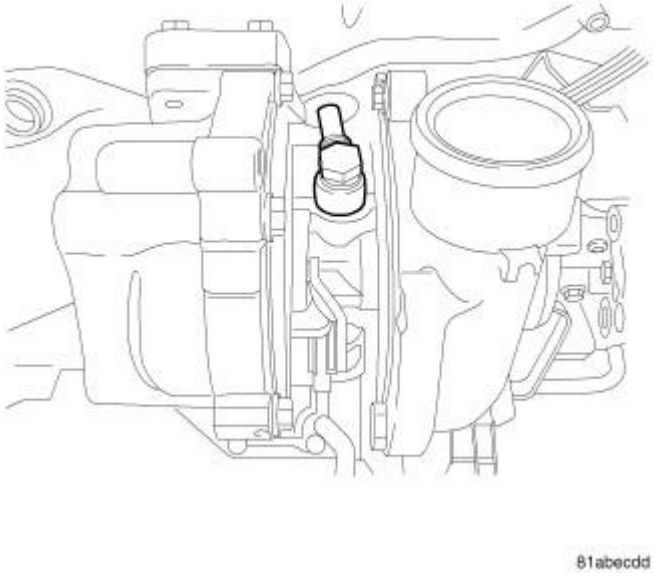

Fig. 266: TURBOCHARGER FEED LINE

Courtesy of CHRYSLER LLC

6. Remove the turbocharger. See **Engine/Turbocharger System - Removal**.

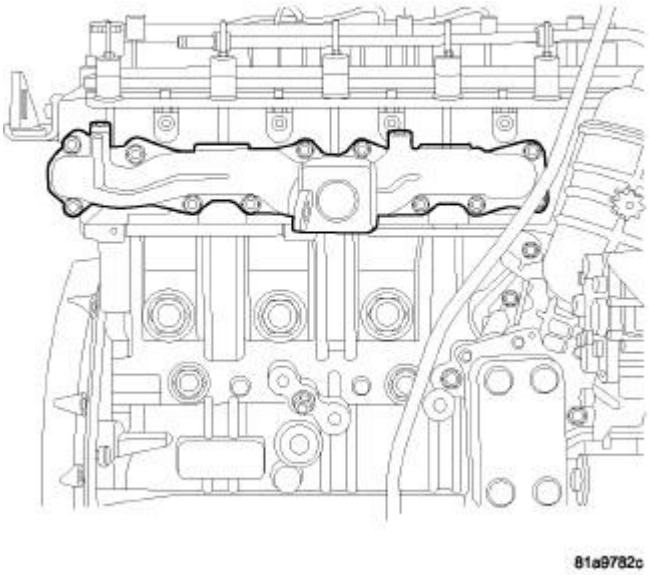

Fig. 267: MANIFOLD - EXHAUST
Courtesy of CHRYSLER LLC

7. Remove nuts and the exhaust manifold.
8. Remove and discard the exhaust manifold gasket.

Installation

INSTALLATION

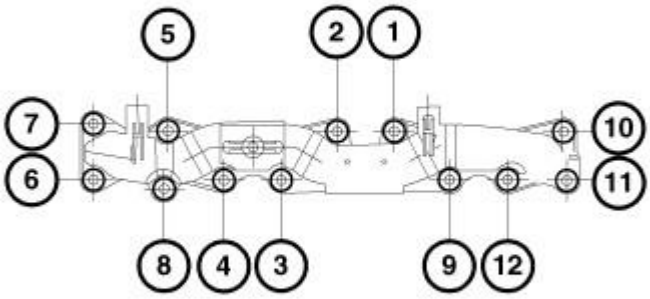

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Fig. 268: EXHAUST MANIFOLD TORQUE SEQUENCE
Courtesy of CHRYSLER LLC

1. Clean the exhaust manifold mating surfaces.
2. Using a new gasket, install the exhaust manifold.
3. Using the sequence shown in illustration, Tighten the exhaust manifold nuts to 36 N.m (27 ft. lbs.).
4. Repeat the tightening procedure at the same torque.

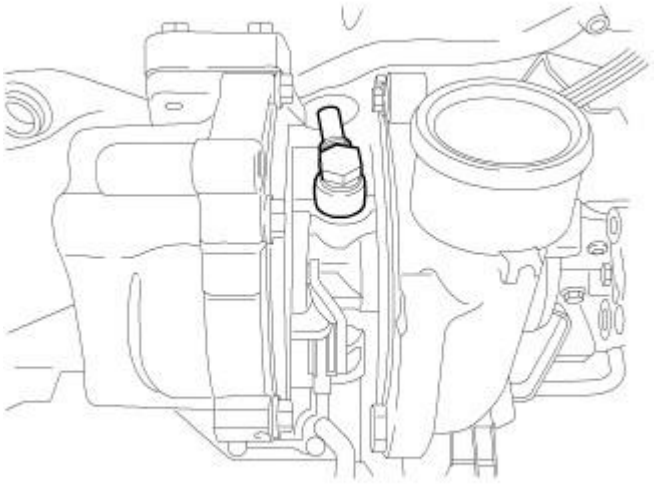

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Fig. 269: TURBOCHARGER FEED LINE
Courtesy of CHRYSLER LLC

5. Install the turbocharger. See **Engine/Turbocharger System - Installation**.

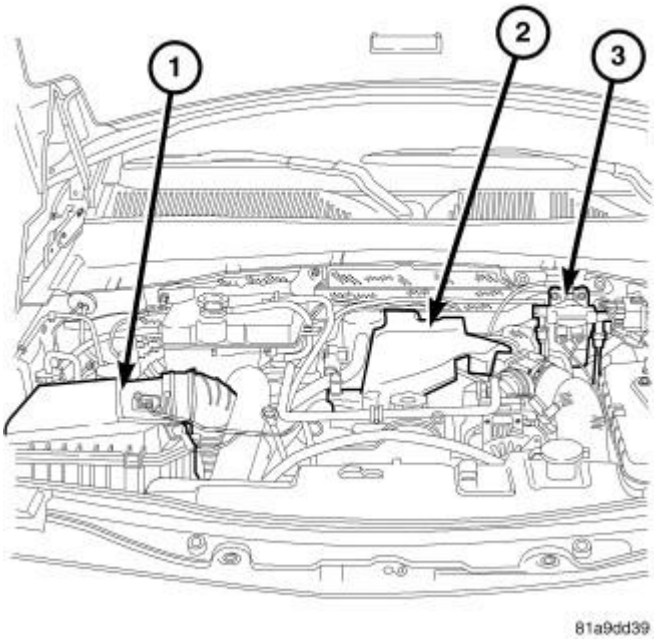

Fig. 270: ENGINE COVER
Courtesy of CHRYSLER LLC

6. Install the inlet air tube to the turbocharger.
7. Install the engine silencer and securely tighten retainers.
8. Install the engine cover.
9. Connect the negative battery cable.

MANIFOLD, INTAKE

Removal

REMOVAL

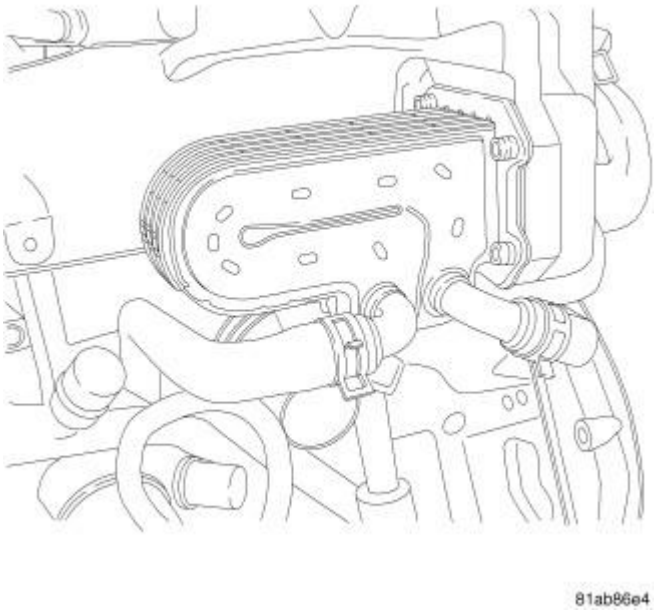

Fig. 271: EGR COOLER
Courtesy of CHRYSLER LLC

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 **Cooling - Standard Procedure** .
6. Remove lower radiator hose clip at fan shroud.
7. On 4x4 models, remove the front axle. Refer to **Differential and Driveline/Front Axle - 186FIA - Removal** .
8. Remove the starter. Refer to **Electrical/Starting/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 coolant hoses from EGR cooler.
12. Remove bolts and the EGR cooler.
13. Disconnect the EGR valve vacuum tube.

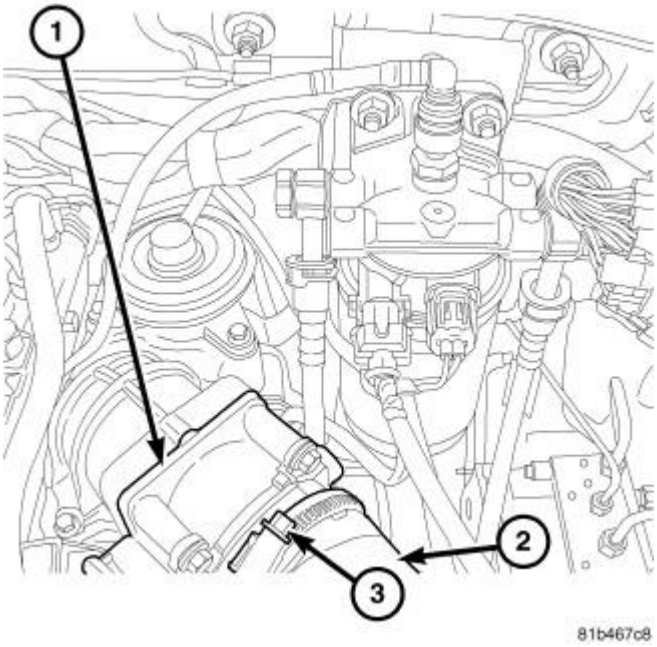

Fig. 272: AIR TUBE - EGR AIR VALVE
Courtesy of CHRYSLER LLC

14. Loosen clamp (3) and disconnect the EGR airflow control valve inlet hose (2) at EGR airflow control valve (1).

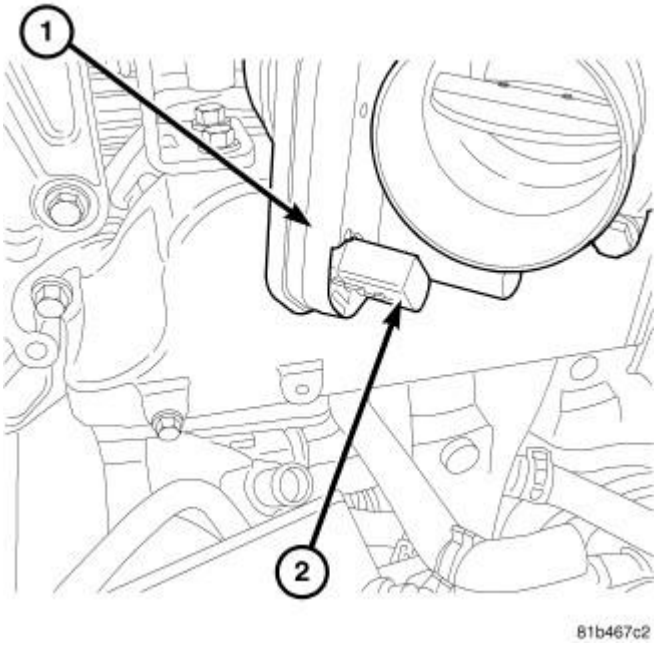

Fig. 273: ELECTRICAL CONNECTOR - EGR AIR VALVE
Courtesy of CHRYSLER LLC

15. Disconnect the EGR airflow control valve harness connector.

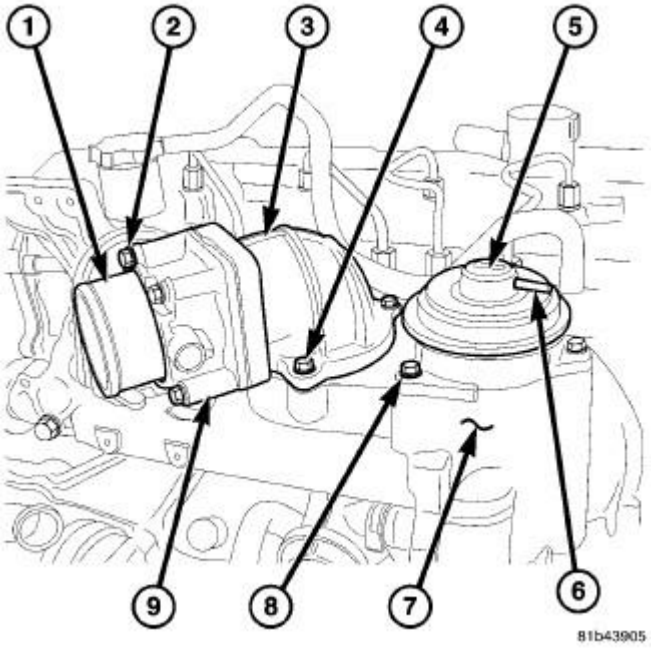

Fig. 274: EGR VALVE/EGR AIRFLOW CONTROL VALVE
Courtesy of CHRYSLER LLC

16. Remove bolts (4) and the EGR air control valve (9) and elbow (3) assembly.
17. Remove the Charge Air Cooler (CAC) hose from (CAC).

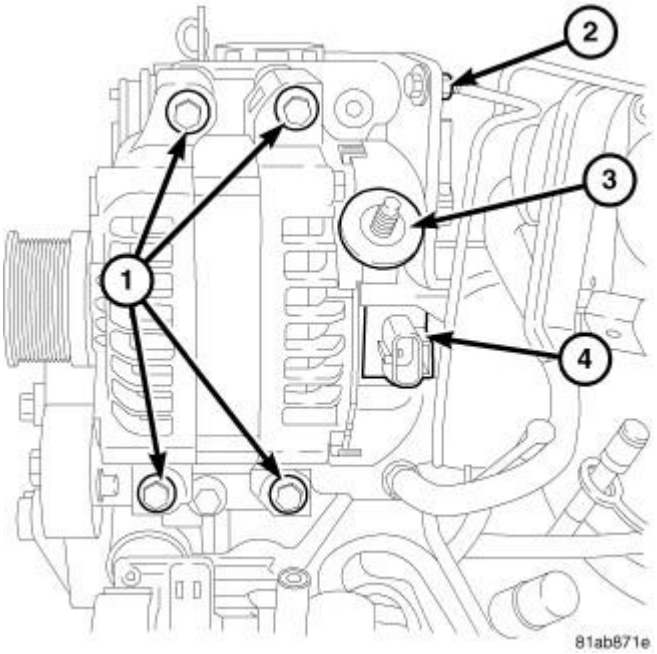

Fig. 275: GENERATOR
Courtesy of CHRYSLER LLC

18. Remove the serpentine belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal** .
19. Disconnect the generator harness connector (4).
20. Remove the battery feed wire from the generator (3) and support bracket.
21. Remove bolts (1) and the generator.

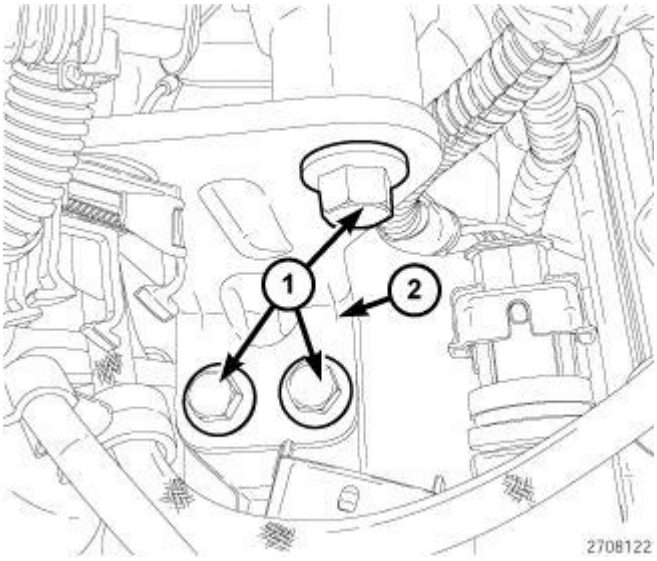

Fig. 276: GENERATOR BRACKET SUPPORT & BOLTS
Courtesy of CHRYSLER LLC

22. Remove bolts (1) and the generator bracket support (2).

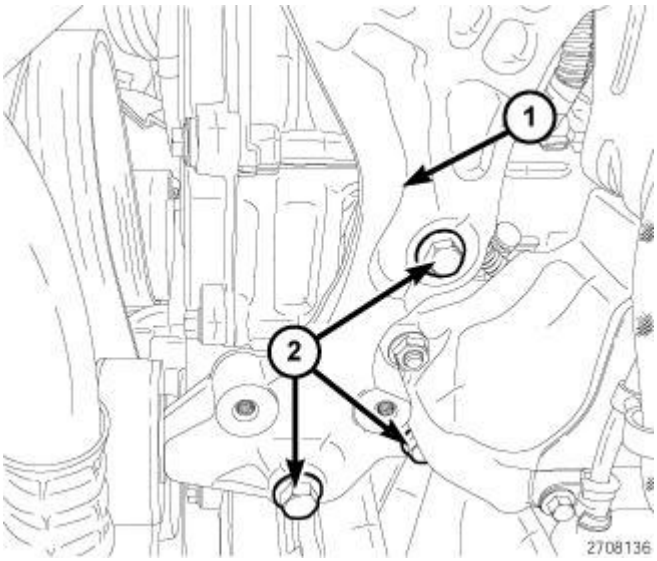

Fig. 277: GENERATOR MOUNTING BRACKET & BOLTS
Courtesy of CHRYSLER LLC

23. Remove bolts (2) and the generator mounting bracket (1).

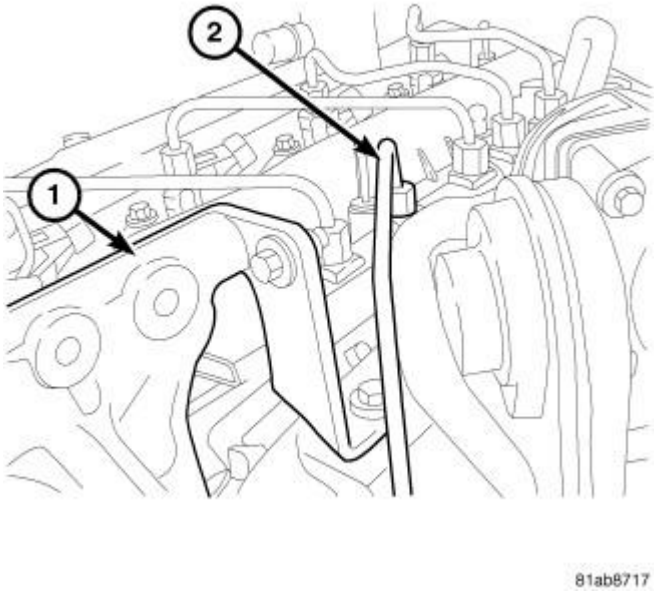

Fig. 278: GENERATOR BRACKET
Courtesy of CHRYSLER LLC

24. Remove bolt securing high pressure fuel line to intake manifold.
25. Remove the high pressure fuel line from fuel rail (2) and injection pump.

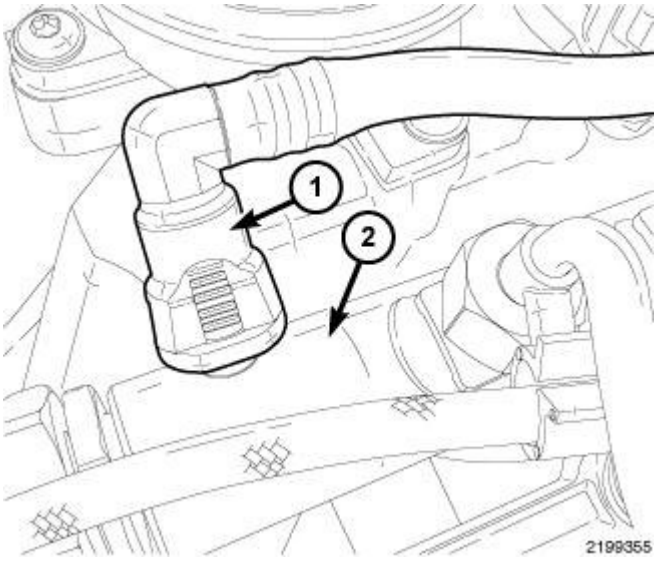

Fig. 279: Fuel Rail & Return Line
Courtesy of CHRYSLER LLC

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

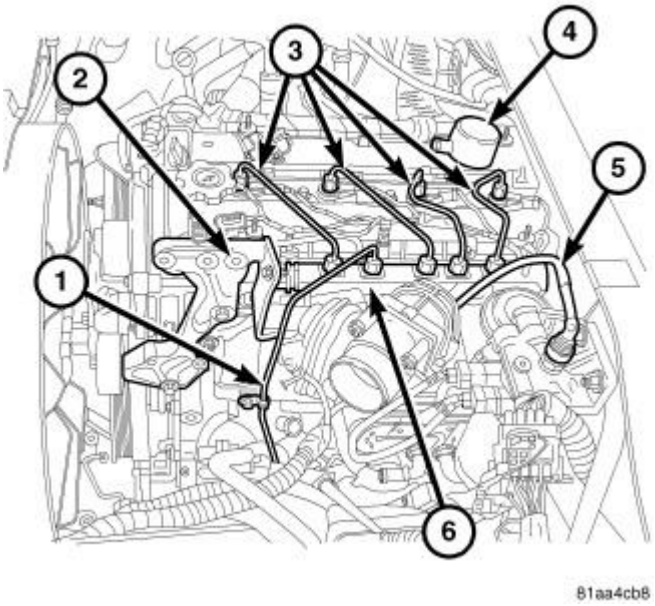

Fig. 280: FUEL RAIL
Courtesy of CHRYSLER LLC

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 and fuel rail any time the lines are removed.

27. Remove the high pressure fuel lines (3) from fuel injectors and fuel rail.
28. Disconnect the fuel rail pressure sensor and pressure solenoid.
29. Remove nuts the fuel rail (6).

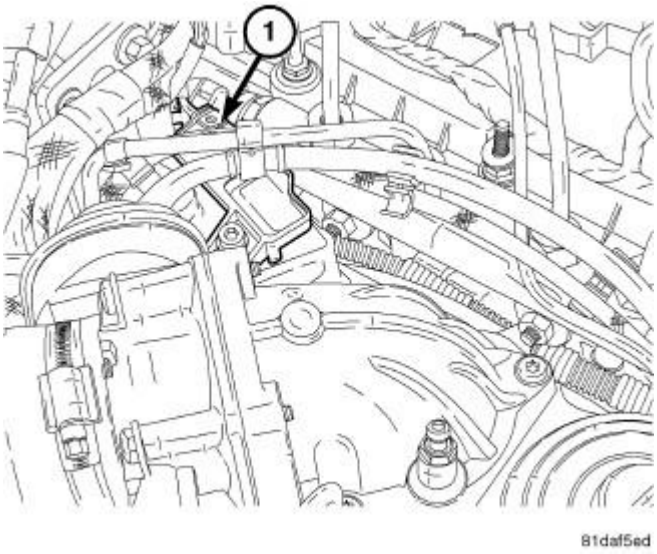

Fig. 281: IAT/BPS SENSOR
Courtesy of CHRYSLER LLC

30. Disconnect the IAT/BPS sensor harness connector.
31. Remove the wire harness loom clip from front of valve cover.
32. Remove nut the A/C suction line support bracket to valve cover.
33. Disconnect the A/C compressor clutch harness connector.
34. Remove bolts and position aside the A/C compressor.

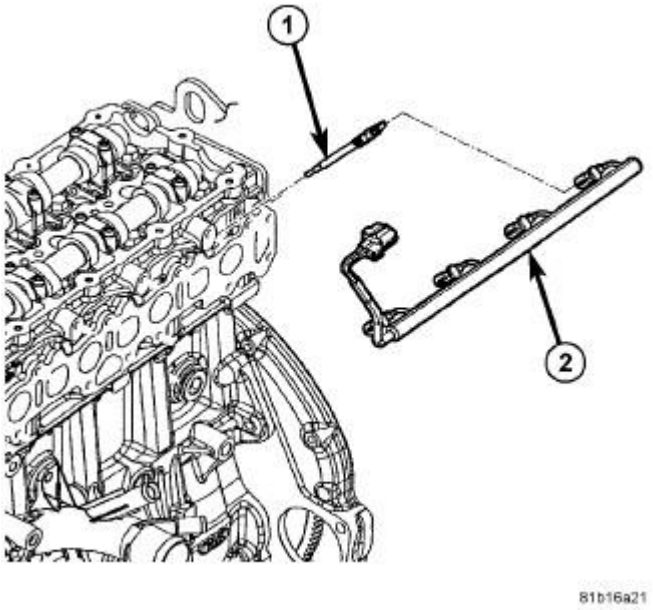

Fig. 282: Glow Plugs & Wiring Harness
Courtesy of CHRYSLER LLC

35. Disconnect and remove the glow plug wire harness (2).

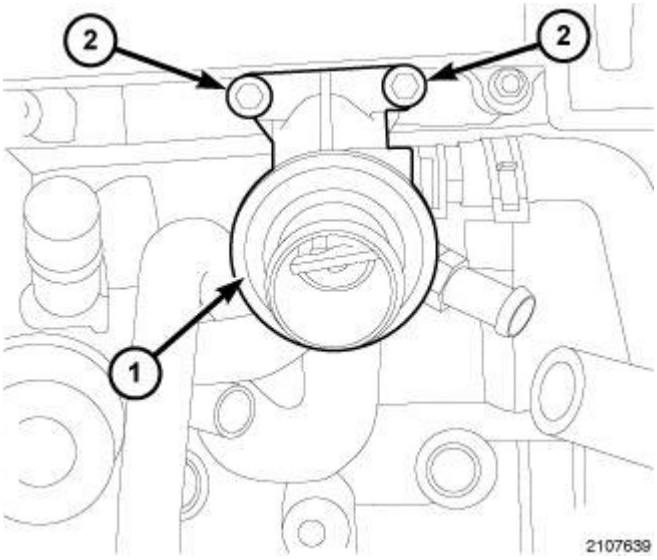

Fig. 283: Thermostat Housing & Bolts
Courtesy of CHRYSLER LLC

36. Remove the thermostat housing (1).

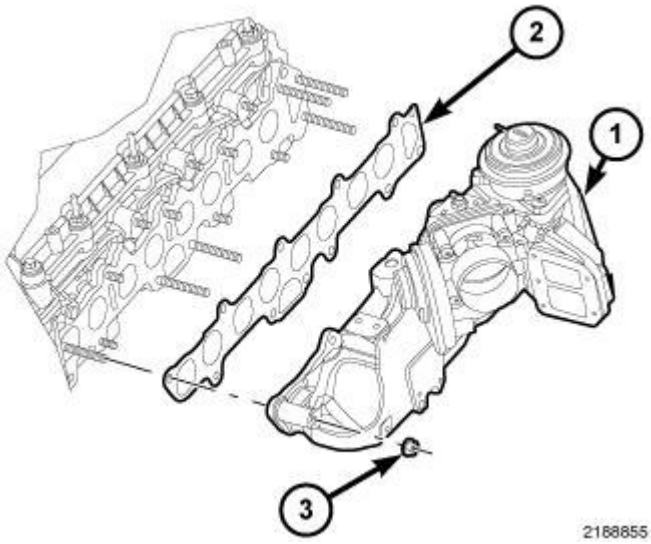

Fig. 284: Identifying Manifold Retaining Nuts, Intake Manifold & Intake Manifold Gasket
Courtesy of CHRYSLER LLC

37. Remove the intake manifold retaining nuts (3).
38. Remove the intake manifold (1).
39. Remove the intake manifold gasket (2).

Installation

INSTALLATION

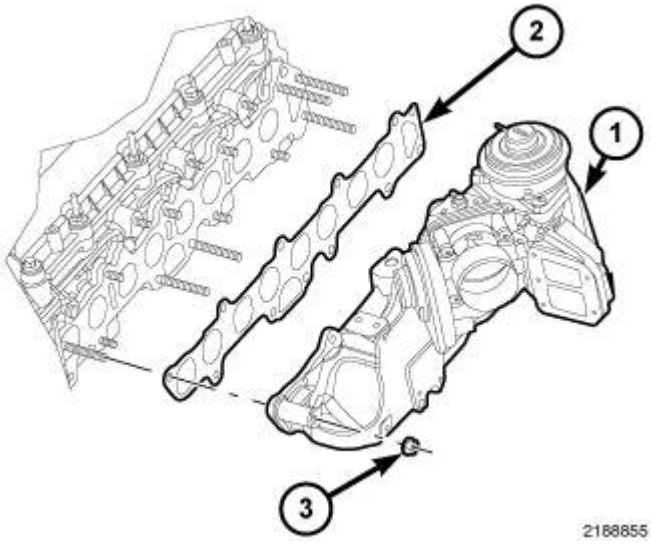

Fig. 285: Identifying Manifold Retaining Nuts, Intake Manifold & Intake Manifold Gasket
Courtesy of CHRYSLER LLC

1. Clean and inspect the gasket surface of the intake manifold and the cylinder head.
2. Install the intake manifold gasket (2).
3. Install the intake manifold (1).

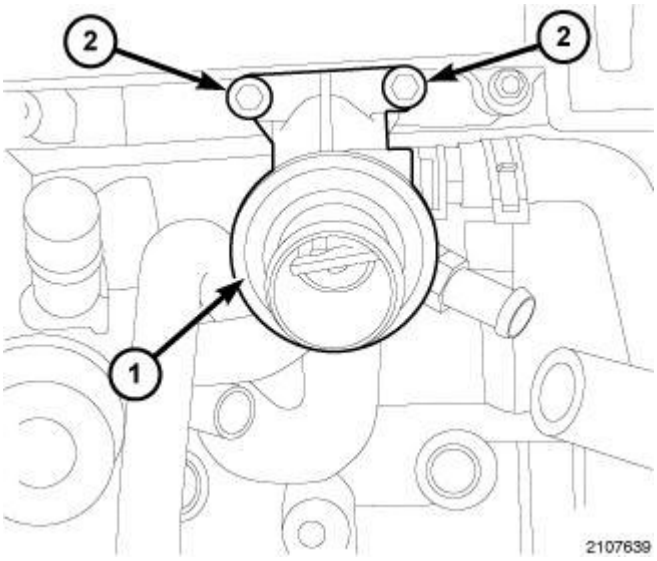

Fig. 286: Thermostat Housing & Bolts
Courtesy of CHRYSLER LLC

4. Install the thermostat housing (1).

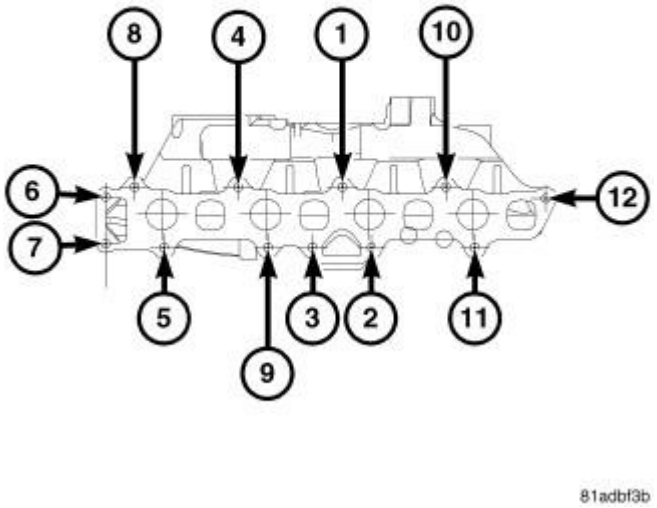

Fig. 287: INTAKE MANIFOLD TORQUE SEQUENCE

Courtesy of CHRYSLER LLC

5. Install the intake manifold retaining nuts. Using the sequence shown in illustration, tighten the intake manifold nuts to 25 N.m (18 ft. lbs.).

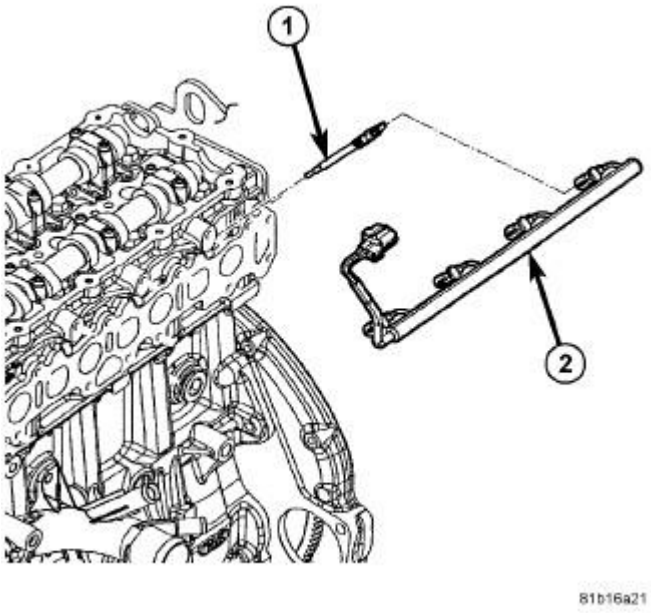

Fig. 288: Glow Plugs & Wiring Harness
Courtesy of CHRYSLER LLC

6. Install and connect the glow plug wire harness (2).

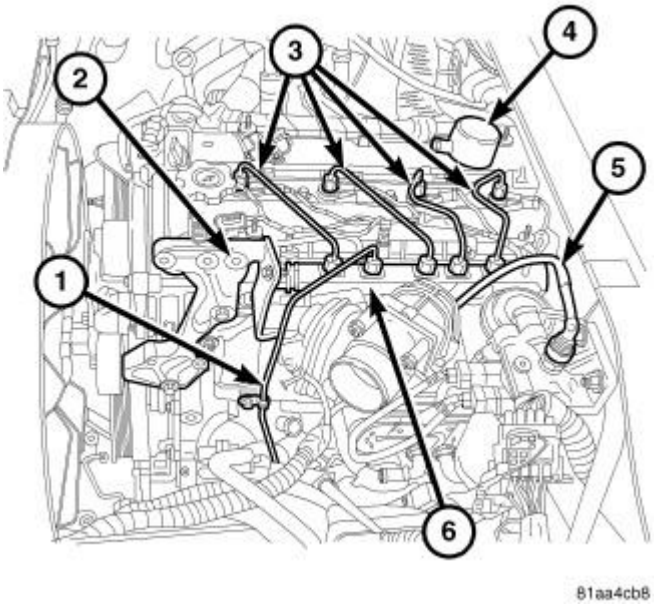

Fig. 289: FUEL RAIL
Courtesy of CHRYSLER LLC

7. Install the A/C compressor. Tighten bolts to 32 N.m (24 ft. lbs.).
8. Connect the A/C compressor clutch harness connector.
9. Install the A/C suction line support bracket to valve cover and securely tighten nut.
10. Install the wire harness loom clip to front of valve cover.
11. Connect the IAT/BPS sensor harness connector.
12. Install the fuel rail (6). Tighten nuts to 24 N.m (18 ft. lbs.).

NOTE: High pressure fuel lines must be replaced with new lines any time they are removed.

13. Remove the protective caps and install new high pressure fuel lines (3). Tighten to 5 N.m (44 in. lbs.) plus an additional 75° at the fuel rail side, and 28 N.m (20 ft. lbs.) at the fuel injectors.

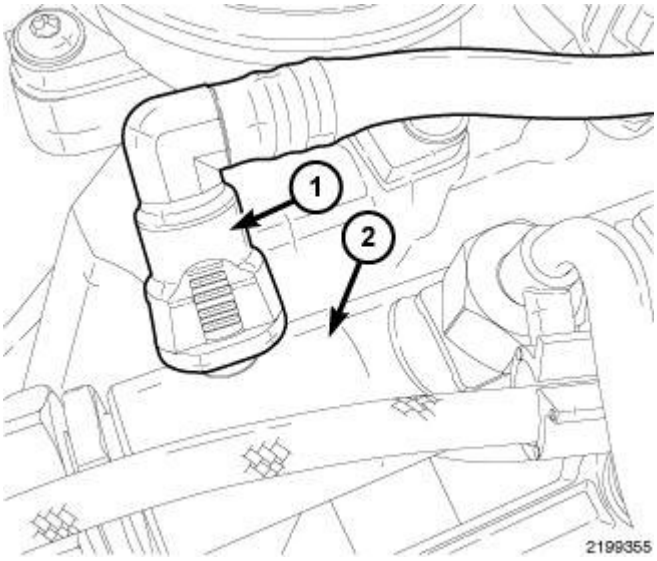

Fig. 290: Fuel Rail & Return Line
Courtesy of CHRYSLER LLC

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

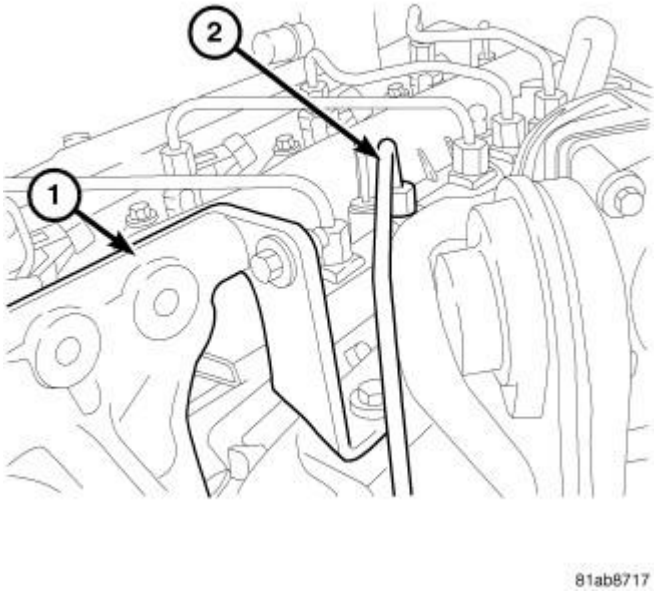

Fig. 291: GENERATOR BRACKET
Courtesy of CHRYSLER LLC

15. Install the high pressure fuel line (2) to the fuel rail. Tighten to 5 N.m (44 in. lbs.) plus an additional 75 degrees. Fuel injection pump side tighten to 28 N.m (20 ft. lbs.).
16. Install bolt securing high pressure fuel line to intake manifold and tighten to 15 N.m (133 in. lbs.).

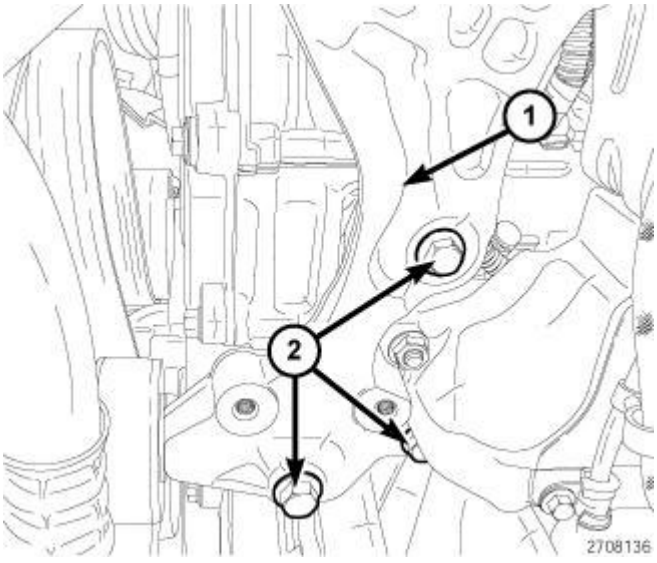

Fig. 292: GENERATOR MOUNTING BRACKET & BOLTS
Courtesy of CHRYSLER LLC

17. Install the generator mounting bracket (1). Tighten bolts (2) to 45 N.m (33 ft. lbs.).

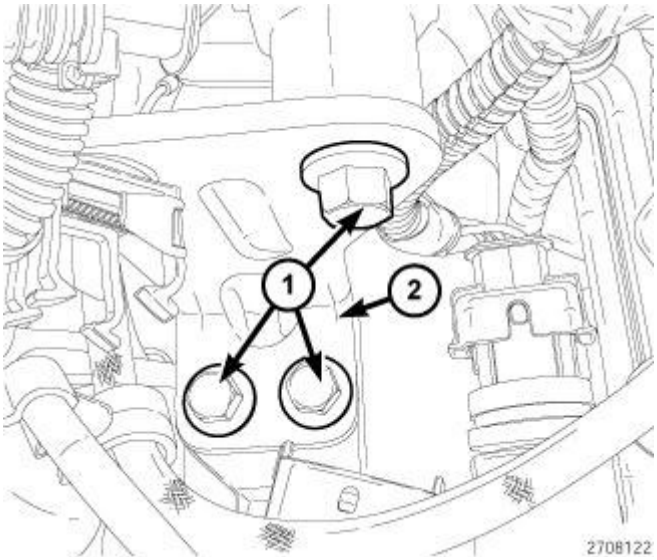

Fig. 293: GENERATOR BRACKET SUPPORT & BOLTS
Courtesy of CHRYSLER LLC

18. Install the generator bracket support (2). Tighten bolts (1) to 25 N.m (18 ft. lbs.).

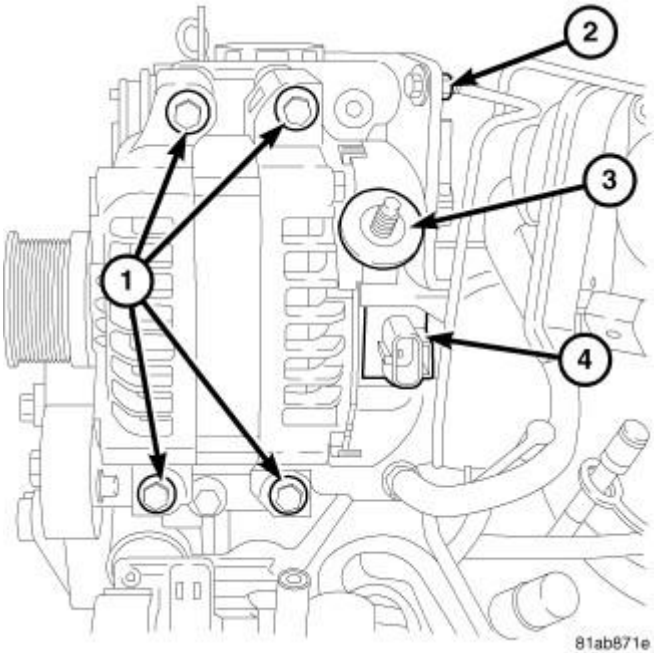

Fig. 294: GENERATOR
Courtesy of CHRYSLER LLC

19. Install the generator. Tighten bolts to 33 N.m (24 ft. lbs).
20. Install the battery feed wire to the generator (3) and support bracket.
21. Connect the generator harness connector (4).
22. Install the serpentine belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation** .

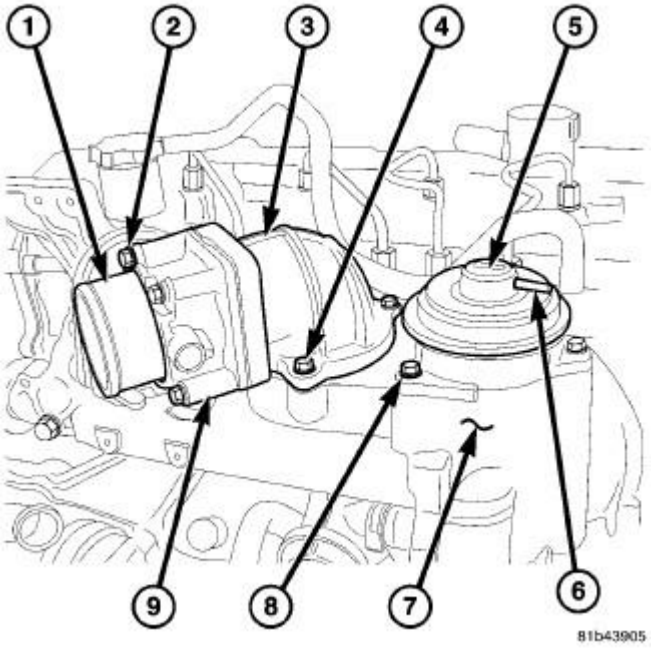

Fig. 295: EGR VALVE/EGR AIRFLOW CONTROL VALVE
Courtesy of CHRYSLER LLC

23. Install the Charge Air Cooler (CAC) hose to (CAC).
24. Using a new gasket, install the EGR air control valve (9) and elbow (3) assembly. Tighten bolts (4) 15 N.m (133 in. lbs.).

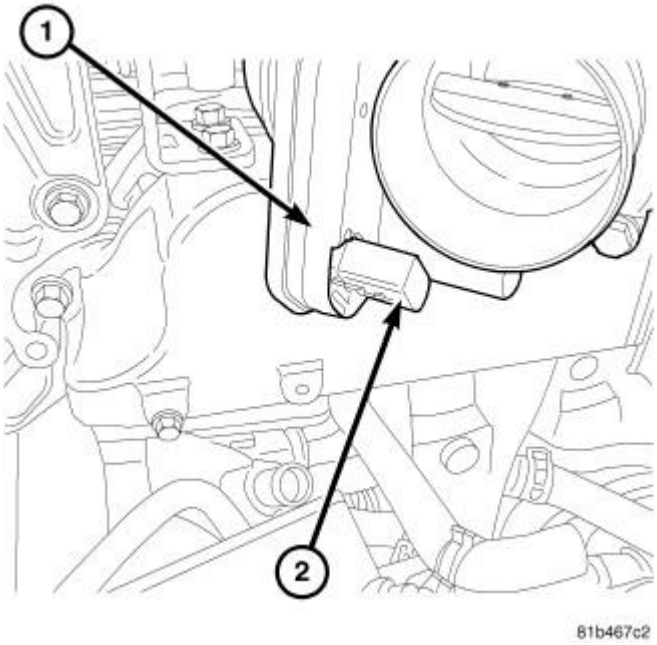

Fig. 296: ELECTRICAL CONNECTOR - EGR AIR VALVE
Courtesy of CHRYSLER LLC

25. Connect the EGR airflow control valve harness connector.

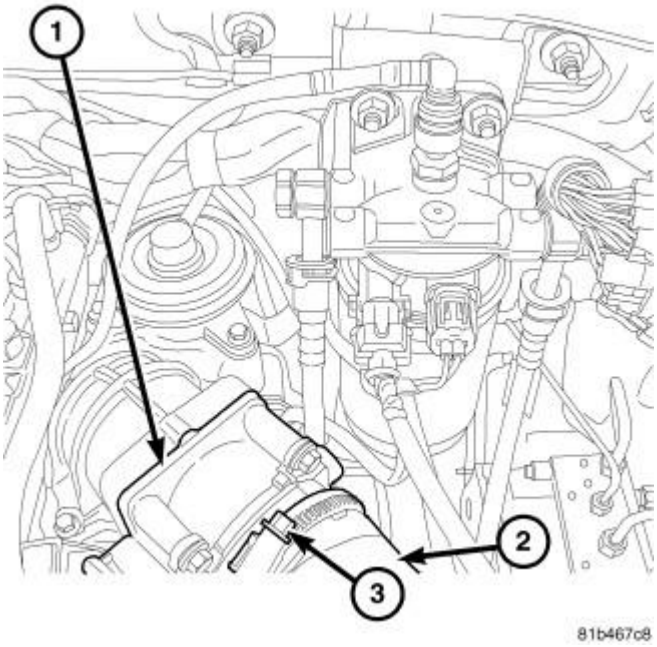

Fig. 297: AIR TUBE - EGR AIR VALVE
Courtesy of CHRYSLER LLC

26. Connect the EGR airflow control valve inlet hose (2) to EGR airflow control valve (1) and securely tighten clamp (3).

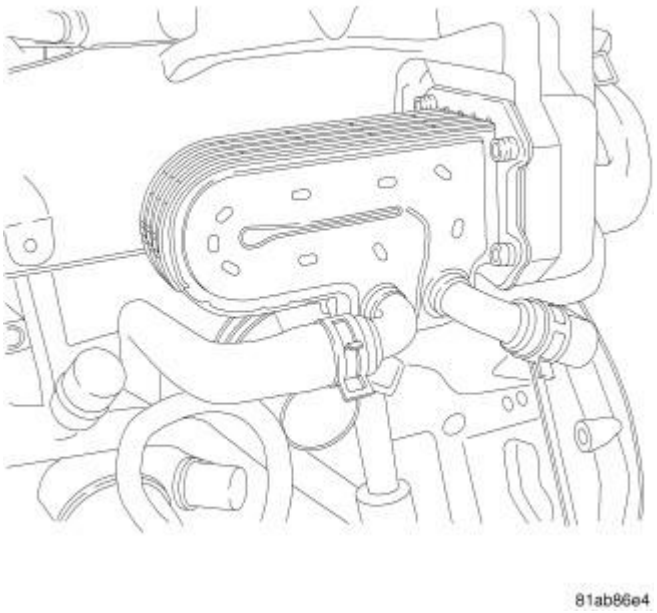

Fig. 298: EGR COOLER
Courtesy of CHRYSLER LLC

27. Connect the EGR valve vacuum tube.
28. Install the EGR cooler. Tighten to 10 N.m (89 in. lbs.).
29. Install the coolant hoses to the EGR cooler.
30. Connect upper radiator hose from thermostat housing.
31. Position the ground and starter harness cables and tighten bolt.
32. Install the starter. Refer to **Electrical/Starting/STARTER - Installation** .
33. On 4x4 models, Install the front axle. Refer to **Differential and Driveline/Front Axle - 186FIA - Installation** .
34. Install the lower radiator hose clip to fan shroud.
35. Fill the coolant. Refer to **Cooling - Standard Procedure** .
36. Install the engine silencer and the four retainers.
37. Install the engine cover.
38. Install the battery
39. Connect the positive and negative battery cable.

TURBOCHARGER SYSTEM

DESCRIPTION

DESCRIPTION

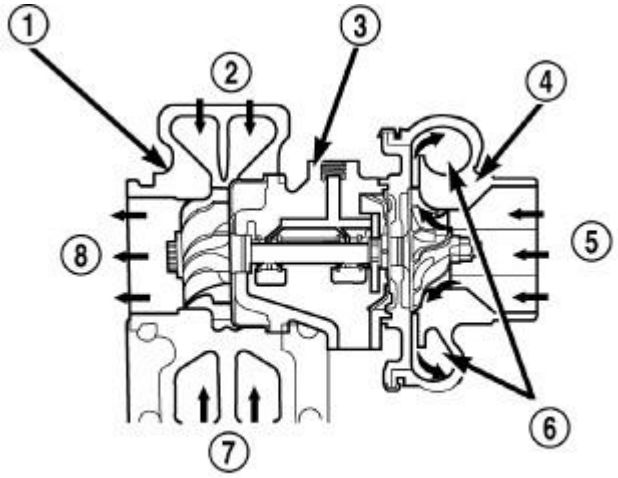

Fig. 299: Turbocharger Operation
Courtesy of CHRYSLER LLC

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

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

OPERATION

OPERATION

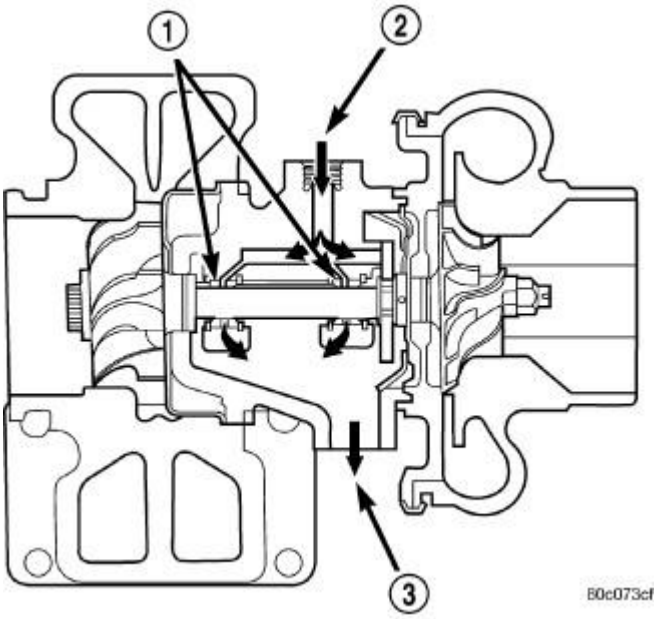

Fig. 300: Turbocharger Oil Supply and Drain
Courtesy of CHRYSLER LLC

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 . 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

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.

See **Engine/Turbocharger System/COOLER and HOSES, Charge Air - Diagnosis and Testing** for diagnosing of low or high boost pressure due to leaks.

REMOVAL

REMOVAL

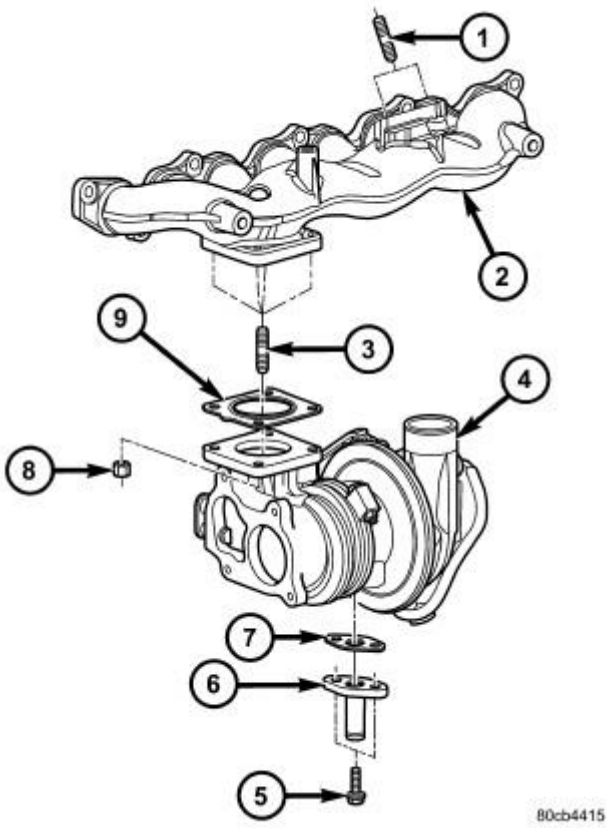

Fig. 301: EXHAUST MANIFOLD AND TURBOCHARGER ASSEMBLY
Courtesy of CHRYSLER LLC

1 - EGR VALVE MOUNTING STUDS
2 - EXHAUST MANIFOLD
3 - TURBOCHARGER TO EXHAUST MANIFOLD MOUNTING STUDS
4 - TURBOCHARGER ASSEMBLY
5 - TURBOCHARGER OIL RETURN FITTING ATTACHING BOLT
6 - TURBOCHARGER OIL RETURN FITTING
7 - OIL RETURN FITTING GASKET
8 - RETAINING NUT
9 - TURBOCHARGER TO EXHAUST MANIFOLD GASKET

1. Disconnect the negative battery cable.
2. Remove the air cleaner assembly. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.
3. Remove the charge air cooler inlet hose from the turbocharger (4). See **Engine/Turbocharger System/COOLER and HOSES, Charge Air - Removal**.

4. Drain the cooling system.
5. Remove the coolant recovery pressure container. Refer to **Cooling/Engine/BOTTLE, Coolant Recovery - Removal** .
6. Raise and support the vehicle.
7. Remove the lower splash shield. Refer to **Body/Exterior/SHIELD, Splash - Removal** .
8. Remove the exhaust manifold heat shield.
9. Remove the front catalytic converter from the turbocharger flange. Refer to **Exhaust System/CONVERTER, Catalytic - Removal** .
10. Disconnect the turbocharger module connector.
11. Remove the turbocharger support bracket.
12. Disconnect turbocharger oil return line at turbocharger.
13. Lower the vehicle.
14. Remove the turbocharger oil supply line.
15. Remove the turbocharger to exhaust manifold retaining nuts (8) and separate the turbocharger (4) and gasket (9) from the exhaust manifold (2).

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

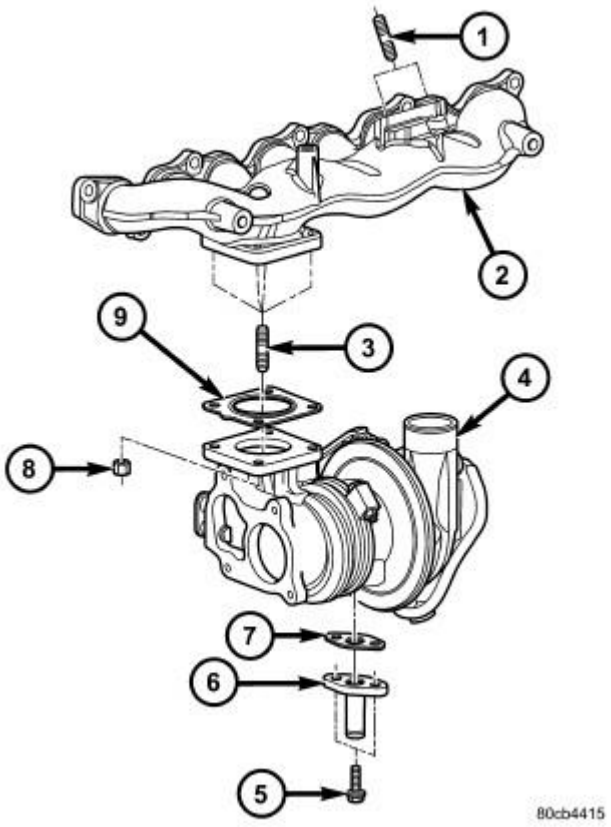

Fig. 302: EXHAUST MANIFOLD AND TURBOCHARGER ASSEMBLY
Courtesy of CHRYSLER LLC

1 - EGR VALVE MOUNTING STUDS
2 - EXHAUST MANIFOLD
3 - TURBOCHARGER TO EXHAUST MANIFOLD MOUNTING STUDS
4 - TURBOCHARGER ASSEMBLY
5 - TURBOCHARGER OIL RETURN FITTING ATTACHING BOLT
6 - TURBOCHARGER OIL RETURN FITTING
7 - OIL RETURN FITTING GASKET
8 - RETAINING NUT
9 - TURBOCHARGER TO EXHAUST MANIFOLD GASKET

1. Install the turbocharger assembly (4) to the exhaust manifold (2) with a new gasket (9). Torque the retaining nuts (8) to 32 N.m (24 ft. lbs.).
2. Connect the turbocharger oil supply line at turbocharger. Tighten the fitting to 24 N.m (18 ft. lbs.).
3. Raise and support the vehicle.
4. Connect the oil return line at the turbocharger. Tighten the fitting to 15 N.m (11 ft. lbs.).
5. Install the turbocharger support bracket. Tighten the bolts to 32 N.m (24 ft. lbs.).
6. Connect the turbocharger module connector.

7. Install the catalytic converter to the turbocharger flange. Refer to **Exhaust System/CONVERTER, Catalytic - Installation** .
8. Install the exhaust manifold heat shield. Tighten the retaining bolts to 24 N.m (18 ft. lbs.).
9. Install the lower splash shield. Refer to **Body/Exterior/SHIELD, Splash - Installation** .
10. Lower the vehicle.
11. Install the coolant recovery pressure container. Refer to **Cooling/Engine/BOTTLE, Coolant Recovery - Installation** .
12. Refill the cooling system. Refer to **Cooling - Standard Procedure** .
13. Connect the charge air cooler inlet hose to the turbocharger. See **Engine/Turbocharger System/COOLER and HOSES, Charge Air - Installation**.
14. Install the air cleaner assembly. See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.
15. Connect the negative battery cable.
16. Start engine and check for any leaks in the cooling, charge air cooling and exhaust systems. Fix any leaks as necessary. Refer to **Cooling - Diagnosis and Testing** . See **Engine/Turbocharger System/COOLER and HOSES, Charge Air - Diagnosis and Testing**. Refer to **Exhaust System - Diagnosis and Testing** .

COOLER AND HOSES, CHARGE AIR

Diagnosis and Testing

CHARGE AIR COOLER SYSTEM - LEAKS

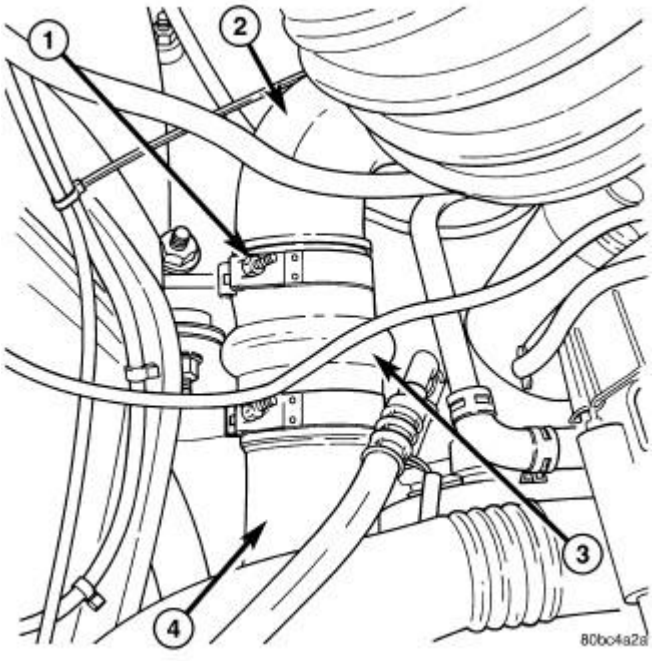

Fig. 303: AIR INLET DUCT RUBBER SLEEVE
Courtesy of CHRYSLER LLC

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 9022 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 9022 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

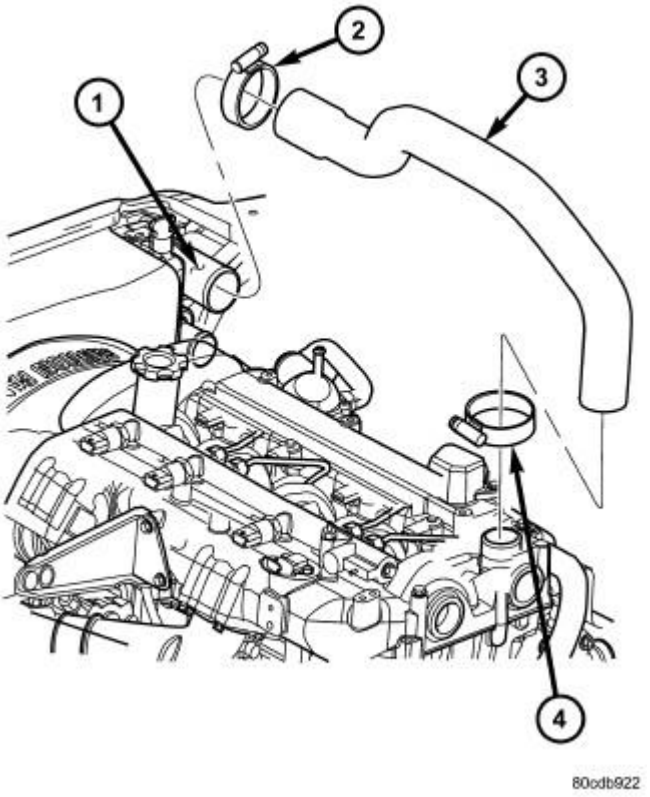

Fig. 304: CHARGE AIR COOLER INLET HOSE
Courtesy of CHRYSLER LLC

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

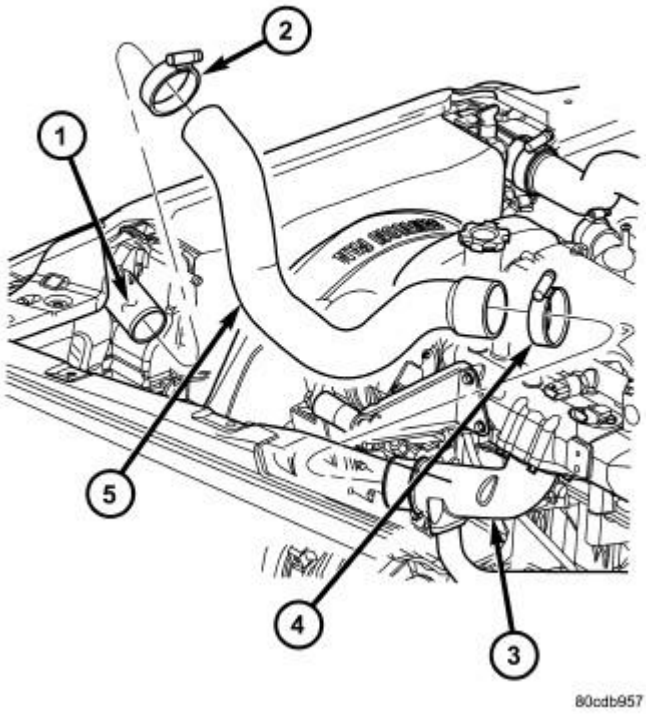

Fig. 305: CHARGE AIR COOLER OUTLET HOSE
Courtesy of CHRYSLER LLC

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) .
3. Remove hose (5) from CAC and intake manifold inlet .

Installation

INLET HOSE

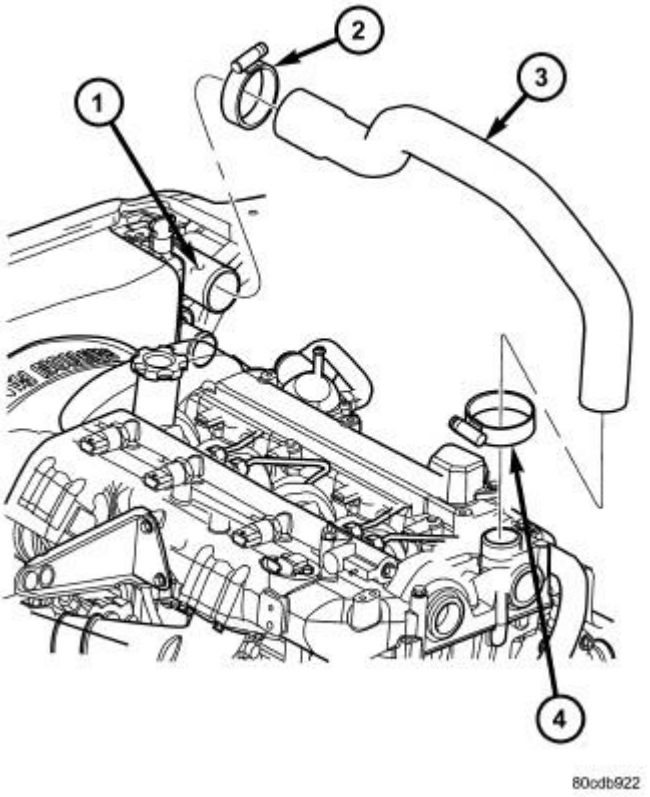

Fig. 306: CHARGE AIR COOLER INLET HOSE
Courtesy of CHRYSLER LLC

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

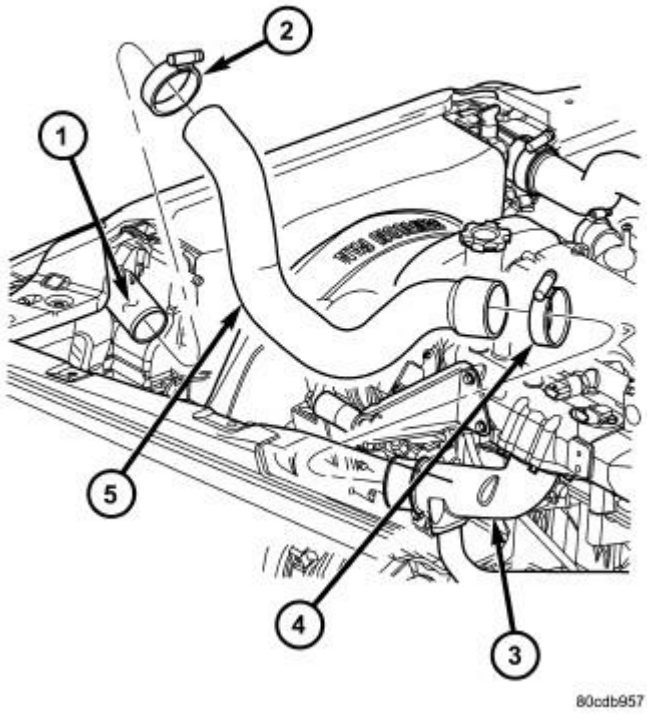

Fig. 307: CHARGE AIR COOLER OUTLET HOSE
Courtesy of CHRYSLER LLC

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

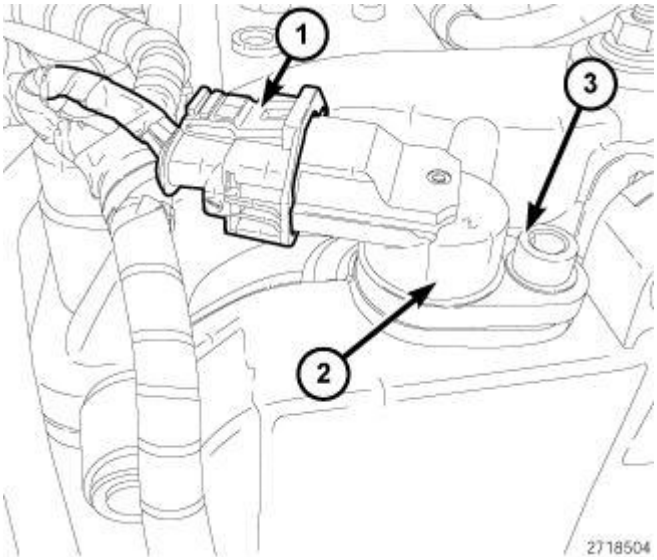

Fig. 308: CAMSHAFT POSITION SENSOR HARNESS CONNECTOR
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Disconnect the camshaft position sensor harness connector (1).
3. Remove bolt (3), the camshaft position sensor (2).

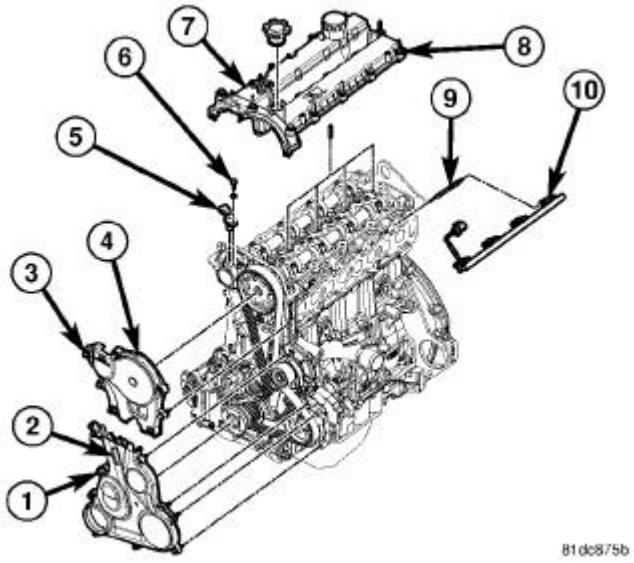

Fig. 309: CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

4. Remove the upper (4) and lower (2) front covers.

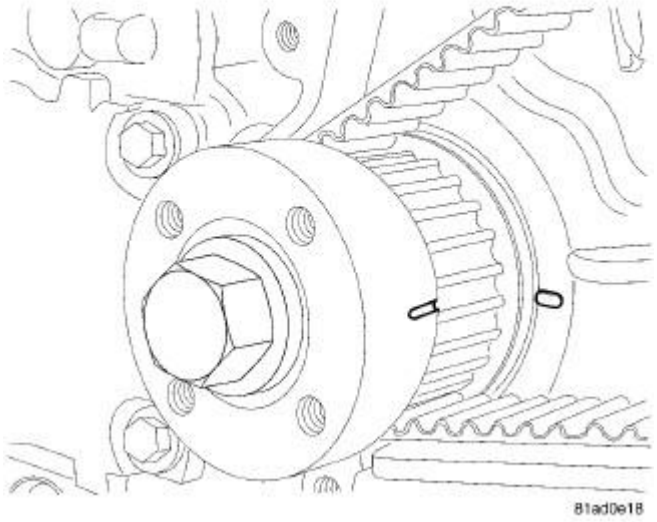

Fig. 310: CRANKSHAFT TIMING MARKS
Courtesy of CHRYSLER LLC

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

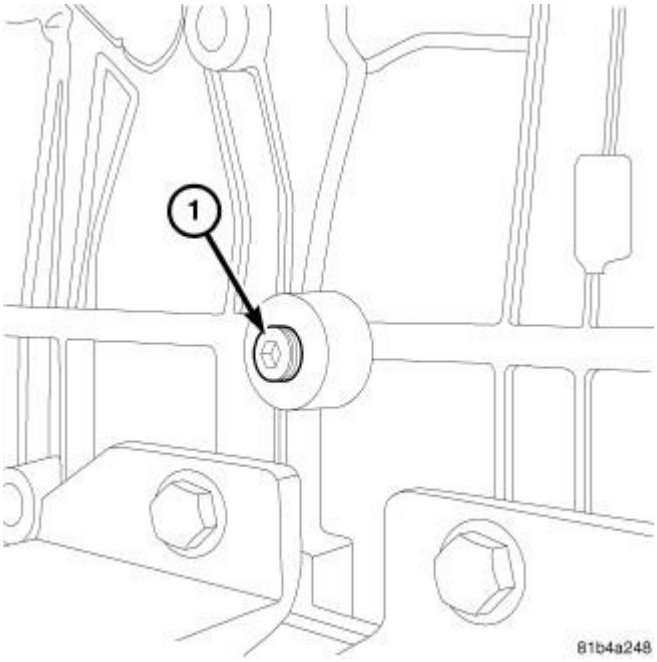

Fig. 311: CRANKSHAFT LOCK PLUG LOCATION
Courtesy of CHRYSLER LLC

6. Remove the engine block plug (1) for the crankshaft locking tool. The crankshaft locking tool is installed

in the left side of the engine slightly rearward of the engine mount.

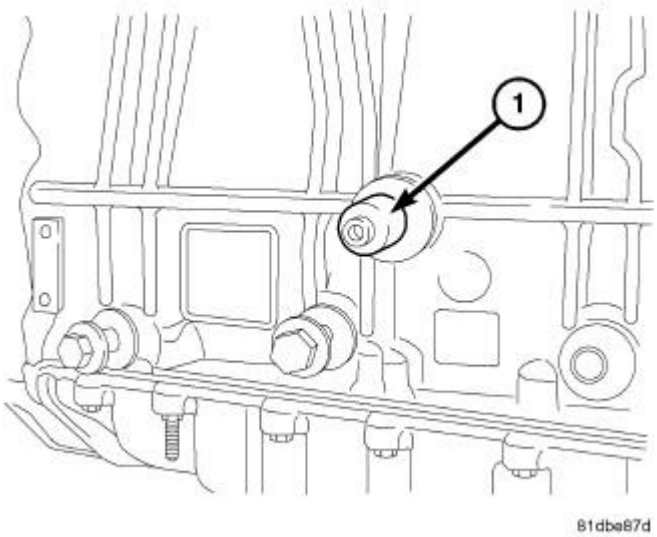

Fig. 312: CRANKSHAFT LOCKING TOOL
Courtesy of CHRYSLER LLC

7. Install the VM 9992 Crankshaft locking tool into the left 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

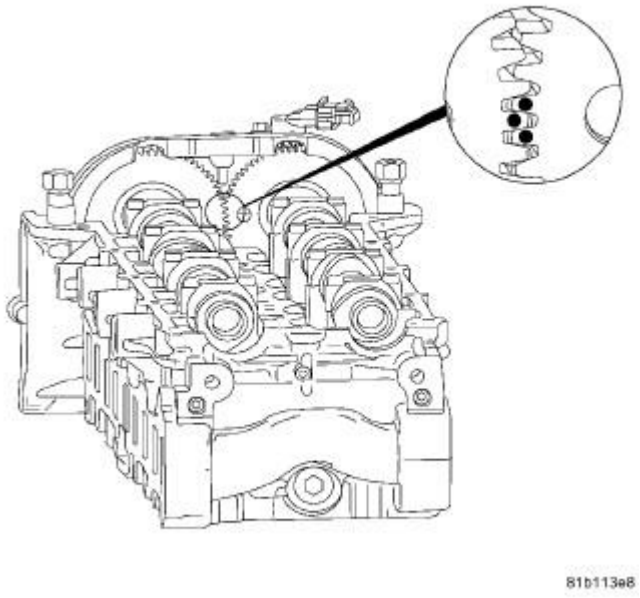

Fig. 313: CAMSHAFT TIMING DOTS

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.

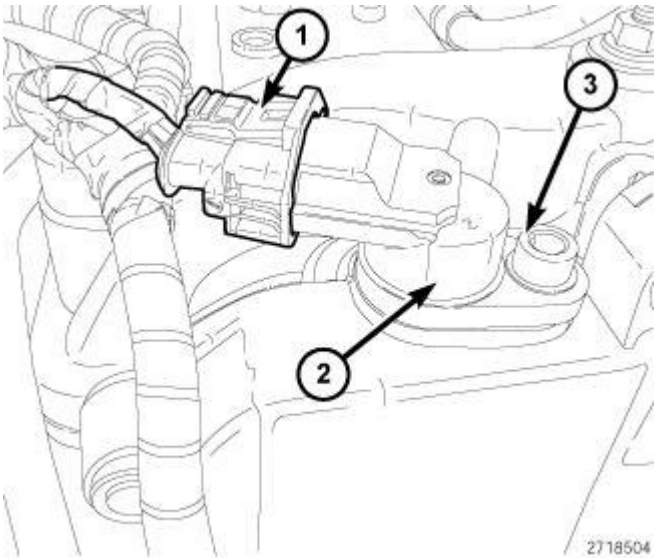

Fig. 314: CAMSHAFT POSITION SENSOR HARNESS CONNECTOR
Courtesy of CHRYSLER LLC

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

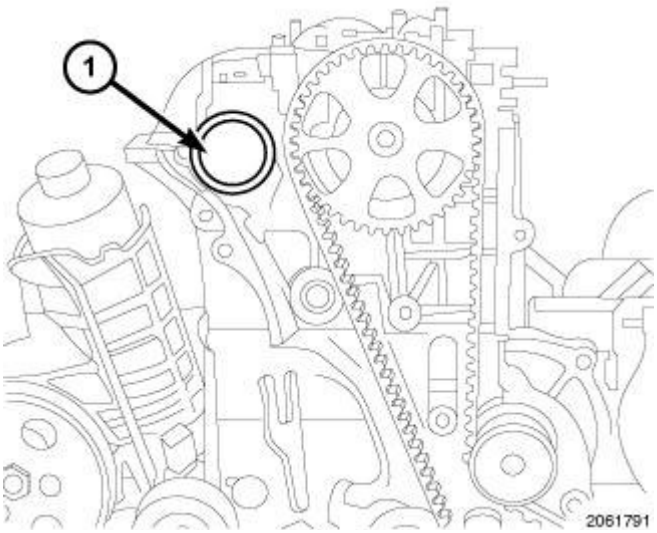

Fig. 315: EXHAUST CAMSHAFT OIL SEAL
Courtesy of CHRYSLER LLC

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

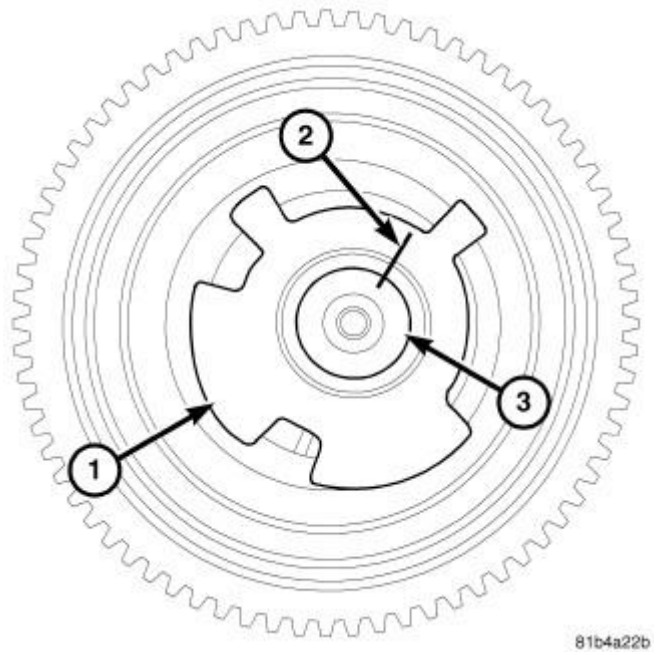

Fig. 316: Mark Camshaft Tone Wheel
Courtesy of CHRYSLER LLC

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

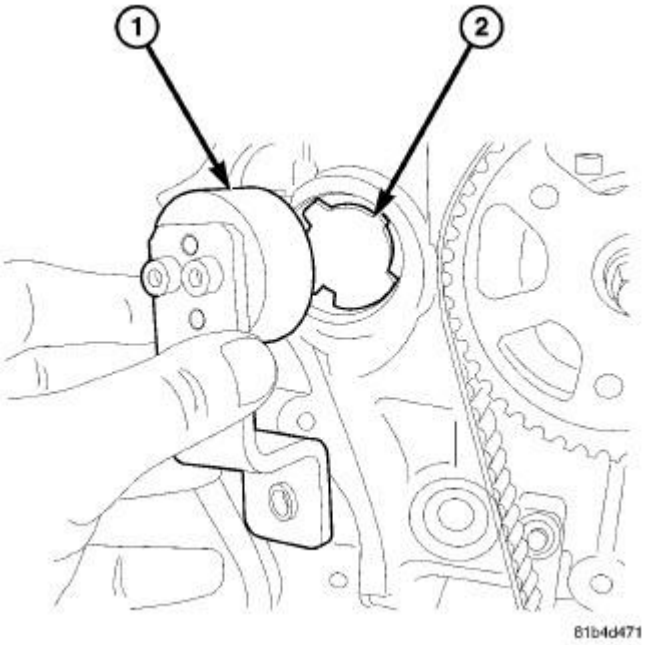

Fig. 317: INSTALLING CAMSHAFT LOCK TOOL
Courtesy of CHRYSLER LLC

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 VM. 9991 can be installed.
7. Install Camshaft Locking tool VM. 9991.

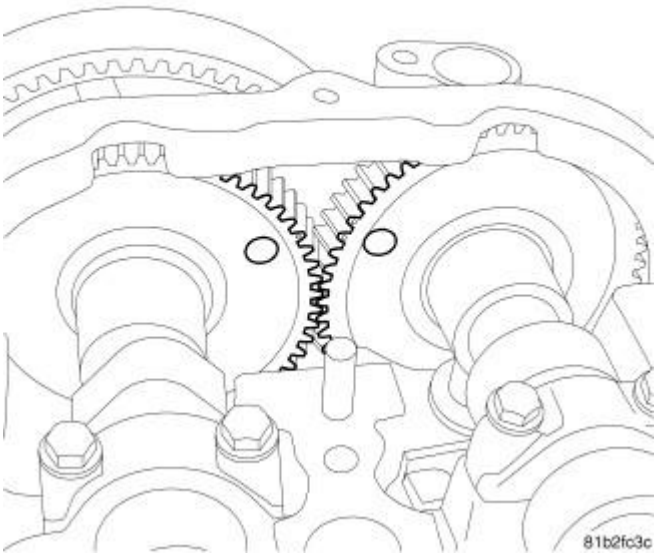

Fig. 318: CAMSHAFT MARKS AT 90° ATDC
Courtesy of CHRYSLER LLC

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

BELT, TIMING

Removal

REMOVAL

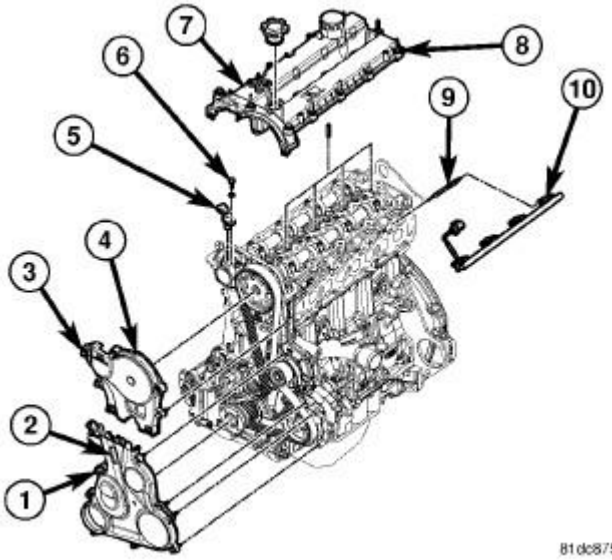

Fig. 319: CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

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

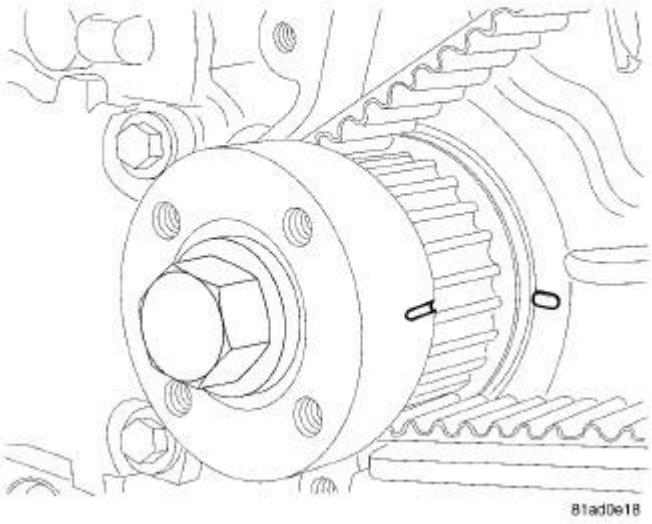

Fig. 320: CRANKSHAFT TIMING MARK
Courtesy of CHRYSLER LLC

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.

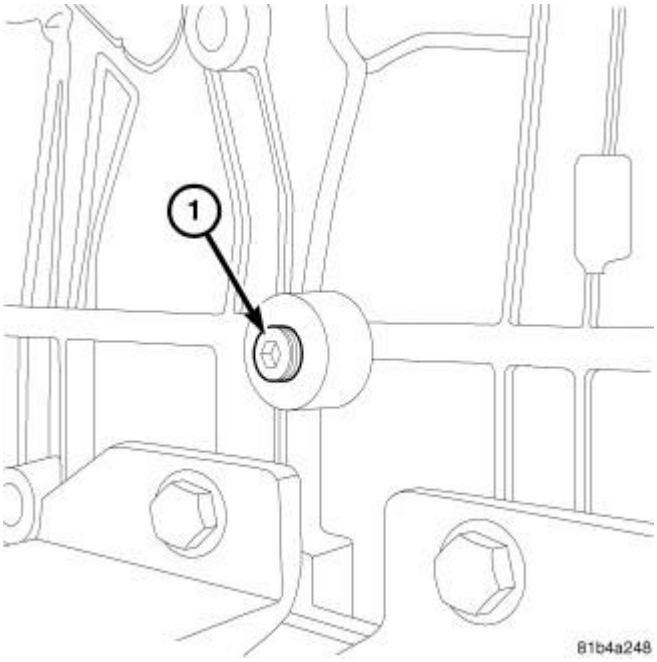

Fig. 321: CRANKSHAFT LOCK PLUG LOCATION
Courtesy of CHRYSLER LLC

5. Remove the engine block plug (1).

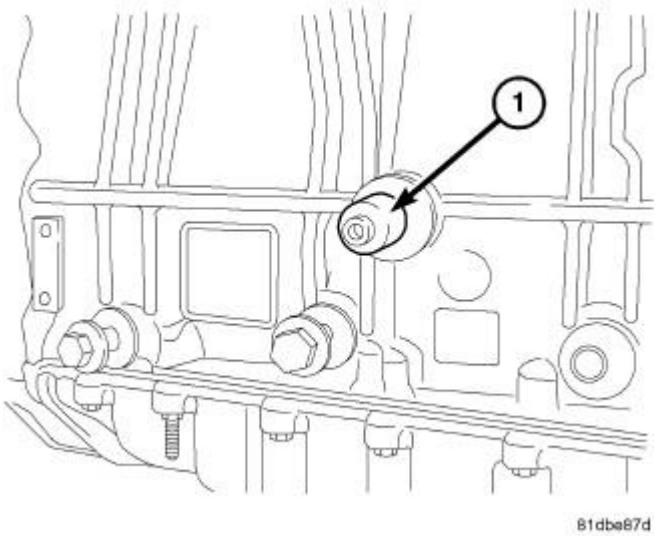

Fig. 322: CRANKSHAFT LOCKING TOOL
Courtesy of CHRYSLER LLC

6. Install the Crankshaft Locking tool VM 9992 (1).

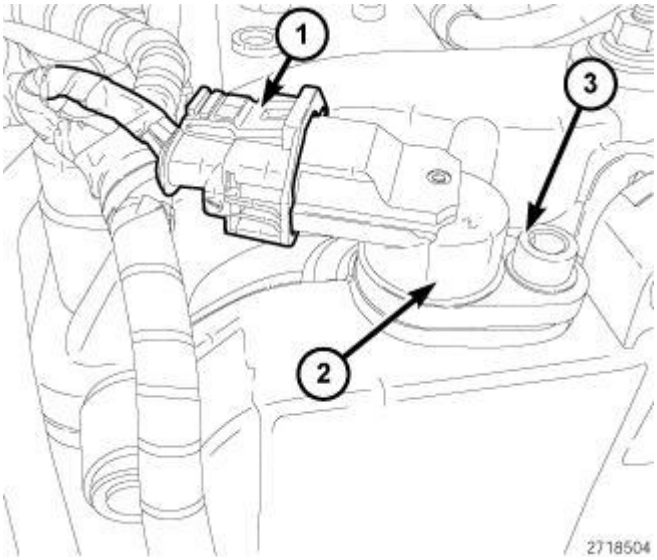

Fig. 323: CAMSHAFT POSITION SENSOR HARNESS CONNECTOR
Courtesy of CHRYSLER LLC

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

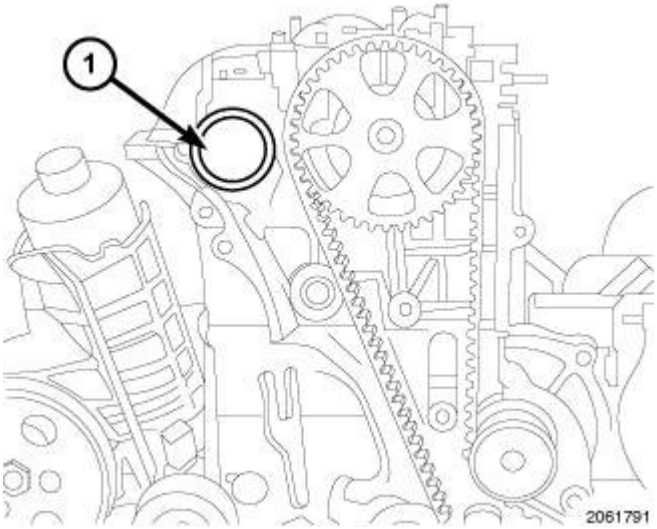

Fig. 324: EXHAUST CAMSHAFT OIL SEAL
Courtesy of CHRYSLER LLC

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

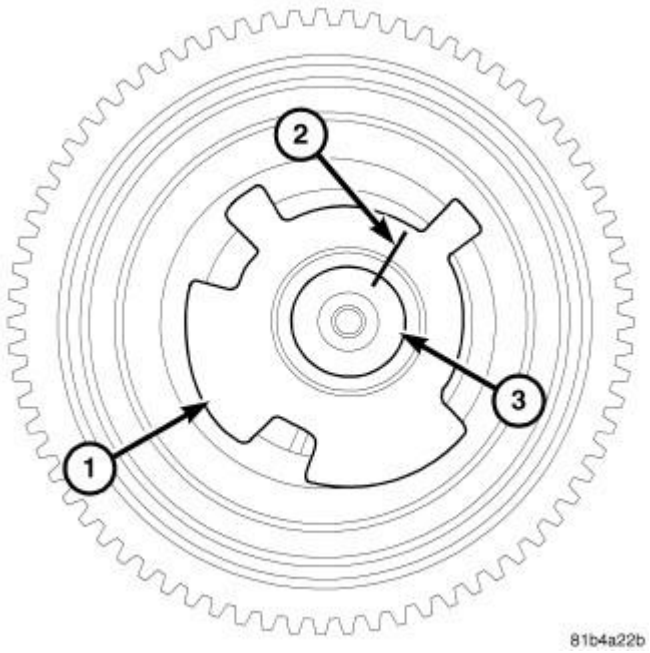

Fig. 325: Mark Camshaft Tone Wheel
Courtesy of CHRYSLER LLC

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

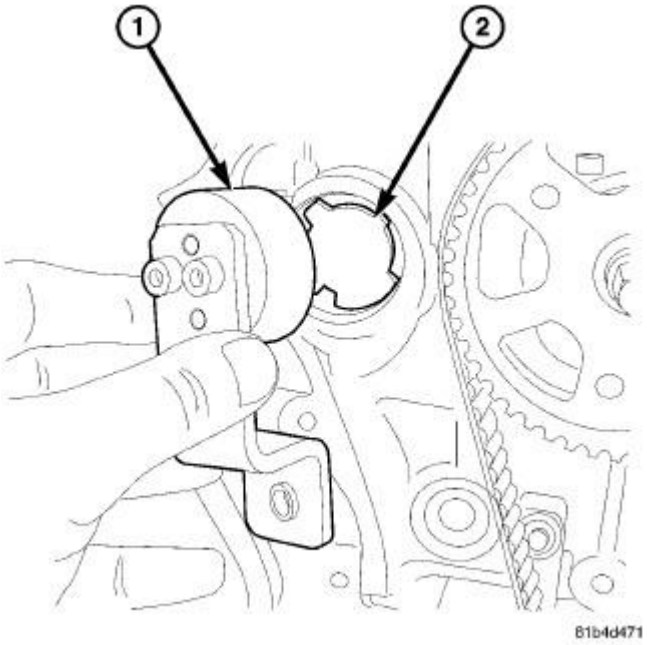

Fig. 326: INSTALLING CAMSHAFT LOCK TOOL
Courtesy of CHRYSLER LLC

11. Install the Camshaft Locking Tool VM. 9991 (1).

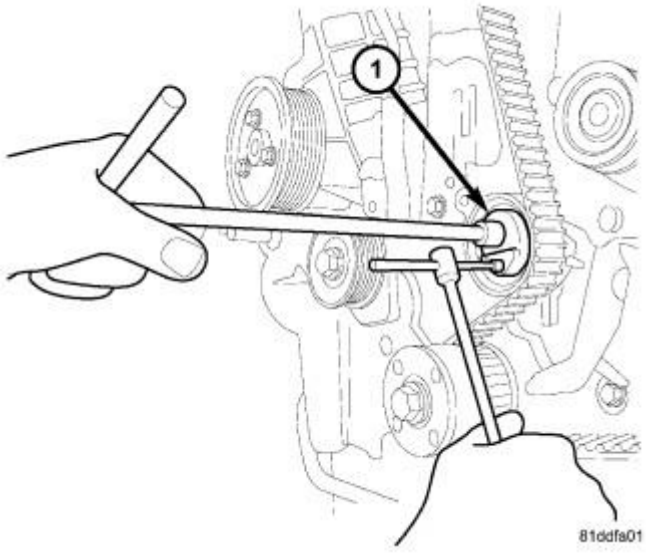

Fig. 327: TIMING BELT TENSIONER TIGHTEN
Courtesy of CHRYSLER LLC

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

Installation

INSTALLATION

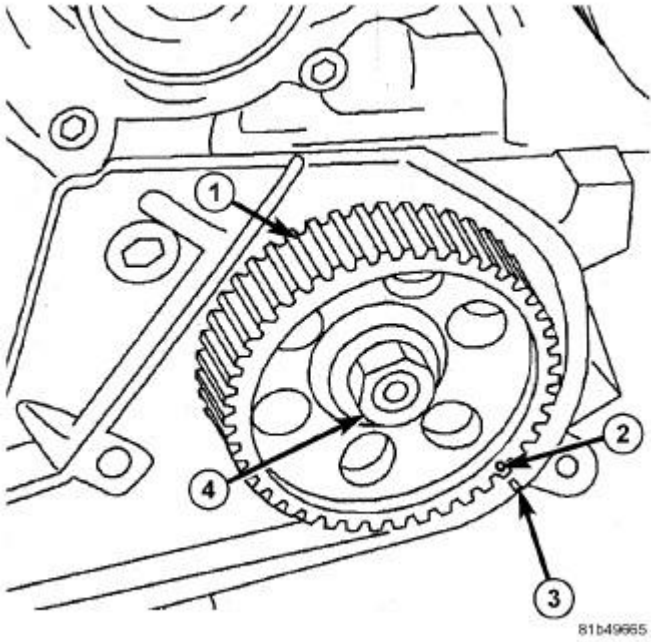

Fig. 328: FUEL INJECTION PUMP TIMING MARKS
Courtesy of CHRYSLER LLC

1. Align the high pressure fuel pump sprocket timing mark (2) with the timing mark (3) on the block.

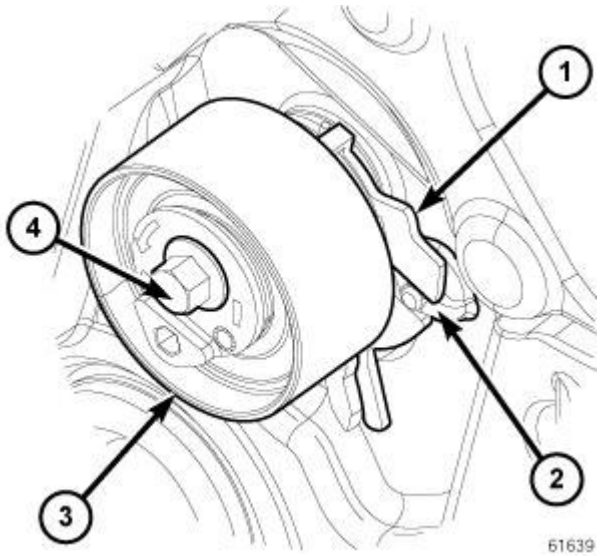

Fig. 329: TIMING BELT TENSIONER
Courtesy of CHRYSLER LLC

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

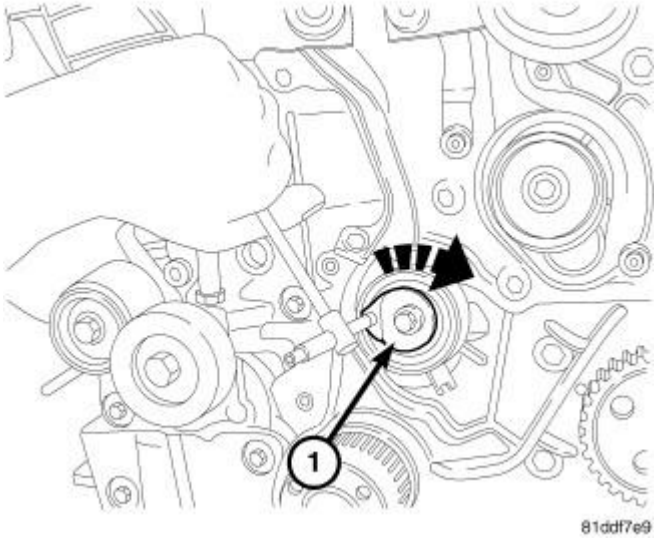

Fig. 330: TIMING BELT TENSIONER ADJUSTMENT
Courtesy of CHRYSLER LLC

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

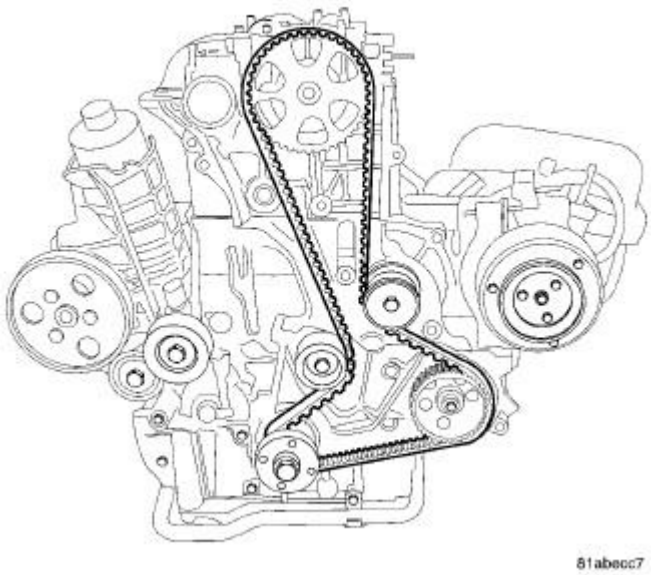

Fig. 331: TIMING BELT
Courtesy of CHRYSLER LLC

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:

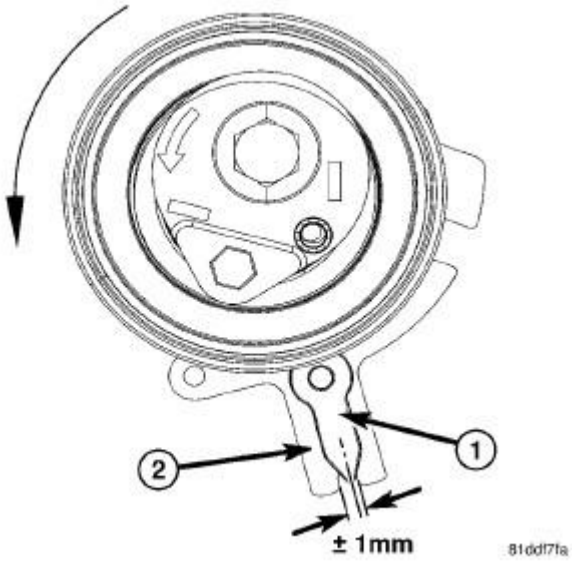

Fig. 332: Identifying Tensioner Indicator & Tensioner Gage Slot
Courtesy of CHRYSLER LLC

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.

- Crankshaft sprocket (1)
- High pressure fuel pump (2)
- Water pump pulley (3)
- Intake camshaft pulley (4)
- Timing belt tensioner (5).

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

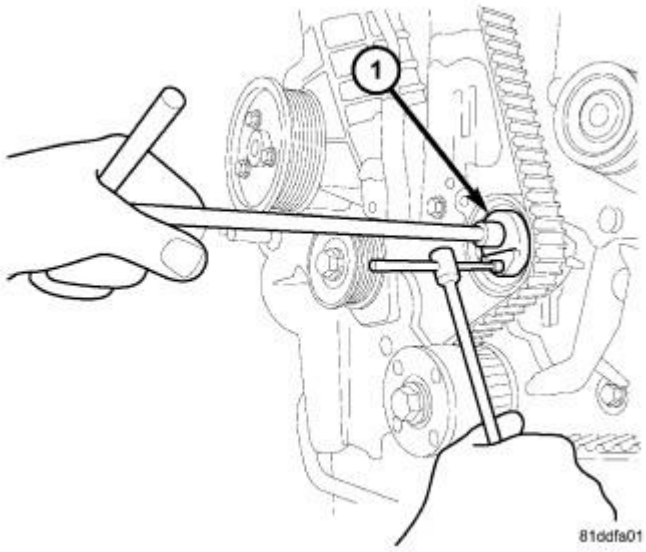

Fig. 333: TIMING BELT TENSIONER TIGHTEN
Courtesy of CHRYSLER LLC

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

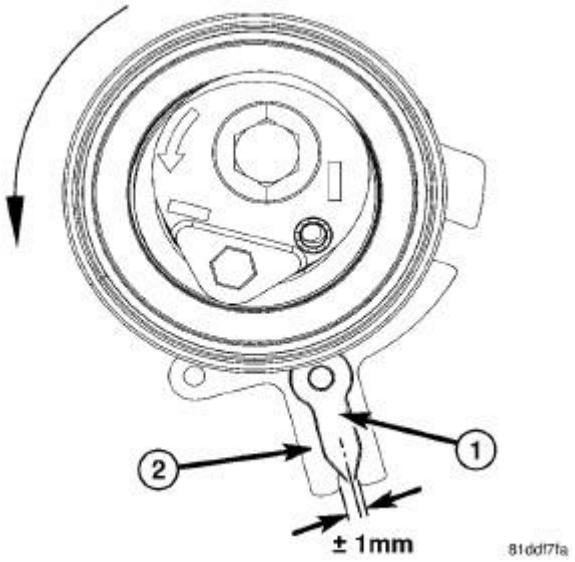

Fig. 334: TIMING BELT TENSIONER MARKS
Courtesy of CHRYSLER LLC

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. See **Engine/Valve Timing/TENSIONER, Engine Timing - Adjustments**.

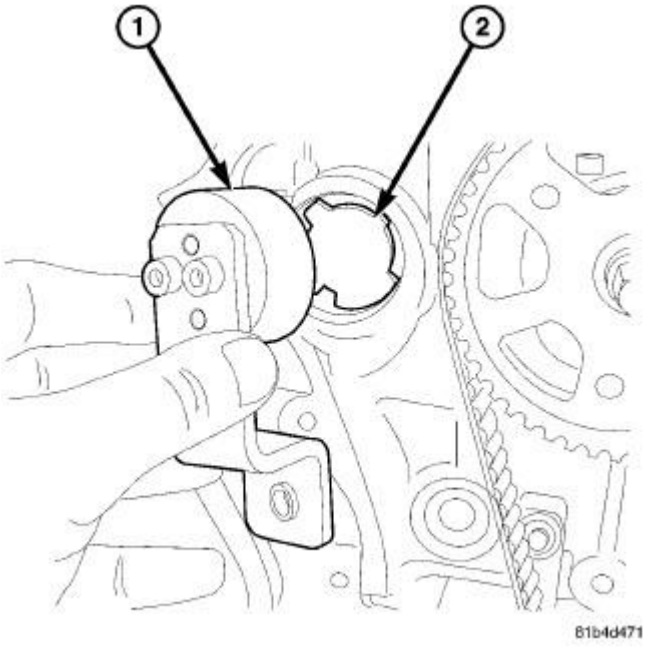

Fig. 335: INSTALLING CAMSHAFT LOCK TOOL
Courtesy of CHRYSLER LLC

8. Remove the Camshaft Locking tool VM 9991(1).

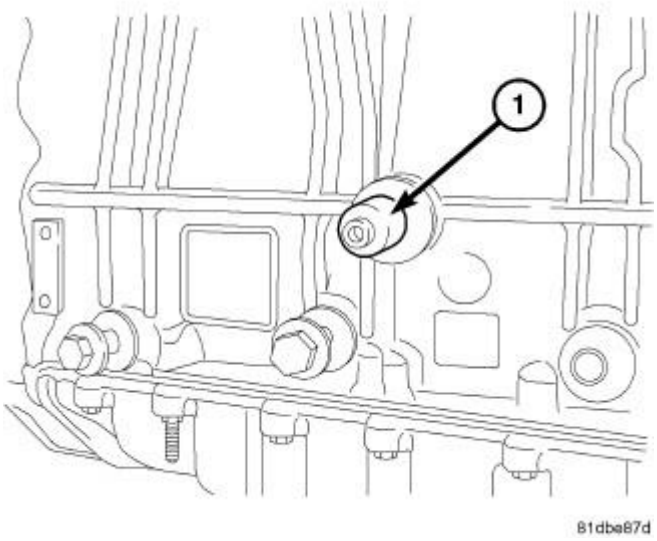

Fig. 336: CRANKSHAFT LOCKING TOOL
Courtesy of CHRYSLER LLC

9. Remove the crankshaft locking tool VM 9992 (1).

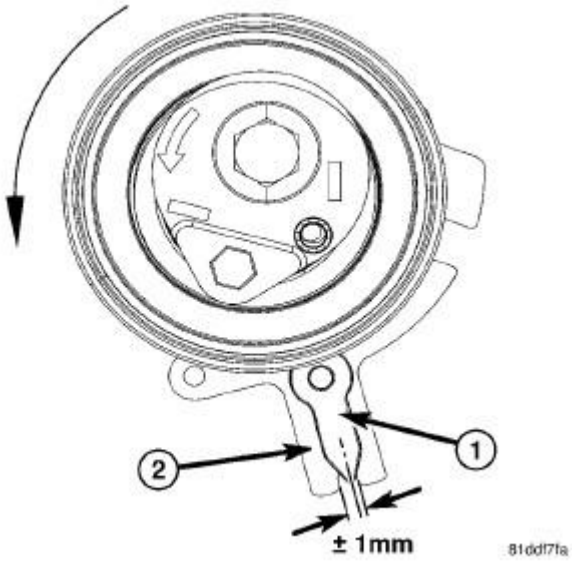

Fig. 337: Identifying Tensioner Indicator & Tensioner Gage Slot
Courtesy of CHRYSLER LLC

NOTE: In order to rotate the engine, the camshaft locking tool VM. 9991 and the crankshaft locking tool VM. 9992 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.

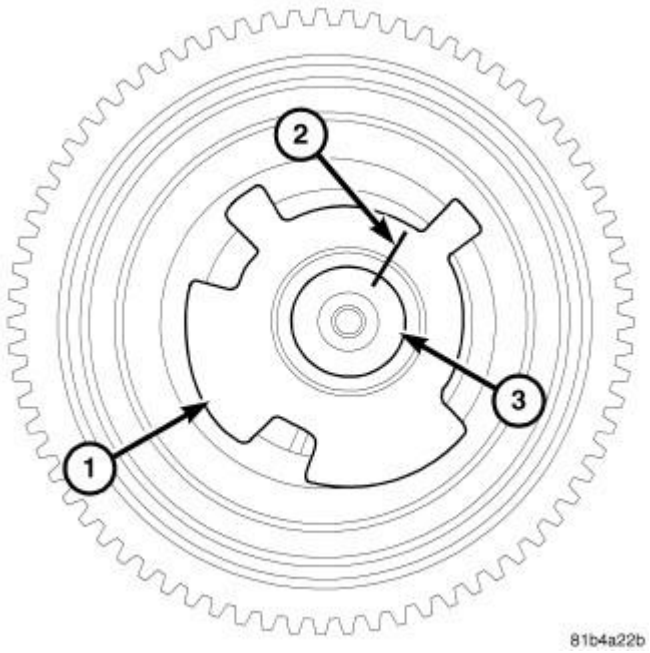

Fig. 338: Mark Camshaft Tone Wheel
Courtesy of CHRYSLER LLC

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.

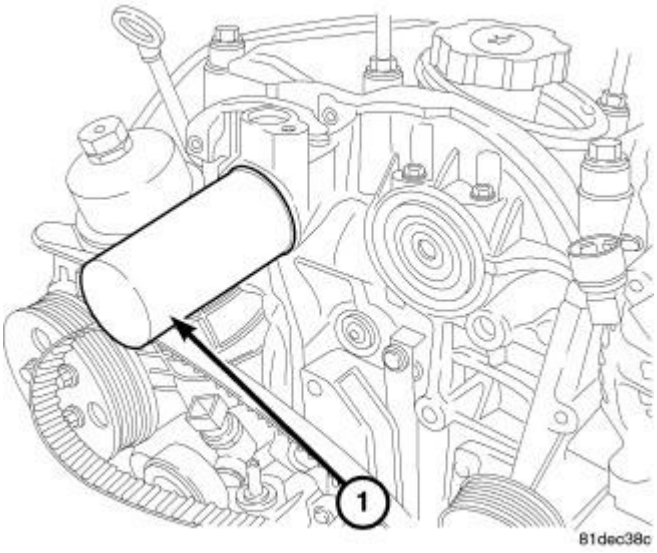

Fig. 339: CAMSHAFT OIL SEAL
Courtesy of CHRYSLER LLC

12. Use VM. 1057-2 seal installer to install the exhaust cam cap.

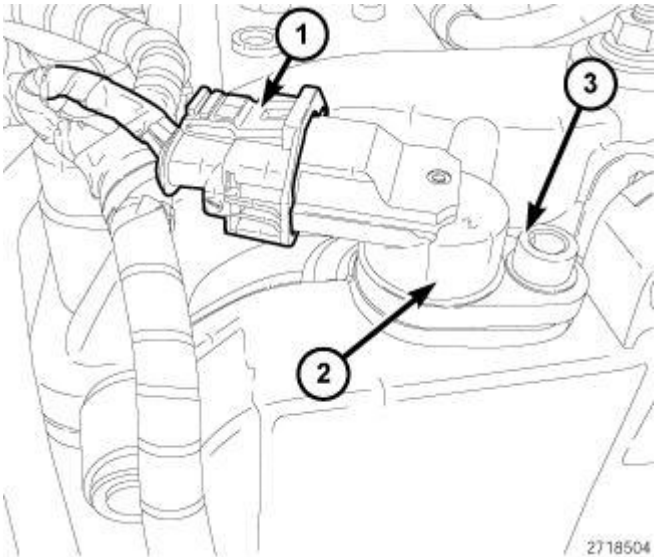

Fig. 340: CAMSHAFT POSITION SENSOR HARNESS CONNECTOR
Courtesy of CHRYSLER LLC

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).

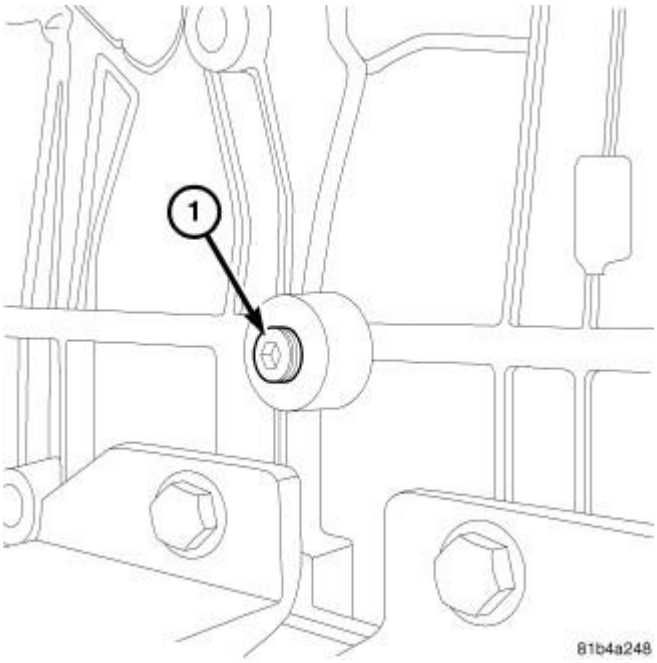

Fig. 341: CRANKSHAFT LOCK PLUG LOCATION
Courtesy of CHRYSLER LLC

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

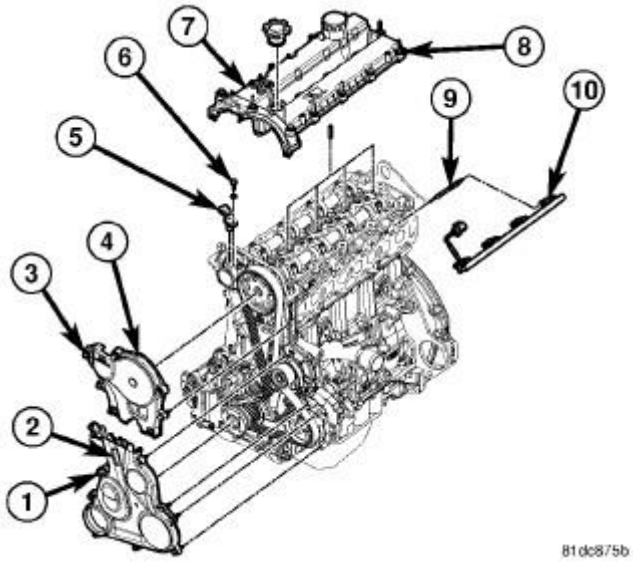

Fig. 342: CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

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

COVER(S), ENGINE TIMING

Removal

TIMING BELT INNER COVER

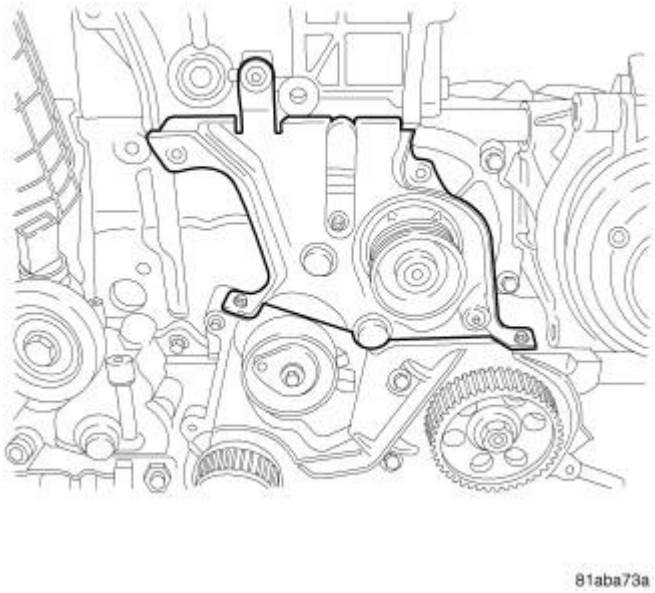

Fig. 343: INNER FRONT COVER
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery.
2. Remove the upper and lower outer front covers. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.
3. Remove the timing belt. See **Engine/Valve Timing/SPROCKET(S), Timing Belt and Chain - Removal**.
4. Remove bolt and the inner front belt cover.

UPPER AND LOWER TIMING BELT OUTER COVERS

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. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.
5. Drain the cooling system. Refer to **Cooling - 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.

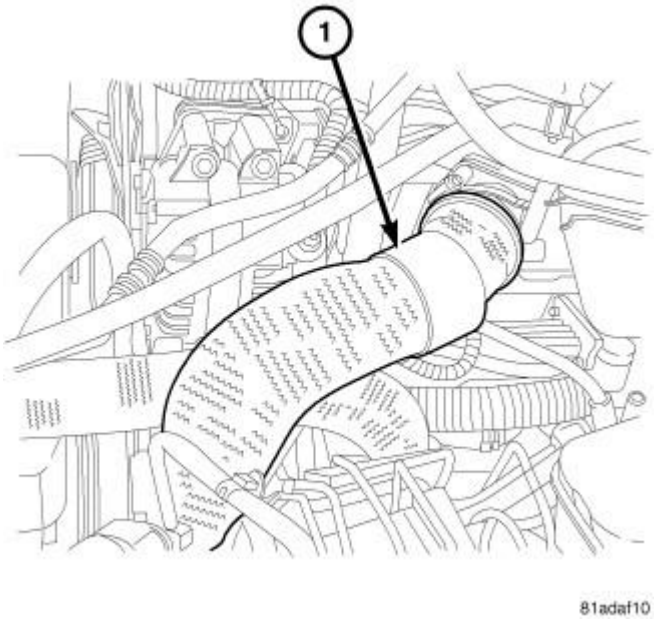

Fig. 344: Charge Outlet Hose
Courtesy of CHRYSLER LLC

9. Remove bolts and the windshield washer reservoir (Refer to **RESERVOIR, WINDSHIELD WASHER**).
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 **Cooling/Engine/FAN, Cooling - Removal** .

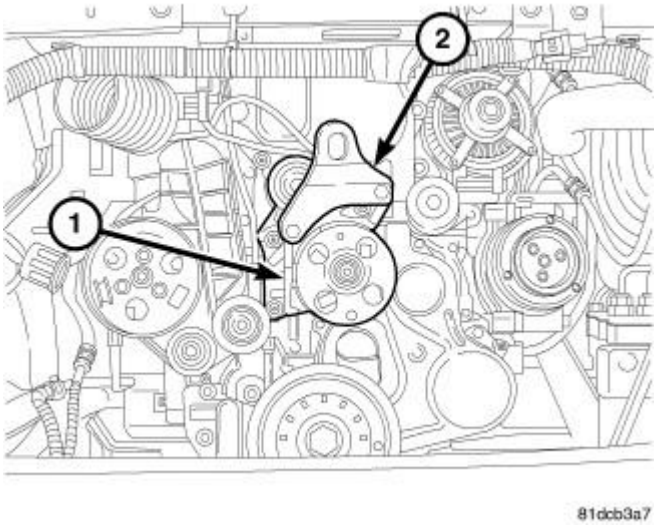

Fig. 345: Accessory Pulley & Engine Lifting Bracket

Courtesy of CHRYSLER LLC

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

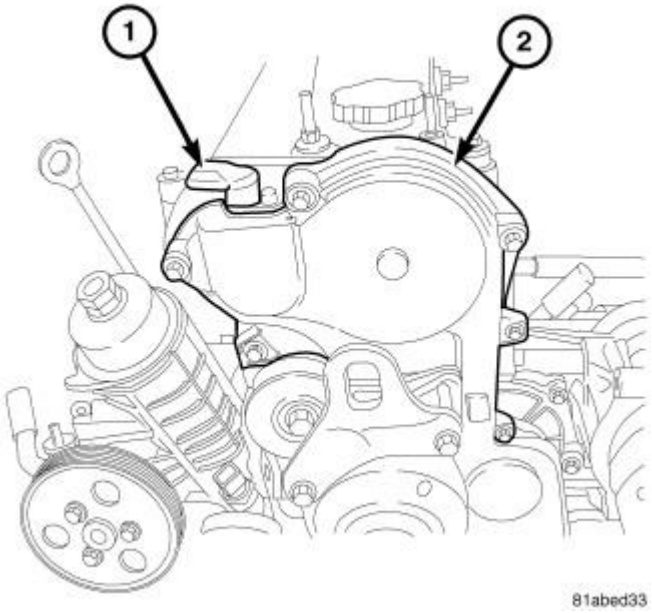

Fig. 346: UPPER FRONT COVER
Courtesy of CHRYSLER LLC

18. Remove the upper front cover (2).

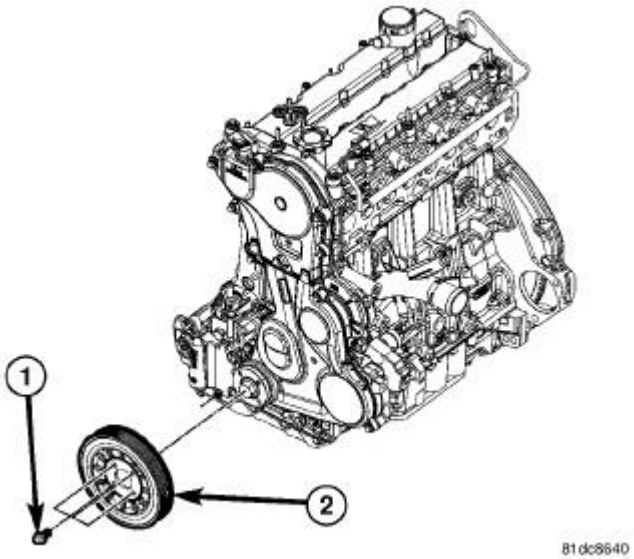

Fig. 347: Crankshaft Damper & Bolt

Courtesy of CHRYSLER LLC

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

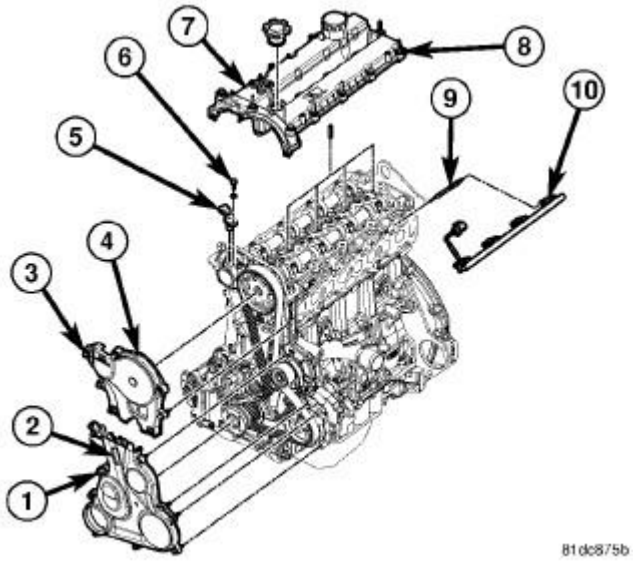

Fig. 348: CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

20. Remove the lower front cover (2).

Installation

TIMING BELT INNER COVER

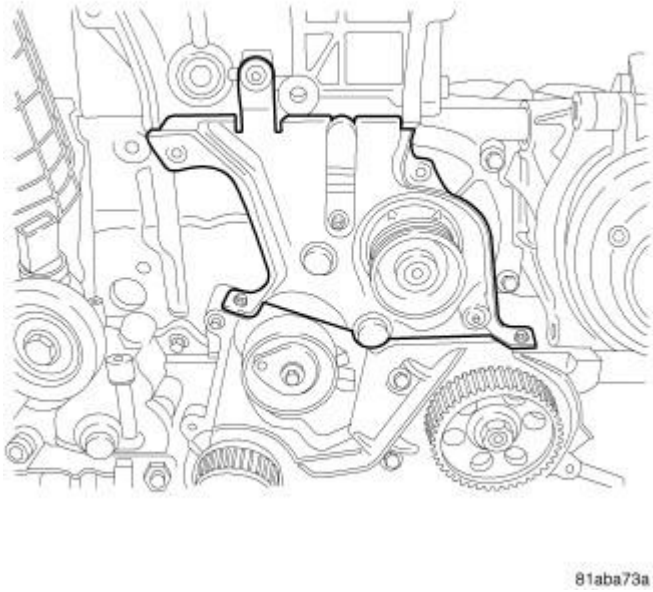

Fig. 349: INNER FRONT COVER
Courtesy of CHRYSLER LLC

1. Install the inner front cover. Tighten the bolts to 11 N.m (97 in. lbs.).
2. Install the timing belt. See **Engine/Valve Timing/SPROCKET(S), Timing Belt and Chain - Installation**.
3. Install the upper and lower outer front covers. See **Engine/Valve Timing/COVER(S), Engine Timing - Installation**.
4. Install the accessory drive belt.
5. Connect negative battery cable.

UPPER AND LOWER OUTER TIMING BELT COVERS

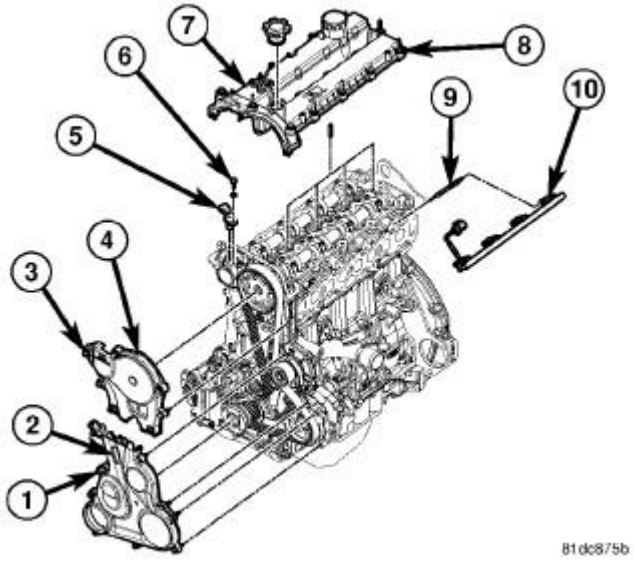

Fig. 350: CYLINDER HEAD COVER
Courtesy of CHRYSLER LLC

1. Install the lower front cover (2). Tighten the bolts to 11 N.m (97 in. lbs.).

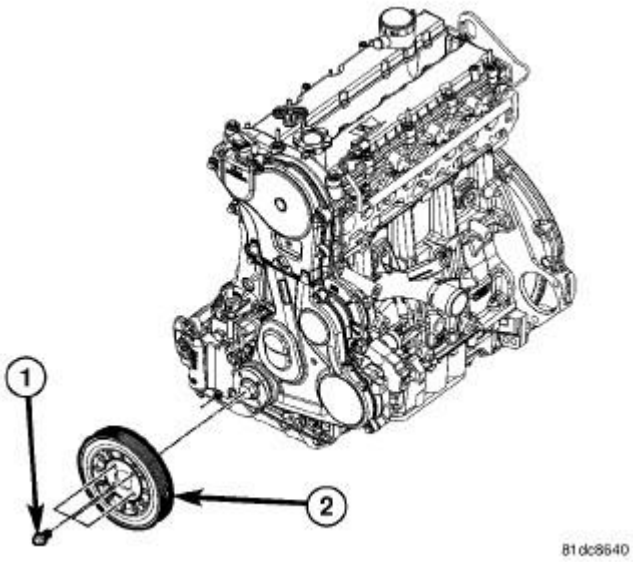

Fig. 351: Crankshaft Damper & Bolt
Courtesy of CHRYSLER LLC

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

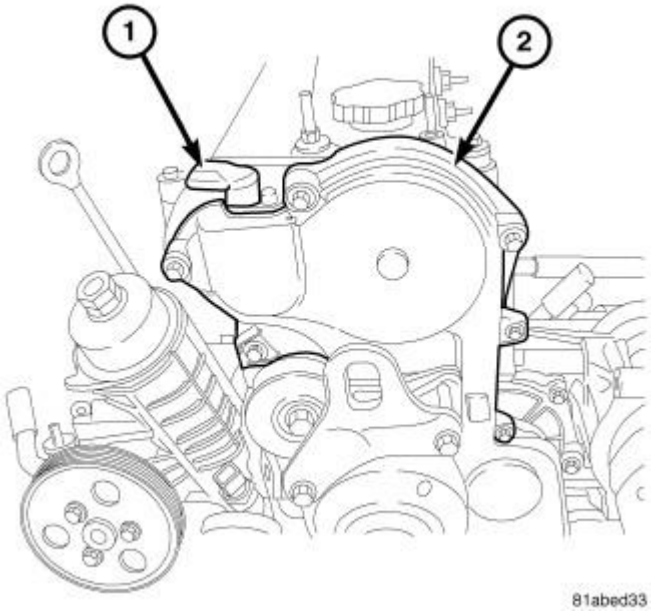

Fig. 352: UPPER FRONT COVER
Courtesy of CHRYSLER LLC

3. Install the upper front cover (2). Tighten the bolts to 11 N.m (97 in. lbs.).

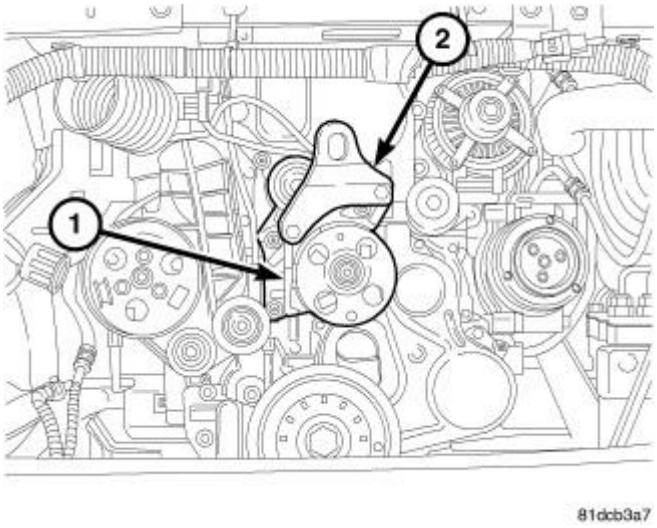

Fig. 353: Accessory Pulley & Engine Lifting Bracket
Courtesy of CHRYSLER LLC

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 **Cooling/Accessory Drive/BELT, Serpentine - Installation** .
7. Install the viscous fan assembly. Refer to **Cooling/Engine/FAN, Cooling - 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 (Refer to **RESERVOIR, WINDSHIELD WASHER**).
13. Install the three wire harness retainers.

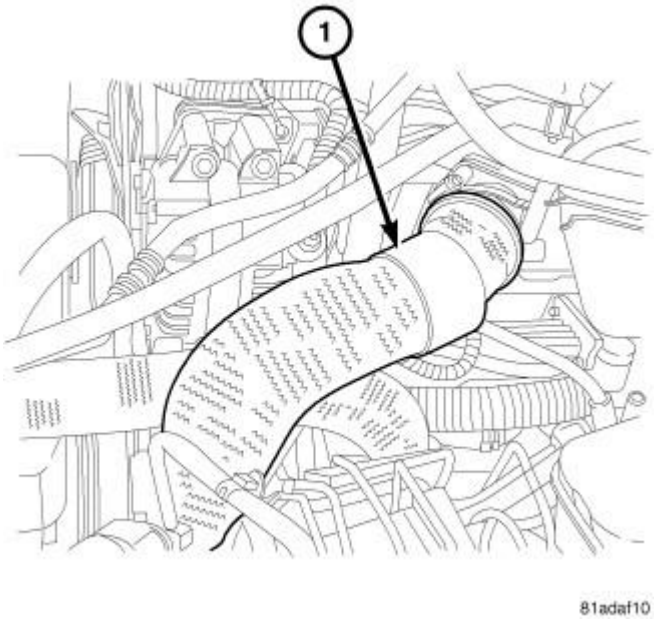

Fig. 354: Charge Outlet Hose
Courtesy of CHRYSLER LLC

14. Install the charge outlet hose to EGR air flow control valve.
15. Install lower radiator hose clip to fan shroud.
16. Fill the cooling system. Refer to **Cooling - Standard Procedure** .
17. Install the air cleaner body. See **Engine/Air Intake System/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

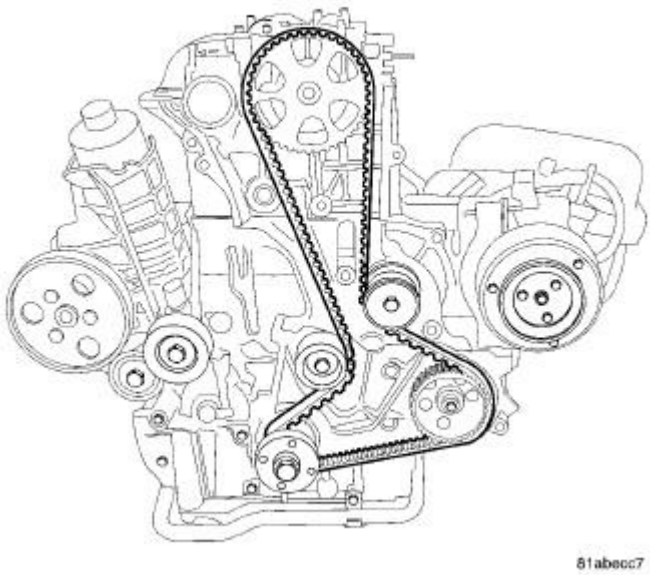

Fig. 355: TIMING BELT
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove the timing belt. See **Engine/Valve Timing/BELT, Timing - Removal**.

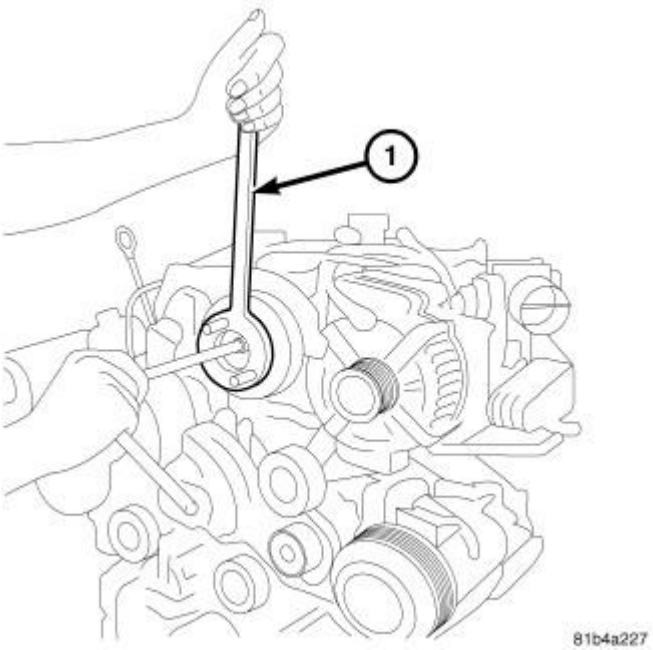

Fig. 356: REMOVE/INSTALL CAMSHAFT SPROCKET BOLT
Courtesy of CHRYSLER LLC

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

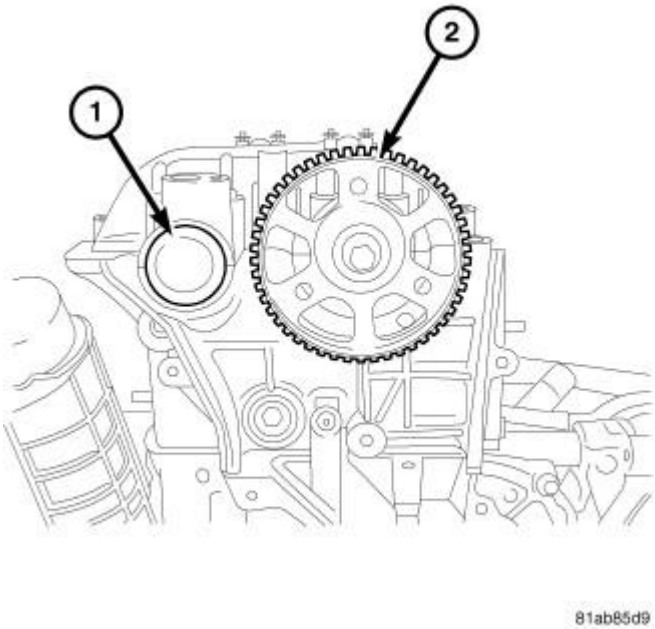

Fig. 357: Intake Camshaft Sprocket
Courtesy of CHRYSLER LLC

4. Remove the intake camshaft sprocket.

CRANKSHAFT SPROCKET

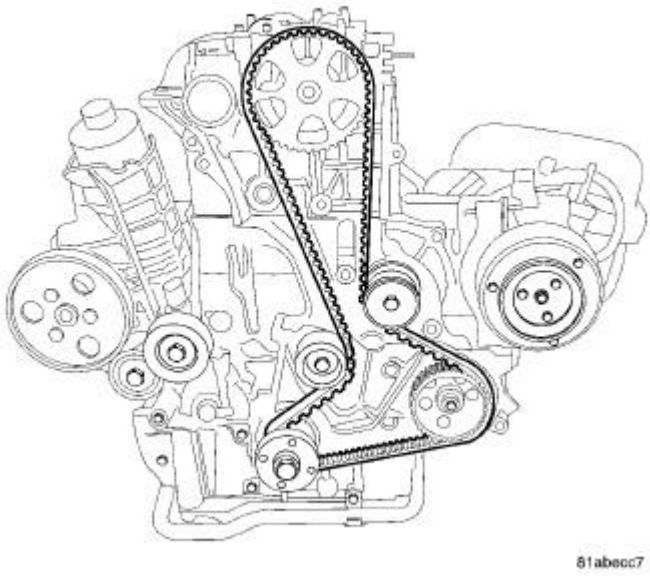

Fig. 358: TIMING BELT
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove the timing belt. See **Engine/Valve Timing/BELT, Timing - Removal**.

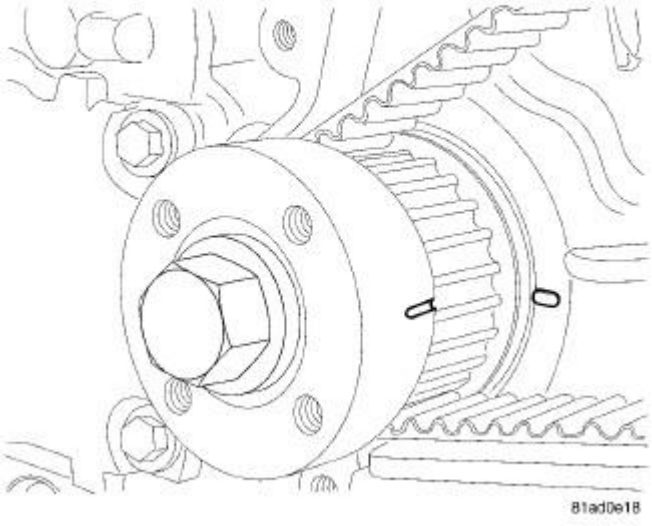

Fig. 359: CRANKSHAFT TIMING MARKS
Courtesy of CHRYSLER LLC

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

3. Remove bolt and the crankshaft sprocket.

Installation

CAMSHAFT SPROCKET

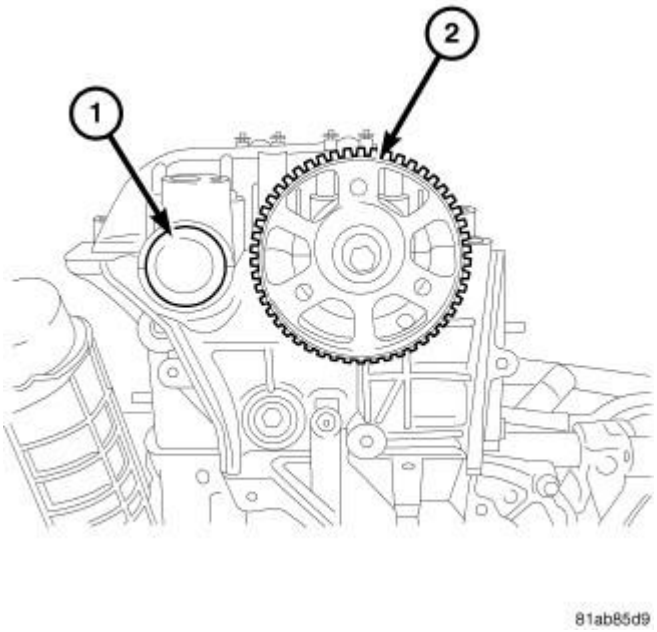

Fig. 360: Intake Camshaft Sprocket
Courtesy of CHRYSLER LLC

1. Install the camshaft sprocket (2).

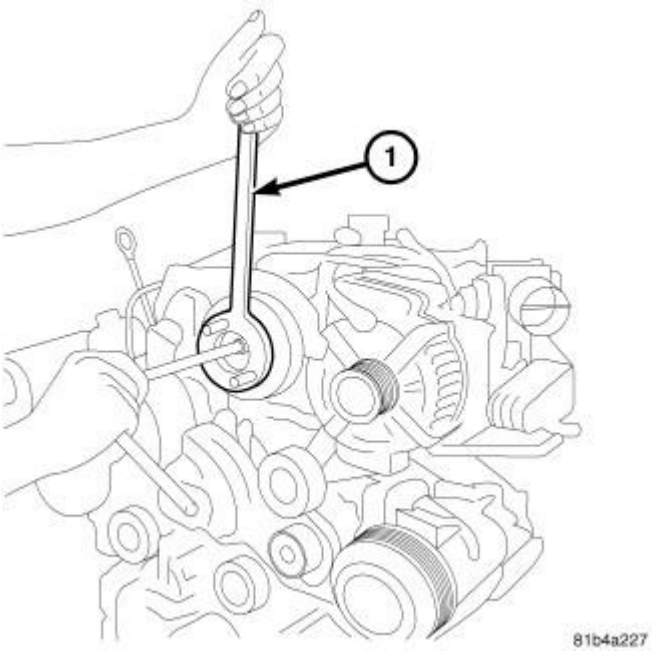

Fig. 361: REMOVE/INSTALL CAMSHAFT SPROCKET BOLT
Courtesy of CHRYSLER LLC

2. Using the Locking tool VM 1055 (1) to hold the camshaft sprocket, tighten bolt to 64 N.m (47 ft. lbs.).
3. Install the timing belt. See **Engine/Valve Timing/SPROCKET(S), Timing Belt and Chain - Installation**.

4. Connect negative battery cable.

CRANKSHAFT SPROCKET

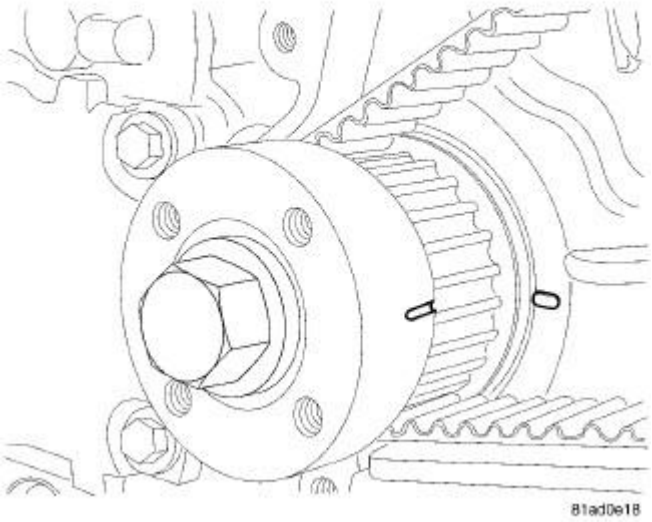

Fig. 362: CRANKSHAFT TIMING MARKS
Courtesy of CHRYSLER LLC

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.

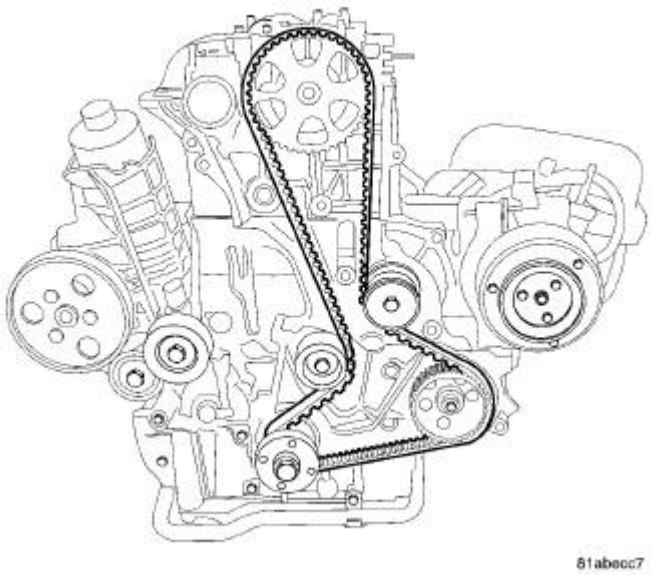

Fig. 363: TIMING BELT
Courtesy of CHRYSLER LLC

2. Install the timing belt. See **Engine/Valve Timing/BELT, Timing - Installation**.
3. Connect the negative battery cable.

TENSIONER, ENGINE TIMING

Removal

REMOVAL

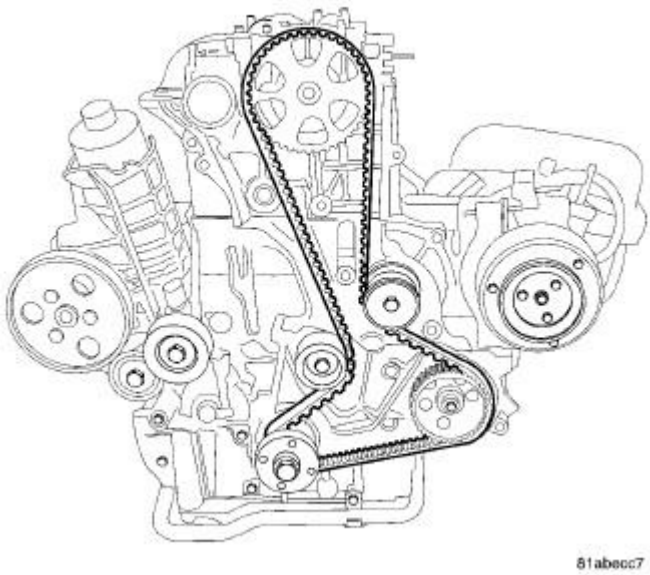

Fig. 364: TIMING BELT
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove the timing. See **Engine/Valve Timing/BELT, Timing - Removal**.

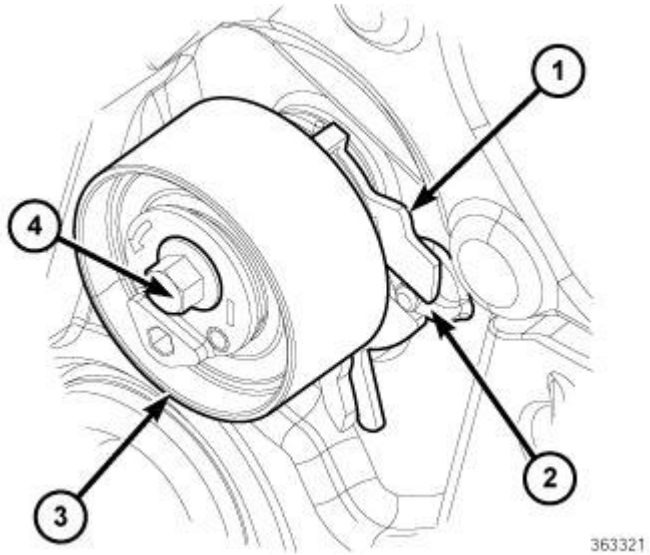

Fig. 365: TIMING BELT TENSIONER
Courtesy of CHRYSLER LLC

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

Installation

INSTALLATION

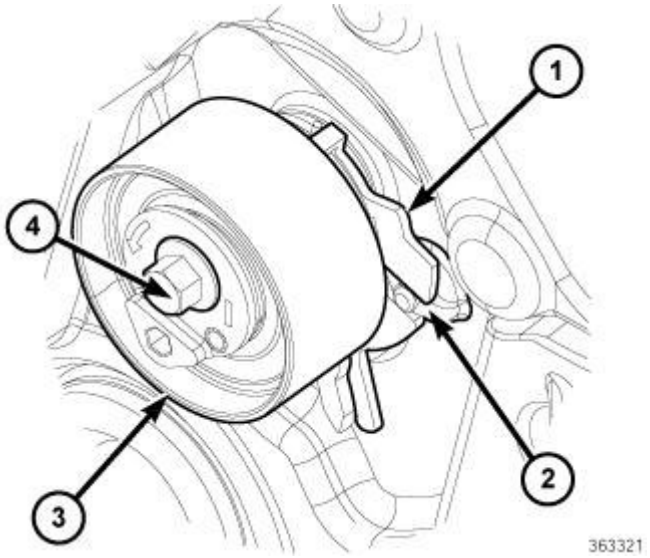

Fig. 366: TIMING BELT TENSIONER
Courtesy of CHRYSLER LLC

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.

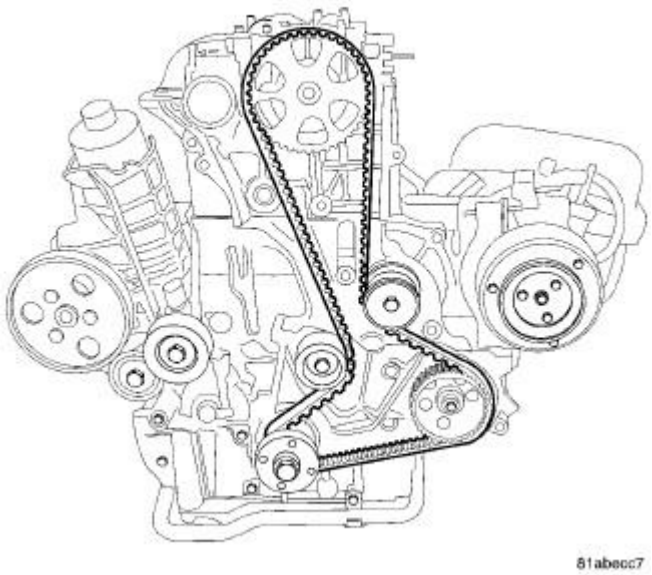

Fig. 367: TIMING BELT
Courtesy of CHRYSLER LLC

2. If the timing belt. See **Engine/Valve Timing/BELT, Timing - Installation**.

3. Connect the negative battery cable.

Adjustments

ADJUSTMENT

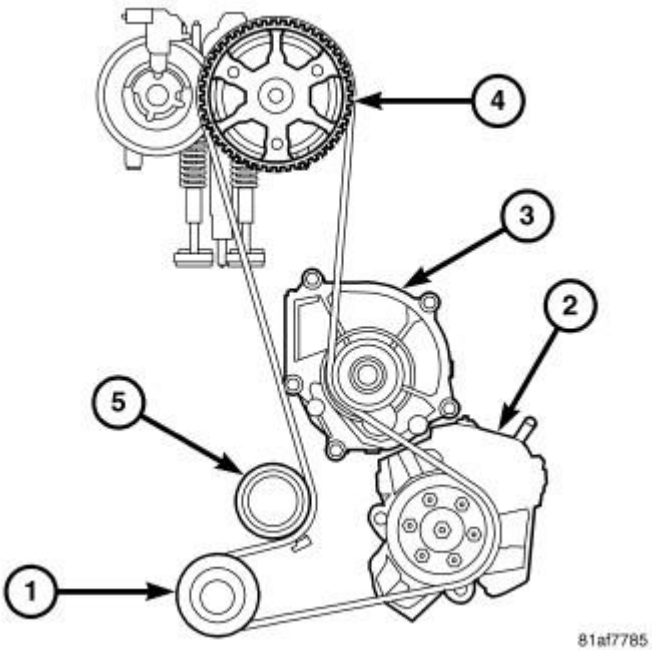

Fig. 368: TIMING BELT TENSIONER
Courtesy of CHRYSLER LLC

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

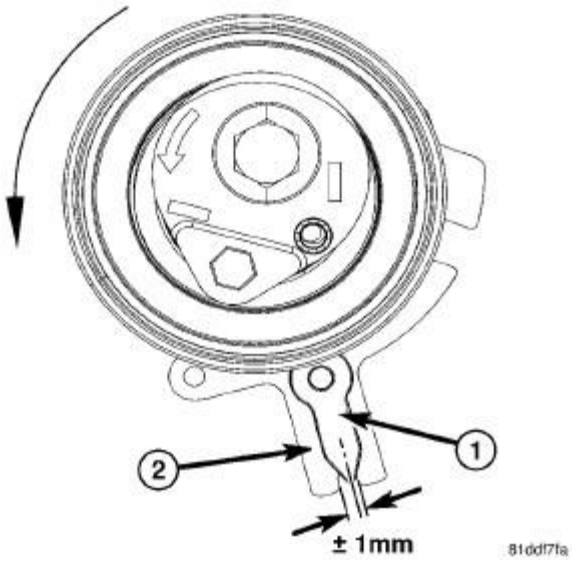

Fig. 369: Identifying Tensioner Indicator & Tensioner Gage Slot

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.).

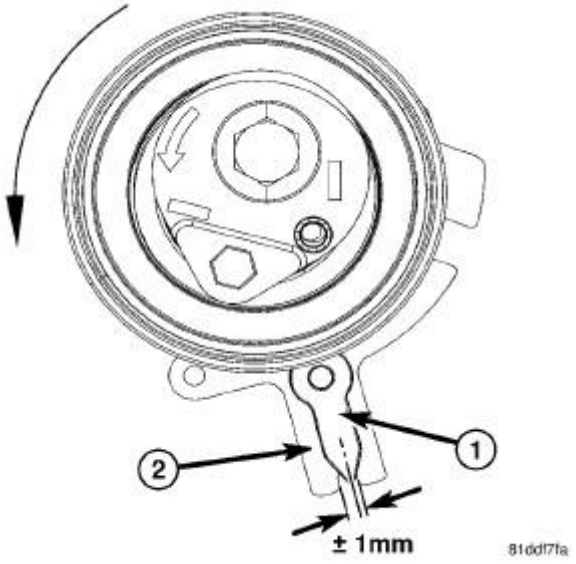

Fig. 370: Identifying Tensioner Indicator & Tensioner Gage Slot
Courtesy of CHRYSLER LLC

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.

AIR INTAKE SYSTEM

AIR CLEANER

Removal

REMOVAL

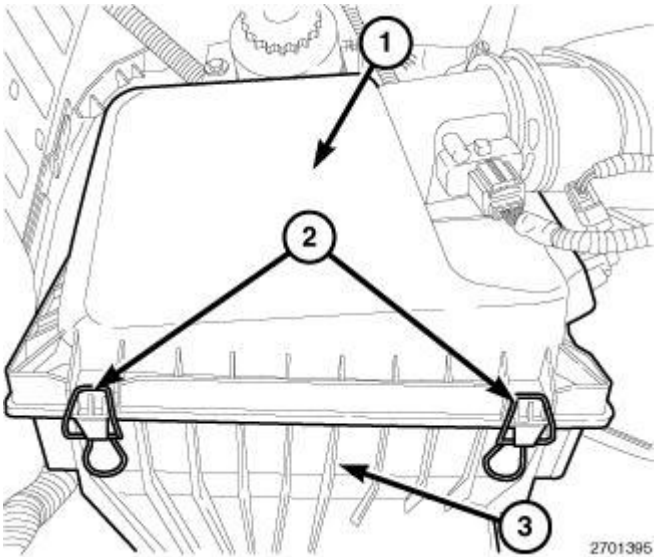

Fig. 371: IDENTIFYING AIR CLEANER HOUSING & CLIPS
Courtesy of CHRYSLER LLC

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

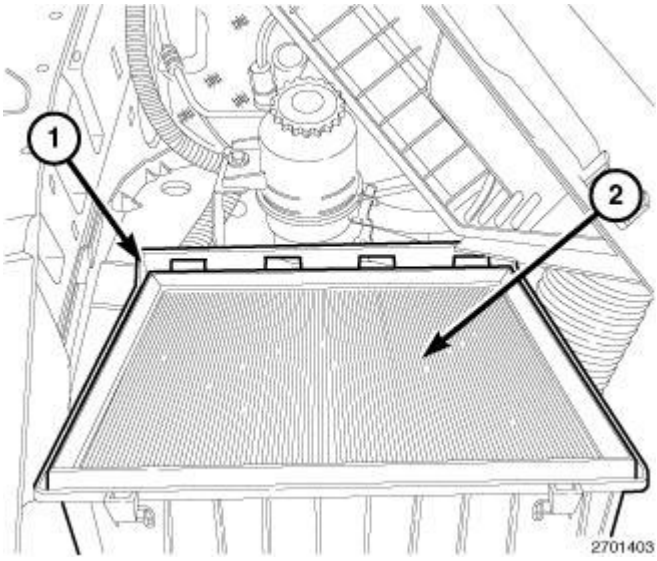

Fig. 372: AIR CLEANER HOUSING & AIR CLEANER FILTER
Courtesy of CHRYSLER LLC

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

Installation

INSTALLATION

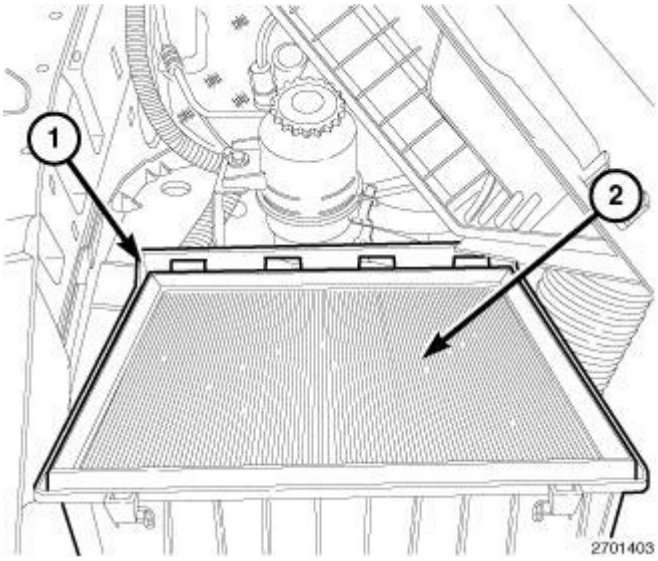

Fig. 373: AIR CLEANER HOUSING & AIR CLEANER FILTER
Courtesy of CHRYSLER LLC

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

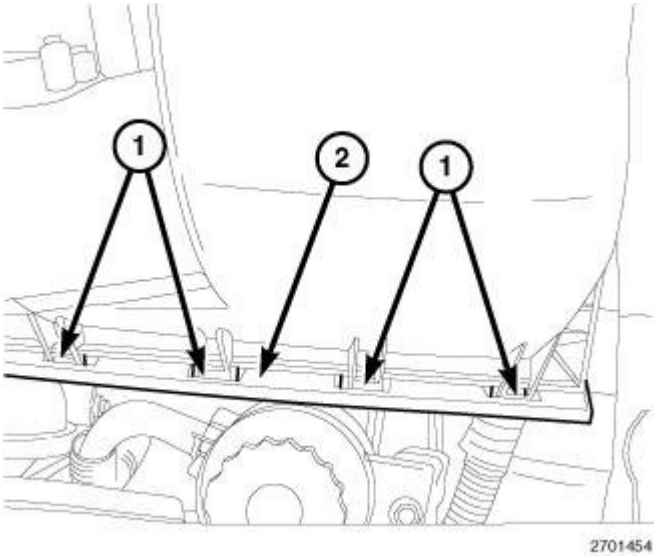

Fig. 374: AIR CLEANER COVER & CLIPS
Courtesy of CHRYSLER LLC

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

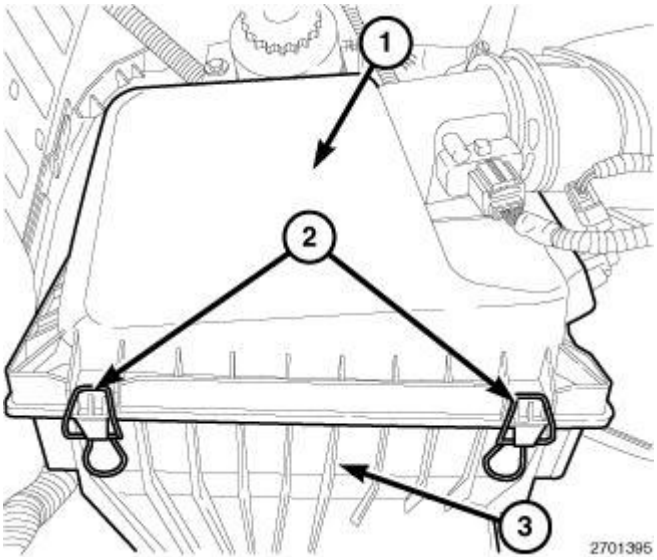

Fig. 375: IDENTIFYING AIR CLEANER HOUSING & CLIPS
Courtesy of CHRYSLER LLC

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

BODY, AIR CLEANER

Removal

REMOVAL

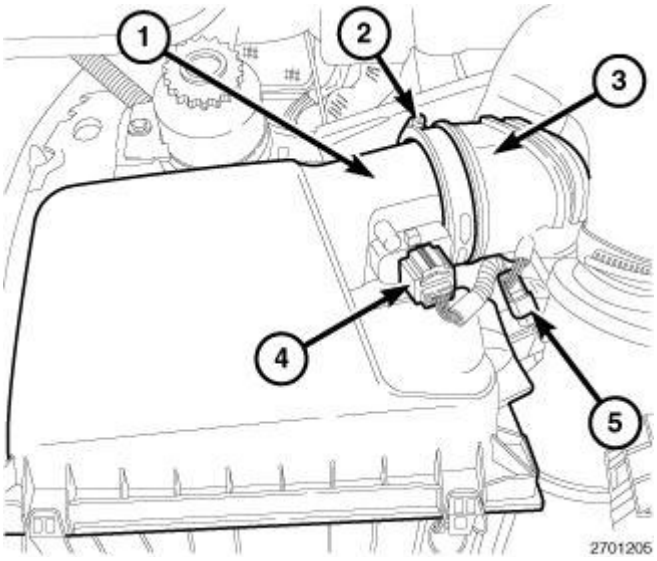

Fig. 376: Identifying Air Cleaner Housing, Worm Clamp, Air Cleaner Outlet Tube, Maf Sensor & IAT Sensor
Courtesy of CHRYSLER LLC

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

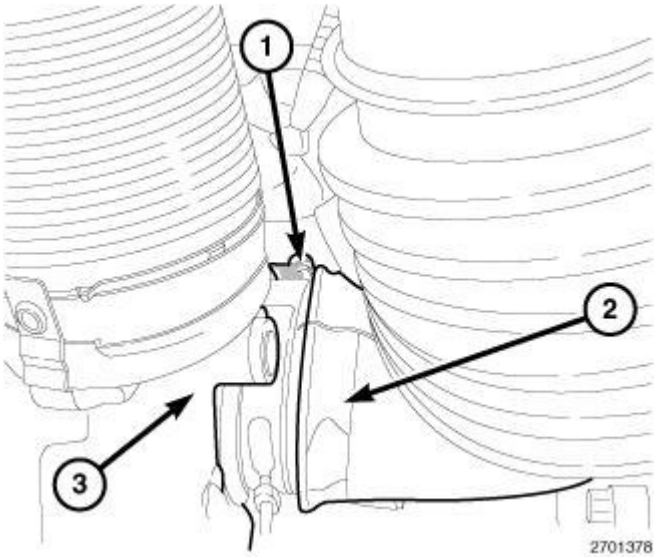

Fig. 377: Identifying Worm Clamp, Turbocharger Air Inlet Tube & Turbocharger
Courtesy of CHRYSLER LLC

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).

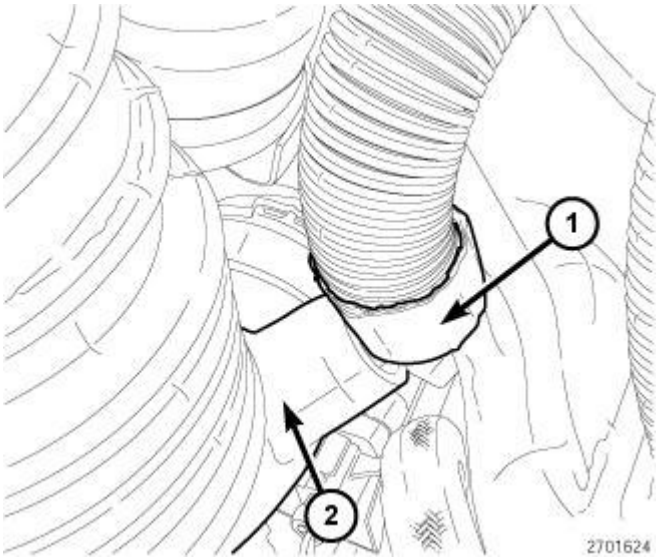

Fig. 378: Oil Separator Hose & Turbocharger Air Inlet Tube
Courtesy of CHRYSLER LLC

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

Installation

INSTALLATION

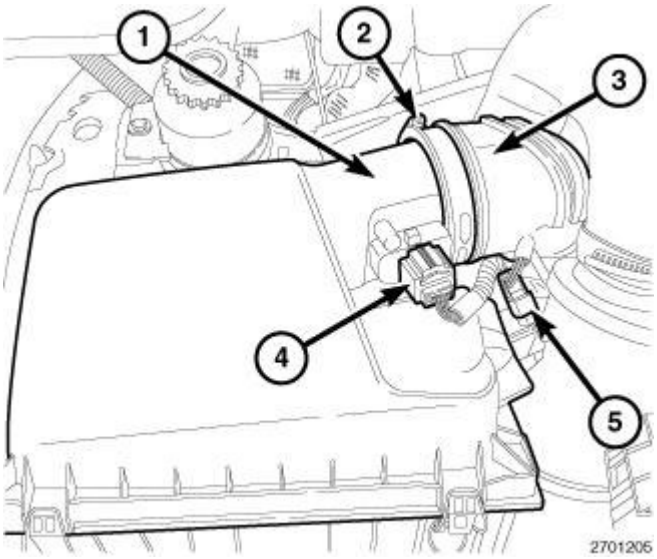

Fig. 379: Identifying Air Cleaner Housing, Worm Clamp, Air Cleaner Outlet Tube, Maf Sensor & IAT Sensor
Courtesy of CHRYSLER LLC

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

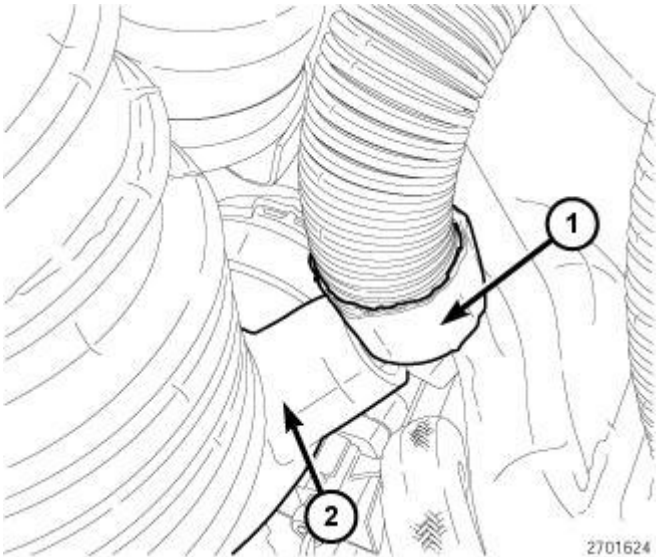

Fig. 380: Oil Separator Hose & Turbocharger Air Inlet Tube
Courtesy of CHRYSLER LLC

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

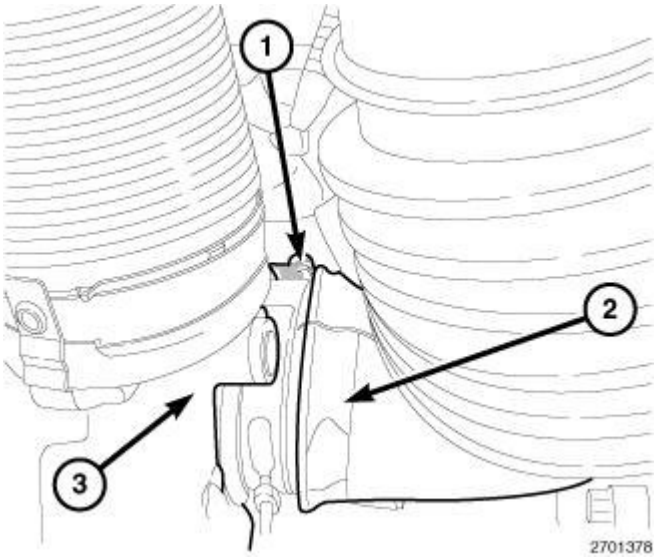

Fig. 381: Identifying Worm Clamp, Turbocharger Air Inlet Tube & Turbocharger
Courtesy of CHRYSLER LLC

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).

