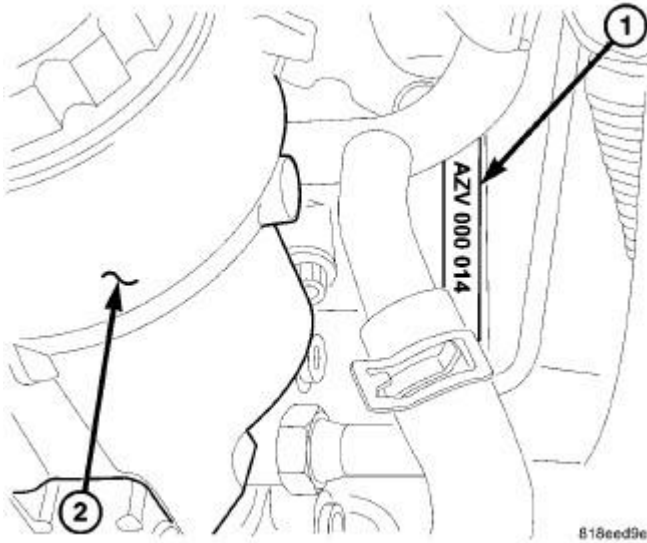


**2009 ENGINE****2.0L Diesel - Service Information - Compass & Patriot****DESCRIPTION****DESCRIPTION**

**Fig. 1: Identifying Engine Serial Number**

Courtesy of CHRYSLER LLC

This is a 2.0L common rail turbo diesel. The engine serial number is located on the rear flange of the engine block behind the oil filter housing (2).

**STANDARD PROCEDURE****ENGINE GASKET SURFACE PREPARATION**

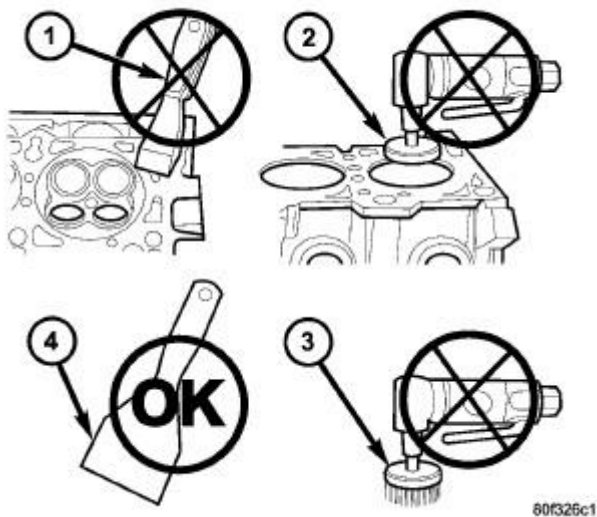


**Fig. 2: Proper Tool Usage for Surface Preparation**  
Courtesy of CHRYSLER LLC

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

**Never** use the following to clean gasket surfaces:

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



**Fig. 3: Proper Tool Usage for Surface Preparation**  
Courtesy of CHRYSLER LLC

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

Only use the following for cleaning gasket surfaces:

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

**CAUTION:** Excessive pressure and/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.

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

## COMPRESSION TESTING ENGINE

**CAUTION:** Injector retaining bolts must be replaced after performing compression test.

1. Warm up engine to operating temperature (approximately 80 °C, 176°F).
2. Shut off engine.
3. Remove engine cover. Refer to **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. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Removal**.
7. Crank engine several times with the starter to eliminate combustion residues in the cylinders.
8. Insert compression adapter 9889 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.
10. Carry out test procedure at the remaining cylinders in the same way.
11. Compare pressure readings obtained with the specified pressures. If the pressure reading is below the minimum compression pressure or if the permissible difference between the individual cylinders is exceeded, refer to **Standard Procedure**.

## 2.0L COMPRESSION SPECIFICATION

COMPRESSION SPECIFICATION	
Minimum Allowable	18 bar (261 psi.)
Maximum Allowable	3 bar (44 psi.)
Difference Between Cylinders	

Average Compression	24 - 30 bar (348 - 435 psi)
---------------------	-----------------------------

12. Remove adapter from cylinder head.

**NOTE:**        **Injector retaining bolts must be replaced when installing injectors.**

13. Install injectors with new bolts. Refer to Fuel System/Fuel Injection/INJECTOR(S), Fuel - Installation .
14. Install engine cover. Refer to ENGINE COVER.

## CYLINDER LEAK DOWN TEST

1. Warm engine to operating temperature.

**WARNING:** Do not open cooling system unless coolant temperature is below 90° c (194°f). Risk of injury to skin and eyes as a result of scalding with hot coolant which splashes out. Risk of poisoning from swallowing coolant. Open cap slowly and release pressure. Store coolant in proper containers only. Wear protective gloves, clothing and eye protection.

**NOTE:**        **Turn cap carefully as far as first detent, release pressure, then unscrew cap.**

2. Open cooling system cap at coolant recover pressure container.
3. Remove engine cover. Refer to ENGINE COVER.
4. Unscrew oil filler cap.
5. Remove glow plugs. Refer to Electrical - Ignition Control/Ignition Control/PLUG, Glow - Removal .

**NOTE:**        **Crank engine at crankshaft in direction of rotation of the engine (clockwise).**

6. Position cylinder to be tested to ignition Top Dead Center (DTC).

**NOTE:**        **Calibrate cylinder leak down tester and remove check valve in screw-in fitting.**

7. Connect cylinder leak down tester and follow INSPECTING Instruction.

## INSPECTING

**NOTE:**        **If crankshaft rotates, install retaining lock for crankshaft/ring gear.**

1. Pressurize cylinder with compressed air and read off pressure loss at cylinder leak tester. If excessive

pressure loss exists, determine cause by viewing the paragraph below.

**NOTE:**        **If the retaining lock is installed, remove it, rotate engine and install lock once again.**

2. Carry out test of other cylinders in the firing order of engine.

## **DETERMINING PRESSURE LOSS**

If a great pressure loss was detected, listen using a stethoscope around suspected areas, such as the cylinder head gasket through the air suction area, the exhaust system, the oil filler neck, the pre-chamber, the bore holes of the cylinder effected or neighboring cylinders. Observe the coolant in the expansion tank, looking for traces of bubbles.

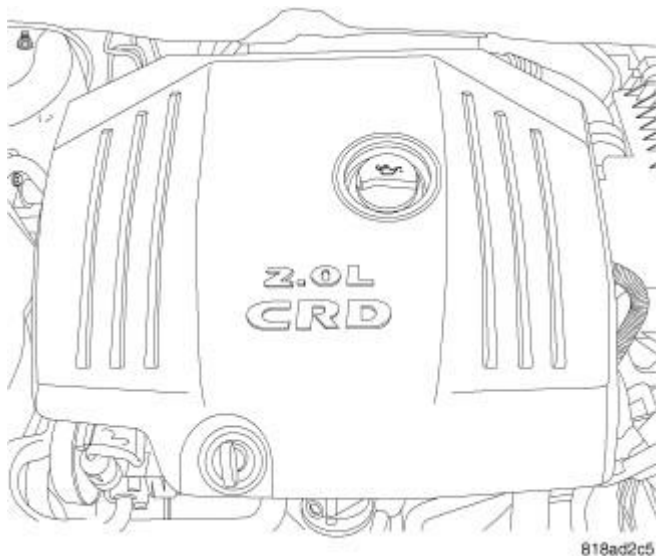
The possible causes of pressure loss are:

- If air leak is detected through the pre-chamber, cylinder bore hole, from a neighboring cylinder or air bubbles in the coolant expansion tank, pressure loss may be caused by the cylinder head gasket.
- If the air leak occurs in the air suction area, the pressure loss may be caused by the intake valve(s).
- Air leak through the exhaust system, may be caused by the exhaust valve(s).
- Air leak through the oil filler neck, may be caused by piston, ring, or cylinder sleeve.

If none of the above evidence supports a failure, the engine may be assembled and run until operating temperature is reached. Reconnect engine leak down tester on a warm engine with a few drops of clean engine oil in the cylinder being tested. Engine oil seals the clearance between the piston and cylinder for a short length of time. If under this condition a smaller pressure loss occurs for a shorter length of time, it is possible that the cause is piston, ring or cylinder sleeve related.

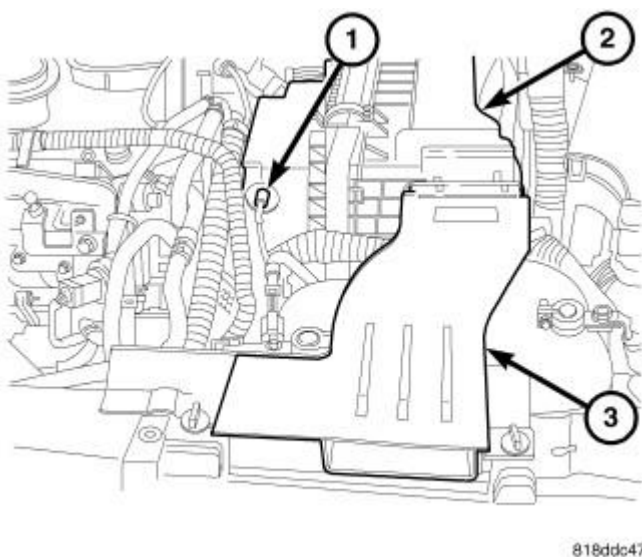
## **REMOVAL**

### **ENGINE COVER**

**Fig. 4: Engine Cover**

Courtesy of CHRYSLER LLC

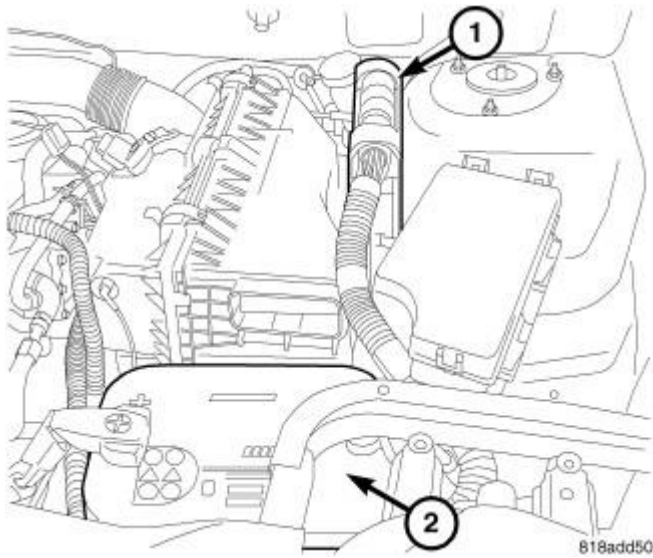
1. Remove engine cover by lifting upwards.

**ENGINE****Fig. 5: Air Cleaner Assembly**

Courtesy of CHRYSLER LLC

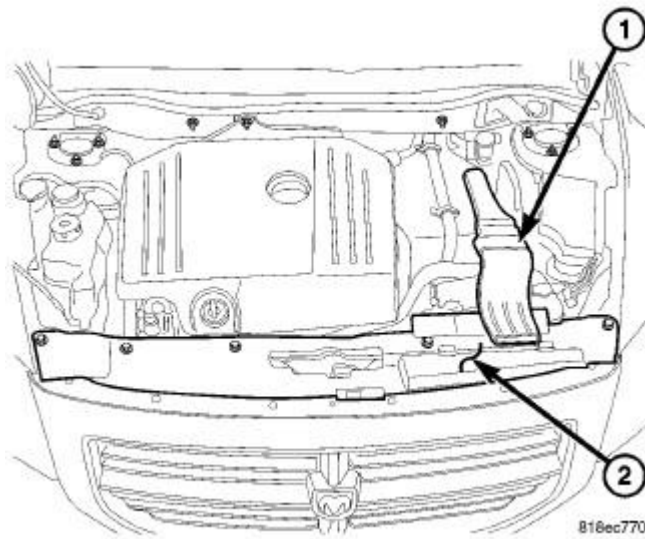
**CAUTION:** When removing ancillary components, plug all inlet/outlet and fluid lines to prevent residual leakage and contamination.

1. Remove air inlet duct (3).
2. Remove air cleaner assembly (2).



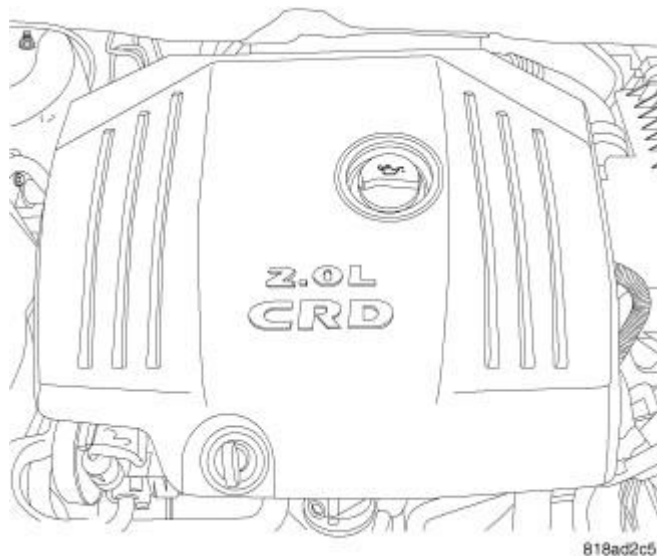
**Fig. 6: Battery**  
Courtesy of CHRYSLER LLC

3. Disconnect cables from battery (2).



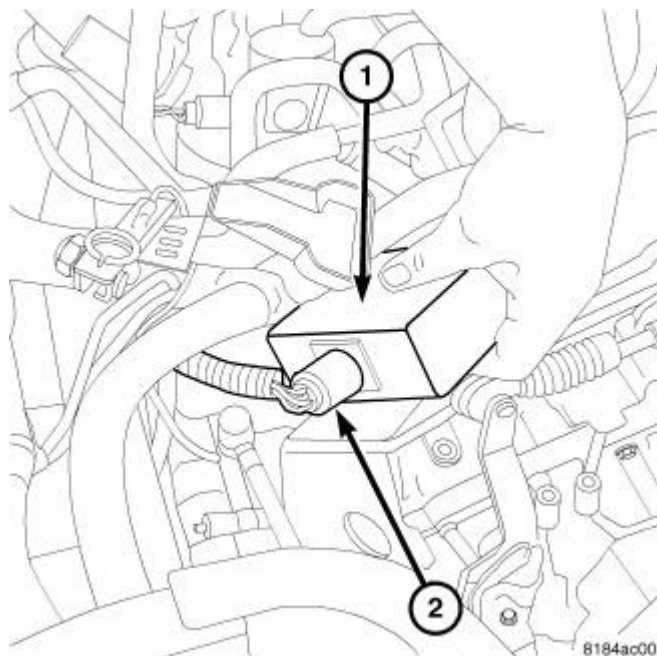
**Fig. 7: Radiator Closeout Panel**  
Courtesy of CHRYSLER LLC

4. Remove radiator closure panel (2).



**Fig. 8: Engine Cover-Removal**  
Courtesy of CHRYSLER LLC

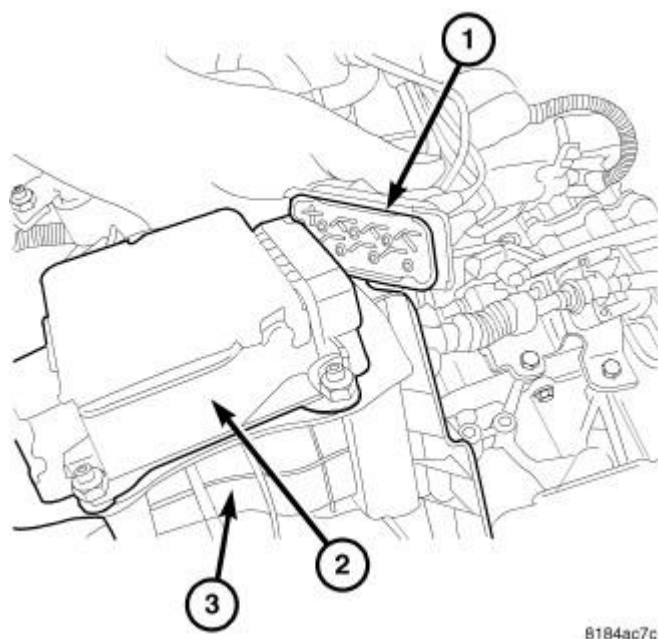
5. Remove engine cover. Refer to **ENGINE COVER**.
6. Reposition TIPM for access.
7. Remove body ground and disconnect PCM electrical connector and remove PCM.



**Fig. 9: Vacuum Module Electrical Connector**  
Courtesy of CHRYSLER LLC

8. Disconnect vacuum module electrical connector (2).

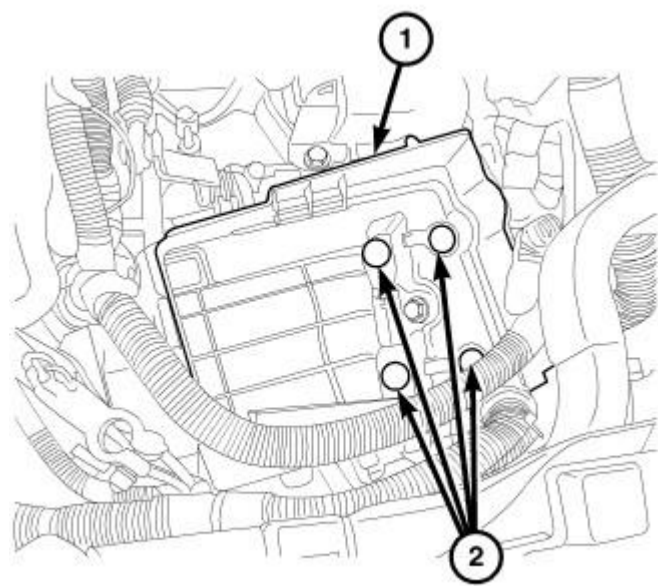




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**Fig. 10: Vacuum Control Module**  
Courtesy of CHRYSLER LLC

9. Disconnect vacuum harness (1) from vacuum control module (2) and remove vacuum control module from battery tray (3).

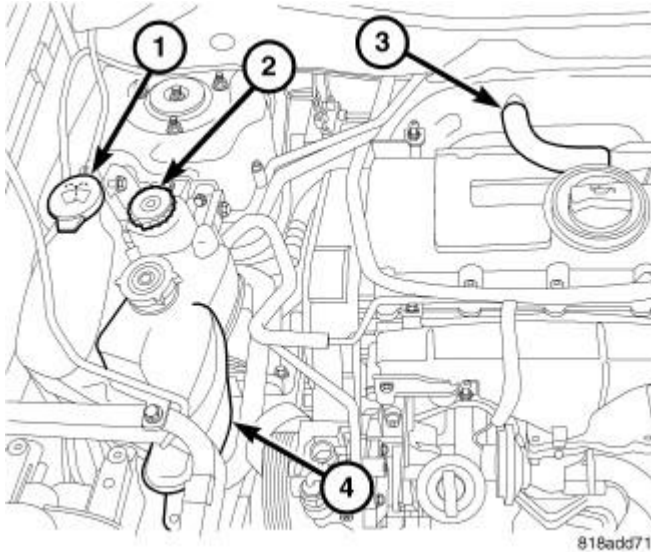


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**Fig. 11: Battery Tray**  
Courtesy of CHRYSLER LLC

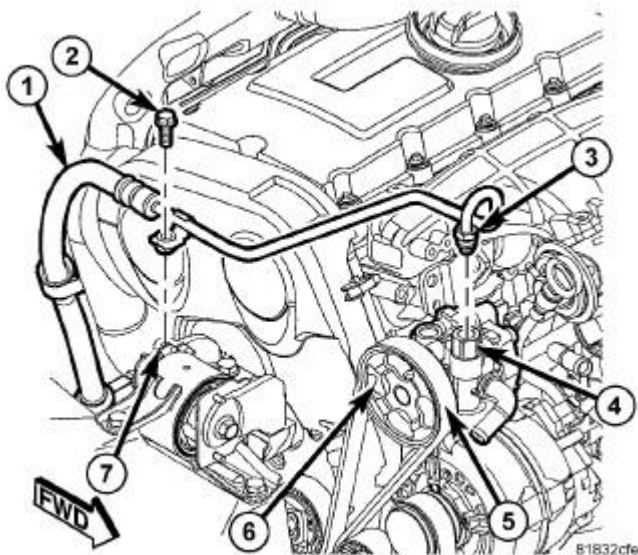
10. Remove battery tray retaining bolts (2) and remove battery tray (1).
11. Remove upper radiator hose support.

12. Drain cooling system. Refer to **Cooling - Standard Procedure** .
13. Discharge air conditioning. Refer to **Heating and Air Conditioning/Plumbing - Standard Procedure** .
14. Remove cooling module assembly. Refer to **Cooling/Engine/FAN, Cooling - Removal** .



**Fig. 12: Coolant Reservoir**  
Courtesy of CHRYSLER LLC

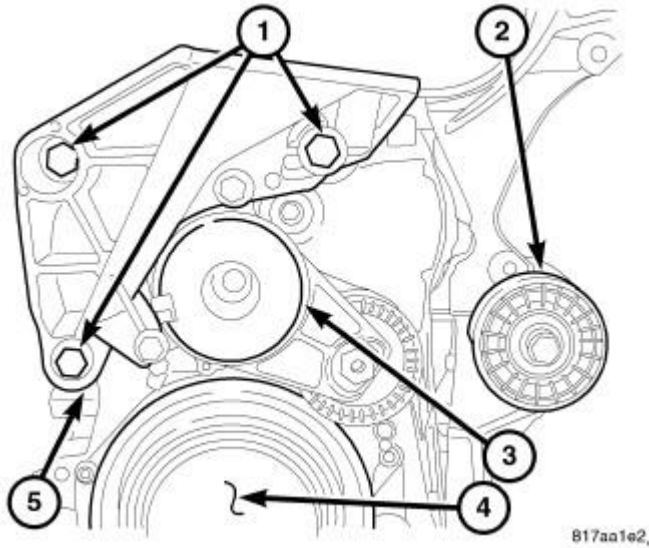
15. Remove coolant recovery reservoir (4).
16. Remove power steering reservoir (2) and reposition.



**Fig. 13: Pressure Line**  
Courtesy of CHRYSLER LLC

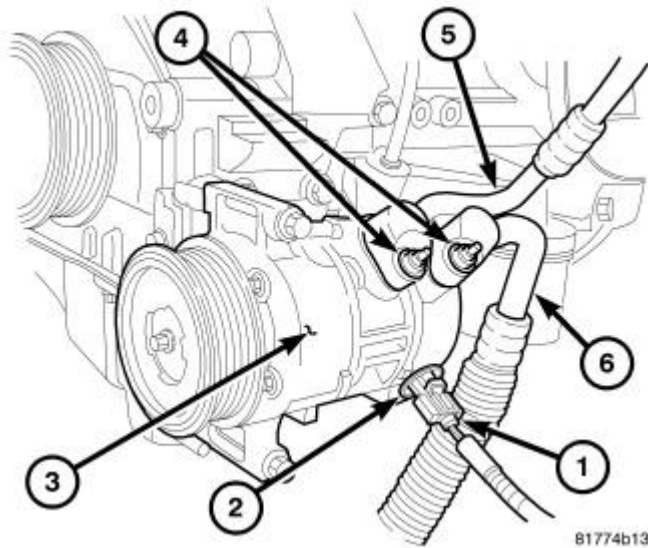
17. Remove accessory drive belt (5).

18. Remove power steering line support bracket retaining bolt (2).
19. Remove power steering pump (6) and set aside.



**Fig. 14: Right Engine Mount Bracket**  
Courtesy of CHRYSLER LLC

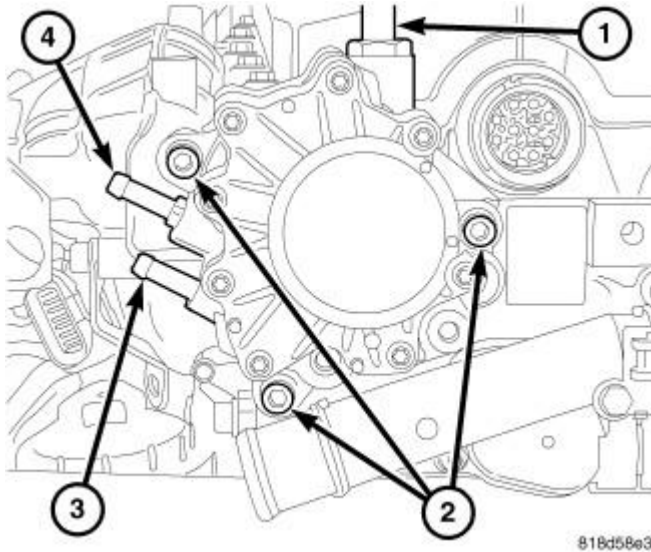
20. Remove accessory drive idler pulley (2).
21. Disconnect electrical connectors at generator.
22. Remove generator.



**Fig. 15: A/C Compressor-Refrigerant Lines**  
Courtesy of CHRYSLER LLC

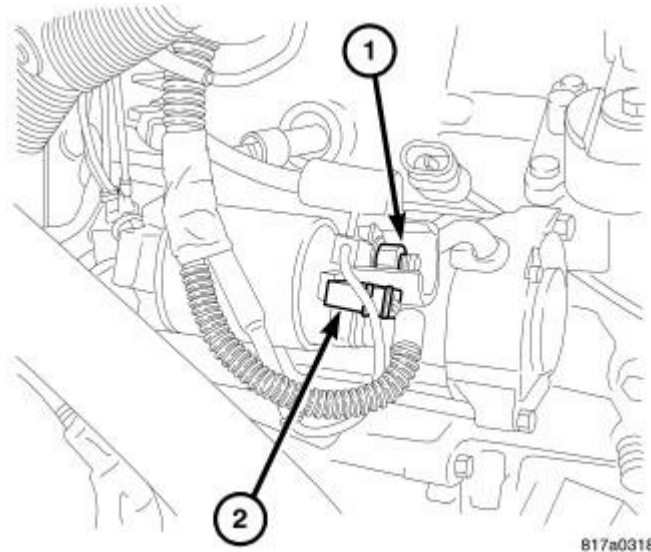
23. Disconnect A/C compressor electrical connector (2).
24. Disconnect A/C lines (4) at the compressor.

25. Remove A/C compressor (3).



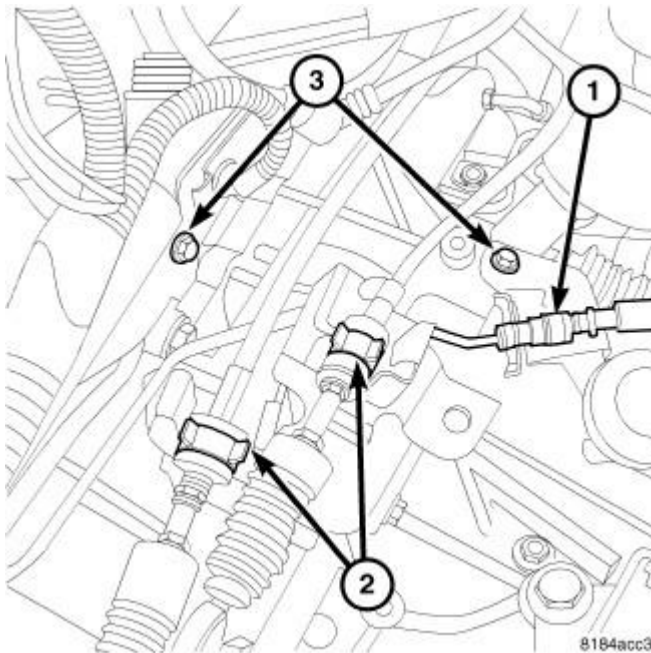
**Fig. 16: Fuel Pump**  
Courtesy of CHRYSLER LLC

26. Disconnect vacuum hose at tandem pump (1).  
27. Disconnect heater hoses at engine.  
28. Remove air inlet tube from throttle body.



**Fig. 17: Starter Electrical Connections**  
Courtesy of CHRYSLER LLC

29. Disconnect starter electrical connections (1,2) and remove starter.

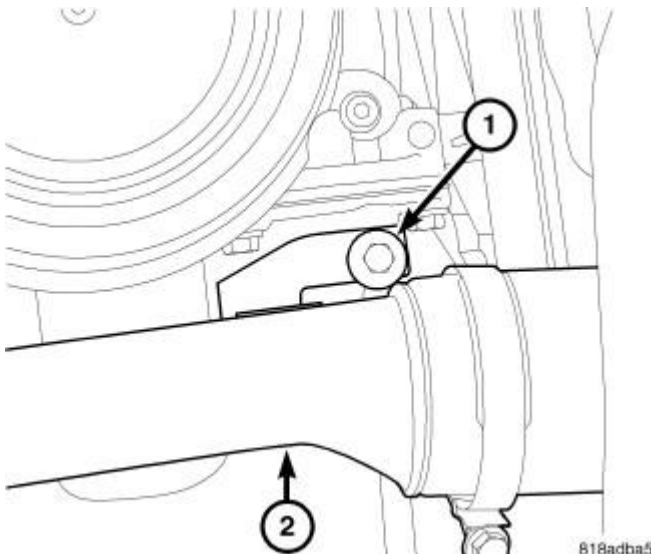


**Fig. 18: Hydraulic Clutch Line**  
Courtesy of CHRYSLER LLC

30. Remove shift cables (2) from transaxle.
31. Remove shift cable retaining bracket from transaxle.
32. Disconnect hydraulic clutch line (1).

**NOTE:** When removing tripod joint, DO NOT let spline or snap ring drag across transaxle oil seal lip.

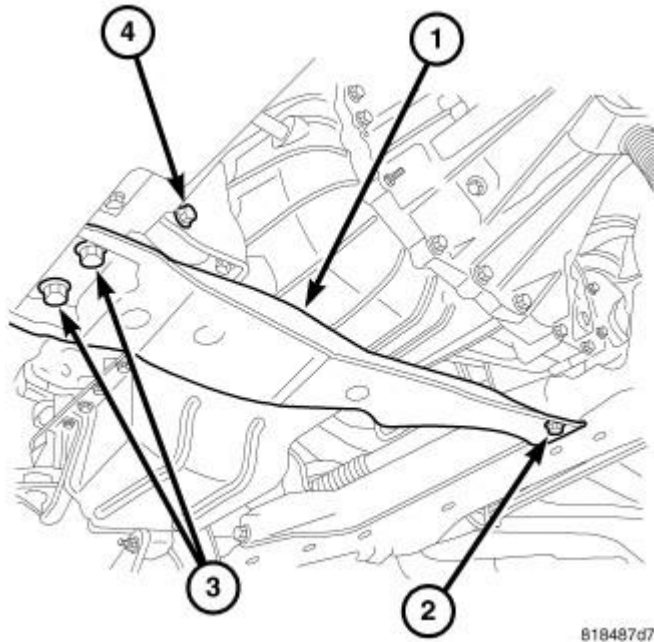
33. Remove left and right axle shafts. Refer to Differential and Driveline/Half Shaft - Removal.



**Fig. 19: Air Inlet Tube**

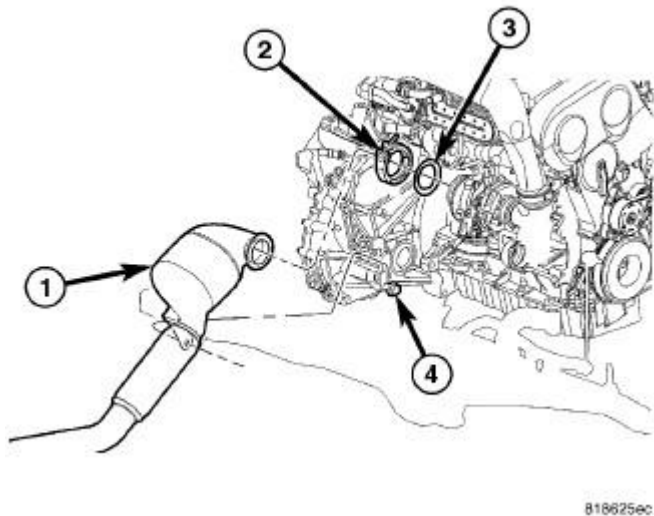
Courtesy of CHRYSLER LLC

34. Remove turbocharger inlet and outlet tubes.
35. Remove air tube retaining bolt (1) and remove air inlet tube (2).



**Fig. 20: Transmission Cross Member**  
Courtesy of CHRYSLER LLC

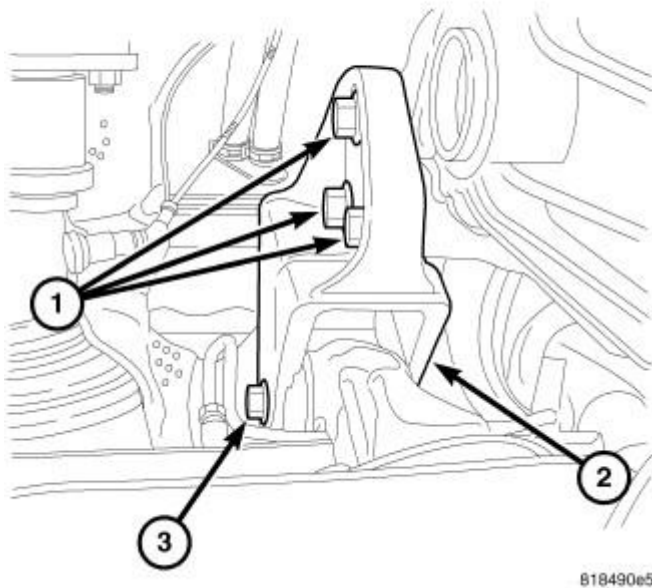
36. Remove front transaxle mount through bolt (4).
37. Remove fore/aft member retaining bolts (2,3) and remove fore/aft member (1).



**Fig. 21: Catalytic Converter - Diesel**

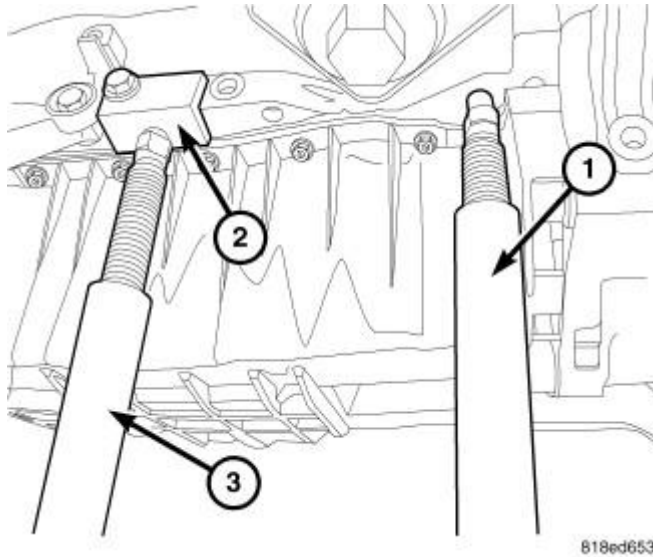
**Courtesy of CHRYSLER LLC**

38. Disconnect catalytic converter (1) from exhaust pipe.
39. Loosen catalytic converter clamp (2) and remove catalytic converter (1) and gasket (3) from turbocharger.
40. Remove catalytic converter assembly.
41. Remove PTU assembly (if equipped). Refer to **Transmission and Transfer Case/Power Transfer Unit - Removal**.



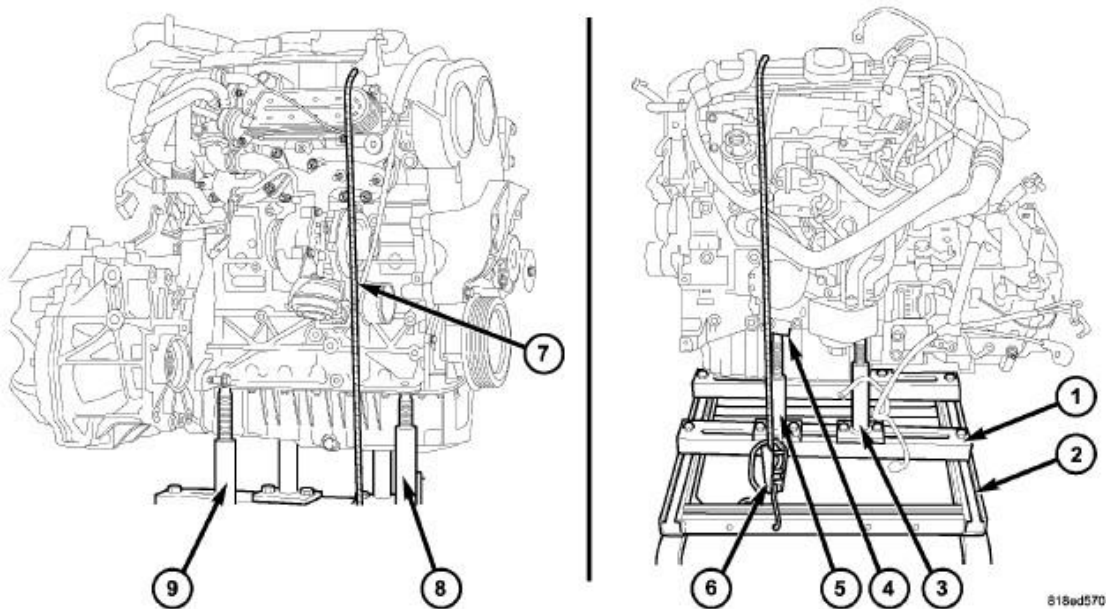
**Fig. 22: Rear Engine Mount**  
**Courtesy of CHRYSLER LLC**

42. Remove rear engine mount through bolt (3).
43. Remove rear engine mount bracket retaining bolts (1) and remove engine mount bracket (2).
44. Remove rear engine mount.



**Fig. 23: Engine Cradle Bracket 6973**  
Courtesy of CHRYSLER LLC

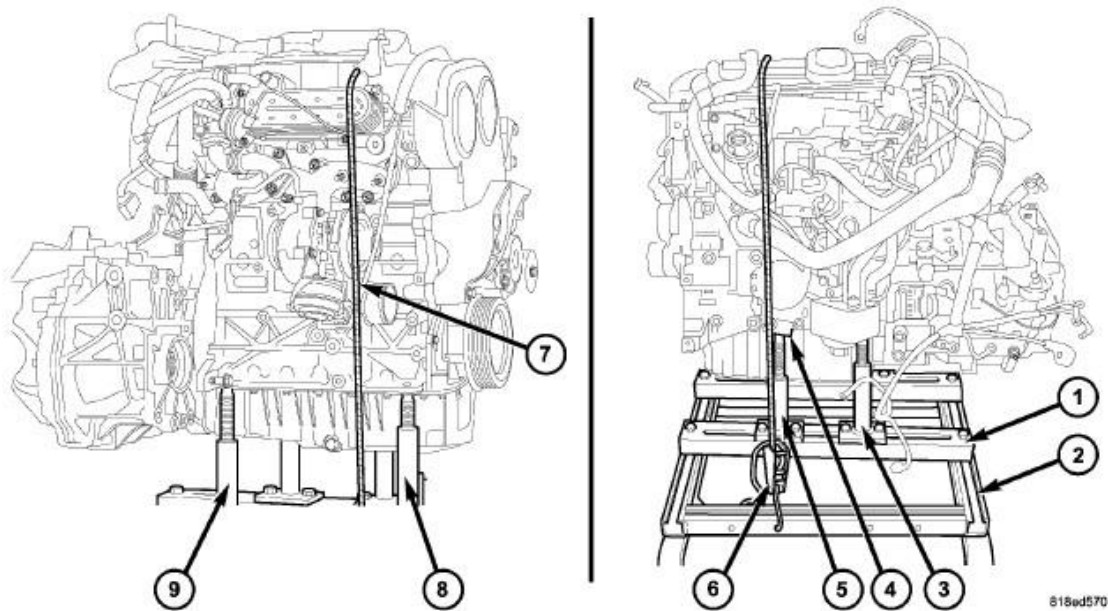
45. Install cradle mount adapter 6973 (2) to engine block.



**Fig. 24: Engine Cradle Dolly**  
Courtesy of CHRYSLER LLC

46. Lower vehicle and position Dolly 6135 (2) and Cradle 6710A (1) under engine.
47. Position the engine cradle dolly with the cradle and support posts 6848 (3,5,8,9) underneath the engine.
48. Carefully lower the vehicle enough to position the engine above the support posts.
49. Adjust the height of each support post as necessary and tighten the support posts and cradle fasteners.



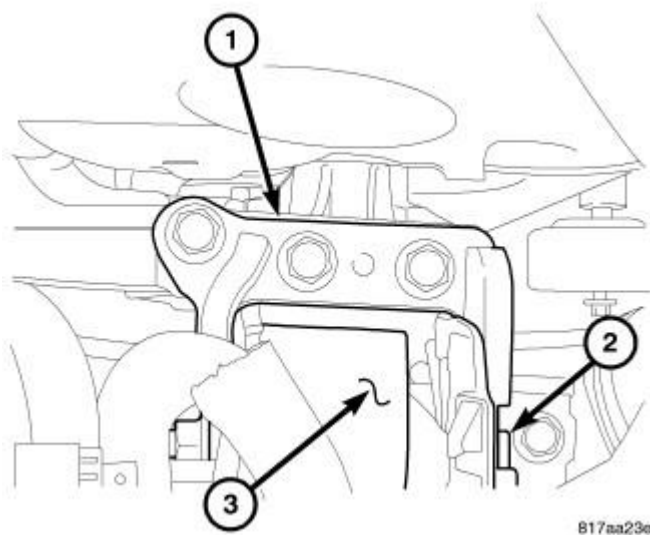


**Fig. 25: Engine Cradle Dolly**  
Courtesy of CHRYSLER LLC

50. Carefully lower vehicle enough to seat engine onto support posts.

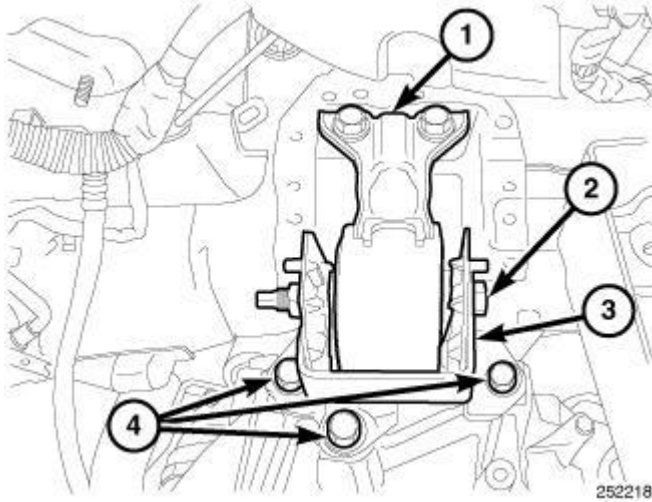
**WARNING: Safety straps must be use to secure engine to the dolly fixture.**

51. Install, tighten and lock safety straps (6,7) around engine and attach them to the cradle.
52. Lower vehicle so that only the weight of the engine and transmission assembly is on dolly fixture.



**Fig. 26: Right Engine Mount**  
Courtesy of CHRYSLER LLC

53. Remove right mount (1) to engine bracket retaining bolts.



**Fig. 27: Left Engine Mount**  
Courtesy of CHRYSLER LLC

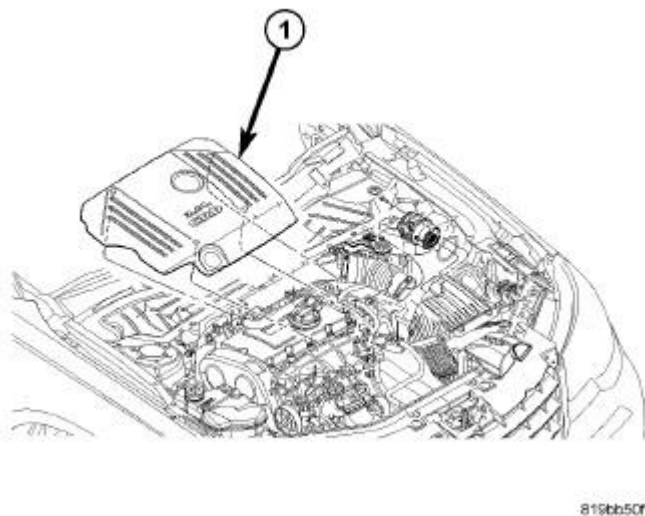
54. Remove left mount (3) to transaxle retaining bolts.

**CAUTION:** It may be necessary to adjust the engine and transmission assembly, with the dolly fixture attached, to successfully clear the engine compartment.

55. While watching for obstructions, slowly raise the vehicle until the engine and transmission assembly clear the engine compartment.
56. Separate engine and transmission.

## INSTALLATION

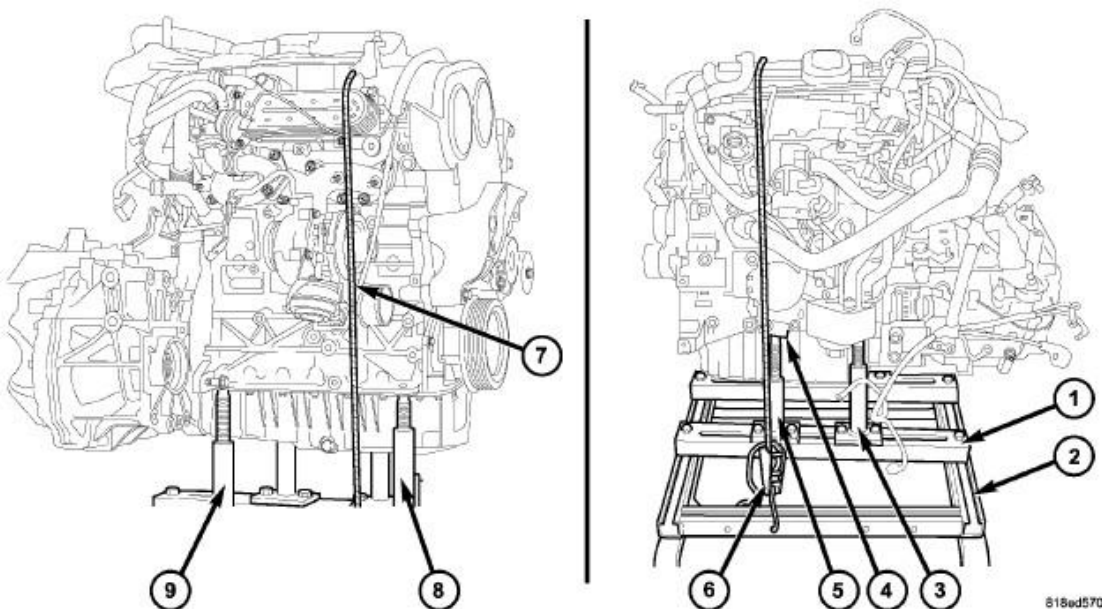
### ENGINE COVER



**Fig. 28: Identifying Engine Cover**  
Courtesy of CHRYSLER LLC

1. Align engine cover (1) with mounting retainers.
2. Firmly press cover onto mounting studs.

## ENGINE



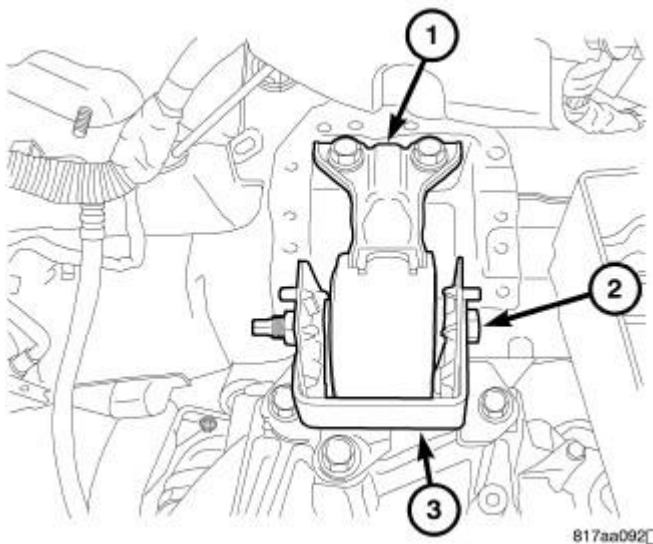
**Fig. 29: Engine Dolly**  
Courtesy of CHRYSLER LLC

**WARNING:** Safety straps must be used to secure engine to the dolly fixture.

1. Seat engine onto fixture support posts then install, tighten and lock safety straps (6,7) around engine, securing it to the cradle.
2. Position the engine and transmission assemblies below vehicle engine compartment.

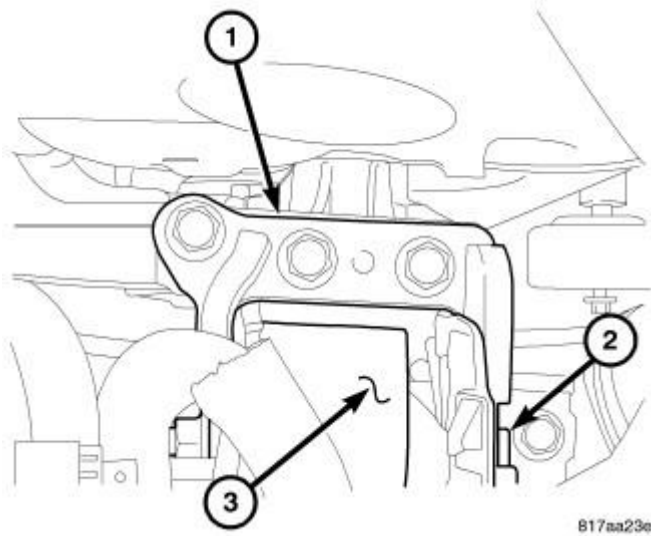
**CAUTION:** It may be necessary to adjust the engine and transmission assembly, with the dolly fixture attached, to successfully clear the engine compartment.

3. While watching for obstructions, slowly lower the vehicle until the engine and transmission assembly clearly fit the engine compartment.



**Fig. 30: Left Engine Mount Bracket**  
Courtesy of CHRYSLER LLC

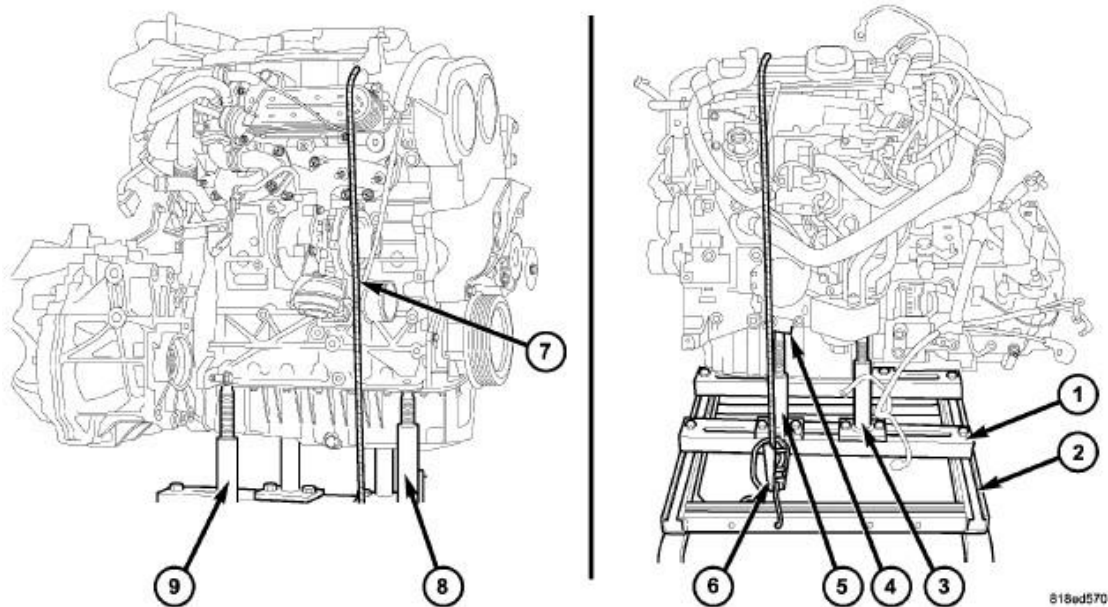
4. Install left mount bracket (3) to transaxle retaining bolts and tighten to 65 N.m (50 ft. lbs.).



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**Fig. 31: Right Engine Mount Bracket**  
Courtesy of CHRYSLER LLC

5. Install right mount bracket (1) to frame rail retaining bolts and tighten to 65 N.m (50 ft. lbs.).

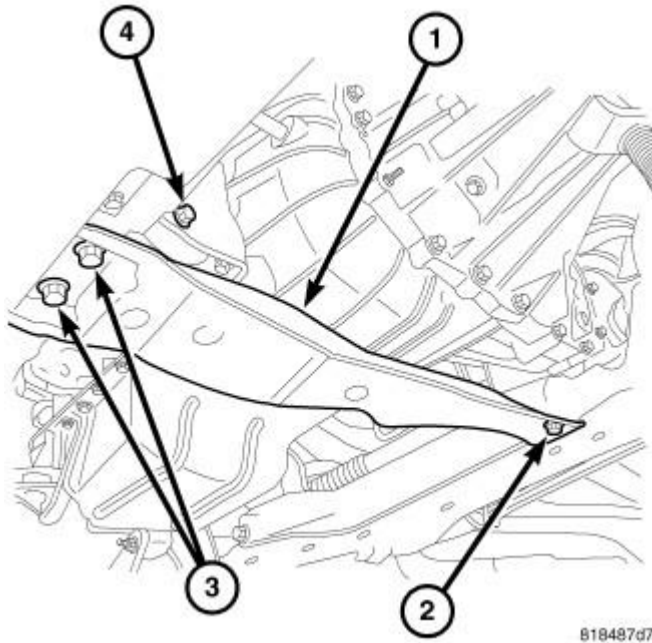


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**Fig. 32: Engine Dolly**  
Courtesy of CHRYSLER LLC

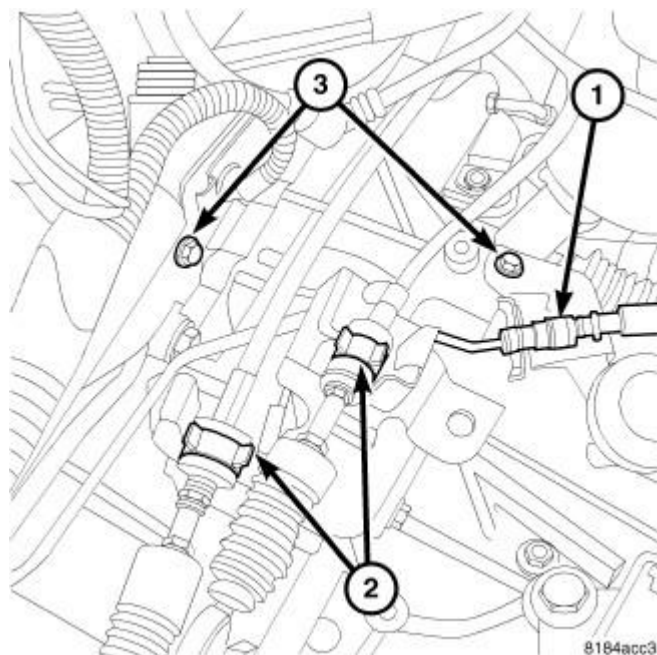
6. Remove safety straps (6,7) and remove dolly fixture.
7. Carefully raise the vehicle enough to clear the cradle and support post.
8. Install catalytic converter loosely.
9. Install PTU (if equipped). Refer to **Transmission and Transfer Case/Power Transfer Unit - Installation**.

10. Place a suitable jack under transaxle and raise engine/trans assembly.
11. Install exhaust to PTU mount.
12. Install catalytic converter band clamp and tighten.
13. Install power steering hose clamp to exhaust manifold.
14. Install PTU to block support bracket.



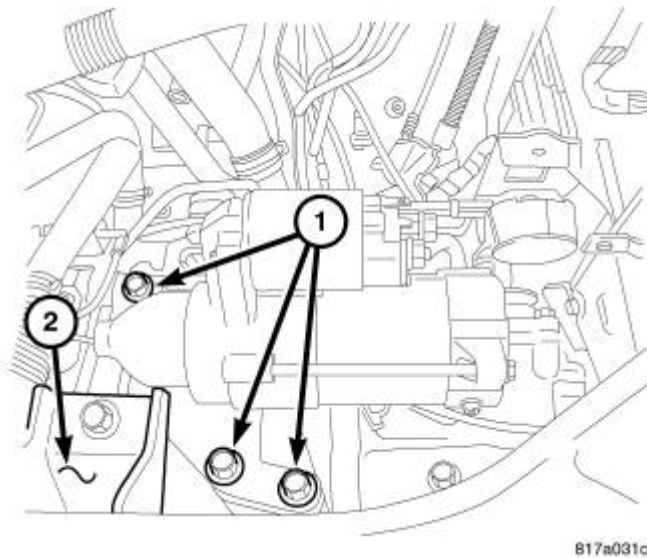
**Fig. 33: Transmission Crossmember**  
 Courtesy of CHRYSLER LLC

15. Install rear mount bracket to cradle.
16. Install front transaxle mount bracket to transaxle.
17. Install fore aft member (1).
18. Install front mount through bolt (4) and tighten.
19. Install turbo outlet pipe.
20. Install axle shafts.
21. Insert ball joint into steering knuckle and tighten pinch bolts and tighten.
22. Install turbo inlet pipe from air cleaner to turbocharger.
23. Install charge air hose from inter cooler to throttle body.



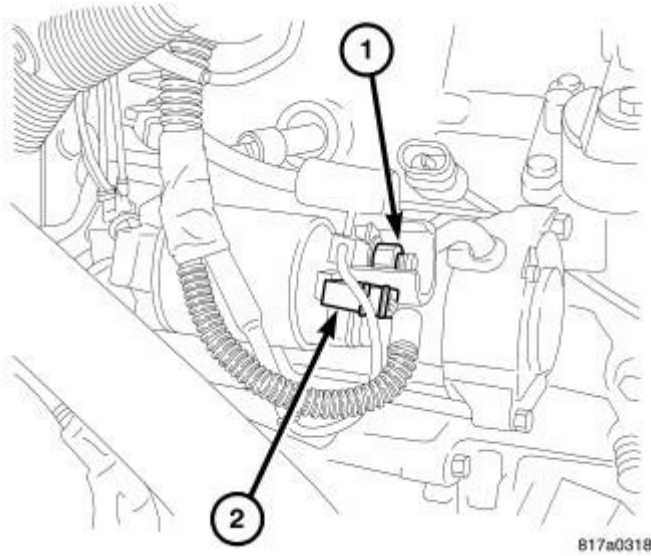
**Fig. 34: Shift Cables**  
Courtesy of CHRYSLER LLC

24. Install shift cables (2).



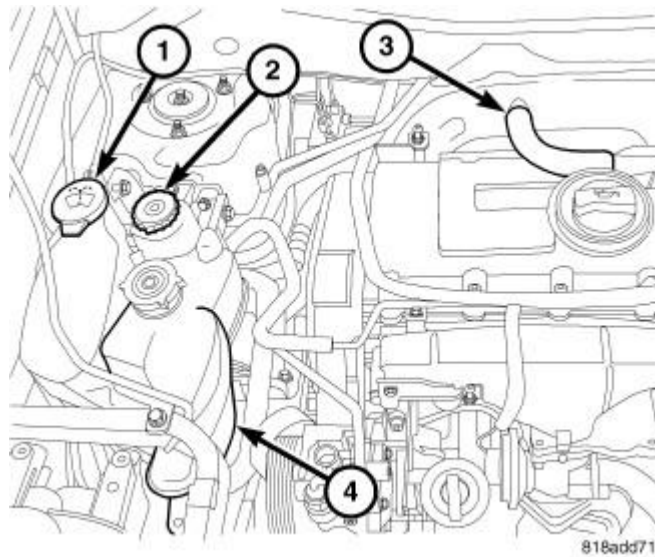
**Fig. 35: Starter Mounting Bolts**  
Courtesy of CHRYSLER LLC

25. Position starter and install starter mounting bolts (1).



**Fig. 36: Starter Electrical**  
Courtesy of CHRYSLER LLC

26. Connect starter electrical connectors (1,2).
27. Install vacuum harness and coolant tube.
28. Connect fuel lines near head.
29. Connect vacuum hose to brake booster.
30. Install A/C compressor and connect A/C lines.
31. Connect engine wiring harness connectors.
32. Install generator and connect electrical connectors.

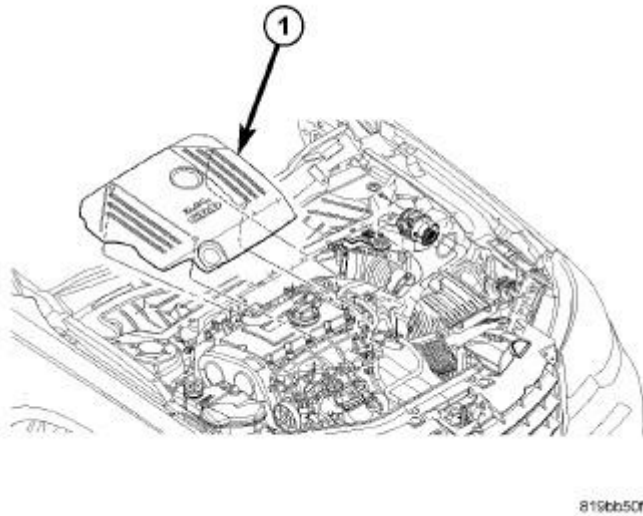


**Fig. 37: Coolant Reservoir**  
Courtesy of CHRYSLER LLC

33. Install serpentine belt tensioner and install serpentine belt.



34. Install coolant recovery bottle (4).
35. Install coolant module, connect cooling fan connectors.
36. Connect upper and lower radiator hoses.
37. Connect charge air hoses to inter cooler.
38. Connect A/C lines to condenser and connect electrical connectors.
39. Fill engine with coolant.
40. Install new oil filter and fill engine with oil.



**Fig. 38: Engine Cover**  
Courtesy of CHRYSLER LLC

**CAUTION:** Do NOT run the engine with a vacuum pump in operation or with a vacuum present within the A/C system. Failure to follow this caution will result in serious A/C compressor damage.

41. Evacuate the refrigerant system. Refer to Heating and Air Conditioning/Plumbing - Standard Procedure.
42. Charge the refrigerant system. Refer to Heating and Air Conditioning/Plumbing - Standard Procedure.
43. Start engine and check for leaks.
44. Install engine cover (1). Refer to ENGINE COVER.

## SPECIFICATIONS

### 2.0L DIESEL ENGINE

#### GENERAL SPECIFICATIONS

**2009 Jeep Patriot Limited**

2009 ENGINE 2.0L Diesel - Service Information - Compass &amp; Patriot

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Type	In-Line OHV, DOHC	
Number of Cylinders	4	
Firing Order	1 - 3 - 4 - 2	
Compression Ratio	18.5:1	
Max. Variation Between Cylinders	25%	
Displacement	2.0 L	122 CID
Bore	81.0 mm	3.188 in.
Stroke	95.5 mm	3.759 in.

**CYLINDER BLOCK**

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Material	Cast Iron	
Cylinder Bore Diameter	81.01 mm	3.189 in.
Cylinder Bore Diameter Out-of-Round (Max.)	0.10 mm	0.003 in.
Cylinder Bore Diameter Taper (Max.)	0.10 mm	0.003 in.

**PISTONS**

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Piston Diameter	80.96 mm	3.187 in.

**PISTON RINGS**

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Ring Gap-Top Compression Ring	0.20 - 0.40 mm	0.007 - 0.015 in.
Wear Limit	1.0 mm	0.039 in.
Ring Gap - 2nd Compression Ring	0.20 - 0.40 mm	0.007 - 0.015 in.
Wear Limit	1.0 mm	0.039 in.
Ring Gap - Oil Scraper	0.20 - 0.50 mm	0.007 - 0.019 in.
Wear Limit	1.0 mm	0.039 in.
Ring Side Clearance-Top Compression	0.06 - 0.09 mm	0.002 - 0.003 in.
Wear Limit	0.25 mm	0.009 in.
Ring Side Clearance -2nd Compression Ring	0.05 - 0.08 mm	0.001 - 0.003 in.
Wear Limit	0.25 mm	0.009 in.
Ring Side Clearance - Oil Scraper	0.03 - 0.06 mm	0.001 - 0.002 in.

**2009 Jeep Patriot Limited**

2009 ENGINE 2.0L Diesel - Service Information - Compass &amp; Patriot

Wear Limit	0.15 mm	0.005 in.
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**CONNECTING ROD**

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bearing Clearance	0.03 - 0.08 mm	0.001 - 0.003 in.
Side Clearance	0.37 mm	0.014 in.

**CRANKSHAFT**

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Connecting Rod Journal Diameter	50.878 - 50.942 mm	2.003 - 2.005 in.
Main Bearing Journal Diameter	53.978 - 54.042 mm	2.125 - 2.127 in.
End Play	0.07 - 0.17 mm	0.002 - 0.006 in.
Wear Limit	0.37 mm	0.014 in.
Main Bearing Clearance	0.03 - 0.08 mm	0.001 - 0.003 in.
Wear Limit	0.17 mm	0.006 in.

**CAMSHAFT**

DESCRIPTION	SPECIFICATION	
	Metric	Standard
End Play - Max	0.15 mm	0.005 in.

**VALVE GUIDE**

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Stem to Guide Clearance - Max	1.3 mm	0.051 in.

**NOTE:**

Insert new valve into guide. The end of the valve stem must be flush with guide. Use only inlet valve in inlet guide and exhaust valve in exhaust guide. Determine rock. Cylinder head must be renewed if rock exceeds wear limit.

**VALVES**

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Face Angle - Intake and Exhaust	45°	45°
Head Diameter - Intake	29.40 mm	1.157 in.
Head Diameter - Exhaust	25.50 mm	1.003 in.
Valve Length (Overall)	-	-
Intake	88.50 mm	3.484 in.
Exhaust	88.20 mm	3.472 in.
Valve Stem Diameter	-	-

## 2009 Jeep Patriot Limited

2009 ENGINE 2.0L Diesel - Service Information - Compass & Patriot

Intake	5.980 mm	0.235 in.
Exhaust	5.965 mm	0.234 in.

### VALVE STEM TO GUIDE CLEARANCE

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake	-	-
Max. Allowable	1.3 mm	0.051 in.
Exhaust	-	-
Max. Allowable	1.3 mm	0.051 in.

### OIL PRESSURE

DESCRIPTION	SPECIFICATION	
	Metric	Standard
At Curb Idle Speed*	0.55 bar	8 psi
At 2000 RPM	2.0 bar	29 psi
Max Oil Pressure	7.0 bar	101 psi
<b>CAUTION:</b>		
*If pressure is ZERO at curb idle, DO NOT run engine at 2000 RPM.		

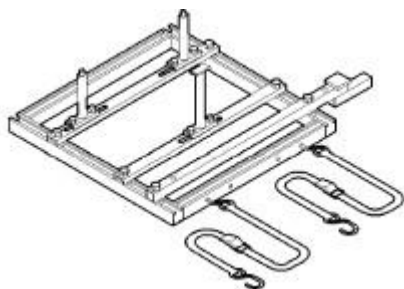
### TORQUE

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Accessory Bracket-Bolts	45	33	-
Accessory Drive Belt Tensioner-Bolt	25	-	221
Bearing Frame-Bolts	20	-	177
Cable Retainer-Bolts	10	-	89
Camshaft Hub-Bolt	100	74	-
Camshaft Position Sensor-Bolt	10	-	89
Camshaft Sprocket-Bolt	25	-	221
Connecting Rod Cap-Bolts	30 + 90°	22 + 90°	-
Crankshaft Main Bearing Cap-Bolts	65 + 90°	48 + 90°	-
Crankshaft Damper-Bolt	10 + 90°	-	89 + 90°
Crankshaft Position Sensor-Bolt	5	-	44
Crankshaft Front Sealing Flange-Bolts	15	-	133
Crankshaft Rear Sealing Flange-Bolts	15	-	133
Crankshaft Sprocket	120 + 90°	89 + 90°	-
Cylinder Head-Bolts	Refer to Procedure		
Cylinder Head Cover-Bolts	10	-	89
Engine Support Bracket-Bolts	45	33	-
Exhaust Gas Recirculation Valve-Bolts	10	-	89

Exhaust Gas Recirculation Valve Tube-Bolts	20	-	177
Exhaust Manifold-Nuts	25	-	221
Exhaust Manifold Heat Shield-Bolts	25	-	221
Flywheel-Bolts	60 + 90°	44 + 90°	-
Fuel Pump-Bolts	20	-	177
Glow Plugs	10	-	89
Injector-Bolts	3 + 90° + 180°	-	27 + 90° + 180°
Intake Manifold-Bolts	20	-	177
Intake Manifold Flap-Bolts	10	-	89
Oil Cooler Connector-Bolt	25	-	221
Oil Dipstick Tube-Bolt	10	-	89
Oil Filter Cover	25	-	221
Oil Filter Housing-Bolts	15 + 90°	-	133 + 90°
Oil Pan-Bolts	15	-	133
Oil Pan Drain-Plug	30	22	-
Oil Pump-Bolts	15	-	133
Oil Pump Drive Chain Tensioner-Bolt	15	-	133
Oil Pump Pick-up Tube-Bolts	15	-	133
Oil Pump Sprocket-Bolt	22 + 90°	-	195 + 90°
Oil Spray Jet-Bolt	25	-	221
Rocker Arm Shaft-Bolts	20 + 90°	-	177 + 90°
Thermostat Housing-Bolts	15	-	133
Timing Belt Covers	10	-	89
Timing Belt Tensioner Assembly-Nut	20 + 45°	-	177 + 45°
Timing Belt Idler Upper Pulley-Bolt	40 + 90°	30 + 90°	-
Timing Belt Idler Lower Pulley-Nut	20	-	177
Turbocharger Oil Supply line at Oil Filter Housing	22	16	-

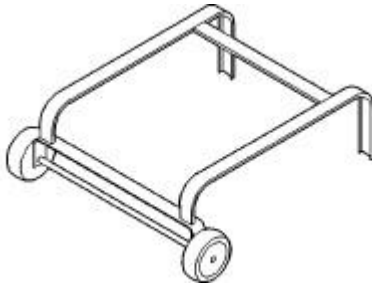
## SPECIAL TOOLS

### SPECIAL TOOLS



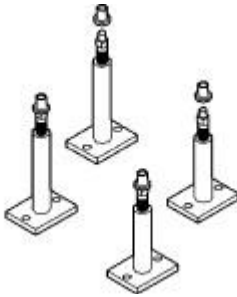
**Fig. 39: Cradle 6710**

Courtesy of CHRYSLER LLC



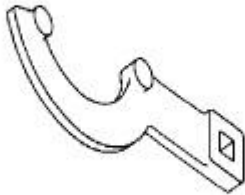
**Fig. 40: Dolly 6135**

Courtesy of CHRYSLER LLC



**Fig. 41: Post Kit Engine Cradle 6848**

Courtesy of CHRYSLER LLC



**Fig. 42: Camshaft Hub Holder 9880**

Courtesy of CHRYSLER LLC



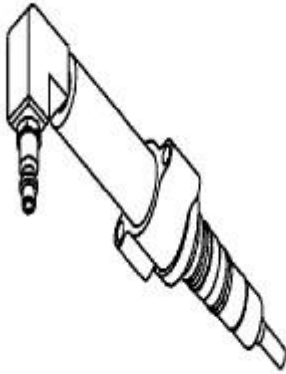
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**Fig. 43: Camshaft Locking Pins 9882**  
Courtesy of CHRYSLER LLC

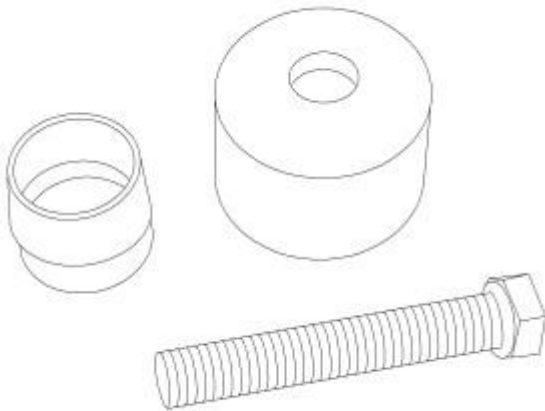


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**Fig. 44: Camshaft Seal Installer 9884**  
Courtesy of CHRYSLER LLC



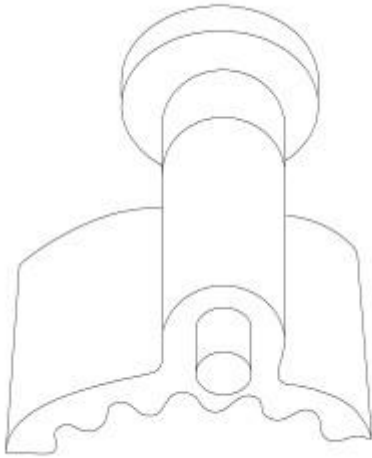
**Fig. 45: Compression Adapter 9889**  
Courtesy of CHRYSLER LLC



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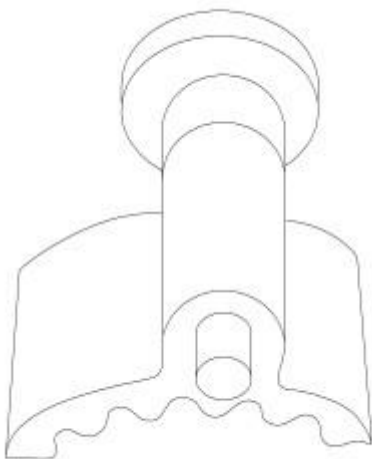
**Fig. 46: Crankshaft Front Seal Installer 9918**  
Courtesy of CHRYSLER LLC





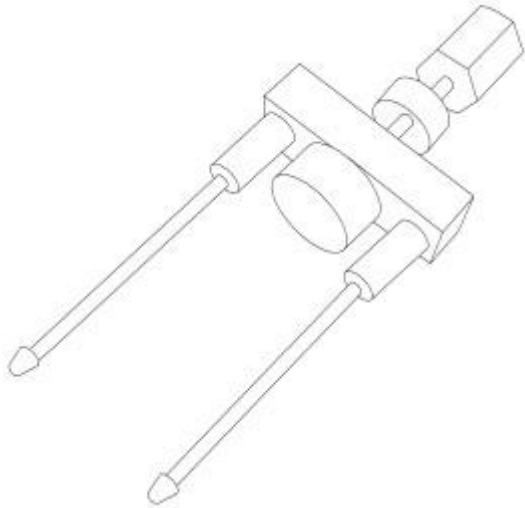
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**Fig. 47: Crankshaft Lock 9883**  
Courtesy of CHRYSLER LLC



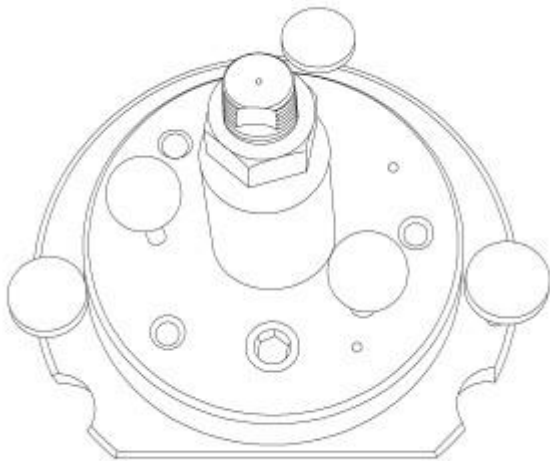
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**Fig. 48: Crankshaft Lock 10122**  
Courtesy of CHRYSLER LLC



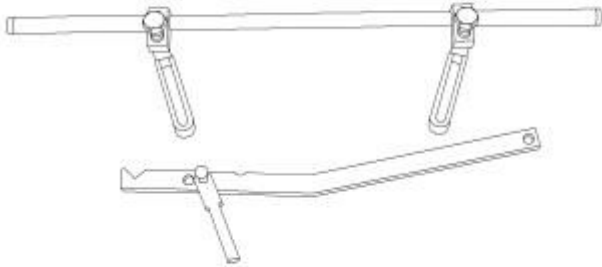
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**Fig. 49: Injector Remover 9887**  
Courtesy of CHRYSLER LLC



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**Fig. 50: Rear Main Seal Installer 9888**  
Courtesy of CHRYSLER LLC

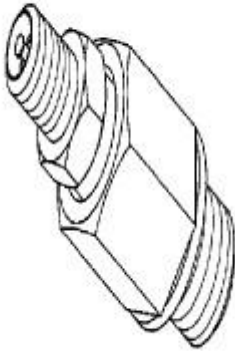


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**Fig. 51: Valve Spring Remover Installer 9916**  
Courtesy of CHRYSLER LLC



**Fig. 52: Glow Plug Adapter 9939**  
Courtesy of CHRYSLER LLC



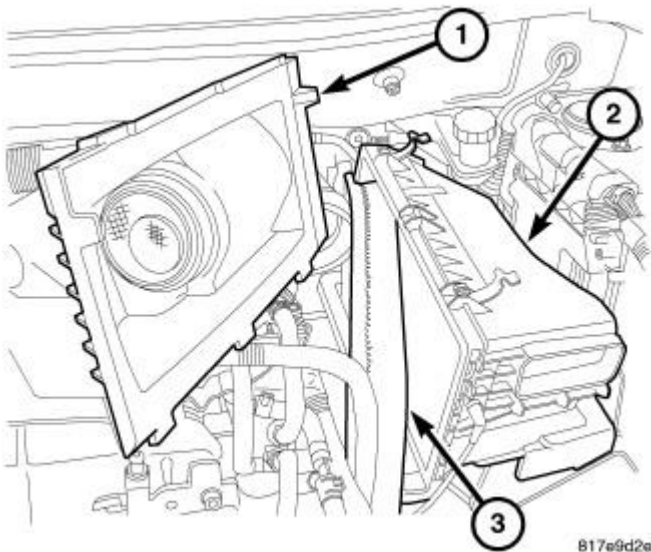
**Fig. 53: Fuel Pressure Adapter 9938**  
Courtesy of CHRYSLER LLC

## AIR INTAKE SYSTEM

### AIR CLEANER

#### Removal

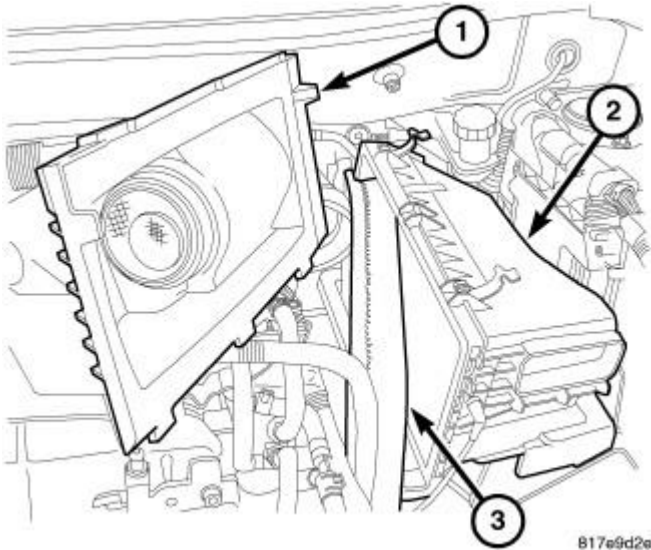
#### REMOVAL



**Fig. 54: Air Filter**  
Courtesy of CHRYSLER LLC

1. Unfasten clasps on sides of air cleaner housing.
2. Move cover (1) aside.
3. Remove filter element (3).

4. If necessary, clean the inside of the air cleaner housing.

**Installation****INSTALLATION**

**Fig. 55: Air Filter**

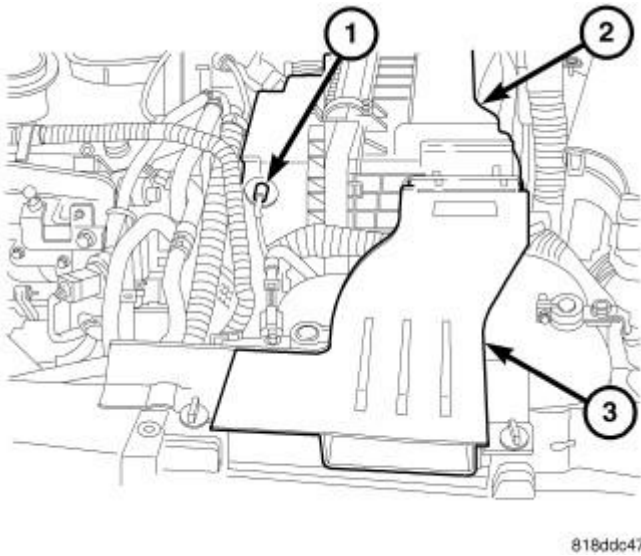
Courtesy of CHRYSLER LLC

1. Install new filter element (3).
2. Replace air cleaner cover (1).
3. Snap clasps in place.

**BODY, AIR CLEANER****Description****DESCRIPTION**

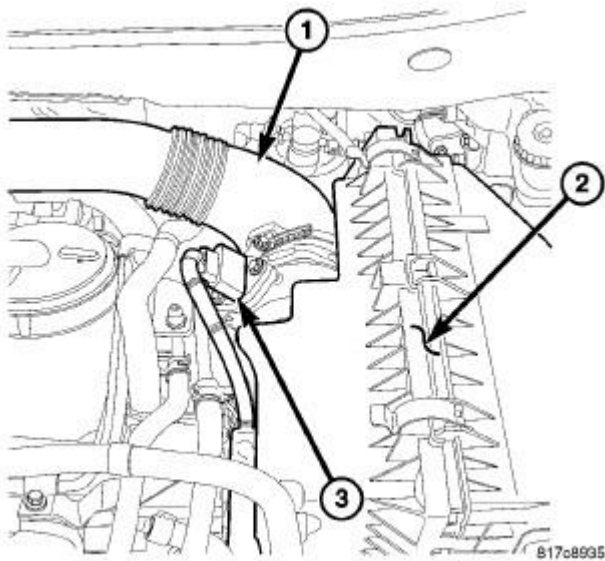
The air cleaner housing attaches to the inner fender in front of the left side strut tower. An ambient air duct supplies underhood air for the engine. It attaches to the lower air cleaner box.

**Removal****REMOVAL**



**Fig. 56: Air Cleaner Housing**  
Courtesy of CHRYSLER LLC

1. Remove the inlet duct (3) from the air cleaner housing (2).
2. Disconnect vacuum line (1) from air cleaner housing (2).

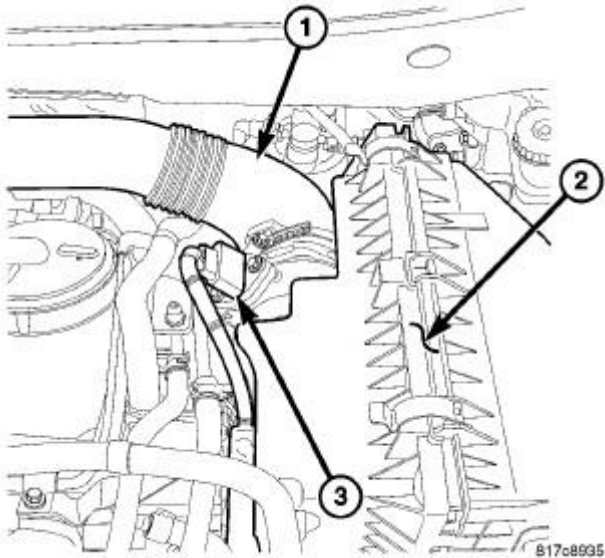


**Fig. 57: Air Cleaner Housing**  
Courtesy of CHRYSLER LLC

3. Disconnect turbocharger inlet hose (1) from air cleaner housing (2).
4. Disconnect mass air flow sensor electrical connector (3).
5. Pull air cleaner housing straight up to remove.

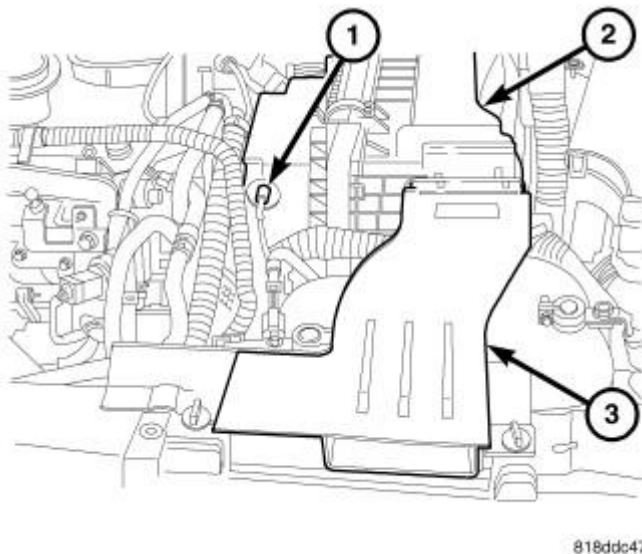
#### Installation

## INSTALLATION



**Fig. 58: Housing Assembly**  
Courtesy of CHRYSLER LLC

1. Lower air cleaner housing assembly into engine compartment and align studs at bottom of housing with bracket. Push housing assembly (2) down until fully seated in bracket.
2. Connect turbocharger inlet hose (1) to air cleaner housing (2).
3. Connect mass air flow sensor connector (3).



**Fig. 59: Air Inlet Tube**  
Courtesy of CHRYSLER LLC

4. Connect vacuum line (1).

5. Install air inlet tube (3).

## CYLINDER HEAD

### DESCRIPTION

#### DESCRIPTION

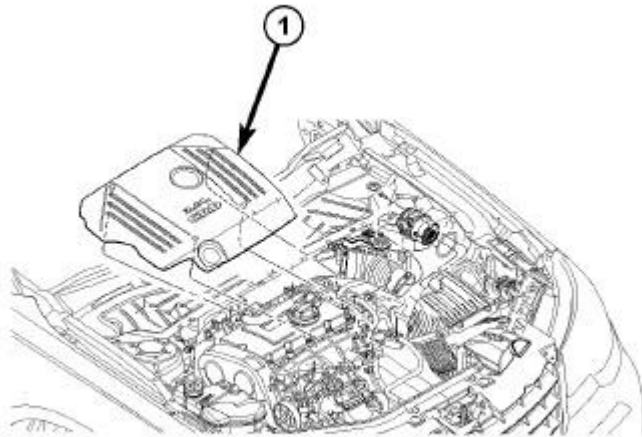
The aluminum cylinder head is a two piece design. It consists of the cylinder head and a bearing frame.

The cylinder head is a cross flow type design with 4 valves per cylinder. The valves are installed vertically.

The bearing frame is used to mount the camshafts and provides mounting of the central power supply connector. It also provides mounting for the injector rocker shaft.

### REMOVAL

#### REMOVAL



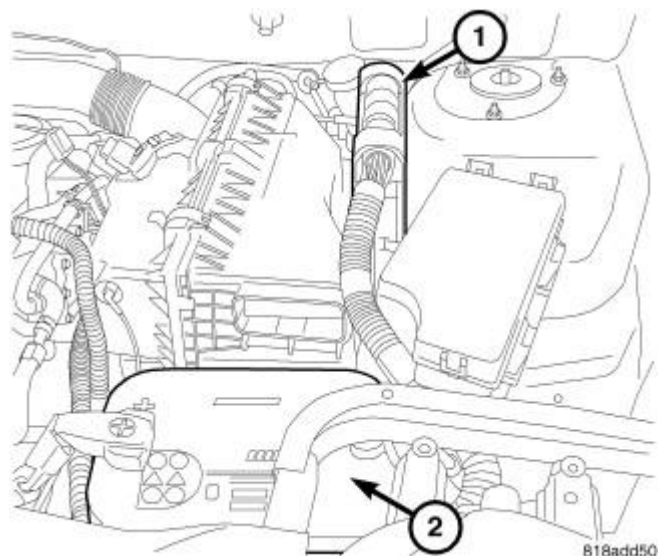
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**Fig. 60: Engine Cover**

Courtesy of CHRYSLER LLC

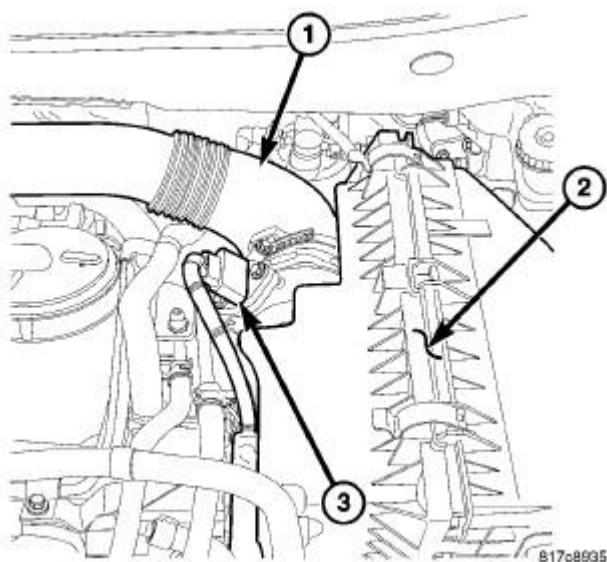
1. Remove engine cover (1). Refer to **ENGINE COVER**.



**Fig. 61: Battery**

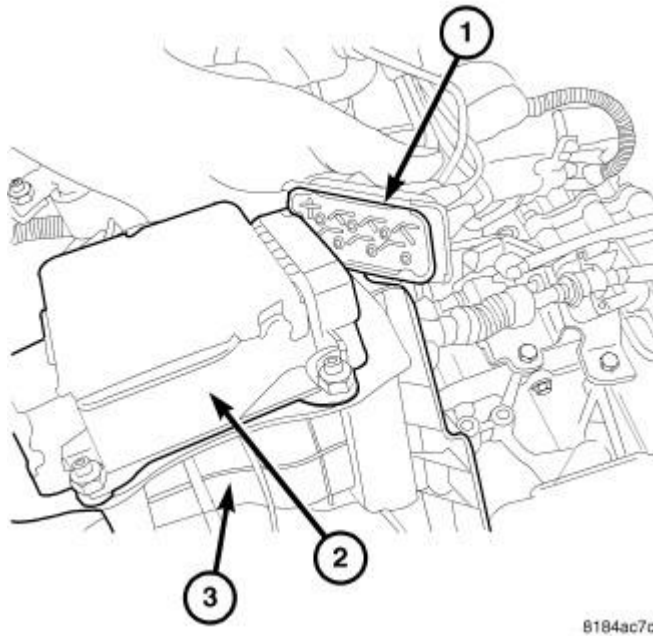
Courtesy of CHRYSLER LLC

2. Remove air cleaner inlet.
3. Disconnect battery (2).

**Fig. 62: Air Filter Housing**

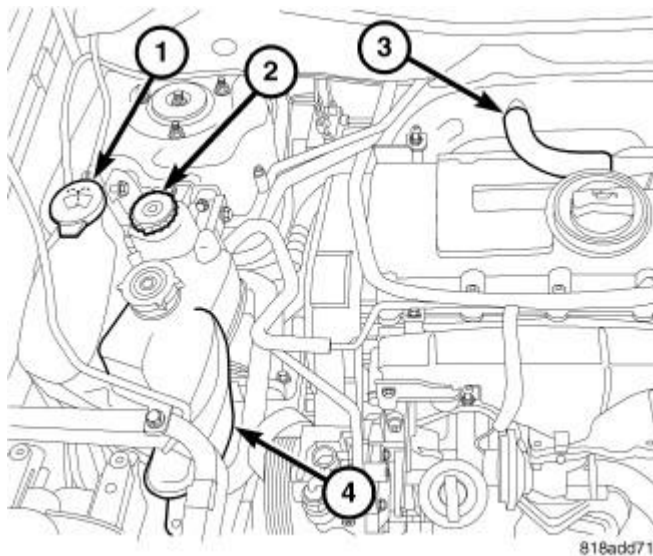
Courtesy of CHRYSLER LLC

4. Disconnect MAF sensor electrical connector (3).
5. Disconnect vacuum line at air cleaner housing.
6. Remove air cleaner housing (2).



**Fig. 63: Vacuum Lines**  
Courtesy of CHRYSLER LLC

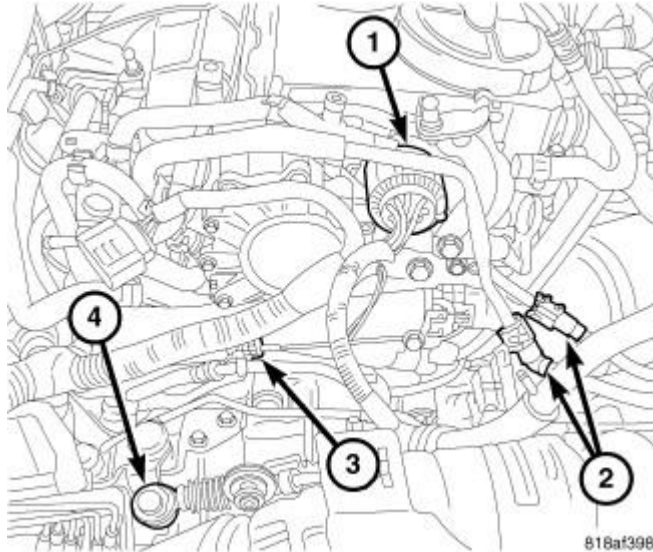
7. Remove vacuum harness (1) and set aside.
8. Disconnect brake booster vacuum line.



**Fig. 64: Coolant Reservoir**  
Courtesy of CHRYSLER LLC

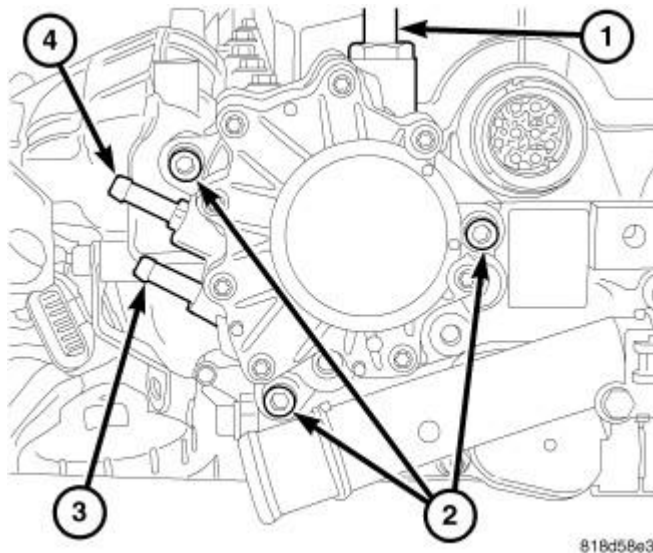
**WARNING:** Risk of injury to skin and eyes from scalding coolant. Do not open cooling system unless temperature is below 90°C (194°F). Open cap slowly to release pressure. Store coolant in approved container only. Wear protective gloves, clothing and eye wear.

9. Drain coolant.
10. Remove coolant tube from reservoir (4).
11. Remove coolant reservoir (4).



**Fig. 65: Injector Harness Connector at Cylinder Head**  
Courtesy of CHRYSLER LLC

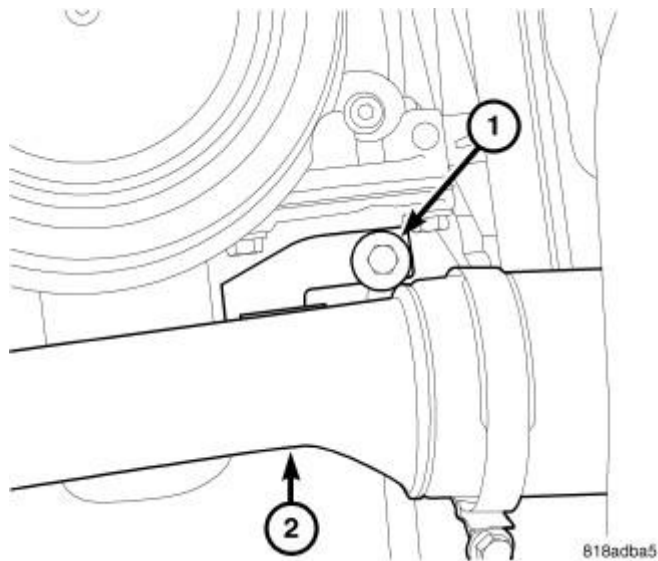
12. Disconnect injector harness connector (1) at cylinder head.
13. Remove fuel line retaining bracket.



**Fig. 66: Tandem Pump**  
Courtesy of CHRYSLER LLC

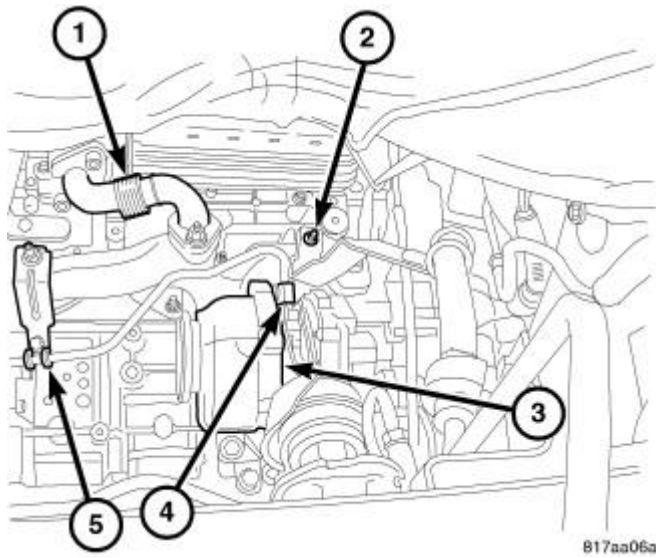
**NOTE:** Place rags below pump to catch fuel spillage.

14. Drain fuel from the injection system prior to removing fuel pump. Refer to **Fuel System/Fuel Injection - Standard Procedure**.
15. Disconnect vacuum line (1) from pump.
16. Disconnect fuel lines (3,4) from pump.
17. Remove fuel pump retaining bolts (2) and remove pump.
18. Disconnect coolant hose near fuel pump.
19. Remove upper radiator hose at cylinder head.
20. Disconnect engine electrical connectors.
21. Remove air inlet hose from throttle body.



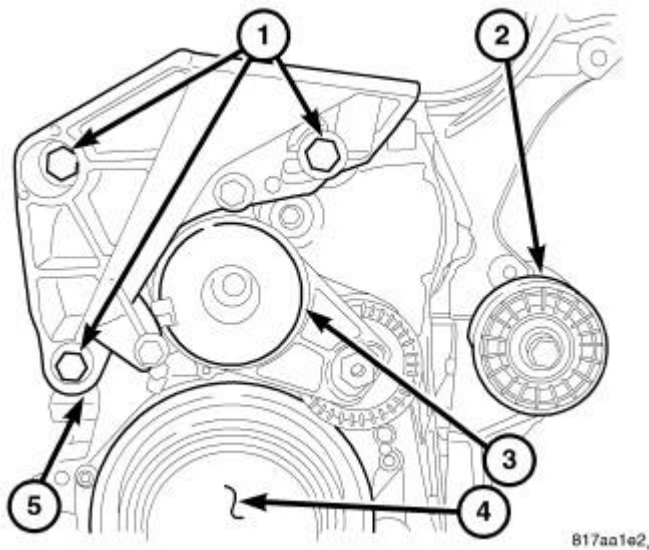
**Fig. 67: Turbo Outlet Pipe**  
**Courtesy of CHRYSLER LLC**

22. Raise vehicle.
23. Remove right splash shield.
24. Remove turbo outlet pipe retaining bolt (1) and remove pipe (2).
25. Remove turbo inlet pipe.



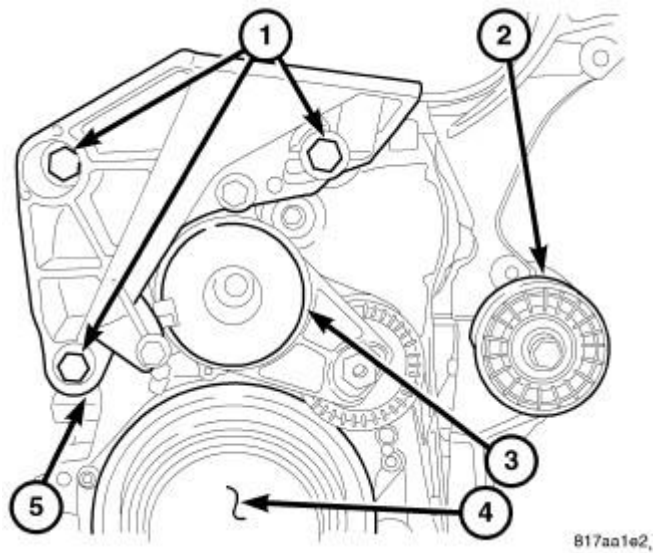
**Fig. 68: Power Steering Line Support**  
Courtesy of CHRYSLER LLC

26. Remove power steering hose support bracket (2) at exhaust manifold.
27. Remove EGR cooler. Refer to Cooling/Engine/COOLER, EGR - Removal .



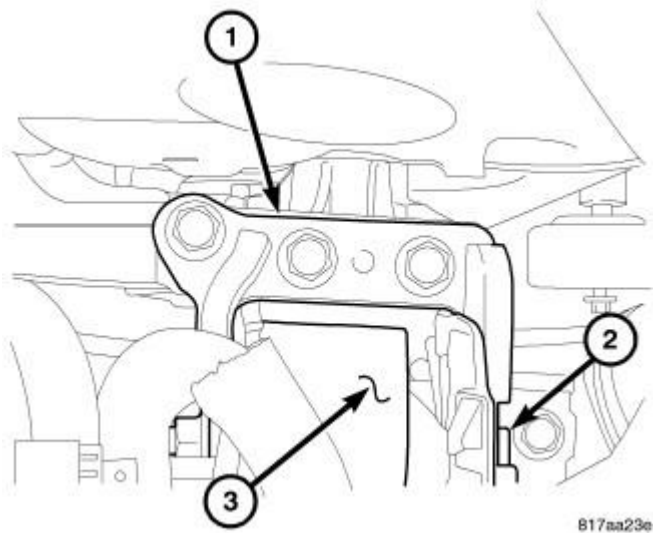
**Fig. 69: Right Engine Mount Bracket**  
Courtesy of CHRYSLER LLC

28. Remove accessory drive belt.
29. Remove balancer (4).



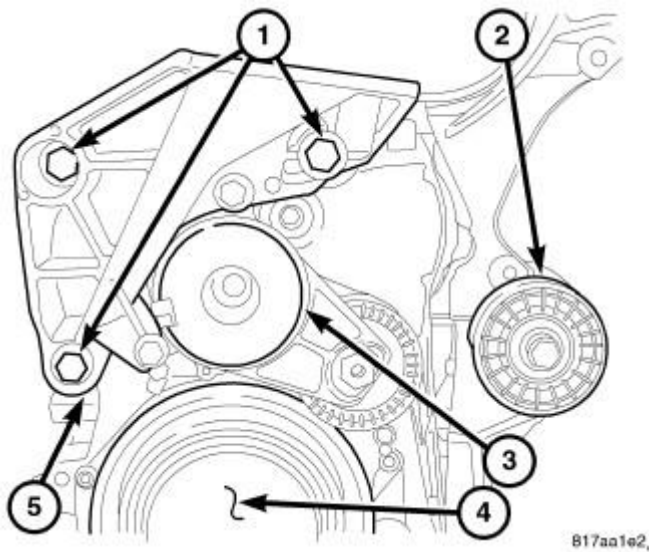
**Fig. 70: Right Engine Mount Bracket**  
Courtesy of CHRYSLER LLC

30. Remove right engine mount bracket (5) lower bolt.
31. Lower vehicle.



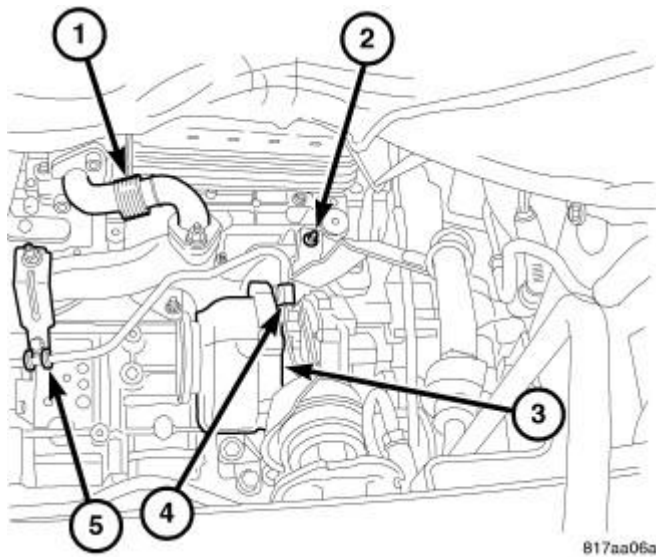
**Fig. 71: Right Engine Mount Bracket**  
Courtesy of CHRYSLER LLC

32. Support oil pan with a suitable jack.
33. Remove right engine mount through bolt (2).
34. Remove right engine mount bracket (1).
35. Remove right engine mount (3).



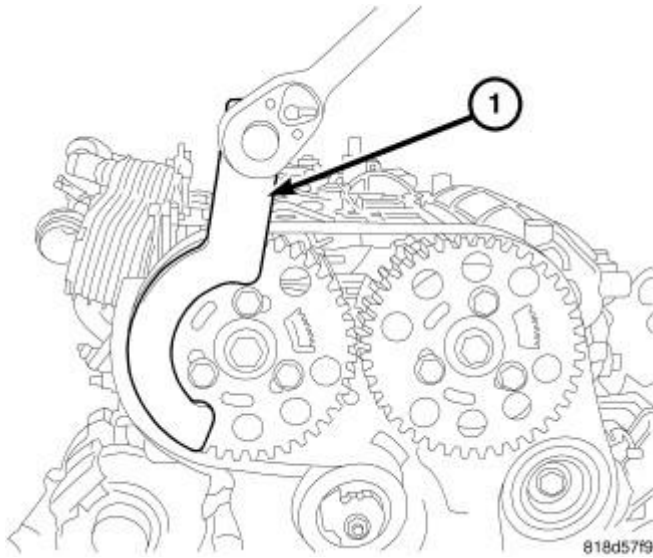
**Fig. 72: Right Engine Mount Bracket**  
Courtesy of CHRYSLER LLC

36. Remove accessory drive belt tensioner (3).
37. Remove the remaining engine mounting bracket retaining bolts (1).
38. Remove right engine mounting bracket (5).
39. Remove harmonic dampener (4).



**Fig. 73: Power Steering Line Support**  
Courtesy of CHRYSLER LLC

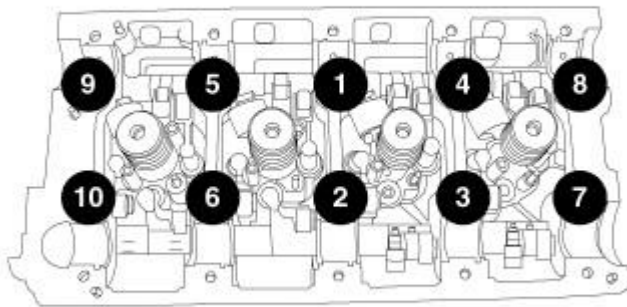
40. Remove timing belt. See **Removal**.
41. Remove oil feed pipe from turbo (4) and remove pipe retainers (5).
42. Remove exhaust manifold.



**Fig. 74: Camshafts**

Courtesy of CHRYSLER LLC

43. Remove camshaft sprockets.
44. Remove camshaft sprocket hubs.
45. Remove injector rocker arm shaft.
46. Remove bearing frame.
47. Remove camshafts.
48. Remove injector retaining bolts and discard.
49. Remove injectors using injector remover 9887. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Removal**.



**Fig. 75: Torque Sequence**

Courtesy of CHRYSLER LLC



**NOTE:** Loosen cylinder head bolts in the reverse order of the tightening sequence.

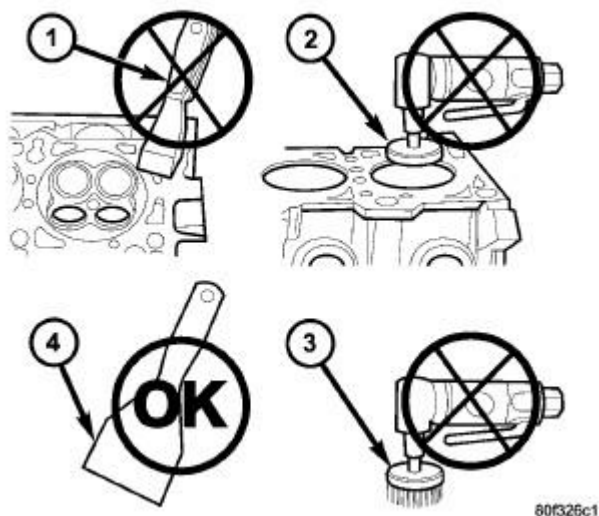
50. Remove cylinder head bolts and discard.

51. Remove cylinder head.

**WARNING:** No fire, open flames or smoking. Risk of poisoning from inhaling and swallowing fuel. Risk of injury from skin and eye contact with fuel. Pour fuels only into suitable and appropriately marked containers. Wear protective clothing when handling fuel.

## CLEANING

### CLEANING



**Fig. 76: Proper Tool Usage for Surface Preparation**  
Courtesy of CHRYSLER LLC

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

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

Remove all gasket material from cylinder head and block. See **Standard Procedure**. Be careful not to gouge or scratch the aluminum head sealing surface.

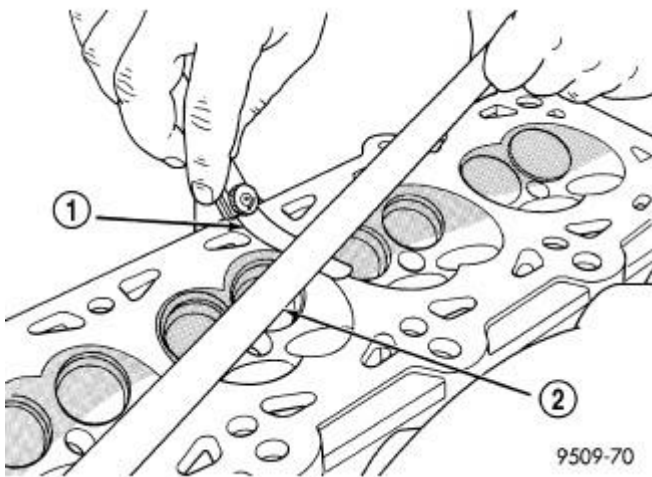
Clean all engine oil passages.

## INSPECTION

## INSPECTION

**NOTE:** Cylinder head cannot be resurfaced.

**NOTE:** Replacement cylinder heads will come complete with valves, seals, springs, retainers, keepers.

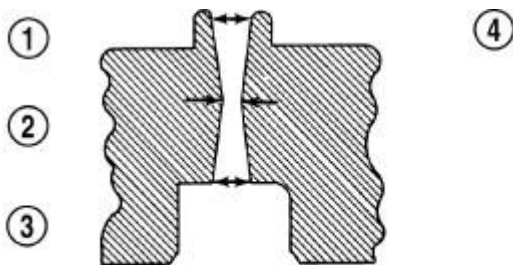


**Fig. 77: Checking Cylinder Head Flatness**

Courtesy of CHRYSLER LLC

- 1 - FEELER GAUGE  
2 - STRAIGHT EDGE

1. Cylinder head must be flat within 0.1 mm (0.004 in.). See **Fig. 77** .



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**Fig. 78: Checking Wear on Valve Guide-Typical**

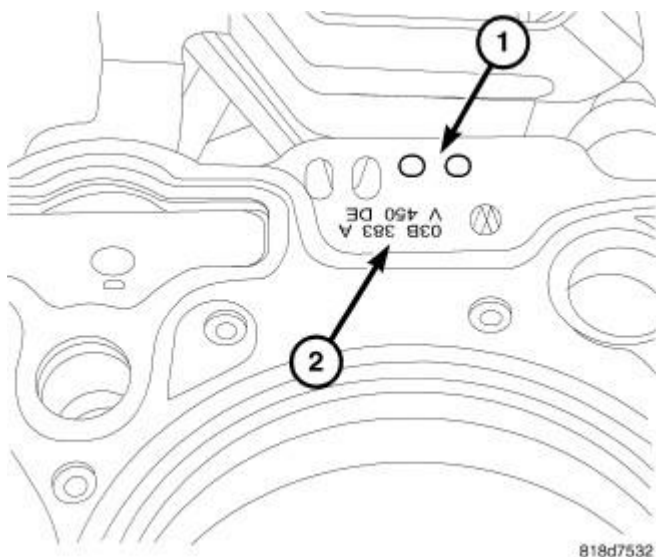
Courtesy of CHRYSLER LLC

- 1 - TOP  
2 - MIDDLE  
3 - BOTTOM  
4 - CUT AWAY VIEW OF VALVE GUIDE  
MEASUREMENT LOCATIONS

2. Inspect camshaft bearing journals for scoring.
3. Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.
4. Using a small hole gauge and a micrometer, measure valve guides in 3 places top (1), middle (2), and bottom (3). See **Specifications**. Replace guides if they are not within specification.
5. Check valve guide height.
6. Prior to installing cylinder head, the cylinder block should be checked for flatness. Refer to **Engine/Engine Block - Inspection**.

## INSTALLATION

### INSTALLATION



**Fig. 79: Gasket Identification**  
Courtesy of CHRYSLER LLC

**WARNING:** No fire, open flames or smoking. Service vehicles in well ventilated areas. Risk of poisoning from inhaling or swallowing fuel. Risk of injury from skin and eye contact with fuel. Wear protective clothing.

**NOTE:** Thoroughly clean all mating surfaces with appropriate solvents and blow out bolt holes, to assure that no grease or oil is present during reassembly.

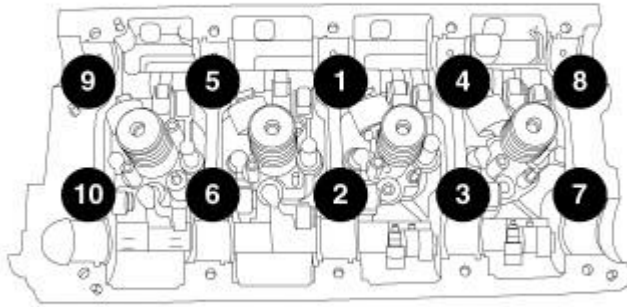
**NOTE:** If piston or connecting rods have been replaced, measure piston projection to ensure proper head gasket selection. See **Standard Procedure**.

**NOTE:** Check facing cylinder head contact surface.

1. Remove crankshaft lock 9883.
2. Rotate crankshaft counterclockwise until all pistons are in the middle of the bore.

**NOTE:** Ensure that the gasket is correct before installing. Gasket is identified by holes stamped in the gasket (1).

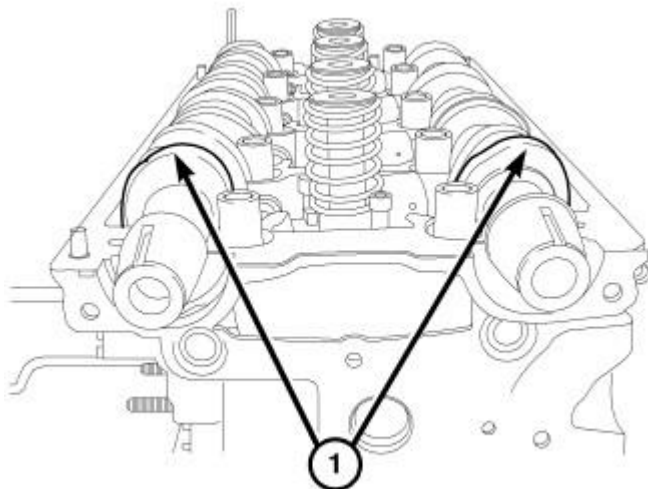
3. Position the cylinder head gasket with writing (2) facing upwards on engine using the dowel pins as guide.



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**Fig. 80: Torque Sequence**  
Courtesy of CHRYSLER LLC

4. Position the cylinder head on the engine and install **new** cylinder head bolts.
  - a. Torque cylinder head bolts to 35 N.m (26 ft. lbs.) in the sequence shown in illustration
  - b. Torque cylinder head bolts to 60 N.m (44 ft. lbs.) in the sequence shown in illustration
  - c. Rotate each bolt in the sequence above 90°.
  - d. Rotate each bolt in the sequence above an additional 90°.



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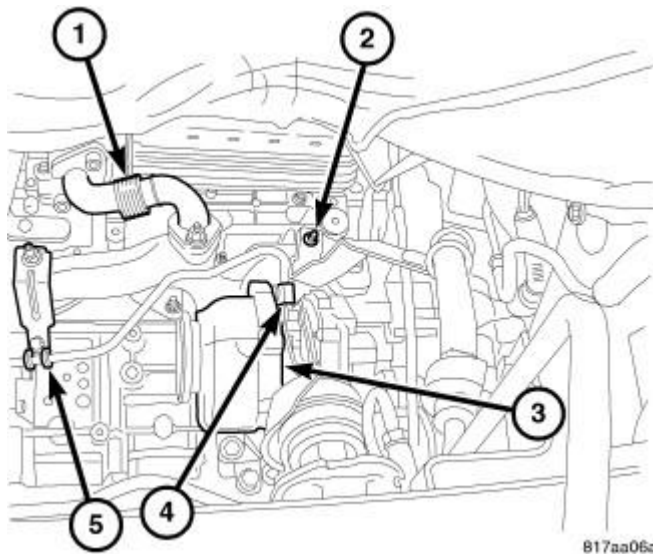
**Fig. 81: Installing Camshafts**  
Courtesy of CHRYSLER LLC

5. Install camshafts (1). See **Installation**
6. Install camshaft oil seals using camshaft front oil seal installer 9884.
7. Install cam position sensor.
8. Install rear timing belt cover.
9. Install camshaft hubs.
10. Install camshaft sprockets.
11. Install camshaft locking pins 9882.
12. Rotate crankshaft clockwise and install crankshaft lock 9883.
13. Install timing belt.

**CAUTION:** When installing unit injectors, new bolts must be used.

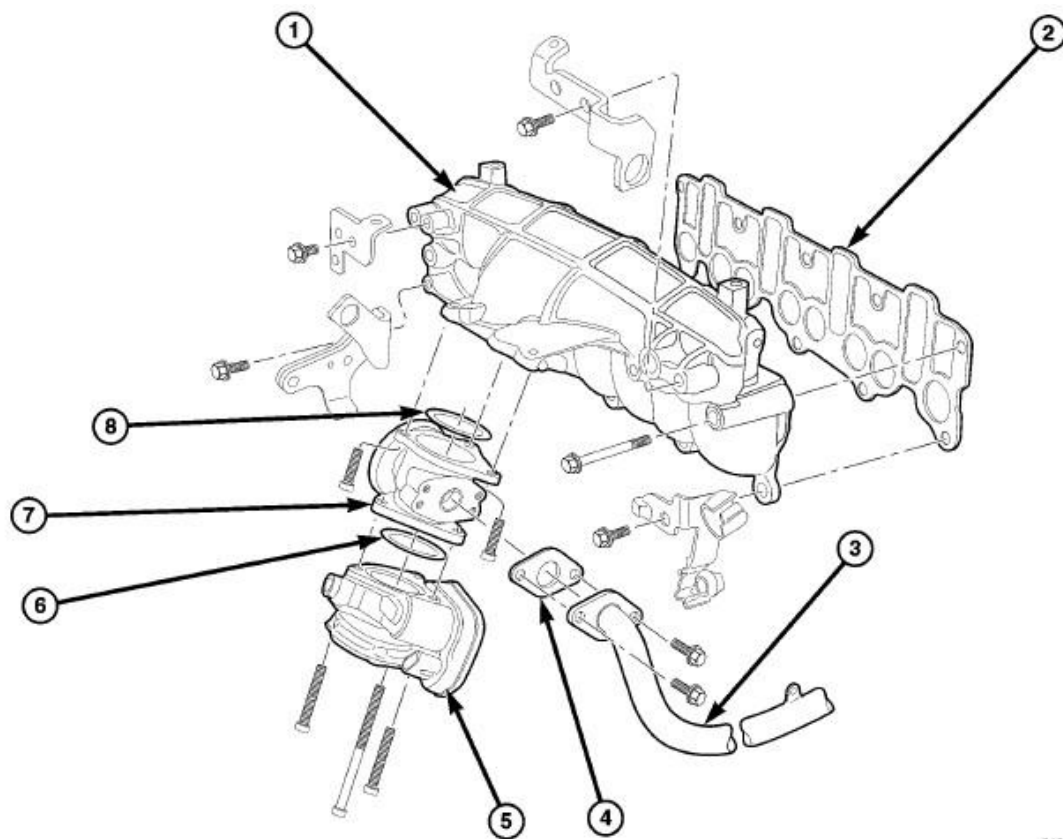
**NOTE:** When installing used unit injector, new o-rings must be used.

14. Install unit injectors. Refer to injector replacement. See **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Installation**.



**Fig. 82: Power Steering Line Support**  
Courtesy of CHRYSLER LLC

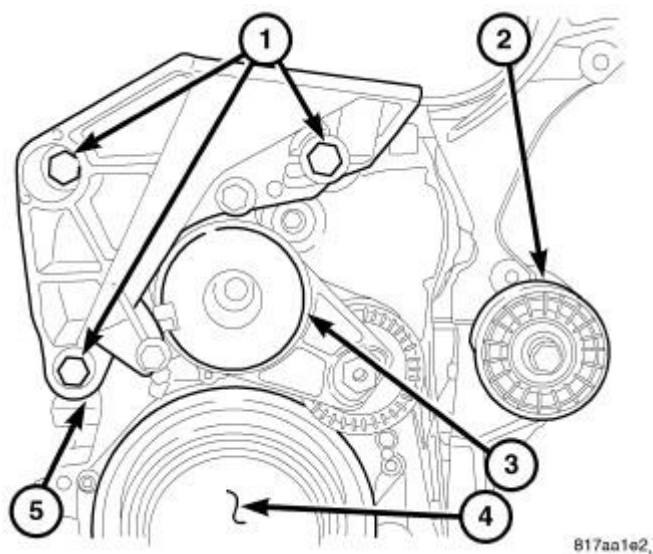
15. Install exhaust manifold gasket and manifold.
16. Install oil feed pipe (4) to turbo and install pipe hold down clamp (5).
17. Install exhaust manifold heat shields.



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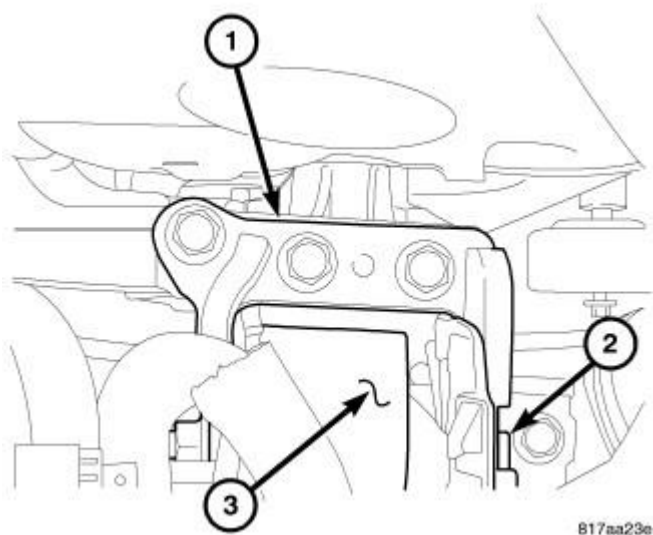
**Fig. 83: Intake Manifold**  
Courtesy of CHRYSLER LLC

18. Install intake manifold gasket (2) and manifold (1). See **Installation**.
19. Install EGR assembly (7).
20. Install throttle plate assembly (5).
21. Install exhaust manifold to EGR tube (3).
22. Install coolant hose to EGR cooler assembly.
23. Install timing belt cover.



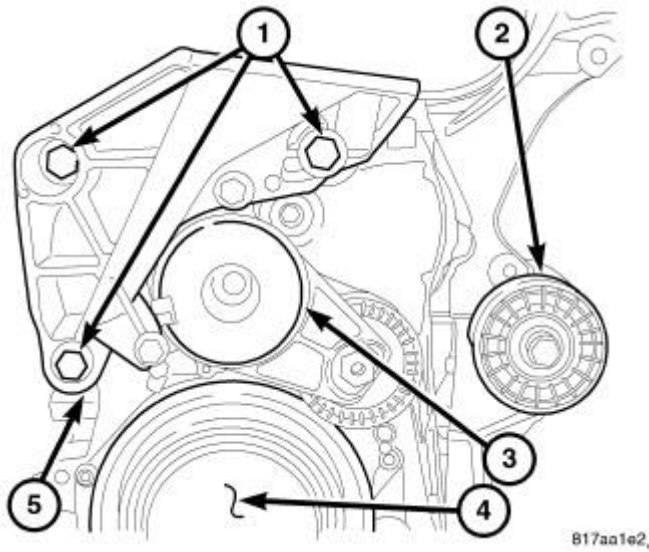
**Fig. 84: Right Engine Mount Bracket**  
Courtesy of CHRYSLER LLC

24. Install right engine mount bracket (5).
25. Install accessory drive belt tensioner.



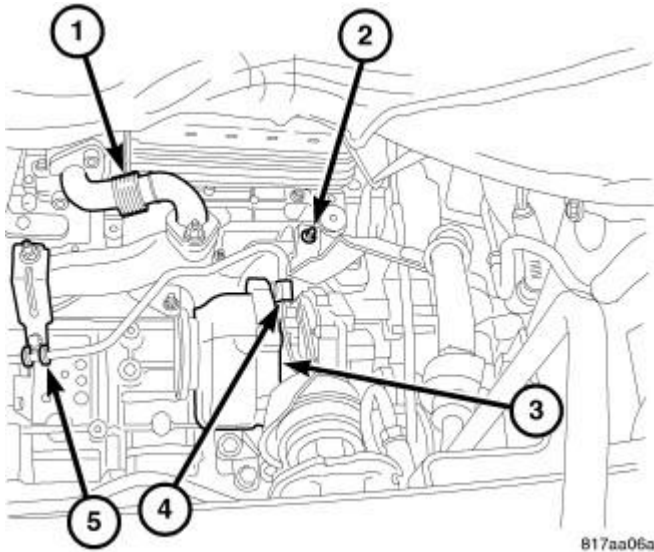
**Fig. 85: Right Engine Mount**  
Courtesy of CHRYSLER LLC

26. Install right engine mount (3).
27. Remove jack.
28. Raise vehicle.
29. Install right engine mount lower bolt.



**Fig. 86: Right Engine Mount Bracket**  
Courtesy of CHRYSLER LLC

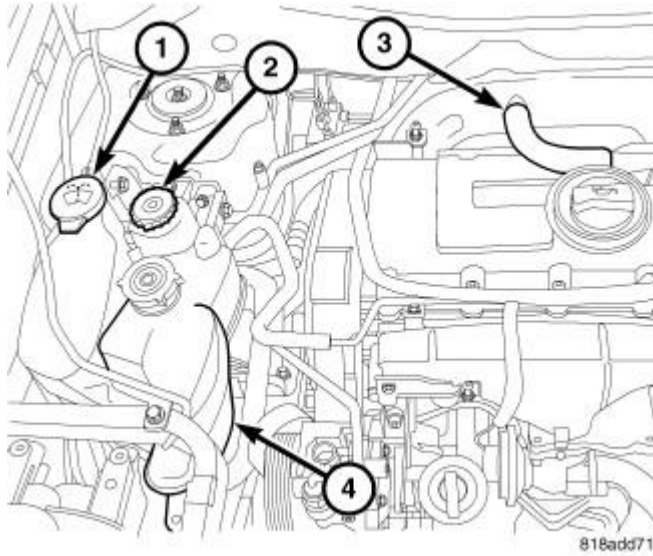
30. Install balancer (4).
31. Install accessory drive belt.



**Fig. 87: Power Steering Line Support**  
Courtesy of CHRYSLER LLC

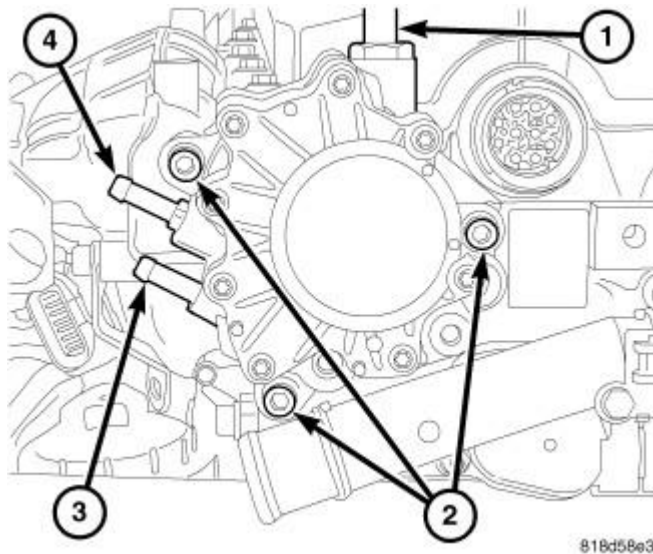
32. Install power steering hose support bracket at exhaust manifold (2).
33. Install turbo outlet pipe.
34. Install turbo inlet pipe.
35. Install right splash shield.
36. Lower vehicle.





**Fig. 88: Coolant Reservoir**  
Courtesy of CHRYSLER LLC

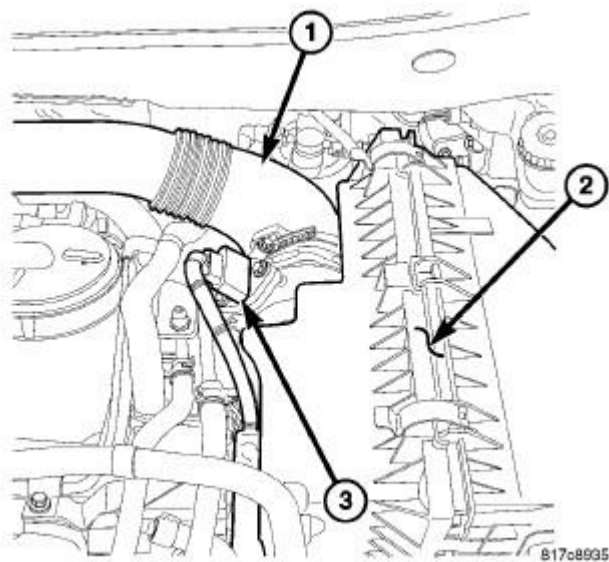
- 37. Install coolant recovery bottle (4).
- 38. Install air inlet hose to throttle body.
- 39. Connect engine electrical connectors.
- 40. Install upper radiator hose at cylinder head.
- 41. Connect coolant hoses near fuel pump.



**Fig. 89: Fuel Pump**  
Courtesy of CHRYSLER LLC

- 42. Install fuel pump. Refer to **Fuel System/Fuel Delivery/PUMP, Tandem Fuel - Installation** .
- 43. Install fuel line retaining bracket.
- 44. Connect injector harness at cylinder head.

45. Connect brake booster vacuum hose (1).
46. Connect coolant tube at reservoir.
47. Install vacuum harness.
48. Fill with coolant.
49. Install new oil filter and fill with oil.



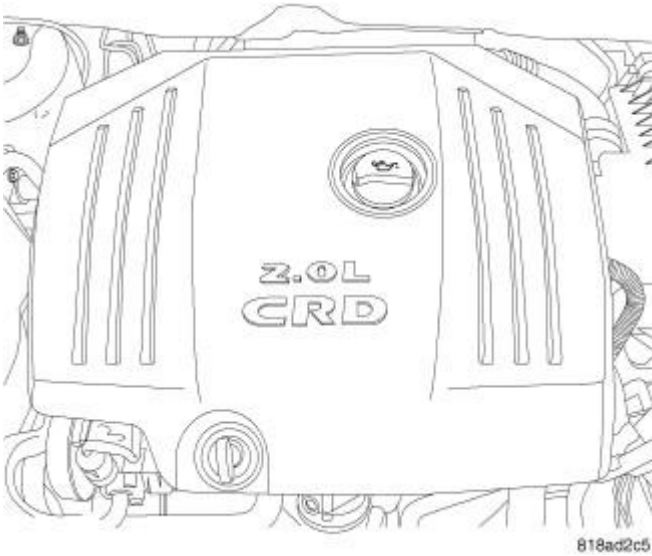
**Fig. 90: Air Cleaner Assembly**  
Courtesy of CHRYSLER LLC

50. Install air cleaner assembly (2).
51. Connect battery.
52. Start engine and check for leaks.

## CAMSHAFT, ENGINE

### Removal

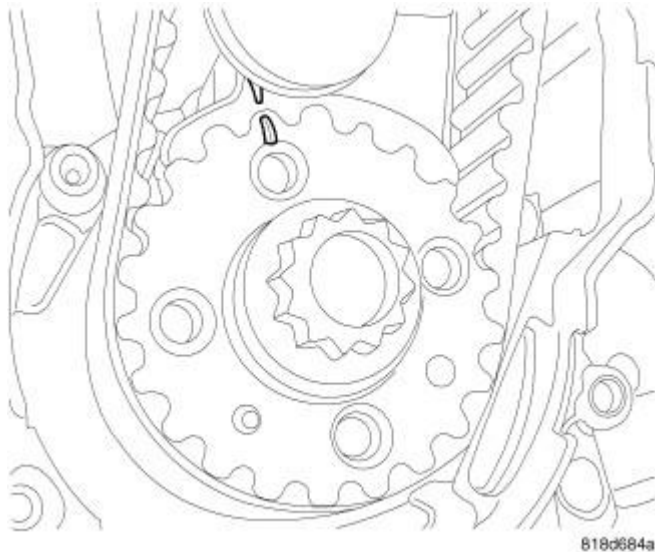
### REMOVAL

**Fig. 91: Engine Cover**

Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove engine cover. Refer to **ENGINE COVER**.

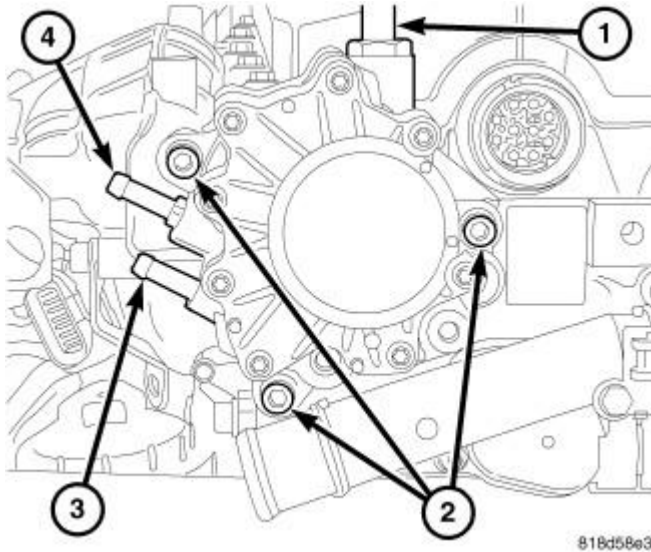
**WARNING:** No fire, open flames or smoking. Risk of poisoning from inhaling or swallowing fuel. Risk of injury from skin and eye contact with fuel. Wear protective clothing. Store fuel only in suitable and appropriately marked containers.

**Fig. 92: Crankshaft Timing Marks**

Courtesy of CHRYSLER LLC

3. Place engine at TDC.
4. Install crankshaft lock 9883.

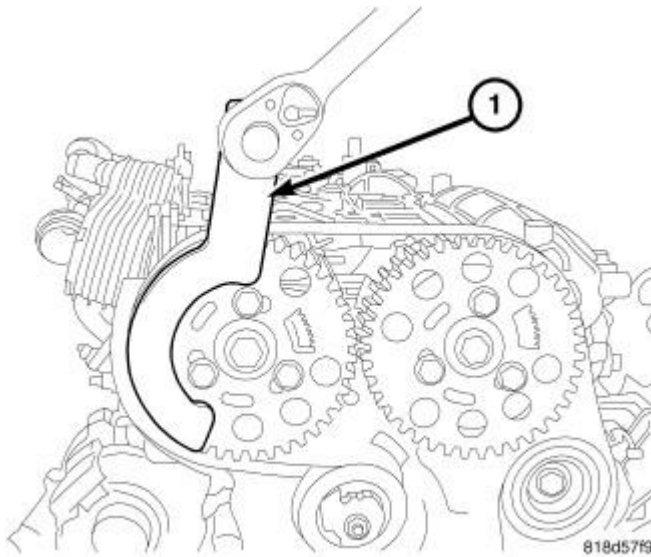
5. Remove timing belt. See **Removal**.



**Fig. 93: Fuel Pump**

Courtesy of CHRYSLER LLC

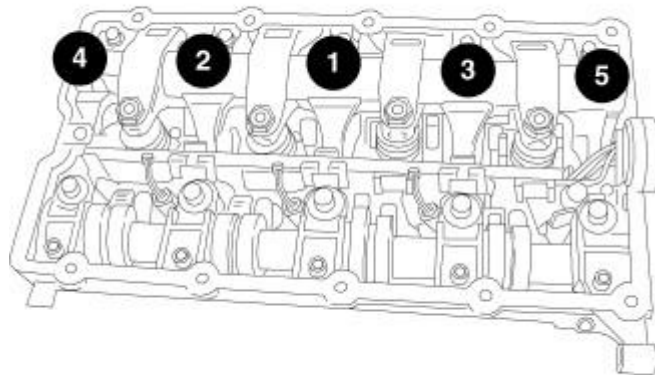
6. Remove fuel pump. Refer to **Fuel System/Fuel Delivery/PUMP, Tandem Fuel - Removal**.



**Fig. 94: Camshaft Holder**

Courtesy of CHRYSLER LLC

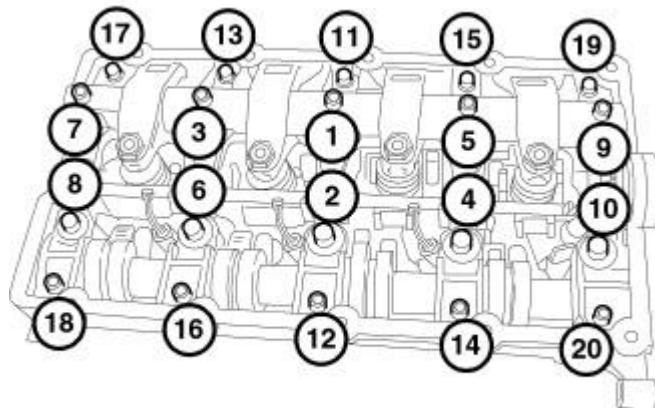
7. Loosen camshaft hub retaining bolt using camshaft sprocket/hub holder 9880 (1).
8. Remove camshaft sprocket retaining bolts using camshaft sprocket/hub holder 9880 (1) and remove sprockets.
9. Remove camshaft hub retaining bolt and remove hubs with puller.
10. Loosen injector adjusting lock nut and back off injector adjuster.



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**Fig. 95: Rocker Arm Shaft And Bearing Frame Retaining Bolts**  
Courtesy of CHRYSLER LLC

11. Remove rocker arm shaft and bearing frame retaining bolts.
12. Remove rocker arm shaft.

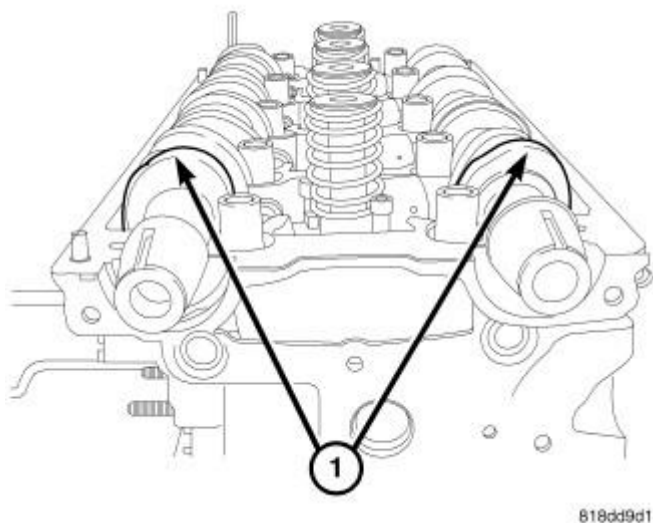


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**Fig. 96: Cam Bearing Frame Removal**  
Courtesy of CHRYSLER LLC

13. Remove bearing frame.

**NOTE:** If bearing shells are to be reused, clean them and identify location with a marker.

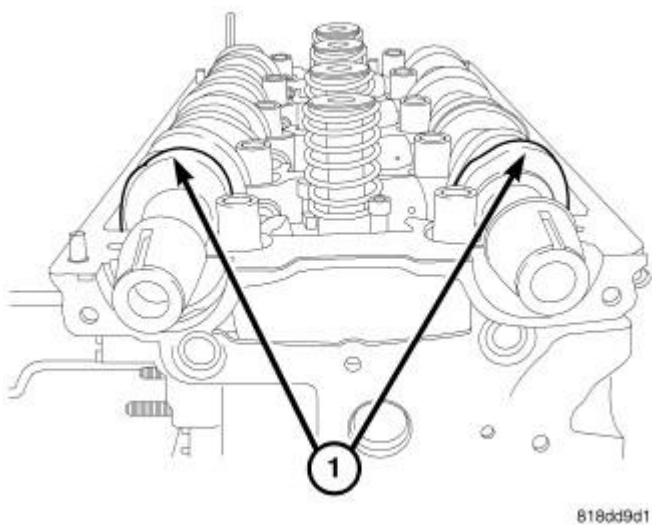


**Fig. 97: Camshafts Removal**  
Courtesy of CHRYSLER LLC

14. Remove camshafts (1).

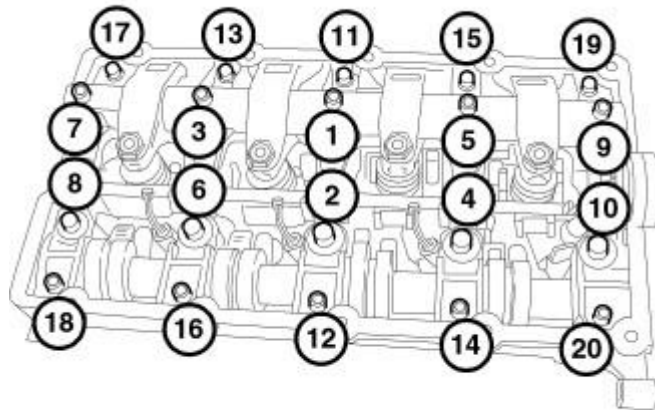
#### **Installation**

#### **INSTALLATION**



**Fig. 98: Installing Camshafts**  
Courtesy of CHRYSLER LLC

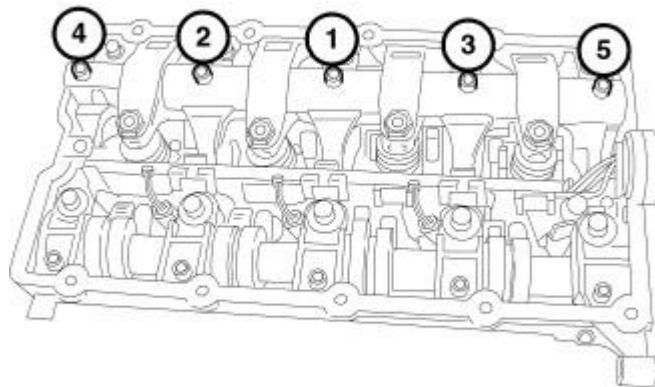
1. Install new bearing shells in cylinder head.
2. Lubricate bearings with clean engine oil.
3. Install camshafts with cylinder #1 lobes pointing upwards.



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**Fig. 99: Cam Bearing Frame Torque**  
Courtesy of CHRYSLER LLC

4. Apply a bead of RTV to cylinder head.
5. Install bearing frame and tighten bolts as shown in illustration.

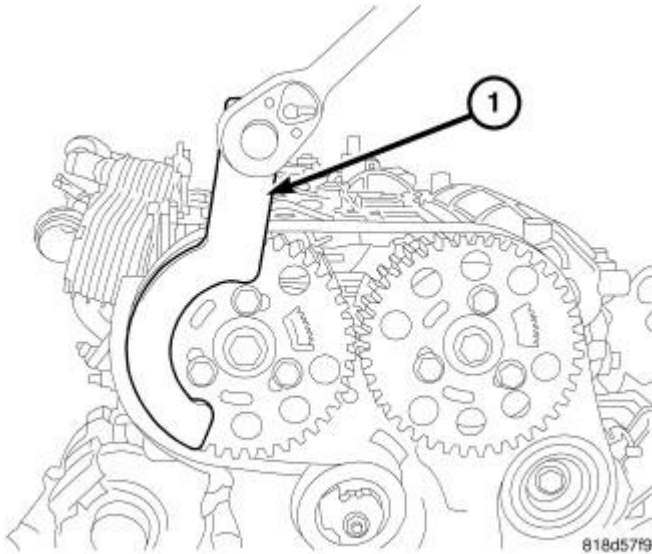


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**Fig. 100: Injector Shaft Torque**  
Courtesy of CHRYSLER LLC

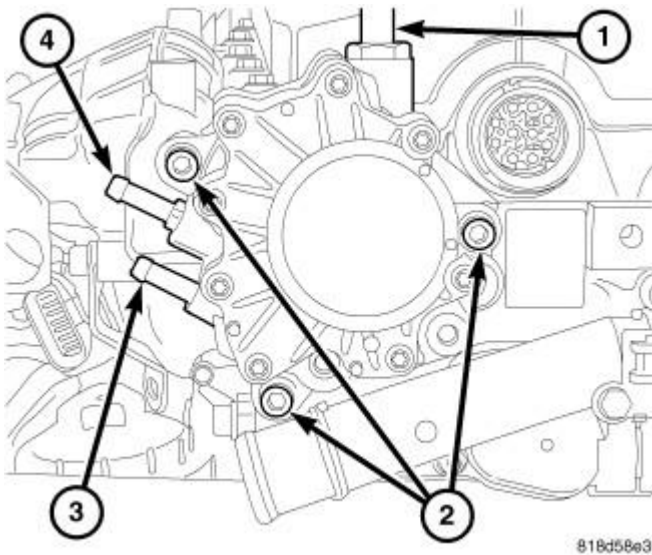
6. Install injector rocker arm shaft.
7. Tighten bolts to 20 N.m (177 in. lbs.) in the sequence shown in illustration.
8. Tighten rocker arm shaft bolts an additional 90° as shown in illustration
9. Install camshaft oil seals using. See **Installation**
10. Install camshafts hubs onto camshafts and install bolts.
11. Install sprockets on camshaft hubs with the toothed segment facing upward as shown in illustration

12. Install retaining bolts finger tight.



**Fig. 101: Camshafts Holder**  
Courtesy of CHRYSLER LLC

13. Tighten camshaft hub bolts to 100 N.m (74 ft. lbs.) using hub/sprocket holder 9880 (1).
14. Install camshaft locking pins 9882.
15. Install timing belt. See **Installation**.
16. Perform injector adjustment. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Standard Procedure**.

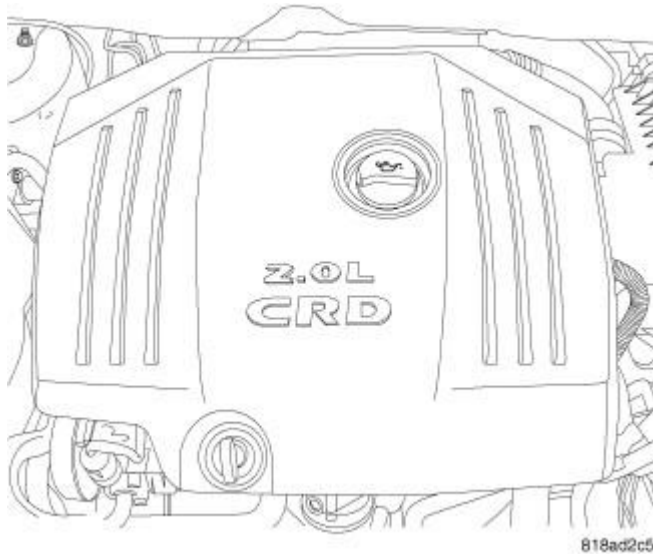


**Fig. 102: Fuel Pump**  
Courtesy of CHRYSLER LLC

17. Install fuel pump. Refer to **Fuel System/Fuel Delivery/PUMP, Tandem Fuel - Installation**.



18. Install cylinder head cover. See **Installation**



**Fig. 103: Engine Cover-Installation**  
Courtesy of CHRYSLER LLC

19. Reconnect negative battery cable.

**WARNING:** Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.

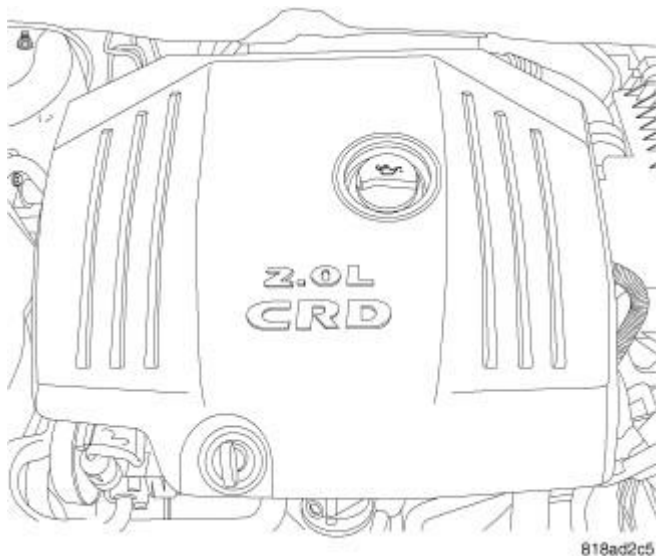
**CAUTION:** When new rocker fingers have been installed, engine must not be started for 30 minutes. The hydraulic compensation elements must settle or the pistons will contact the valves.

20. Start engine and inspect for leaks.  
21. Install engine cover. Refer to **ENGINE COVER**.

## COVER(S), CYLINDER HEAD

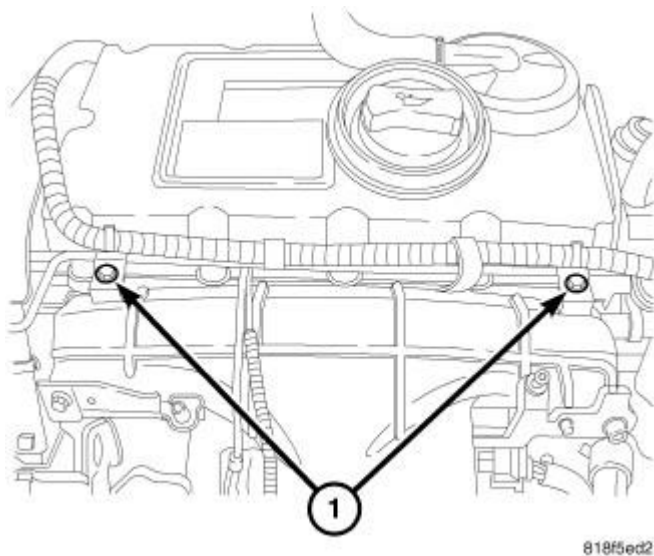
### Removal

### REMOVAL

**Fig. 104: Engine Cover**

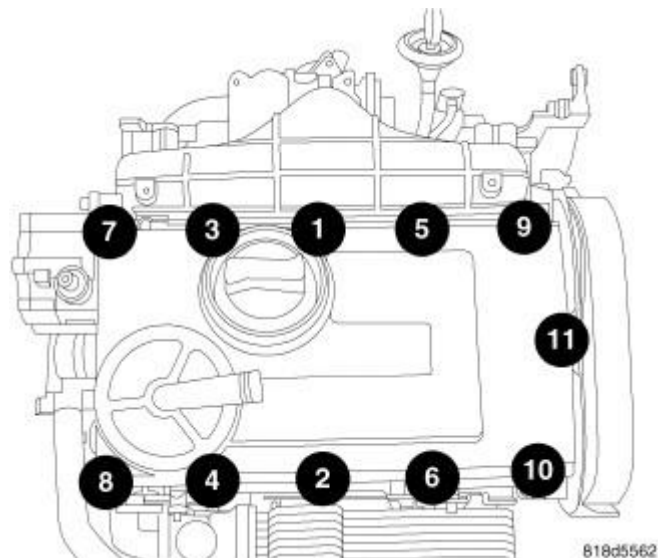
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove engine cover. Refer to **ENGINE COVER**.

**Fig. 105: Coolant Tube Retaining Bolts**

Courtesy of CHRYSLER LLC

3. Remove coolant tube retaining bolts (1) and reposition coolant tube.

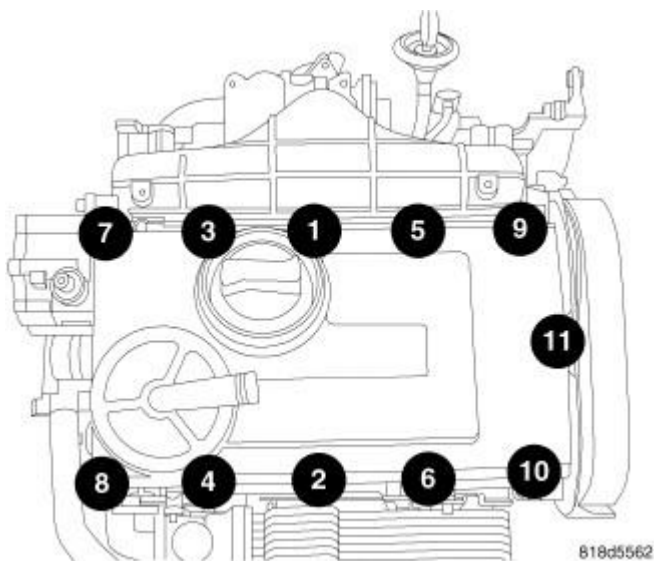


**Fig. 106: Cylinder Head Cover**  
Courtesy of CHRYSLER LLC

4. Remove cylinder head cover retaining bolts and remove cover.

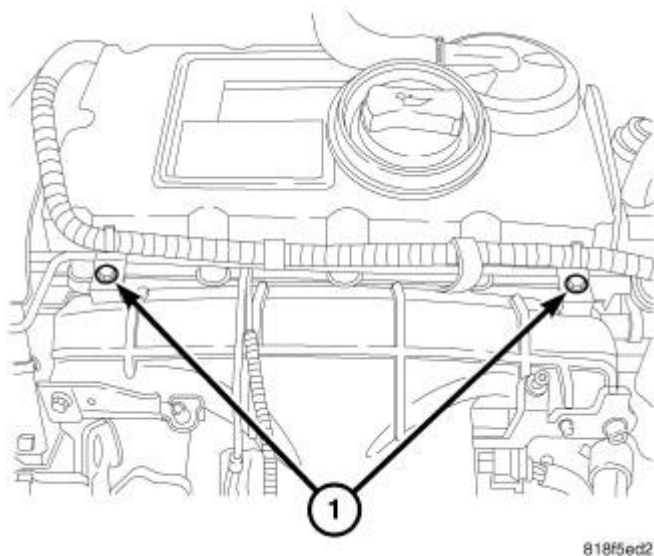
#### Installation

#### INSTALLATION



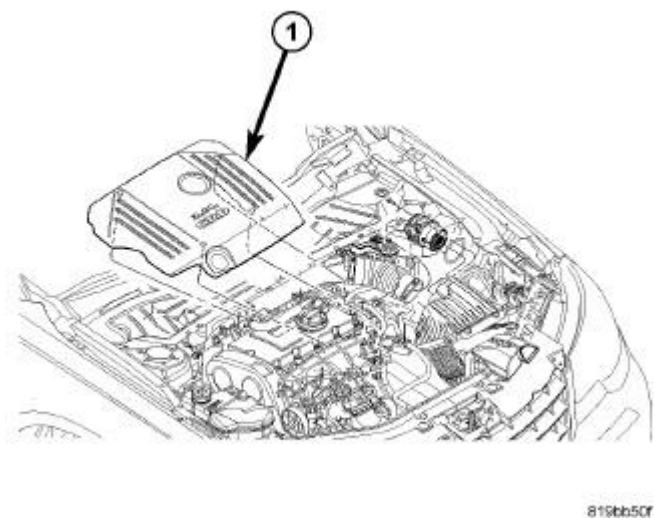
**Fig. 107: Cylinder Head Cover**  
Courtesy of CHRYSLER LLC

1. Clean sealing surfaces.
2. Install new cylinder head cover gasket.
3. Install cylinder head cover.
4. Tighten cylinder head cover bolts in the sequence shown in illustration



**Fig. 108: Coolant Tube**  
Courtesy of CHRYSLER LLC

5. Install coolant tube retaining bolts (1) and tighten.



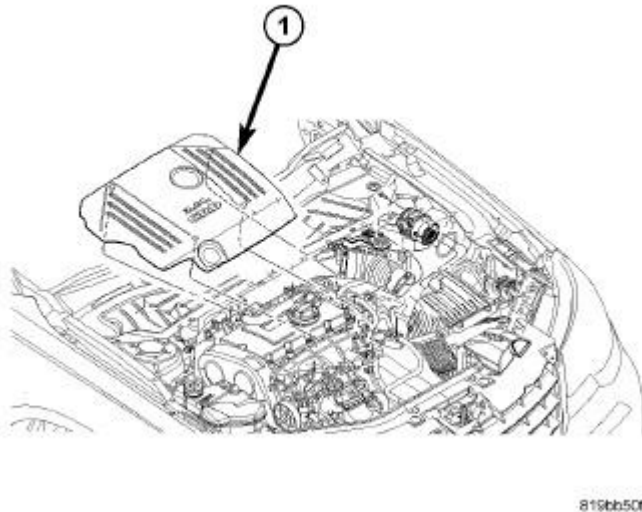
**Fig. 109: Engine Cover**  
Courtesy of CHRYSLER LLC

6. Install engine cover (1). Refer to **ENGINE COVER**.

## SEAL(S), CAMSHAFT

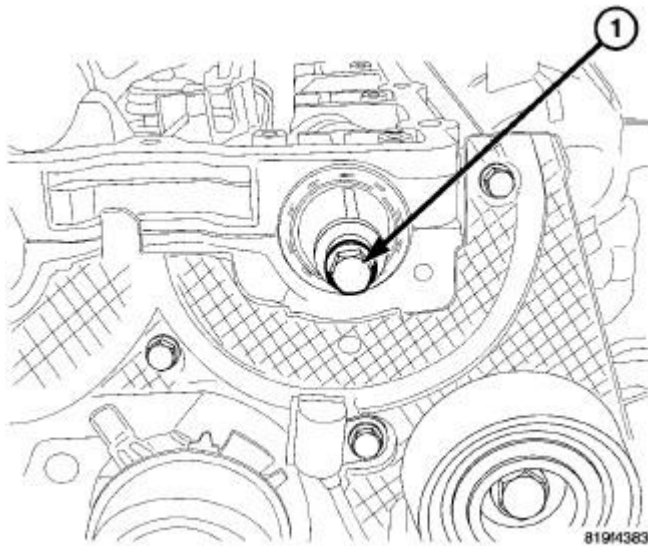
### Removal

### REMOVAL



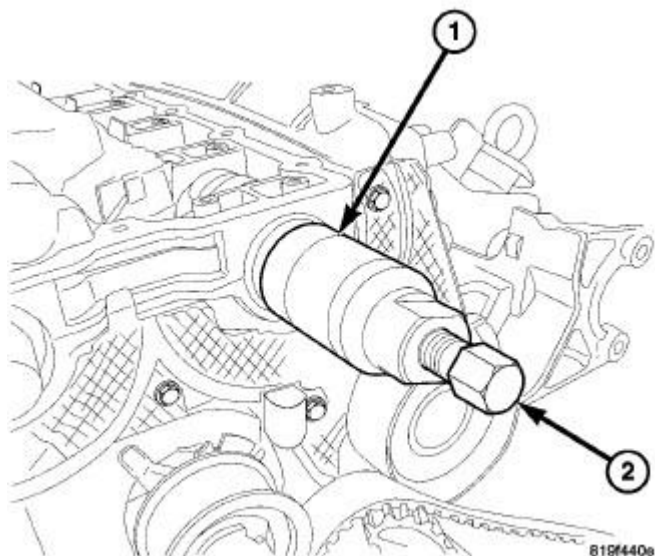
**Fig. 110: Engine Cover - Removal**  
Courtesy of CHRYSLER LLC

1. Remove engine cover (1). Refer to **ENGINE COVER**.
2. Remove timing belt. See **Removal**.
3. Remove timing belt tensioner. See **Removal**.
4. Remove timing belt rear cover.
5. Remove camshaft sprockets.
6. Remove camshaft hubs.



**Fig. 111: Inserting Bolt In Camshaft**  
Courtesy of CHRYSLER LLC

7. Insert a bolt (1) in the camshaft.

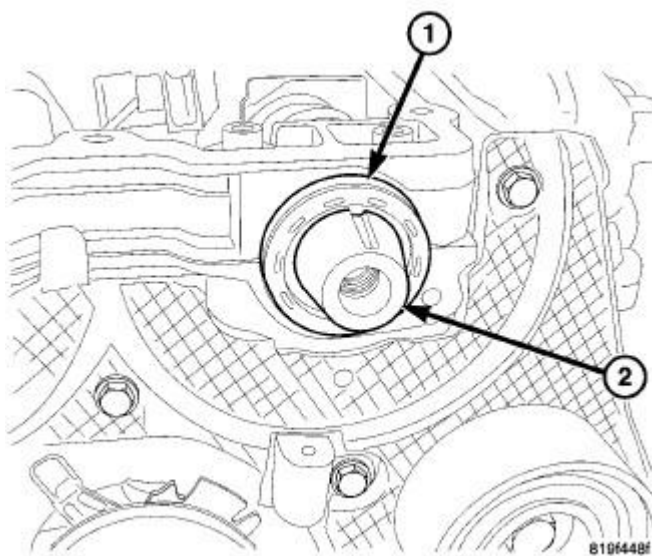


**Fig. 112: Camshaft Seal Removal**  
Courtesy of CHRYSLER LLC

8. Screw seal remover 6771 (1) into camshaft seal.
9. Tighten force screw (2) to remove camshaft oil seals.

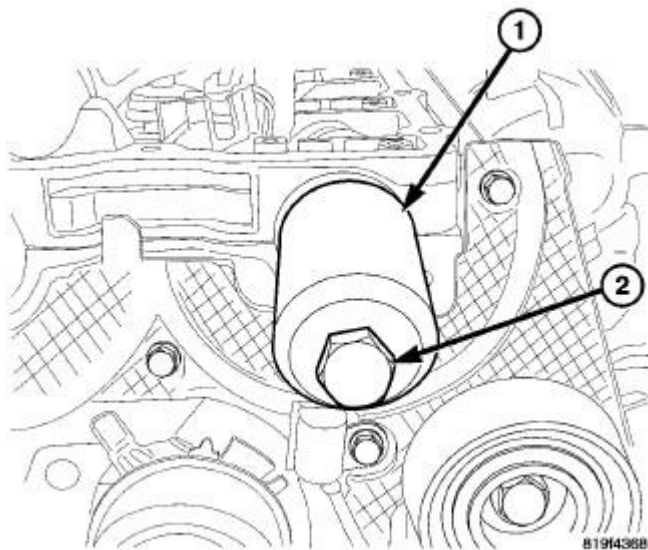
## Installation

### INSTALLATION



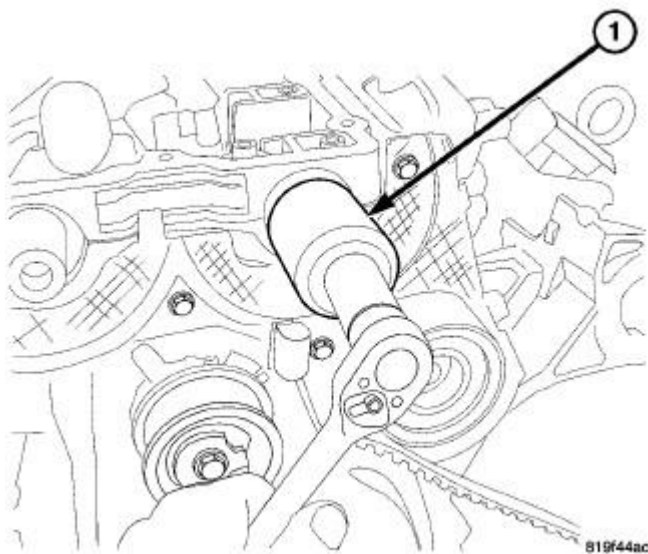
**Fig. 113: Cam Seal**  
Courtesy of CHRYSLER LLC

1. Position new cam seal (1) on camshaft (2) as shown in illustration



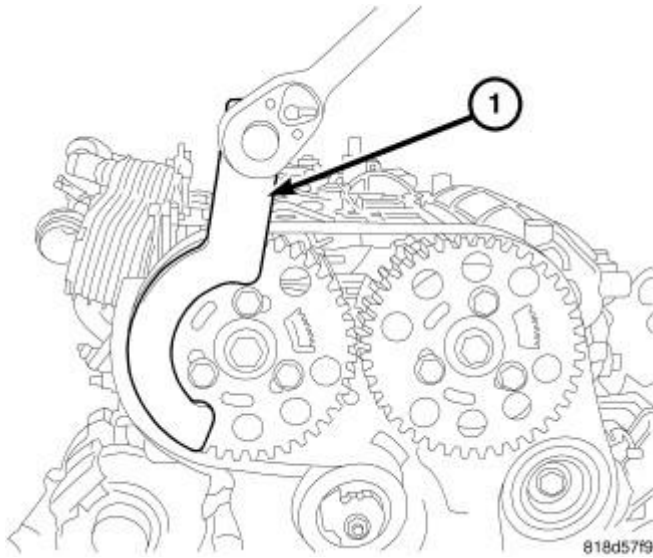
**Fig. 114: Cam Seal Installer**  
Courtesy of CHRYSLER LLC

2. Position cam seal installer 9884 (1) over camshaft and insert bolt (2).



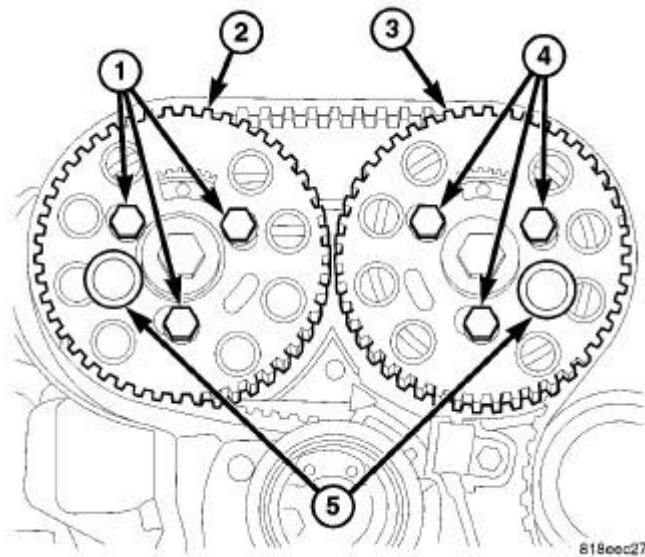
**Fig. 115: Cam Seal Installation**  
Courtesy of CHRYSLER LLC

3. Tighten bolt until seal bottoms out.



**Fig. 116: Cam Holder**  
Courtesy of CHRYSLER LLC

4. Install timing belt hubs and hand tighten bolts.
5. Install timing belt sprockets and hand tighten bolts.
6. Install cam holder 9880 (1).
7. Tighten hub center bolt.

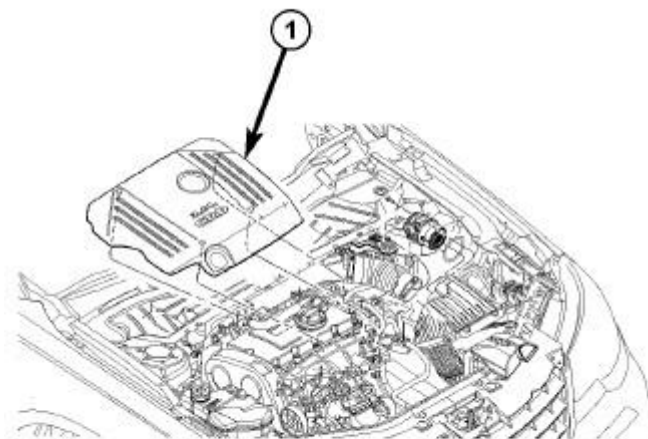


**Fig. 117: Camshaft Locking Pins**  
Courtesy of CHRYSLER LLC

8. Install camshaft locking pins 9882 (5).
9. Tighten camshaft sprocket retaining bolts (1,4).
10. Install timing belt tensioner. See **Installation**.



11. Install timing belt. See **Installation**.
12. Install right engine mount bracket.
13. Install damper.
14. Install right engine mount.



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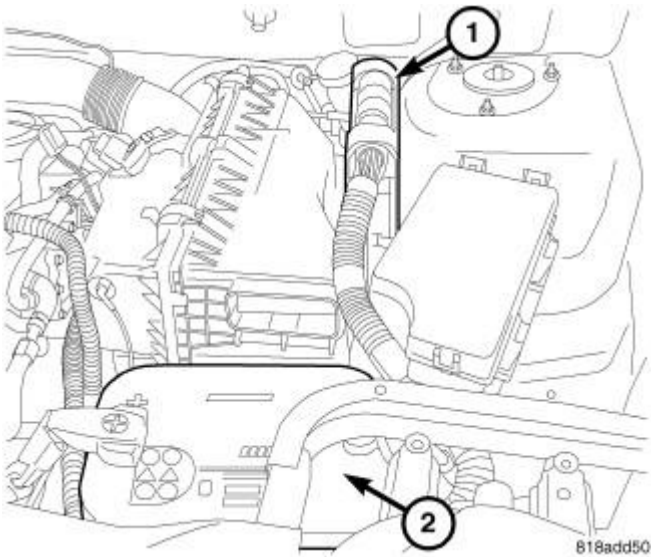
**Fig. 118: Engine Cover**  
Courtesy of CHRYSLER LLC

15. Install engine cover (1). Refer to **ENGINE COVER**.

## **SPRING(S), VALVE**

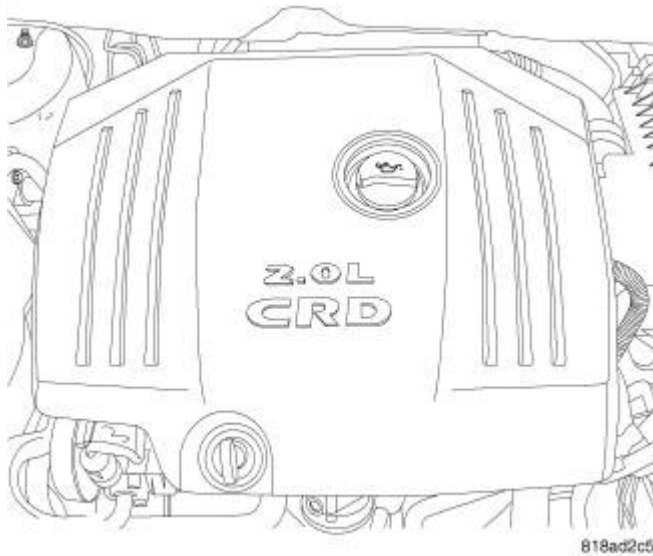
### **Removal**

### **VALVE SPRINGS**



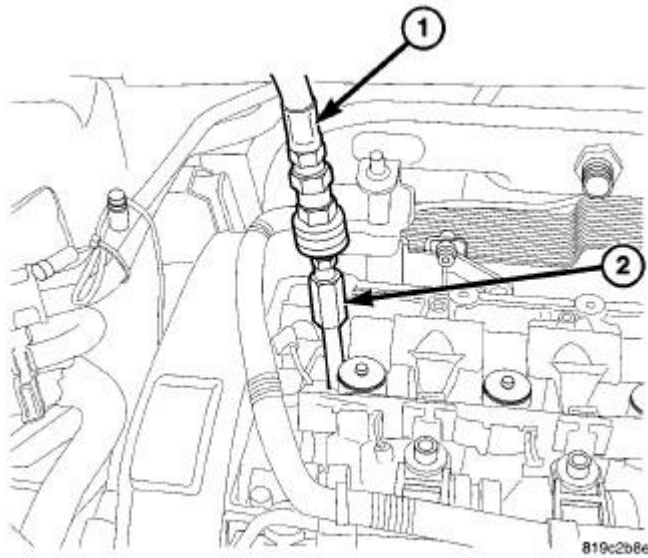
**Fig. 119: Battery Cable**  
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable (2).



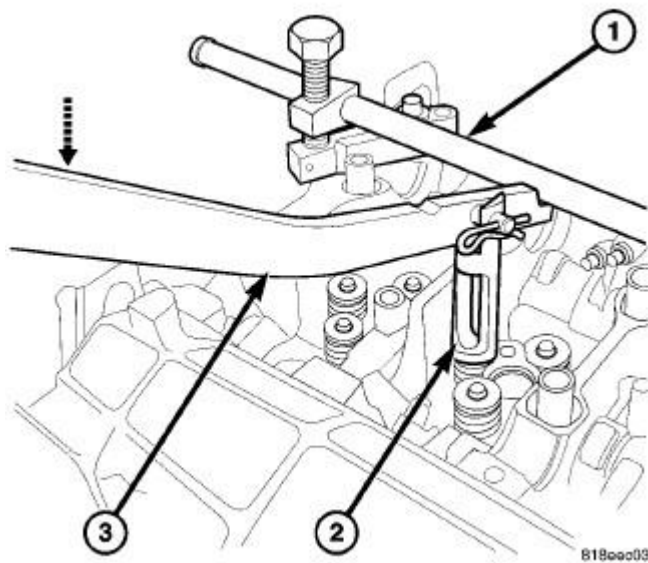
**Fig. 120: Engine Cover**  
Courtesy of CHRYSLER LLC

2. Remove engine cover. Refer to **ENGINE COVER**.
3. Remove camshafts. See **Removal**.
4. Position piston of cylinder to be processed to TDC by rotating the crankshaft clockwise. **DO NOT crank engine. DO NOT rotate engine backward.**



**Fig. 121: Glow Plug Adapter 9939**  
Courtesy of CHRYSLER LLC

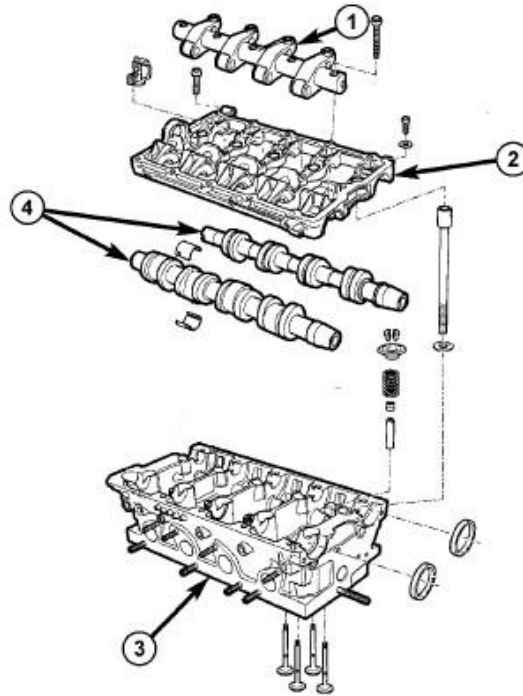
5. Remove glow plugs. Refer to **Electrical - Ignition Control/Ignition Control/PLUG, Glow - Removal**.
6. Install glow plug adapter 9939 (2).
7. Connect air supply (1) to glow plug adapter 9939 (2) and pressurize the cylinder to 5 bar (73 psi.).



**Fig. 122: Valve Spring Compressor 9916**  
Courtesy of CHRYSLER LLC

**CAUTION:** Valve springs and retainers must be kept in order of the cylinder they were removed.

8. Install valve spring compressor 9916 (1,2,3).
9. Compress valve spring.



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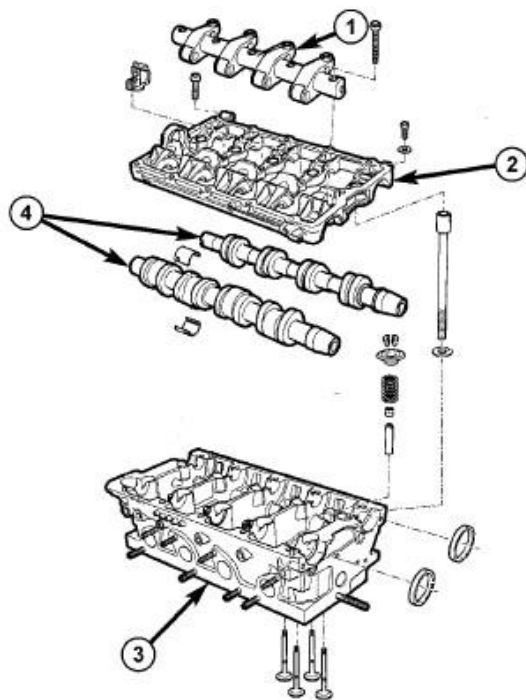
**Fig. 123: Valve Spring**  
Courtesy of CHRYSLER LLC

10. Remove valve keepers.
11. Remove top valve spring retainer and valve spring.
12. Remove valve stem seals.
13. Remove bottom valve spring retainer.

**NOTE:** Inspect all cylinder head components for wear or damage.

14. Repeat procedure for each cylinder as necessary.

#### VALVES



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**Fig. 124: Cylinder Head**

Courtesy of CHRYSLER LLC

**NOTE:** Valves can not be ground, only lapping is permitted.

1. Remove cylinder head. See Removal.

**CAUTION:** Suitably mark the valve and the position in the cylinder head before removal. Failure to do so will result in improperly seated valves and possible engine damage after reassembly.

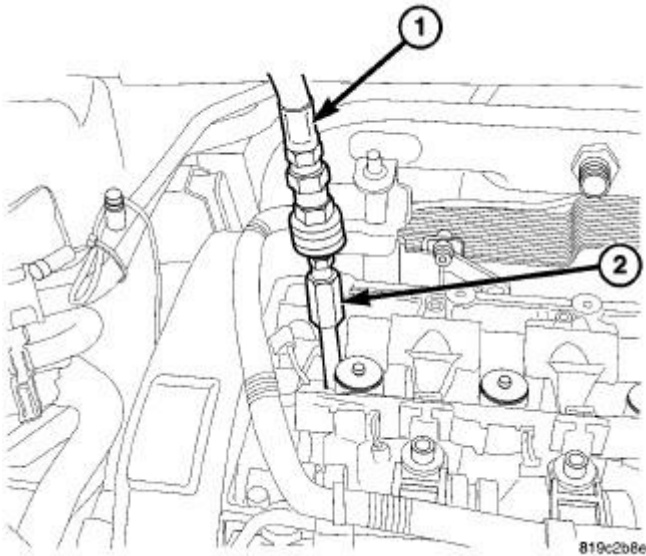
2. Using a suitable valve spring compressor, compress valve spring.
3. Remove valve keepers.
4. Remove top valve spring retainer and valve spring.
5. Remove valve stem seals.
6. Repeat steps 5 through 9 for each valve as necessary.
7. Remove any burrs with a file prior to pulling valves through the guide.

**CAUTION:** Valves, springs and retainers must be kept in order of the cylinder they were removed.

8. Remove valves.

#### Installation

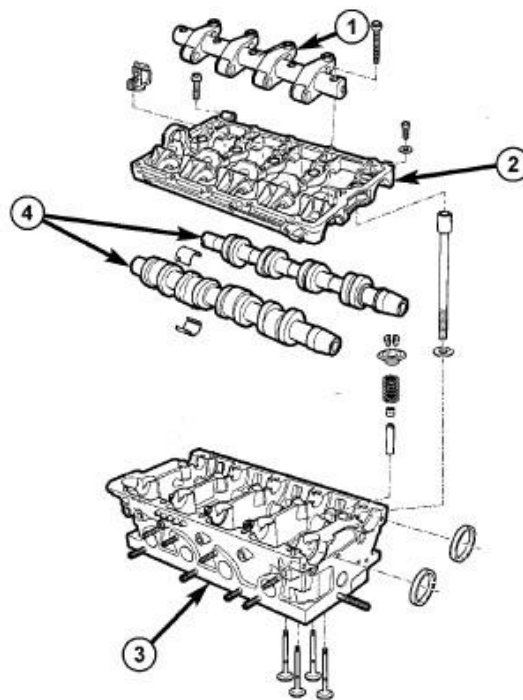
## VALVE SPRINGS



**Fig. 125: Compression Adapter 9939**  
Courtesy of CHRYSLER LLC

**NOTE:**        **Inspect all valve springs and retainers for wear or damage. Replace as necessary.**

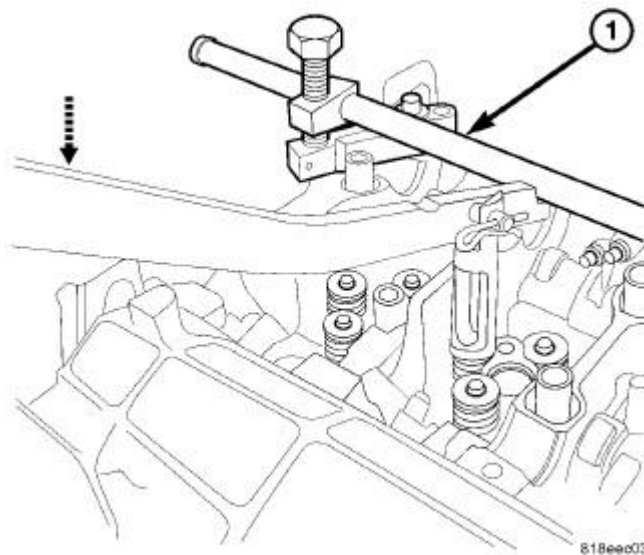
1. Position piston of cylinder to be processed to TDC by rotating the crankshaft clockwise. **DO NOT crank engine or rotate engine counter clockwise.**
2. Install glow plug adapter 9939 (2).
3. Connect air supply (1) to #9939 glow plug adaptor and pressurize the cylinder to 5 bar (73 psi).



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**Fig. 126: Valve Spring Retainer**  
Courtesy of CHRYSLER LLC

4. Install lower valve spring retainer.
5. Install valve stem seal.
6. Install valve spring.
7. Install valve spring retainer.



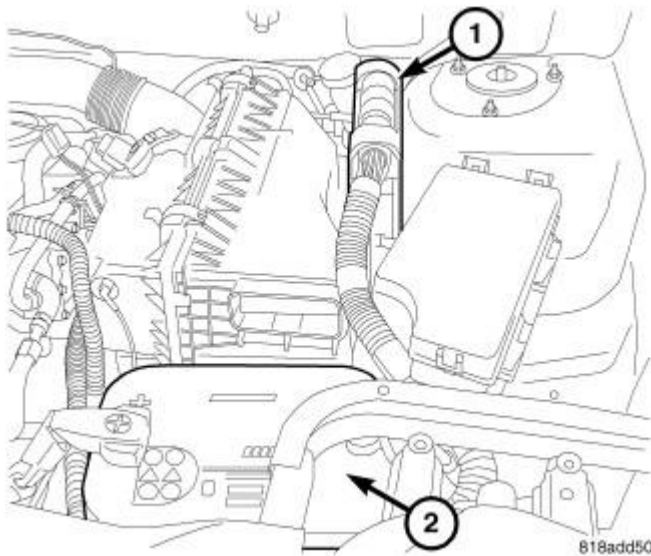
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**Fig. 127: Valve Spring Installer 9916**  
Courtesy of CHRYSLER LLC

8. Install valve spring installer 9916.
9. Compress valve and install valve keepers.

**NOTE:** Ensure that the valve keepers are seated properly.

10. Repeat procedure for each cylinder as necessary.
11. Remove special tooling from cylinder head.
12. Position piston of #1 cylinder to ignition TDC.
13. Install camshafts and check basic position. See **Installation**.



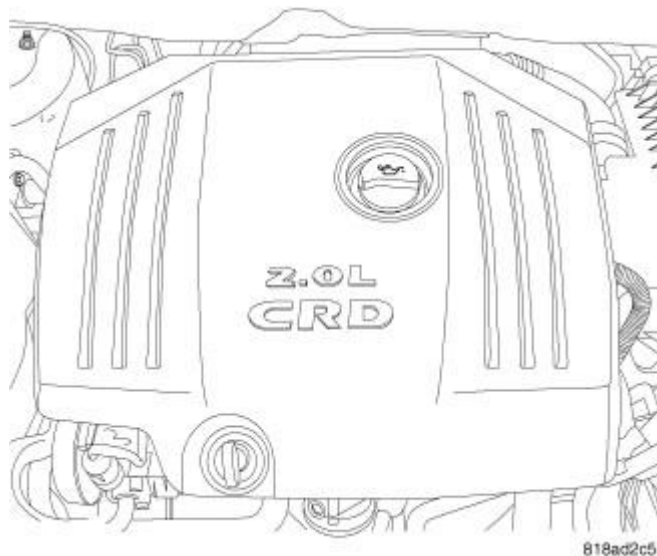
**Fig. 128: Battery Cable**  
Courtesy of CHRYSLER LLC

14. Reconnect negative battery cable (2).

**CAUTION:** Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.

15. Start the engine and inspect for leaks.

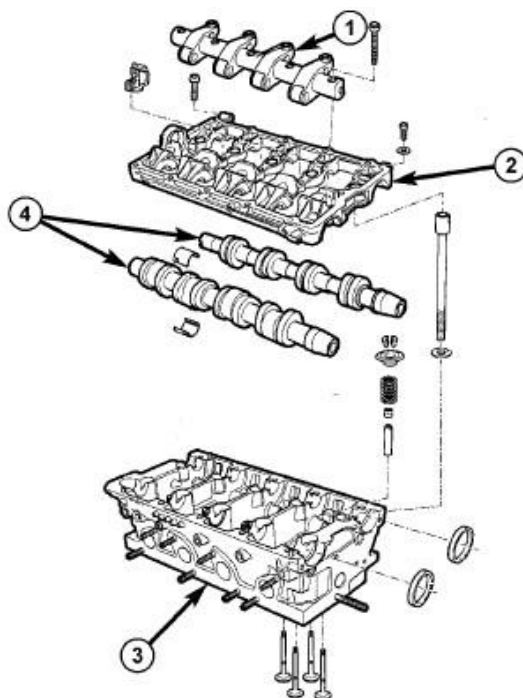




**Fig. 129: Engine Cover**  
Courtesy of CHRYSLER LLC

16. Install engine cover. Refer to **ENGINE COVER**.

#### VALVES



**Fig. 130: Cylinder Head**  
Courtesy of CHRYSLER LLC

**WARNING:** Valves must be kept in their original positions in cylinder head. Failure to do so will result in engine damage.

**NOTE:**        **Inspect all valves, springs and retainers for wear or damage. Replace as necessary.**

1. Install valves in their original position in the cylinder head.
2. Install lower valve spring retainer.
3. Install valve stem seal.
4. Install valve spring.
5. Install valve spring retainer.

**NOTE:**        **Using tool, screw retaining fork into threaded edge of cylinder head and position thrust piece vertically at the top of each valve spring retainer.**

**NOTE:**        **Ensure that the valve keepers are seated properly.**

6. Using a suitable valve spring compressor, compress valve spring and install valve keepers.
7. Repeat steps 3 through 7 for each valve as necessary.
8. Install cylinder head on engine block. See Installation.

**WARNING:** **Use extreme caution when the engine is in operation. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.**

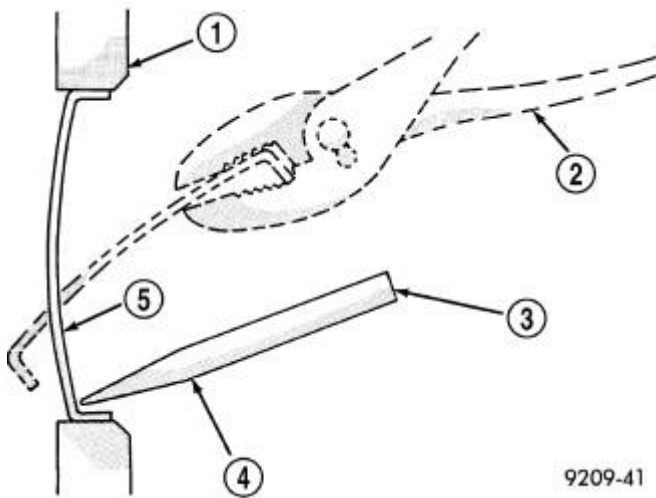
9. Start engine and check for leaks.
10. Install engine cover. Refer to ENGINE COVER.

## **ENGINE BLOCK**

### **STANDARD PROCEDURE**

#### **REPLACING ENGINE CORE AND OIL GALLERY PLUGS**

Using a blunt tool such as a drift and a hammer, strike the bottom edge of the cup plug. With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug .



**Fig. 131: Removing Core Hole Plug**  
Courtesy of CHRYSLER LLC

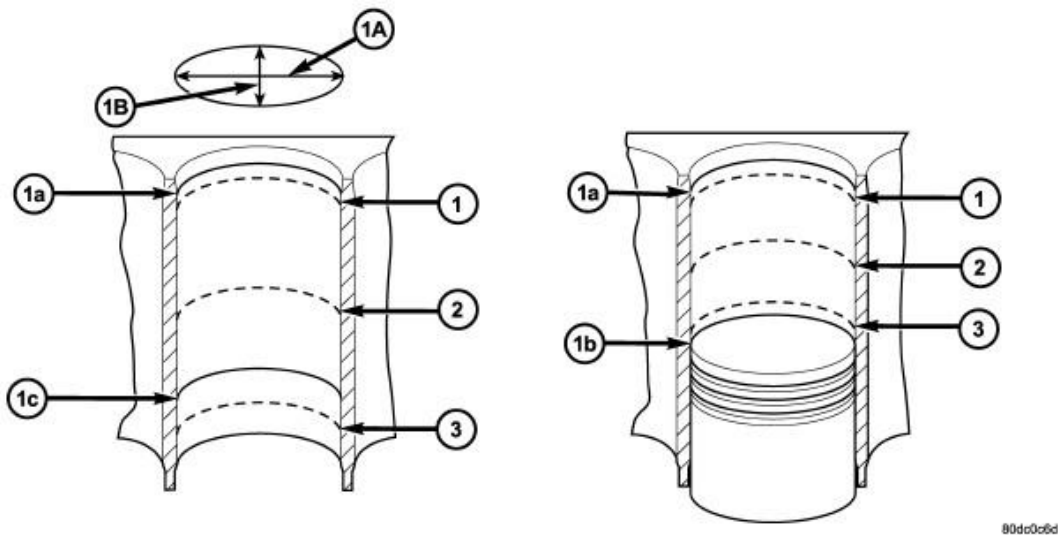
- 1 - CYLINDER BLOCK
- 2 - REMOVE PLUG WITH PLIERS
- 3 - STRIKE HERE WITH HAMMER
- 4 - DRIFT PUNCH
- 5 - CUP PLUG

**CAUTION:** Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with Mopar® Stud and Bearing Mount. Make certain the new plug is cleaned of all oil or grease. Using proper drive plug, drive plug into hole so that the sharp edge of the plug is at least 0.5 mm (0.020 in.) inside the lead-in chamfer.

It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

#### MEASURING CYLINDER BORES



**Fig. 132: Measuring Cylinder Bores**  
**Courtesy of CHRYSLER LLC**

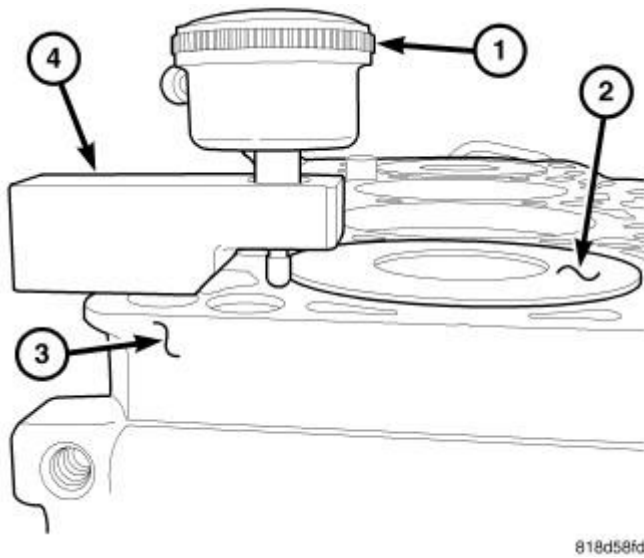
- 1 - MEASURING POINT OF CYLINDER BORE  
2 - MEASURING POINT OF CYLINDER BORE  
3 - MEASURING POINT OF CYLINDER BORE  
1a - UPPER REVERSAL POINT OF #1 PISTON RING  
1b - BOTTOM DEAD CENTER OF PISTON  
1c - BOTTOM REVERSAL POINT OF OIL SCRAPER RING  
1A - LONGITUDINAL DIRECTION  
1B - TRANSVERSE DIRECTION

**NOTE:** This must be done with engine completely disassembled.

1. Thoroughly clean all cylinder bores with appropriate cleaning solvent.
2. Measure each cylinder at the three measuring points shown in **Fig. 132** .
3. Using the three measurement points, measure cylinder in the longitudinal and in the transverse direction shown in **Fig. 132** .

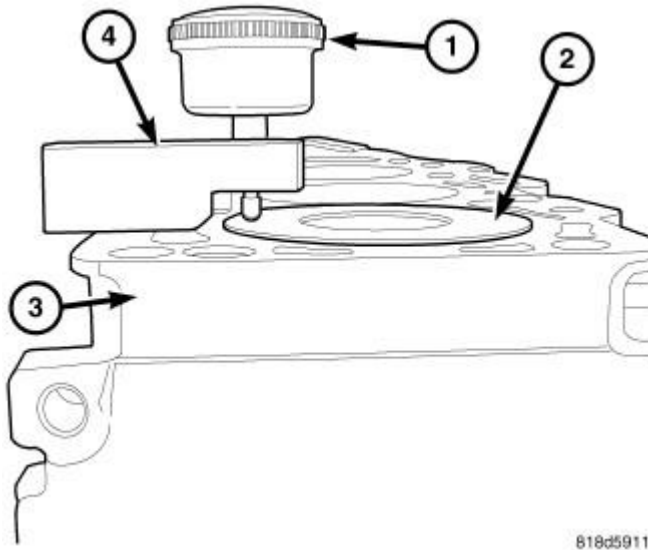
## PISTON PROTRUSION

**NOTE:** Any time a rod or piston is replaced, the piston protrusion must be checked.



**Fig. 133: Zero Dial Indicator**  
Courtesy of CHRYSLER LLC

1. Position scooter block D-115-2A (4) and a dial indicator flat on the cylinder block (3) head surface and zero the dial indicator.



**Fig. 134: Piston Height**  
Courtesy of CHRYSLER LLC

2. Slide Scooter block D-155-2A (4) so that the dial indicator (1) is now on the piston (2).
3. Read measurement and refer to the chart below for the correct head gasket.

Piston Protrusion		Head Gasket Identification Notches
0.91 - 1.00 mm	0.035 - 0.039 in.	1
1.01 - 1.10 mm	0.040 - 0.043 in.	2

1.11 - 1.20 mm	0.044 - 0.047	3
----------------	---------------	---

- Look up piston protrusion measurement in the chart above to find the correct head gasket. The head gasket is marked with notches (round holes) (1). The gasket will have 1, 2, or 3 notches corresponding to piston protrusion.

## CRANKSHAFT

### Standard Procedure

#### MEASURE CRANKSHAFT AND BLOCK JOURNALS

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

- Remove crankshaft. See Removal.
- Clean all engine parts thoroughly.

**CAUTION:** After bearing has damage has occurred, replace connecting rods which have suffered overheating because of bearing damage. The connecting rod must not have any cross scores and notches.

- Inspect connecting rod. If damage is present, inspect crankshaft, replace as necessary.
- Inspect crankcase.
- Inspect standard size of crankshaft bearing shells.
- Inspect crankshaft bearing cap.
- Mount crankshaft radially.
- Inspect crankshaft bearing play.

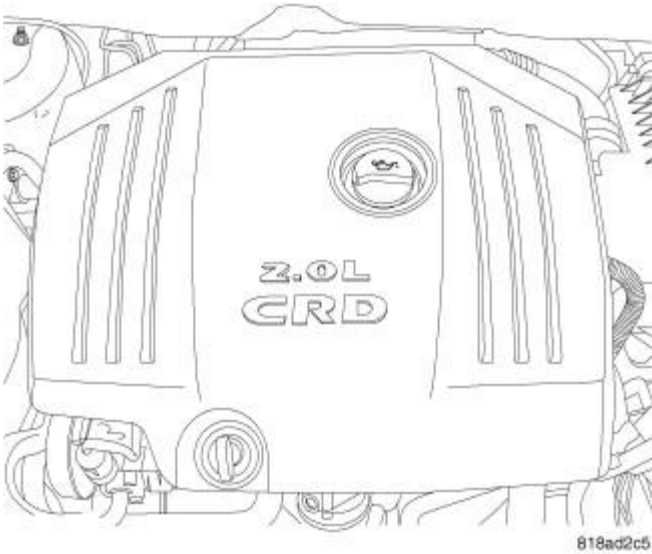
**NOTE:** Radial mounting of the main bearings of standard size crankshaft is possible by assigning the color-coded bearing shells.

#### ASSIGN CRANKSHAFT BEARING SHELLS

The oil pan rail of the cylinder block is marked with chisel punches indicating what bearing shell are used.

- Assign crankshaft bearing shells.
- Mount crankshaft axially.
- Inspect crankshaft bearing play.

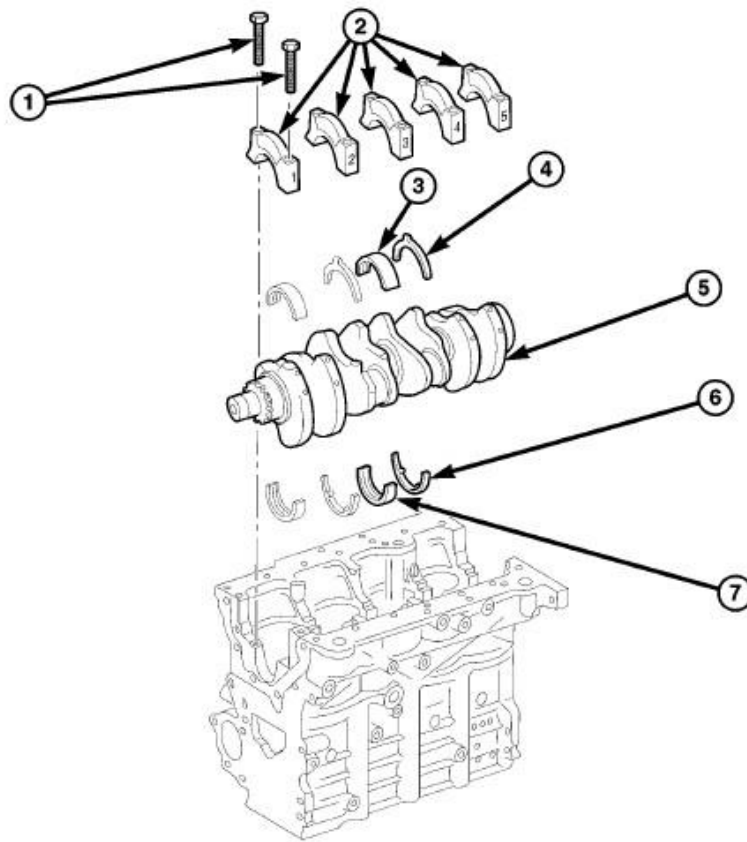
### Removal

**REMOVAL**

**Fig. 135: Engine Cover - Removal**  
Courtesy of CHRYSLER LLC

**NOTE:**        **The engine must be removed from the vehicle to service crankshaft.**

1. Disconnect negative battery cable.
2. Remove engine cover. Refer to **ENGINE COVER**.
3. Remove engine. See **Removal**.
4. Remove cylinder head. See **Removal**.
5. Remove rear crankshaft seal adapter. See **Removal**.



**Fig. 136: Crankshaft Bearing Caps**  
Courtesy of CHRYSLER LLC

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6. Remove front crankshaft seal retainer.

**NOTE:** Mark piston and rod location prior to removal with paint pen. Do not use a punch.

7. Remove piston and connecting rod assemblies. See Removal.

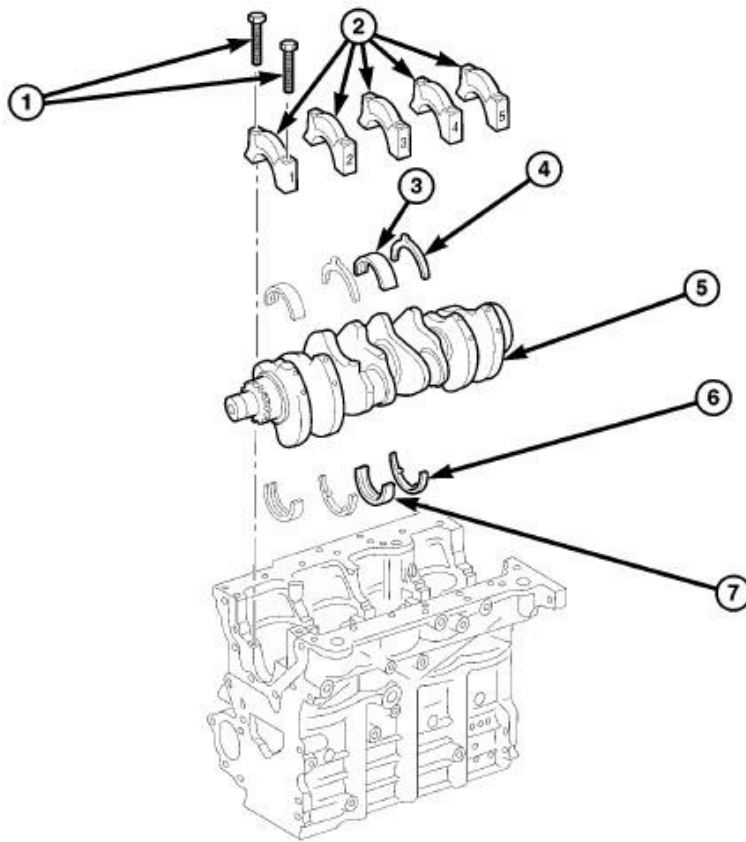
**CAUTION:** The crankshaft bearing caps are numbered consecutively, beginning with the first crankshaft bearing cap at the front of engine. Attention must be paid to the way crankshaft bearing caps fit.

8. Unbolt crankshaft bearing caps (2).
9. Inspect crankshaft bearing caps (2) and bolts (1) for wear and stretching.
10. Remove crankshaft (5) from engine block.

## Installation

### INSTALLATION





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**Fig. 137: Crank And Bearings**  
Courtesy of CHRYSLER LLC

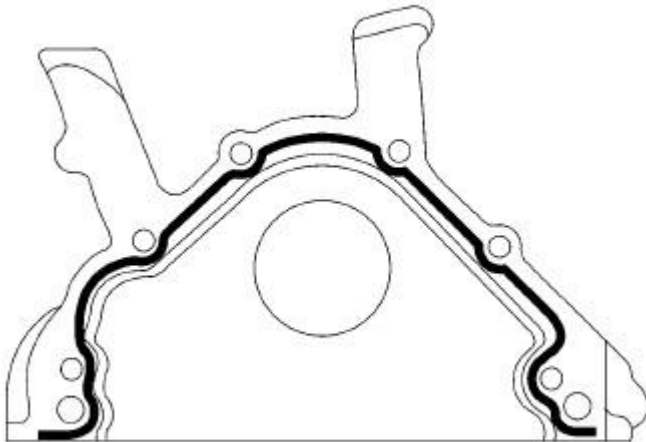
**CAUTION:** Oil bearing shells before inserting crankshaft.

**CAUTION:** Oil thread and head contact surfaces of bolts that retain crankshaft bearing caps; tighten bolts from inside to outside, beginning at fit bearing. Rotate crankshaft to check clearance.

**NOTE:** The crankshaft bearing caps are numbered consecutively, beginning with the first crankshaft bearing cap at the front of engine. Attention must be paid to the way crankshaft bearing caps fit.

1. Install bearing shells into engine block.
2. Oil bearing shells.
3. Install upper thrust bearings in block.
4. Install crankshaft into engine block.
5. Install bearing shells into bearing caps.
6. Install lower thrust bearings.

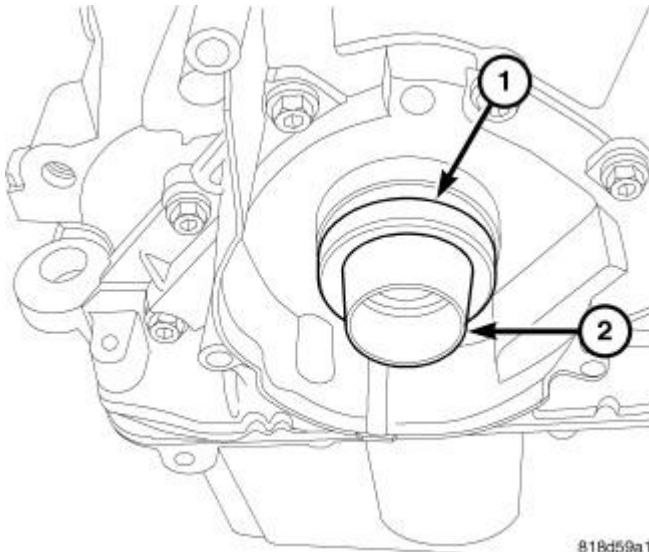
7. Install crankshaft bearing caps. Tighten bolts in two stages. 65 N.m (48 lbs ft), then 90°.
8. Install piston and connecting rod assemblies. See **Installation**.



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**Fig. 138: Front Seal Flange RTV Path**  
Courtesy of CHRYSLER LLC

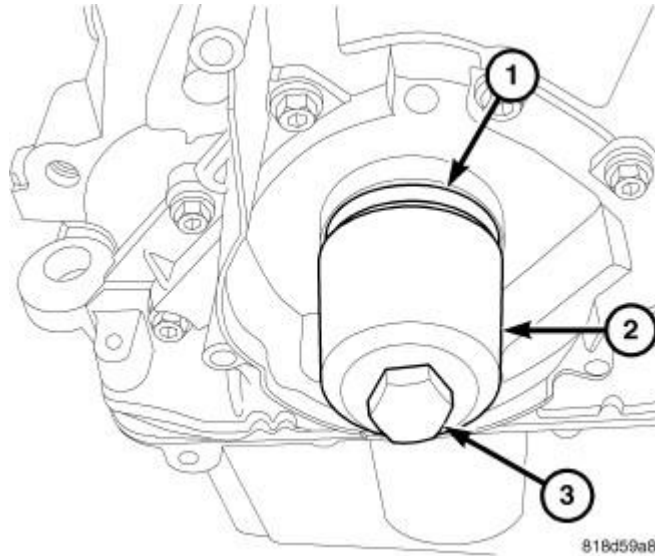
9. Apply RTV to front sealing flange as shown in illustration.
10. Install front crankshaft sealing flange.



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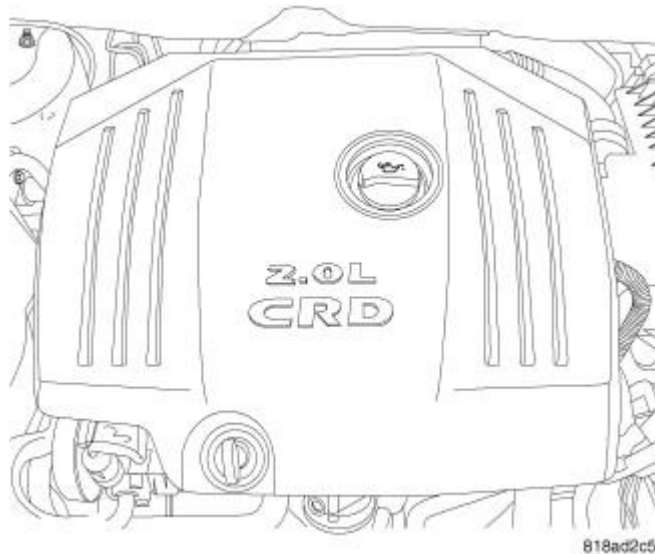
**Fig. 139: Front Crank Seal Sleeve**  
Courtesy of CHRYSLER LLC

11. Install front seal and seal installation guide.



**Fig. 140: Front Crank Seal Installation**  
Courtesy of CHRYSLER LLC

12. Install front crankshaft oil seal.
13. Install rear timing belt cover.
14. Install rear crankshaft oil seal. See **Installation**.
15. Install timing belt cover. See **Installation**.
16. Install the engine. See **Installation**.
17. Fill crankcase with the correct engine oil, to the proper level.
18. Fill cooling system with the proper coolant, to the proper level. Refer to **Cooling - Standard Procedure**.



**Fig. 141: Engine Cover - Installation**  
Courtesy of CHRYSLER LLC

19. Connect negative battery cable.

**WARNING:** Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothes.

20. Start engine and inspect for leaks.

21. Install engine cover. Refer to **ENGINE COVER**.

## MODULE, BALANCE SHAFT

### Description

#### DESCRIPTION

The balance shaft module bolts to the bottom of the engine. The oil pump is an integral part of the balance shaft module and cannot be serviced separately.

### Operation

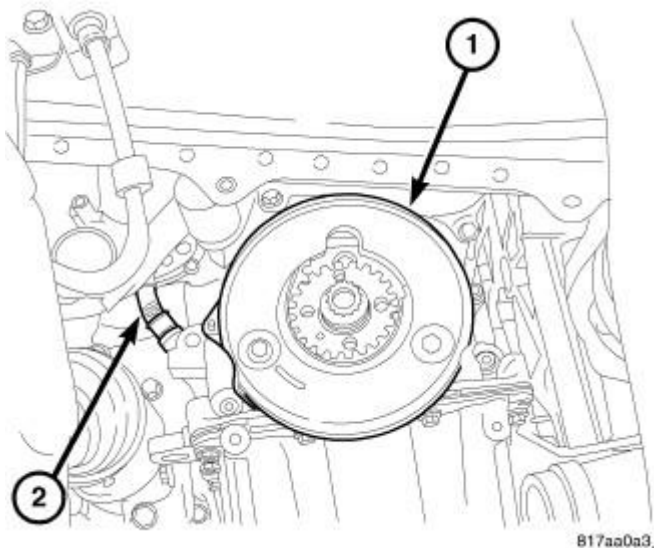
#### OPERATION

The balance shaft module is gear driven off the crankshaft. The oil pump is housed in the front portion of the module. The oil pump supplies the engines oil requirements. The balance shaft portion is for NVH reduction.

### Removal

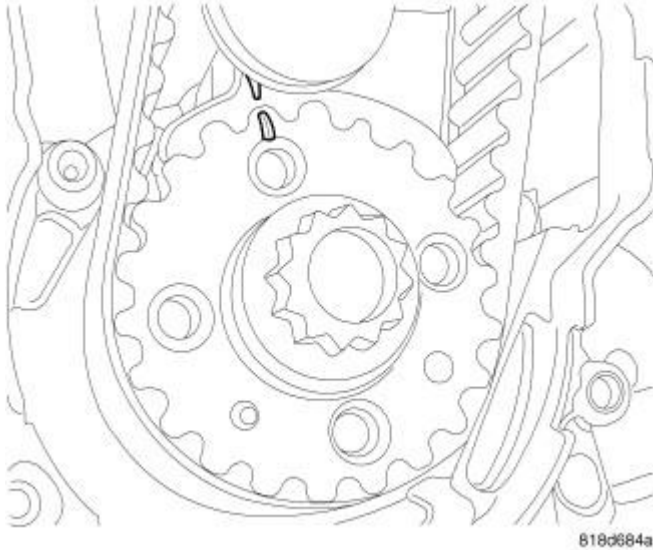
#### REMOVAL

**NOTE:** When Balance Shaft Module (BSM) is removed, a new BSM **MUST** be installed.



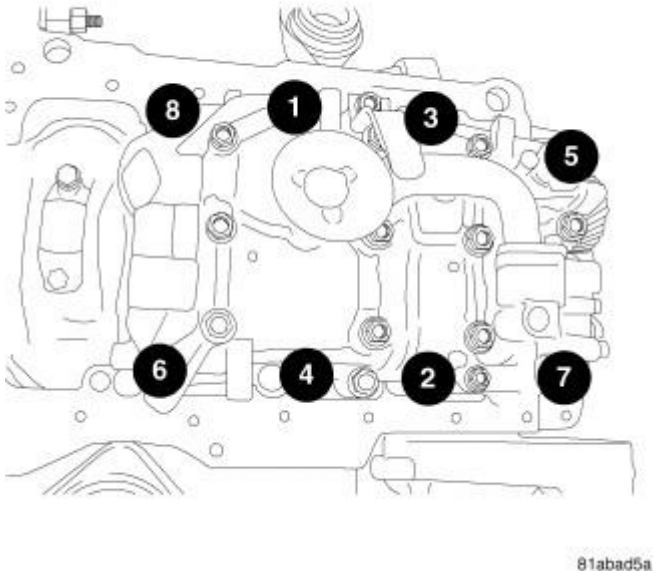
**Fig. 142: Lower Timing Belt Cover**  
Courtesy of CHRYSLER LLC

1. Remove oil pan. See **Removal**.
2. Remove lower timing belt cover (1).



**Fig. 143: Crankshaft Timing Marks**  
Courtesy of CHRYSLER LLC

3. Rotate engine to TDC and insert crankshaft timing lock 9883.

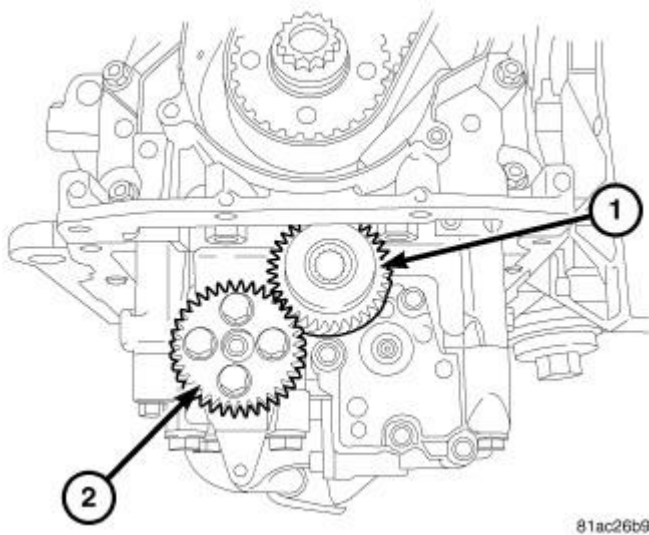


**Fig. 144: Torque Sequence**  
Courtesy of CHRYSLER LLC

4. Remove balance shaft retaining bolts.
5. Remove balance shaft.

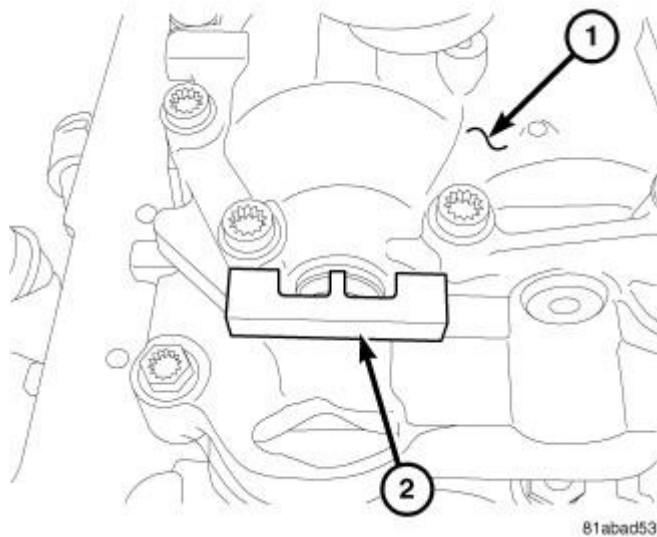
**Installation****INSTALLATION**

**NOTE:** When installing a new balance shaft module, the oil pick-up and dip stick guide must be removed.



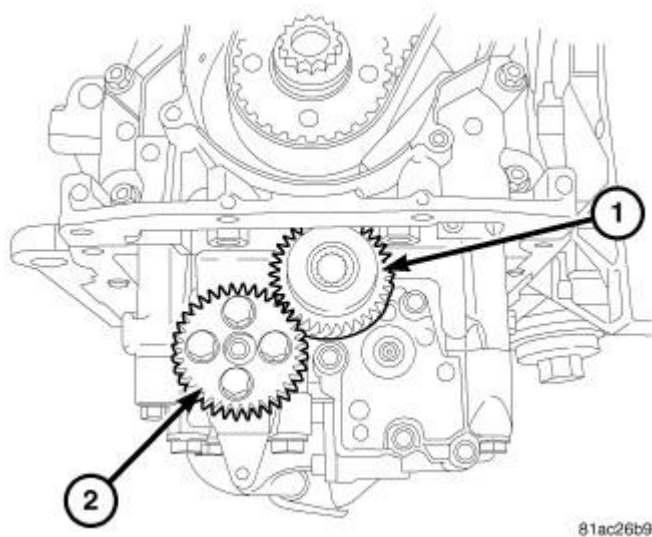
**Fig. 145: BSM Timing Marks**  
Courtesy of CHRYSLER LLC

1. Remove dipstick guide from new BSM and discard.
2. Remove pick-up tube from BSM and discard.
3. Pour 15 ml (0.5 oz.) of oil into oil pump and turn balance shaft gear (2) a minimum of 3 revolutions.
4. Install new pick-up tube and new o-ring.
5. Tighten pick-up tube retaining bolt to 10 N.m (89 in. lbs.).
6. Tighten pick-up tube support bracket to 22 N.m (195 in. lbs.).



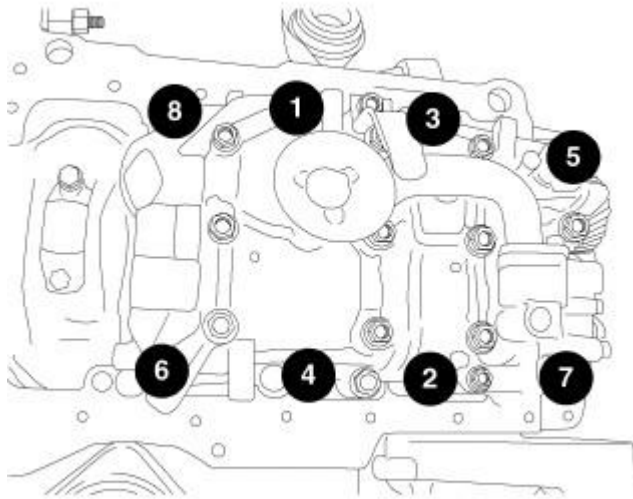
**Fig. 146: BSM Timing Lock**  
Courtesy of CHRYSLER LLC

7. Install BSM lock 9991-2 (2).
8. Install 2 new locating sleeves.



**Fig. 147: BSM Timing Marks**  
Courtesy of CHRYSLER LLC

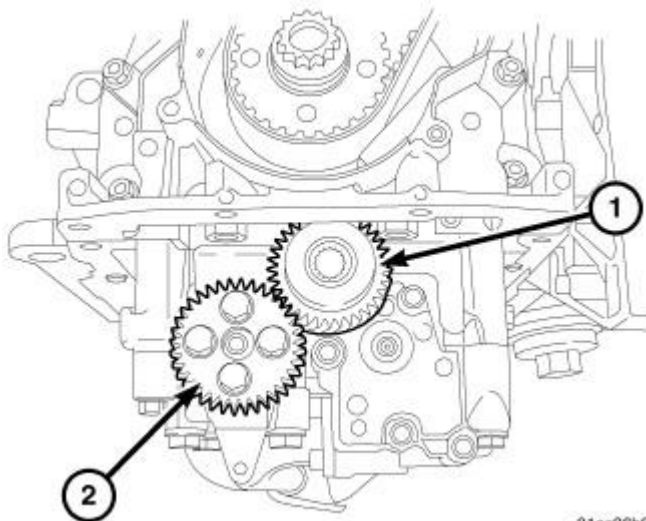
9. Loosen intermediate gear (1) retaining bolt 90°.
10. Install BSM with white dot on intermediate gear pointing towards the crankshaft.



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**Fig. 148: Torque Sequence**  
Courtesy of CHRYSLER LLC

11. Tighten all bolts to 6 N.m (53 in. lbs.) in the sequence shown in illustration.
12. Tighten bolts 1,2,3,4,6,8 to 20 N.m (177 in. lbs.).
13. Tighten bolts 5 and 7 to 15 N.m (133 in. lbs.).
14. Tighten all bolts an additional 90°.

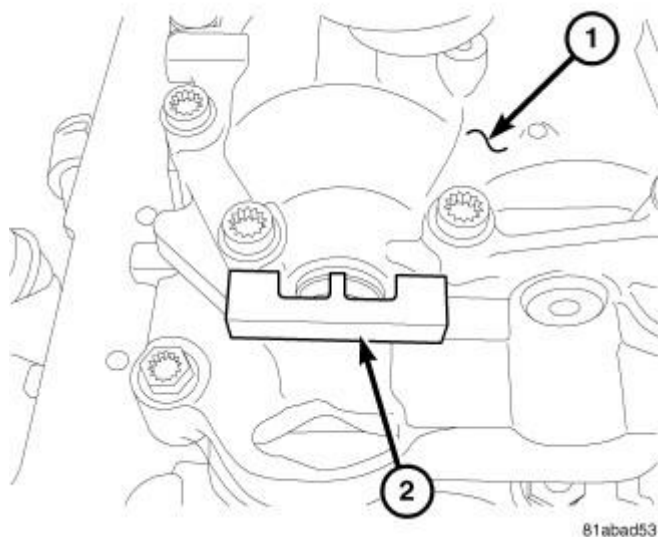


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**Fig. 149: BSM Timing Marks**  
Courtesy of CHRYSLER LLC

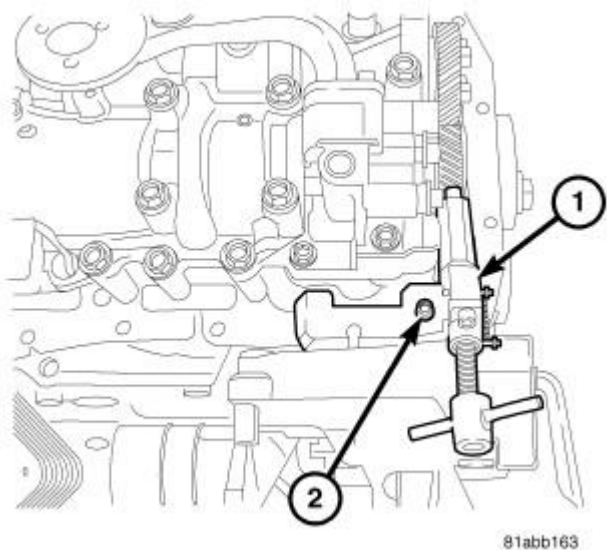
15. Install balance shaft gear (2) and tighten bolts to 20 N.m (177 in. lbs.).
16. Tighten bolts an additional 90°.





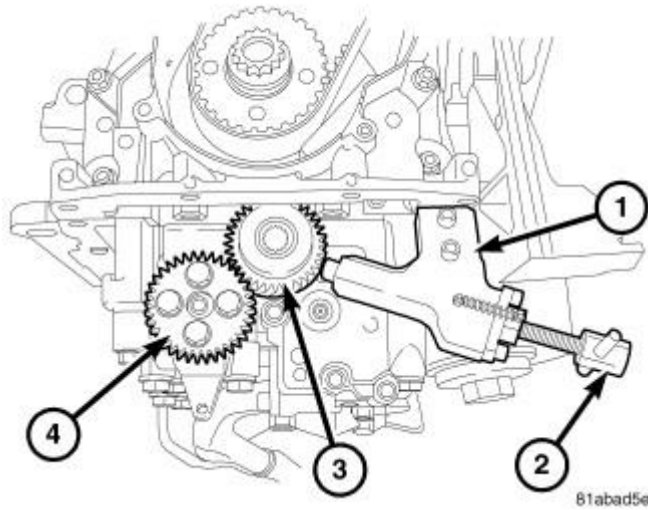
**Fig. 150: BSM Timing Lock**  
Courtesy of CHRYSLER LLC

17. Remove BSM timing lock 9991-2 (2).



**Fig. 151: Securing Bolt**  
Courtesy of CHRYSLER LLC

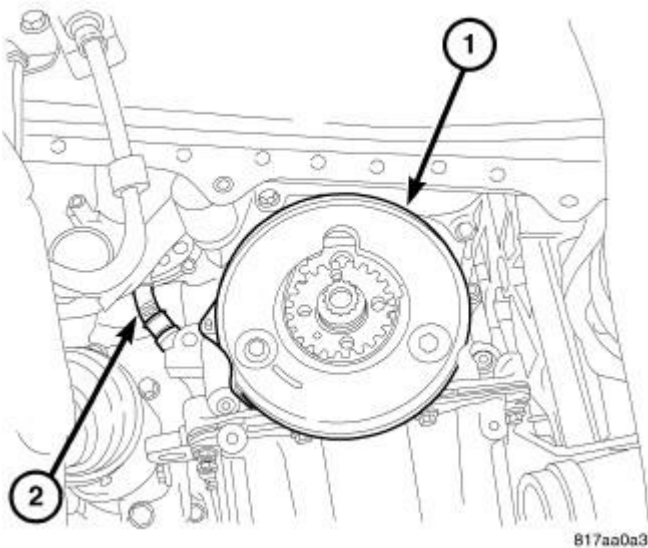
18. Secure gear lash adjuster 9991-1 (1) to engine block and install securing bolt (2).



**Fig. 152: Gear Lash Adjuster**  
Courtesy of CHRYSLER LLC

19. Tighten tensioner screw (2) to 2-4 N.m (18-35 in. lbs.).
20. Tighten intermediate gear (3) bolt to 90 N.m (66 ft. lbs.).
21. Loosen tension screw (2).
22. Check for zero backlash between gears.
23. If backlash is present, loosen intermediate gear (3) bolt 90° and repeat steps 19 through 22.
24. If no backlash was present, tighten intermediate gear an additional 90°.

**CAUTION:** If you have backlash after the intermediate bolt has been tightened the additional 90°, the BSM **MUST** be replaced.



**Fig. 153: Lower Timing Belt Cover**

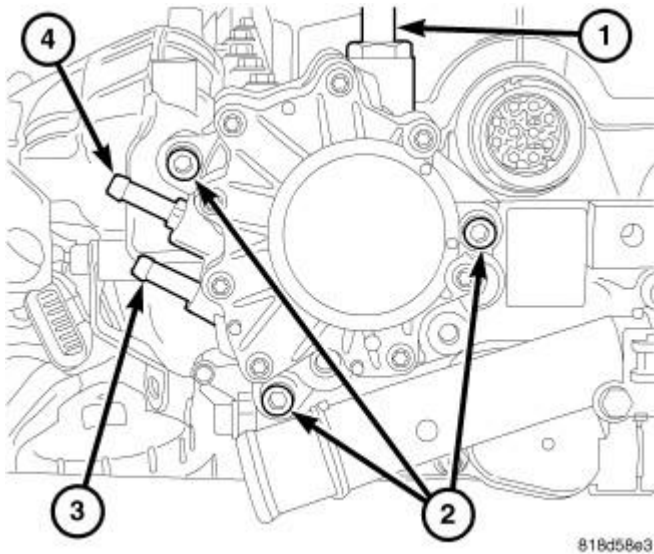
Courtesy of CHRYSLER LLC

25. Install the lower timing belt cover (1).
26. Install the crankshaft damper.
27. Install the oil pan. See **Installation**.
28. Fill with oil.
29. Start engine and check for leaks.

**PUMP, TANDEM VACUUM**

**Description**

**DESCRIPTION**



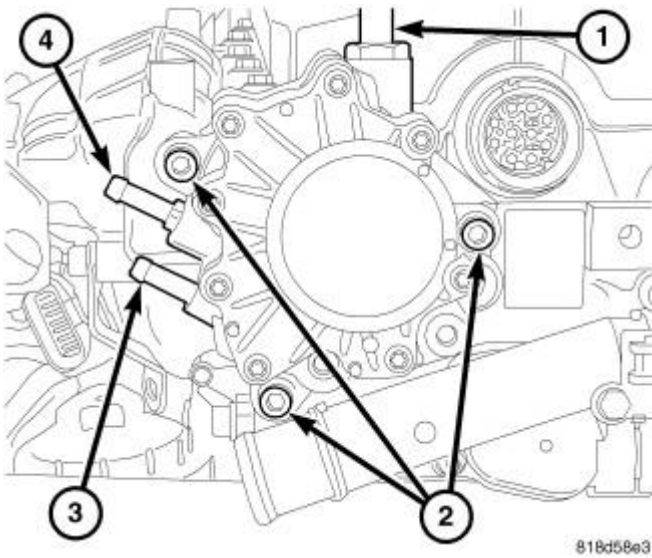
**Fig. 154: Fuel Pump**

Courtesy of CHRYSLER LLC

This pump is a tandem pump design. It contains a fuel pump and a vacuum pump in one housing. If either pump fails, the tandem pump assembly must be replaced.

**Removal**

**REMOVAL**

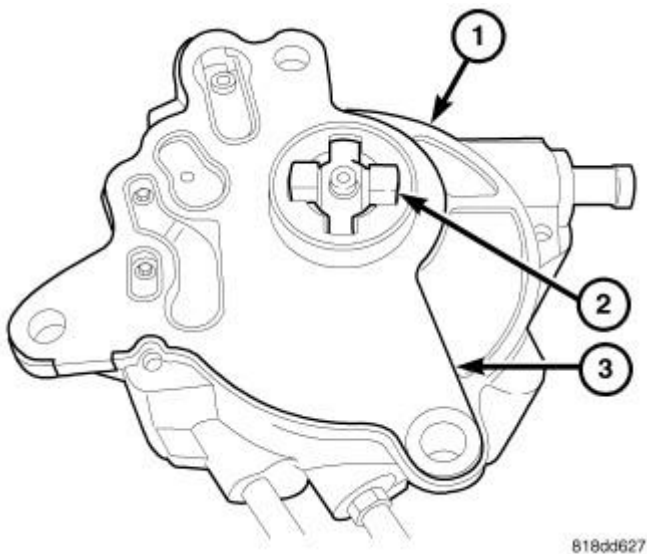


**Fig. 155: Fuel Pump**  
Courtesy of CHRYSLER LLC

1. Perform fuel draining procedure. Refer to **Fuel System/Fuel Injection - Standard Procedure**.
2. Disconnect vacuum line (1) from pump.
3. Remove fuel feed line (4).
4. Remove fuel return line (3).
5. Remove retaining bolts (2) and remove pump.

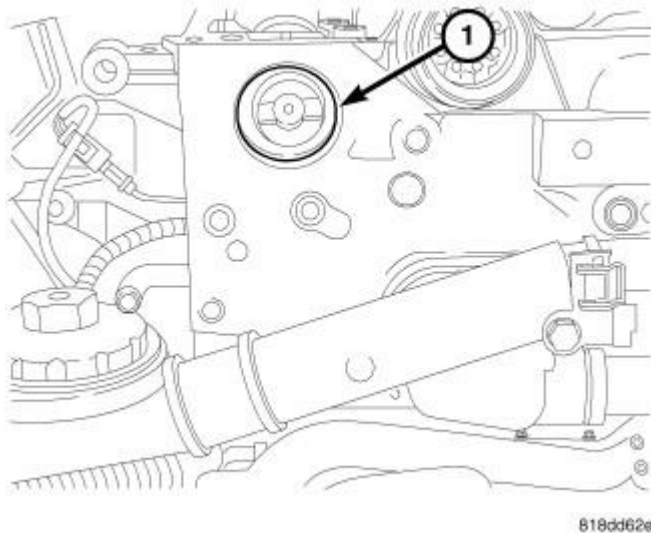
### Installation

#### INSTALLATION



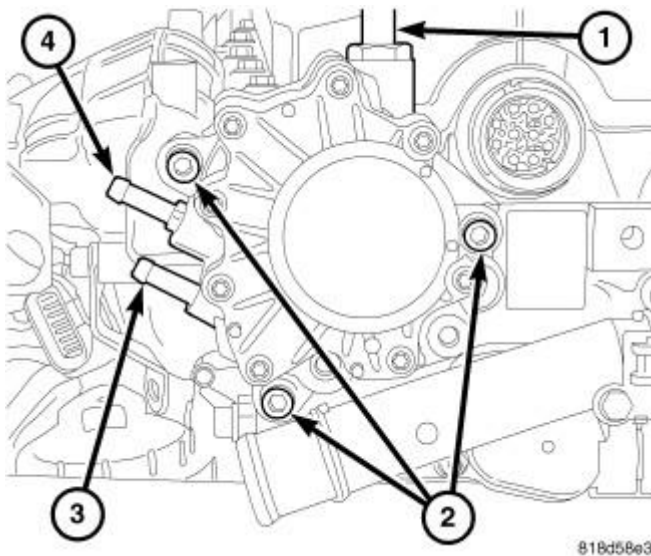
**Fig. 156: Pump And Gasket**  
Courtesy of CHRYSLER LLC

1. Place new gasket (3) on pump (1).
2. Align pump drive (2) on pump.



**Fig. 157: Fuel Pump Drive**  
Courtesy of CHRYSLER LLC

3. Insert pump drive into slot on camshaft (1).



**Fig. 158: Fuel Feed Line**  
Courtesy of CHRYSLER LLC

4. install pump retaining bolts (2) and tighten.
5. Install fuel feed line (4).
6. Install fuel return line (3).

## ROD, PISTON AND CONNECTING

### Removal

#### REMOVAL

1. Remove cylinder head.
2. Remove oil pan.

**NOTE:** It may be necessary to remove the oil pump to gain access to all of the rods.

3. Remove oil pump if necessary.

**NOTE:** Do not use a punch to mark connecting rods.

4. Mark connecting rods with paint marker.
5. Remove connecting rod bolts and discard.
6. Push piston and rod assembly out of the engine block.
7. Repeat as needed.

### Installation

#### INSTALLATION

1. Make sure the ring end gaps are properly staggered.
2. Lubricate the piston and rings with clean engine oil.
3. Compress piston rings with a ring compressor.
4. Install upper rod bearing shell in to connecting rod and oil bearing shell.
5. Push piston into cylinder.

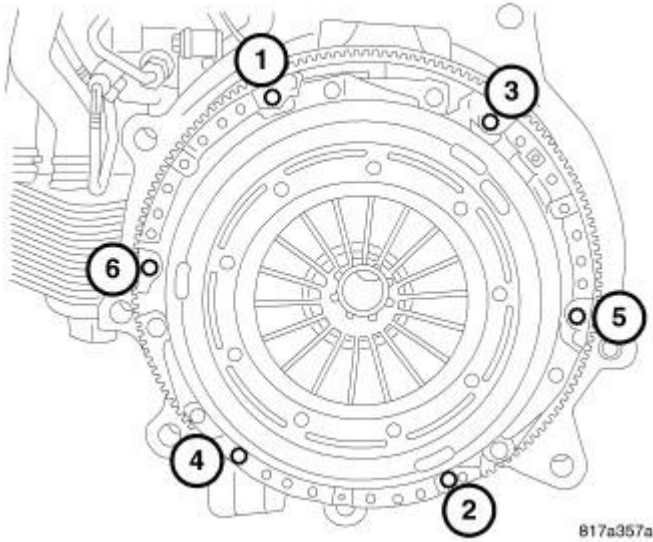
**NOTE:** Be careful when guiding rod into place not to nick the crankshaft journals.

6. Install lower bearing shell into connecting rod cap.
7. Lubricate lower bearing shell and position rod cap.
8. Install new rod bolts and torque to 30 N.m + 90° (22 ft. lbs. + 90°).
9. Install oil pan. See **Installation**.
10. Install cylinder head. See **Installation**.
11. Replace oil filter and fill with oil. See **Installation**.
12. Fill cooling system. Refer to **Cooling - Standard Procedure**.
13. Start engine and check for leaks.

## SEAL, CRANKSHAFT OIL, REAR

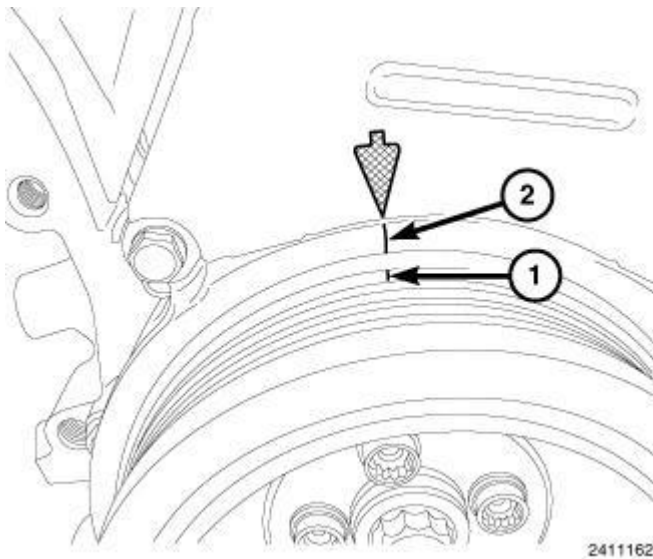
## Removal

### REMOVAL



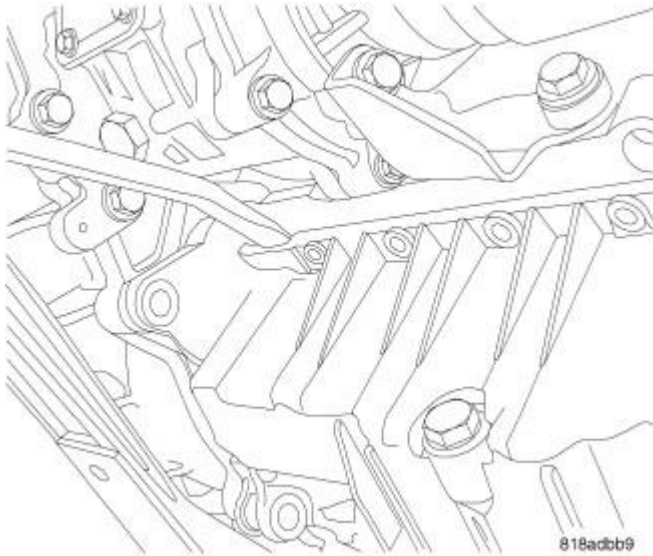
**Fig. 159: Pressure Plate**  
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Remove the dual mass flywheel. Refer to **Clutch/FLYWHEEL - Removal**.



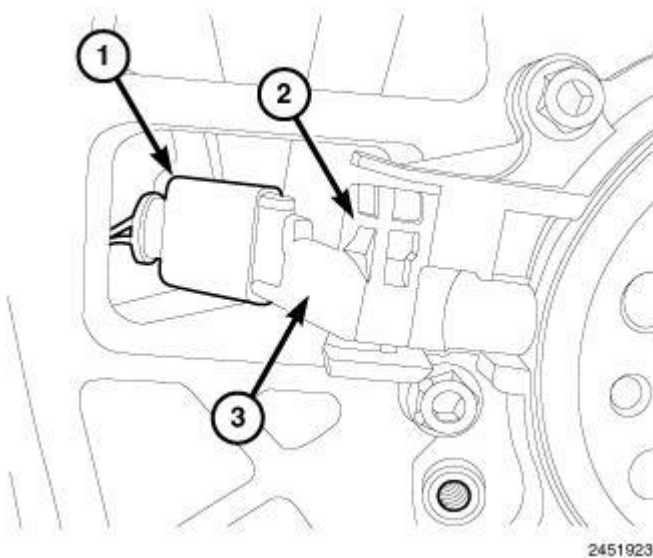
**Fig. 160: Vibration Damper Dust Cover**  
Courtesy of CHRYSLER LLC

3. If equipped, remove the vibration damper dust cover.
4. Rotate the crankshaft to align the timing marks (1,2) to set the No. 1 cylinder at Top Dead Center (TDC).



**Fig. 161: OIL PAN-REMOVAL**  
Courtesy of CHRYSLER LLC

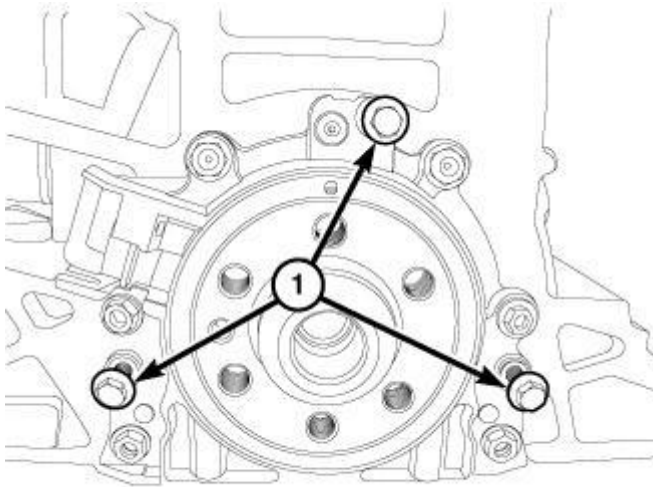
5. Drain the engine oil.
6. Remove the oil pan bolts.
7. Using a suitable pry bar, remove the oil pan.



**Fig. 162: Crankshaft Position Sensor**  
Courtesy of CHRYSLER LLC

8. Disconnect the crankshaft position sensor harness connector (1).
9. Remove the bolt (2) and the Crankshaft Position Sensor (CKP) (3).





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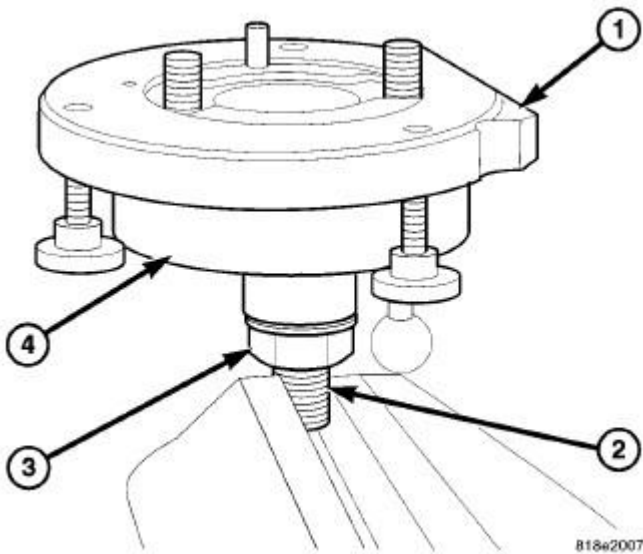
**Fig. 163: Rear Crankshaft Seal Assembly**  
Courtesy of CHRYSLER LLC

10. Install the three M6 x 35 bolts into the rear crankshaft seal assembly as illustrated.
11. Remove the rear main seal by alternately screw in bolts 1/2 turn at a time to pull seal assembly off.
12. Wipe excess oil off the crankshaft.

#### Installation

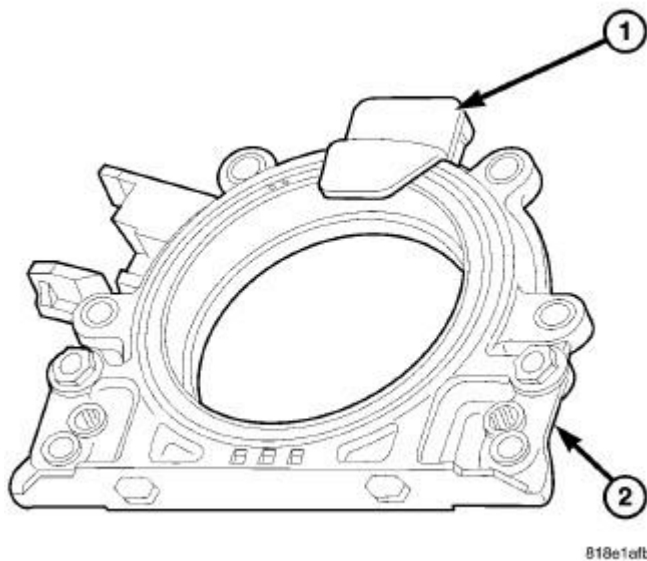
#### INSTALLATION

- NOTE:** The rear crankshaft seal comes with an installation sleeve that must not be removed prior to installation.
- NOTE:** The sealing flange and sender wheel must not be separated or rotated after removing from package.
- NOTE:** The sealing flange and seal are one unit that must be replaced together with the sender wheel only.



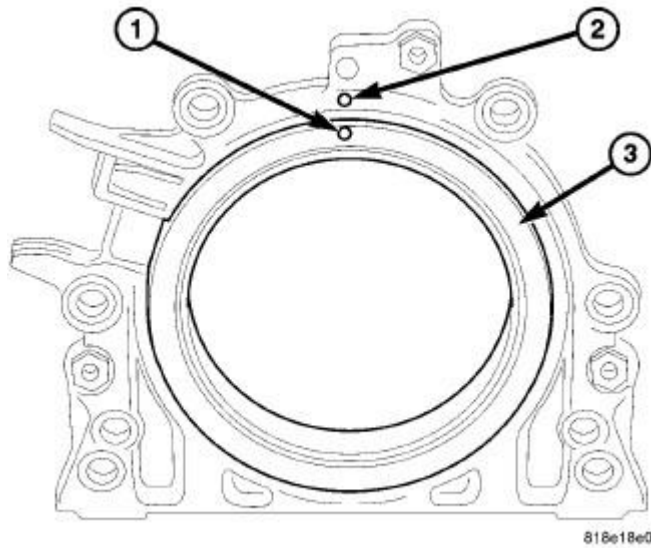
**Fig. 164: Rear Main Installer 9888**  
Courtesy of CHRYSLER LLC

1. Screw in nut (3) to the edge of the clamping surface (2) of threaded spindle.
2. Clamp rear main seal installer 9888 in a vice on the clamping surface of threaded spindle (2).
3. Press assembly bell housing (4) down so it lies on nut (3).
4. Screw nut (3) onto threaded spindle (1) until inner part of assembly device and assembly are bell housing are level.



**Fig. 165: Securing Clip**  
Courtesy of CHRYSLER LLC

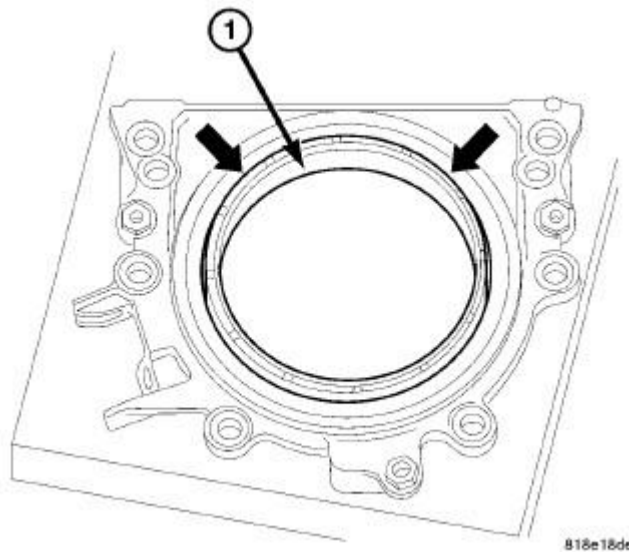
5. Remove securing clip (1) from rear crankshaft sealing flange (2).



**Fig. 166: Locating Hole**  
Courtesy of CHRYSLER LLC

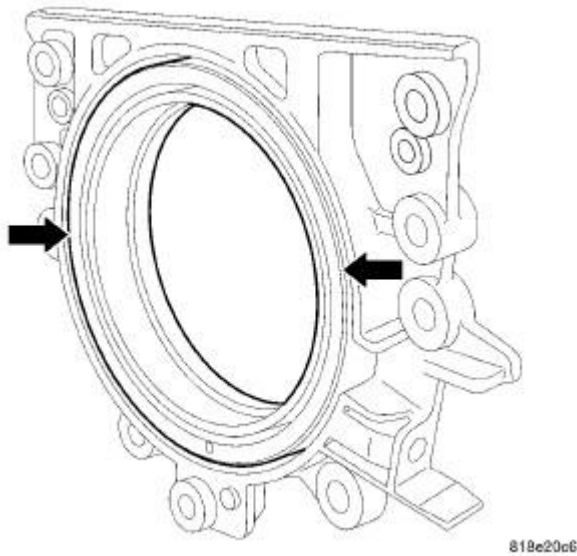
**NOTE:** The sender wheel must not be taken out of the sealing flange or turned.

6. Locating hole (1) on sender wheel (3) must align with marking (2) on rear main seal.



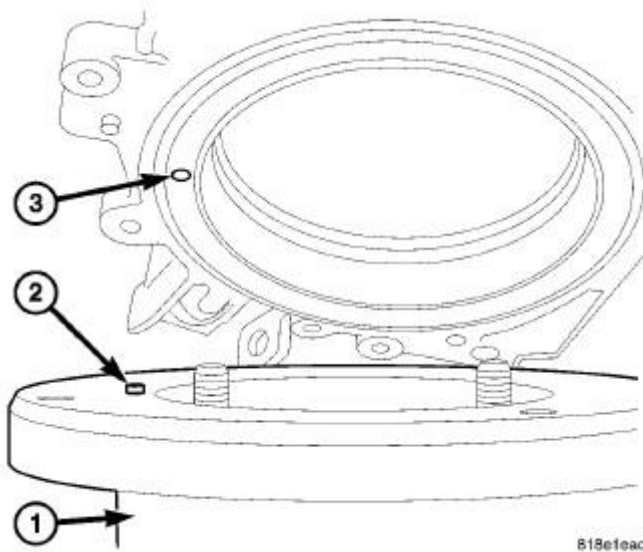
**Fig. 167: Sealing Lip Support**  
Courtesy of CHRYSLER LLC

7. Place seal on clean flat surface with the outer edge facing down.
8. Push sealing lip support ring (1) downward until it lies on flat surface.



**Fig. 168: Sender Wheel Alignment**  
Courtesy of CHRYSLER LLC

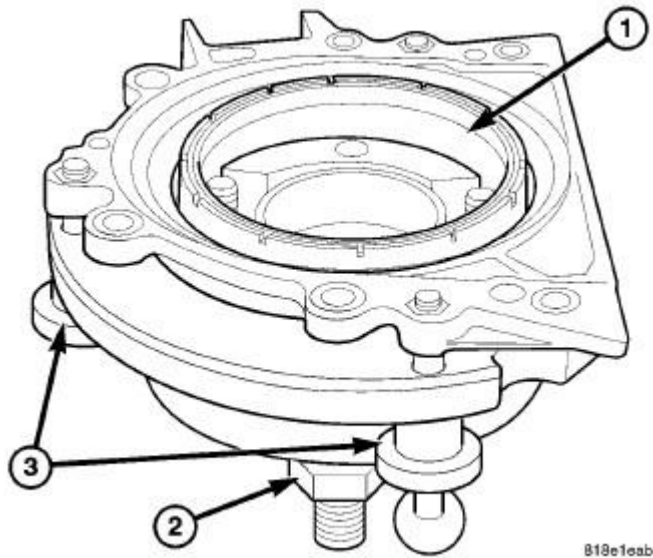
9. Upper edge of sender wheel and front edge of rear main seal must align.



**Fig. 169: Locating Pin**  
Courtesy of CHRYSLER LLC

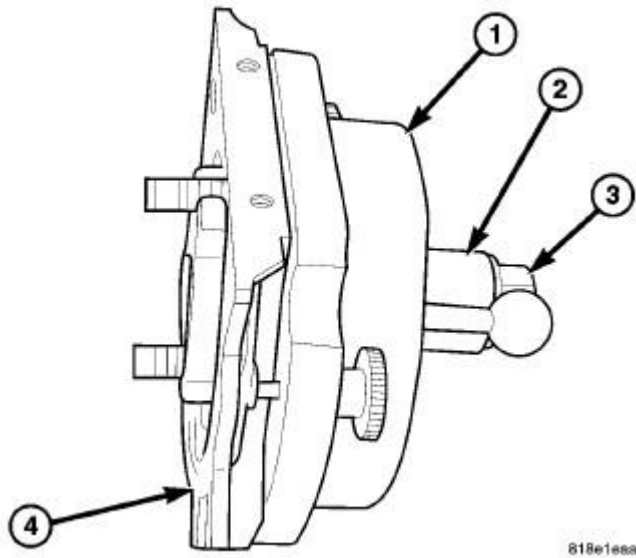
10. Place rear main seal with outer edge on rear main seal installer 9888 (1) so that locating pin (2) can be inserted into hole (3).

**NOTE:** Ensure that the rear main seal lies flat on the installer.



**Fig. 170: Sealing Lip Installer**  
Courtesy of CHRYSLER LLC

11. Push the flange and support ring for the sealing lip (1) against the installer (2) while tightening the three knurled knobs (3) so the locating pin cannot slide out of the sender wheel hole.



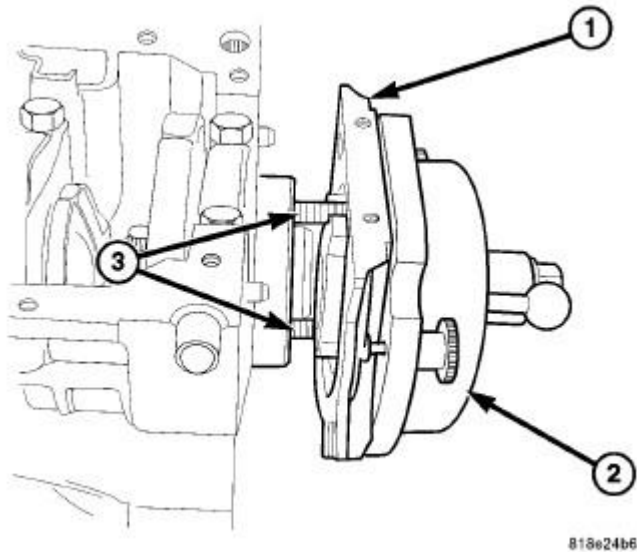
**Fig. 171: Attaching Seal to Installer**  
Courtesy of CHRYSLER LLC

**NOTE:** When installing rear main seal, the sender wheel must remain fixed in assembly tool.

**NOTE:** The crankshaft flange must be free from oil and grease.

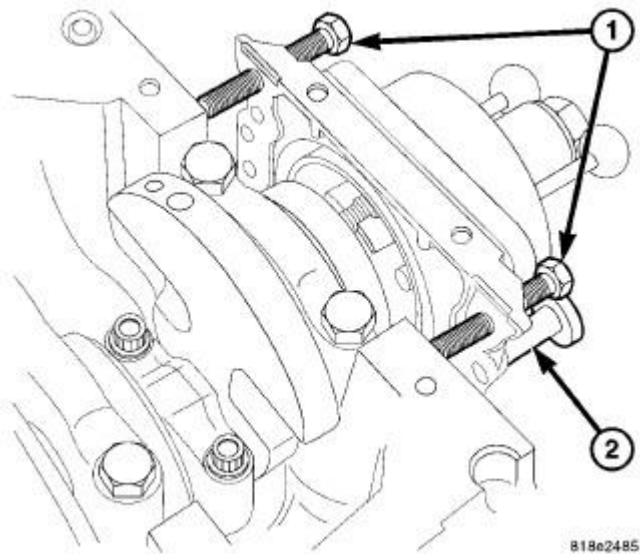
**NOTE:** Verify that the engine is still at Top Dead Center (TDC).

12. Screw nut (3) to the end of the spindle.
13. Press threaded spindle of seal installer (1) until nut (3) lies against assembly bell housing (2).
14. Align flat side of assembly bell housing on sump side of crankcase sealing surface.



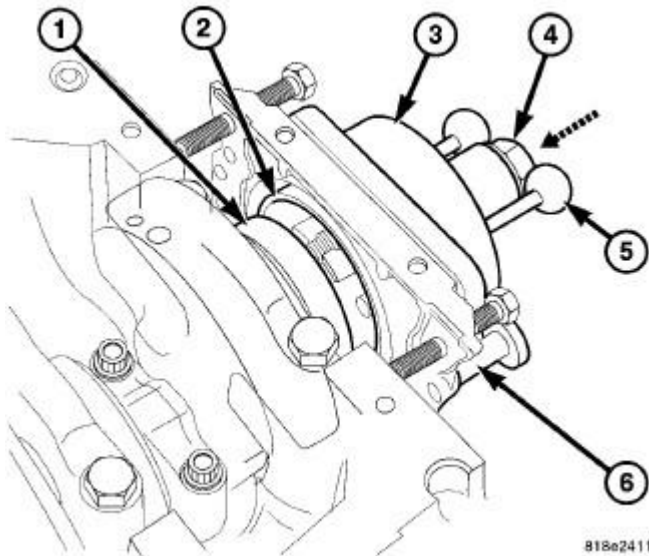
**Fig. 172: Rear Main Seal Installer 9888**  
Courtesy of CHRYSLER LLC

15. Secure the rear main seal installer 9888 to crankshaft using Allen head bolts (3).



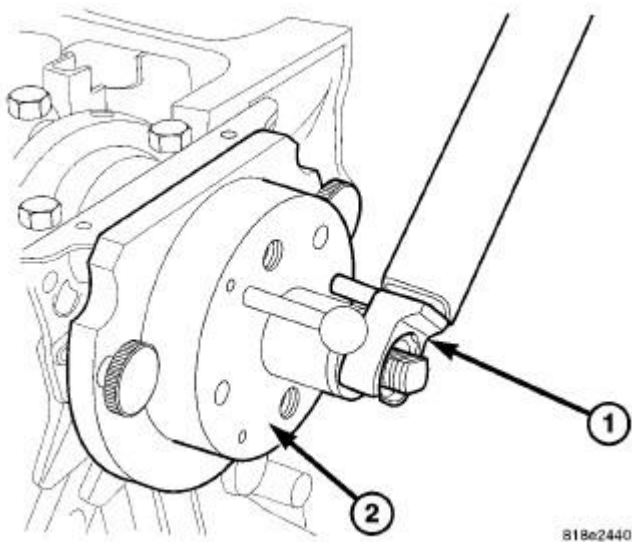
**Fig. 173: Guide Bolts**  
Courtesy of CHRYSLER LLC

16. To guide sealing flange, screw two M7 x 35 mm bolts (1) into cylinder block.



**Fig. 174: Seal to Crankshaft Alignment**  
Courtesy of CHRYSLER LLC

17. Push assembly bell housing (3) by hand in the direction shown in illustration until sealing lip support ring (2) contacts the crankshaft (1).
18. Push guide pin with black knob (5), into hole in crankshaft. This is done to ensure the sender wheel reaches its final installation position.
19. Hand tighten both hexagon socket head bolts of assembly tool.
20. Screw hexagon nut (4) onto threaded spindle by hand until it lies against assembly bell housing (3).



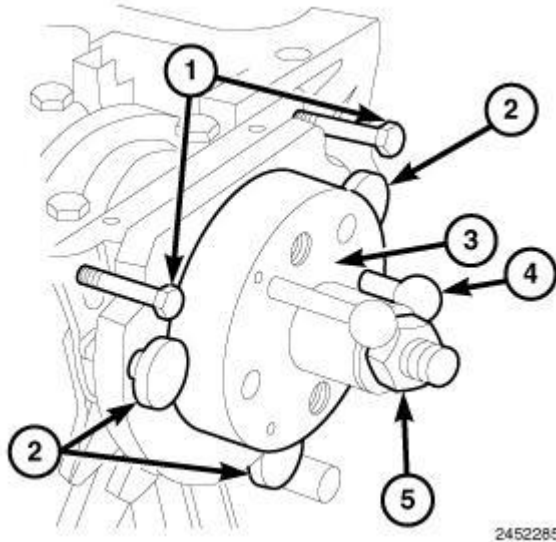
**Fig. 175: Pressing Seal in Place**

Courtesy of CHRYSLER LLC

**NOTE:** After nut is torqued, a small air gap must be present between cylinder block and sealing flange.

21. Tighten hexagon nut (1) to 35 N.m (26 ft. lbs.).

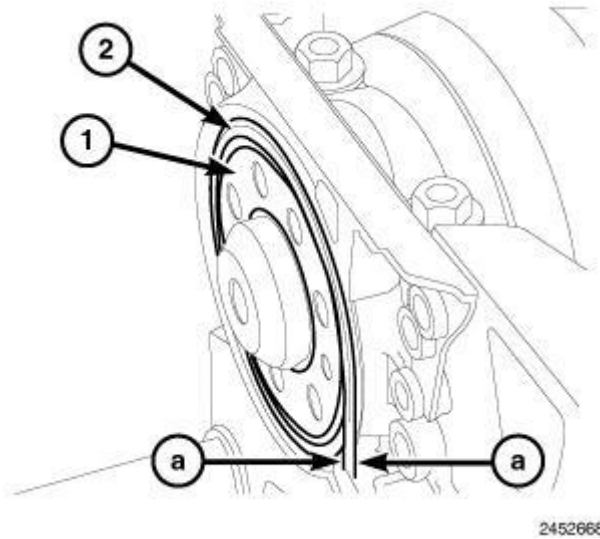
Checking sender wheel installation position



**Fig. 176: Checking Sender Wheel Installation Position**  
Courtesy of CHRYSLER LLC

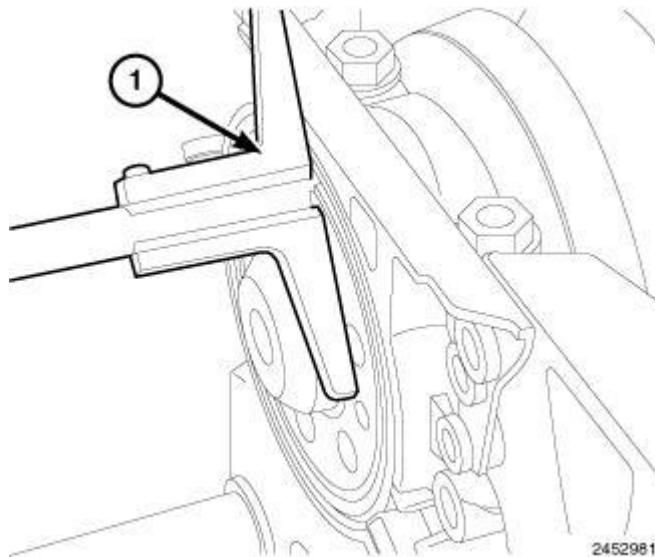
1. Remove hexagon nut (5) to the end of the threaded spindle.
2. Remove the two bolts (1) from cylinder block.
3. Loosen the three knurled screws (2).
4. Remove rear main installer 9888.
5. Remove sealing lip support ring.





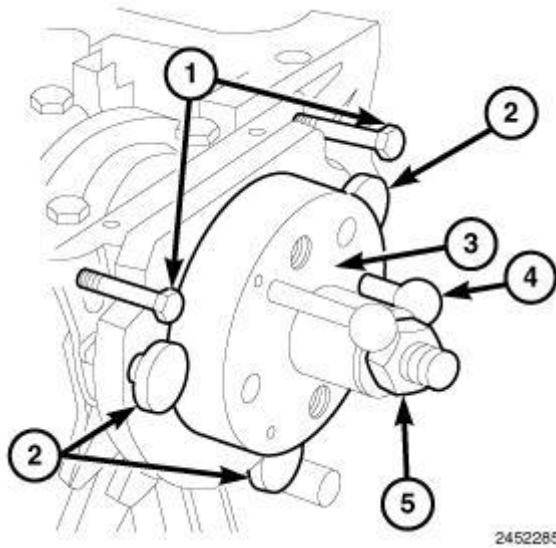
**Fig. 177: Crankshaft Flange And Sender Wheel**  
Courtesy of CHRYSLER LLC

6. The sender wheel is in the correct position if a gap of 0.5 mm (0.019 in.) exists between the crankshaft flange (1) and the sender wheel (2). Measure the distance -a- between the crankshaft flange and the sender wheel.



**Fig. 178: Measure Distance Between Crankshaft Flange**  
Courtesy of CHRYSLER LLC

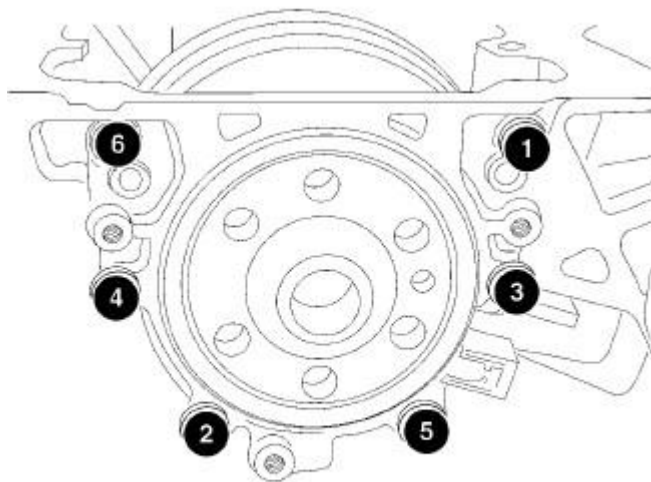
7. Set vernier gauge on crankshaft flange.
8. Measure the distance between the crankshaft flange and the sender wheel.
9. If the measurement is too small, press sender wheel on further.



**Fig. 179: Checking Sender Wheel Installation Position**  
Courtesy of CHRYSLER LLC

**NOTE: Re-pressing sender wheel.**

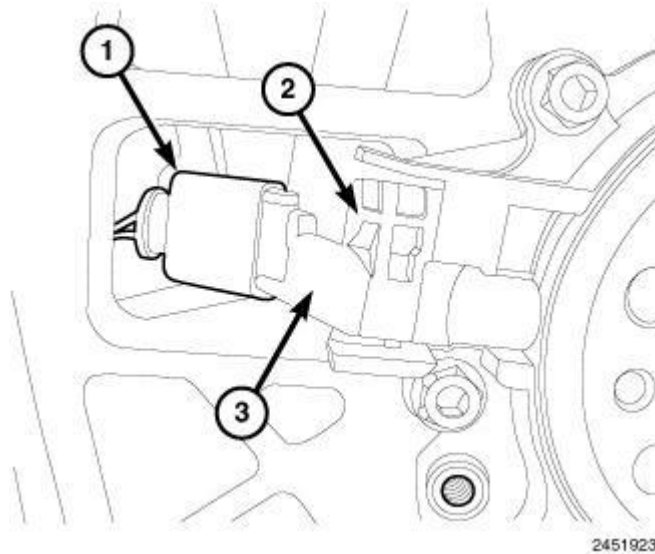
- Secure assembly rear main installer 9888 to crankshaft flange using Allen head bolts.
- Hand tighten both hexagon socket head bolts.
- Push assembly tool by hand to sealing flange.
- Screw hexagon nut (5) onto threaded spindle by hand until it lies against assembly bell housing (3).
- Tighten nut to 40 N.m (30 ft. lbs.).
- Check installation position again.
- If dimension is too small, repeat steps a through d again and torque to 45 N.m (33 ft. lbs.).
- Check installation position again.



**Fig. 180: Rear Main Torque Sequence**

Courtesy of CHRYSLER LLC

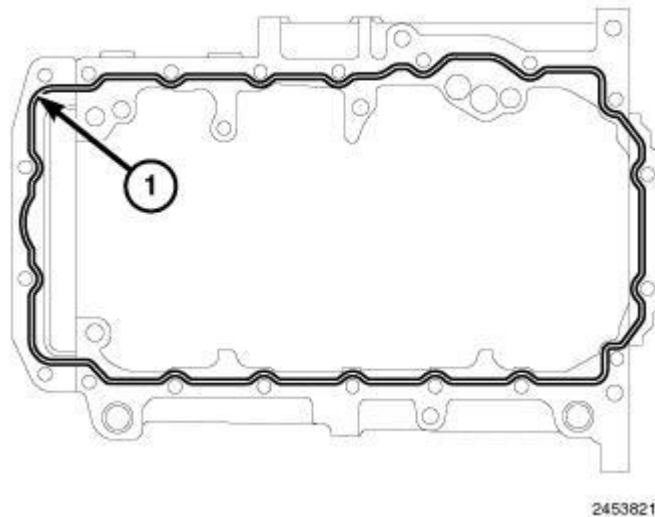
10. If dimension is attained, tighten rear sealing flange bolts to 15 N.m (133 in. lbs.) in the sequence shown in illustration.



**Fig. 181: Crankshaft Position Sensor**

Courtesy of CHRYSLER LLC

11. Install crankshaft position sensor (3). Tighten bolt (2) to 5 N.m (44 in. lbs.).
12. Connect the crankshaft position sensor harness connector (1).

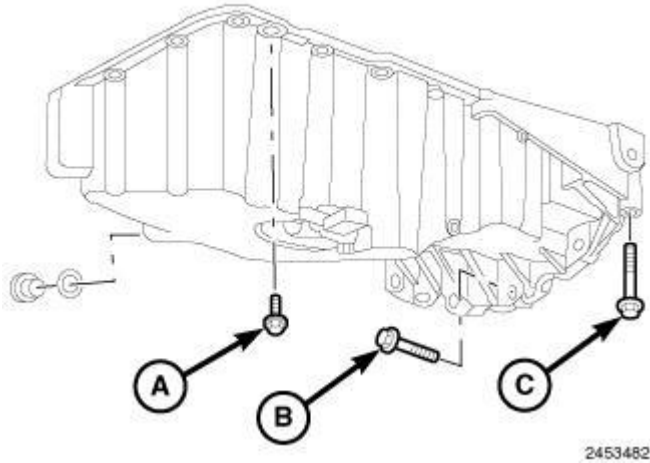


**Fig. 182: Oil Gasket Surfaces**

Courtesy of CHRYSLER LLC

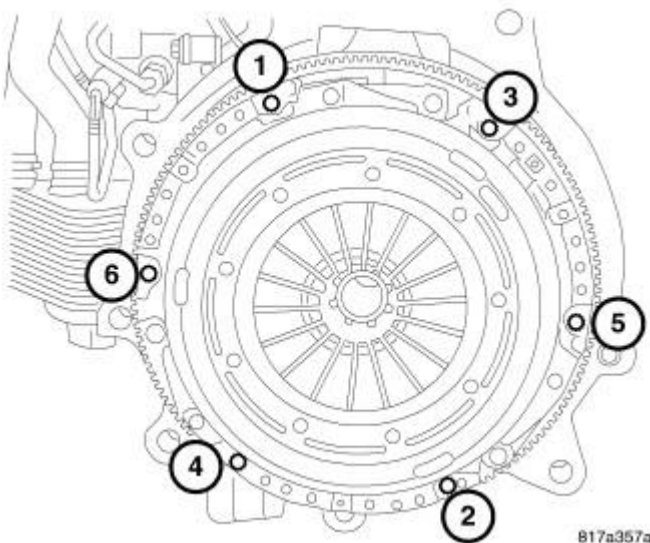
13. Clean the oil gasket surfaces.

14. Apply a 3 mm (1) bead of engine sealant RTV.



**Fig. 183: Tightening Bolts**  
Courtesy of CHRYSLER LLC

15. Install oil pan.
  - Tighten bolts (A) to 15 N.m (133 in. lbs).
  - Tighten bolts (B) to 45 N.m (33 ft. lbs).
  - Tighten bolts (C) to 40 N.m (30 ft. lbs).



**Fig. 184: Flywheel Assembly**  
Courtesy of CHRYSLER LLC

16. Install the dual mass flywheel. Refer to **Clutch/FLYWHEEL - Installation**
17. If equipped, install the vibration damper dust cover.

**WARNING:** Use extreme caution when the engine is operating. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothes.

18. Fill engine with the recommended engine oil.
19. Connect the negative battery cable.
20. Start engine and inspect for leaks.

## ENGINE MOUNTING

### DESCRIPTION

#### DESCRIPTION

The engine mounting system consists of a four-point system utilizing two load-carrying mounts and two torque controlling mounts. The load-carrying mounts are located on each frame rail. The right and left mounts are hydro-elastic mounts. The two torque controlling mounts are attached to a fore/aft member and the front and rear of the engine.

### OPERATION

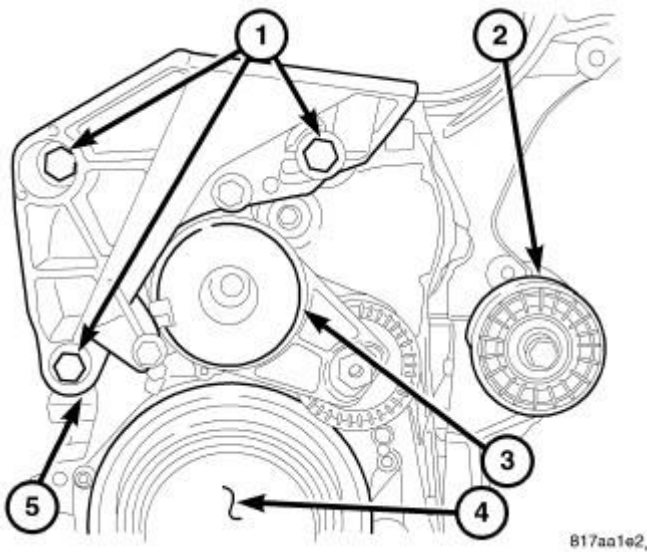
#### OPERATION

The four-point engine mounting system minimizes the transmission of structure-borne engine noise to the passenger compartment. The load-carrying right and left mounts dampen and isolate vertical motion and vibration. The front and rear mount absorb torque reaction forces and torsional vibrations.

## BRACKET, ENGINE MOUNT, RIGHT

### Removal

#### REMOVAL

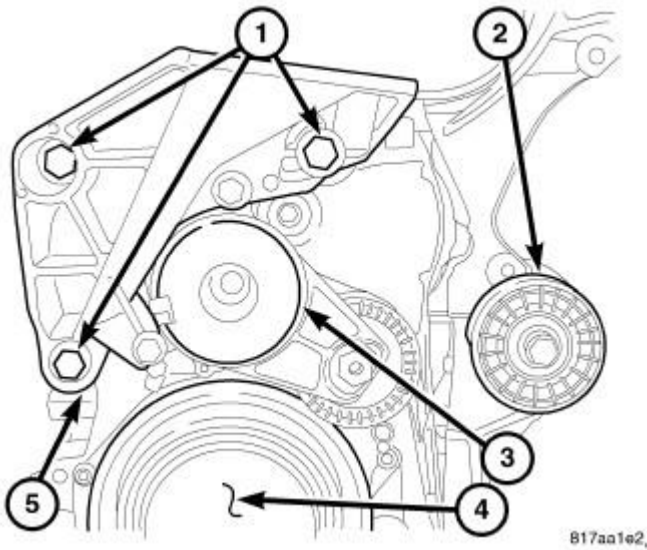


**Fig. 185: Right Engine Mount Bracket**  
Courtesy of CHRYSLER LLC

1. Remove right engine mount. See **Removal**.
2. Remove accessory drive belt.
3. Remove bracket retaining bolts (1).
4. Remove bracket (5) through bottom rear.

#### Installation

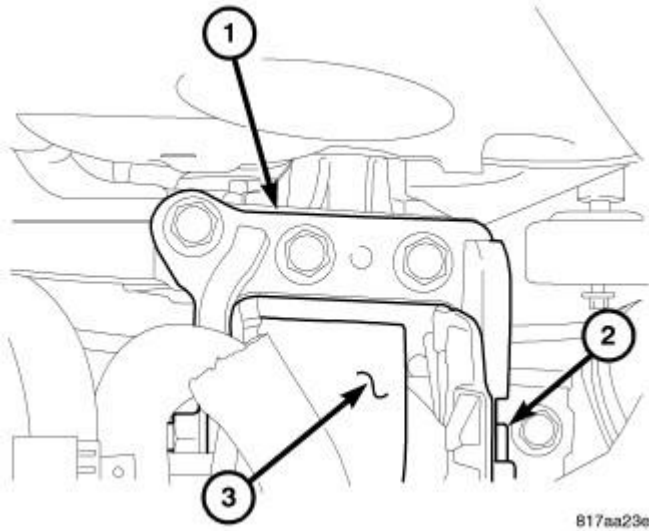
#### INSTALLATION



**Fig. 186: Right Engine Mount Bracket**  
Courtesy of CHRYSLER LLC

1. Position right engine mount bracket (5).

2. Install bracket retaining (1) bolts and tighten to 50 N.m (37 ft. lbs.).
3. Install accessory drive belt.



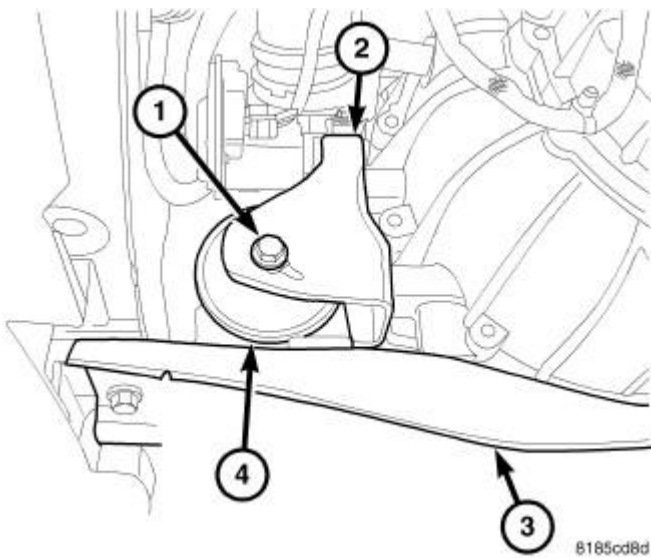
**Fig. 187: Right Engine Mount**  
Courtesy of CHRYSLER LLC

4. Install mount (3). See Installation.

## INSULATOR, ENGINE MOUNT, FRONT

### Removal

### REMOVAL

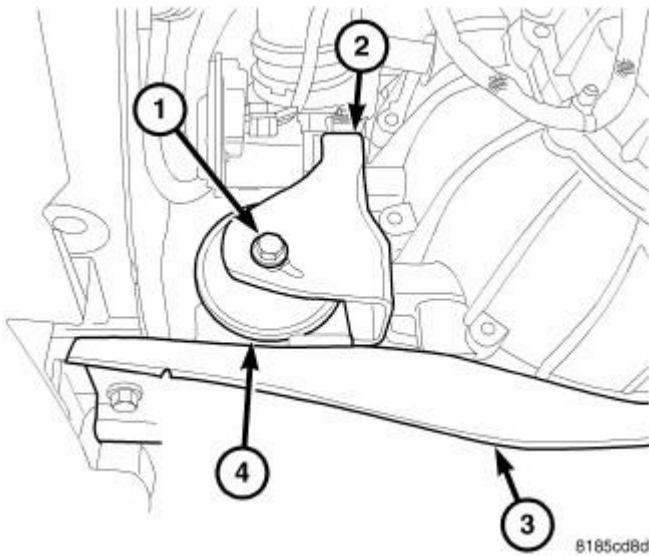


**Fig. 188: Front Mount Through Bolt**  
Courtesy of CHRYSLER LLC

1. Raise vehicle.
2. Remove fore aft member (3) to mount (4) bolts.
3. Remove mount through bolt (1).
4. Remove fore aft member (3) mounting bolts and remove.
5. Remove front mount (4).

## Installation

### INSTALLATION



**Fig. 189: Front Mount Through Bolt**  
Courtesy of CHRYSLER LLC

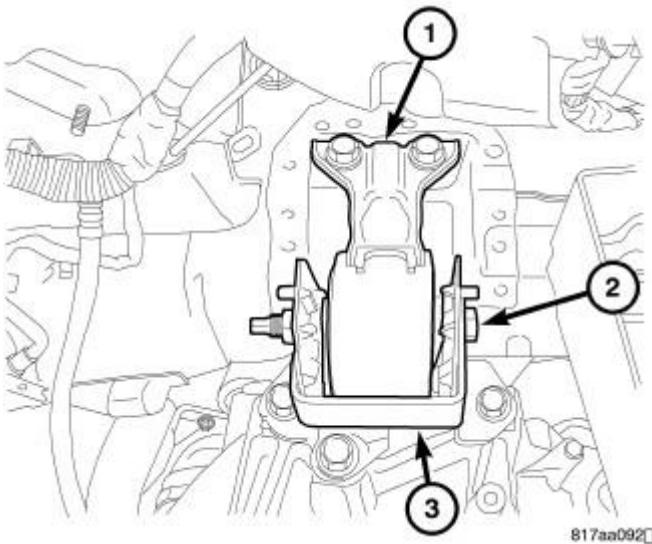
1. Position mount (4) and tighten bolts to 47 N.m (35 ft. lbs.).
2. Install fore aft member (3) and tighten bolts to 100 N.m (74 ft. lbs.).
3. Install mount through bolt (1) and tighten to 47 N.m (35 ft. lbs.).
4. Lower vehicle.

## INSULATOR, ENGINE MOUNT, LEFT

### Removal

### REMOVAL



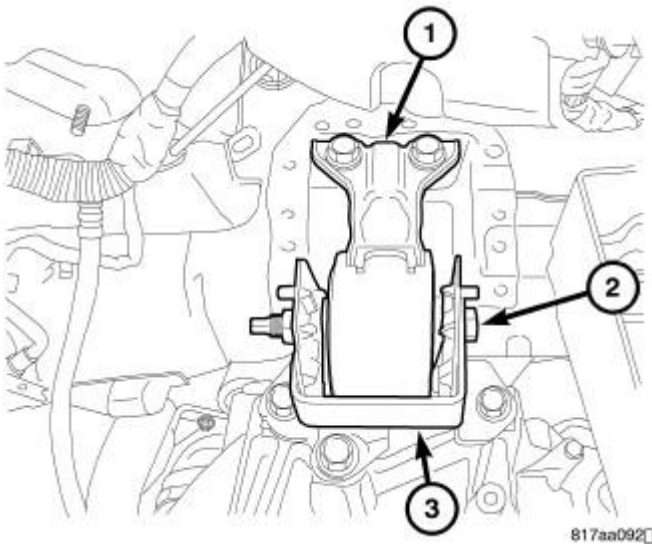


**Fig. 190: Left Engine Mount**  
Courtesy of CHRYSLER LLC

1. Remove air cleaner assembly.
2. Remove battery.
3. Remove battery tray.
4. Disconnect PCM connectors and reposition harness.
5. Remove PCM.
6. Remove PCM mounting bracket.
7. Support engine with a suitable jack.
8. Remove mount through bolt (2).
9. Remove mount bracket from transaxle (3).
10. Remove mount to frame rail retaining bolts.
11. Remove engine mount (1).

#### Installation

#### INSTALLATION



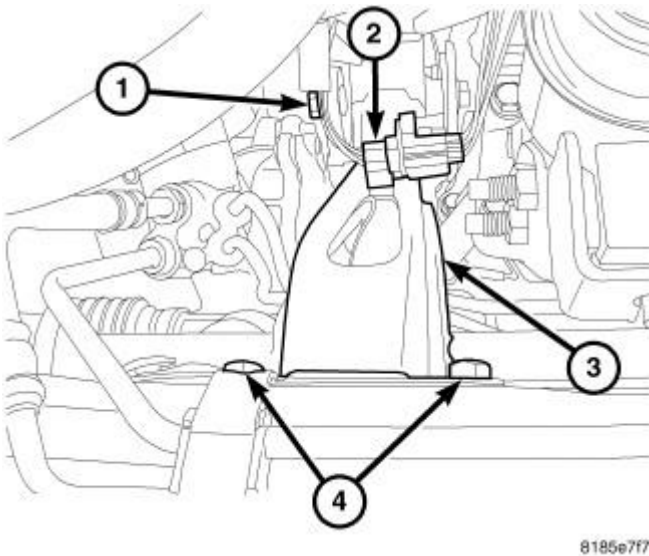
**Fig. 191: Left Engine Mount**  
Courtesy of CHRYSLER LLC

1. Position mount (1) on frame rail.
2. Install mount retaining bolts and tighten to 75 N.m (55 ft. lbs.).
3. Install mount bracket (3) to transaxle and tighten bolts to 61 N.m (45 ft. lbs.).
4. Install mount through bolt (2) and tighten to 100 N.m (74 ft. lbs.).
5. Remove jack.
6. Install PCM mounting bracket.
7. Install PCM.
8. Connect PCM electrical connectors.
9. Install battery tray.
10. Install battery.
11. Install air cleaner assembly.

## INSULATOR, ENGINE MOUNT, REAR

### Removal

### REMOVAL

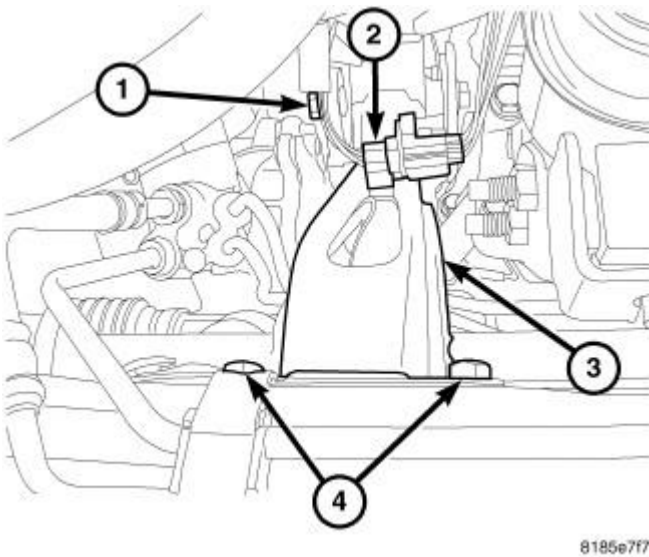


**Fig. 192: Rear Mount Retaining Bolts**  
Courtesy of CHRYSLER LLC

1. Remove rear mount retaining bolts (4).
2. Remove rear mount through bolt (1).
3. Remove oxygen sensor connector (2) from mount.
4. Remove rear mount (3).

#### Installation

#### INSTALLATION



**Fig. 193: Rear Mount Retaining Bolts**  
Courtesy of CHRYSLER LLC

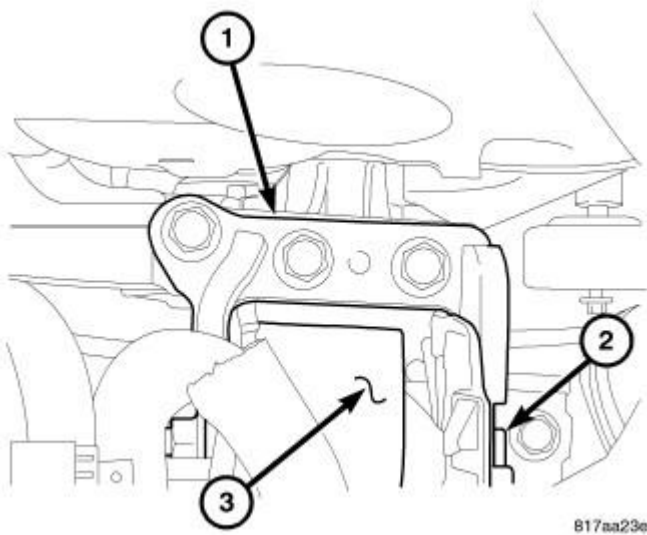
1. Position rear mount (3).

2. Install rear mount retaining bolts (4) and tighten to 50 N.m (37 ft. lbs.).
3. Install rear mount through bolt (1) and tighten to 47 N.m (35 ft. lbs.).
4. Install oxygen sensor connector (2) retainer to mount (3).

## INSULATOR, ENGINE MOUNT, RIGHT

### Removal

#### REMOVAL

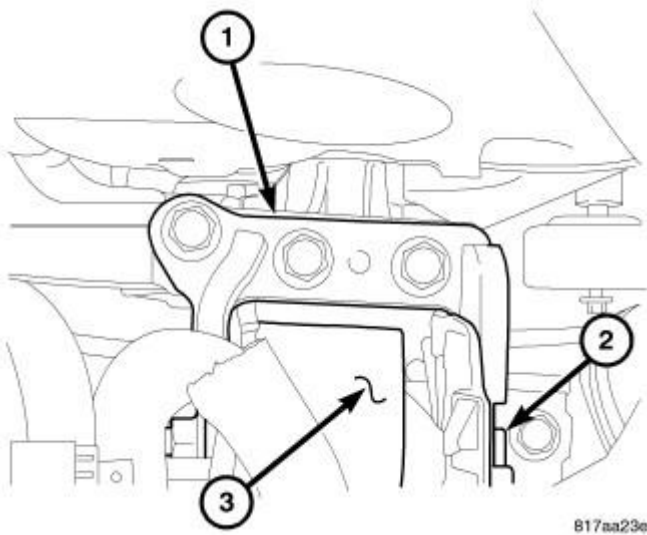


**Fig. 194: Right Engine Mount**  
Courtesy of CHRYSLER LLC

1. Remove right splash shield.
2. Remove accessory drive belt.
3. Remove lower tensioner bolt.
4. Remove lower mount bracket bolt.
5. Lower vehicle.
6. Support engine with suitable jack.
7. Remove coolant reservoir.
8. Remove windshield washer bottle.
9. Remove upper mount bolts.
10. Remove through bolt (2).
11. Remove mount (3).

### Installation

#### INSTALLATION



**Fig. 195: Right Engine Mount**  
Courtesy of CHRYSLER LLC

1. Position mount (3) in place.
2. Install mount retaining bolts and tighten to 75 N.m (55 ft. lbs.).
3. Install mount through bolt (2) and tighten to 88 N.m (65 ft. lbs.).
4. Install windshield washer bottle.
5. Install coolant reservoir.
6. Remove jack.
7. Raise vehicle.
8. Install lower mount bracket bolt and tighten to 68 N.m (50 ft. lbs.).
9. Install tensioner bolt.
10. Install accessory drive belt. Refer to Cooling/Accessory Drive/BELT, Serpentine - Installation .
11. Install splash shield.

## LUBRICATION

### DESCRIPTION

### DESCRIPTION

The lubrication system is a full-flow filtration, pressure feed type. The balance shaft module (BSM) is mounted below the ladder frame and chain driven by the crankshaft. The BSM consists of a non-serviceable pump, oil pressure relief valve, and a non-serviceable balance assembly.

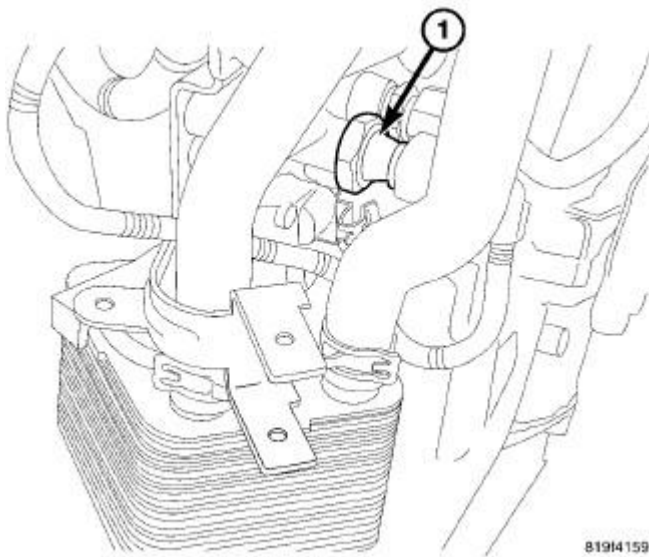
### OPERATION

### OPERATION

Engine oil is drawn up through the pickup tube and is pressurized by the oil pump and routed through the full-flow filter to the main oil gallery running the length of the cylinder block on the intake side. A diagonal hole in each bulkhead feeds oil to each main bearing. Drilled passages within the crankshaft route oil from main bearing journals to connecting rod journals. Balance shaft lubrication is provided through an internal oil passage at the #3 bearing location around the BSM mounting bolt. A vertical hole at the number one bulkhead routes pressurized oil through a filter screen and head gasket up to the cylinder head. The oil then divides into three passages; one to the intake cam phaser, one to the exhaust cam phaser and one to the camshafts. The passage to the camshafts divides to feed both of the hollow camshafts at the second cam journal. The rest of cam journals are fed oil through the hollow camshafts. The #1 cam journals are fed oil through the VVT oil passages. Oil passages to the phasers are directed through the OCV (oil control valves) to the #1 journals. The oil then flows through the camshafts to the cam phasers. Oil returning to the pan from pressurized components supplies lubrication to the valve stems, cam lobes, and tappets. Cylinder bores and wrist pins are splash lubricated from directed slots on the connecting rod thrust collars.

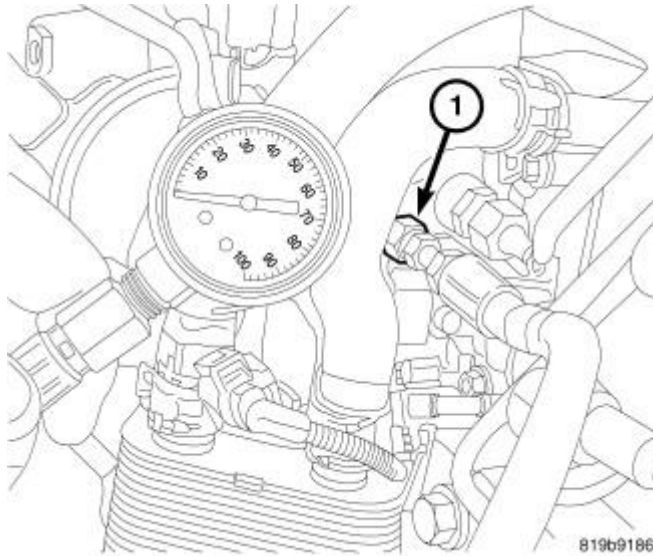
## DIAGNOSIS AND TESTING

### CHECKING ENGINE OIL PRESSURE



**Fig. 196: Oil Pressure Sender**  
Courtesy of CHRYSLER LLC

1. Disconnect and remove oil pressure switch (1). See **Removal**.

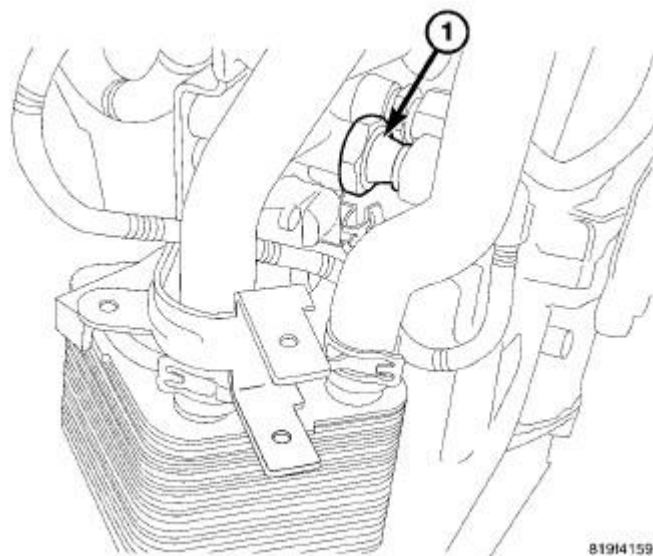


**Fig. 197: Oil Pressure Gauge**  
Courtesy of CHRYSLER LLC

2. Install oil pressure gauge (1).
3. Start engine and record oil pressure. Refer to Specifications for correct oil pressure requirements. See **Specifications**.

**CAUTION: If oil pressure is 0 at idle, do not perform the 3000 RPM test**

4. If oil pressure is 0 at idle, shut off engine. check for pressure relief valve stuck open, a clogged oil pick-up screen or a damaged oil pick-up tube O-ring.
5. Remove oil pan and inspect for debris. See **Removal**.
6. Remove pressure relief valve and inspect, if damaged replace pressure relief valve.
7. If pressure relief valve is OK, replace balance shaft module assembly.
8. After test is complete, remove test gauge and fitting (1).



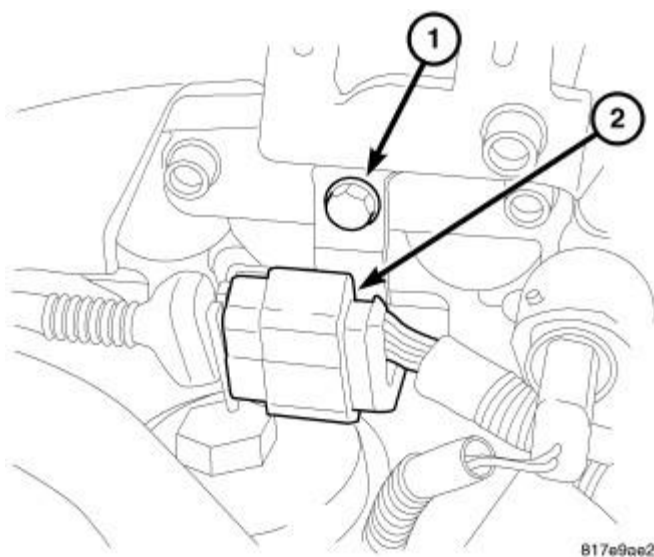
**Fig. 198: Oil Pressure Sender**  
Courtesy of CHRYSLER LLC

9. Install oil pressure switch (1) and connector. See **Installation** .

## FILTER, ENGINE OIL

### Removal

### REMOVAL

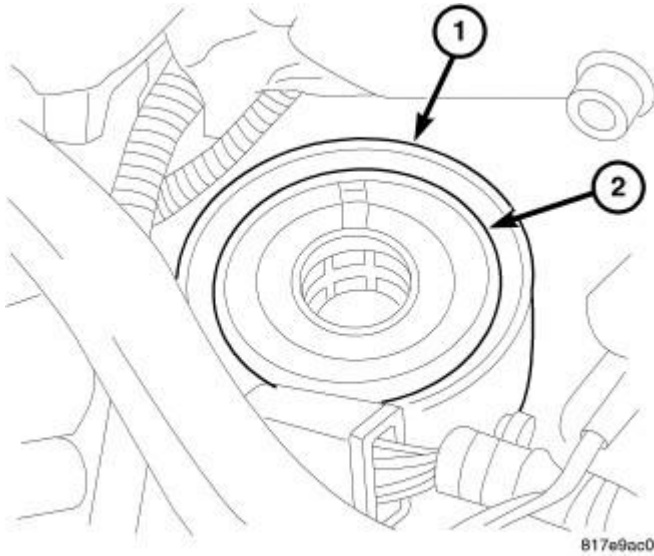


**Fig. 199: Electrical Connector**  
Courtesy of CHRYSLER LLC

1. Remove harness hold down bracket retaining bolt (1) and reposition out of the way.



2. Remove oil filter housing cover.

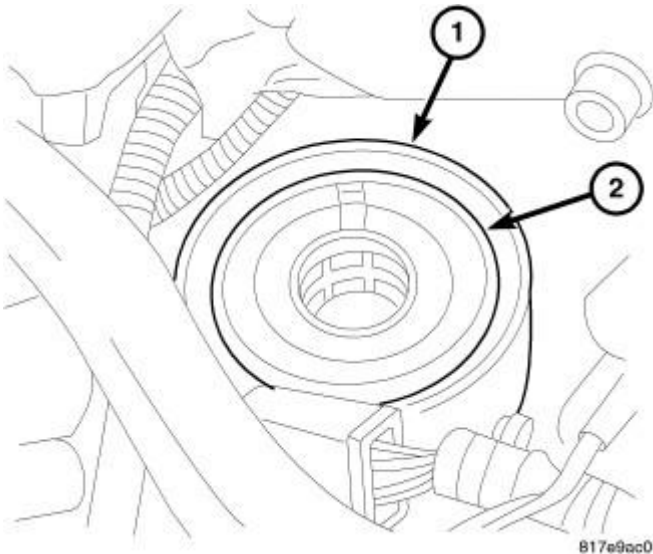


**Fig. 200: Filter Housing**  
Courtesy of CHRYSLER LLC

3. Pull filter cartridge (2) out of the filter housing (1) and discard.

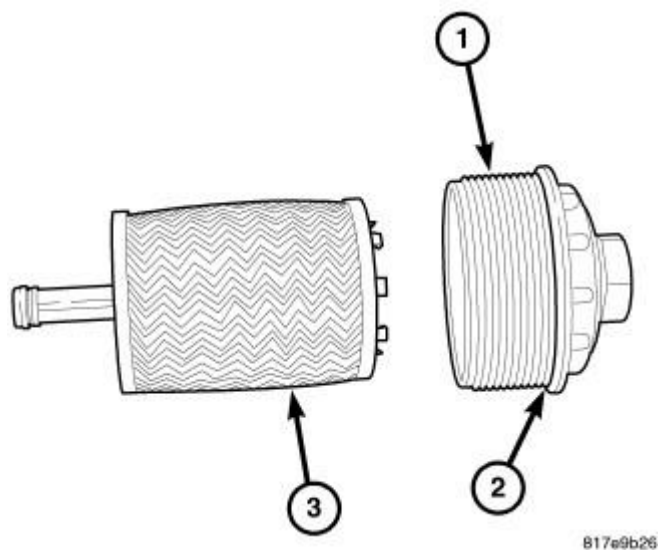
### Installation

#### INSTALLATION



**Fig. 201: Oil Filter Cartridge**  
Courtesy of CHRYSLER LLC

1. Install oil filter cartridge (2) into housing (1).



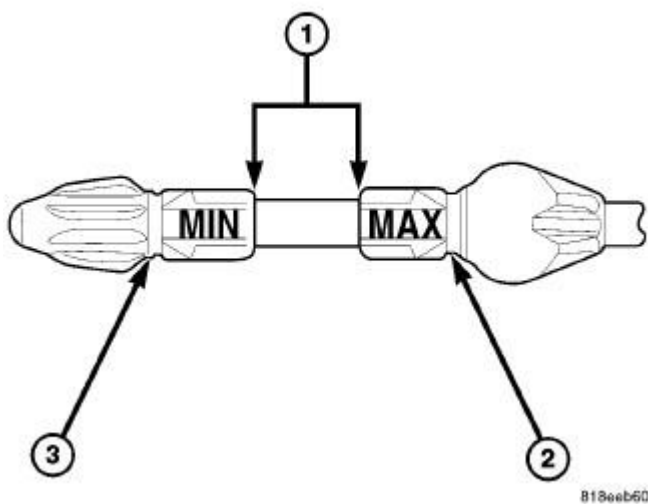
**Fig. 202: Oil Filter**  
Courtesy of CHRYSLER LLC

2. Install new O-ring (2) onto cover (1).
3. Install cover.

## OIL

### Standard Procedure

#### ENGINE OIL LEVEL CHECK



**Fig. 203: Oil Level Indicator**  
Courtesy of CHRYSLER LLC

The best time to check engine oil level is after the vehicle has sat overnight, or if the engine has been running, allow the engine to be shut off for at least 5 minutes before checking oil level.

Checking the oil while the vehicle is on level ground will improve the accuracy of the oil level reading. Remove dipstick and observe oil level. Add oil only when the level is at or below the MIN mark (3).

**CAUTION: Do not operate engine if the oil level is above the MAX (2) mark on the dipstick. Excessive oil volume can cause oil aeration which can lead to engine failure due to loss of oil pressure or increase in oil temperature.**

#### ENGINE OIL AND FILTER CHANGE

**WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY. CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.**

Change engine oil at mileage and time intervals described in the Maintenance Schedule. Refer to Vehicle Quick Reference/Maintenance Schedules - Description .

1. Run engine until achieving normal operating temperature.
2. Position the vehicle on a level surface and turn engine off.
3. Remove oil fill cap.
4. Raise vehicle on hoist.
5. Place a suitable oil collecting container under oil pan drain plug.
6. Remove oil pan drain plug or and allow oil to drain into collecting container. Inspect drain plug threads for stretching or other damage. Replace drain plug and gasket if damaged.
7. Remove oil filter. See Removal.
8. Install oil pan drain plug. Torque drain plug to 28 N.m (20 ft. lbs.).
9. Install new oil filter. See Installation.
10. Lower vehicle and fill crankcase with specified type and amount of engine oil. Refer to Vehicle Quick Reference/Capacities and Recommended Fluids - Specifications and refer to Vehicle Quick Reference/Capacities and Recommended Fluids - Description .
11. Install oil fill cap.
12. Start engine and inspect for leaks.
13. Stop engine and inspect oil level.

#### OIL FILTER SPECIFICATION

All engines are equipped with a high quality full-flow, disposable type oil filter. Replace oil filter with a Mopar® or the equivalent.

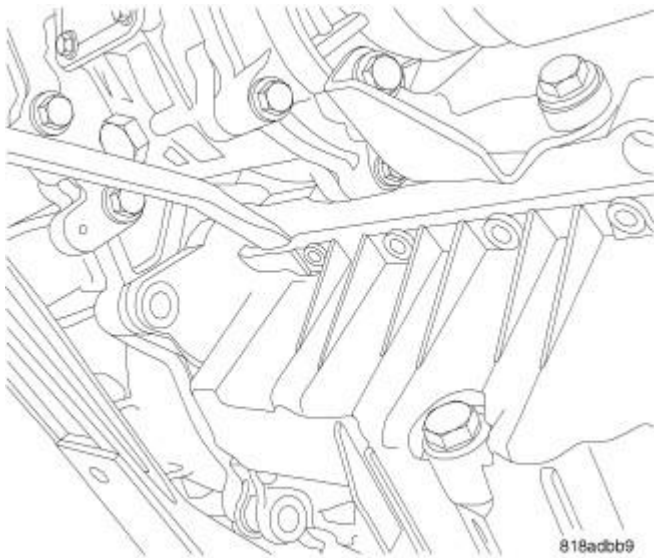
#### USED ENGINE OIL DISPOSAL

Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING listed above.

#### PAN, OIL

##### Removal

##### REMOVAL



**Fig. 204: OIL PAN-REMOVAL**  
Courtesy of CHRYSLER LLC

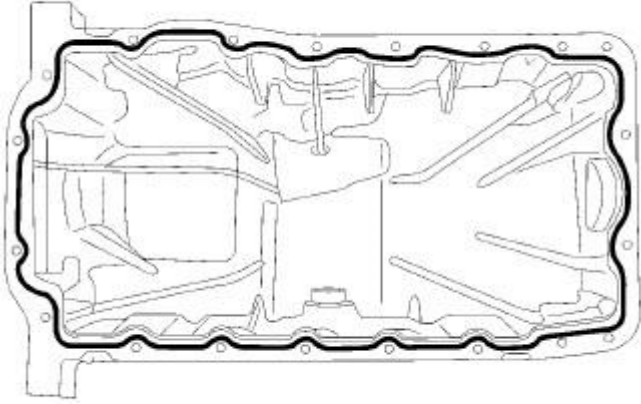
1. Disconnect negative battery cable.
2. Raise vehicle on hoist.
3. Remove engine compartment lower silencer and accessory drive belt splash shield.
4. Drain engine oil.

**NOTE:** It maybe necessary to rotate crankshaft to gain access to the rear oil pan bolts.

5. Remove oil pan fasteners.
6. Remove oil pan by prying off with suitable pry bar.
7. Clean oil pan and engine block sealing surfaces.

##### Installation

## INSTALLATION



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**Fig. 205: Oil Pan RTV Path**

Courtesy of CHRYSLER LLC

1. Clean oil pan and all sealing surfaces.
2. Apply a 2 - 3 mm bead of RTV to oil pan as shown in illustration.
3. Position oil pan and install bolts.
4. Hand tighten oil pan bolts.
5. Install oil pan to bell housing bolts and hand tighten.
6. Tighten oil pan bolts to 15 N.m (133 in. lbs.).
7. Tighten oil pan to bell housing bolts to 40 N.m (30 ft. lbs.).
8. Install accessory drive belt splash shield and engine compartment lower silencer.
9. Lower vehicle.

**NOTE:** Sealer must cure for a minimum of 30 minutes prior to filling with oil.

10. Refill engine oil.
11. Connect negative battery cable.
12. Start engine and check for leaks.

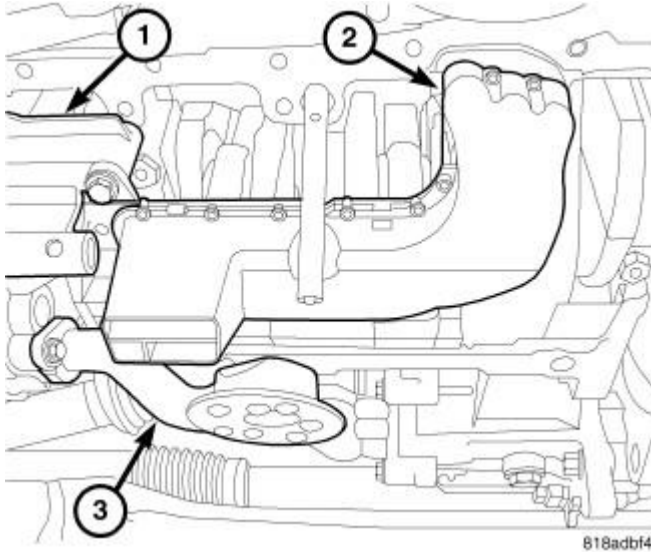
## PUMP, ENGINE OIL

### Removal

### REMOVAL

1. Disconnect negative battery cable.

2. Raise vehicle on hoist.
3. Drain engine oil.
4. Remove oil pan. See **Removal**.



**Fig. 206: Windage Tray - Removal**  
Courtesy of CHRYSLER LLC

5. Remove windage tray retaining bolt and remove windage tray (2).
6. Remove oil pump retaining bolts.
7. Push on oil pump chain tensioner to release tension on chain and remove oil pump chain from oil pump sprocket.
8. Remove oil pump.

## Installation

### INSTALLATION

1. Release tension from oil pump chain tensioner and install chain on oil pump sprocket.
2. Position oil pump on cylinder block and install retaining bolts. Tighten bolts to 18 N.m (13 lbs. ft.).
3. Position windage tray and instal retaining bolt.
4. Install oil pan. See **Installation**.
5. Lower vehicle from hoist.
6. Refill engine oil to proper level.
7. Connect negative battery cable.

## SENSOR, OIL PRESSURE

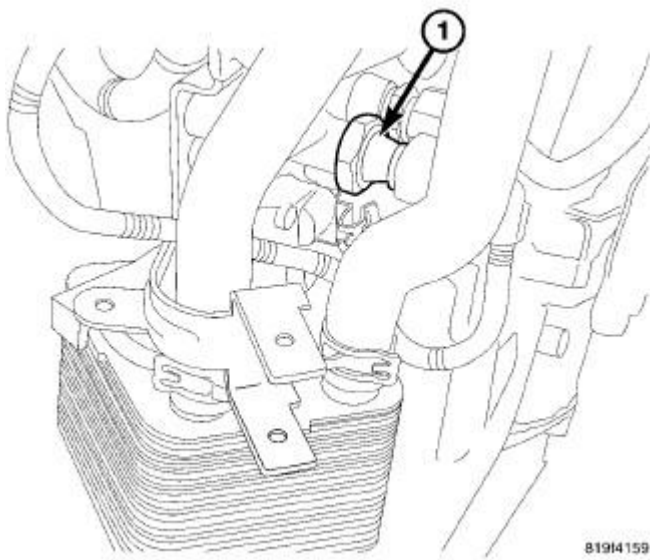
### Description

**DESCRIPTION**

The oil pressure switch is located on the right front side of the engine block. The oil pressure switch is a pressure sensitive switch that is activated by the engine's oil pressure (in the main oil gallery). The switch is a single terminal device.

**Operation****OPERATION**

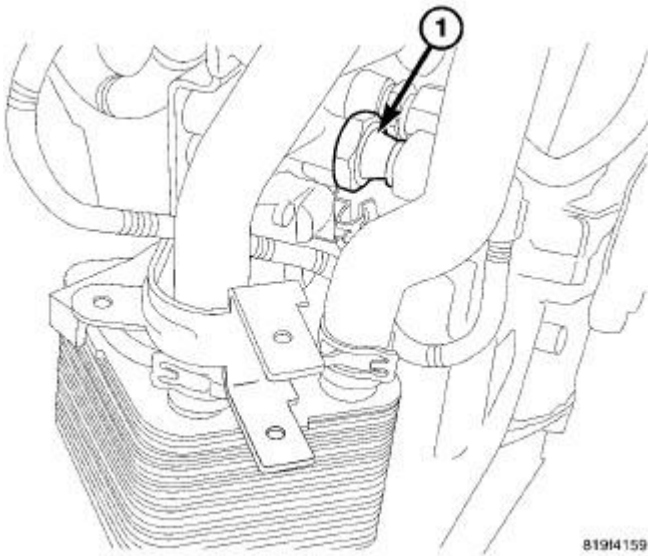
The oil pressure switch is normally "Closed." The switch changes from a "Closed" circuit to an "Open" circuit, on increasing pressure of 7 psig. The oil pressure switch changes from an "Open" circuit to a "Closed" circuit, on decreasing pressure, between 2 psig and 4 psig.

**Removal****REMOVAL**

**Fig. 207: Oil Pressure Sender Electrical Connector**  
Courtesy of CHRYSLER LLC

1. Disconnect oil pressure sensor electrical connector.
2. Remove oil pressure sensor (1).

**Installation****INSTALLATION**



**Fig. 208: Oil Pressure Sender Electrical Connector**  
Courtesy of CHRYSLER LLC

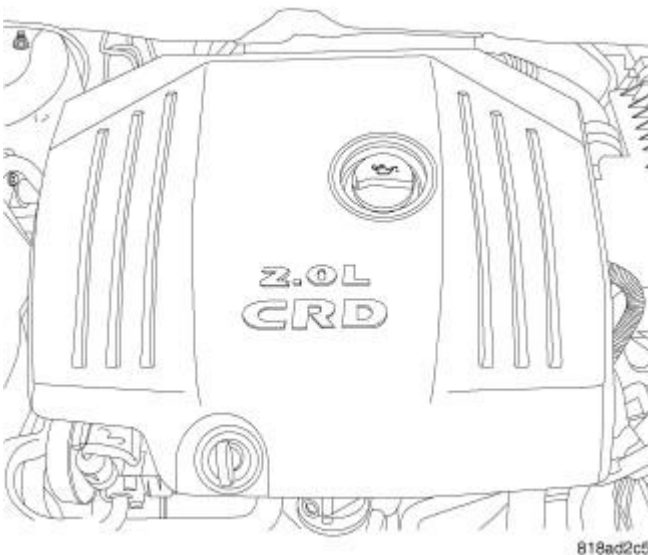
1. Apply Mopar® thread sealant to threads.
2. Install oil pressure sensor and tighten to 8 N.m (71 in. lbs.).
3. Connect oil pressure sensor electrical connector.

## MANIFOLDS

### MANIFOLD, EXHAUST

#### Removal

#### REMOVAL

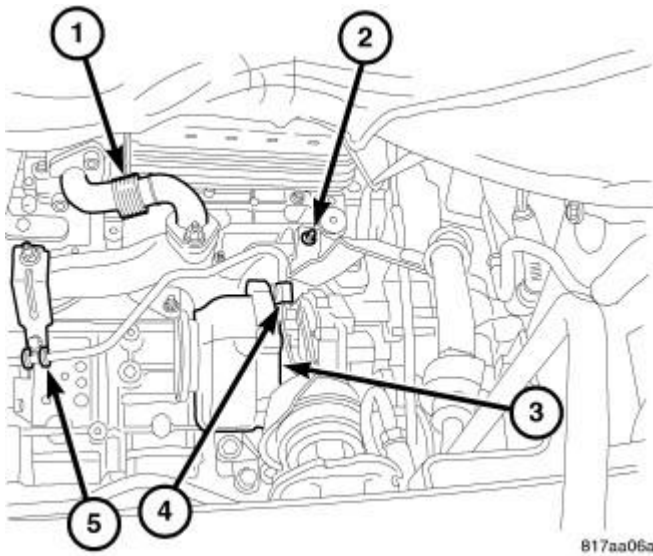




**Fig. 209: Engine Cover-Removal**

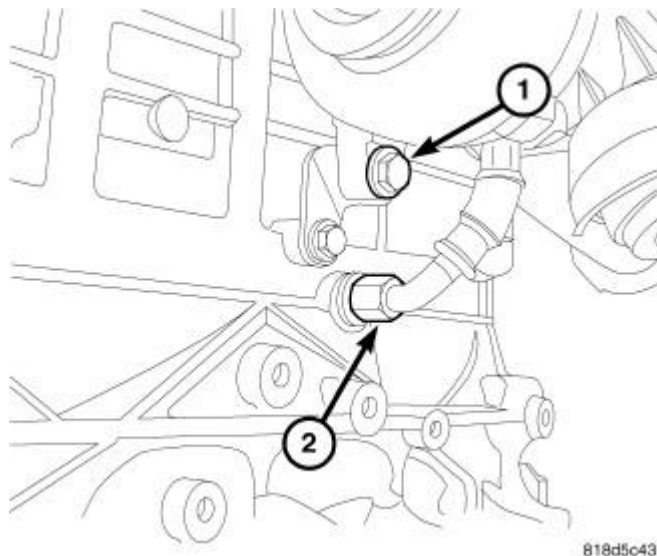
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove engine cover. Refer to **ENGINE COVER**.
3. Remove exhaust manifold upper heat shield bolts and remove upper heat shield.
4. Remove exhaust manifold lower heat shield.
5. Separate exhaust pipe from catalytic converter.

**Fig. 210: Power Steering Line Support**

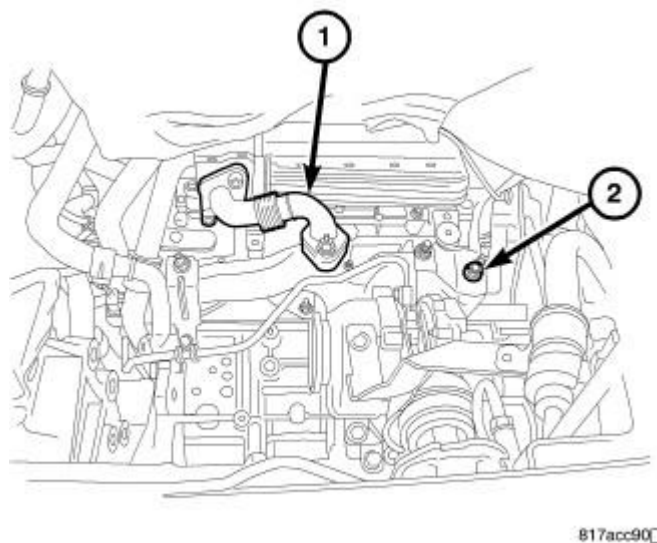
Courtesy of CHRYSLER LLC

6. Remove upper turbo inlet tube.
7. Remove lower turbo outlet tube.
8. Remove turbo lower vacuum line.
9. Remove turbo oil feed line support bracket (5).
10. Remove turbo oil feed line at turbo (4).
11. Remove power steering line support (2).
12. Remove turbo oil feed line at oil filter housing.



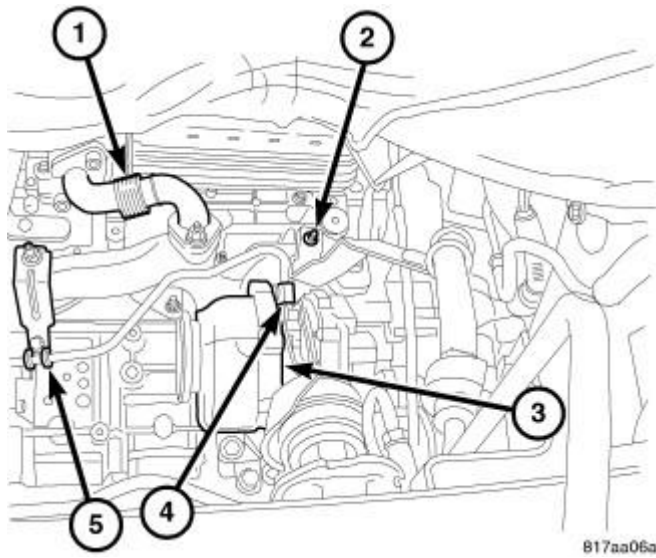
**Fig. 211: Turbo Support Bracket**  
Courtesy of CHRYSLER LLC

13. Remove turbo oil return line (2).
14. Remove turbo support bracket (1).



**Fig. 212: EGR Tube**  
Courtesy of CHRYSLER LLC

15. Remove EGR tube (1) from exhaust manifold.
16. Remove heat shield (2).

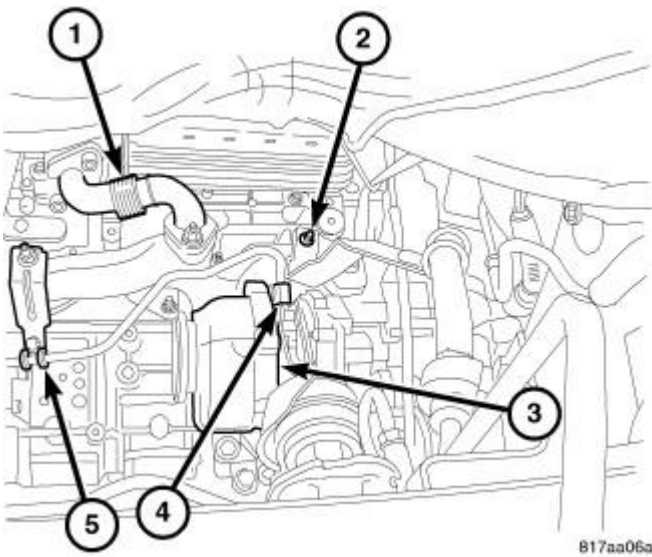


**Fig. 213: Exhaust Manifold/Turbo Assembly**  
Courtesy of CHRYSLER LLC

17. Remove exhaust manifold bolts.
18. Remove exhaust manifold/turbo assembly (3).
19. Remove gasket.
20. Clean gasket surfaces.

#### Installation

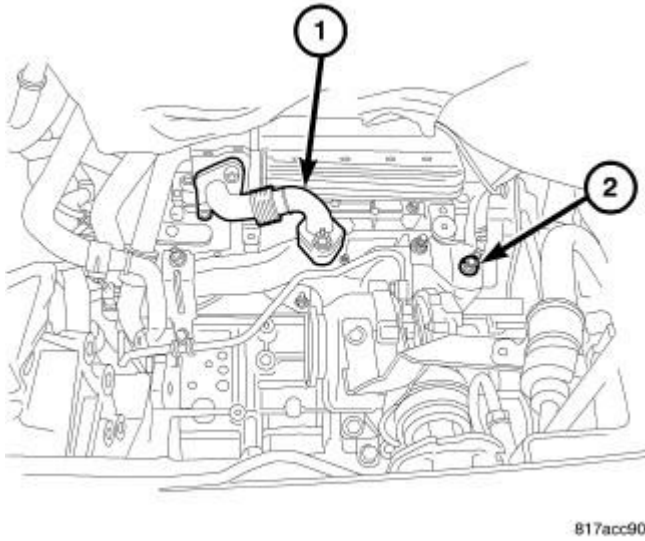
#### INSTALLATION



**Fig. 214: Power Steering Line Support**  
Courtesy of CHRYSLER LLC

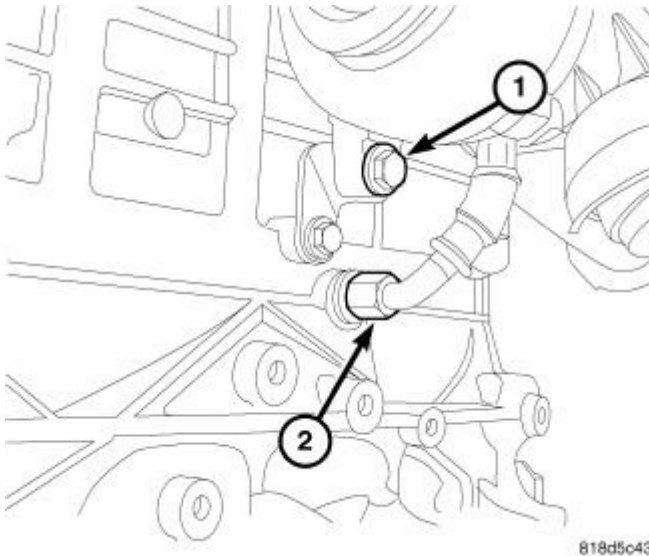
1. Install new exhaust manifold gasket.

2. Position exhaust manifold/turbo assembly (3) in place.
3. Install exhaust manifold bolts and tighten.



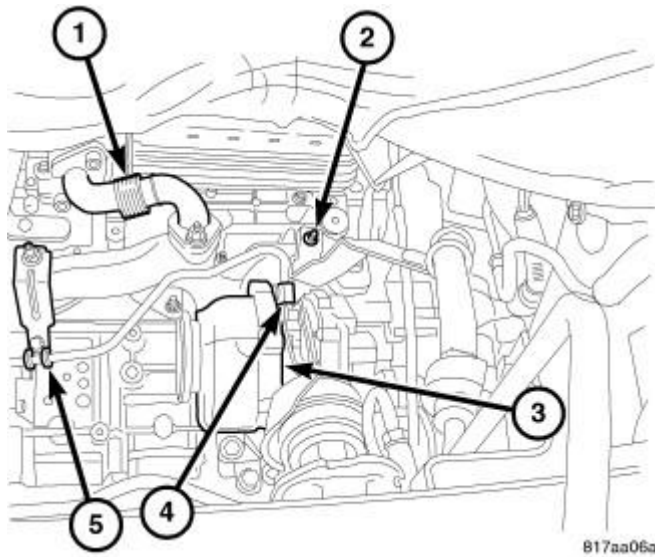
**Fig. 215: EGR Tube**  
Courtesy of CHRYSLER LLC

4. Install EGR tube (1) to exhaust manifold.



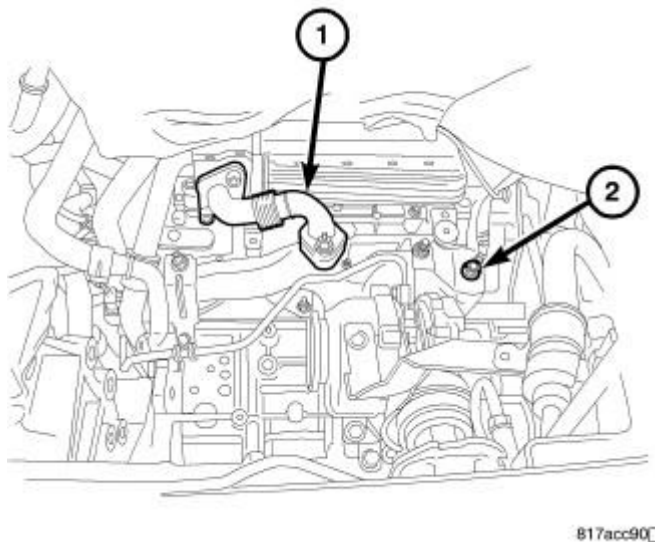
**Fig. 216: Turbo Support Bracket**  
Courtesy of CHRYSLER LLC

5. Install lower manifold support bracket (1)
6. Install turbo oil return line (2).
7. Install turbo oil feed line at oil filter housing.



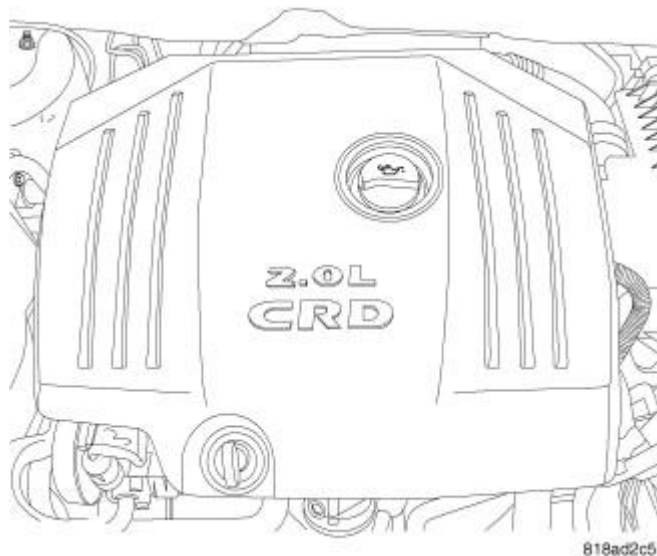
**Fig. 217: Power Steering Line Support**  
Courtesy of CHRYSLER LLC

8. Install oil feed line (4) at turbo.
9. Install turbo oil feed line support bracket (5).
10. Install turbo lower vacuum lines.
11. Install lower turbo outlet tube.
12. Install upper turbo inlet tube.
13. Connect exhaust pipe to catalytic converter.



**Fig. 218: EGR Tube**  
Courtesy of CHRYSLER LLC

14. Install exhaust manifold lower heat shield (2).
15. Install exhaust manifold upper heat and install upper heat shield bolts.



**Fig. 219: Engine Cover**  
Courtesy of CHRYSLER LLC

16. Install engine cover by pushing downward.
17. Connect negative battery cable.

## MANIFOLD, INTAKE

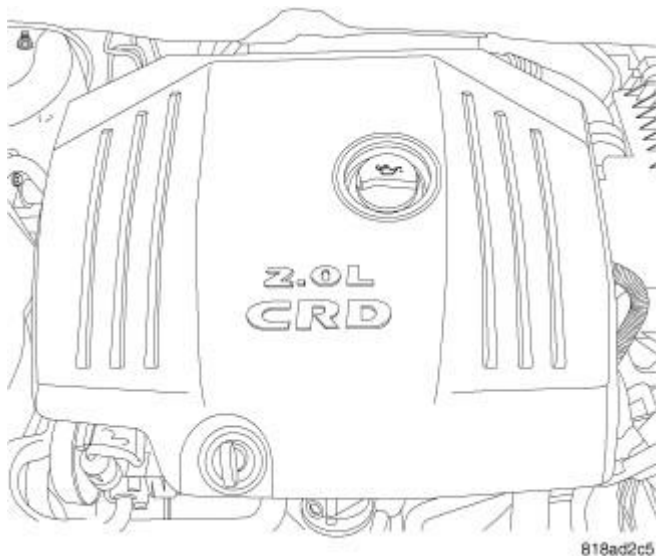
### Description

#### DESCRIPTION

The intake manifold is one-piece design and is made from aluminum.

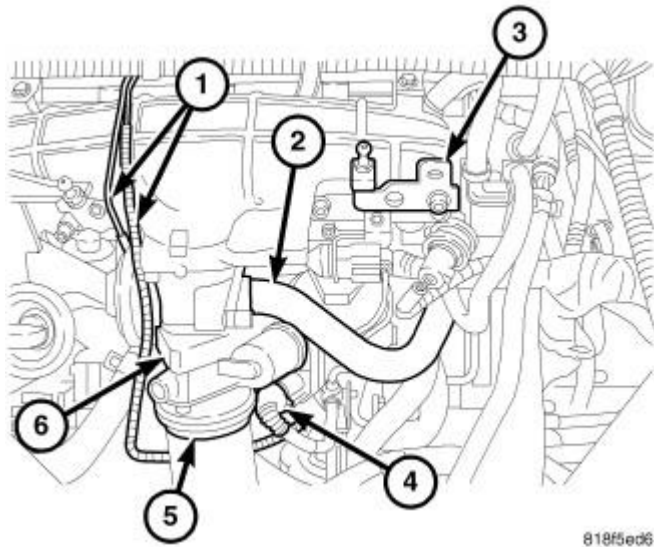
### Removal

#### REMOVAL



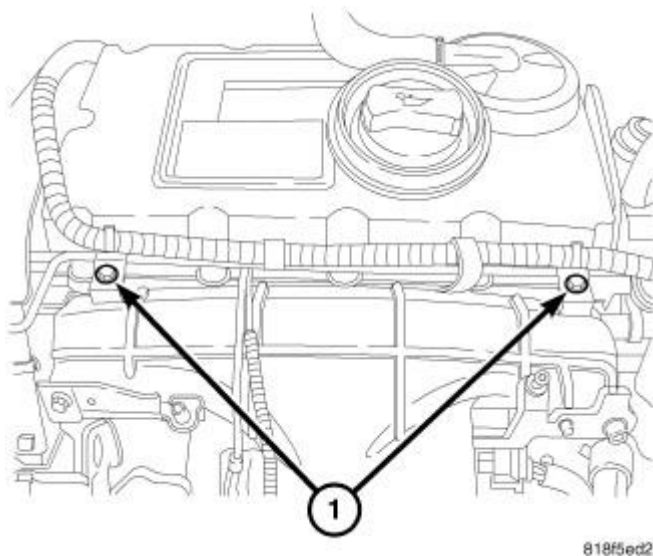
**Fig. 220: Engine Cover - Removal**  
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove engine cover by pulling upward.
3. Partially drain cooling system. Refer to Cooling - Standard Procedure .



**Fig. 221: EGR Valve**  
Courtesy of CHRYSLER LLC

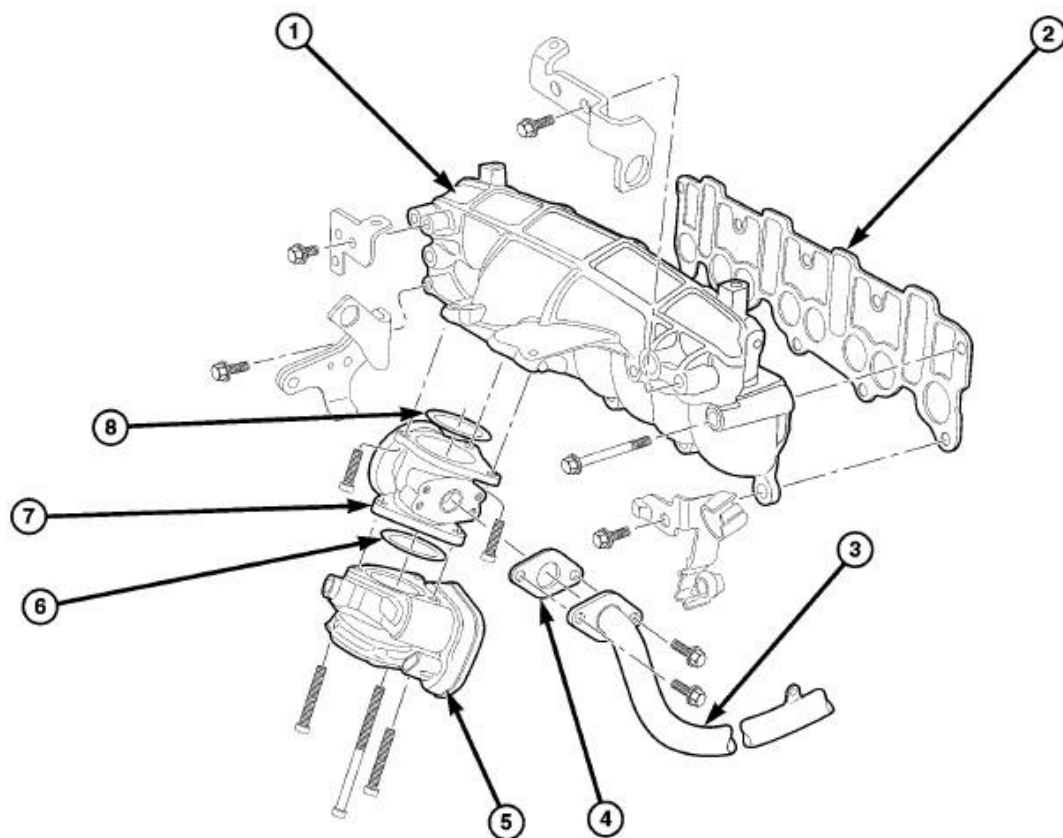
4. Remove vacuum harness (1).



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**Fig. 222: Coolant Tube**  
Courtesy of CHRYSLER LLC

5. Remove coolant bypass tube retaining bolts (1) and reposition tube.
6. Remove fuel hose from lift bracket.
7. Remove upper radiator hose from cylinder head and reposition.



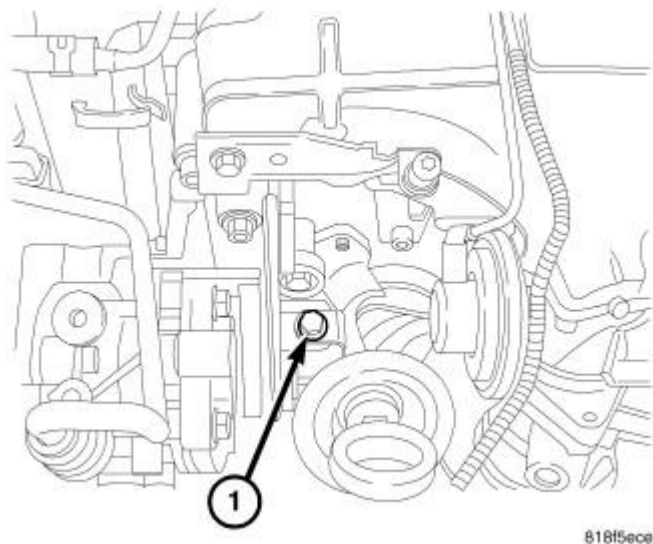
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**Fig. 223: Intake Manifold**

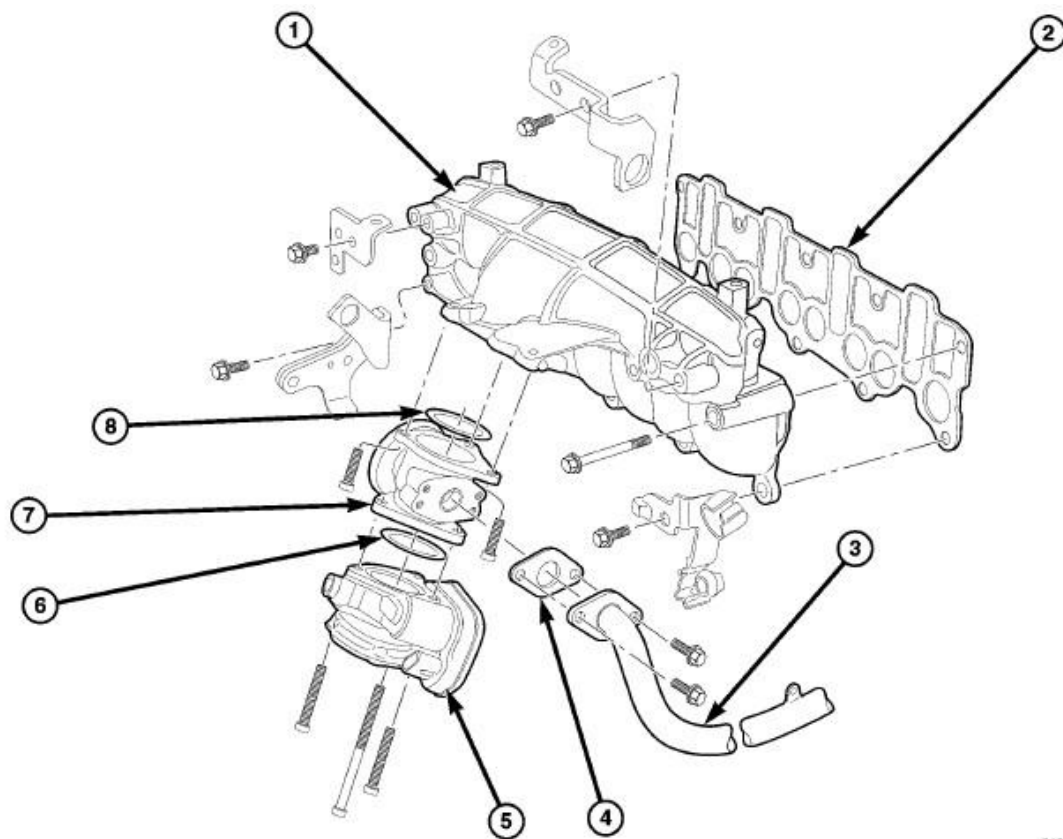
Courtesy of CHRYSLER LLC

8. Release air inlet pipe from throttle body.
9. Remove EGR pipe (3).

**Fig. 224: dipstick support retaining bolt**

Courtesy of CHRYSLER LLC

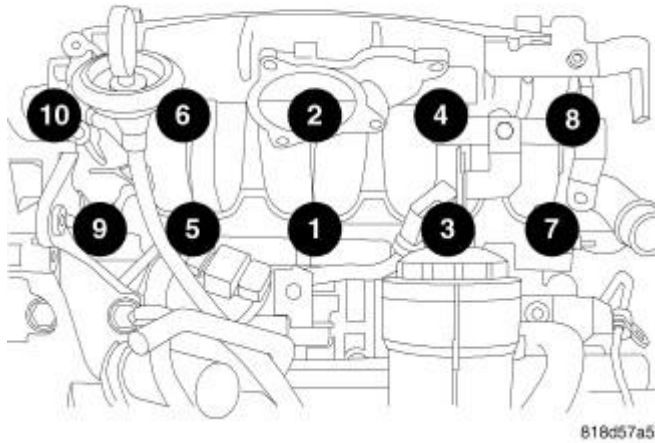
10. Remove dip stick support bracket retaining bolt (1).
11. Remove left and right engine cover brackets.



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**Fig. 225: Intake Manifold****Courtesy of CHRYSLER LLC**

12. Disconnect throttle body connectors.
13. Remove throttle body assembly (5).
14. Remove EGR valve (7).
15. Remove electrical connector from intake bracket.



**Fig. 226: Torque Sequence**  
Courtesy of CHRYSLER LLC

16. Remove intake manifold bolts.
17. Remove intake manifold.

### **Cleaning**

#### **CLEANING**

1. Discard gasket(s).
2. Clean all sealing surfaces.

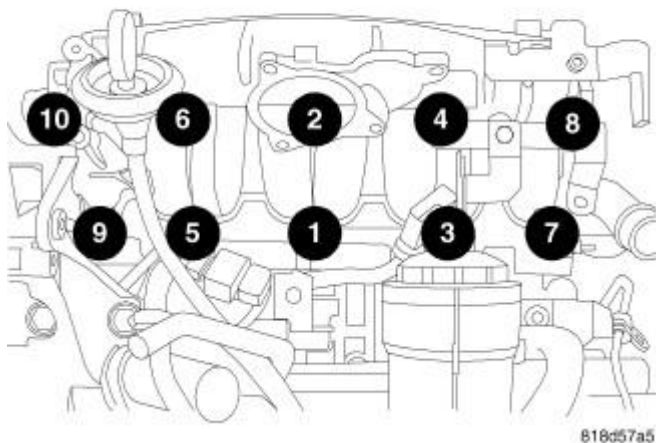
### **Inspection**

#### **INSPECTION**

1. Inspect manifold for cracks or distortion. Replace manifold if necessary.
2. Inspect manifold for gasket surface damage or warpage. Replace manifold if necessary.

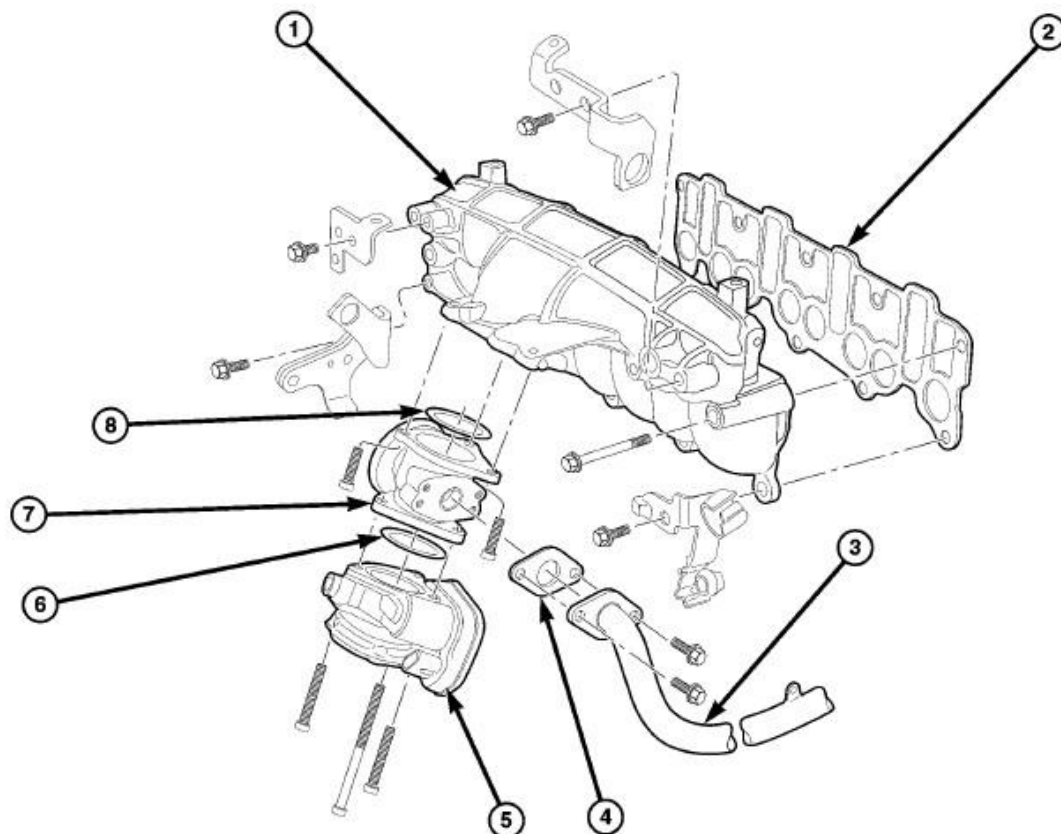
### **Installation**

#### **INSTALLATION**



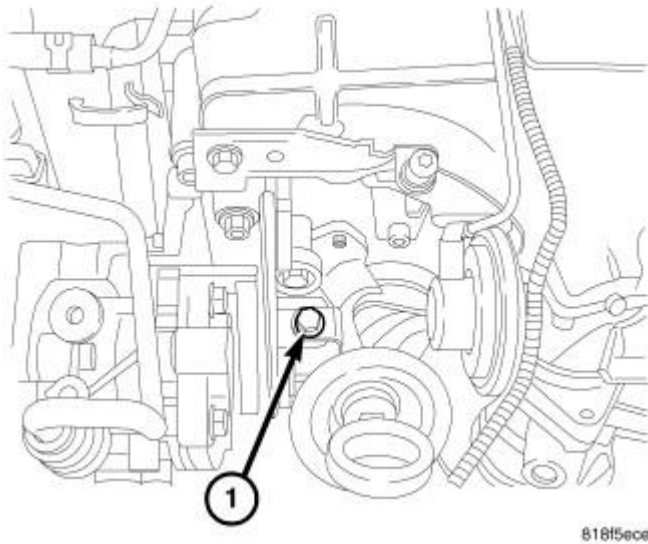
**Fig. 227: Torque Sequence**  
Courtesy of CHRYSLER LLC

1. Clean gaskets/seals mating surfaces.
2. Install new gasket.
3. Place intake on cylinder head and install retaining bolts. Tighten bolts to 20 N.m (14.7 lbs. ft.) as shown in illustration.



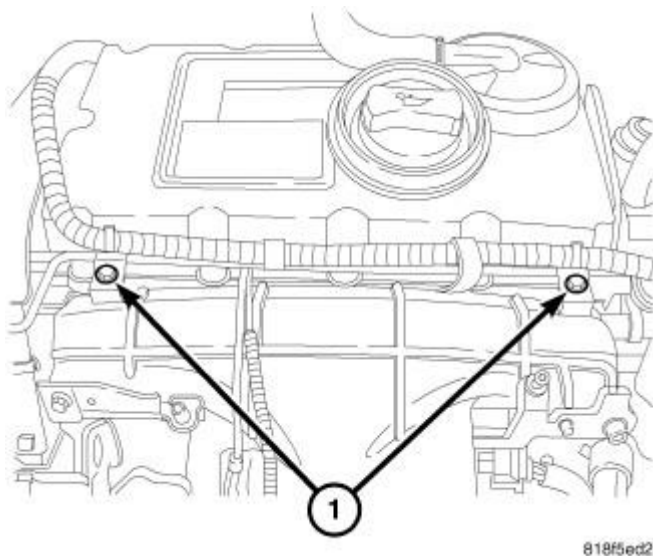
**Fig. 228: Throttle Plate Assembly**  
Courtesy of CHRYSLER LLC

4. Install electrical connector to intake bracket.
5. Install new EGR gasket (8) and EGR valve (7).
6. Install throttle plate assembly (5).
7. Connect throttle body electrical connector.
8. Install right and left engine cover brackets.
9. Install EGR pipe.
10. Install EGR pipe support bracket.



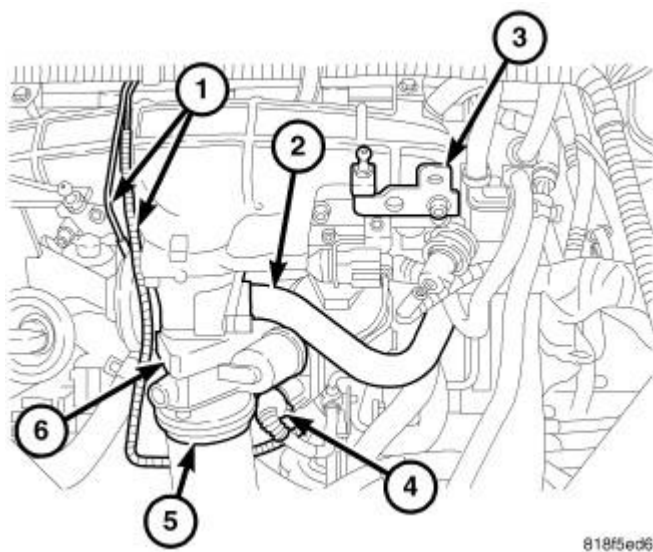
**Fig. 229: Dipstick Support Retaining Bolt**  
Courtesy of CHRYSLER LLC

11. Install dipstick support retaining bolt (1).
12. Connect air inlet pipe to throttle body.
13. Install upper radiator hose to cylinder head.
14. Install fuel hose retainer to engine lift bracket.



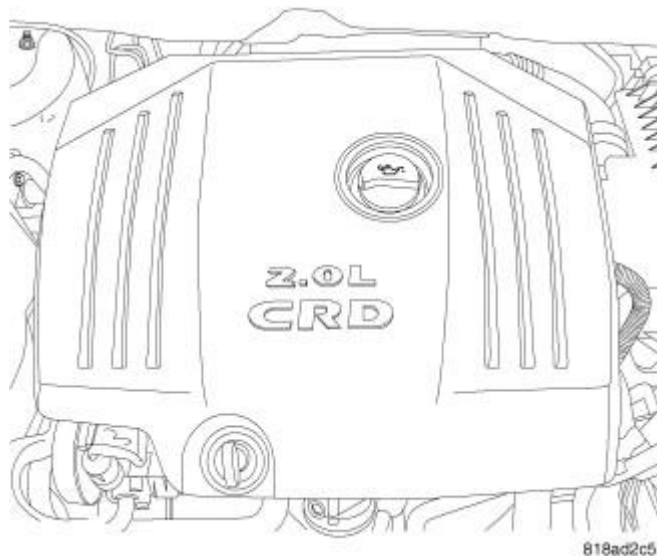
**Fig. 230: Coolant Tube**  
Courtesy of CHRYSLER LLC

15. Position coolant tube in place and install fasteners (1).



**Fig. 231: EGR Valve**  
Courtesy of CHRYSLER LLC

16. Install vacuum harness (1).
17. Fill cooling system.
18. Change oil and filter.
19. Connect negative battery cable.
20. Start engine and check for leaks.



**Fig. 232: Engine Cover**  
Courtesy of CHRYSLER LLC

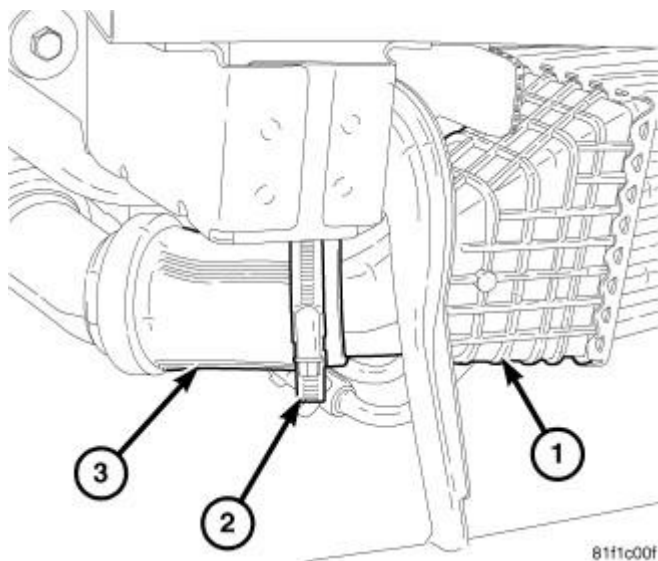
21. Install engine cover. Refer to **ENGINE COVER**.

## **TURBOCHARGER SYSTEM**

### **COOLER AND HOSES, CHARGE AIR**

#### **Removal**

#### **REMOVAL**



**Fig. 233: Charge Air Cooler LH Clamp**  
Courtesy of CHRYSLER LLC

1 - CHARGE AIR COOLER

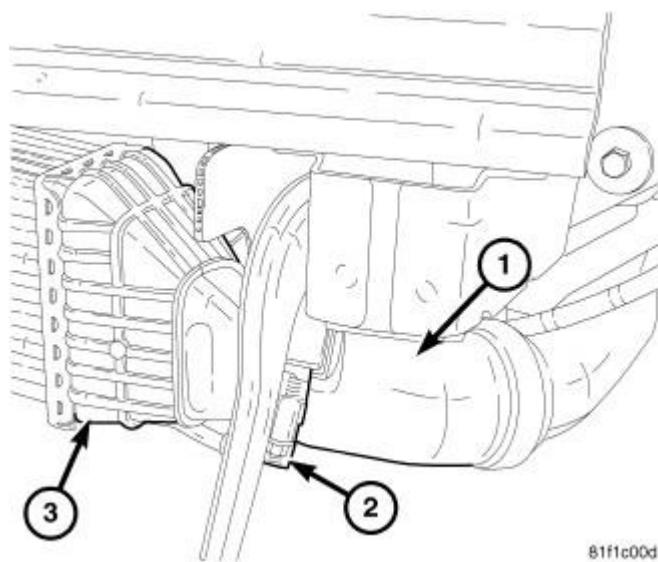
2 - LH CLAMP

3 - TUBING

**CAUTION:** Do not use any tools to remove the rubber isolators-remove by hand only. Soapy water or silicone based lubricant spray may be used to assist removal/installation of isolators. DO NOT use a petroleum based lubricant on the isolators, as damage to the rubber material can occur.

**NOTE:** Band clamps are spot welded to exhaust system. If a band clamp must be replaced, the spot weld must be ground off the exhaust pipe.

1. Remove front fascia.
2. Raise and support vehicle.
3. Remove RH tubing clamp and tubing at charge air cooler



**Fig. 234: Charge Air Cooler RH Clamp**  
Courtesy of CHRYSLER LLC

1 - TUBING

2 - CLAMP

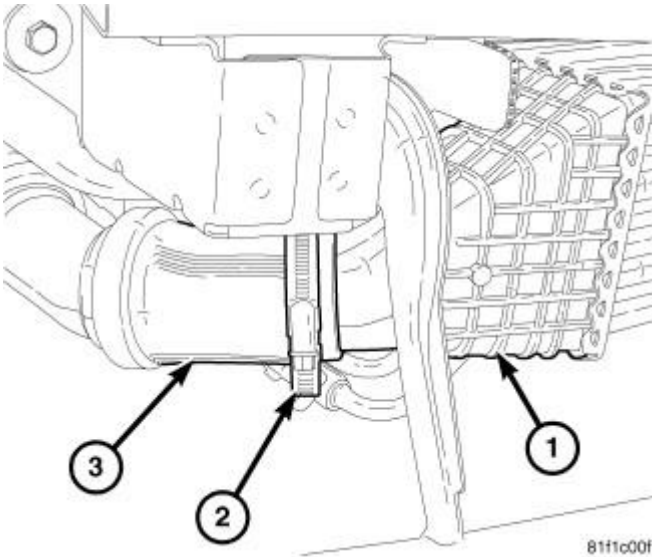
3 - CHARGE AIR COOLER

4. Remove LH tubing clamp and tubing at charge air cooler.
5. Remove charge air cooler mounting bolts and charge air cooler.

#### Installation

#### INSTALLATION

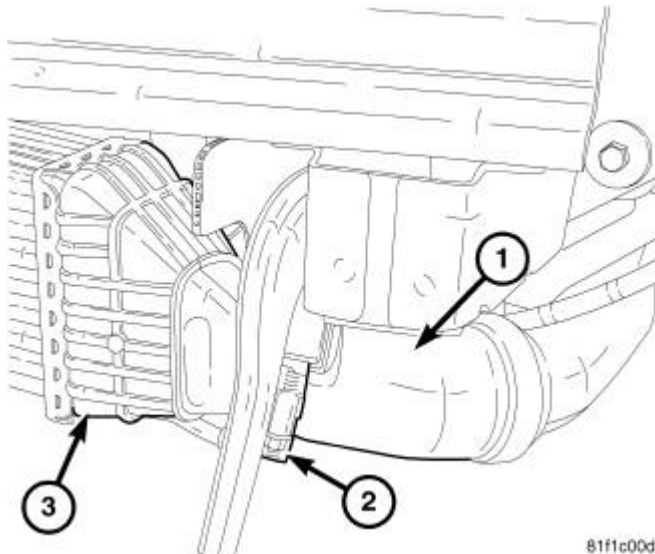




**Fig. 235: Charge Air Cooler LH Clamp**  
Courtesy of CHRYSLER LLC

- |                       |
|-----------------------|
| 1 - CHARGE AIR COOLER |
| 2 - LH CLAMP          |
| 3 - TUBING            |

1. Position charge air cooler and install mounting bolts. Tighten bolts to 35 N.m (25 ft. lbs.).
2. Install LH tubing and clamp at charge air cooler. Tighten clamp to 10 N.m (89 in. lbs.).



**Fig. 236: Charge Air Cooler RH Clamp**  
Courtesy of CHRYSLER LLC

- |            |
|------------|
| 1 - TUBING |
| 2 - CLAMP  |

**3 - CHARGE AIR COOLER**

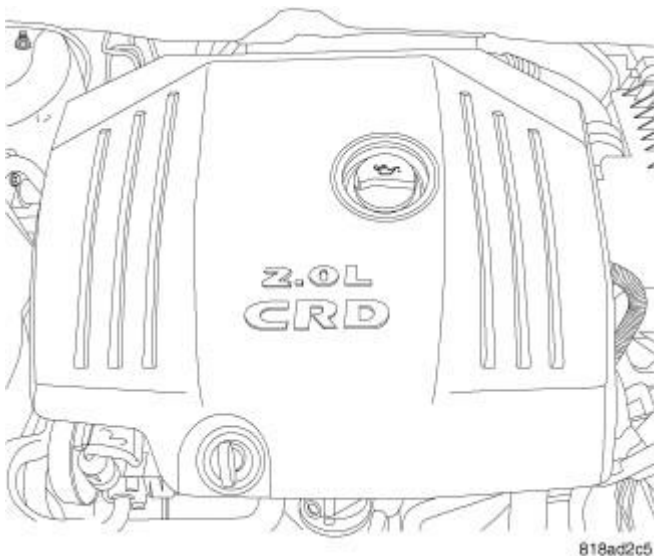
3. Install RH tubing and clamp at charge air cooler. Tighten clamp to 10 N.m (89 in. lbs.).
4. Install front fascia.

**TURBOCHARGER****Removal****DIESEL ENGINE**

1. For turbocharger removal, see **Removal**.

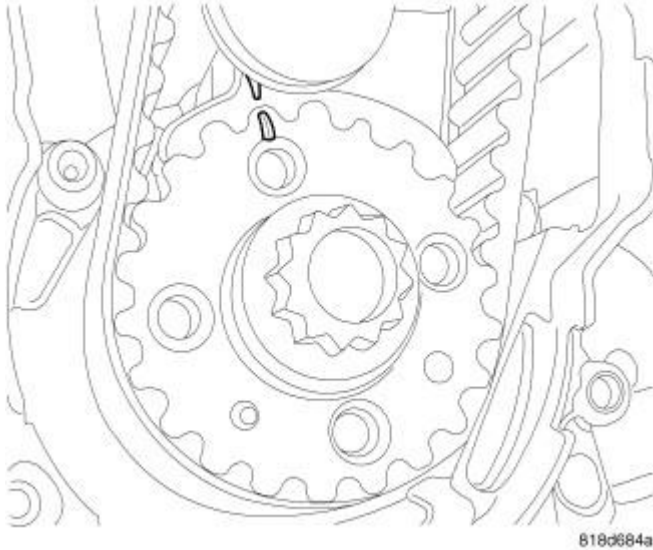
**Installation****DIESEL ENGINE**

1. For turbocharger installation, see **Installation**.

**VALVE TIMING****BELT, TIMING****Removal****REMOVAL****Fig. 237: Engine Cover****Courtesy of CHRYSLER LLC**

1. Disconnect negative battery cable.

2. Remove engine cover. Refer to **ENGINE COVER**.
3. Remove cylinder head cover.



**Fig. 238: Crankshaft Timing Marks**  
Courtesy of CHRYSLER LLC

**NOTE:** When rotating engine to TDC, verify that the cylinder #1 is on the compression stroke. The camshaft lobes for cylinder #1 should be pointing upward.

4. Rotate engine to TDC and insert crankshaft lock 10122.
5. Insert camshaft locking pins 9882.
6. Loosen tensioner retaining nut.
7. rotate tensioner counter clockwise to release tension.
8. Remove timing belt.

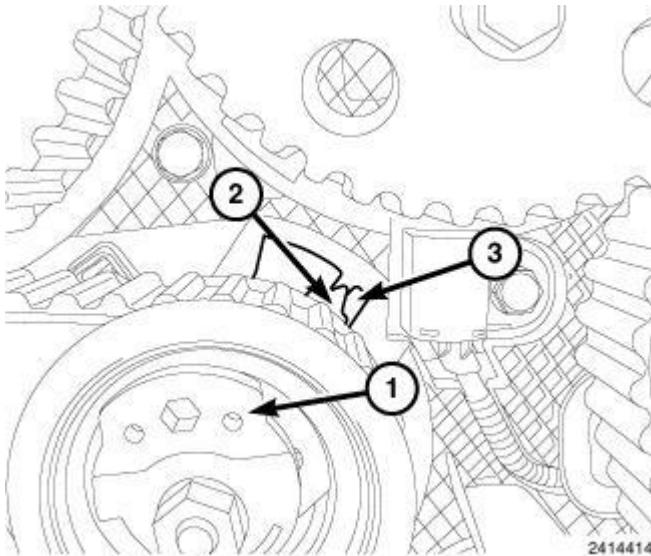
#### Installation

#### INSTALLATION

**CAUTION: IT IS ESSENTIAL** that the installation procedure is followed exactly. Failure to do so will result in severe engine damage.

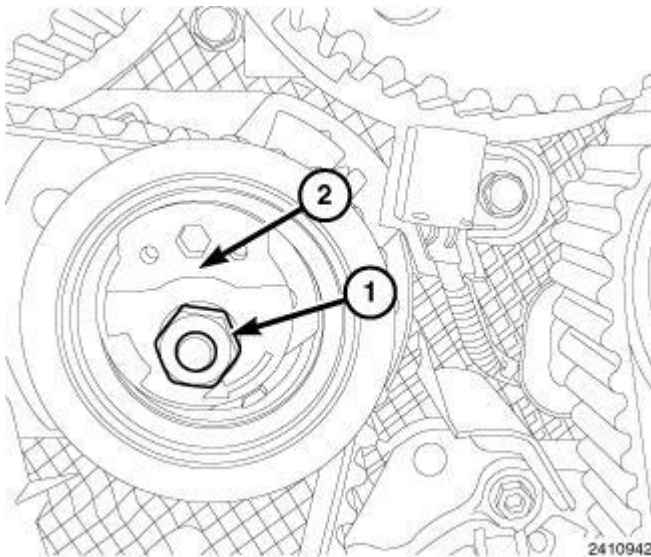
1. Install the timing belt on the components in the following order:
  - Crankshaft sprocket
  - Timing belt tensioner
  - Camshaft sprockets
  - Idler pulley

- Water pump pulley



**Fig. 239: Alignment Slot**  
Courtesy of CHRYSLER LLC

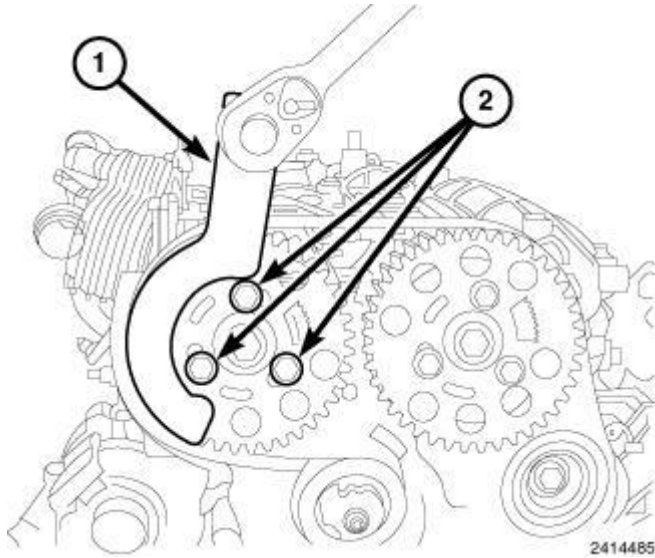
- Using an Allen wrench, rotate tensioner (1) clockwise until the pointer (2) is centered in the alignment slot (3).



**Fig. 240: Tighten Tensioner Nut**  
Courtesy of CHRYSLER LLC

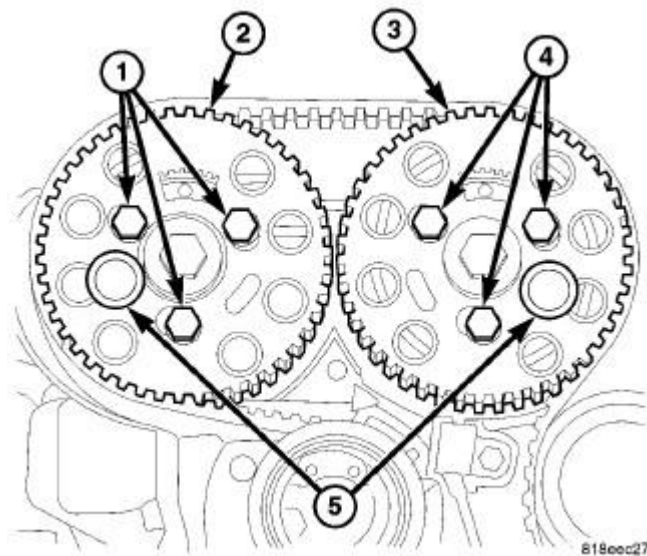
**NOTE:** When tightening the tensioner nut, the pointer will turn a maximum of 5 mm to the right outside the alignment slot. Do not readjust because the pointer will re-center itself after it has run a while.

- Tighten tensioner nut (1) to 20 N.m plus 45° (177 in. lbs. plus 45°).



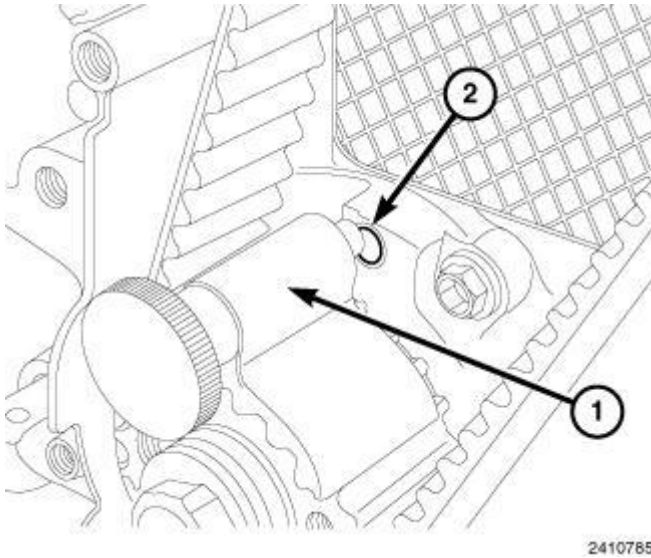
**Fig. 241: Exhaust Camshaft Sprocket Bolts**  
Courtesy of CHRYSLER LLC

4. Using sprocket/hub holder 9880 (1), tighten the intake and exhaust camshaft sprocket bolts (2) to 25 N.m (18 ft. lbs.).



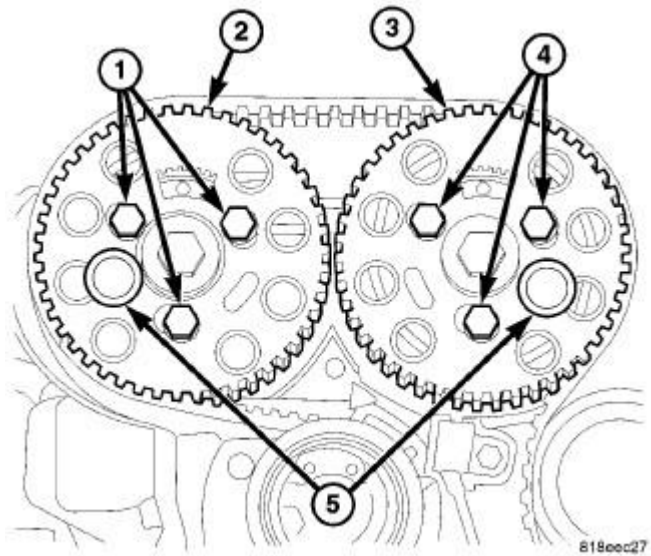
**Fig. 242: Camshaft Locking Pins**  
Courtesy of CHRYSLER LLC

5. Remove camshaft locking pins 9882 (5).



**Fig. 243: Crankshaft Lock 9883**  
Courtesy of CHRYSLER LLC

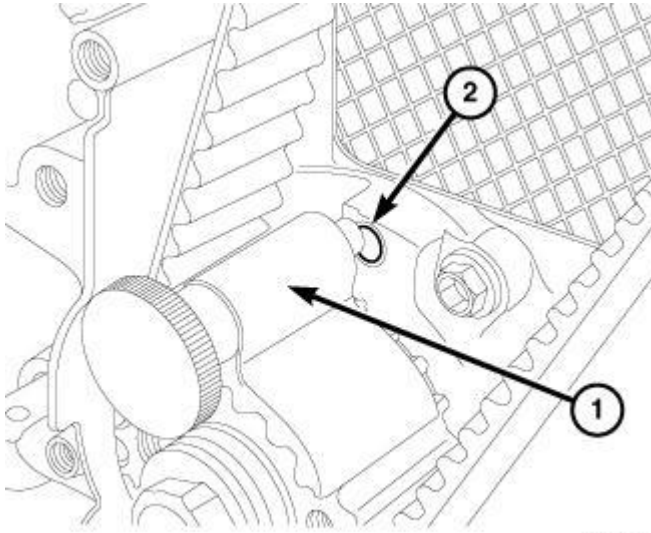
6. Remove crankshaft lock 9883 or 10122 (1).
7. Rotate the engine two revolutions back to Top Dead Center (TDC) cylinder No. 1 and recheck the alignment of the tensioner pointer.



**Fig. 244: Camshaft Locking Pins**  
Courtesy of CHRYSLER LLC

8. Rotate engine until camshaft locking pin 9882 (5) can be installed in camshaft sprocket (2).
9. Check to see if the camshaft locking pin 9882 (5) can be installed in camshaft sprocket (3). If it can not be locked, loosen the bolts (1) on camshaft sprocket (2) and turn crankshaft until camshaft sprocket (3) can be locked.

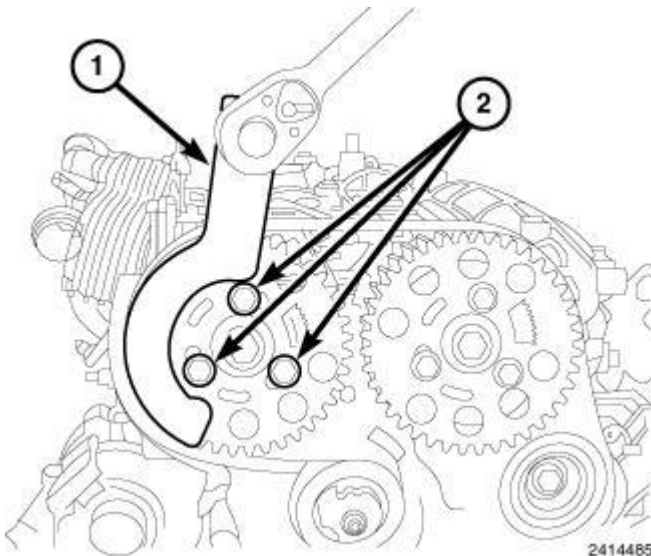
10. Loosen the bolts (4) on camshaft sprocket (3).



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**Fig. 245: Crankshaft Lock 9883**  
Courtesy of CHRYSLER LLC

11. Now rotate the crankshaft counter direction of engine rotation until the crankshaft lock (1) 9883 or 10122 is positioned just before the hole (2).
12. Rotate crankshaft in engine direction of rotation until crankshaft lock (1) is engaged unto the hole (2).

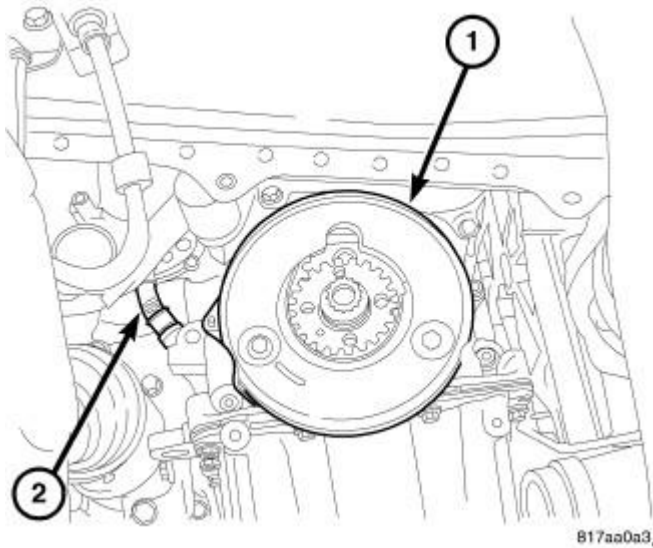


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**Fig. 246: Exhaust Camshaft Sprocket Bolts**  
Courtesy of CHRYSLER LLC

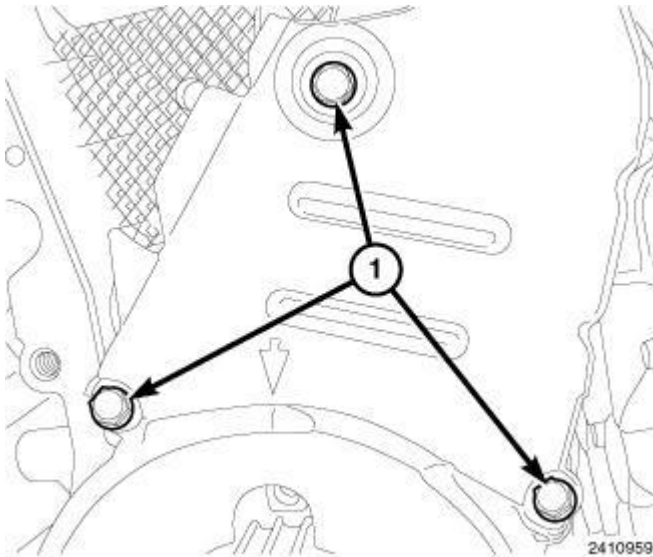
13. Using sprocket/hub holder 9880 (1), tighten the intake and exhaust camshaft sprocket bolts (2) to 25 N.m (18 ft. lbs.).
14. Remove the camshaft lock pins 9882 and the crankshaft lock 9883 or 10122.

15. Rotate the engine two revolutions back to (TDC) cylinder No. 1 and recheck alignment.



**Fig. 247: Lower Timing Belt Cover**  
Courtesy of CHRYSLER LLC

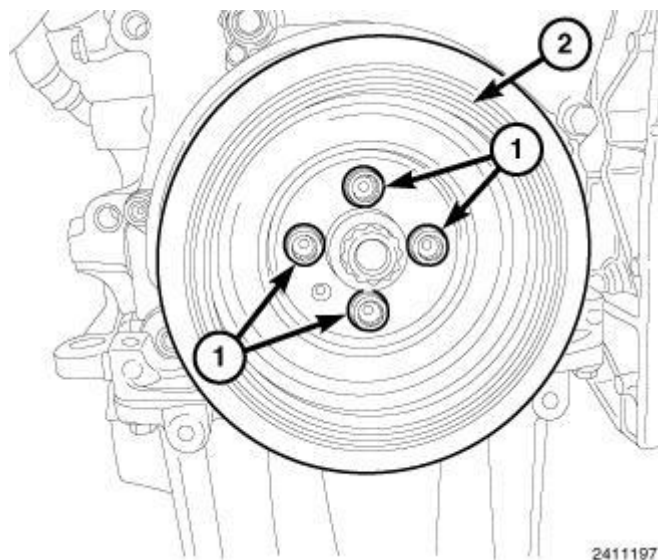
16. Install lower timing belt cover (1). Tighten bolts to 10 N.m (89 in. lbs.).



**Fig. 248: Middle Timing Belt Cover**  
Courtesy of CHRYSLER LLC

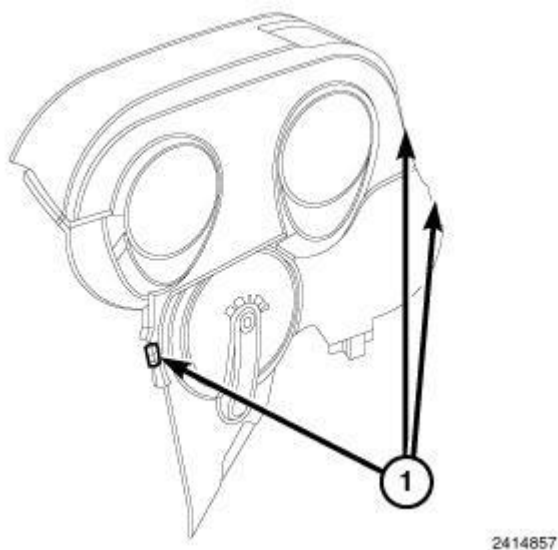
17. Install the middle timing belt cover. Tighten bolts to 10 N.m (89 in. lbs.).





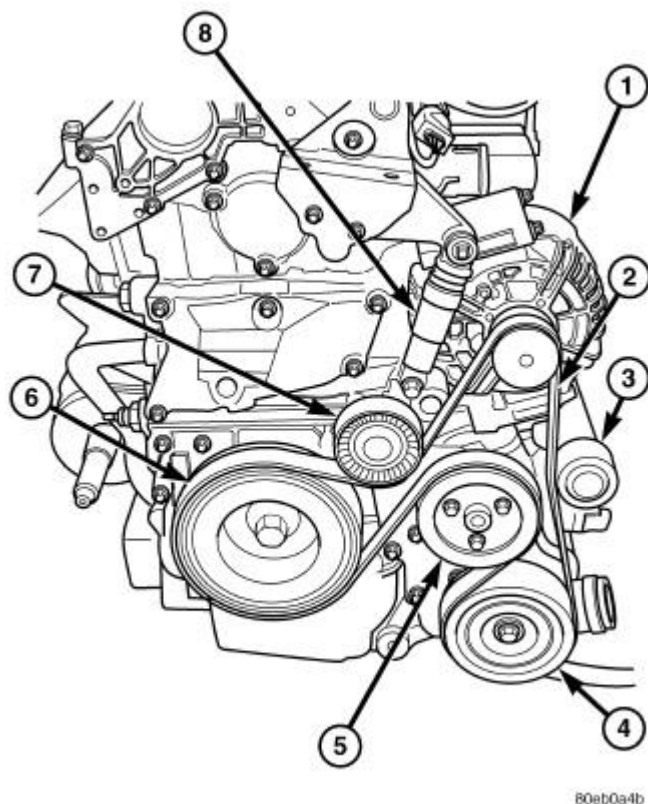
**Fig. 249: Vibration Damper Dust Cover**  
Courtesy of CHRYSLER LLC

18. Install the vibration damper. Tighten bolts to 10 N.m plus 90° (89 in. lbs. plus 90°).
19. If equipped, install the vibration damper dust cover.



**Fig. 250: Upper Timing Belt Cover**  
Courtesy of CHRYSLER LLC

20. Install upper timing belt cover.

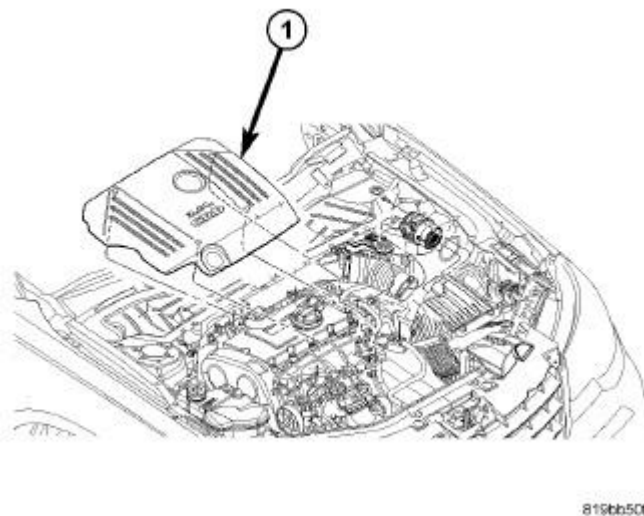


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**Fig. 251: Accessory Belt Routing**  
Courtesy of CHRYSLER LLC

- 1 - GENERATOR
- 2 - ACCESSORY DRIVE BELT
- 3 - IDLER PULLEY
- 4 - A/C COMPRESSOR
- 5 - POWER STEERING PUMP
- 6 - CRANKSHAFT PULLEY/VIBRATION DAMPER
- 7 - BELT TENSIONER PULLEY
- 8 - BELT TENSIONER

21. Install accessory drive belt (2). Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation**.



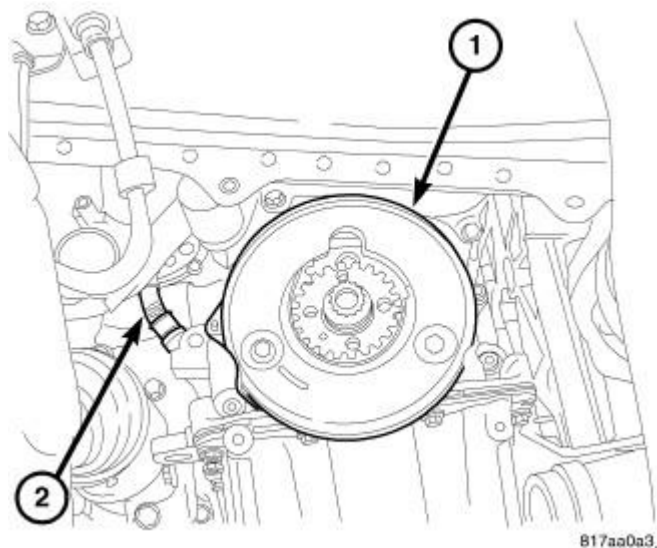
**Fig. 252: Engine Cover**  
Courtesy of CHRYSLER LLC

22. Install engine cover. Refer to **ENGINE COVER**.
23. Connect negative battery cable.

## COVER(S), ENGINE TIMING, LOWER

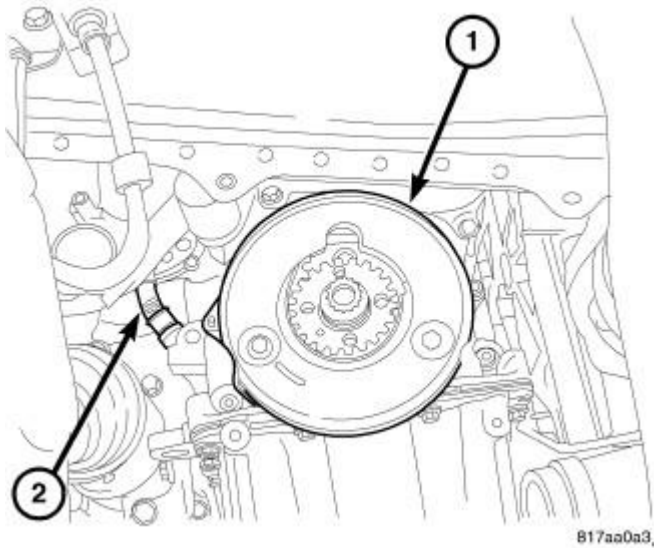
### Removal

### REMOVAL



**Fig. 253: Lower Timing Belt Cover**  
Courtesy of CHRYSLER LLC

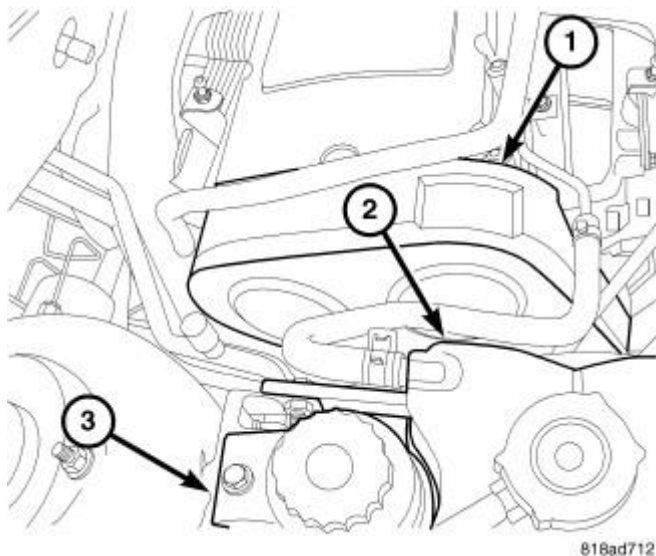
1. Remove right splash shield.
2. Remove accessory drive belt.
3. Remove crankshaft damper.
4. Remove lower timing belt cover (1).

**Installation****INSTALLATION**

**Fig. 254: Lower Timing Belt Cover**  
Courtesy of CHRYSLER LLC

1. Position lower timing belt cover.
2. Install lower timing belt cover retaining bolts and tighten.
3. Install crankshaft balancer and tighten to 10 N.m + 90° (89 lbs. in. +90°).
4. Install accessory drive belt.
5. Install splash shield.

**COVER(S), ENGINE TIMING, UPPER****Removal****REMOVAL**

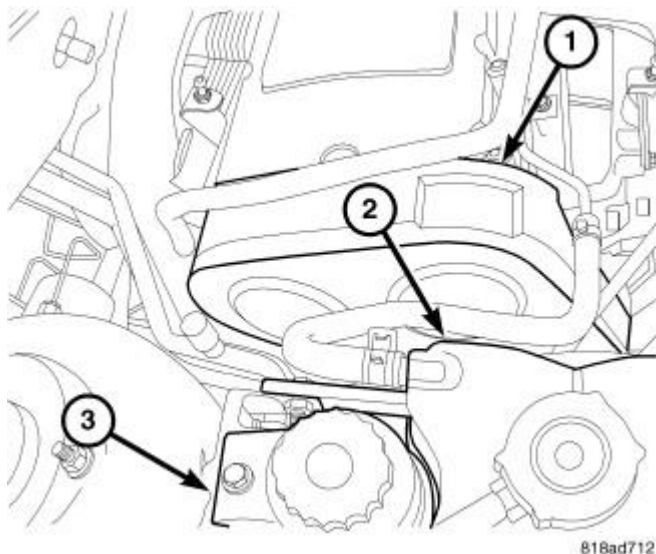


**Fig. 255: Timing Belt Cover**  
Courtesy of CHRYSLER LLC

1. Remove upper timing belt cover (1) by releasing clasps and pull upward.

#### Installation

#### INSTALLATION



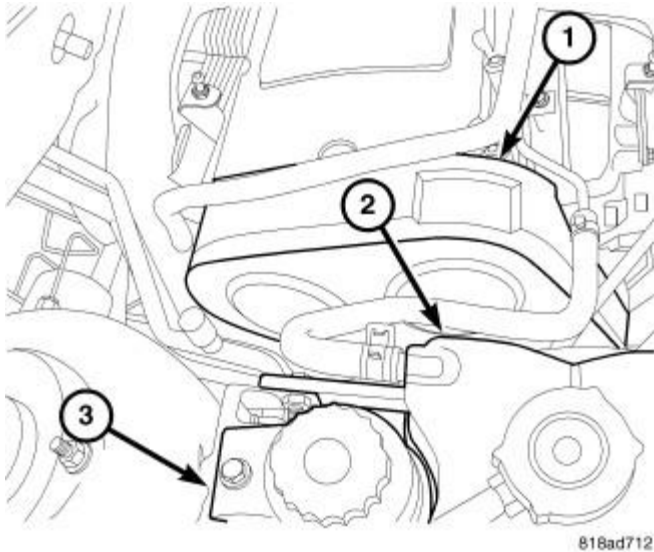
**Fig. 256: Timing Belt Cover**  
Courtesy of CHRYSLER LLC

1. Position upper timing belt cover (1) in place and snap clasps in place.

#### TENSIONER, ENGINE TIMING

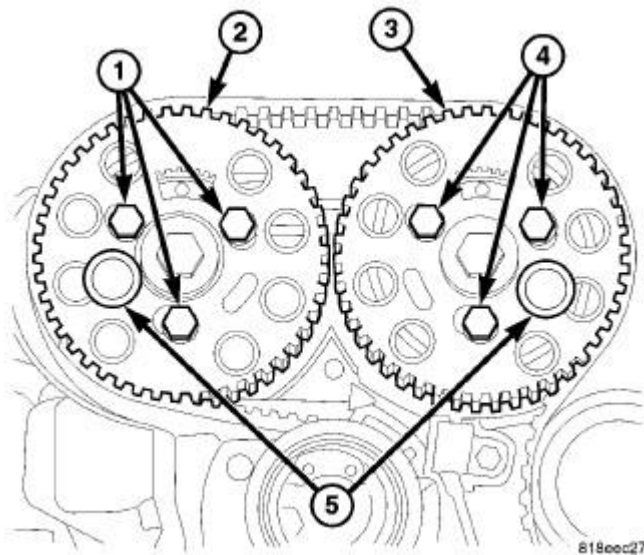
#### Removal

## REMOVAL



**Fig. 257: Timing Belt Cover**  
Courtesy of CHRYSLER LLC

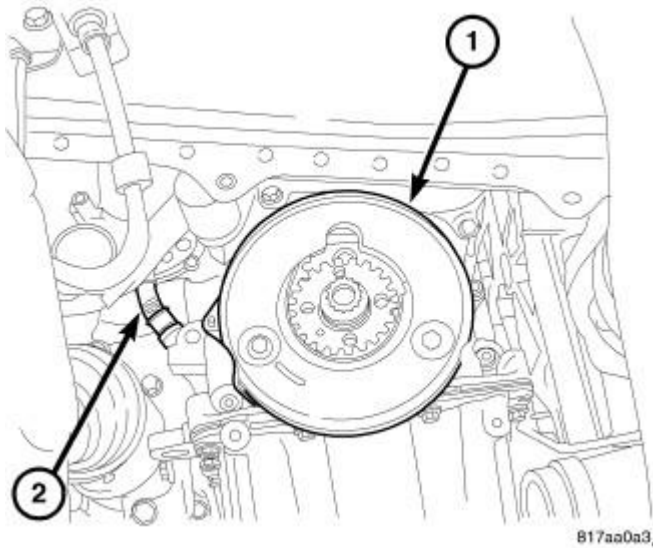
1. Disconnect negative battery cable.
2. Position piston of number #1 cylinder to ignition TDC.
3. Remove upper timing belt cover (1).



**Fig. 258: Cam Timing**  
Courtesy of CHRYSLER LLC

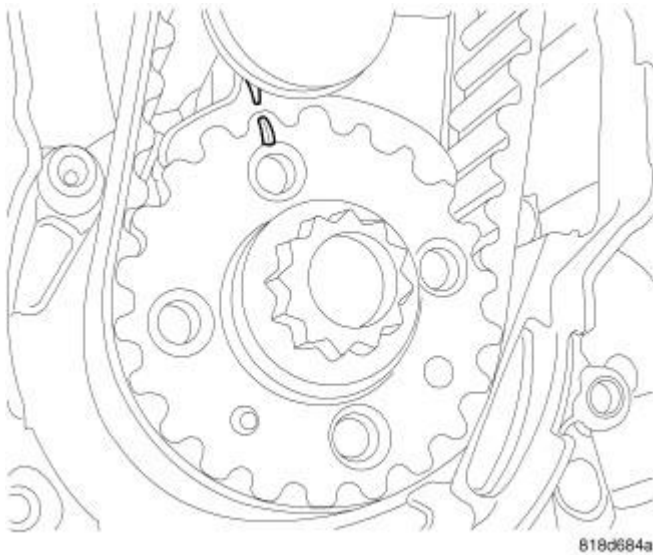
4. Install camshaft lock pins 9882 (5).
5. Install engine support fixture.

6. Remove right engine mount.
7. Remove right engine mount bracket.
8. Raise vehicle on hoist.



**Fig. 259: Lower Timing Belt Cover**  
Courtesy of CHRYSLER LLC

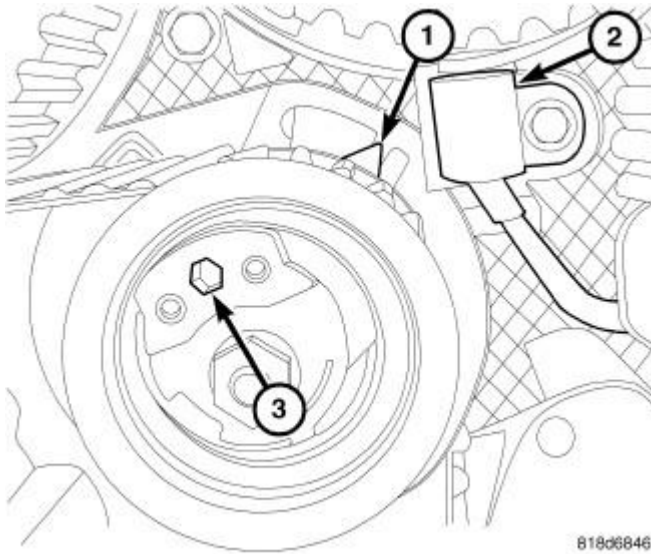
9. Remove balancer.
10. Remove splash shield.
11. Remove lower timing belt cover (1).



**Fig. 260: Crankshaft Timing Marks**  
Courtesy of CHRYSLER LLC

12. Install crankshaft lock 9883.

13. Lower vehicle.



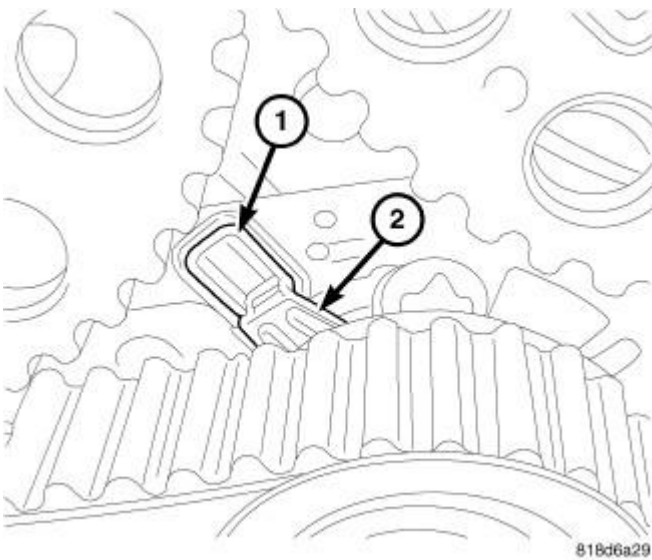
**Fig. 261: Tensioner Adjustment**  
Courtesy of CHRYSLER LLC

14. Remove tensioner retaining nut.

15. Remove timing belt tensioner.

## Installation

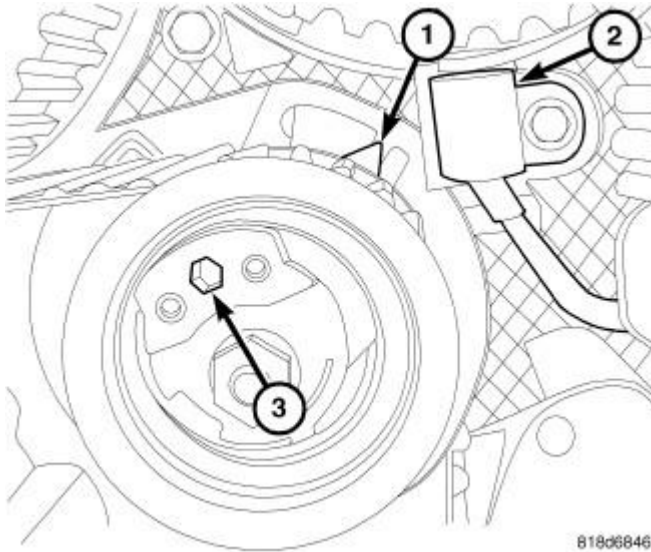
### INSTALLATION



**Fig. 262: Timing Belt Tensioner**  
Courtesy of CHRYSLER LLC

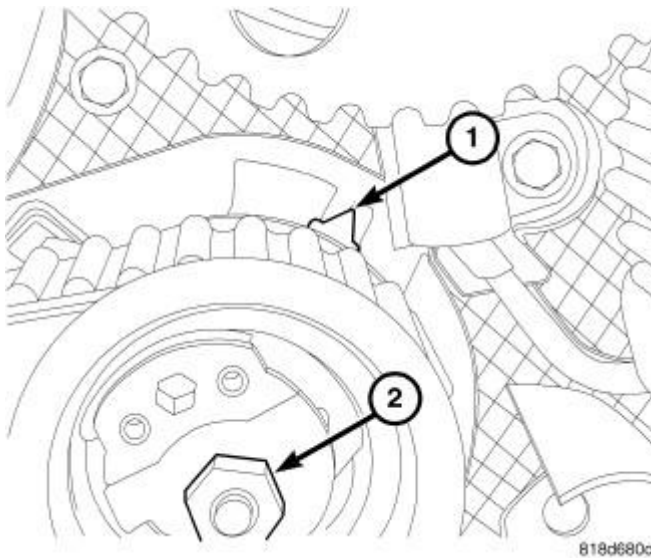
1. Position timing belt tensioner so finger (2) is in slot (1) and hand tighten nut.





**Fig. 263: Tensioner Adjustment**  
Courtesy of CHRYSLER LLC

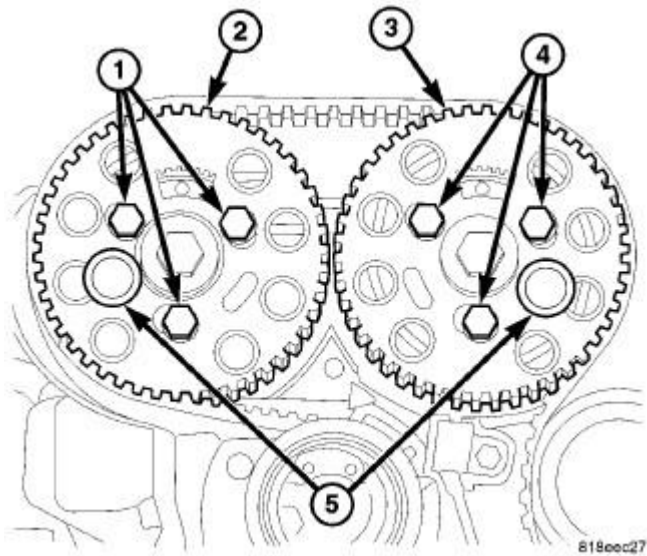
2. Insert Allen wrench into tensioner (3) and rotate tensioner until indicator (1) is in the middle of the slot.



**Fig. 264: Tightening Tensioner**  
Courtesy of CHRYSLER LLC

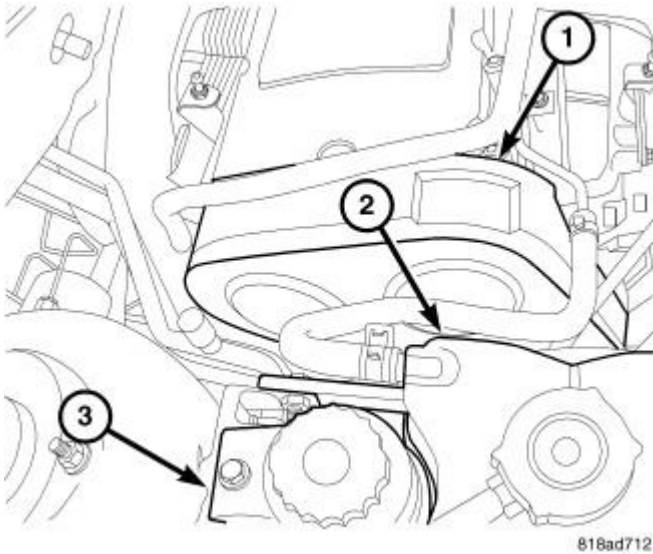
3. Tighten nut (2) to 20 N.m + 45° (177 in. lbs. +45°).

**NOTE:** Tensioner indicator (1) will move out of the slot when nut (2) is tighten. This is normal, do not reposition tensioner.



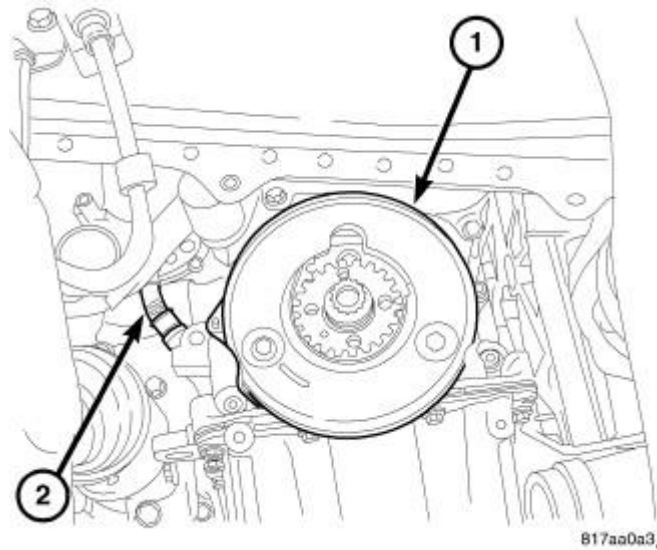
**Fig. 265: Camshaft Locking Pins 9882**  
Courtesy of CHRYSLER LLC

4. Remove camshaft locking pins 9882 (5).



**Fig. 266: Upper Timing Belt Cover**  
Courtesy of CHRYSLER LLC

5. Install upper timing belt cover (1).
6. Remove crankshaft lock 9883.



**Fig. 267: Lower Timing Belt Cover**  
Courtesy of CHRYSLER LLC

7. Install mid and lower (1) timing belt covers.
8. Install balancer and tighten bolt to 10 N.m + 90° (89 in. lbs.+ 90°).
9. Install engine mount bracket.
10. Install engine mount.
11. Remove engine support fixture.
12. Install accessory drive belt.
13. Install splash shield.
14. Lower vehicle.
15. Connect negative battery cable.
16. Install engine cover. Refer to **ENGINE COVER**.