2009 ENGINE

2.2L Diesel - Service Information - PT Cruiser

DESCRIPTION

DESCRIPTION

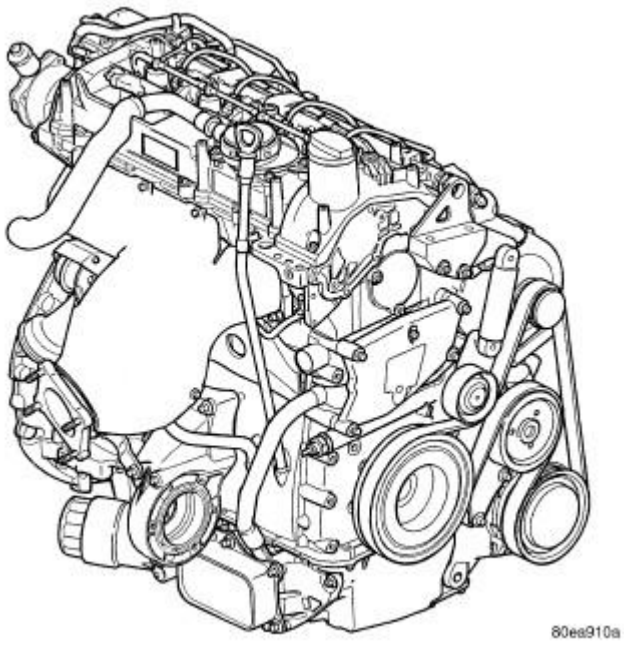

Fig. 1: 2.2L Diesel Engine
Courtesy of CHRYSLER LLC

This 2.2 Liter four-cylinder Common Rail Diesel Injection (CDI) engine is an in-line overhead valve diesel engine . See **Fig. 1**. This engine utilizes a cast iron cylinder block and an aluminum cylinder head. The engine is turbocharged and intercooled. This engine also has four valve per cylinder and dual overhead camshafts.

DESCRIPTION	SPECIFICATION
Engine	2.2L CDI
Engine Description	4 Cylinder In-Line Engine With 4-Valve Technology
Fuel Injection System	Common Rail Diesel Injection (CDI)
Fuel	Diesel
Rated Output	85/4200 kW at RPM
Torque	250/1400-2600 Nm at RPM
Maximum Speed	4600 RPM
Compression Ratio	18:0
Bore/Stroke	88.0/88.3 mm

Eff. Displacement	2148 cm3

STANDARD PROCEDURE

ENGINE GASKET SURFACE PREPARATION

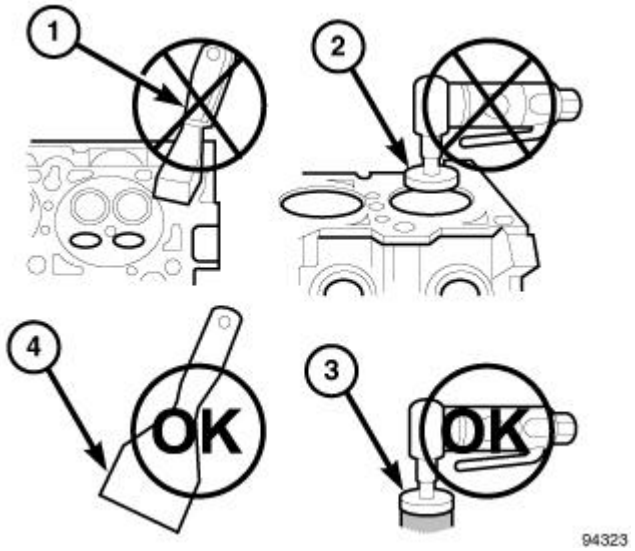

Fig. 2: PROPER TOOL USAGE FOR SURFACE PREPARATION
Courtesy of CHRYSLER LLC

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

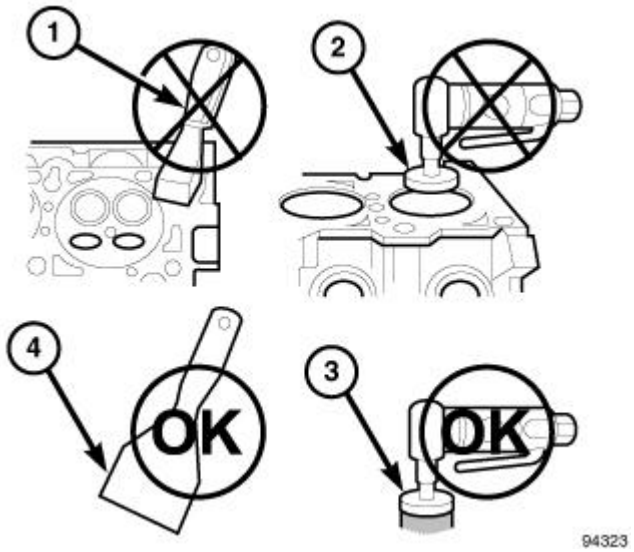

Fig. 3: PROPER TOOL USAGE FOR SURFACE PREPARATION
Courtesy of CHRYSLER LLC

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).

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

COMPRESSION TESTING ENGINE

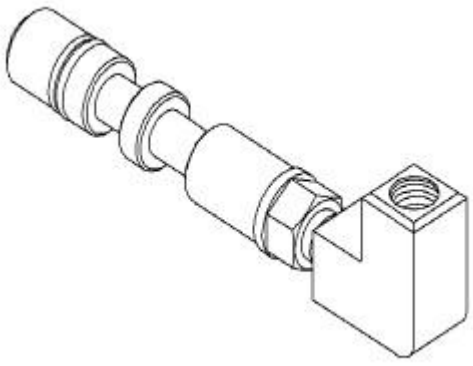

Fig. 4: #9543 ADAPTER
Courtesy of CHRYSLER LLC

1. Warm up engine to operating temperature (approximately 80°C, 176°F).

2. Shut off engine.
3. Remove engine cover. See **Engine - Removal**.
4. Remove injectors. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Removal** .
5. Crank engine several times with the starter to eliminate combustion residues in the cylinders.
6. Insert Adapter 9543 into injector hole of cylinder to be tested. Install injector retainer.
7. Test compression pressure by cranking engine with starter for at least 8 revolutions.
8. Carry out test procedure at the remaining cylinders in the same way.
9. Compare pressure readings obtained with the specified pressures. If the pressure reading is below the minimum compression pressure or if the permissible difference between the individual cylinders is exceeded, refer to **Engine - Standard Procedure**.

2.2L COMPRESSION SPECIFICATION

COMPRESSION SPECIFICATION	
Minimum Allowable	18 bar (261 psi.)
Maximum Allowable Difference Between Cylinders	3 bar (44 psi.)
Average Compression Ratio	24 - 30 bar (348 - 435 psi)

10. Remove Adapter 9543 from cylinder head.
11. Install injectors. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Installation** .
12. Install engine cover. See **Engine - Installation**.

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. See **Engine - Removal**.
4. Unscrew oil filler cap.
5. Remove glow plugs. Refer to **Electrical/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 wholes 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 prechamber, 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.

CHECKING OIL PRESSURE

1. Remove engine cover. See **Engine - Removal**.

2. Remove oil galley plug together with seal at timing case cover.
3. Screw oil pressure gauge adaptor fitting together with seal onto timing case cover.
4. Connect oil pressure gauge to adaptor fitting.
5. Check oil level, adjust with correct engine oil if necessary.
6. Insert temperature of remote thermometer into oil level indicator tube.

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

CAUTION: Ensure that fan and accessory drive belt DO NOT damage oil pressure gauge hose.

7. Start engine and bring to operating temperature 90°C (194°F).
8. Record engine oil pressure at idle.
9. Raise engine speed to 3000 RPM and record oil pressure.
10. At normal operating temperature the oil pressure must not drop below 3 bar (44 psi). When engine speed is raised, oil pressure must rise with out delay and be no less than 3 bar (44 psi) at 3000 RPM.
11. If oil pressure is out of range, determine cause.

REMOVAL

ENGINE COVER

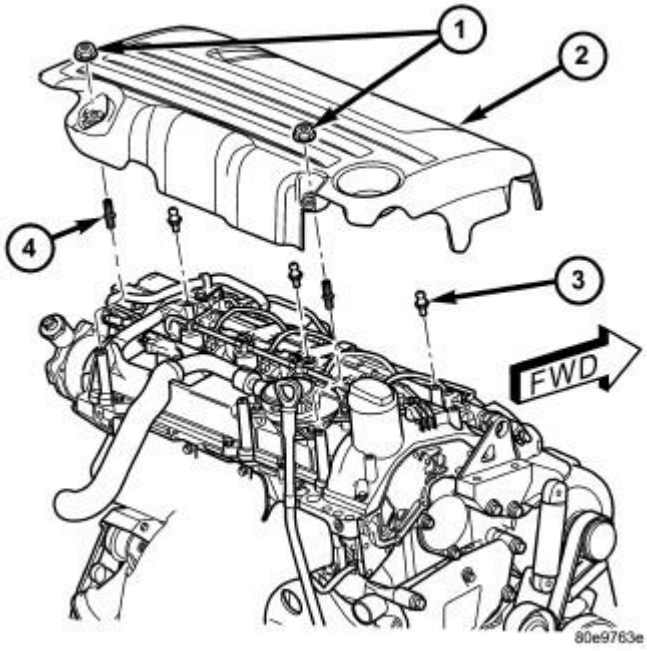

Fig. 5: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1. Remove engine cover retaining nuts (1). See **Fig. 5** .
2. Unclip engine cover (2) from engine cover mounts (3) and remove engine cover from engine.

ENGINE

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

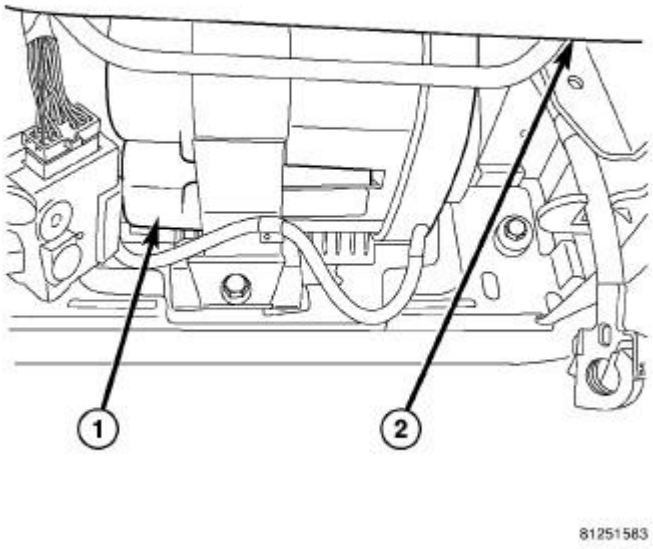

Fig. 6: Battery Location
Courtesy of CHRYSLER LLC

1 - BATTERY 2 - PASSENGER SEAT

1. Disconnect negative battery (1) cable located under the front passenger seat.
2. Discharge air conditioning (refer to **REFRIGERANT SYSTEM EVACUATE**).
3. Drain cooling system (refer to **SYSTEM DRAINING**).

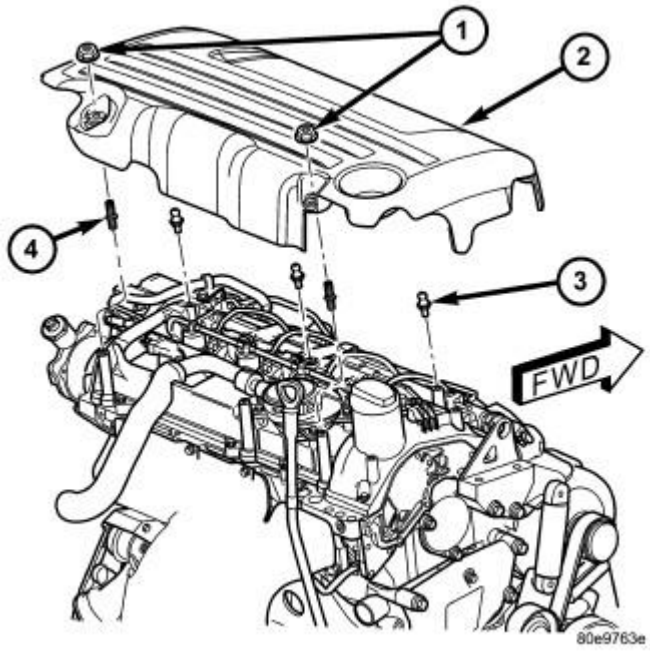

Fig. 7: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1 - ENGINE COVER RETAINING NUTS
2 - ENGINE COVER
3 - ENGINE COVER MOUNTS
4 - ENGINE COVER MOUNTING STUDS

4. Remove engine cover (1). See **Engine - Removal**.
5. Remove front grille assembly. Refer to **Body/Exterior/GRILLE - Removal** .
6. Remove upper radiator closure panel. Refer to **Body/Exterior/CROSSMEMBER, Radiator - Removal** .

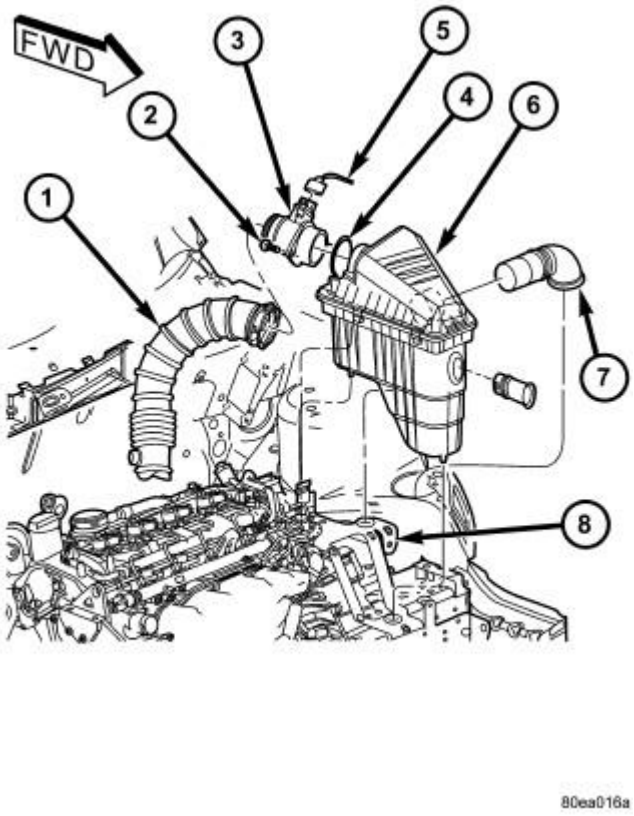

Fig. 8: Air Cleaner Housing Assembly
Courtesy of CHRYSLER LLC

1 - TURBOCHARGER INLET HOSE
2 - MAF SENSOR RETAINING BOLT
3 - MAF SENSOR
4 - O-RING
5 - MAF SENSOR ELECTRICAL CONNECTOR
6 - AIR CLEANER ASSEMBLY
7 - INLET DUCT
8 - AIR CLEANER HOUSING ASSEMBLY BRACKET

7. Remove air cleaner housing (6) and air inlet hose (7) assembly. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.
8. Remove radiator and A/C condenser. Refer to **Cooling/Engine/RADIATOR, Engine Cooling - Removal** .
9. Remove engine compartment lower silencer and accessory drive belt splash shield.

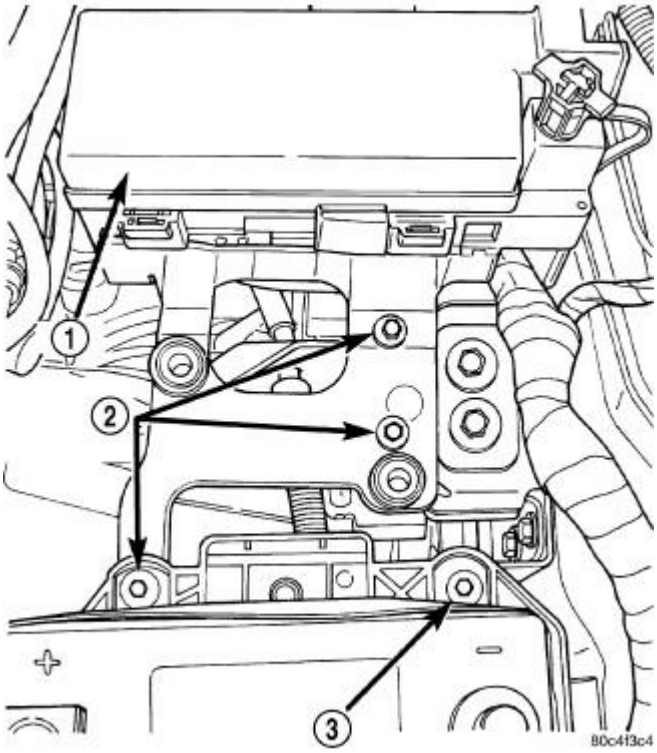

Fig. 9: TIPM Bracket Attaching Bolts - Typical
Courtesy of CHRYSLER LLC

1 - Totally Integrated Power Module (TIPM)
2 - TIPM BRACKET BOLTS
3 - BATTERY TRAY BOLT

10. Remove power distribution center bracket.
11. Disconnect shift cables at transaxle.

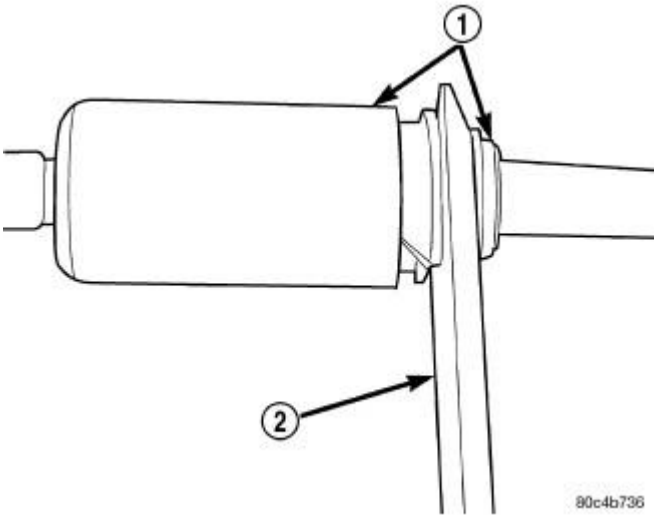

Fig. 10: Disconnecting Clutch Hydraulic Line
Courtesy of CHRYSLER LLC

1 - QUICK CONNECT FITTING 2 - DISCONNECT TOOL 6638 A

12. Disconnect clutch hydraulic line at transaxle.
13. Disconnect reverse light switch harness connector at transaxle.
14. Disconnect speed sensor harness connector at transaxle.
15. Disconnect wiring at starter and alternator, position wiring harness aside.
16. Disconnect three wiring harness connectors and two ECM harness connectors, position wiring harnesses aside.
17. Disconnect engine coolant heater harness connector.

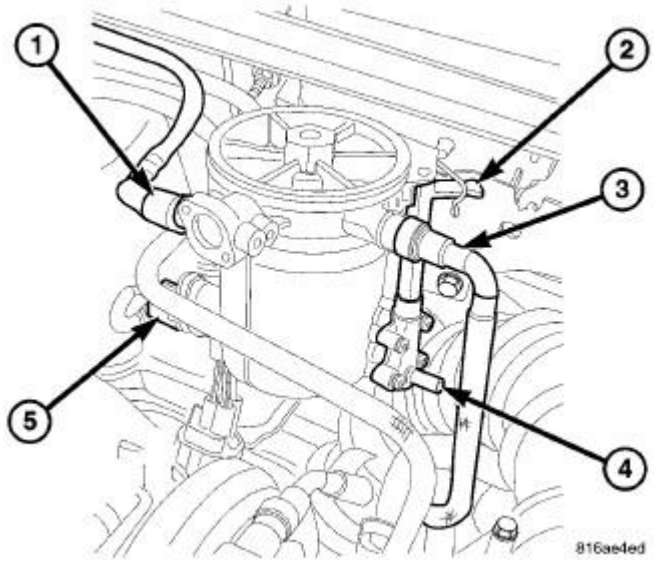

Fig. 11: FUEL FILTER
Courtesy of CHRYSLER LLC

1 - FUEL INLET
2 - FUEL FILTER DRAIN
3 - FUEL FILTER OUTLET
4 - FUEL FILTER DRAIN NIPPLE
5 - FUEL HEATER CONNECTOR

18. Disconnect harness connector (5) at fuel filter/fuel heater.
19. Disconnect fuel lines (1,3) at fuel filter/water separator.
20. Disconnect heater hoses at heater core.
21. Disconnect power brake booster vacuum hose at engine.
22. Disconnect coolant recovery hose at engine.
23. Disconnect coolant recovery hose at coolant pressure recovery container.
24. Disconnect supply hose at power steering fluid reservoir and set aside.
25. Disconnect vacuum hose at turbocharger.
26. Disconnect suction line at A/C compressor and position aside.
27. Remove fastener retaining ground strap to engine.

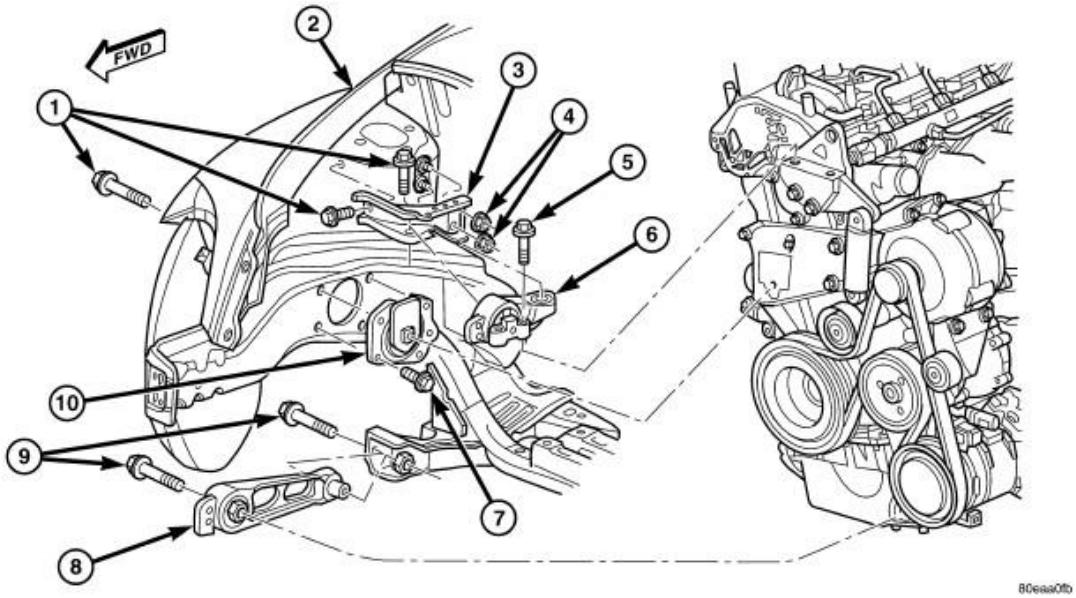

Fig. 12: Engine Mounting - Right Side
Courtesy of CHRYSLER LLC

1 - BOLT
2 - RIGHT FENDER
3 - UPPER TORQUE STRUT BRACKET

4 - NUTS
5 - BOLT
6 - UPPER TORQUE STRUT
7 - BOLT
8 - LOWER TORQUE STRUT
9 - BOLT
10 - RIGHT ENGINE MOUNT

28. Remove two fasteners from upper torque strut (6).
29. Disconnect swirl valve actuator hose at actuator.
30. Raise support vehicle.
31. Remove front wheels.
32. Remove two fasteners retaining left strut to steering knuckle.
33. Separate front strut from steering knuckle.
34. Disengage left half shaft tripod joint from output shaft.

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

35. Remove left half shaft tripod joint from transaxle while pulling outward on top of the steering knuckle.
36. Support half shaft to prevent damage to seal boot and clamp.
37. Perform steps 34 through 38 to remove right side tripod.

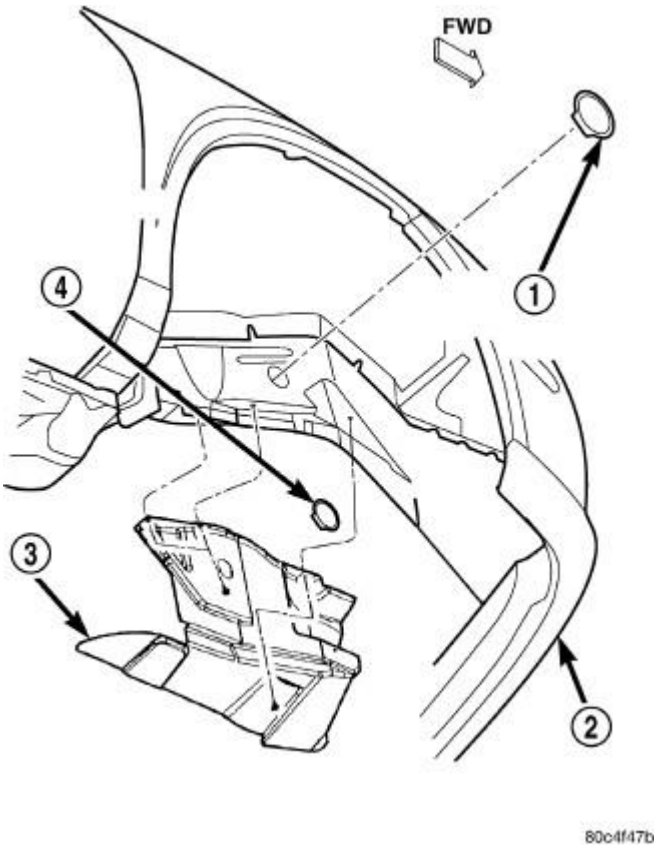

Fig. 13: Splash Shield
Courtesy of CHRYSLER LLC

1 - RIGHT MOUNT BOLT ACCESS PLUG
2 - FASCIA
3 - SPLASH SHIELD
4 - CRANKSHAFT BOLT ACCESS PLUG

38. Remove inner splash shield (3).
39. Disconnect engine oil pressure sensor harness connector and remove sensor from engine.
40. Disconnect power steering pressure hose at steering gear, position aside.
41. Remove exhaust manifold.

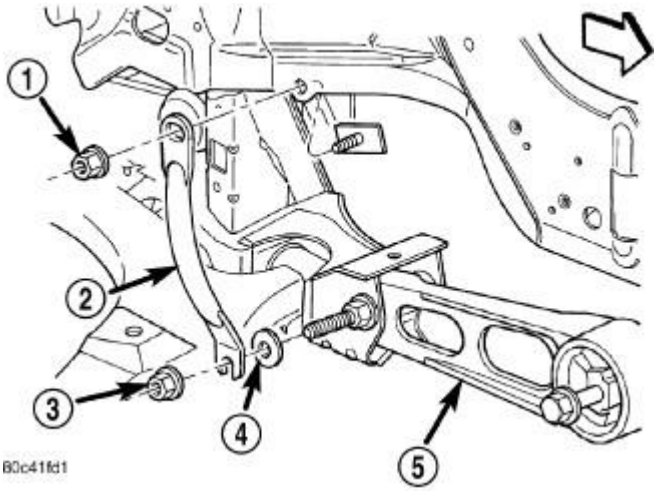

Fig. 14: Pencil Strut
Courtesy of CHRYSLER LLC

1 - NUT
2 - PENCIL STRUT
3 - NUT
4 - FLAT WASHER
5 - LOWER TORQUE STRUT

42. Remove pencil strut (2) and lower torque strut (5).
43. Remove inner cooler tube.

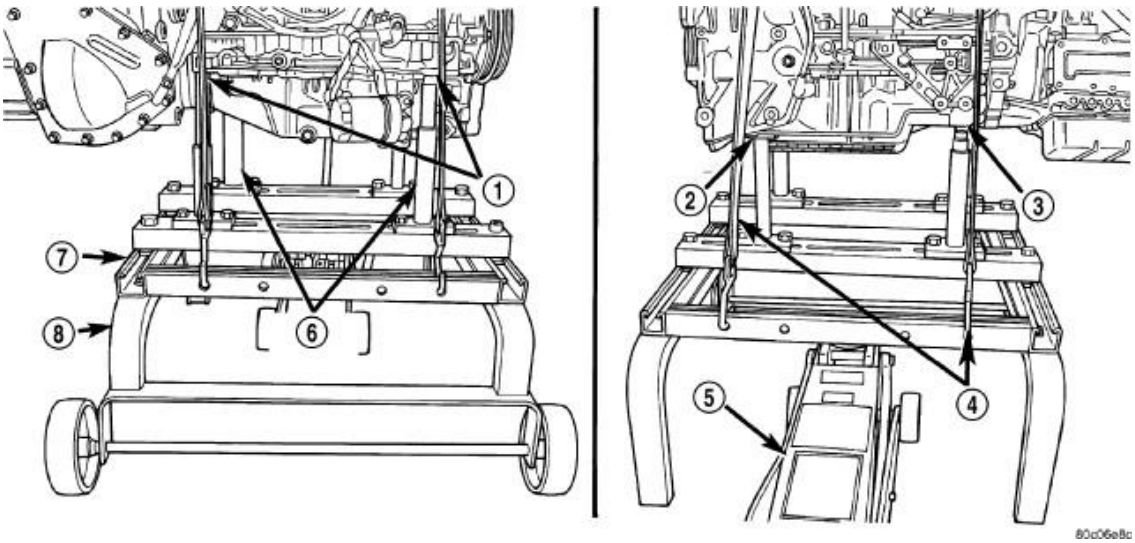

Fig. 15: Positioning Engine Cradle Support Post
Courtesy of CHRYSLER LLC

1 - POST LOCATING HOLES IN BLOCK
2 - POST POSITIONED UNDER BRACKET

3 - POST LOCATING HOLE IN STRUT 4 - SAFETY STRAPS 5 - FLOOR JACK 6 - POST KIT ENGINE CRADLE 6848 7 - DOLLY 6135 8 - CRADLE 6710

44. Position the engine dolly 6135 (7) with the cradle 6710A (8) and Post Kit Engine Cradle 6848 (6) underneath the engine.
45. Carefully lower the vehicle enough to position the engine above the support posts.
46. Align three support posts with three engine mounting sockets.
47. Position the fourth support post and adaptor underneath engine oil cooler flange.
48. Adjust the height of each support post as necessary and tighten the support posts and cradle fasteners.
49. Carefully lower vehicle enough to seat engine onto support posts.

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

50. Install, tighten and lock safety straps (4) around engine and attach them to the cradle.
51. Raise vehicle enough to verify safety straps (4) retain dolly fixture to engine.
52. Lower vehicle so that only the weight of the engine and transmission assembly is on dolly fixture.

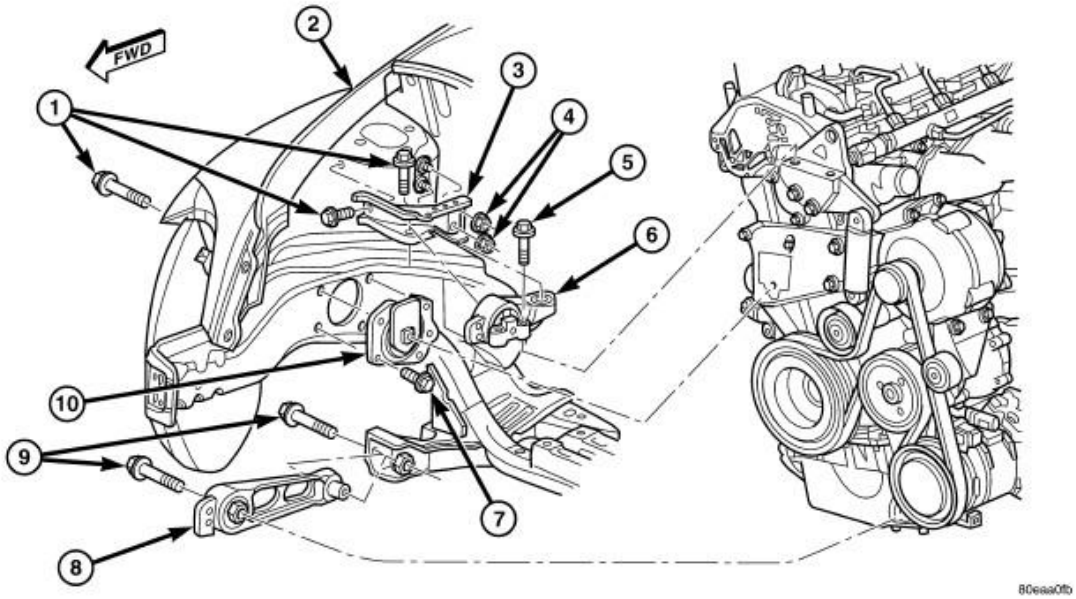

Fig. 16: Engine Mounting - Right Side
Courtesy of CHRYSLER LLC

1 - BOLT

2 - RIGHT FENDER
3 - UPPER TORQUE STRUT BRACKET
4 - NUTS
5 - BOLT
6 - UPPER TORQUE STRUT
7 - BOLT
8 - LOWER TORQUE STRUT
9 - BOLT
10 - RIGHT ENGINE MOUNT

53. Remove right mount (10) through bolt.

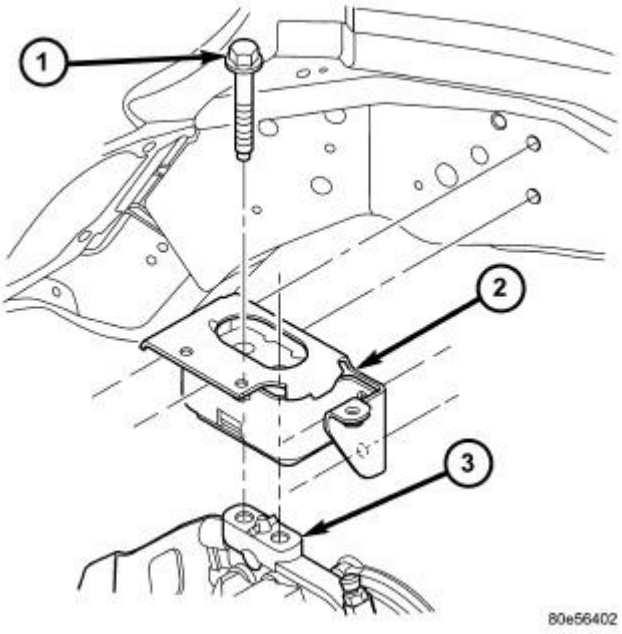

Fig. 17: LEFT MOUNT - TYPICAL
Courtesy of CHRYSLER LLC

1 - BOLT (2)
2 - MOUNT
3 - BRACKET

54. Remove two left mount through bolts (1).

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.

INSTALLATION

ENGINE COVER

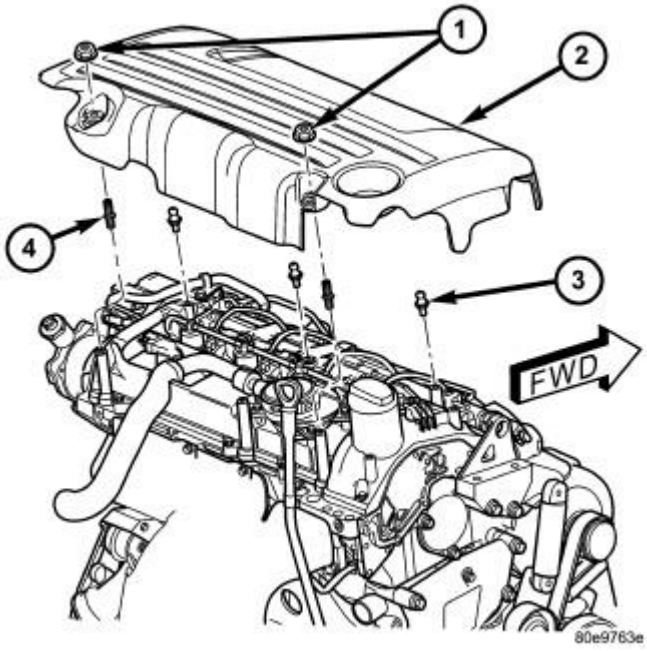

Fig. 18: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1. Align engine cover (2) with mounting studs. See **Fig. 18** .
2. Firmly press cover onto mounting studs (4).
3. Install retaining nuts (1) at rear of engine cover.

ENGINE

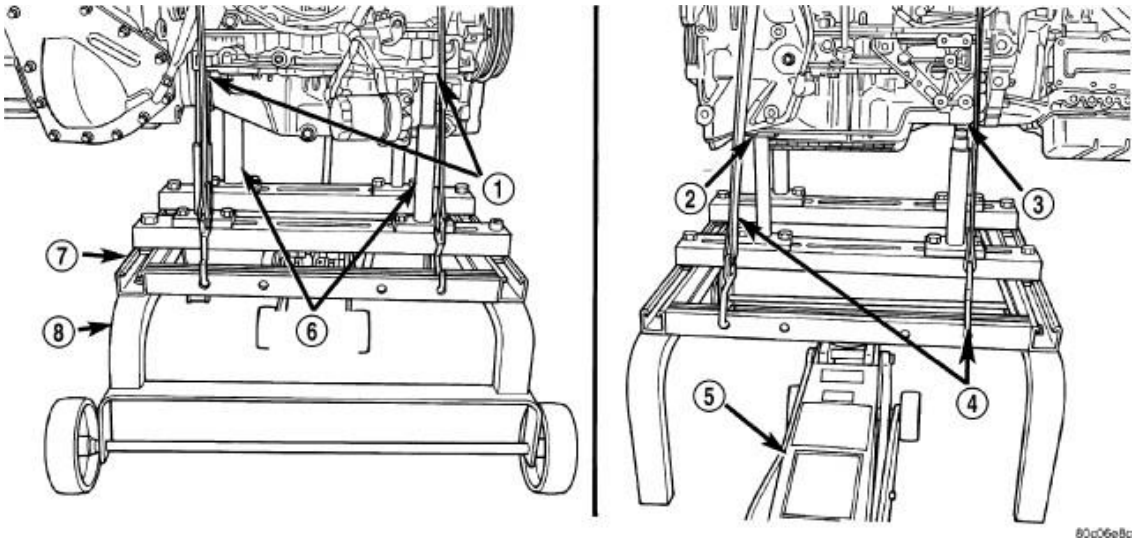

Fig. 19: Positioning Engine Cradle Support Post
Courtesy of CHRYSLER LLC

WARNING: Safety straps (4) must be used to secure engine to the dolly fixture.

1. Seat engine onto Post Kit Engine Cradle 6848 then install, tighten and lock safety straps (4) around engine, securing it to the cradle 6710A.
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.

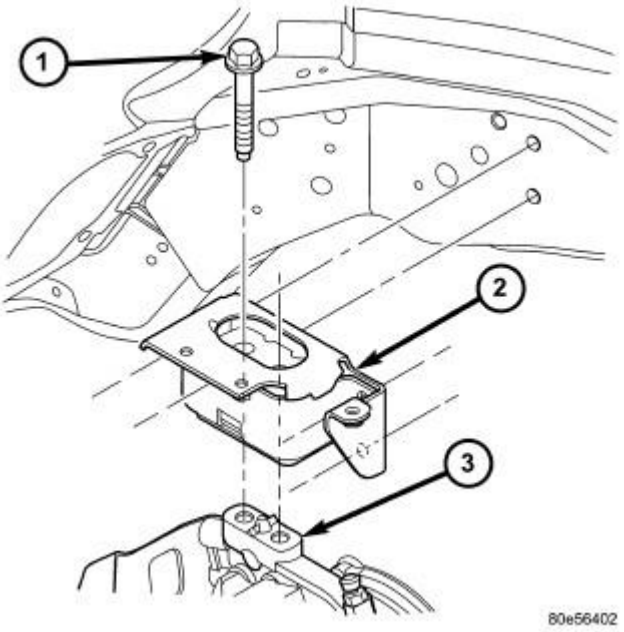

Fig. 20: LEFT MOUNT - TYPICAL
Courtesy of CHRYSLER LLC

4. Install two left mount through bolts (1). See **Engine/Engine Mounting/INSULATOR, Engine Mount - Installation**.

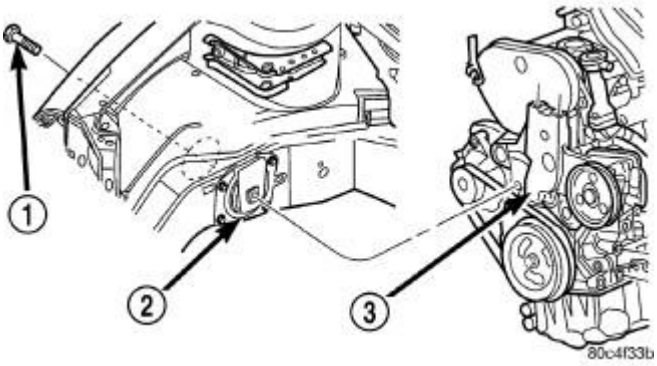

Fig. 21: Right Mount Through Bolt
Courtesy of CHRYSLER LLC

5. Install right mount through bolt (1). See **Engine/Engine Mounting/INSULATOR, Engine Mount - Installation**.

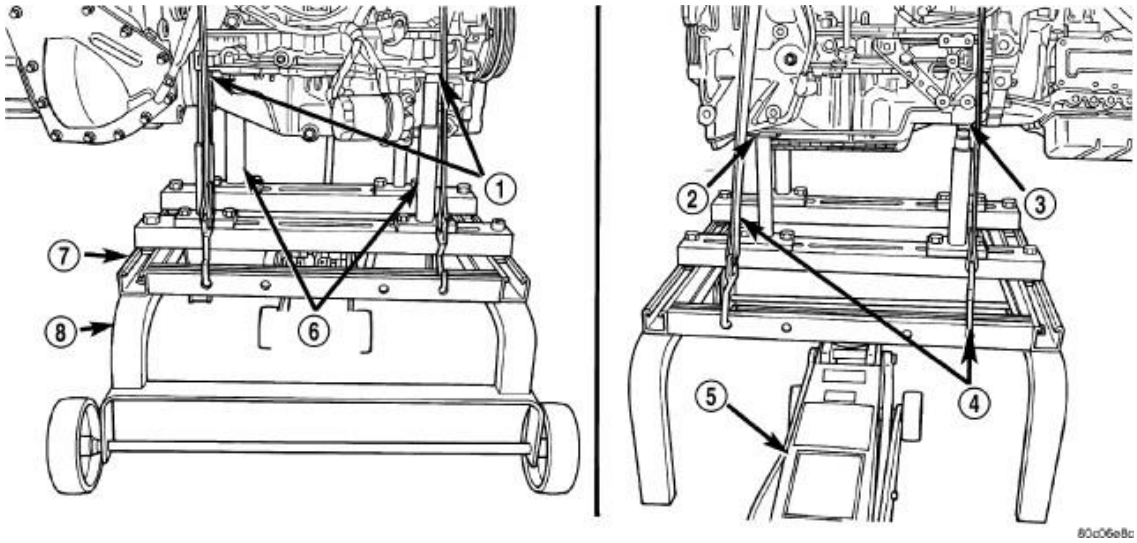

Fig. 22: Positioning Engine Cradle Support Post
Courtesy of CHRYSLER LLC

6. Remove safety straps (4).
7. Carefully raise the vehicle enough to clear the Cradle 6710A (1) and Post Kit Engine Cradle 6848 (6).
8. Install charge air cooler pipe.

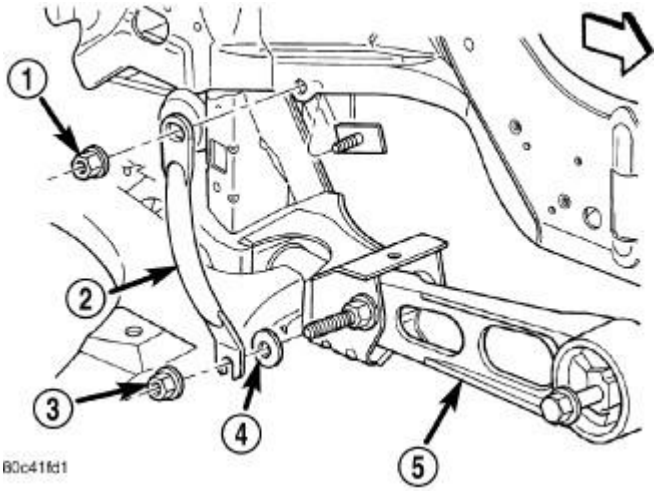

Fig. 23: Pencil Strut
Courtesy of CHRYSLER LLC

9. Install pencil strut (2) and lower torque strut (5). See **Engine/Engine Mounting/STRUT, Torque - Installation**.
10. Install exhaust manifold down pipe.
11. Connect power steering pressure hose at steering gear.
12. Connect oil pressure switch electrical connector.

NOTE: When installing tripod joint, DO NOT let spline or snap ring drag across

transaxle oil seal lip.

13. Pull outward on the right steering knuckle and position the right half shaft tripod joint to the transaxle.
14. Engage right half shaft tripod joint to output shaft.
15. Connect steering knuckle to strut.
16. Install two fasteners retaining strut to knuckle.
17. Perform steps 13 through 16 to install left side tripod joint.

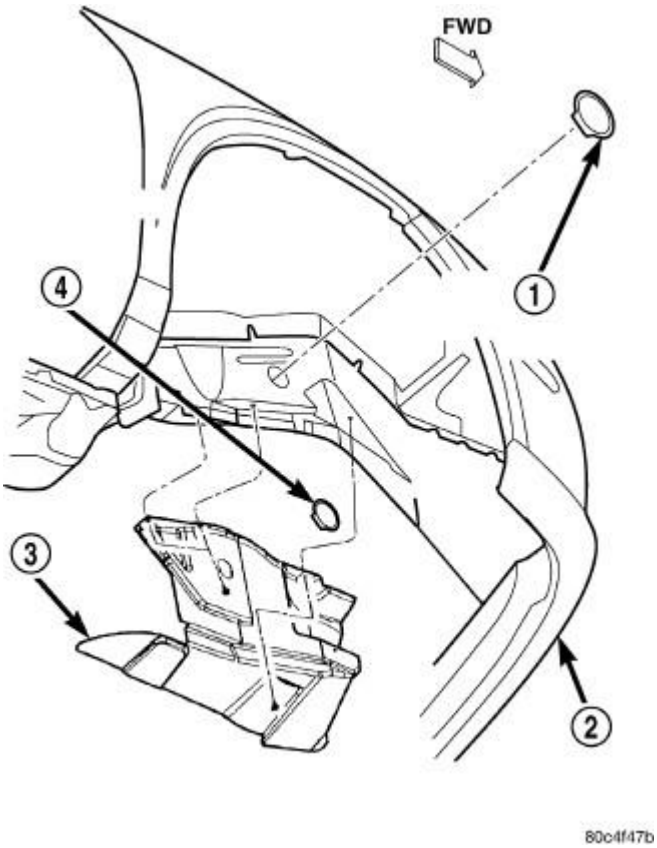

Fig. 24: Splash Shield
Courtesy of CHRYSLER LLC

18. Install splash shield (3).
19. Install front wheels.
20. Remove cradle assembly from beneath vehicle and lower vehicle.
21. Connect swirl actuator line at engine.

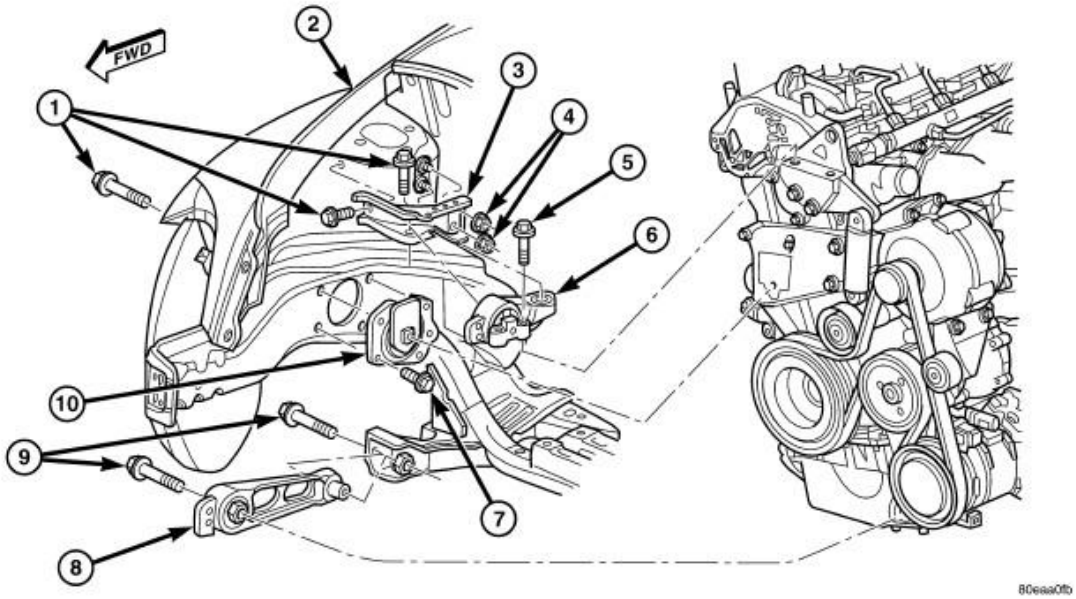

Fig. 25: Engine Mounting - Right Side
Courtesy of CHRYSLER LLC

22. Install two fasteners for the upper torque strut (6).
23. Install ground strap.
24. Connect suction line to A/C compressor.
25. Connect vacuum hose at turbocharger.
26. Connect power steering fluid reservoir supply hose.
27. Connect coolant recovery hose to recovery container.
28. Connect coolant recovery hose to engine.
29. Connect power brake booster vacuum hose to engine.
30. Connect heater hoses to heater core.

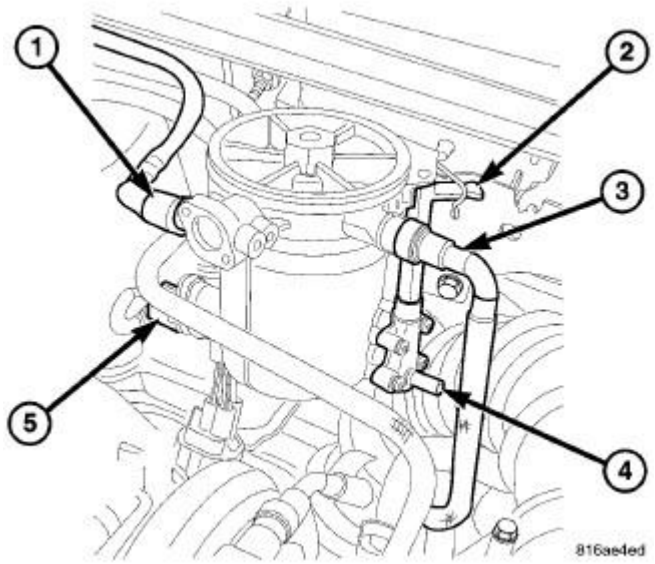

Fig. 26: FUEL FILTER
Courtesy of CHRYSLER LLC

31. Connect fuel lines (1,3) to fuel filter/water separator.
32. Connect harness connector to fuel filter/fuel heater.
33. Connect engine coolant heater harness connector.
34. Connect three wiring harness connectors and two Engine Control Module harness connectors.
35. Connect wiring at starter and alternator.

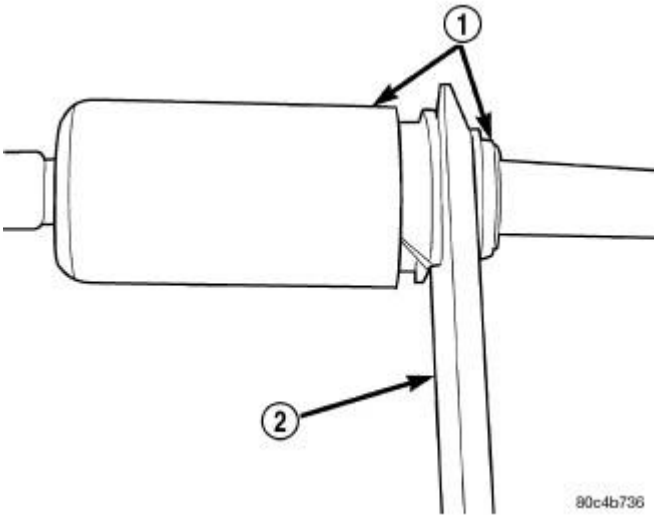

Fig. 27: Disconnecting Clutch Hydraulic Line
Courtesy of CHRYSLER LLC

36. Connect speed sensor harness connector to transaxle.
37. Connect reverse light switch harness connector to transaxle.

38. Connect clutch hydraulic line at transaxle.

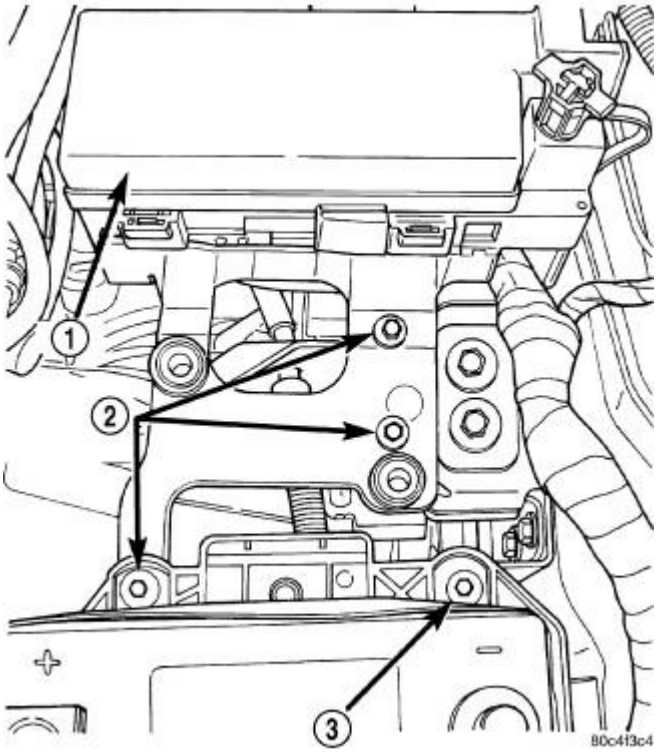

Fig. 28: PDC Bracket Attaching Bolts - Typical
Courtesy of CHRYSLER LLC

39. Install power distribution center bracket (2).
40. Install lower engine compartment silencer.
41. Install coolant module assembly and connect radiator fan electrical connector.
42. Install air cleaner inlet housing and air inlet hose.
43. Install upper radiator closure pane. Refer to **Body/Exterior/CROSSMEMBER, Radiator - Installation** .

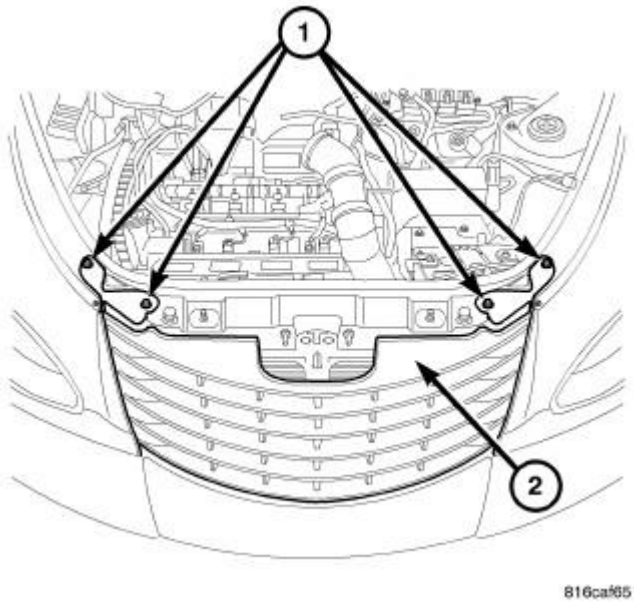

Fig. 29: GRILL REMOVAL
Courtesy of CHRYSLER LLC

44. Install front grille assembly (2). Refer to **Body/Exterior/GRILLE - Installation** .
45. Refill cooling system with the appropriate coolant mixture to the proper level (refer to **SYSTEM FILLING - DIESEL ENGINE**).
46. Be sure all oil and fluid levels are adjust to specification.
47. Connect negative battery cable.
48. Start engine and inspect for leaks
49. Check all fluid levels in accordance with owners guide and adjust levels as necessary.
50. Recharge air conditioning (refer to **REFRIGERANT SYSTEM CHARGE**).

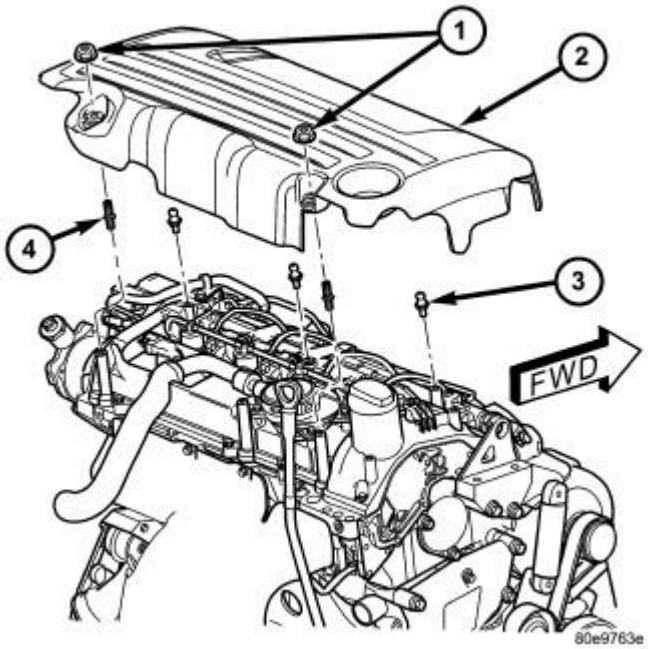

Fig. 30: Engine Cover Mounts
Courtesy of CHRYSLER LLC

51. Install engine cover (2). See **Engine - Installation**.

SPECIFICATIONS

SPECIFICATIONS

SPECIFICATIONS

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Crankcase Ventilation			
Screw-Air Charge Distribution Pipe to Air Charge Distribution Panel	11	-	97
Cylinder Head			
8m-Bolt- Cylinder Head to Timing Case Cover	20	15	-
Bolt-Front Cover to Cylinder Head	14	-	124
12m-Bolt-Cylinder Head to Crankcase (3 stages, torque, torque angle, torque angle)	60, 90°, 90°	44, 90°, 90°	-
Crankcase, Timing Case Cover, End Cover			
Bolt-Crankshaft Bearing			

Cap to Crankcase (2 stages, torque, torque angle)	55, 90°	40, 90°	-
Bolt-End Cover to Crankcase	9	-	80
Bolt-Timing Case Cover to Crankcase	20	15	-
Plug-Coolant Drain to Crankcase	30	22	-
Oil Pan			
6m-Bolt-Oil Pan to Crankcase	9	-	80
8m-Bolt-Oil Pan to Crankcase	20	15	-
Bolt-Oil Pan to End Cover	9	-	80
Bolt-Oil Pan to Timing Case Cover	9	-	80
Bolt-Oil Pan to Transmission Bell Housing	40	30	-
Plug-Oil Pan to Oil Drain	47	35	-
Connecting Rod			
Bolt-Connecting Rod Cap to Connecting Rod (3 stage, 1 AND 2 torque, 3 torque angle)	5,25,90°	-	44,221, 90°
Crankshaft			
Bolt-Crankshaft Bearing Cap (2 stage, 1 torque, 2 torque angle	55,90°	40.5, 90°	-
Flywheel, Driven Plate, Vibration Damper, Starter Ring Gear			
8.8m-Bolt-Central Bolt of Vibration Damper (2 stage, 1 torque, 2 torque angle)	200,90°	147.5, 90°	-
10.9m-Bolt-Central Bolt of Vibration Damper (2 stage, 1 torque, 2 torque angle)	325,90°	240, 90°	-
Bolt-Stretch Shank for Flywheel or 2 Mass Flywheel to Crankshaft (2 stage, 1 torque, 2 torque angle)	45,90°	33, 90°	-

Turbo Charger			
Bolt-Oil Feed Line to Cylinder Head	9/22	-	80-194
Bolt-Oil Feed Line to Turbo Charger	30	22	-
Bolt-Turbo Charger Support	30	22	-
Bolt-Turbo Charger Support to Crankcase	20	-	177
Bolt-Oil Outlet Line to Turbo Charger	9	-	80
Connection-Flange of Exhaust Manifold to Turbo Charger	30	22	-
Connection-Turbo Charger to Front Catalytic Converter	30	22	-
Charge Air Pipe/Charge Air Cooling			
Bolt-Charge Air Distribution Pipe	16	-	141
Bolt-Inlet Port Shut Off Positioning Motor to Air Charge Distribution Pipe	9	-	80
Bolt-Support to Charge Air Distribution Pipe	20	-	177
Bolt-Support to Engine Bracket	40	30	-
Clamp-Charge Air Pipes/Hoses	3	-	27
Belt Tensioning Device			
Bolt-Guide Pulley to Coolant Pump	35	26	-
Bolt-Guide Pulley to Timing Case Cover	35	26	-
Bolt-V-Belt Tensioning Device to Tensioning Pulley	36	26.5	-
Bolt-V-Belt Tensioning Device to Timing Case Cover	30	22	-
Exhaust Manifold			
Nut-Exhaust Manifold at Cylinder Head	30	22	-
Position Sensor			

Nut/Bolt-Camshaft Position Sensor to Cylinder Head Cover	11	-	97
Nut/Bolt-Crankshaft Position Sensor to Engine Block	8	-	70
Pre-Glow System			
Cylinder Head to Glow Plug	12	-	106
Starter			
Bolt-Starter to Crankcase	42	31	-
Nut-Connection of Circuit 30	14	-	124
Nut-Connection of Circuit 50	6	-	53
Alternator			
Bolt-Generator to Timing Case Cover	20	15	-
Bolt-Generator to Cooler Housing	6	-	53
Bolt-Cooler Housing of Generator to Crankcase	20	-	177
Nut-B+ Circuit to Generator	13-18	-	115-159
Nut-D+ Circuit to Generator	5	-	44
Nut-Collar to V-Belt Pulley	80	59	-
Oil Pump			
Bolt-Oil Pump to Crankcase	18	-	133
Bolt-Oil Pipe to Crankshaft Bearing Cap	8	-	70
Oil Filter			
Screw Cap to Oil Filter	25	18.5	-
Oil Cooling System			
Bolt-Oil-Water Heat Exchanger to Timing Cover Case	15	-	133
Oil Level Pressure			
Bolt-Dip Stick Guide Tube to Cylinder Head	14	-	123
Bolt-Oil Level Sensor to Oil Pan	14	-	123

Coolant Pre- Heater			
Coolant Pre-Heater in Engine Block	35	26	-
Engine Cooling General			
Bolt-Belt Pulley to Coolant Pump	8-35	6-26	-
Bolt-Coolant Pump to Timing Case Cover 6m/8m	14/20	10-15	-
Bolt-Thermostat Housing to Cylinder Head	9	-	80
Coolant Drain Plug to Crankcase	30	22	-
Engine Suspension, Engine Mount, Engine Bracket			
Bolt-Engine Bracket to Crankcase (2 stage, torque, torque angle)	20, 90°	15, 90°	-
Bolt-Engine Mount to Engine Bracket	55	40.5	-
Bolt-Front Engine Mount to Front Axle Carrier	35	26	-
Bolt-Rear Engine Cross Member to Body	40	30	-
Bolt-Rear Engine Mount to Rear Engine Cross Member	35	26	-
Bolt/Nut- Rear Engine Mount to Transmission	40	26	-
Bolt-Shroud to Engine Bracket	10	-	88.5
Nut-Front Engine Mount to Engine Bracket	65	48	-
Nut-Engine Mount to Vehicle Frame	35	26	-
Fuel Filter			
Bolt-Clip to Fuel Filter	8	-	70
Bolt- Fuel Filter to Charge Air Distribution Pipe	14	-	124
Exhaust System			
Bolt- Catalytic Converter Bracket to Crankcase	20	-	177
Clamp-Connection Between Front Exhaust	55	41	-

Pipe and Rear Exhaust System			
Clip-Front Catalytic Converter to Engine Mount	20	-	177
Nut-Bracket to Tail Pipe	55	40.5	-
Nut-Exhaust Bracket to Threaded Plate of Center Exhaust Pipe	20	-	177
Support-Exhaust Bracket on Transmission	20	-	177
Refrigerant Compressor			
Bolt-Refrigerant Compressor to Timing Case Cover	20	-	177
Bolt-Refrigerant Compressor to Bracket	20	-	177
Bolt-Refrigerant Lines to Refrigerant Compressor	20	-	177
Timing Chain, Chain Tensioner			
Bolt-Camshaft Sprocket to Exhaust Camshaft	18	-	159
Bolt-Intermediate Gear of High Pressure Pump to Cylinder Head	40	29.5	-
Timing Chain Tensioner to Timing Case Cover	80	59	-
Camshaft			
Bolt-Camshaft Bearing Cap to Cylinder Head	9	-	80
Bolt-Driver to Inlet Camshaft	50	37	-
Common Rail Diesel Injection			
Bolt-Banjo Bolt of Leak Oil Line to Rail	20	-	177
Bolt-Bracket to High Pressure Pump	9	-	80
Bolt-High Pressure Pump to Cylinder Head	14	-	124
Bolt-Pre-delivery Pump to Top Cover of Cylinder Head	9	-	80
Bolt-Pressure Control Valve to Rail (2 stage,	3, 5	-	26, 44

torque)			
Bolt-Rail to Cylinder Head	14	-	124
Bolt-Shutoff Valve to Cylinder Head	8	-	70
Nut-Pressure Line to Rail/Injector (New, Reused)	22/25	16/18.5	-
Nut-Pressure Line to High Pressure Pump/Rail	22	16	-
Screw-Tensioning Claw to Injector (2 stage, 1 torque, 2 torque angle)	7, 90°	-	62, 90°
Rail- Pressure Sensor to Rail	22	16	-
Pressure Pipe Connection to Injector	42	31	-
Threaded Rail to Rail	22	16	-
Fuel Cooling System			
Bolt-Fuel Cooler to Charge Air Distribution Pipe	14	-	124
Heater Booster, Heater Unit			
Bolt- Temperature Controlled Cut Out to Heater Booster control Module	12	-	106
Nut-Threaded Stud to Electronic Heater Booster	18	-	159

SPECIAL TOOLS

SPECIAL TOOLS

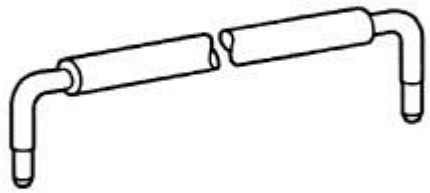

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Fig. 31: LOCKING PINS - 8929
Courtesy of CHRYSLER LLC

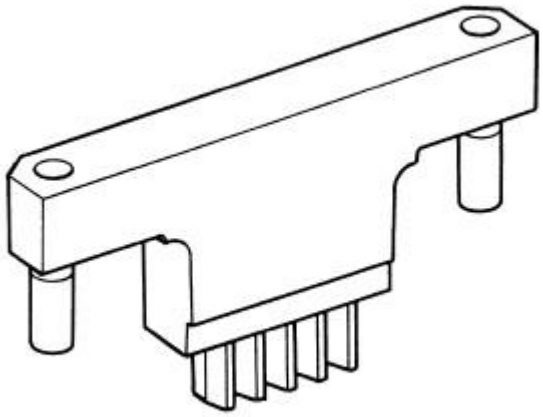

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Fig. 32: #8933 CRANKSHAFT LOCK
Courtesy of CHRYSLER LLC

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Fig. 33: INSTALLER, SEAL - 8936A
Courtesy of CHRYSLER LLC

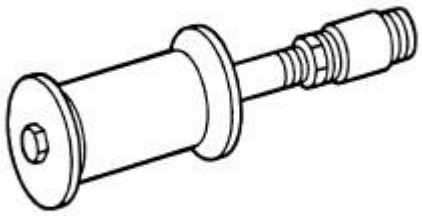

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Fig. 34: #8937 SLIDE HAMMER
Courtesy of CHRYSLER LLC

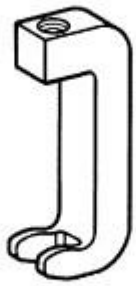

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Fig. 35: EXTRACTION CLAW - 8938A
Courtesy of CHRYSLER LLC

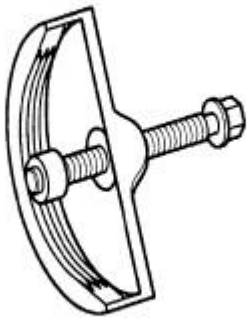

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Fig. 36: REMOVER, CRANKSHAFT DAMPER - 9544
Courtesy of CHRYSLER LLC

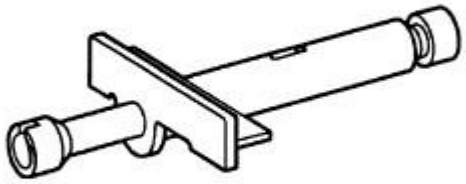

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Fig. 37: REMOVER/INSTALLER, OIL JET - 8942
Courtesy of CHRYSLER LLC

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Fig. 38: ASSEMBLY SLEEVE - 8944
Courtesy of CHRYSLER LLC

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Fig. 39: #9307 VALVE SERVICE TOOLS
Courtesy of CHRYSLER LLC

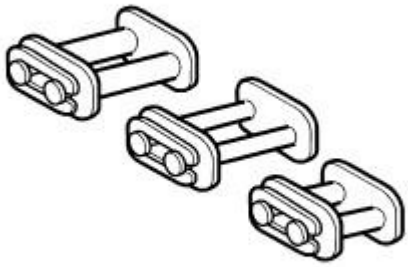

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Fig. 40: ASSEMBLY LINKS - 8951
Courtesy of CHRYSLER LLC

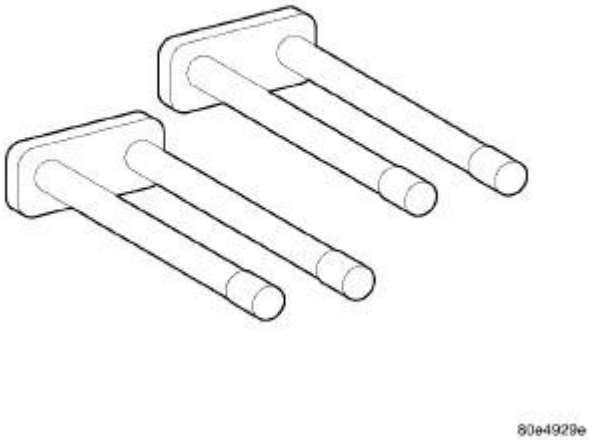

Fig. 41: #8952 ASSEMBLY INSERTS
Courtesy of CHRYSLER LLC

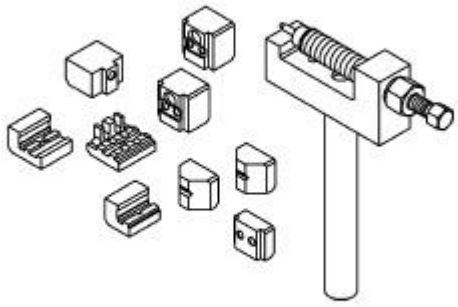

Fig. 42: REMOVER/INSTALLER, CHAIN LINK - 9312A
Courtesy of CHRYSLER LLC

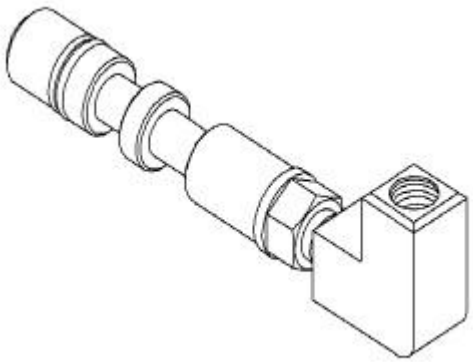

Fig. 43: ADAPTER, COMPRESSION TEST - 9543
Courtesy of CHRYSLER LLC

AIR INTAKE SYSTEM

AIR CLEANER

Removal

REMOVAL

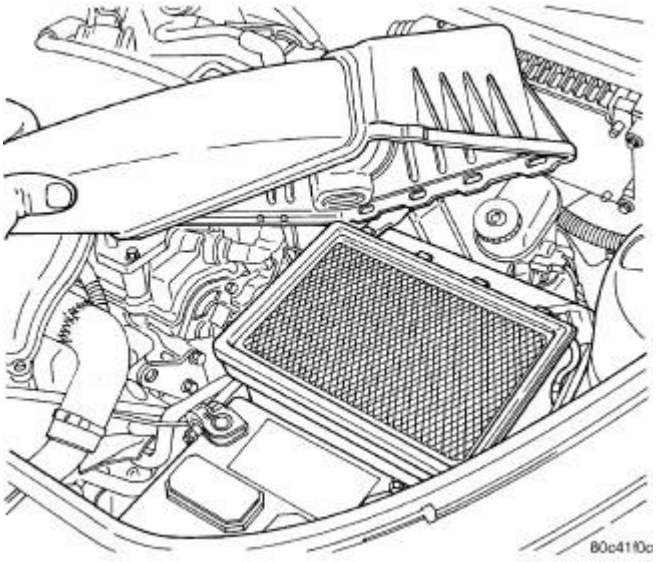

Fig. 44: Air Cleaner Cover - Typical
Courtesy of CHRYSLER LLC

1. Unfasten clasps on sides of air cleaner housing cover. Lift cover off air cleaner housing. See **Fig. 44** .
2. Remove filter element.
3. If necessary, clean the inside of the air cleaner housing.

Installation

INSTALLATION

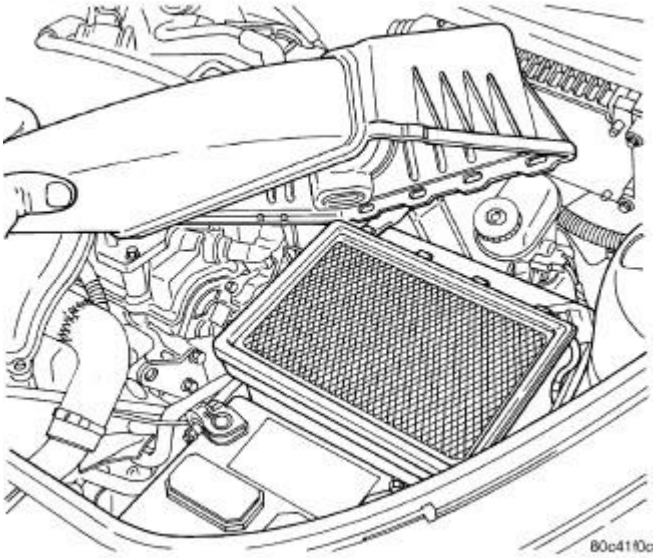

Fig. 45: Air Cleaner Cover - Typical
Courtesy of CHRYSLER LLC

1. Install new filter element.
2. Place cover over air cleaner housing. 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

AIR CLEANER HOUSING

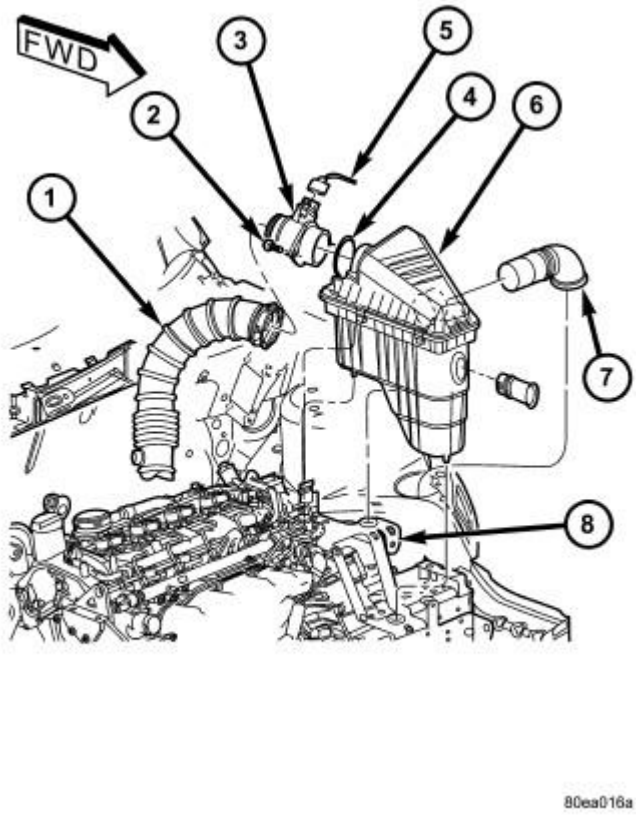

Fig. 46: Air Cleaner Housing Assembly
Courtesy of CHRYSLER LLC

1 - TURBOCHARGER INLET HOSE
2 - MAF SENSOR RETAINING BOLT
3 - MAF SENSOR
4 - O-RING
5 - MAF SENSOR ELECTRICAL CONNECTOR
6 - AIR CLEANER ASSEMBLY
7 - INLET DUCT
8 - AIR CLEANER HOUSING ASSEMBLY BRACKET

1. Disconnect turbocharger inlet hose (1) at air cleaner (6). See **Fig. 46**. .
2. Pull air cleaner housing (6) straight up to remove.
3. Remove the inlet duct (7) from the air cleaner housing (6).

AIR CLEANER BODY

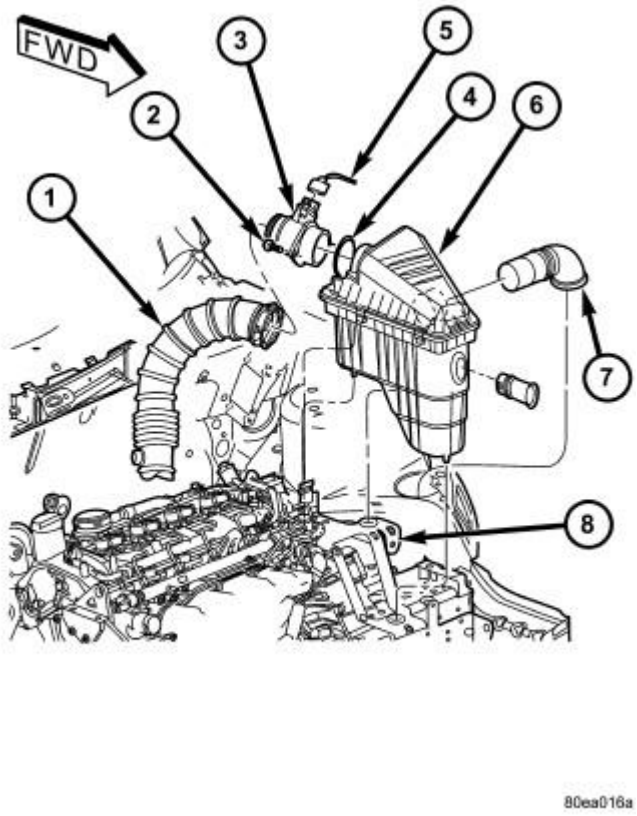

Fig. 47: Air Cleaner Housing Assembly
Courtesy of CHRYSLER LLC

1 - TURBOCHARGER INLET HOSE
2 - MAF SENSOR RETAINING BOLT
3 - MAF SENSOR
4 - O-RING
5 - MAF SENSOR ELECTRICAL CONNECTOR
6 - AIR CLEANER ASSEMBLY
7 - INLET DUCT
8 - AIR CLEANER HOUSING ASSEMBLY BRACKET

1. Remove engine cover. See **Engine - Removal**.
2. Disconnect turbocharger inlet hose (1) at MAF sensor (3). See **Fig. 48** .

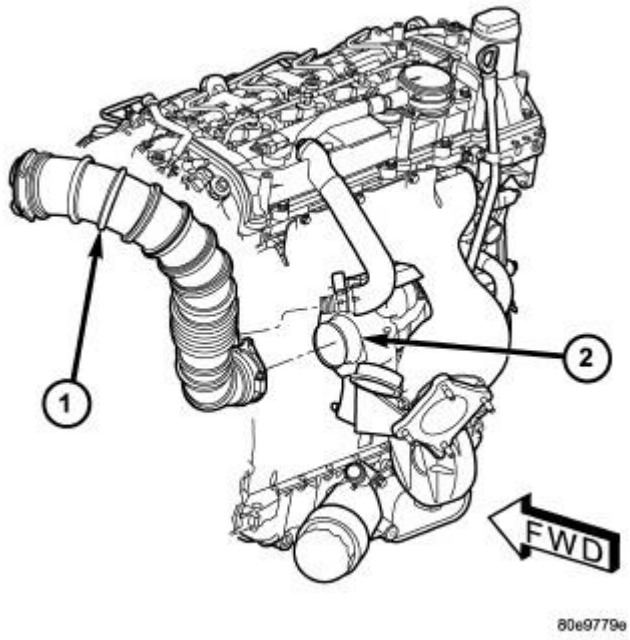

Fig. 48: Turbocharger Inlet Hose
Courtesy of CHRYSLER LLC

3. Disconnect turbocharger inlet hose (1) at turbocharger (2) and remove inlet tube.

Installation

AIR CLEANER HOUSING

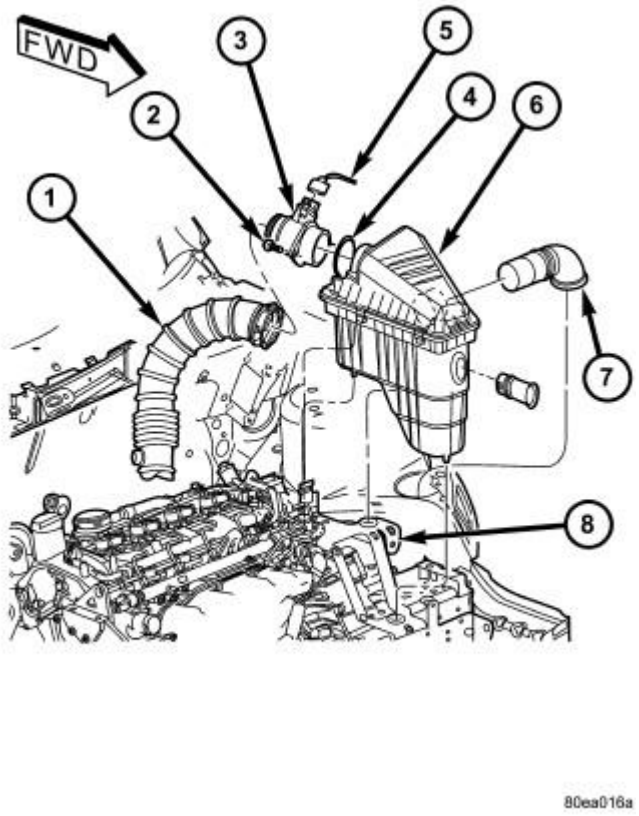

Fig. 49: Air Cleaner Housing Assembly
Courtesy of CHRYSLER LLC

1 - TURBOCHARGER INLET HOSE
2 - MAF SENSOR RETAINING BOLT
3 - MAF SENSOR
4 - O-RING
5 - MAF SENSOR ELECTRICAL CONNECTOR
6 - AIR CLEANER ASSEMBLY
7 - INLET DUCT
8 - AIR CLEANER HOUSING ASSEMBLY BRACKET

Make sure that the rubber grommets, for the lower pins, are in place when reinstalling the air cleaner housing (6). The rubber grommet for the Totally Integrated Power Module (TIPM) bracket must be installed also.

1. Install air inlet duct (7) into air cleaner housing (6).
2. Lower air cleaner housing assembly (6) into engine compartment and align studs at bottom of housing with bracket. Push housing assembly down until fully seated in bracket.
3. Connect turbocharger inlet hose (1) to air cleaner assembly (6).

AIR CLEANER BODY

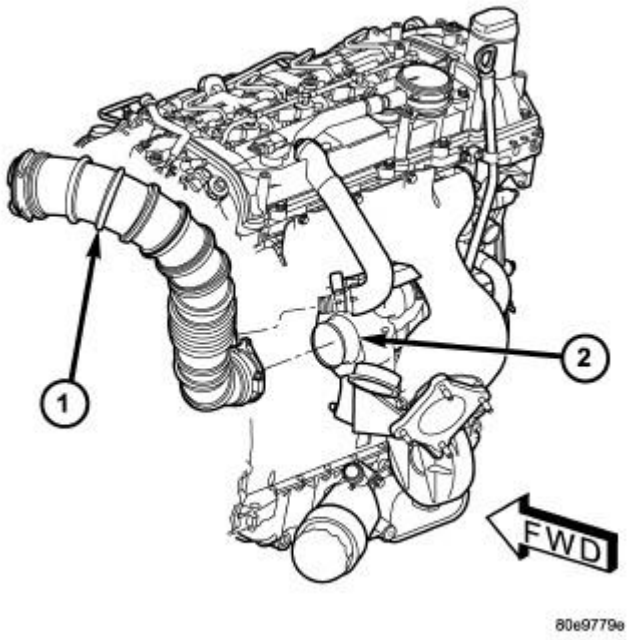

Fig. 50: Turbocharger Inlet Hose
Courtesy of CHRYSLER LLC

1 - TURBOCHARGER INLET HOSE 2 - TURBOCHARGER

1. Connect turbocharger inlet hose (1) at turbocharger (2).

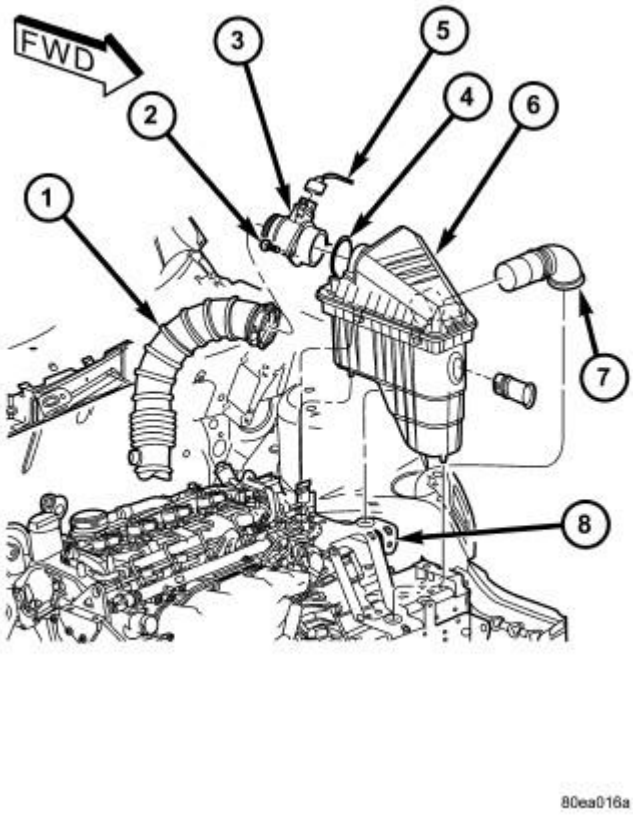

Fig. 51: Air Cleaner Housing Assembly
Courtesy of CHRYSLER LLC

1 - TURBOCHARGER INLET HOSE
2 - MAF SENSOR RETAINING BOLT
3 - MAF SENSOR
4 - O-RING
5 - MAF SENSOR ELECTRICAL CONNECTOR
6 - AIR CLEANER ASSEMBLY
7 - INLET DUCT
8 - AIR CLEANER HOUSING ASSEMBLY BRACKET

2. Connect turbocharger inlet hose (1) at MAF sensor (3).
3. Install engine cover. See **Engine - Installation**.

CYLINDER HEAD

STANDARD PROCEDURE

CYLINDER HEAD BOLT INSPECTION

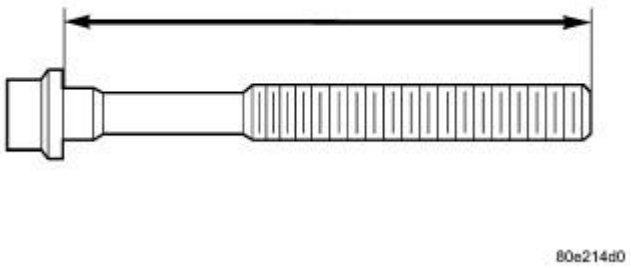

Fig. 52: Measuring Cylinder Head Bolts
Courtesy of CHRYSLER LLC

1. Measure cylinder head bolts between points as shown. See **Fig. 52**.

Cylinder Head Bolts -	Thread Diameter	12 M
	Length When New	102 mm
	Maximum Length	104 mm

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

MEASURE CYLINDER HEAD SURFACE

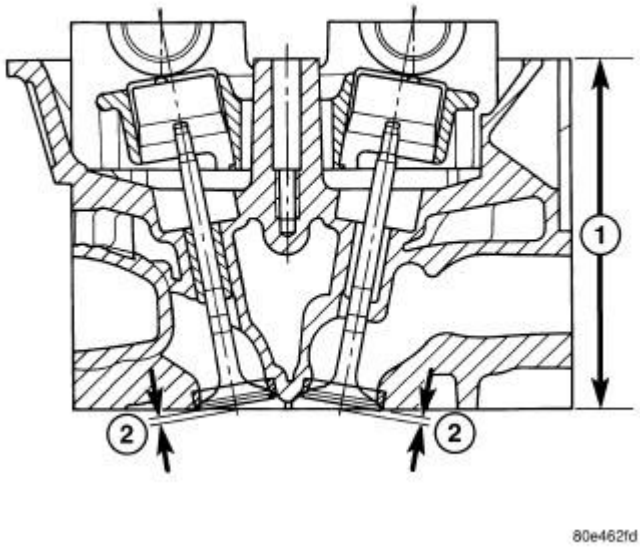

Fig. 53: Cylinder Head Measurements
Courtesy of CHRYSLER LLC

1 - CYLINDER HEAD HEIGHT
2 - VALVE SETBACK

NOTE: Only resurface cylinder head contact surface if porous or damaged. IT IS NOT necessary to rework minor variations in flatness in the longitudinal direction.

1. Disconnect negative battery cable.
2. Remove cylinder head. See **Engine/Cylinder Head - Removal**.
3. Remove valves.
4. Inspect cylinder head contact surface for flatness, porous and damage.
5. Using a straight edge, measure cylinder head and cylinder block flatness.
6. Measure cylinder head height at point (1) indicated and retain reading. See **Fig. 53** .

NOTE: The camshaft housing Must Not be machined. Basic bore of the camshaft bearings will be altered.

7. Machine cylinder head contact surface, if necessary.
8. Measure cylinder head height (1) at point indicated, record stock removal. See **Fig. 53** .
9. Measure valve setback at points (2) indicated. See **Fig. 53** .

NOTE: If measurement is less than dimension "2" no further correct valve clearance compensation is possible; replace valve seat ring or cylinder head if measurement is greater than specification.

CYLINDER HEAD SPECIFICATIONS

Description	Specification
Height of Cylinder Head (1), With Out Camshaft Housing	126.85mm to 127.15mm
Valve Set Back (2) With New Valves and New Valve Seat Rings -	Exhaust Valve: 1.0mm - 1.4mm Intake Valve: 1.1mm - 1.5mm

REMOVAL

CYLINDER HEAD

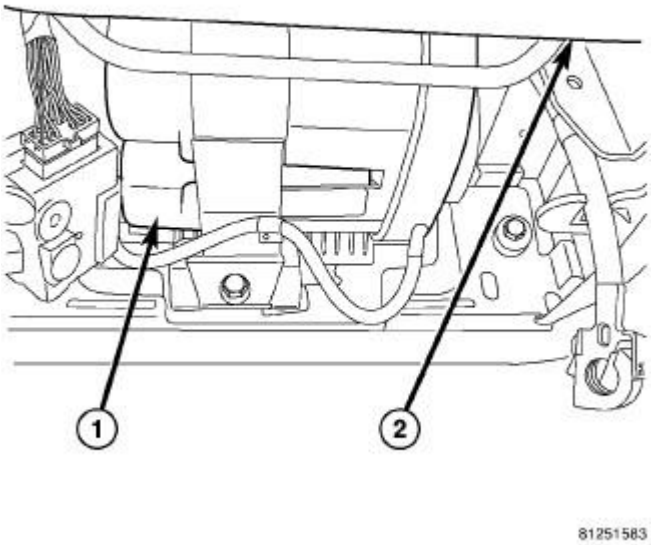

Fig. 54: Battery Location
Courtesy of CHRYSLER LLC

1. Disconnect negative battery (1) cable located under passenger seat.
2. Raise and support vehicle.

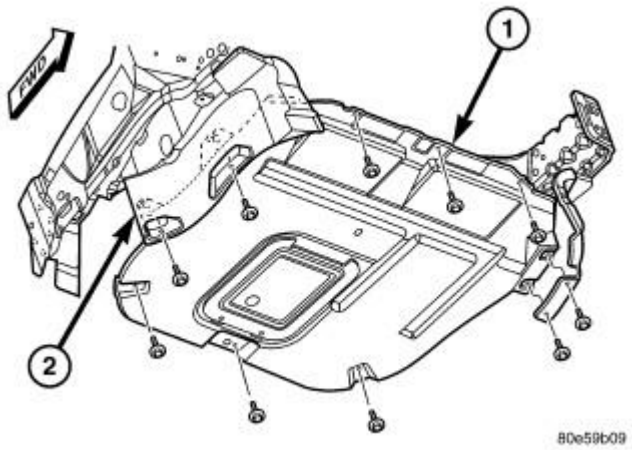

Fig. 55: Engine Compartment Lower Silencer
Courtesy of CHRYSLER LLC

3. Remove engine compartment lower silencer (1) and drive belt splash shield (2). See **Fig. 55** .

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.

4. Drain cooling system (refer to **SYSTEM DRAINING**).

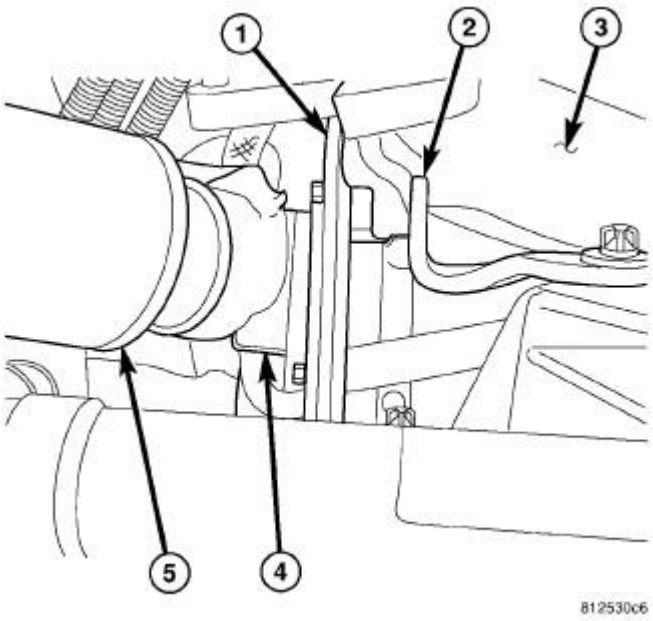

Fig. 56: Turbo Support Bracket
Courtesy of CHRYSLER LLC

5. Disconnect exhaust pipe from turbocharger downpipe.
6. Remove exhaust manifold support bracket (2).
7. Remove turbocharger support bracket (1).
8. Disconnect charge air cooler pipe from turbocharger.
9. Disconnect oil return line from turbocharger.
10. Remove starter and position out of the way.
11. Remove accessory drive belt.
12. Lower vehicle.

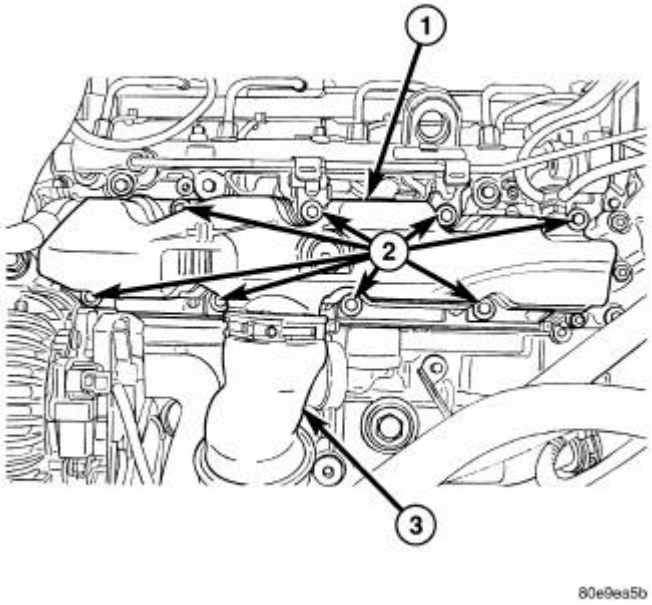

Fig. 57: Intake Manifold
Courtesy of CHRYSLER LLC

13. Remove front grille assembly. Refer to **Body/Exterior/GRILLE - Removal** .
14. Remove radiator closure panel. Refer to **Body/Exterior/CROSSMEMBER, Radiator - Removal** .
15. Disconnect upper radiator hose from thermostat housing.
16. Pull cooling module forward to gain access to the intake manifold inlet hose (3). Disconnect inlet hose (3) at manifold.

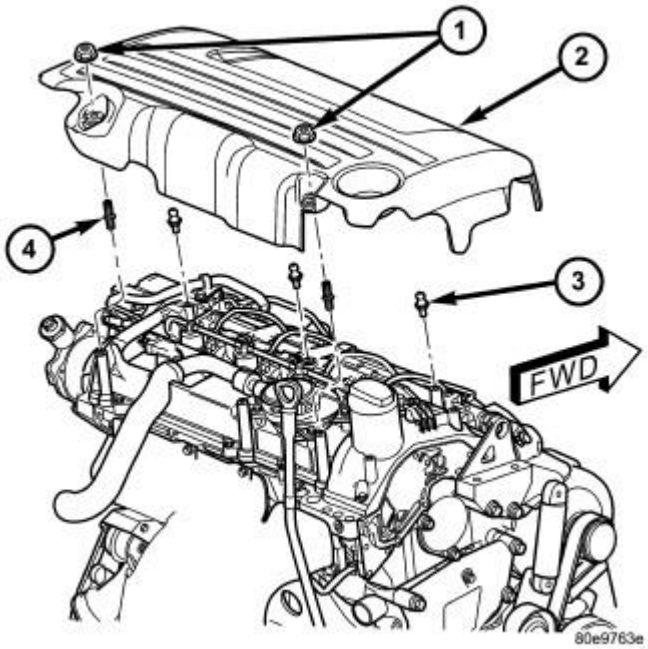

Fig. 58: Engine Cover Mounts
Courtesy of CHRYSLER LLC

17. Remove engine cover retaining nuts (1). Pull upwards on cover to remove. See **Engine - Removal**.
18. Remove air cleaner housing and turbocharger inlet hose. See **Fig. 59** . See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.

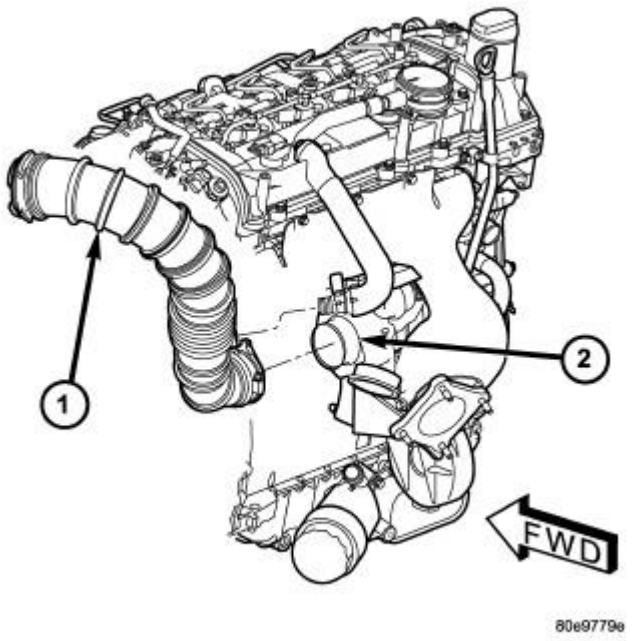

Fig. 59: Turbocharger Inlet Hose

Courtesy of CHRYSLER LLC

19. Remove coolant recovery pressure container.
20. Disconnect vacuum hose at turbocharger (2) waste gate actuator.

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.

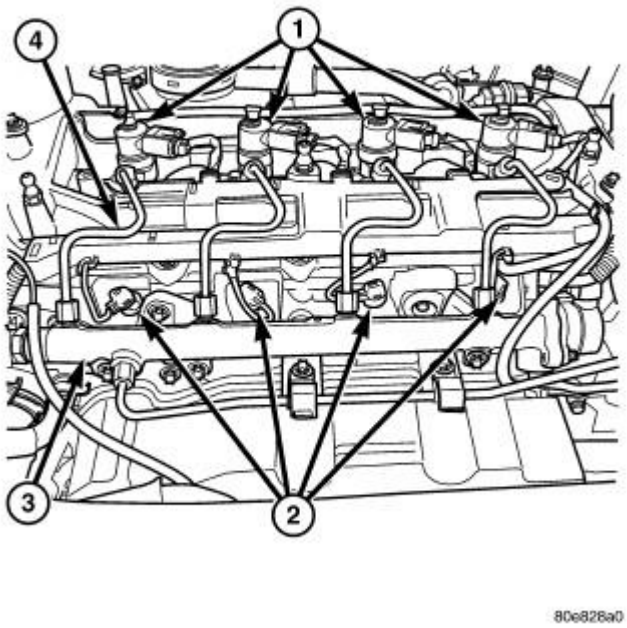

Fig. 60: Fuel Injector and Glow Plug Locations
Courtesy of CHRYSLER LLC

21. Disconnect fuel injector (1), glow plug (2) electrical connectors.
22. Remove fuel high pressure lines (4) , return lines, injectors (1), and fuel rail (3).
23. Reposition wiring harness out of way.

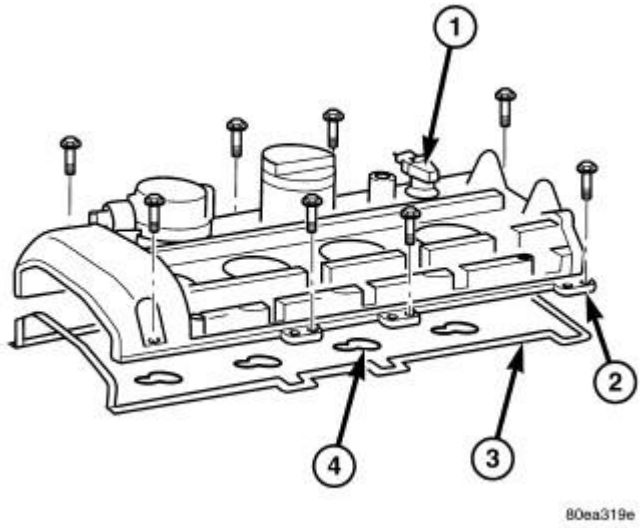

Fig. 61: Cylinder Head Cover - Typical
Courtesy of CHRYSLER LLC

24. Remove camshaft position sensor (1) electrical connector.
25. Remove cylinder head cover (2). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.

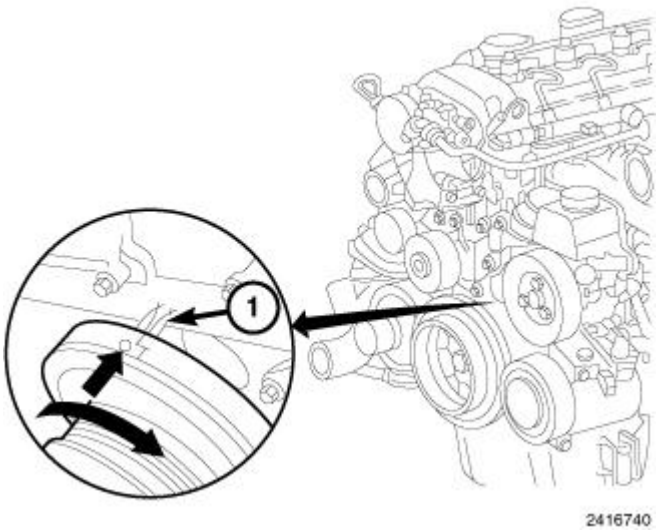

Fig. 62: Aligning Timing Mark
Courtesy of CHRYSLER LLC

NOTE: Rotate engine by the crankshaft bolt in a clockwise direction. DO NOT rotate the engine using the camshaft sprocket bolt.

NOTE: DO NOT rotate the engine backwards (counter clockwise).

26. Position piston of cylinder #1 to ignition TDC. **Markings on the camshaft bearing cap must be aligned.**

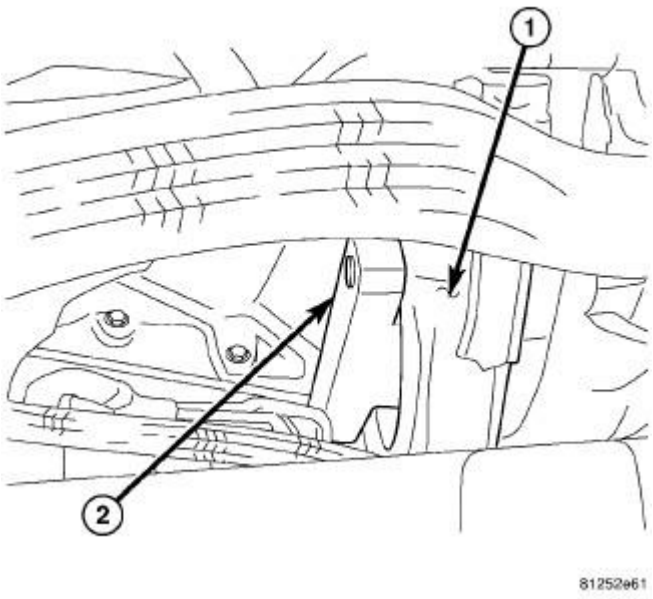

Fig. 63: Crankshaft Lock 8933
Courtesy of CHRYSLER LLC

27. Install Crankshaft Lock 8933 (2) into the engine block (1)

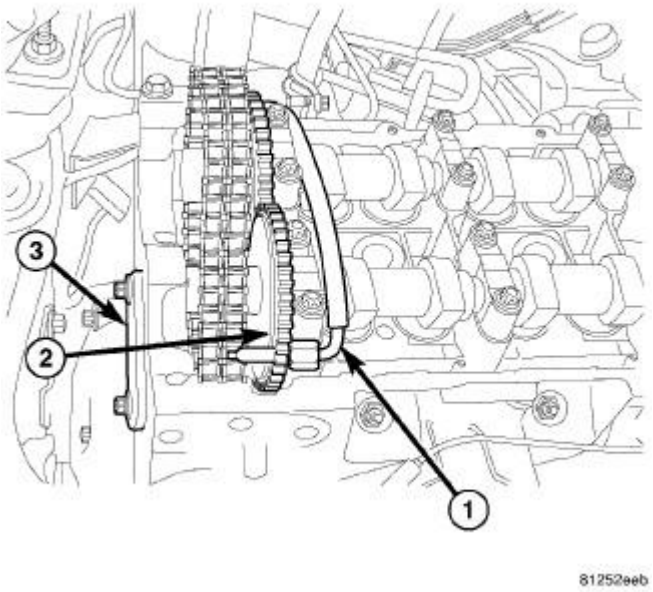

Fig. 64: Special Tool #8929
Courtesy of CHRYSLER LLC

28. Install Camshaft Locking Pins 8929 (1) into cylinder head and intake camshaft sprocket (2). See **Fig. 64**.

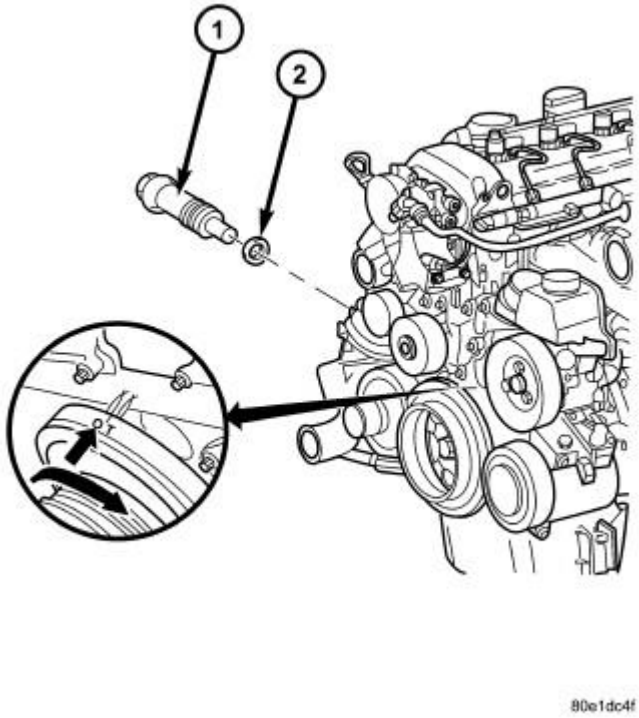

Fig. 65: Timing Chain Tensioner - Typical
Courtesy of CHRYSLER LLC

29. Remove right upper engine mount.
30. Remove right engine mount bracket from cylinder head.
31. Mark timing chain and sprockets with paint.
32. Remove timing chain tensioner (1). See **Engine/Valve Timing/CHAIN, Timing - Removal**.

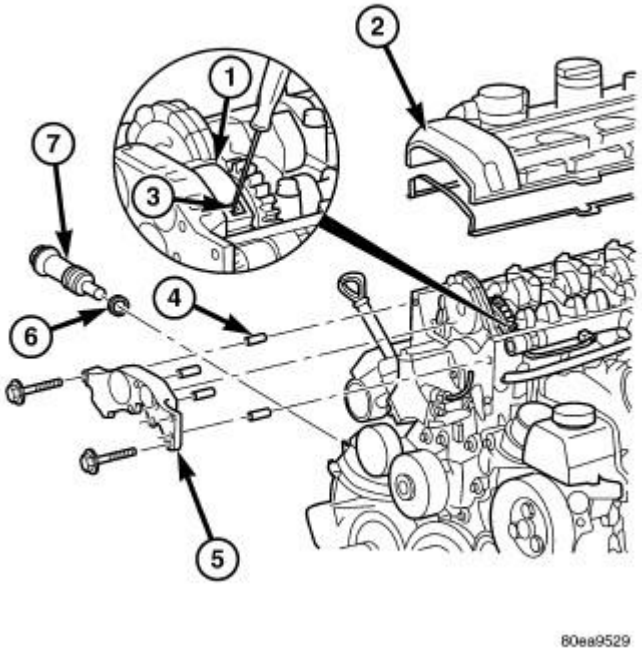

Fig. 66: Cylinder Head Front Cover - Typical
Courtesy of CHRYSLER LLC

33. Remove cylinder head front cover (5). See **Engine/Cylinder Head - Removal**.
34. Remove top guide rail (1). See **Engine/Valve Timing/CHAIN, Timing - Removal**.
35. Remove high pressure pump. Refer to **Fuel System/Fuel Delivery/PUMP, Fuel Injection - Removal** .
36. Remove vacuum pump. See **Engine/Engine Block/PUMP, Vacuum - Removal**.
37. Remove camshafts. See **Engine/Cylinder Head/CAMSHAFT, Engine - Removal**.

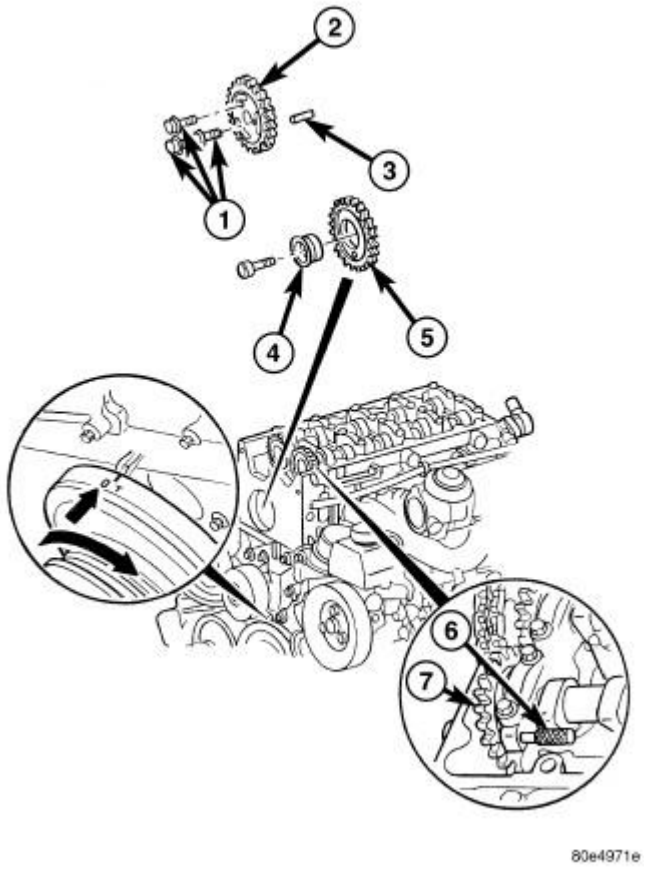

Fig. 67: Intermediate Gear
Courtesy of CHRYSLER LLC

38. Remove intermediate gear (5). See **Engine/Valve Timing/CHAIN, Timing - Removal**.
39. Unbolt oil dip stick tube, ground, and electrical connectors from cylinder head.
40. Disconnect EGR valve to mixing chamber pipe at EGR valve.
41. Remove upper timing case to cylinder head bolts.

NOTE: Loosen cylinder head bolts in the reverse order of the tightening sequence. See Fig. 68.

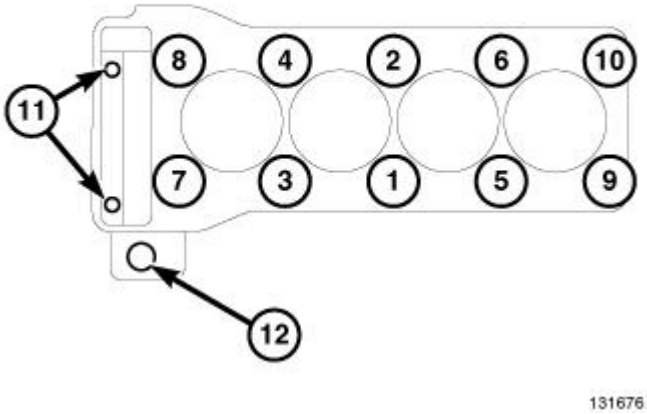

Fig. 68: Cylinder Head Bolt Torque Sequence
Courtesy of CHRYSLER LLC

42. Remove cylinder head bolts in reverse order of the tightening sequence and inspect bolts. See **Fig. 68**. See **Engine/Cylinder Head - Standard Procedure**.
43. Remove cylinder head assembly from engine.
44. Disassemble cylinder head assembly as necessary for service.

CYLINDER HEAD FRONT COVER

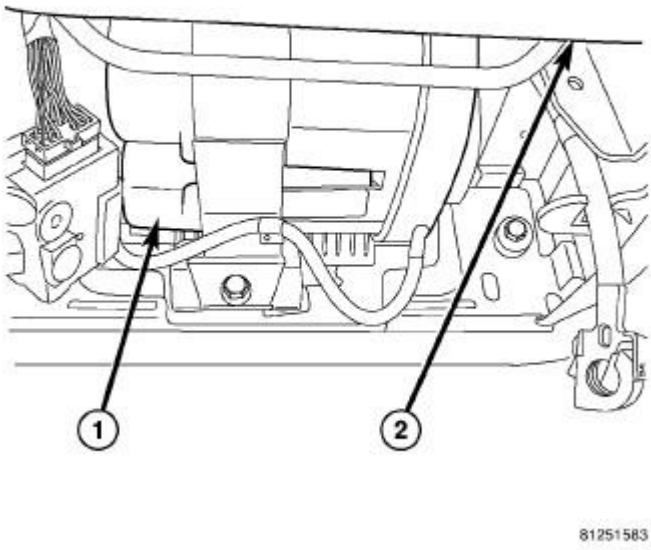

Fig. 69: Battery Location
Courtesy of CHRYSLER LLC

1 - BATTERY 2 - PASSENGER SEAT

1. Disconnect negative battery (1) cable located under passenger seat.

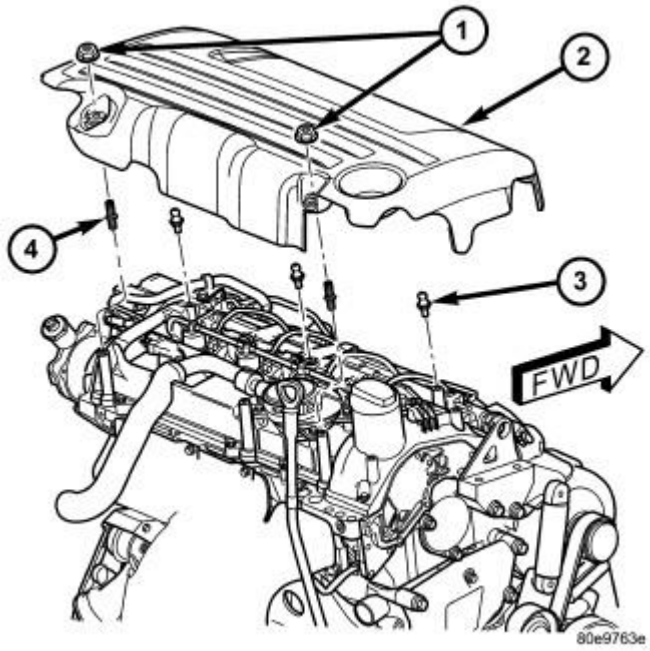

Fig. 70: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1 - ENGINE COVER RETAINING NUTS 2 - ENGINE COVER 3 - ENGINE COVER MOUNTS 4 - ENGINE COVER MOUNTING STUDS

2. Remove engine cover (2). See **Engine - Removal**.

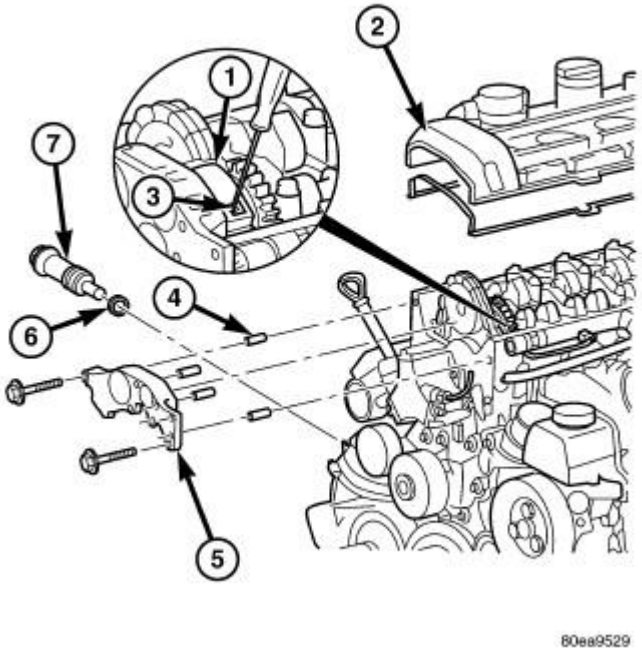

Fig. 71: Cylinder Head Front Cover - Typical
Courtesy of CHRYSLER LLC

1 - TOP GUIDE RAIL
2 - CYLINDER HEAD COVER
3 - LOCKING PAWL
4 - DOWEL PIN
5 - CYLINDER HEAD FRONT COVER
6 - SEAL
7 - TIMING CHAIN TENSIONER

3. Remove cylinder head cover (2). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
4. Remove timing chain tensioner (7). See **Engine/Valve Timing/TENSIONER, Engine Timing - Removal**.
5. Remove bolts attaching front cover (5).

NOTE: Lower portion of front cover is sealed with RTV sealant. Carefully tug at front cover until it loosens from cylinder head.

6. Raise locking pawl (3) of top guide rail (1) and remove cylinder head front cover (5). See **Fig. 71**. .

NOTE: Dowel pins are use as a guide during assembly and must remain in the proper position to assure a good sealing surface.

CYLINDER HEAD GUIDE RAIL

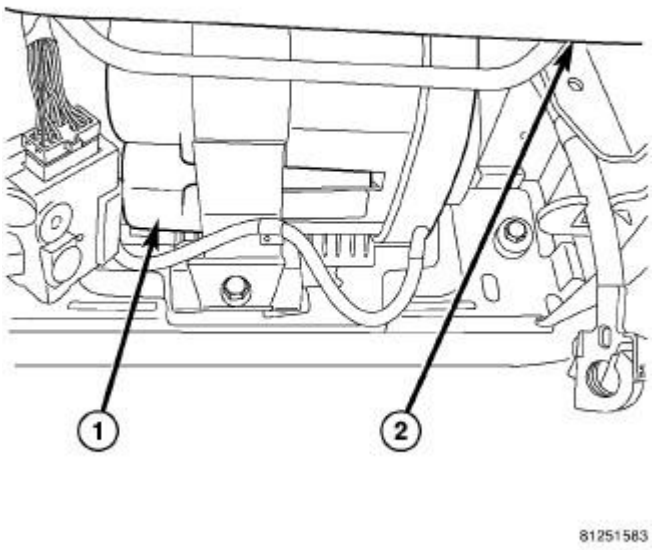

Fig. 72: Battery Location
Courtesy of CHRYSLER LLC

1 - BATTERY 2 - PASSENGER SEAT

1. Disconnect negative battery (1) cable located under passenger seat.

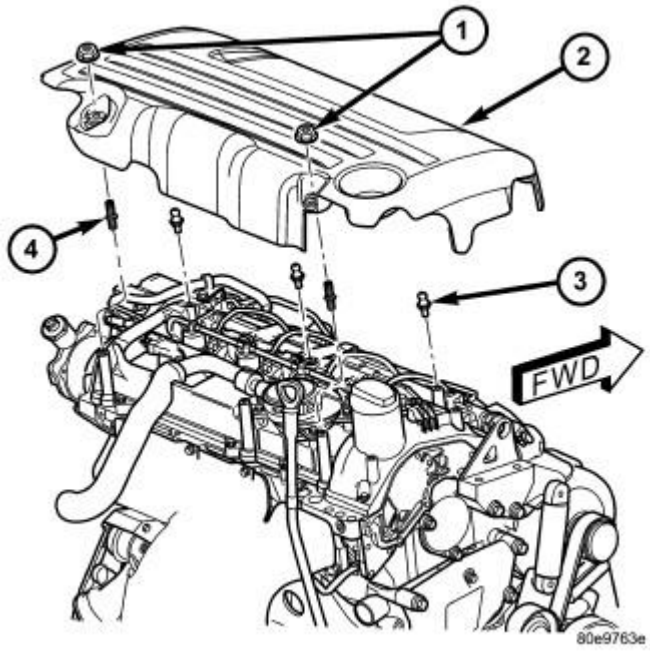

Fig. 73: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1 - ENGINE COVER RETAINING NUTS
2 - ENGINE COVER
3 - ENGINE COVER MOUNTS
4 - ENGINE COVER MOUNTING STUDS

2. Remove engine cover (2). See **Engine - Removal**.

CAUTION: Rotate engine at crankshaft only. DO NOT rotate the engine with the bolt of the camshaft sprocket. DO NOT rotate the engine back.

NOTE: Markings on the camshaft and camshaft bearing cap must be aligned.

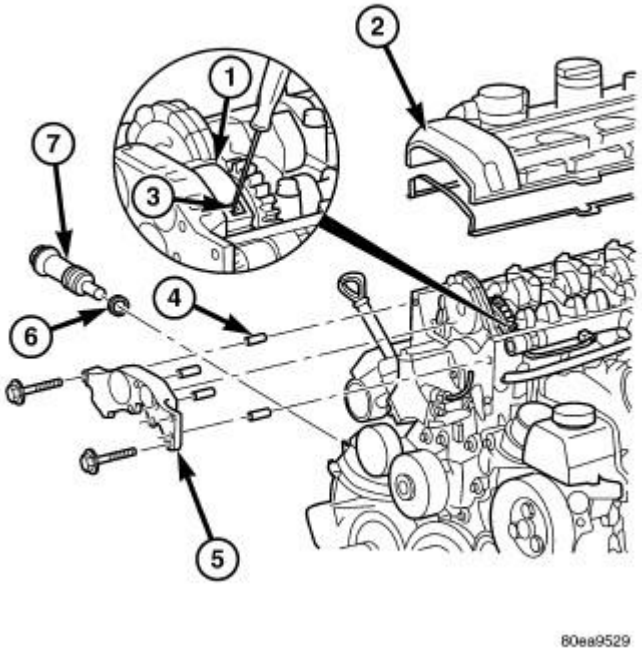

Fig. 74: Cylinder Head Front Cover - Typical
Courtesy of CHRYSLER LLC

1 - TOP GUIDE RAIL
2 - CYLINDER HEAD COVER
3 - LOCKING PAWL
4 - DOWEL PIN
5 - CYLINDER HEAD FRONT COVER
6 - SEAL
7 - TIMING CHAIN TENSIONER

3. Remove cylinder head cover (2). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
4. Remove timing chain tensioner (7). See **Engine/Valve Timing/CHAIN, Timing - Removal**.
5. Carefully raise locking pawl (3) of top slide rail (1) and remove cylinder head front cover (5) . See **Fig. 74** and see **Engine/Cylinder Head - Removal**.

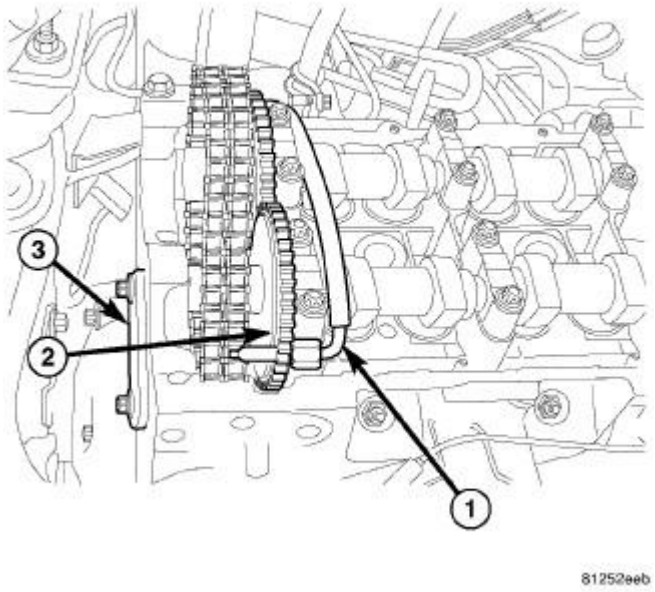

Fig. 75: Camshaft Locking Pin 8929
Courtesy of CHRYSLER LLC

1 - CAMSHAFT LOCKING PIN 8929
2 - INTAKE CAMSHAFT SPROCKET
3 - INTERMEDIATE GEAR COVER

6. Insert Camshaft Locking Pin 8929 through 1st camshaft bearing cap into the hole in the intake camshaft sprocket (2).
7. Counter hold the camshaft with an open end wrench to avoid damage and unbolt driver of inlet camshaft sprocket.

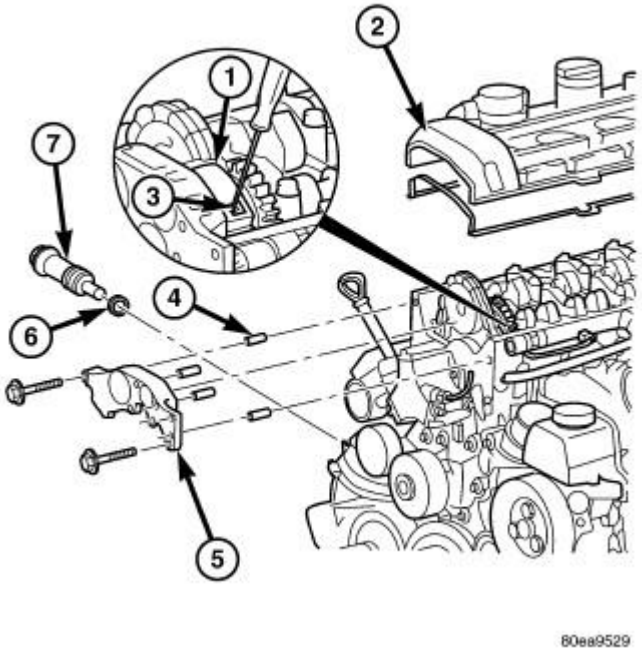

Fig. 76: Cylinder Head Front Cover - Typical
Courtesy of CHRYSLER LLC

1 - TOP GUIDE RAIL
2 - CYLINDER HEAD COVER
3 - LOCKING PAWL
4 - DOWEL PIN
5 - CYLINDER HEAD FRONT COVER
6 - SEAL
7 - TIMING CHAIN TENSIONER

8. Remove top guide rail (1).

CLEANING

CLEANING

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 **Engine - Standard Procedure**. Be careful not to gouge or scratch the aluminum head sealing surface.

Clean all engine oil passages.

INSTALLATION

CYLINDER HEAD

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.

NOTE: Check facing cylinder head contact surface.

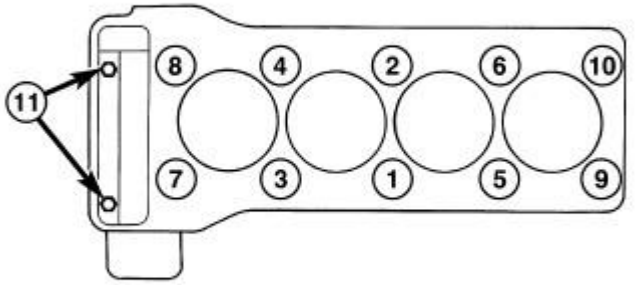

Fig. 77: Cylinder Head Bolt Torque Sequence
Courtesy of CHRYSLER LLC

1. Position the cylinder head and gasket properly on engine using the dowel pins as guide.

   NOTE: Inspect all cylinder head bolts for defects and stretching before installation. See Engine/Cylinder Head - Standard Procedure.

   The M12 cylinder head bolts must be torqued in 3 stages.

2. Install cylinder head assembly on engine block.

3. Install M12 cylinder head bolts finger tight.
4. Torque bolts in numeric order starting with number 1 to 60 N.m (44 lbs. in.). See **Fig. 77**.
5. Install M8 timing chain cover to cylinder head bolts. Tighten to 20N.m (177 lbs. in.).
6. Tighten M12 cylinder head bolts in numeric order starting with number 1 an additional 90°. See **Fig. 77**.

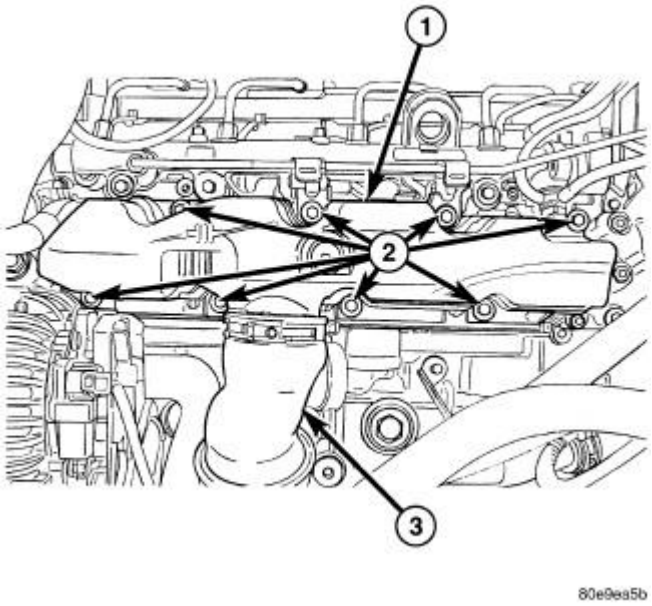

Fig. 78: Intake Manifold
Courtesy of CHRYSLER LLC

1 - INTAKE MANIFOLD
2 - INTAKE MANIFOLD RETAINING BOLTS
3 - INTAKE INLET HOSE

7. Connect vacuum hose at turbocharger waste gate solenoid.
8. Connect intake manifold inlet tube (3) at intake manifold (1).
9. Connect EGR valve to mixing chamber pipe at EGR valve.
10. Connect oil dip stick tube. Tighten to 14 N.m (124 lbs. in.).

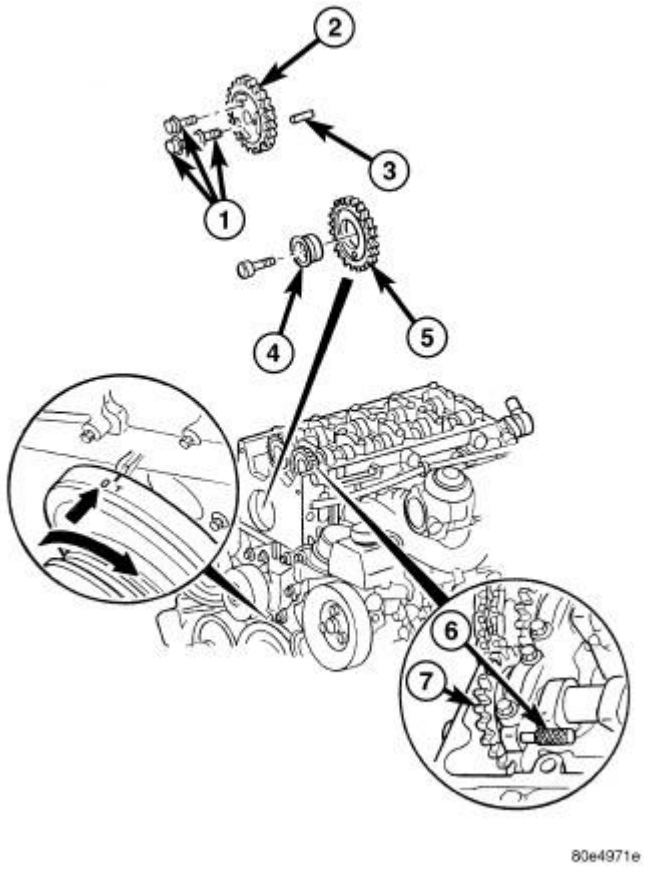

Fig. 79: Intermediate Gear
Courtesy of CHRYSLER LLC

1 - CAMSHAFT SPROCKET BOLTS
2 - INTAKE CAMSHAFT
3 - DOWEL PIN
4 - INTERMEDIATE GEAR BUSHING
5 - INTERMEDIATE GEAR
6 - CAMSHAFT LOCKING PIN
7 - INTAKE CAMSHAFT SPROCKET

11. Install intermediate timing chain gear (5). See **Engine/Valve Timing/CHAIN, Timing - Installation**.
12. Install camshafts. See **Engine/Cylinder Head/CAMSHAFT, Engine - Installation**.
13. Install vacuum pump. See **Engine/Engine Block/PUMP, Vacuum - Installation**.
14. Install high pressure pump. Refer to **Fuel System/Fuel Delivery/PUMP, Fuel Injection - Installation** .

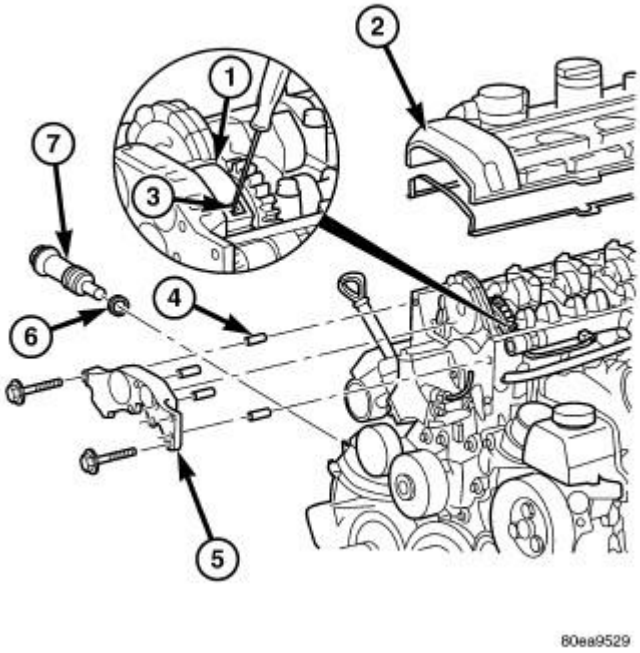

Fig. 80: Cylinder Head Front Cover - Typical
Courtesy of CHRYSLER LLC

1 - TOP GUIDE RAIL
2 - CYLINDER HEAD COVER
3 - LOCKING PAWL
4 - DOWEL PIN
5 - CYLINDER HEAD FRONT COVER
6 - SEAL
7 - TIMING CHAIN TENSIONER

15. Install cylinder head front cover (5) and top guide rail (1). See **Engine/Cylinder Head - Installation**.

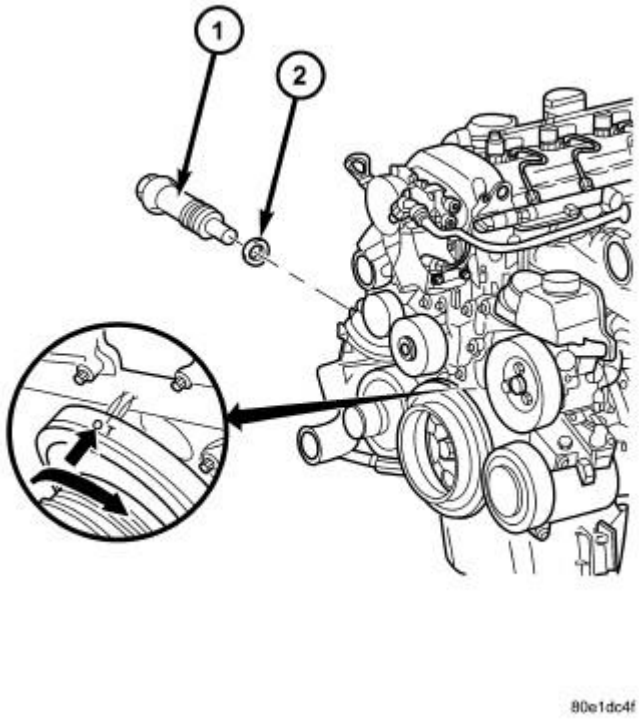

Fig. 81: TIMING CHAIN TENSIONER - TYPICAL
Courtesy of CHRYSLER LLC

1 - TIMING CHAIN TENSIONER 2 - TIMING CHAIN TENSIONER SEAL

16. Install timing chain tensioner (1) with new seal (2). See **Engine/Valve Timing/CHAIN, Timing - Installation**. Tighten to 80N.m (59 lbs. ft.).

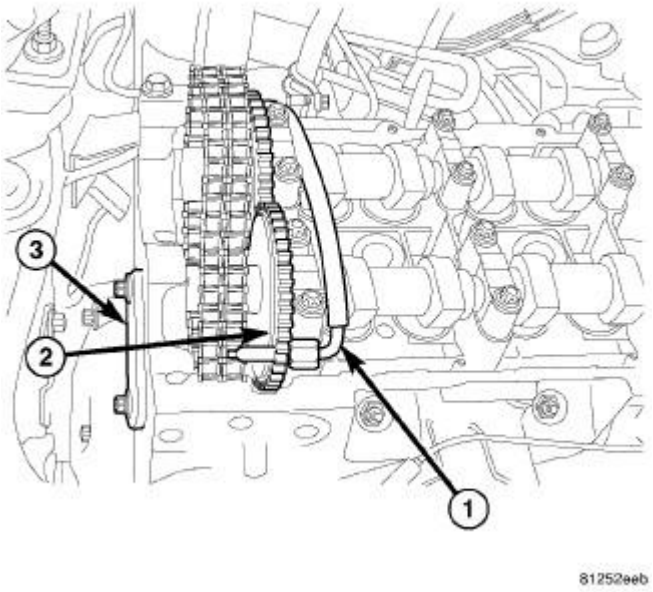

Fig. 82: Special Tool #8929
Courtesy of CHRYSLER LLC

17. Remove Camshaft Locking Pin 8929 (1).

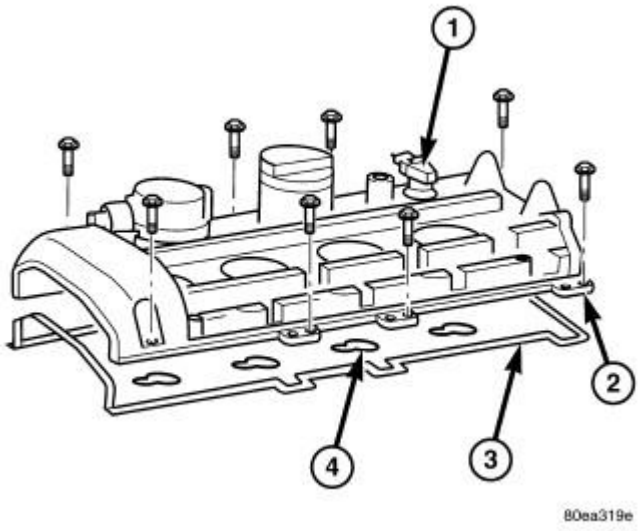

Fig. 83: Cylinder Head Cover - Typical
Courtesy of CHRYSLER LLC

1 - CAMSHAFT POSITION (CMP) SENSOR
2 - CYLINDER HEAD COVER
3 - CYLINDER HEAD COVER GASKET

4 - INJECTOR BORE SEALS

18. Install cylinder head cover (2). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.
19. camshaft position sensor connector (1).

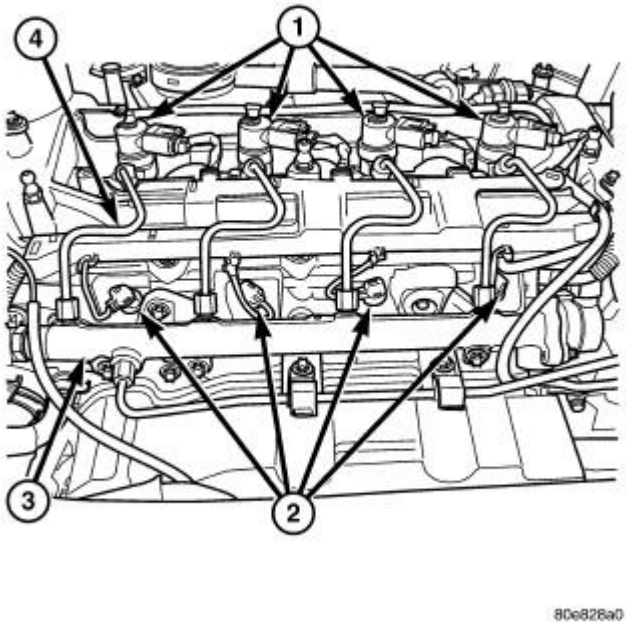

Fig. 84: Fuel Injector and Glow Plug Locations
Courtesy of CHRYSLER LLC

1 - FUEL INJECTORS
2 - GLOW PLUGS
3 - FUEL RAIL
4 - HIGH PRESSURE FUEL LINE

20. Reposition engine electrical harness and connect the fuel injector (1), glow plug (2), and coolant temperature electrical connectors.

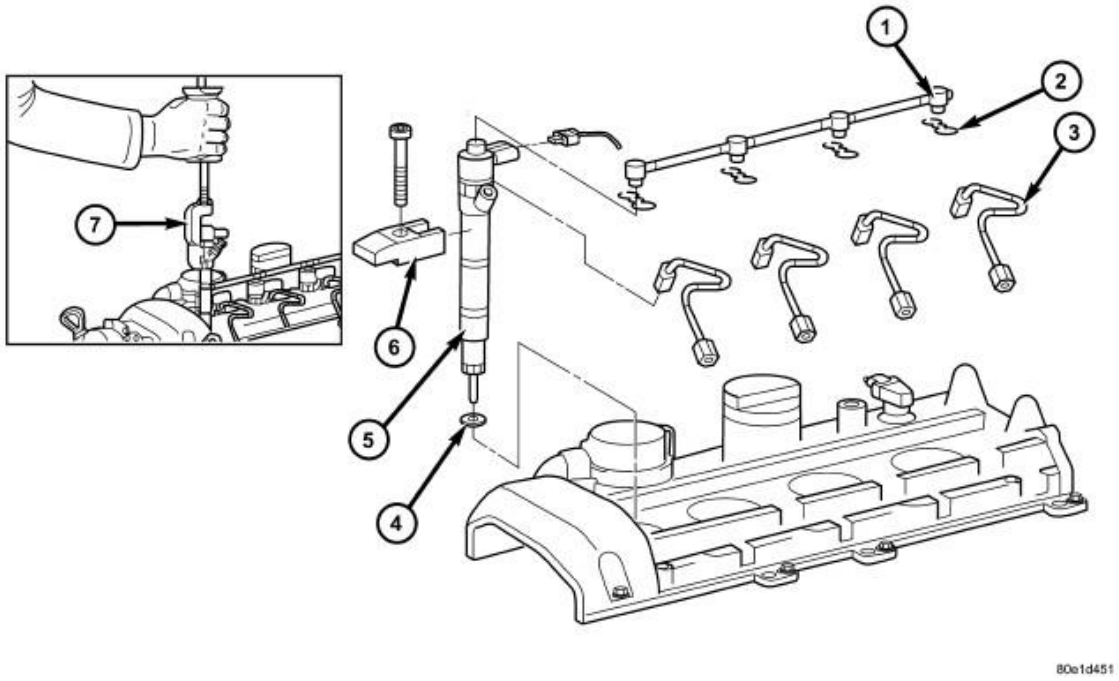

Fig. 85: FUEL INJECTOR REMOVAL/INSTALLATION - TYPICAL
Courtesy of CHRYSLER LLC

1 - INJECTOR DRAIN TUBES
2 - RETAINING CLIP
3 - INJECTOR HIGH PRESSURE LINE
4 - INJECTOR SEAL
5 - FUEL INJECTOR
6 - TENSIONING CLAW
7 - SPECIAL TOOLS #8938 AND #8937

21. Install fuel injectors (5) and high pressure lines (3).

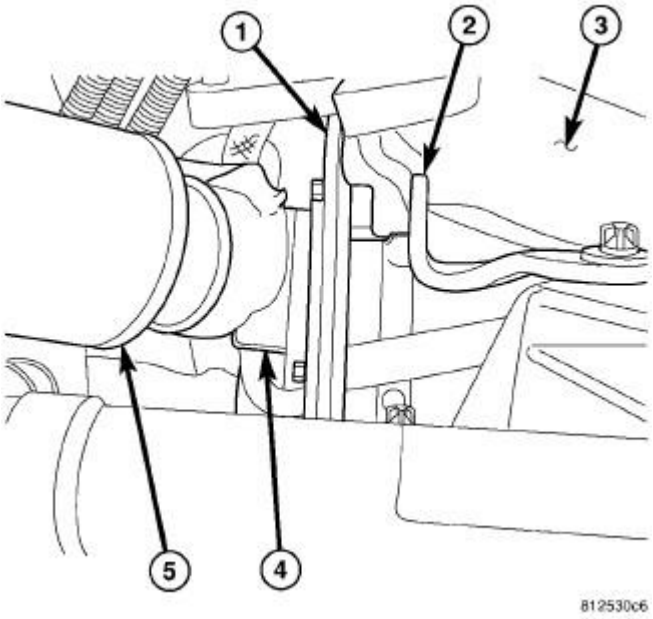

Fig. 86: Turbo Support Bracket
Courtesy of CHRYSLER LLC

22. Raise vehicle on hoist.
23. Install turbocharger support bracket (1). Tighten bolts to 30N.m (22 lbs. ft.).
24. Install oil return flow line at turbocharger.

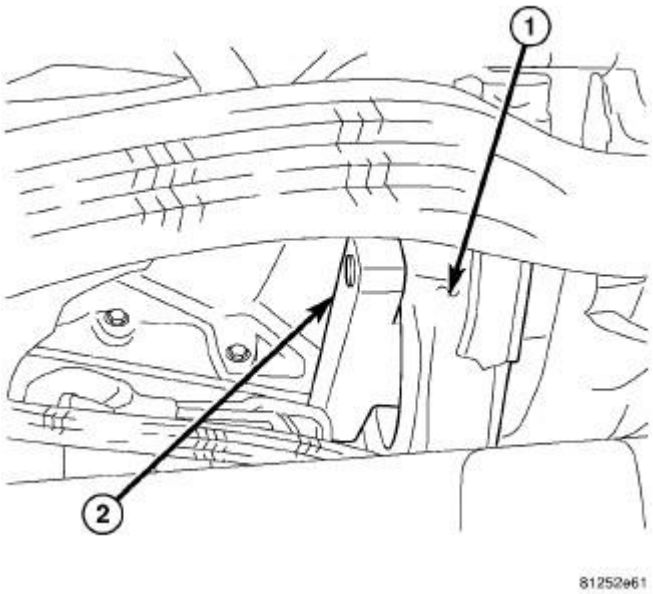

Fig. 87: Crankshaft Lock 8933

Courtesy of CHRYSLER LLC

25. Remove Crankshaft Lock 8933 (2).
26. Install starter.
27. Install charge air distribution pipe.

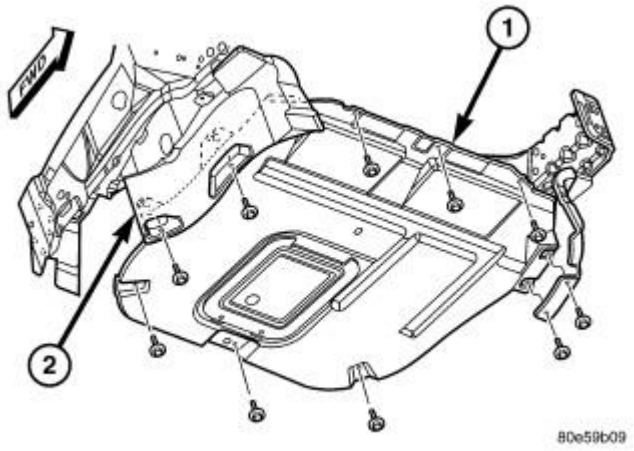

Fig. 88: Engine Compartment Lower Silencer
Courtesy of CHRYSLER LLC

28. Install engine compartment lower silencer (1) and accessory drive belt splash shield (2).
29. Lower vehicle.

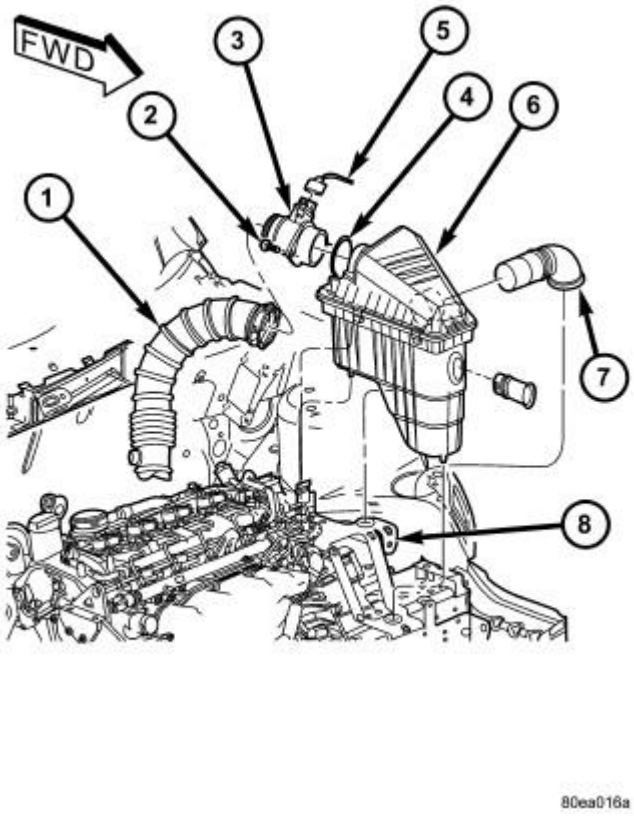

Fig. 89: Air Cleaner Housing Assembly
Courtesy of CHRYSLER LLC

1 - TURBOCHARGER INLET HOSE
2 - MAF SENSOR RETAINING BOLT
3 - MAF SENSOR
4 - O-RING
5 - MAF SENSOR ELECTRICAL CONNECTOR
6 - AIR CLEANER ASSEMBLY
7 - INLET DUCT
8 - AIR CLEANER HOUSING ASSEMBLY BRACKET

30. Install air cleaner housing (6) and turbocharger air intake hose (1).
31. Install coolant recovery pressure container.
32. Connect upper radiator hose to thermostat housing.
33. Install radiator closure panel. Refer to **Body/Exterior/CROSSMEMBER, Radiator - Installation** .

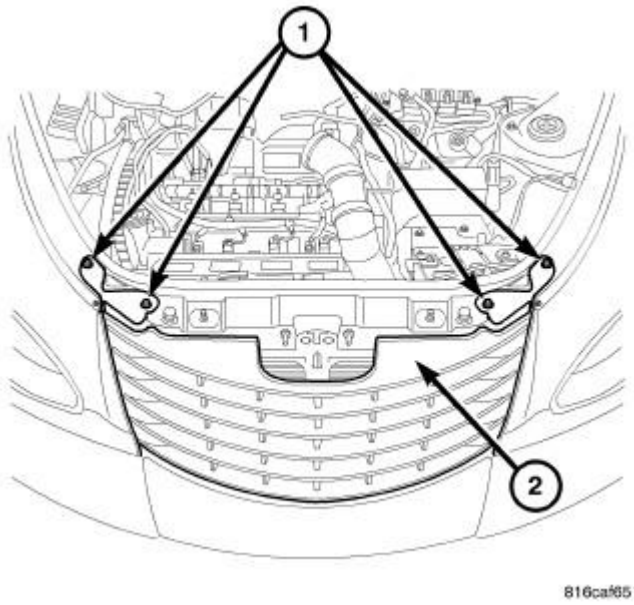

Fig. 90: GRILL REMOVAL
Courtesy of CHRYSLER LLC

34. Install front grille assembly (2). Refer to **Body/Exterior/GRILLE - Installation** .
35. Refill cooling system with proper coolant mixture to proper level. Refer to **SYSTEM FILLING - DIESEL ENGINE** .

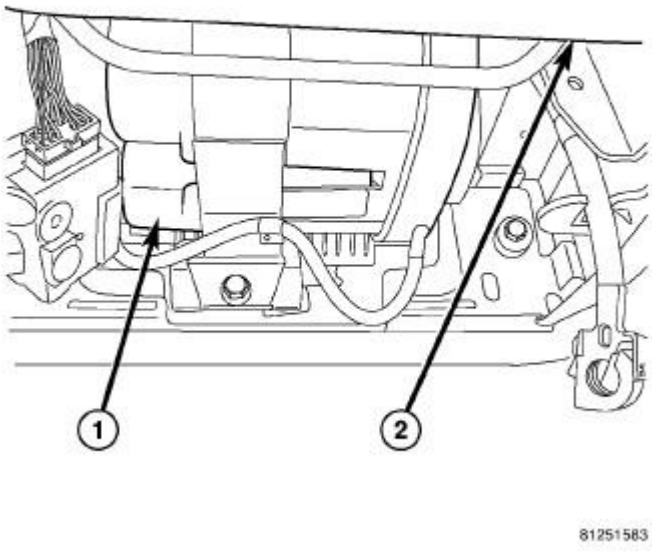

Fig. 91: Battery Location
Courtesy of CHRYSLER LLC

36. Connect negative battery (1) cable located under passenger seat.

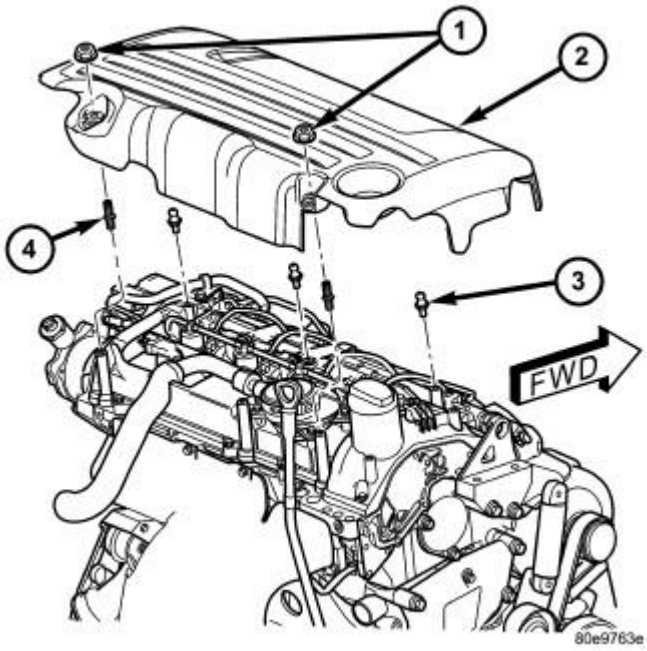

Fig. 92: Engine Cover Mounts
Courtesy of CHRYSLER LLC

37. Start engine and inspect for leaks.
38. Install engine cover (2). See **Engine - Installation**.

CYLINDER HEAD FRONT COVER

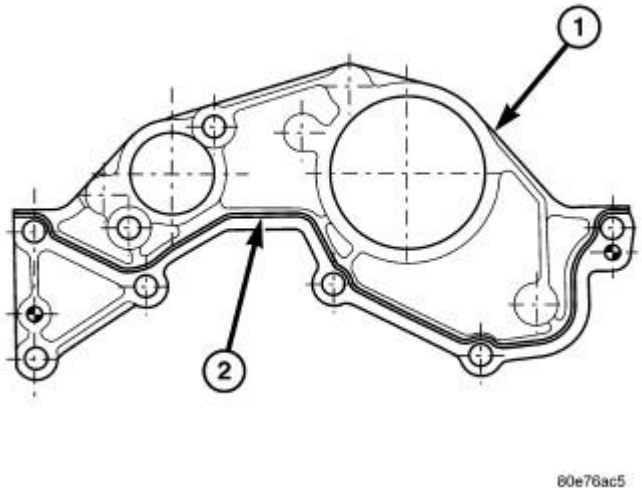

Fig. 93: Cylinder Head Cover Sealing Surface
Courtesy of CHRYSLER LLC

1 - CYLINDER HEAD FRONT COVER 2 - SEALANT BEAD

NOTE: Thoroughly clean all mating surfaces with appropriate solvents to assure that no grease or oil is present during reassembly.

NOTE: Dowel pins are used as a guide during assembly and must remain in the proper position to assure a good sealing surface.

1. Apply sealant to the marked surfaces with a bead thickness of 1.5 ± 0.5 mm. See **Fig. 93**.

NOTE: Install front cover of cylinder head within 10 minutes after applying sealant. Do not spread sealing bead.

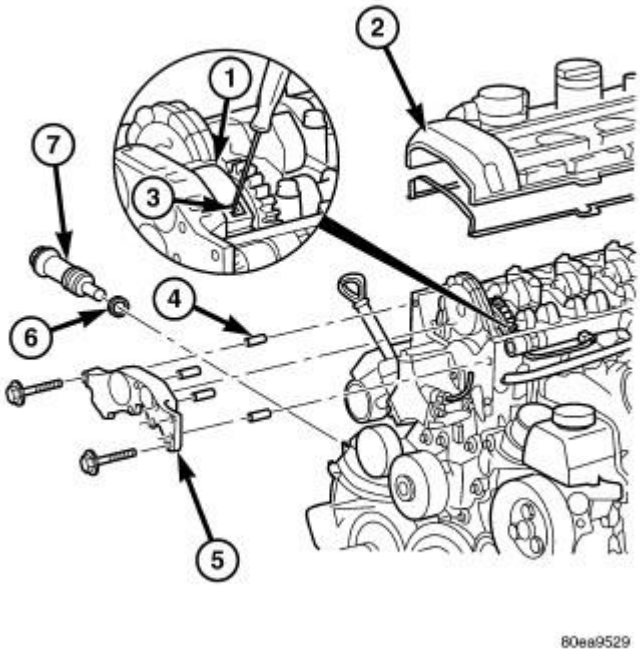

Fig. 94: Cylinder Head Front Cover - Typical
Courtesy of CHRYSLER LLC

1 - TOP GUIDE RAIL 2 - CYLINDER HEAD COVER 3 - LOCKING PAWL

4 - DOWEL PIN 5 - CYLINDER HEAD FRONT COVER 6 - SEAL 7 - TIMING CHAIN TENSIONER

2. Raise locking pawl (3) of top guide rail and guide front cover (5) onto guide pins.
3. Install bolts attaching front cover (5). See **Fig. 94**. Tighten bolts to 14N.m (124 lbs. in.).

NOTE: Timing chain tensioner must be installed with a new seal.

4. Install timing chain tensioner (7) and new seal (6). See **Engine/Valve Timing/CHAIN, Timing - Installation**.

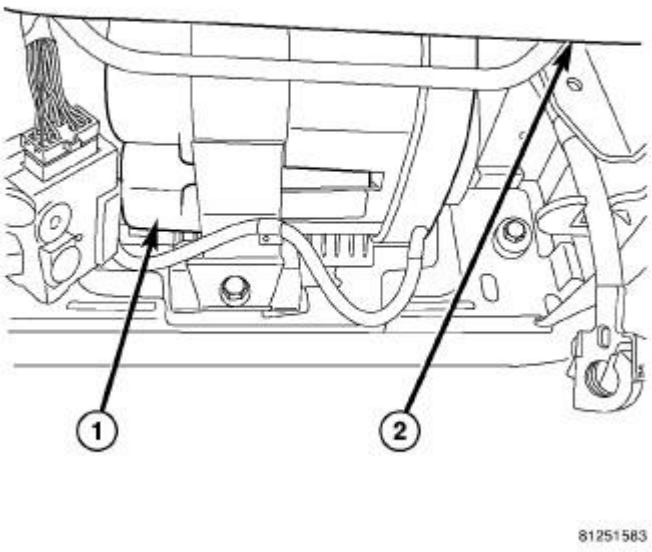

Fig. 95: Battery Location
Courtesy of CHRYSLER LLC

1 - BATTERY 2 - PASSENGER SEAT

5. Connect negative battery (1) cable located under passenger seat.

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.

6. Start the engine and inspect for leaks.

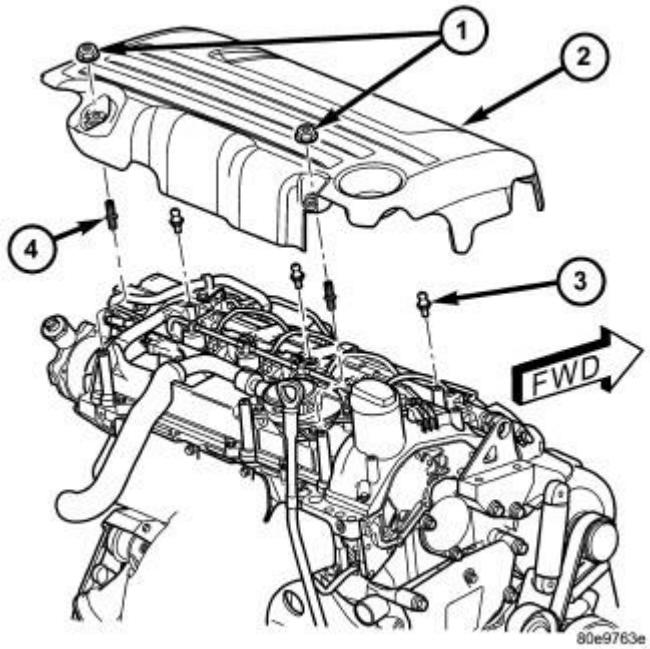

Fig. 96: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1 - ENGINE COVER RETAINING NUTS
2 - ENGINE COVER
3 - ENGINE COVER MOUNTS
4 - ENGINE COVER MOUNTING STUDS

7. Install engine cover (2). See **Engine - Installation**.

CYLINDER HEAD GUIDE RAIL

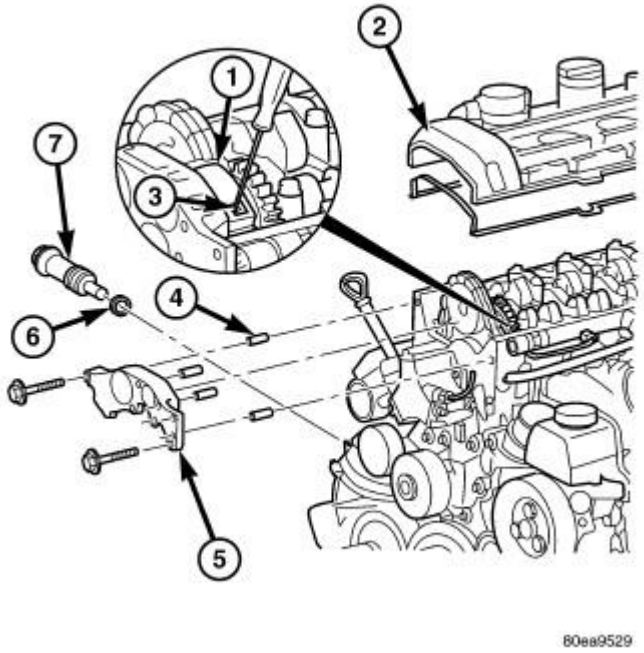

Fig. 97: Cylinder Head Front Cover - Typical
Courtesy of CHRYSLER LLC

1 - TOP GUIDE RAIL
2 - CYLINDER HEAD COVER
3 - LOCKING PAWL
4 - DOWEL PIN
5 - CYLINDER HEAD FRONT COVER
6 - SEAL
7 - TIMING CHAIN TENSIONER

1. Carefully position the top guide rail (1) onto the dowel pins (4).
2. Counter hold the camshaft with an open end wrench and install driver of inlet camshaft sprocket. Tight bolt to 50N.m (37 lbs. ft.).
3. Carefully raise locking pawl (3) of top guide rail (1) and install cylinder head front cover . See **Fig. 97**. See **Engine/Cylinder Head - Installation**.
4. Install timing chain tensioner (7) with new seal (6). See **Engine/Valve Timing/CHAIN, Timing - Installation**.
5. Install cylinder head cover (2). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.

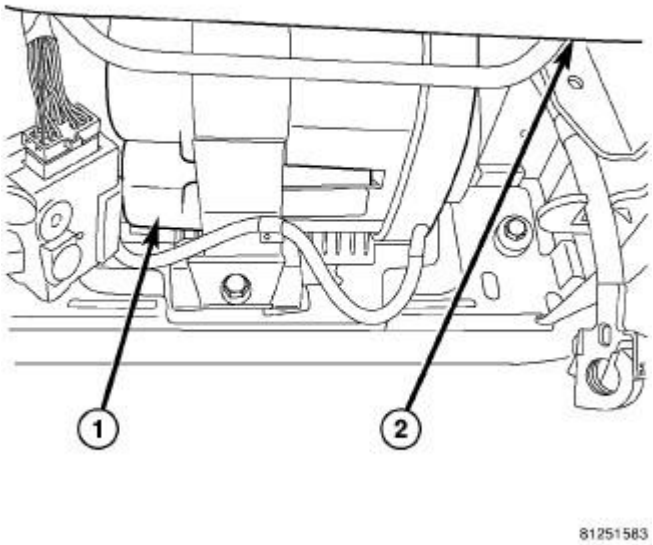

Fig. 98: Battery Location
Courtesy of CHRYSLER LLC

1 - BATTERY 2 - PASSENGER SEAT

6. Reconnect negative battery (1) cable.

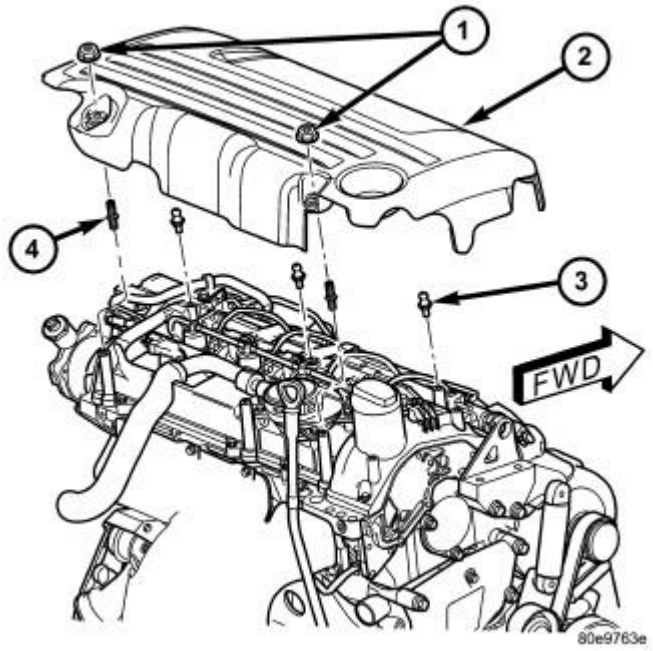

Fig. 99: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1 - ENGINE COVER RETAINING NUTS
2 - ENGINE COVER
3 - ENGINE COVER MOUNTS
4 - ENGINE COVER MOUNTING STUDS

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.

7. Start engine and inspect for leaks.
8. Install engine cover (2). See **Engine - Installation**.

CAMSHAFT, ENGINE

Standard Procedure

CHECKING CAMSHAFT POSITION

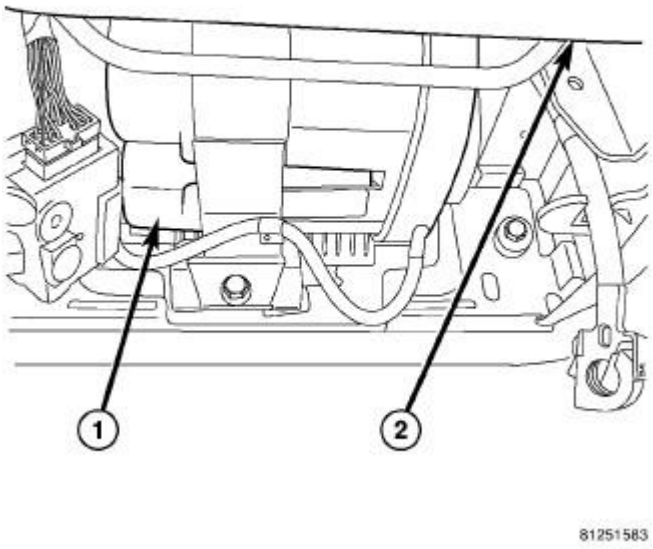

Fig. 100: Battery Location
Courtesy of CHRYSLER LLC

1 - BATTERY
2 - PASSENGER SEAT

1. Disconnect negative battery (1) cable.
2. Remove engine cover. See **Engine - Removal**.

WARNING: No fire, sparks, or smoking. Risk of poisoning from inhaling and swallowing fuel as well as risk of injury to eyes and skin from contact with fuel. Pour fuel only into suitable and marked containers. Wear protective clothing when handling fuel.

3. Remove injectors. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Removal** .
4. Clean injectors and recesses. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Standard Procedure** .

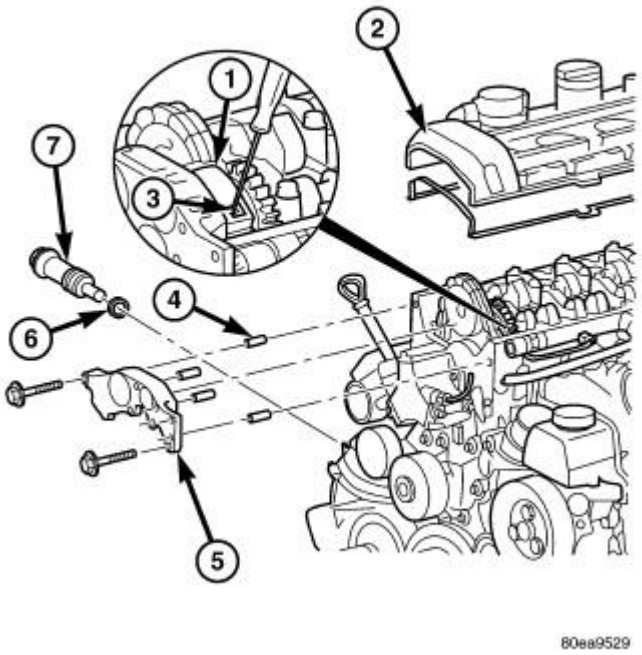

Fig. 101: Cylinder Head Front Cover - Typical
Courtesy of CHRYSLER LLC

1 - TOP GUIDE RAIL
2 - CYLINDER HEAD COVER
3 - LOCKING PAWL
4 - DOWEL PIN
5 - CYLINDER HEAD FRONT COVER
6 - SEAL
7 - TIMING CHAIN TENSIONER

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

NOTE: Rotate engine at crankshaft only. DO NOT crank engine at the camshaft and DO NOT rotate the engine backward.

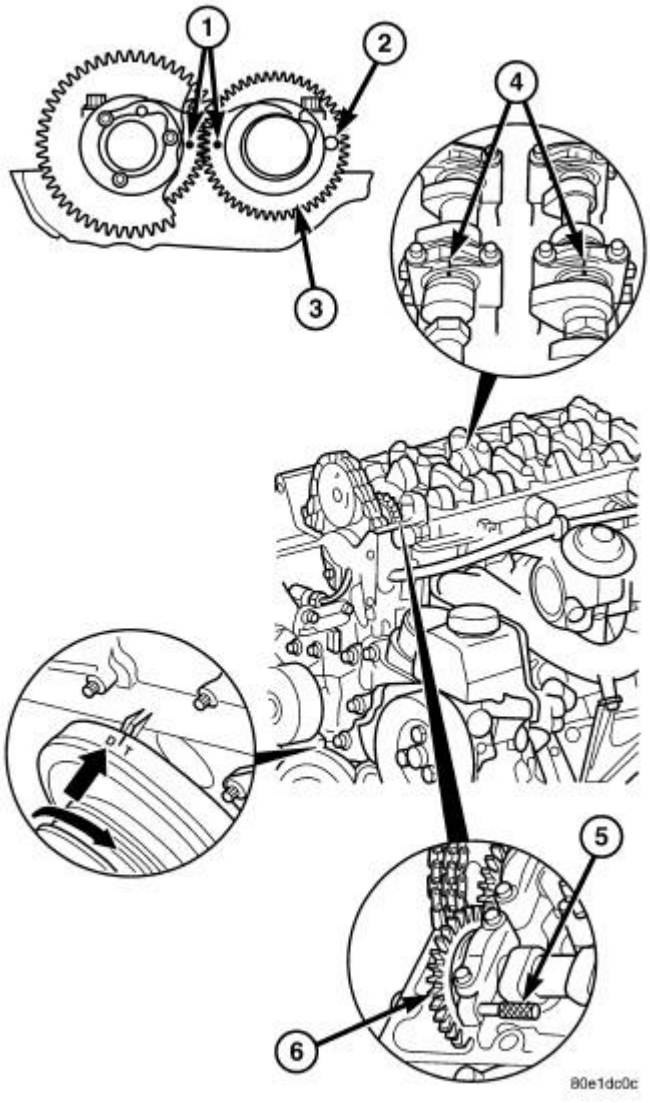

Fig. 102: Checking Camshaft Position - Typical
Courtesy of CHRYSLER LLC

1 - CAMSHAFT SPROCKET ALIGNMENT DOTS
2 - CAMSHAFT LOCK POSITION
3 - INTAKE CAMSHAFT SPROCKET
4 - CAMSHAFT AND BEARING CAP ALIGNMENT MARKS

5 - CAMSHAFT LOCKING PIN 8929
6 - INTAKE CAMSHAFT SPROCKET

6. Position piston of cylinder #1 to ignition TDC.
7. Insert the Camshaft Locking Pin 8929 (5) through first camshaft bearing cap into the hole in the left inlet camshaft sprocket. See **Fig. 102**.

NOTE: The two markings in the inlet camshaft sprockets (1) must be positioned opposite and markings of camshaft and camshaft bearing cap must be aligned. If not, perform basic position of camshafts.

8. Remove Camshaft Locking Pin 8929 (5) from camshaft bearing cap hole.

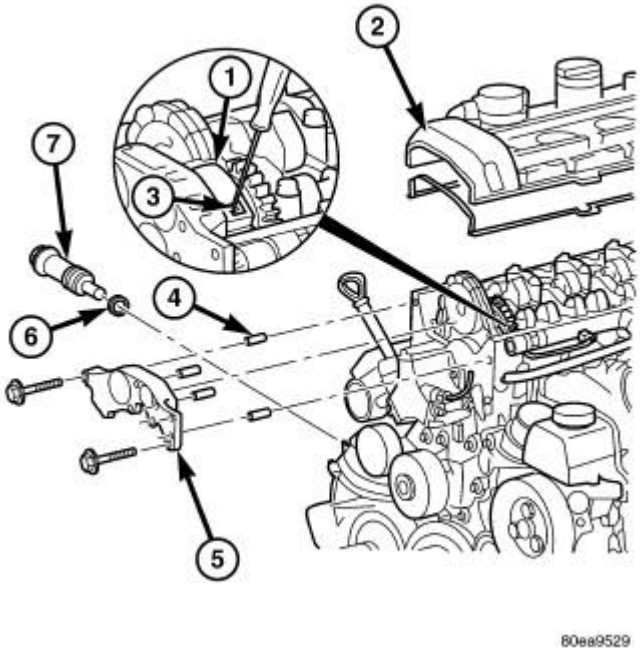

Fig. 103: Cylinder Head Front Cover - Typical
Courtesy of CHRYSLER LLC

1 - TOP GUIDE RAIL
2 - CYLINDER HEAD COVER
3 - LOCKING PAWL
4 - DOWEL PIN
5 - CYLINDER HEAD FRONT COVER
6 - SEAL
7 - TIMING CHAIN TENSIONER

9. Install cylinder head cover (2). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.
10. Install injectors. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Installation** .

WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do no wear loose clothing.

11. Start the engine and inspect for leaks.
12. Install engine cover.

Removal

REMOVAL

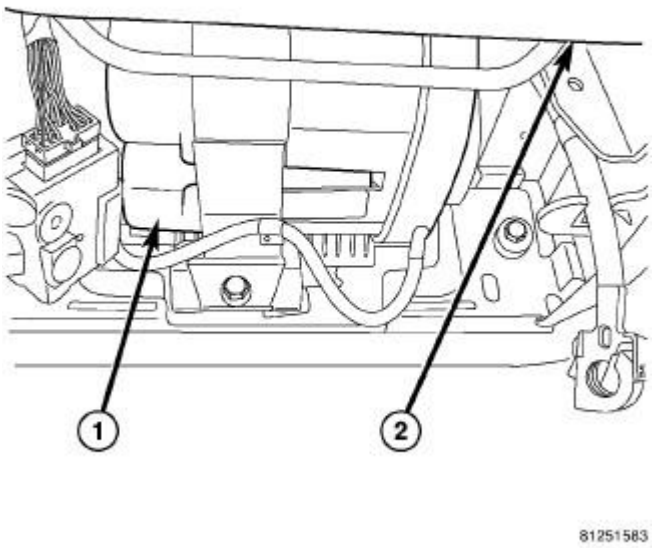

Fig. 104: Battery Location
Courtesy of CHRYSLER LLC

1 - BATTERY 2 - PASSENGER SEAT

1. Disconnect negative battery (1) cable located under the passenger seat.
2. Remove engine cover. See **Engine - Removal**.

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.

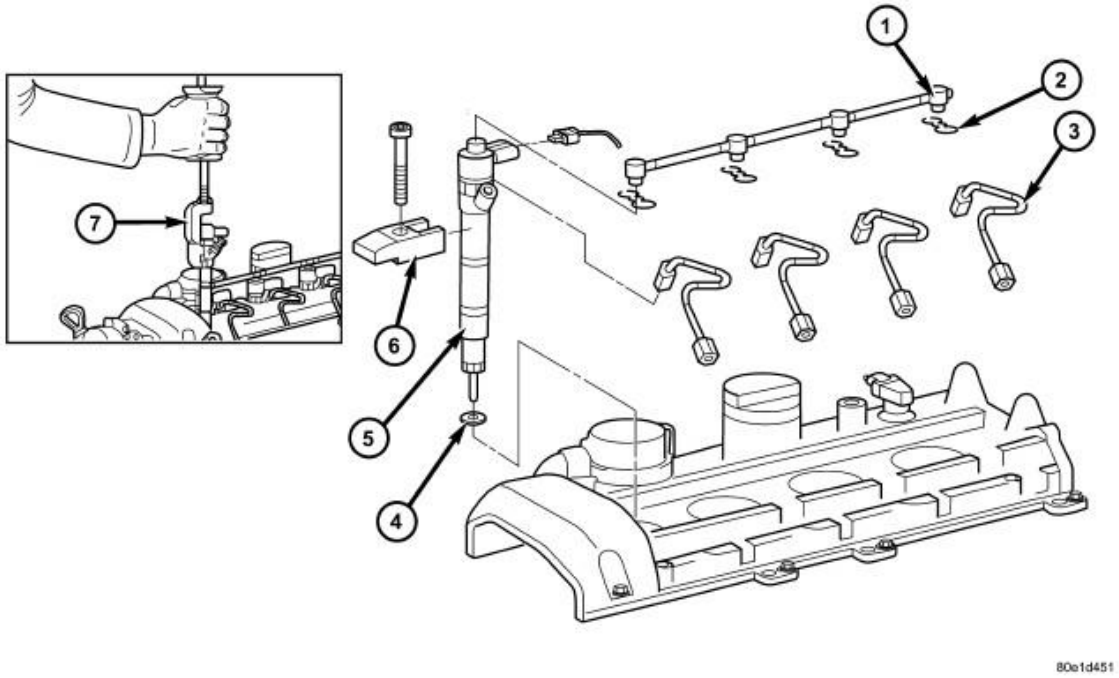

Fig. 105: FUEL INJECTOR REMOVAL/INSTALLATION - TYPICAL
Courtesy of CHRYSLER LLC

1 - INJECTOR DRAIN TUBES
2 - RETAINING CLIP
3 - INJECTOR HIGH PRESSURE LINE
4 - INJECTOR SEAL
5 - FUEL INJECTOR
6 - TENSIONING CLAW
7 - SPECIAL TOOLS #8938 AND #8937

3. Remove high pressure lines (3) and injectors (5). Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Removal** .
4. Remove cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.

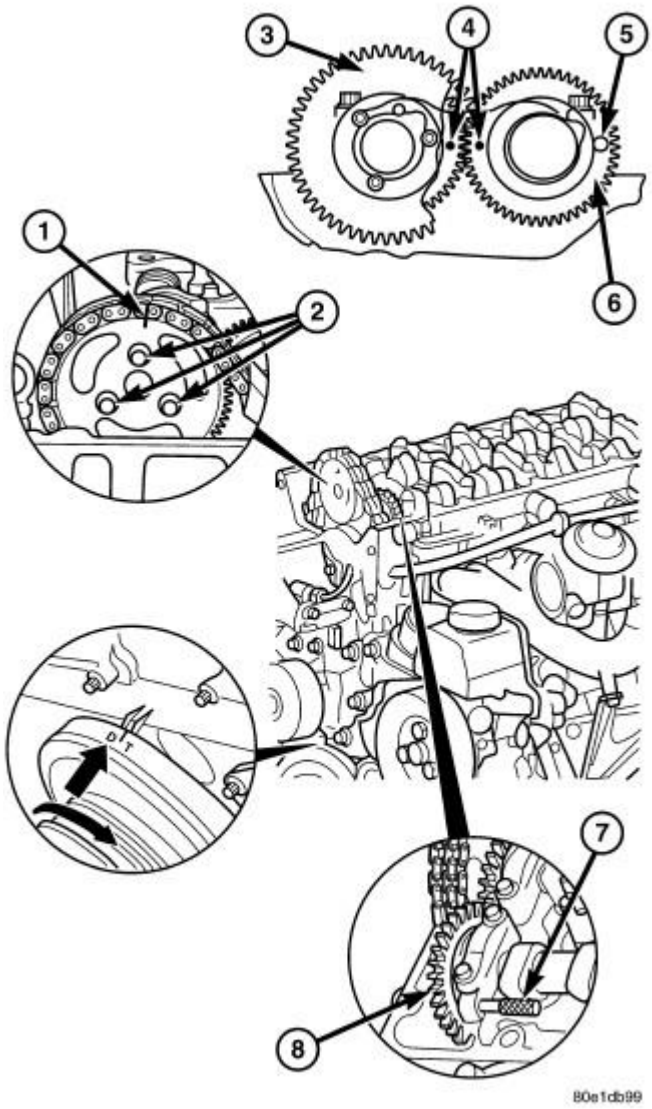

Fig. 106: Camshaft Alignment - Typical
Courtesy of CHRYSLER LLC

1 - EXHAUST CAMSHAFT SPROCKET AND CHAIN MARKING
2 - EXHAUST CAMSHAFT SPROCKET BOLTS
3 - EXHAUST CAMSHAFT SPROCKET
4 - CAMSHAFT ALIGNMENT DOTS
5 - INTAKE CAMSHAFT LOCK POSITION
6 - INTAKE CAMSHAFT SPROCKET
7 - CAMSHAFT LOCKING PIN 8929
8 - INTAKE CAMSHAFT SPROCKET

5. Position piston of cylinder #1 to ignition TDC. See **Fig. 106**.

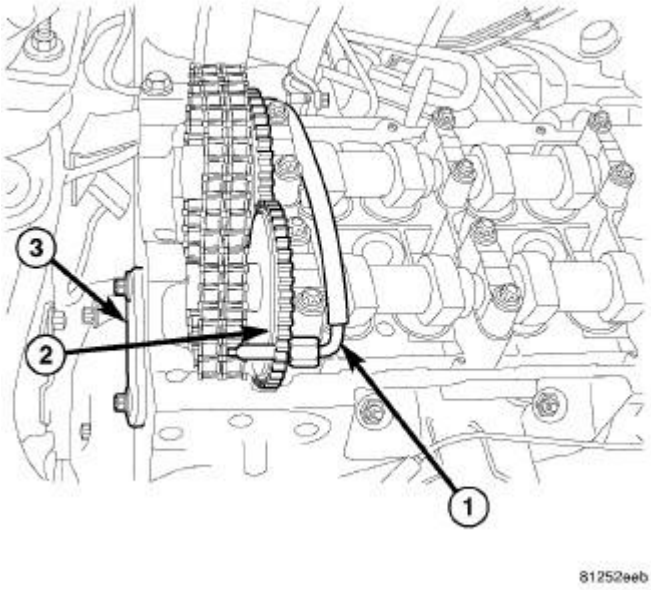

Fig. 107: Special Tool 8929-Camshaft Locking Pin
Courtesy of CHRYSLER LLC

1 - CAMSHAFT LOCKING PIN 8929
2 - INTAKE CAMSHAFT SPROCKET
3 - INTERMEDIATE GEAR COVER

6. Install Camshaft Locking Pin 8929 (1). See **Fig. 107**.
7. Remove starter and position out of the way.
8. Install Crankshaft Lock 8933.

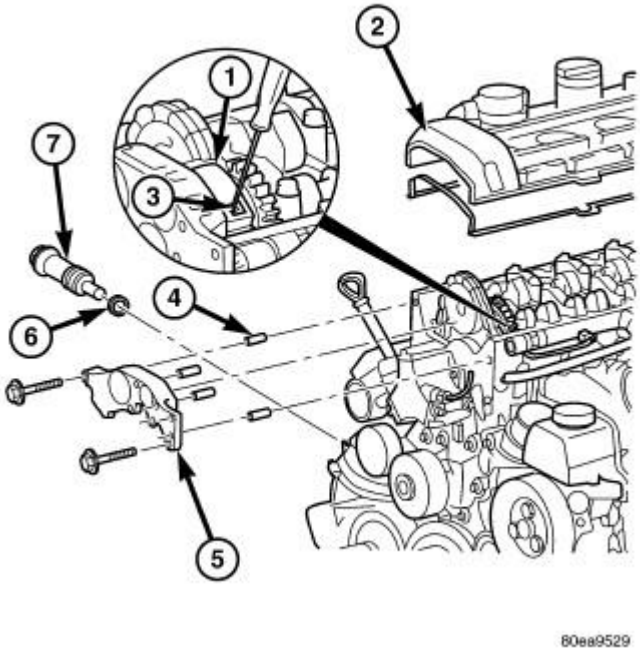

Fig. 108: Cylinder Head Front Cover - Typical
Courtesy of CHRYSLER LLC

1 - TOP GUIDE RAIL
2 - CYLINDER HEAD COVER
3 - LOCKING PAWL
4 - DOWEL PIN
5 - CYLINDER HEAD FRONT COVER
6 - SEAL
7 - TIMING CHAIN TENSIONER

9. Remove timing chain tensioner (7). See **Engine/Valve Timing/CHAIN, Timing - Removal**.

NOTE: The lower portion of the cylinder head front cover is sealed with RTV sealant. Carefully tug front cover after bolt removal to loosen from cylinder head.

10. Remove cylinder head front cover (5). See **Engine/Cylinder Head - Removal**.
11. Remove top side rail (1). See **Engine/Cylinder Head - Removal**.

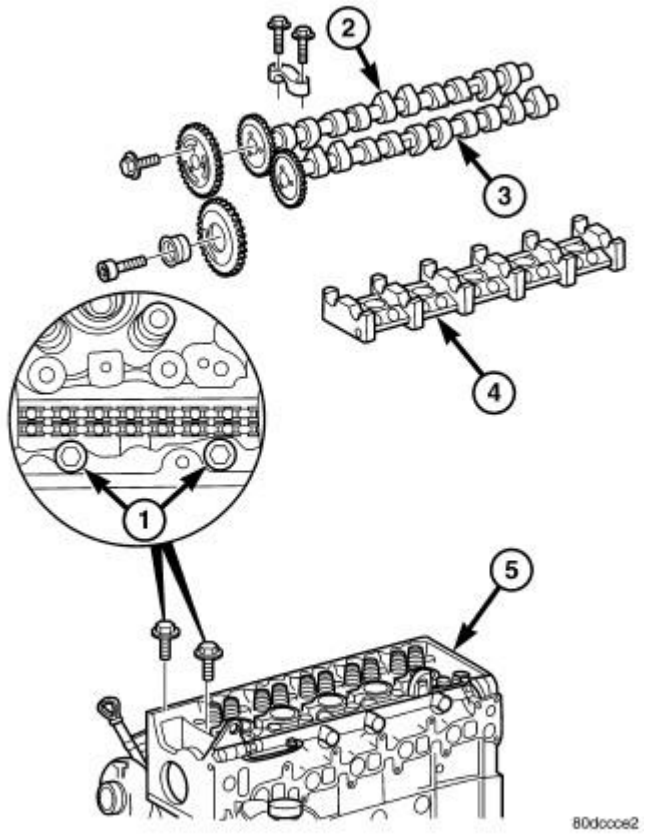

Fig. 109: Camshafts and Housing Assembly - Typical
Courtesy of CHRYSLER LLC

1 - CYLINDER HEAD BOLTS
2 - EXHAUST CAMSHAFT
3 - INTAKE CAMSHAFT
4 - CAMSHAFT HOUSING
5 - CYLINDER HEAD

CAUTION: For all work in which the crankshaft should not rotate, secure camshaft gear to timing chain.

12. Mark camshaft sprocket relative to timing chain.
13. Unbolt camshaft sprocket from exhaust camshaft (2).

NOTE: Note the position of dowel pin for camshaft sprocket alignment during reassembly.

14. Remove camshaft sprocket.

CAUTION: Camshaft bearing caps must remain in proper order and position.

15. Mark and remove camshaft bearing caps.
16. Remove the inlet and exhaust camshafts. See **Fig. 109**. .

Installation

INSTALLATION

CAUTION: The camshafts are sensitive to fracturing. Ensure they are installed free of stress.

CAUTION: Pay attention to assignment of camshafts. Camshaft code numbers are visible on the thrust collar of the axial bearing.

CAUTION: Oil bucket tappets and camshaft bearing points. Inspect ease of operation of bucket tappets.

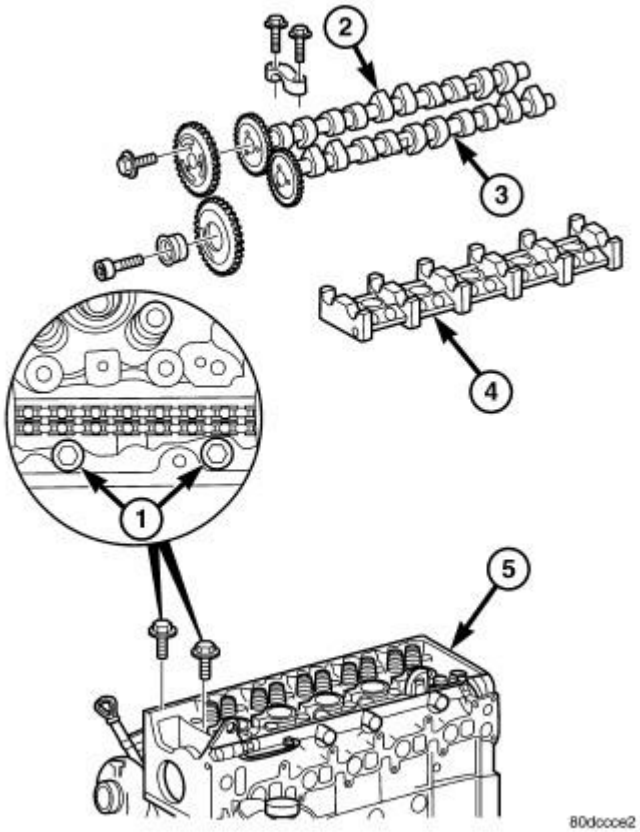

Fig. 110: Camshafts and Housing Assembly - Typical

Courtesy of CHRYSLER LLC

1 - CYLINDER HEAD BOLTS
2 - EXHAUST CAMSHAFT
3 - INTAKE CAMSHAFT
4 - CAMSHAFT HOUSING
5 - CYLINDER HEAD

1. Install inlet (3) and exhaust (2) camshafts.

CAUTION: Install camshafts so that the two holes in camshaft sprockets are positioned opposite and the markings of the camshaft and camshaft bearing cap are aligned.

2. Align inlet (3) and exhaust (2) camshafts at axial bearing. See **Engine/Cylinder Head/CAMSHAFT, Engine - Standard Procedure**).
3. Position piston of cylinder #1 to 30° TDC.

NOTE: Pay attention to markings on camshaft bearing caps.

4. Install camshaft bearing caps in the proper order. Tighten bolts to 9N.m (80 lbs. in.).

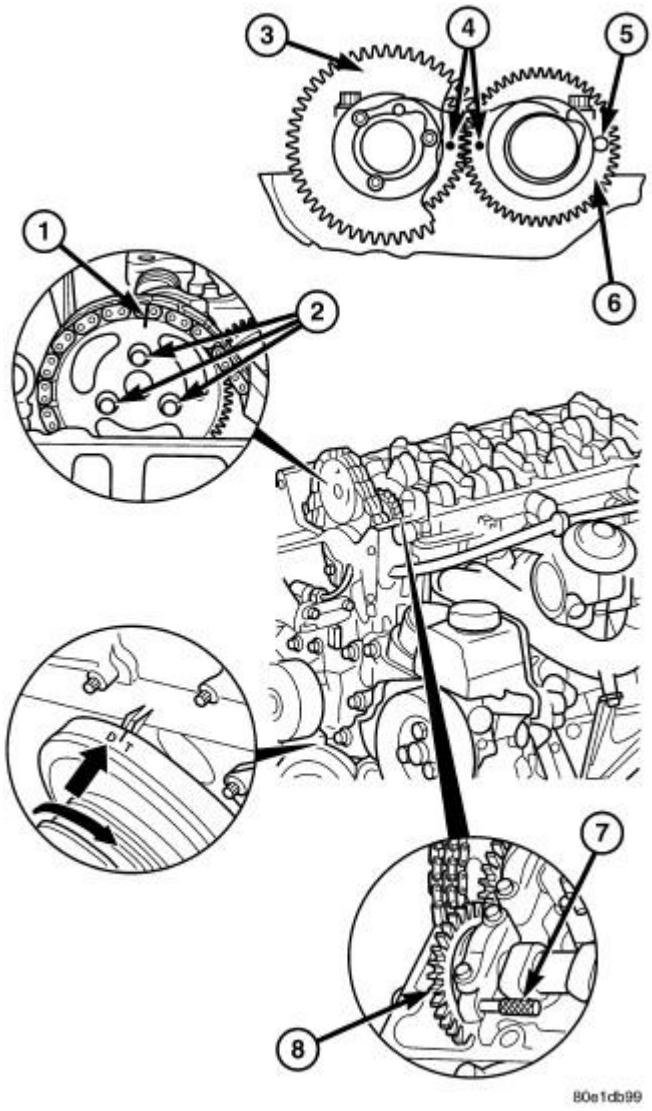

Fig. 111: Camshaft Alignment - Typical
Courtesy of CHRYSLER LLC

1 - EXHAUST CAMSHAFT SPROCKET AND CHAIN MARKING
2 - EXHAUST CAMSHAFT SPROCKET BOLTS
3 - EXHAUST CAMSHAFT SPROCKET
4 - CAMSHAFT ALIGNMENT DOTS
5 - INTAKE CAMSHAFT LOCK POSITION
6 - INTAKE CAMSHAFT SPROCKET
7 - CAMSHAFT LOCKING PIN 8929
8 - INTAKE CAMSHAFT SPROCKET

CAUTION: Do not rotate engine counter clockwise.

5. Position the piston of cylinder #1 to ignition TDC.

NOTE: Pay attention to markings on camshaft bearing caps.

6. Install the bearing caps in reverse order at the same point. Tighten bearing cap bolts evenly in steps each of 1 turn.

NOTE: The piston of cylinder #1 must be positioned at ignition TDC when the inlet camshaft is locked.

7. Insert Camshaft Locking Pin 8929 (7) in through the first camshaft bearing cap into the whole in the camshaft sprocket.

NOTE: Do Not use old camshaft sprocket bolts.

8. Fit exhaust camshaft sprocket with timing chain (1) onto exhaust camshaft paying attention to position of dowel pin. Tighten bolt to 18N.m (159 lbs. in.).

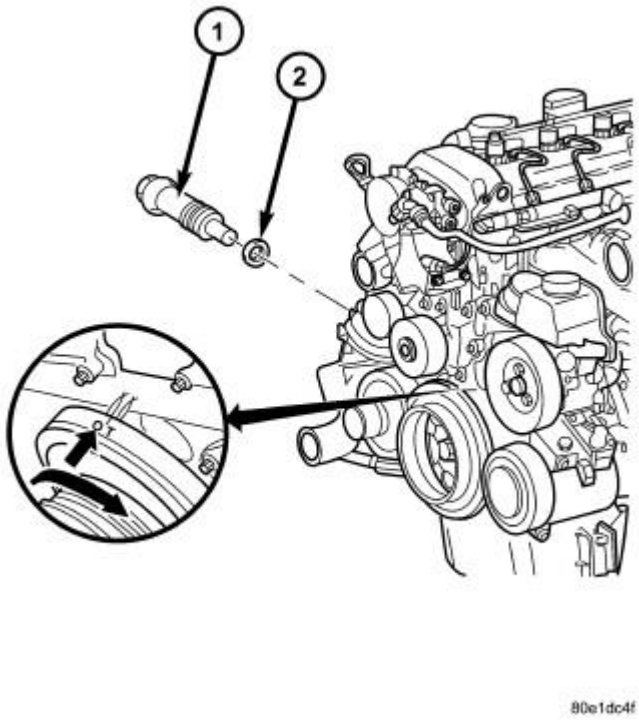

Fig. 112: TIMING CHAIN TENSIONER - TYPICAL
Courtesy of CHRYSLER LLC

1 - TIMING CHAIN TENSIONER 2 - TIMING CHAIN TENSIONER SEAL

9. Install timing chain tensioner (1) with new seal (2). See **Engine/Valve Timing/CHAIN, Timing - Installation**.

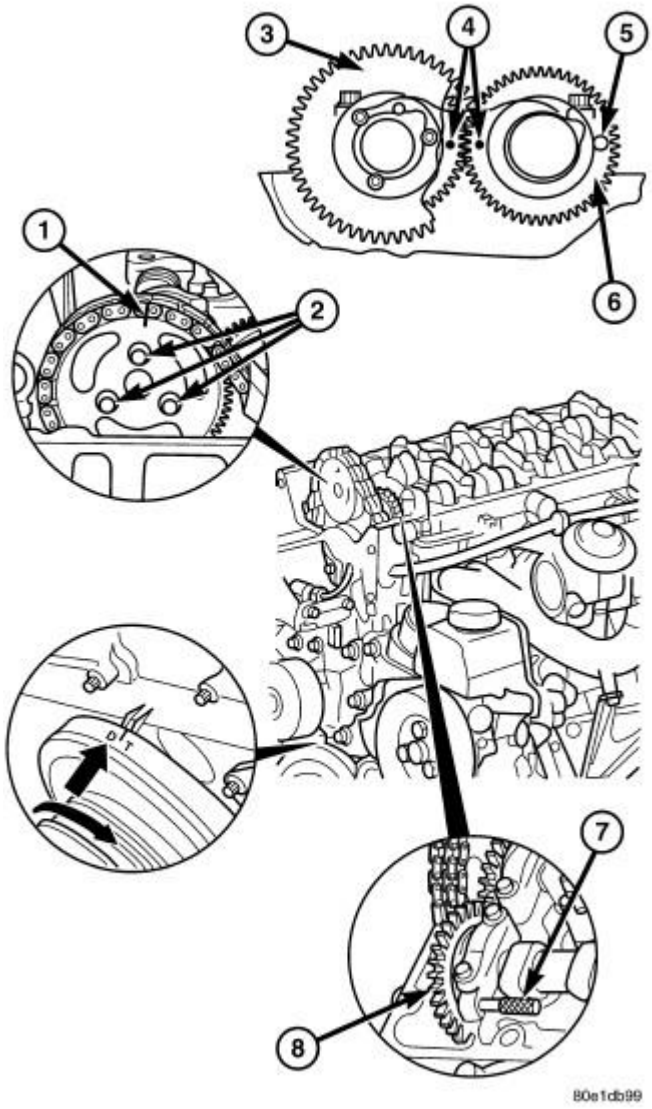

Fig. 113: Camshaft Alignment - Typical
Courtesy of CHRYSLER LLC

1 - EXHAUST CAMSHAFT SPROCKET AND CHAIN MARKING 2 - EXHAUST CAMSHAFT SPROCKET BOLTS 3 - EXHAUST CAMSHAFT SPROCKET

4 - CAMSHAFT ALIGNMENT DOTS
5 - INTAKE CAMSHAFT LOCK POSITION
6 - INTAKE CAMSHAFT SPROCKET
7 - CAMSHAFT LOCKING PIN 8929
8 - INTAKE CAMSHAFT SPROCKET

10. Inspect/Set basic position of camshafts. See **Engine/Cylinder Head/CAMSHAFT, Engine - Standard Procedure**).
11. Remove Crankshaft Lock 8933.
12. Install starter.
13. Remove Camshaft Locking Pin 8929(7).

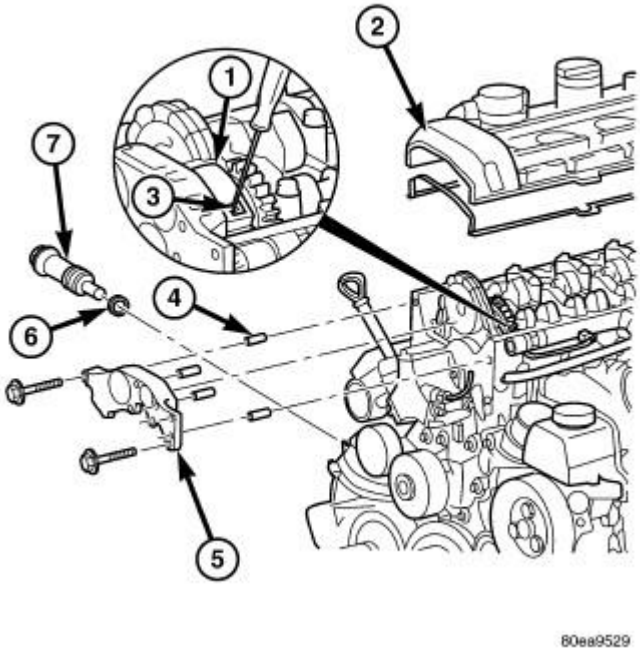

Fig. 114: Cylinder Head Front Cover - Typical
Courtesy of CHRYSLER LLC

1 - TOP GUIDE RAIL
2 - CYLINDER HEAD COVER
3 - LOCKING PAWL
4 - DOWEL PIN
5 - CYLINDER HEAD FRONT COVER
6 - SEAL
7 - TIMING CHAIN TENSIONER

14. Install cylinder head cover (2). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.

NOTE: Refer to the appropriate injector servicing procedures for cleaning of injectors and recesses.

15. Clean and install injectors. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Standard Procedure** . Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Installation** .

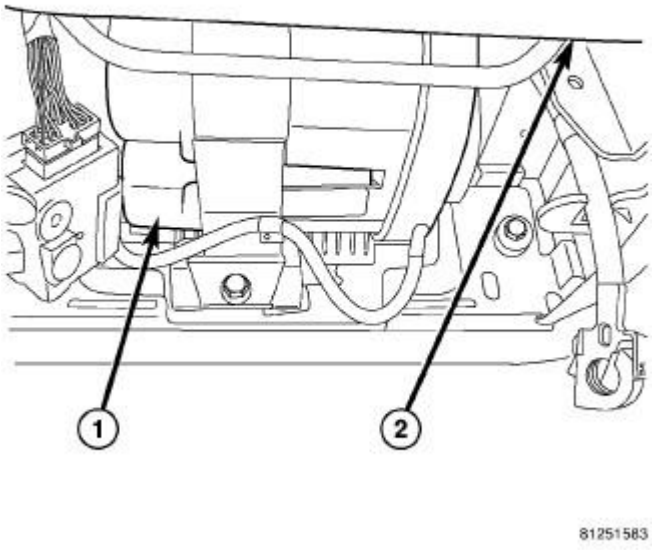

Fig. 115: Battery Location
Courtesy of CHRYSLER LLC

1 - BATTERY 2 - PASSENGER SEAT

16. Connect negative battery (1) 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.

17. Start engine and inspect for leaks.

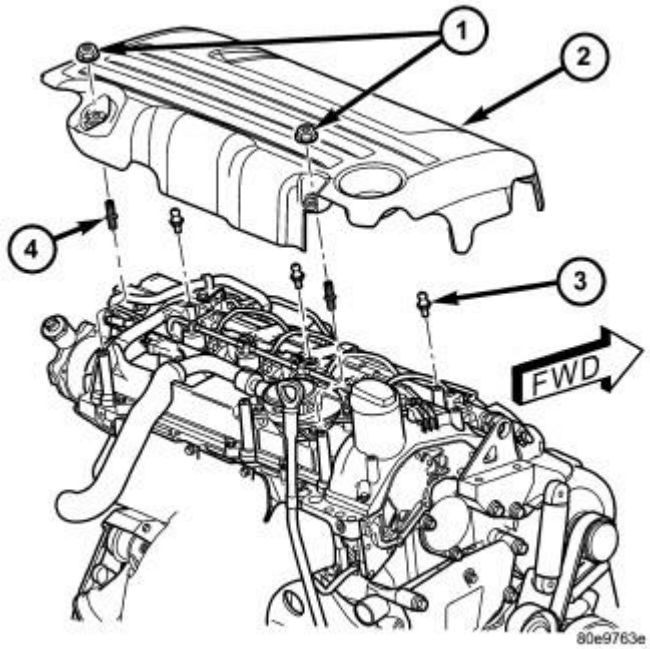

Fig. 116: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1 - ENGINE COVER RETAINING NUTS
2 - ENGINE COVER
3 - ENGINE COVER MOUNTS
4 - ENGINE COVER MOUNTING STUDS

18. Install engine cover (2). See **Engine - Installation**.

COVER(S), CYLINDER HEAD

Removal

REMOVAL

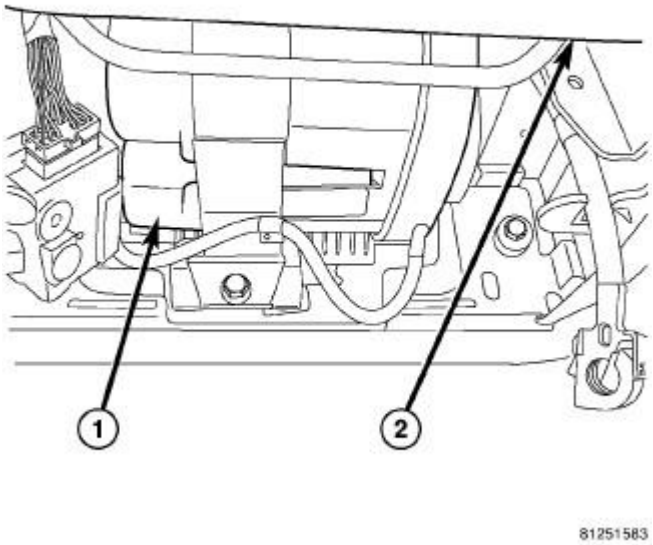

Fig. 117: Battery Location
Courtesy of CHRYSLER LLC

1 - BATTERY 2 - PASSENGER SEAT

1. Disconnect negative battery (1) cable.

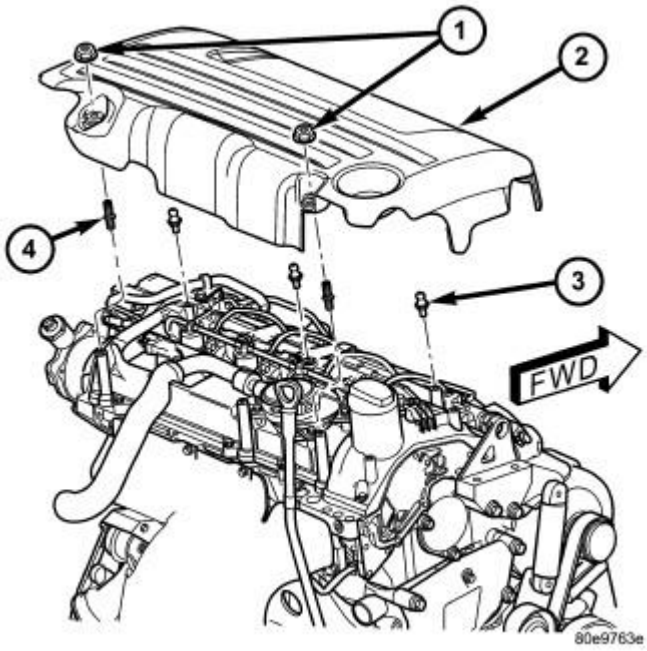

Fig. 118: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1 - ENGINE COVER RETAINING NUTS
2 - ENGINE COVER
3 - ENGINE COVER MOUNTS
4 - ENGINE COVER MOUNTING STUDS

2. Remove engine cover (2). See **Engine - Removal**.

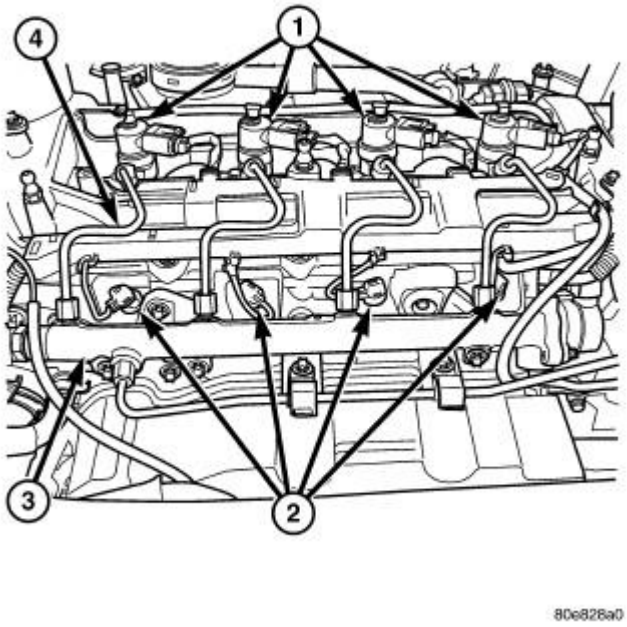

Fig. 119: Fuel Injector and Glow Plug Locations
Courtesy of CHRYSLER LLC

1 - FUEL INJECTORS
2 - GLOW PLUGS
3 - FUEL RAIL
4 - HIGH PRESSURE FUEL LINE

3. Remove high pressure fuel lines (4) to fuel injectors (1). See **Fig. 119**.
4. Disconnect fuel injector (1), camshaft position sensor, fuel pressor sensor, fuel pressure solenoid, and glow plug (2) electrical connectors.

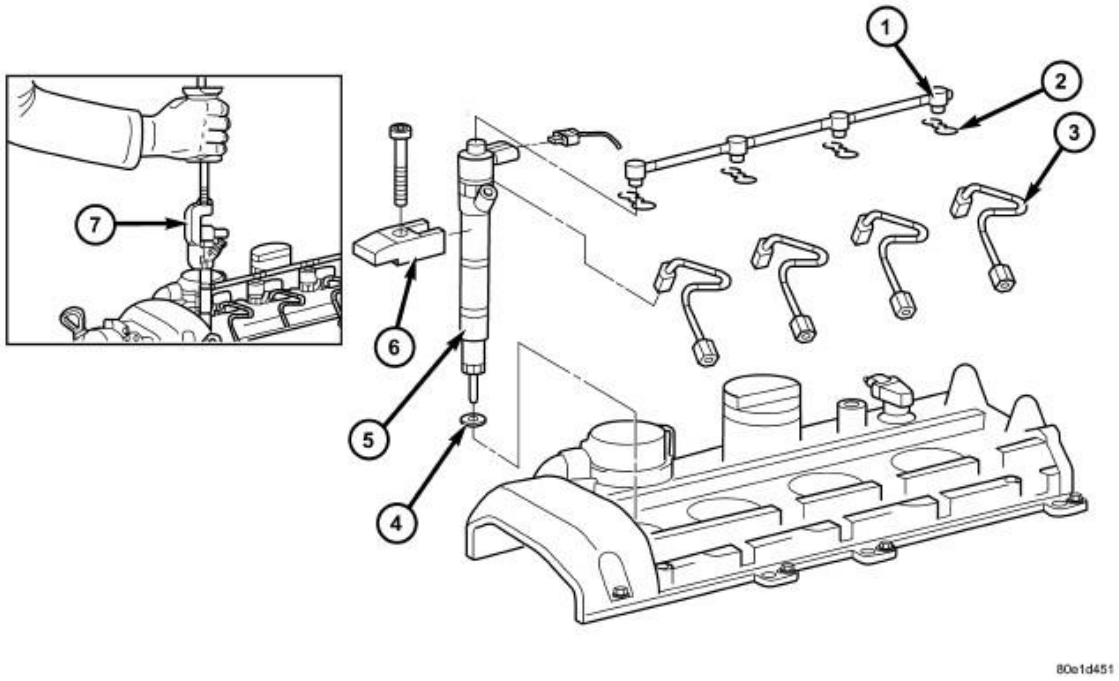

Fig. 120: FUEL INJECTOR REMOVAL/INSTALLATION - TYPICAL
Courtesy of CHRYSLER LLC

1 - INJECTOR DRAIN TUBES
2 - RETAINING CLIP
3 - INJECTOR HIGH PRESSURE LINE
4 - INJECTOR SEAL
5 - FUEL INJECTOR
6 - TENSIONING CLAW
7 - SPECIAL TOOLS #8938 AND #8937

5. Disconnect injector drain tubes (1) at injectors (5).
6. Disconnect fuel rail return line to pump at rail.
7. Remove engine harness retaining bolts and reposition harness out of way.
8. Remove fuel injectors (5). Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Removal** .

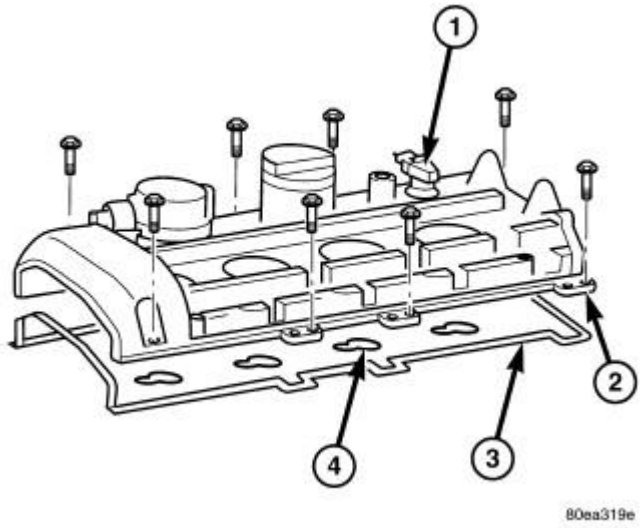

Fig. 121: Cylinder Head Cover - Typical
Courtesy of CHRYSLER LLC

1 - CAMSHAFT POSITION (CMP) SENSOR
2 - CYLINDER HEAD COVER
3 - CYLINDER HEAD COVER GASKET
4 - INJECTOR BORE SEALS

9. Detach hose from oil separator.
10. Remove cylinder head cover retaining bolts and remove cover (2). See **Fig. 121**.

Installation

INSTALLATION

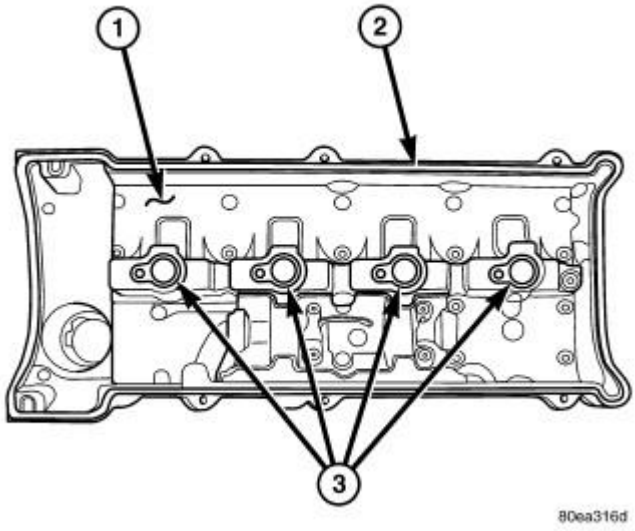

Fig. 122: Cylinder Head Cover Gasket and Seal Location
Courtesy of CHRYSLER LLC

1 - CYLINDER HEAD COVER
2 - CYLINDER HEAD COVER GASKET
3 - INJECTOR BORE SEALS

1. Install new gasket (2) and injector bore seals (3) on cylinder head cover (1). See **Fig. 122**.

NOTE: Do not tighten cylinder head cover bolts until injectors are installed.

2. Position cylinder head cover with new gasket and seals. Tighten bolts only finger tight.

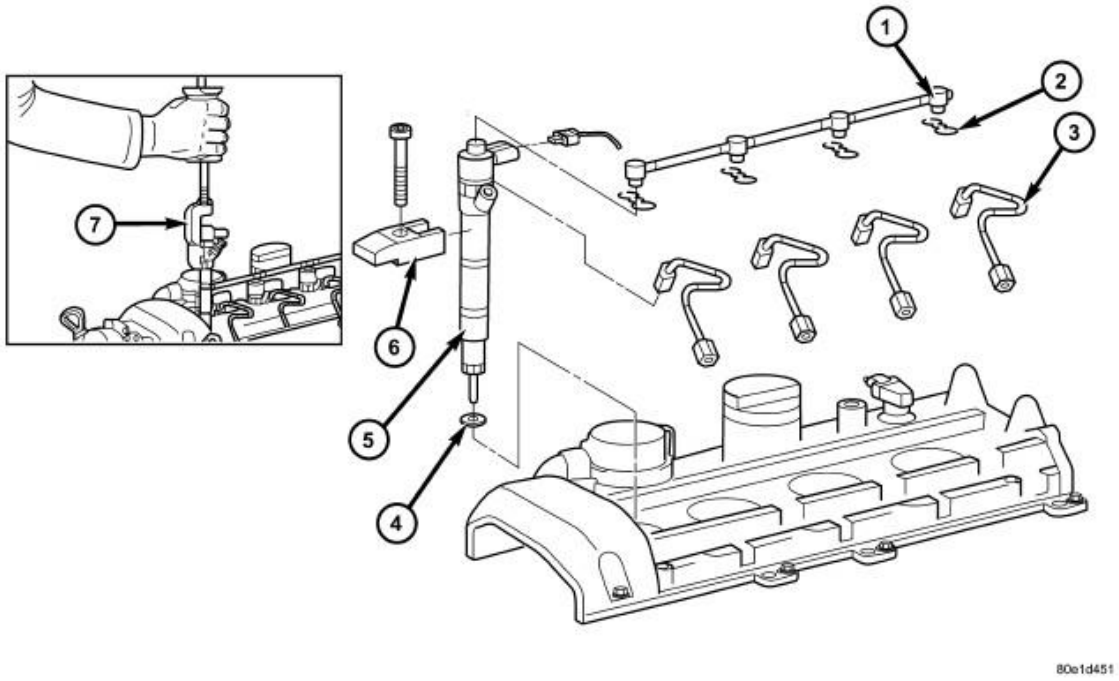

Fig. 123: FUEL INJECTOR REMOVAL/INSTALLATION - TYPICAL
Courtesy of CHRYSLER LLC

1 - INJECTOR DRAIN TUBES
2 - RETAINING CLIP
3 - INJECTOR HIGH PRESSURE LINE
4 - INJECTOR SEAL
5 - FUEL INJECTOR
6 - TENSIONING CLAW
7 - SPECIAL TOOLS #8938 AND #8937

3. Install injectors (5) into cylinder head. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Installation** .
4. Torque cylinder head cover bolts to 9N.m (80 lbs. in.).
5. Reroute engine harness and install retaining bolts.
6. Install injector high pressure fuel lines (3).
7. Torque injector retaining bolts to 7N.m (62 lbs. in.) + 90°.

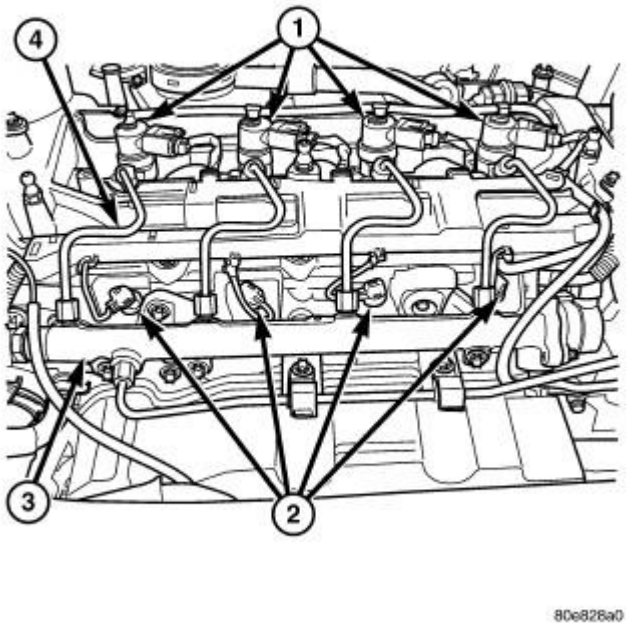

Fig. 124: Fuel Injector and Glow Plug Locations
Courtesy of CHRYSLER LLC

1 - FUEL INJECTORS
2 - GLOW PLUGS
3 - FUEL RAIL
4 - HIGH PRESSURE FUEL LINE

8. Connect fuel injector (1), camshaft position sensor, fuel pressure sensor, fuel pressure solenoid, and glow plug (2) electrical connectors.

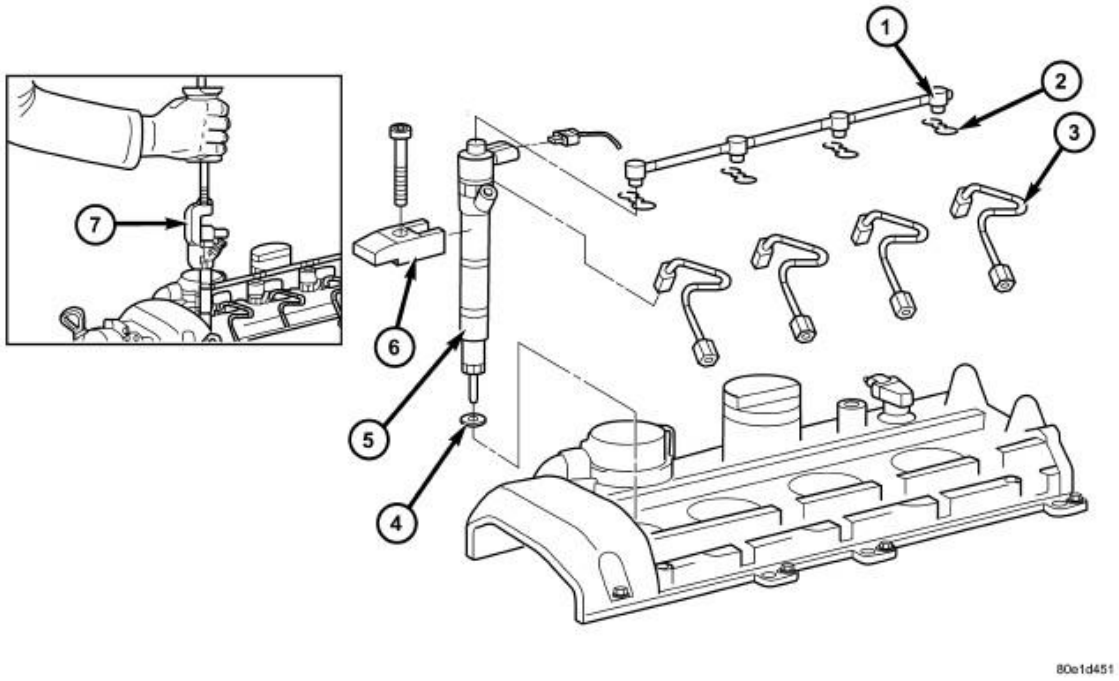

Fig. 125: FUEL INJECTOR REMOVAL/INSTALLATION - TYPICAL
Courtesy of CHRYSLER LLC

1 - INJECTOR DRAIN TUBES
2 - RETAINING CLIP
3 - INJECTOR HIGH PRESSURE LINE
4 - INJECTOR SEAL
5 - FUEL INJECTOR
6 - TENSIONING CLAW
7 - SPECIAL TOOLS #8938 AND #8937

9. Connect fuel drain tubes (1) at injectors.
10. Attach oil separator hose.

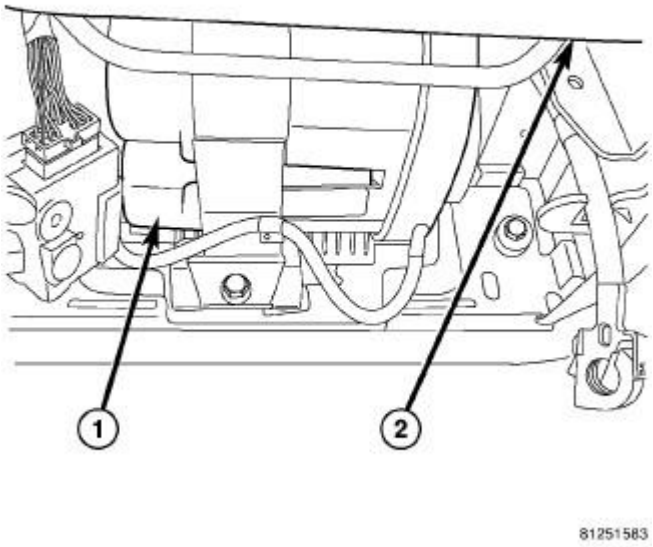

Fig. 126: Battery Location
Courtesy of CHRYSLER LLC

11. Connect negative battery (1) cable.

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

12. Start engine and inspect for leaks.
13. Install engine cover. See **Engine - Installation**.

SPRING(S), VALVE

Removal

VALVE SPRINGS

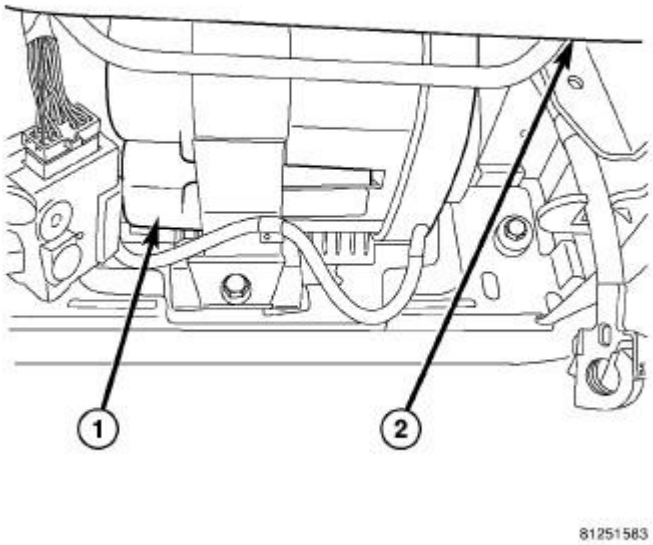

Fig. 127: Battery Location
Courtesy of CHRYSLER LLC

1 - BATTERY 2 - PASSENGER SEAT

1. Disconnect negative battery (1) cable.

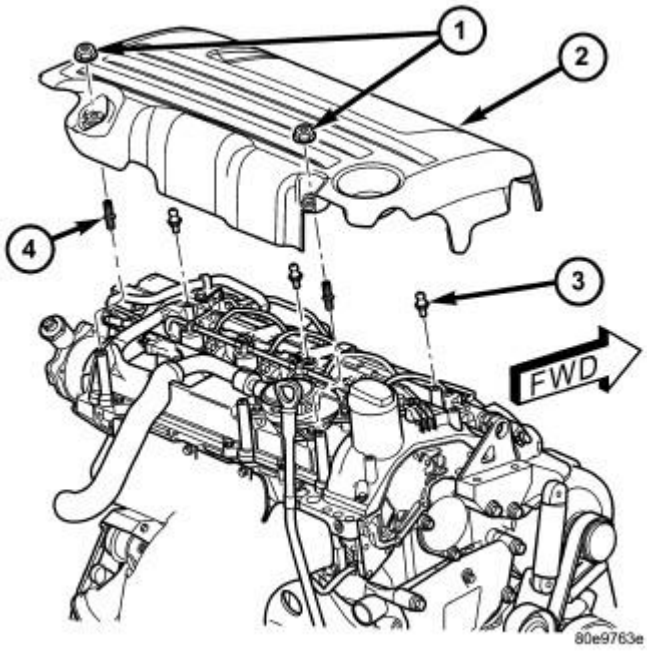

Fig. 128: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1 - ENGINE COVER RETAINING NUTS
2 - ENGINE COVER
3 - ENGINE COVER MOUNTS
4 - ENGINE COVER MOUNTING STUDS

2. Remove engine cover (2). See **Engine - Removal**.
3. Remove injectors. Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Removal** .

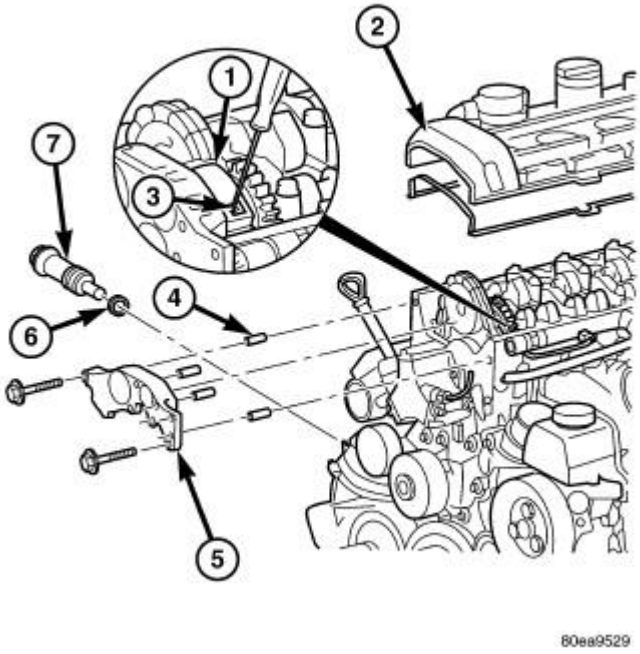

Fig. 129: Cylinder Head Front Cover - Typical
Courtesy of CHRYSLER LLC

1 - TOP GUIDE RAIL
2 - CYLINDER HEAD COVER
3 - LOCKING PAWL
4 - DOWEL PIN
5 - CYLINDER HEAD FRONT COVER
6 - SEAL
7 - TIMING CHAIN TENSIONER

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

5. Remove timing chain tensioner (7). See **Engine/Valve Timing/CHAIN, Timing - Removal**.
6. Remove front cover at cylinder head (5). See **Engine/Cylinder Head - Removal**.
7. Remove top guide rail (1). See **Engine/Cylinder Head - Removal**.
8. Remove camshafts. See **Engine/Cylinder Head/CAMSHAFT, Engine - Removal**.

NOTE: The timing chain must be held in up position so as not to jam during procedure.

9. Position piston of cylinder to be processed to TDC by rotating the crankshaft clockwise. **DO NOT crank engine. DO NOT rotate engine backward.**

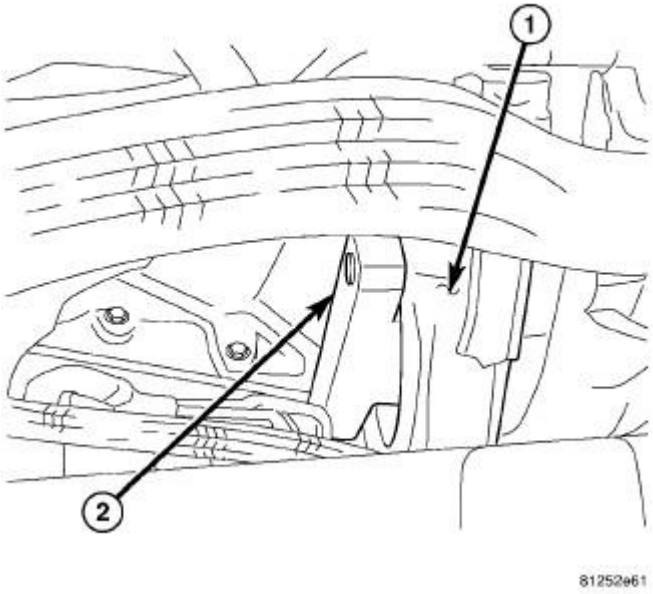

Fig. 130: Crankshaft Lock 8933
Courtesy of CHRYSLER LLC

1 - ENGINE BLOCK 2 - CRANKSHAFT LOCK 8933

10. Install Crankshaft Lock 8933.
11. install special tool #9543 into injector hole and retain with original tensioning claw.
12. Connect air supply to adapter and pressurize the cylinder to 5 bar (73 psi).

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

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

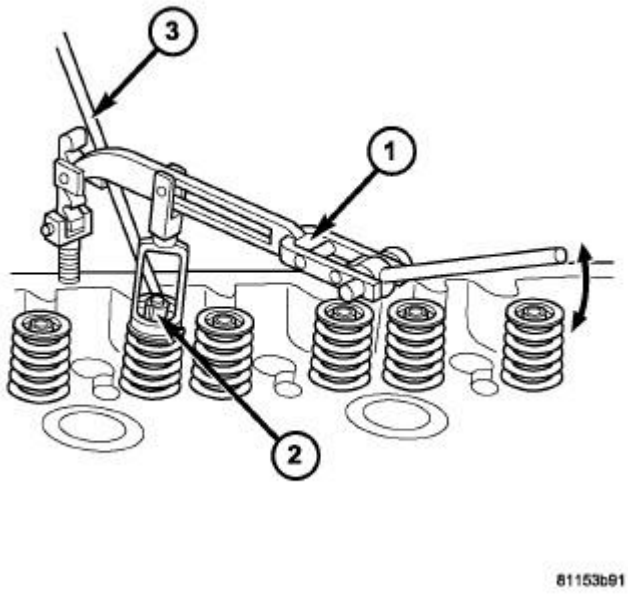

Fig. 131: VALVE COMPRESSOR
Courtesy of CHRYSLER LLC

1 - VALVE ASSEMBLY TOOL
2 - VALVE KEEPERS
3 - MAGNET

13. Compress valve spring.
14. Remove valve keepers (2).
15. Remove valve spring retainer and valve spring.
16. Remove valve stem seals.
17. Remove valve spring seat.

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

18. Repeat procedure for each cylinder as necessary.

VALVES

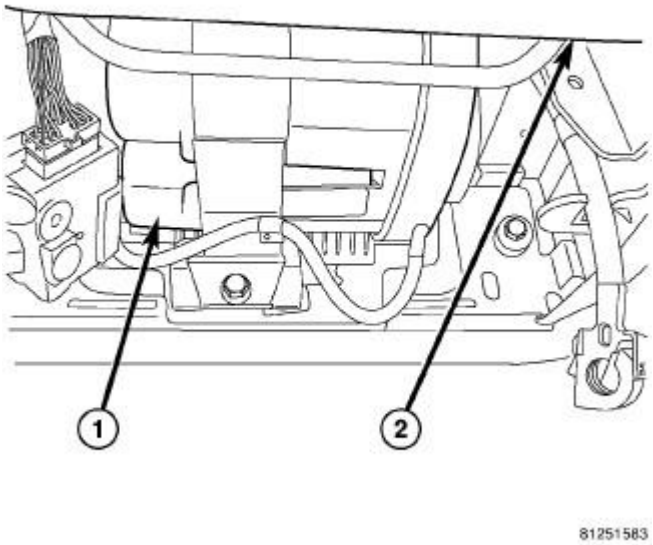

Fig. 132: Battery Location
Courtesy of CHRYSLER LLC

1 - BATTERY 2 - PASSENGER SEAT

1. Disconnect negative battery (1) cable.

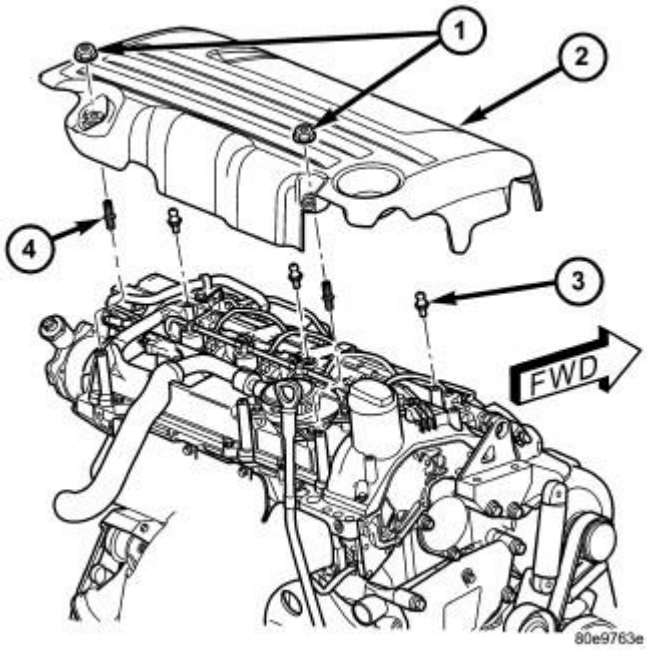

Fig. 133: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1 - ENGINE COVER RETAINING NUTS
2 - ENGINE COVER
3 - ENGINE COVER MOUNTS
4 - ENGINE COVER MOUNTING STUDS

2. Remove engine cover (2). See **Engine - Removal**
3. Remove cylinder head. See **Engine/Cylinder Head - 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.

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

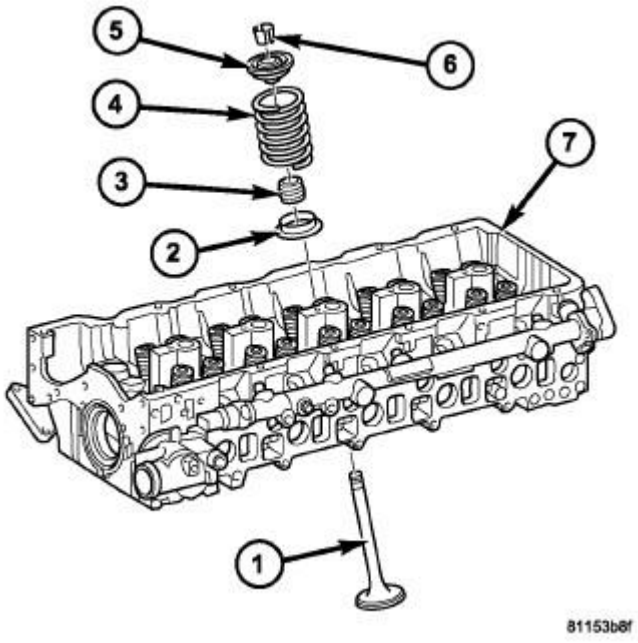

Fig. 134: VALVE ASSEMBLY
Courtesy of CHRYSLER LLC

1 - VALVE
2 - VALVE SPRING SEAT
3 - VALVE STEM SEAL
4 - VALVE SPRING
5 - VALVE SPRING RETAINER

6 - VALVE KEEPERS 7 - CYLINDER HEAD

4. Using a suitable valve spring compressor, compress valve spring.
5. Remove valve keepers (2).
6. Remove valve spring retainer (5) and valve spring (4).
7. Remove valve stem seals (3).
8. Repeat steps 5 through 9 for each valve as necessary.

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

9. Remove valves (1).

Installation

VALVE SPRINGS

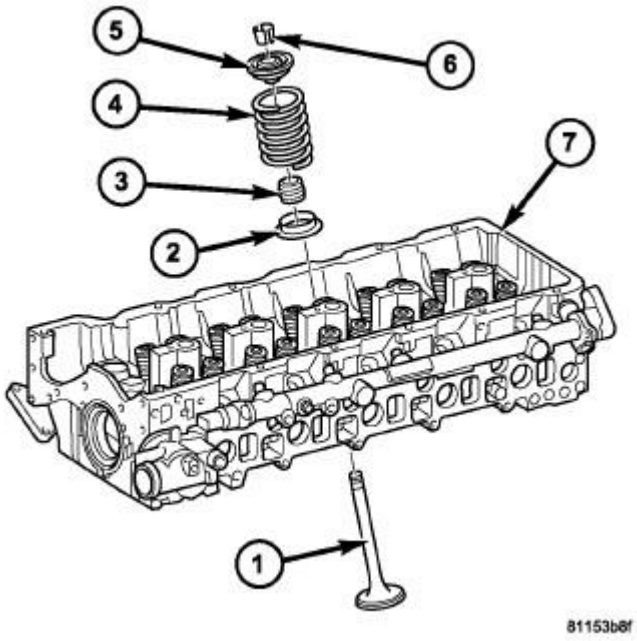

Fig. 135: VALVE ASSEMBLY
Courtesy of CHRYSLER LLC

1 - VALVE 2 - VALVE SPRING SEAT 3 - VALVE STEM SEAL 4 - VALVE SPRING

5 - VALVE SPRING RETAINER
6 - VALVE KEEPERS
7 - CYLINDER HEAD

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. Connect air supply to #9543 adaptor and pressurize the cylinder to 5 bar (73 psi).
3. Install lower valve spring seat (2).
4. Install valve stem seal (3).
5. Install valve spring (4).
6. Install valve spring retainer (5).

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.

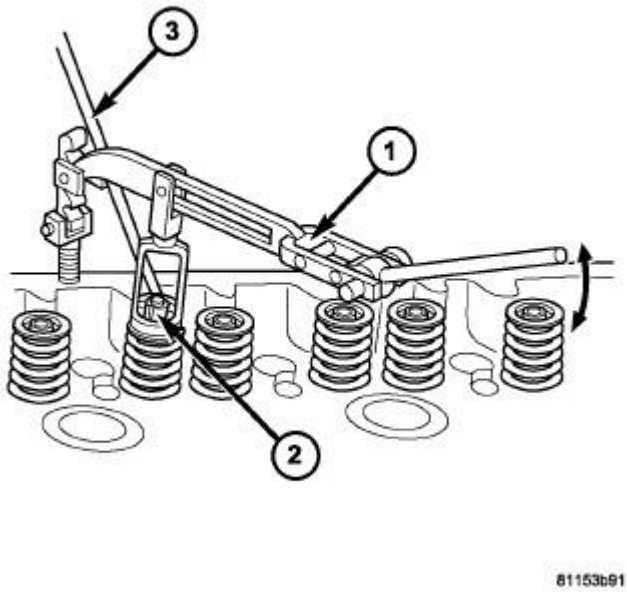

Fig. 136: VALVE COMPRESSOR
Courtesy of CHRYSLER LLC

1 - VALVE ASSEMBLY TOOL
2 - VALVE KEEPERS

3 - MAGNET

7. Compress valve and install valve keepers (2).
8. Repeat procedure for each cylinder as necessary.
9. Remove special tooling from cylinder head.

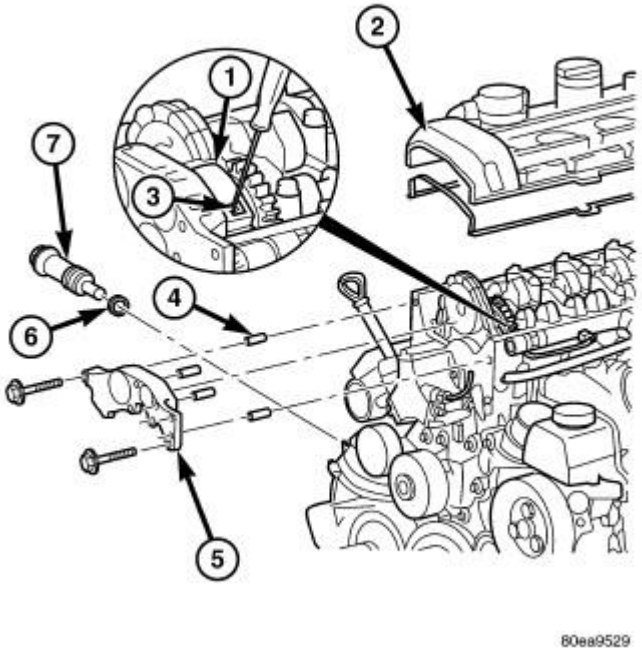

Fig. 137: Cylinder Head Front Cover - Typical
Courtesy of CHRYSLER LLC

1 - TOP GUIDE RAIL
2 - CYLINDER HEAD COVER
3 - LOCKING PAWL
4 - DOWEL PIN
5 - CYLINDER HEAD FRONT COVER
6 - SEAL
7 - TIMING CHAIN TENSIONER

10. Position piston of #1 cylinder to ignition TDC.
11. Install camshafts and check basic position. See **Engine/Cylinder Head/CAMSHAFT, Engine - Installation**.
12. Install top guide rail (1). See **Engine/Cylinder Head - Installation**.
13. Install front cover (5) at cylinder head. See **Engine/Cylinder Head - Installation**.

14. Install timing chain tensioner (7) with new seal (6). See **Engine/Valve Timing/CHAIN, Timing - Installation**.
15. Install cylinder head cover (2). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.

WARNING: Service vehicles in a well ventilated area and avoid ignition sources. Risk of injury to skin and eyes from fuel jet flowing out.

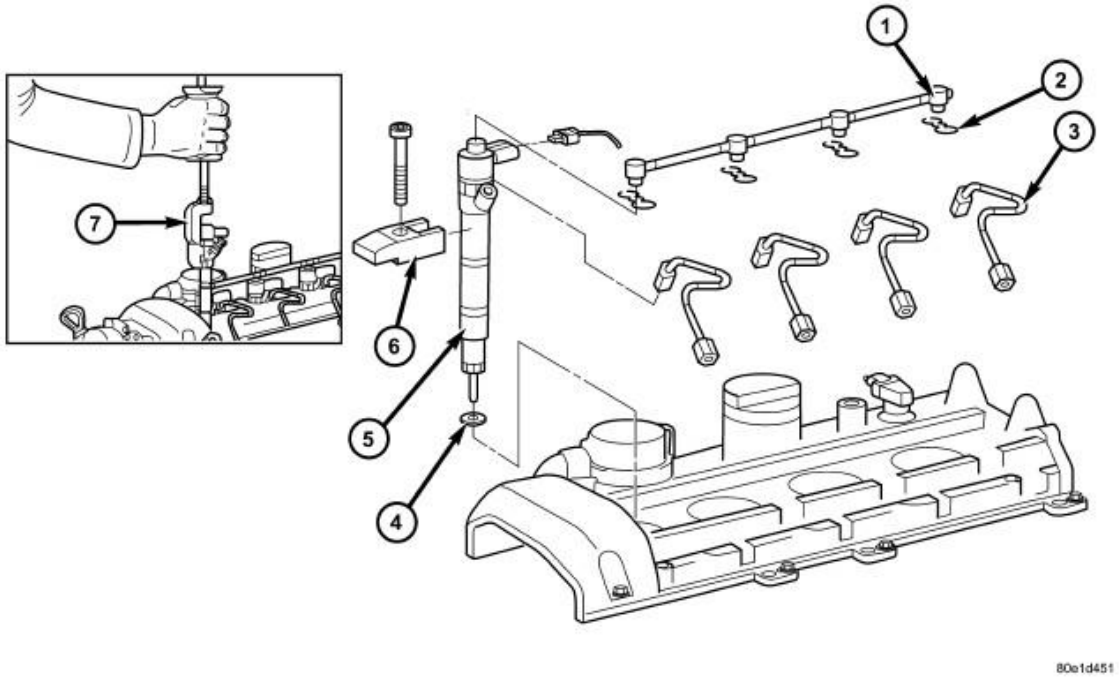

Fig. 138: FUEL INJECTOR REMOVAL/INSTALLATION - TYPICAL
Courtesy of CHRYSLER LLC

1 - INJECTOR DRAIN TUBES
2 - RETAINING CLIP
3 - INJECTOR HIGH PRESSURE LINE
4 - INJECTOR SEAL
5 - FUEL INJECTOR
6 - TENSIONING CLAW
7 - SPECIAL TOOLS #8938 AND #8937

16. Install injectors (5). Refer to **Fuel System/Fuel Injection/INJECTOR(S), Fuel - Installation** .

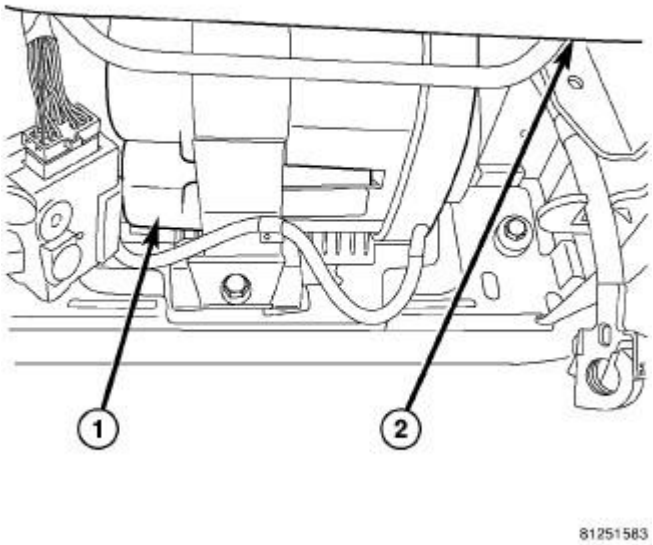

Fig. 139: Battery Location
Courtesy of CHRYSLER LLC

1 - BATTERY 2 - PASSENGER SEAT

17. Reconnect negative battery (1) 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.

18. Start the engine and inspect for leaks.

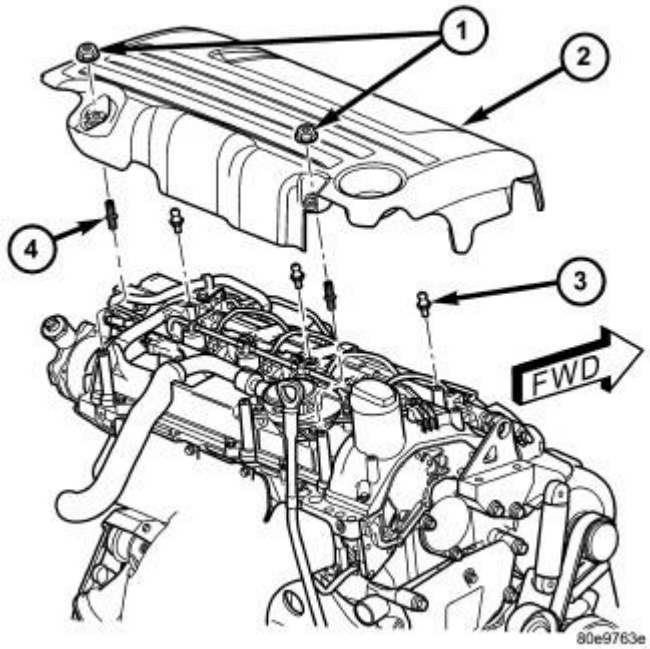

Fig. 140: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1 - ENGINE COVER RETAINING NUTS
2 - ENGINE COVER
3 - ENGINE COVER MOUNTS
4 - ENGINE COVER MOUNTING STUDS

19. Install engine cover (2). See **Engine - Installation**.

VALVES

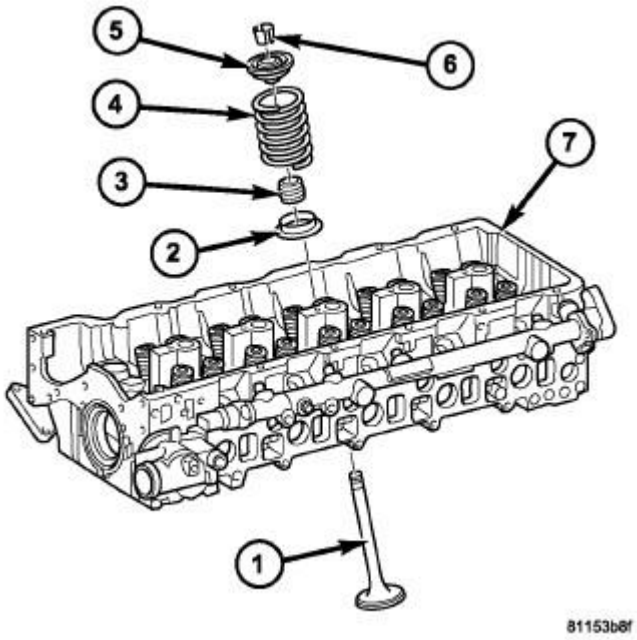

Fig. 141: VALVE ASSEMBLY
Courtesy of CHRYSLER LLC

1 - VALVE
2 - VALVE SPRING SEAT
3 - VALVE STEM SEAL
4 - VALVE SPRING
5 - VALVE SPRING RETAINER
6 - VALVE KEEPERS
7 - CYLINDER HEAD

CAUTION: 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 (1) in their original position in the cylinder head (7).
2. Install valve spring seat (2).
3. Install valve stem seal (3).
4. Install valve spring (4).
5. Install valve spring retainer (5).

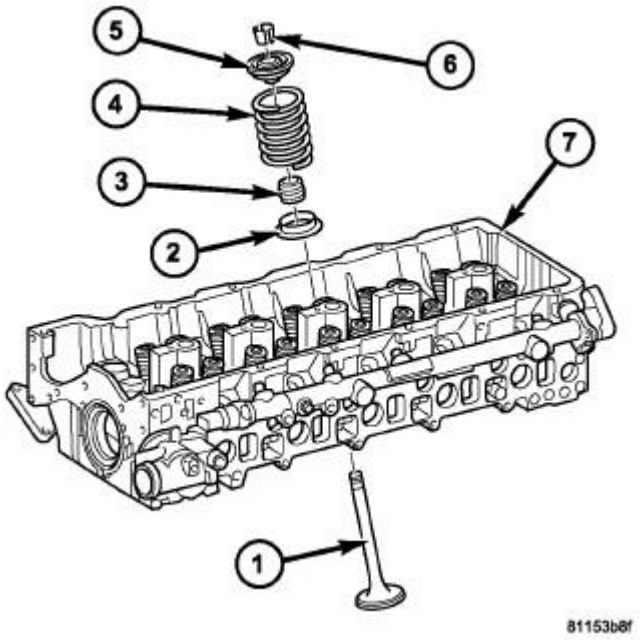

Fig. 142: VALVE ASSEMBLY
Courtesy of CHRYSLER LLC

1 - VALVE
2 - VALVE SPRING SEAT
3 - VALVE STEM SEAL
4 - VALVE SPRING
5 - VALVE SPRING RETAINER
6 - VALVE KEEPERS
7 - CYLINDER HEAD

NOTE: Ensure that the valve keepers are seated properly.

6. Using a suitable valve spring compressor, compress valve spring (4) and install valve keepers (6).
7. Repeat steps 3 through 7 for each valve as necessary.
8. Install cylinder head on engine block. See **Engine/Cylinder Head - Installation**.
9. Install glow plugs. Refer to **Electrical/Ignition Control/PLUG, Glow - Installation** .

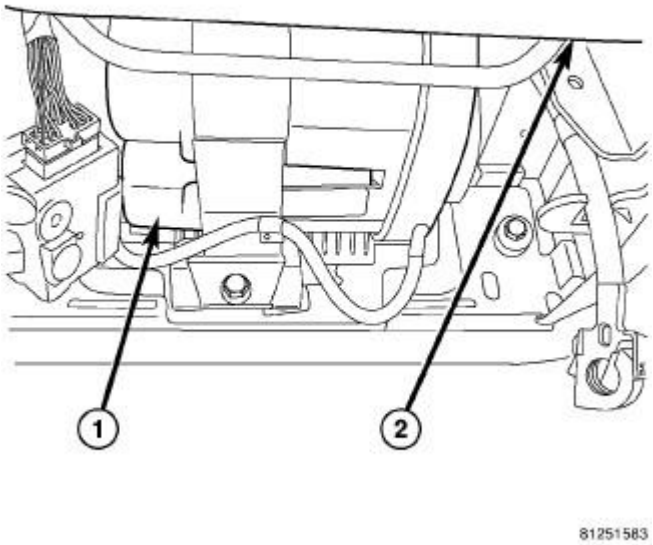

Fig. 143: Battery Location
Courtesy of CHRYSLER LLC

1 - BATTERY 2 - PASSENGER SEAT

10. Connect negative battery (1) cable.

> **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.**

11. Start engine and check for leaks.

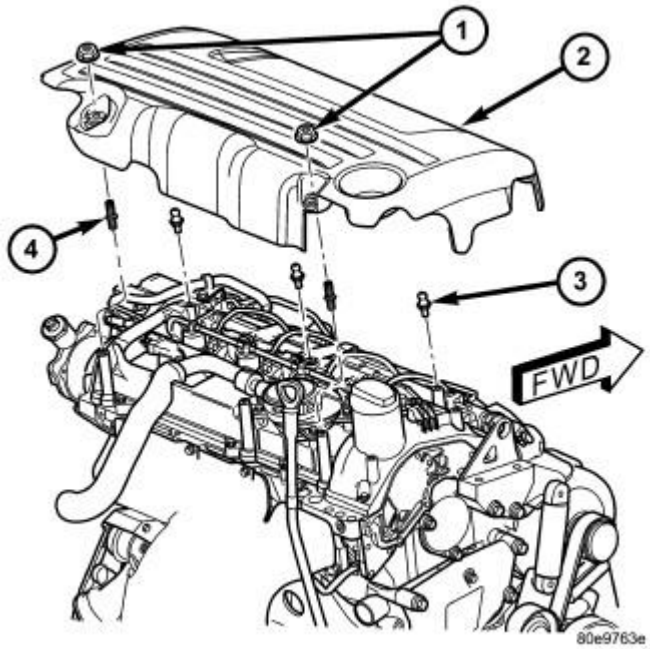

Fig. 144: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1 - ENGINE COVER RETAINING NUTS
2 - ENGINE COVER
3 - ENGINE COVER MOUNTS
4 - ENGINE COVER MOUNTING STUDS

12. Install engine cover (2). See **Engine - Installation**.

ENGINE BLOCK

STANDARD PROCEDURE

REPLACING ENGINE CORE AND OIL GALLERY PLUGS

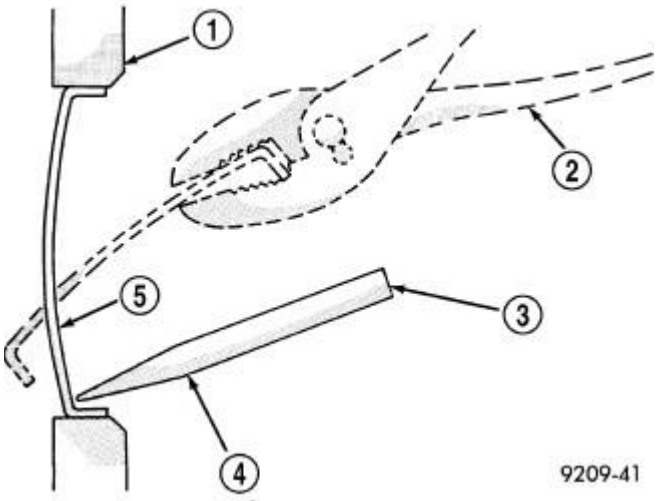

Fig. 145: Core Hole Plug Removal
Courtesy of CHRYSLER LLC

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

Using a blunt tool such as a drift (4) and a hammer, strike the bottom edge of the cup plug (5). With the cup plug (5) rotated, grasp firmly with pliers (2) or other suitable tool and remove plug. See **Fig. 145**. .

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

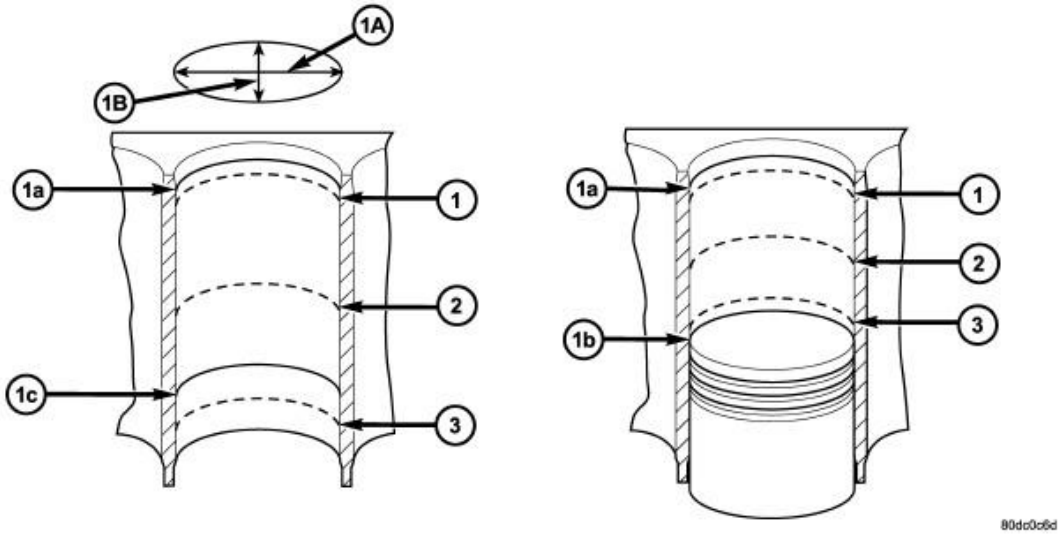

Fig. 146: Measuring Cylinder Bores
Courtesy of CHRYSLER LLC

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 (1 ,2, 3). See **Fig. 146**.
3. Using the three measurement points, measure cylinder in the longitudinal and in the transverse direction. See **Fig. 146**.

Standard size	88.0 mm
Group code letter A	88.000-88.006 mm
Group code letter X	88.006-88.012 mm
Group code letter B	88.012-88.018 mm
Wear limit in longitudinal in transverse direction	0.020 mm
Permissible variation of cylinder shape (when new)	0.000-0.014 mm

4. Use the measurement and table above to group cylinder bores.

CRANKSHAFT

Standard Procedure

MEASURE CRANKSHAFT AND BLOCK JOURNALS

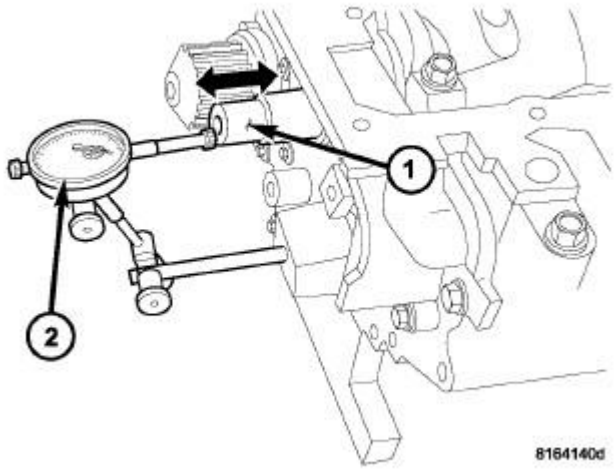

Fig. 147: Checking Crankshaft End Play - Typical
Courtesy of CHRYSLER LLC

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

1. Using a dial indicator (2) check crankshaft (1) end play by moving the crankshaft back and forth in the appropriate direction. See **Fig. 147**.
2. Remove crankshaft. See **Engine/Engine Block/CRANKSHAFT - Removal**.
3. 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.

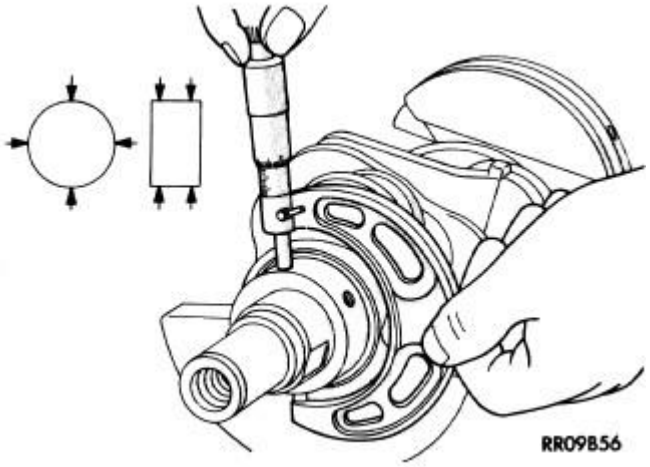

Fig. 148: Crankshaft Journal Measurements - Typical
Courtesy of CHRYSLER LLC

4. Inspect connecting rod. If damage is present, inspect crankshaft, replace as necessary.
5. Inspect crankcase.
6. Inspect standard size of crankshaft bearing shells.
7. Inspect crankshaft bearing cap.
8. Measure crankshaft rod and main bearing journals with a micrometer. See **Fig. 148**.

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

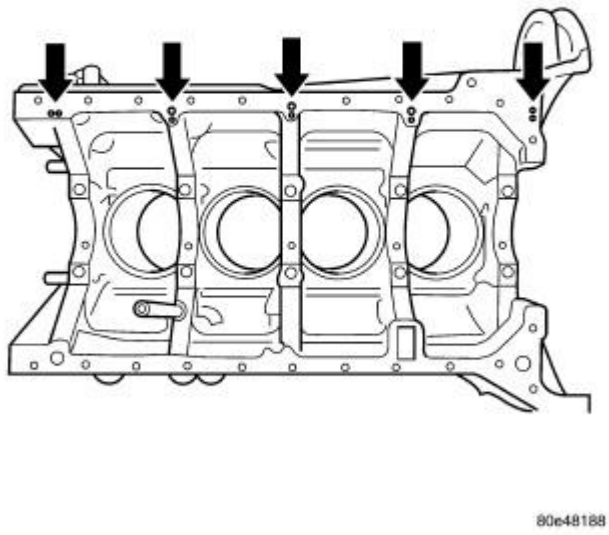

Fig. 149: Chisel Punch Marks

Courtesy of CHRYSLER LLC

ASSIGN CRANKSHAFT BEARING SHELLS

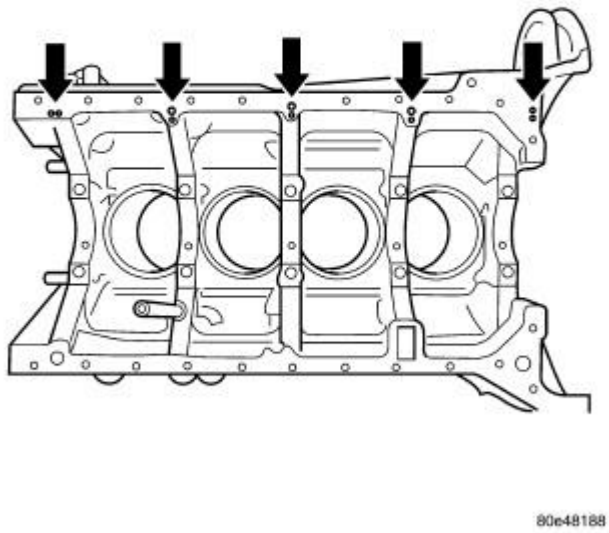

Fig. 150: Chisel Punch Marks
Courtesy of CHRYSLER LLC

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

9. Assign crankshaft bearing shells.
10. Mount crankshaft axially.
11. Inspect crankshaft bearing play.

Removal

REMOVAL

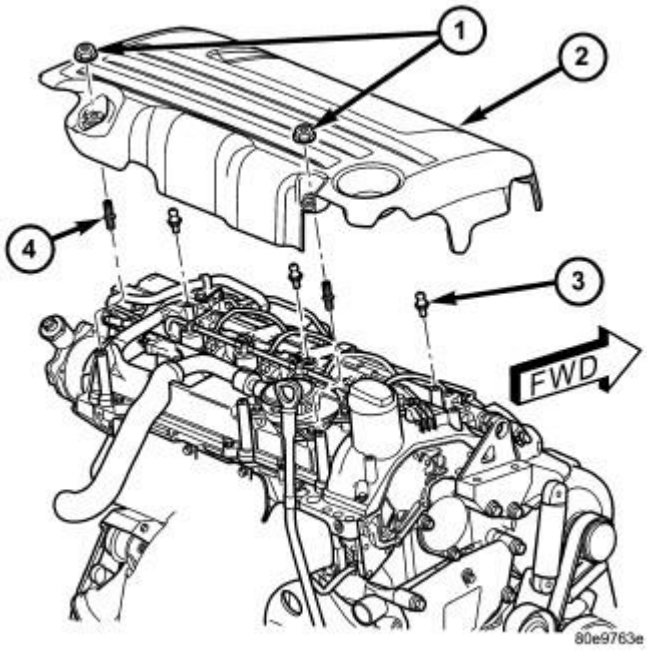

Fig. 151: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1 - ENGINE COVER RETAINING NUTS
2 - ENGINE COVER
3 - ENGINE COVER MOUNTS
4 - ENGINE COVER MOUNTING STUDS

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

1. Disconnect negative battery cable.
2. Remove engine cover (2). See **Engine - Removal**.
3. Remove engine. See **Engine - Removal**.
4. Remove timing chain cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.

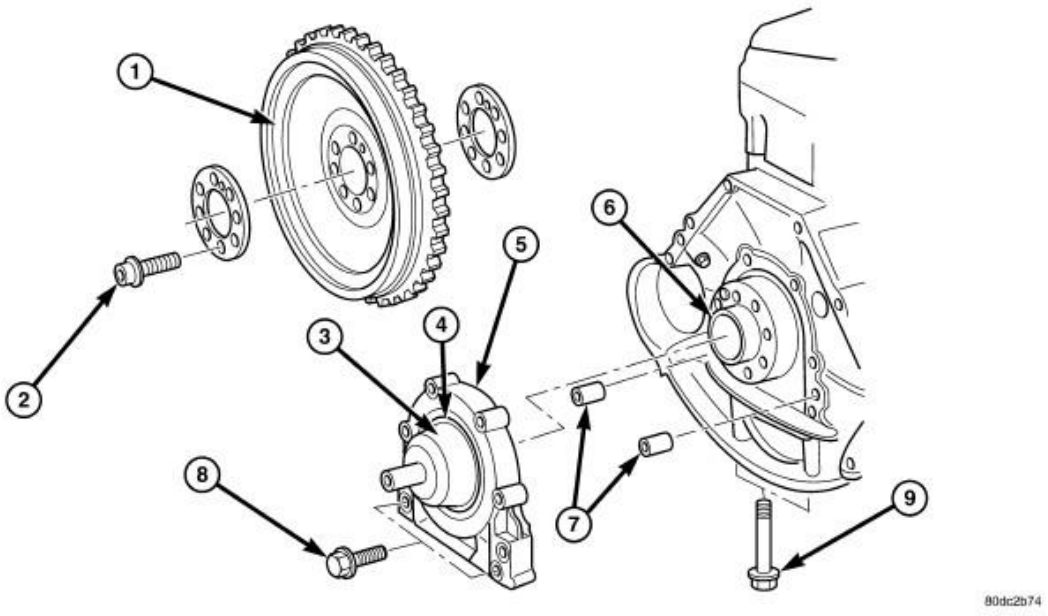

Fig. 152: Rear Crankshaft Seal/Adapter
Courtesy of CHRYSLER LLC

1 - FLYWHEEL
2 - FLYWHEEL BOLTS
3 - SPECIAL TOOL #8944
4 - REAR CRANKSHAFT OIL SEAL
5 - REAR CRANKSHAFT SEAL ADAPTER
6 - CRANKSHAFT
7 - ALIGNMENT DOWELS
8 - REAR CRANKSHAFT SEAL ADAPTER RETAINING BOLT
9 - OIL PAN TO REAR CRANKSHAFT SEAL ADAPTER RETAINING BOLT

5. Remove rear crankshaft seal adapter (5). See **Engine/Engine Block/SEAL, Crankshaft Oil - Removal**.
6. Remove piston and connecting rod assemblies. Refer to **Engine/Engine Block/ROD, Piston and Connecting - Removal** .

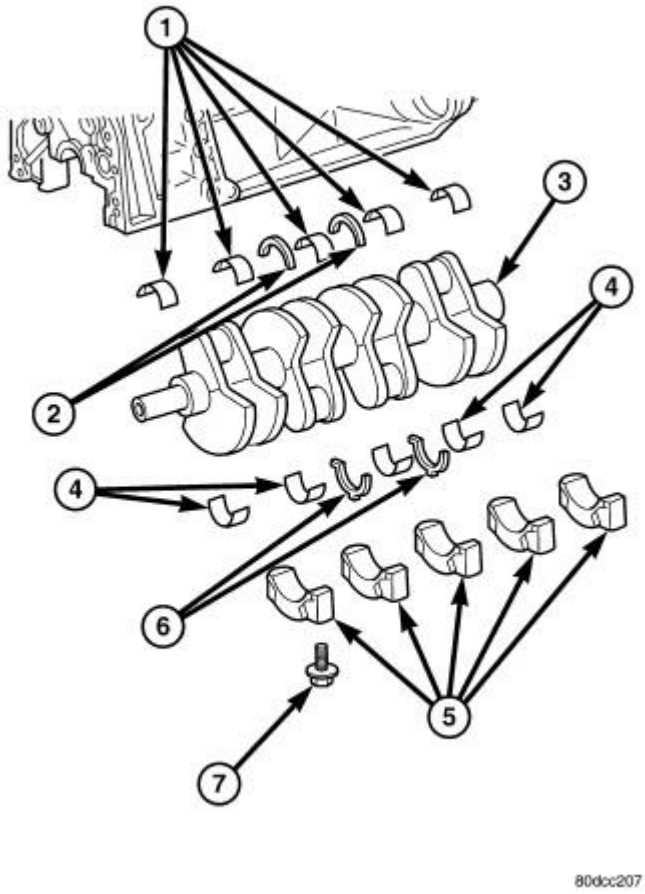

Fig. 153: Crankshaft Assembly - Typical
Courtesy of CHRYSLER LLC

CAUTION: The crankshaft main bearing caps (5) 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.

7. Unbolt crankshaft main bearing caps (5). See 6 .
8. Inspect crankshaft bearing caps (5) and bolts (7) for wear and stretching.
9. Remove crankshaft (3) from engine block.

Installation

INSTALLATION

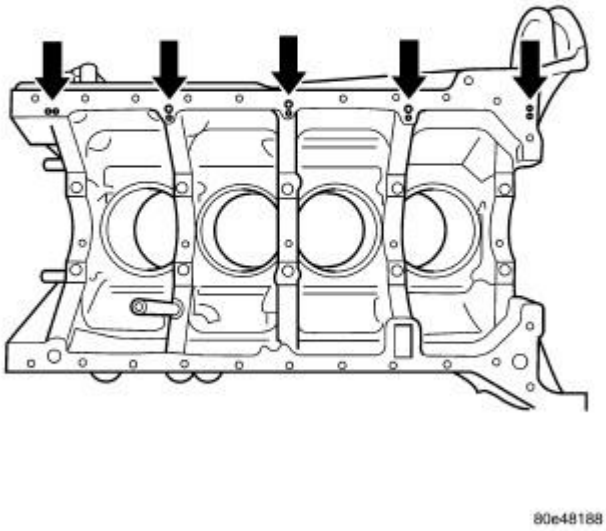

Fig. 154: CYLINDER BLOCK MARKINGS - TYPICAL
Courtesy of CHRYSLER LLC

NOTE: The cylinder block is marked for main bearing shell selection.

CAUTION: Oil bearing shells before inserting crankshaft.

CAUTION: Oil grooves in thrust washers must point toward the thrust collars of the crankshaft.

CAUTION: Thrust washers in bearing cap each have two retaining lugs as a anti-twist lock.

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.

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.

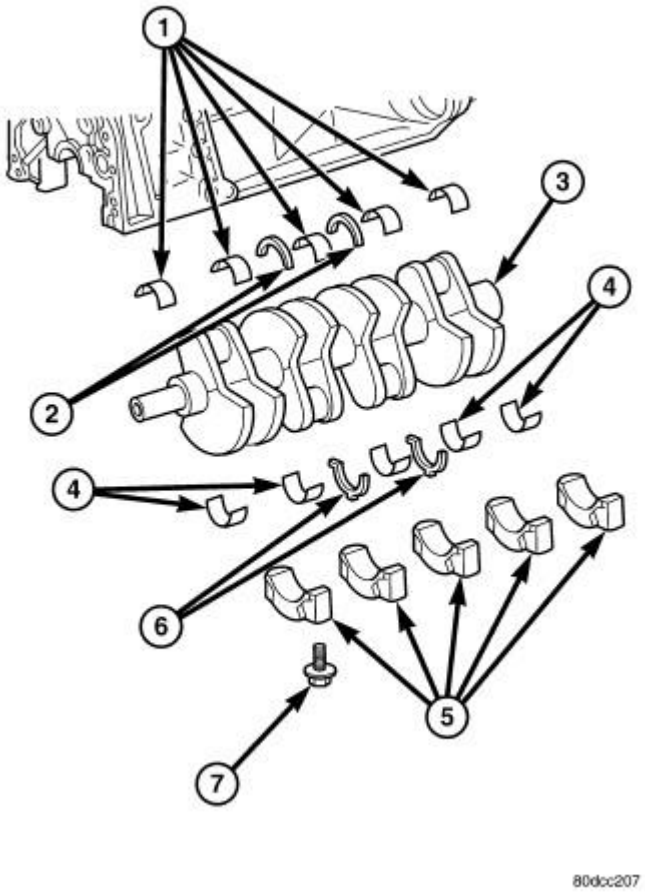

Fig. 155: Crankshaft Assembly - Typical
Courtesy of CHRYSLER LLC

1. Install bearing halves into engine block (1).
2. Install crankshaft (3) into engine block.
3. Install bearing halves into bearing caps (4).
4. Install crankshaft main bearing caps (5). Tighten bolts in two stages. 55N.m (40.5 lbs ft), then 90°.
5. Install piston and connecting rod assemblies. Refer to **Engine/Engine Block/ROD, Piston and Connecting - Installation** .

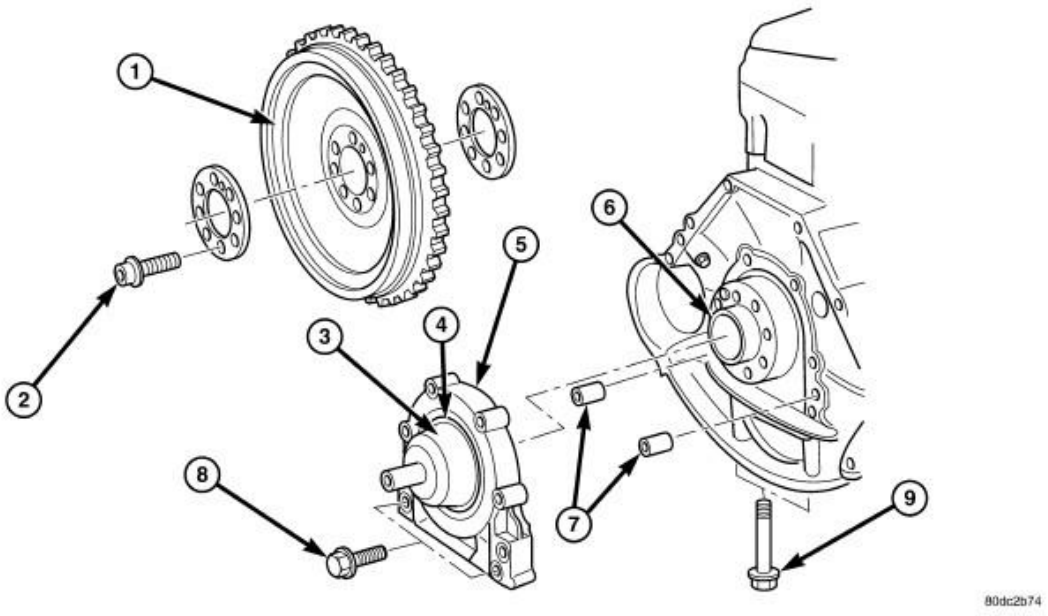

Fig. 156: Rear Crankshaft Seal/Adapter
Courtesy of CHRYSLER LLC

6. Install rear crankshaft seal adapter (5). See **Engine/Engine Block/SEAL, Crankshaft Oil - Installation**.
7. Install timing chain cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Installation**.
8. Install the engine. See **Engine - Installation**.
9. Fill crankcase with the correct engine oil, to the proper level. Refer to the owner's manual for specifications.
10. Fill cooling system with the proper coolant, to the proper level. Refer to **SYSTEM FILLING - DIESEL ENGINE** .

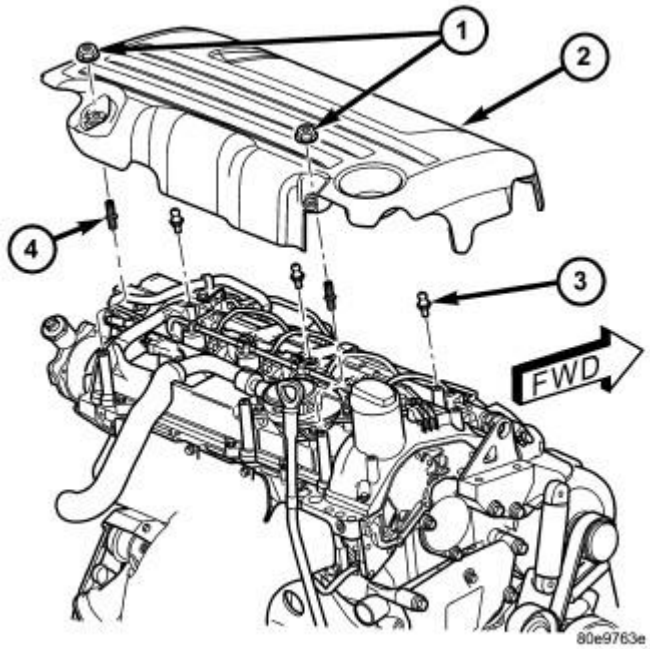

Fig. 157: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1 - ENGINE COVER RETAINING NUTS
2 - ENGINE COVER
3 - ENGINE COVER MOUNTS
4 - ENGINE COVER MOUNTING STUDS

11. 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.

12. Start engine and inspect for leaks.
13. Install engine cover (2). See **Engine - Installation**.

FLEXPLATE

Removal

REMOVAL

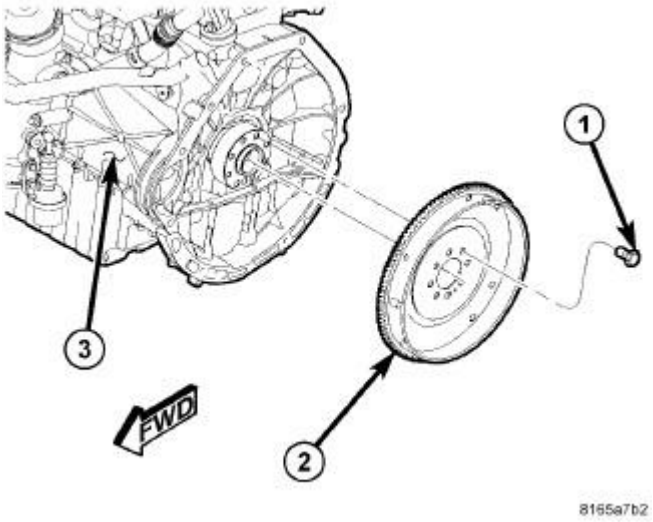

Fig. 158: FLEX PLATE
Courtesy of CHRYSLER LLC

1. Remove transaxle. Refer to **Transmission and Transfer Case/Manual - Removal** .
2. Remove flex plate retaining bolts (1).
3. Remove flex plate (2).

Installation

INSTALLATION

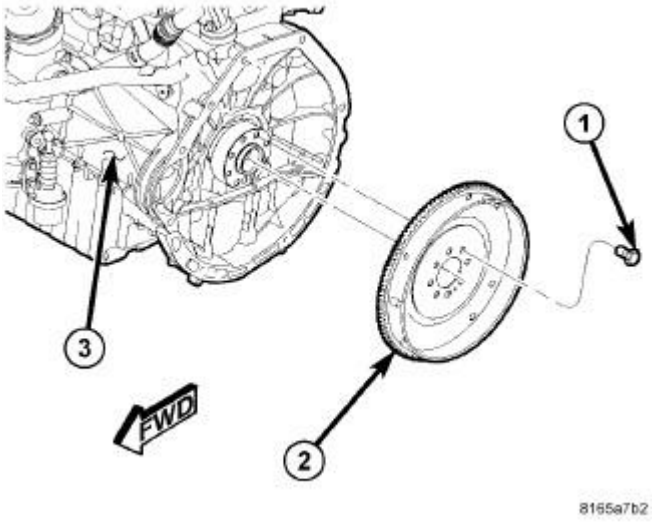

Fig. 159: FLEX PLATE
Courtesy of CHRYSLER LLC

1. Install flex plate (2).
2. Install flex plate retaining bolts (1). Torque bolts to 45N.m (33 lbs. ft.) then 90°.
3. Install transaxle. Refer to **Transmission and Transfer Case/Manual - Removal** .

MODULE, BALANCE SHAFT

Description

DESCRIPTION

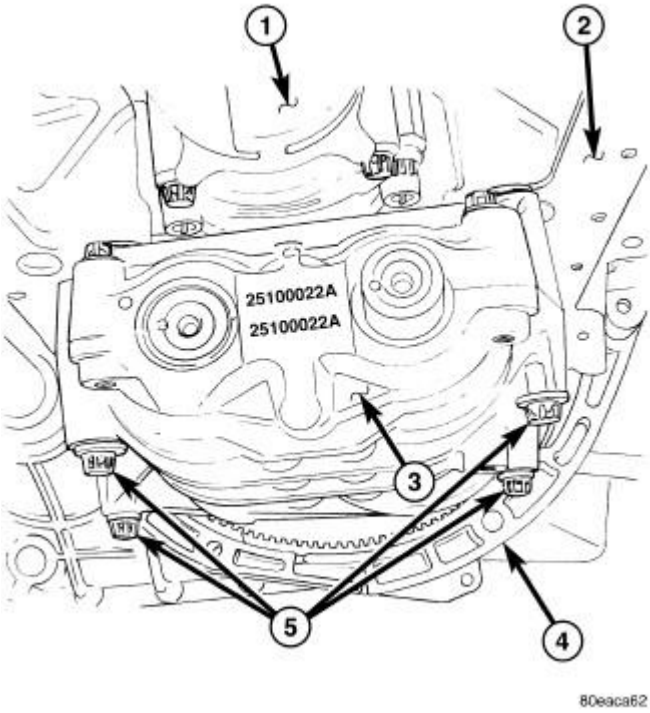

Fig. 160: Balance Shaft Location
Courtesy of CHRYSLER LLC

1 - CRANKSHAFT
2 - ENGINE BLOCK
3 - BALANCE SHAFT ASSEMBLY
4 - TRANSMISSION BELL HOUSING
5 - RETAINING BOLTS

The 2.2L engine is equipped with two nodular cast iron balance shafts installed in a cast iron carrier attached to the lower cylinder block. See **Fig. 160** .

Operation

OPERATION

The balance shafts are driven by the crankshaft via a roller chain and sprockets. The balance shafts are connected by helical gears. The dual counter rotating shafts decrease second order vertical shaking forces caused by component movement.

Removal

REMOVAL

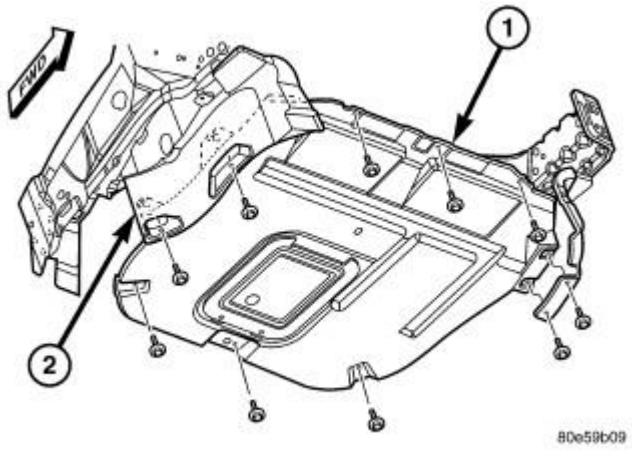

Fig. 161: Engine Compartment Lower Silencer
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Raise vehicle on hoist.
3. Remove engine compartment lower silencer (1) and accessory drive belt splash shield (2). See **Fig. 161** .
4. Drain engine oil.
5. Remove oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.

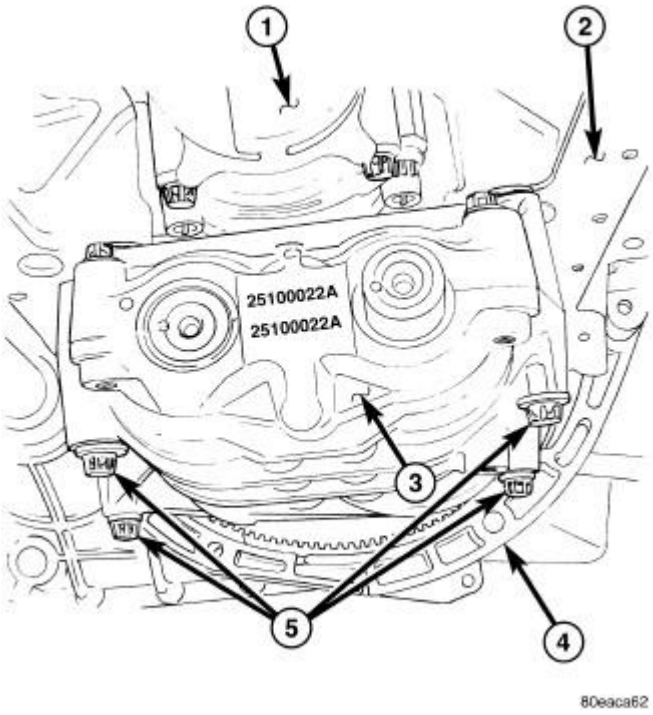

Fig. 162: Balance Shaft Location
Courtesy of CHRYSLER LLC

1 - CRANKSHAFT
2 - ENGINE BLOCK
3 - BALANCE SHAFT ASSEMBLY
4 - TRANSMISSION BELL HOUSING
5 - RETAINING BOLTS

6. Remove balance shaft retaining bolts (5) and remove balance shaft assembly (3) from engine block (2). See **Fig. 162** .

Installation

INSTALLATION

Before the balance shaft assembly can be installed, the balance shaft shim thickness must be determined. Follow steps below to determine shim thickness.

DETERMINING BALANCE SHAFT SHIM THICKNESS

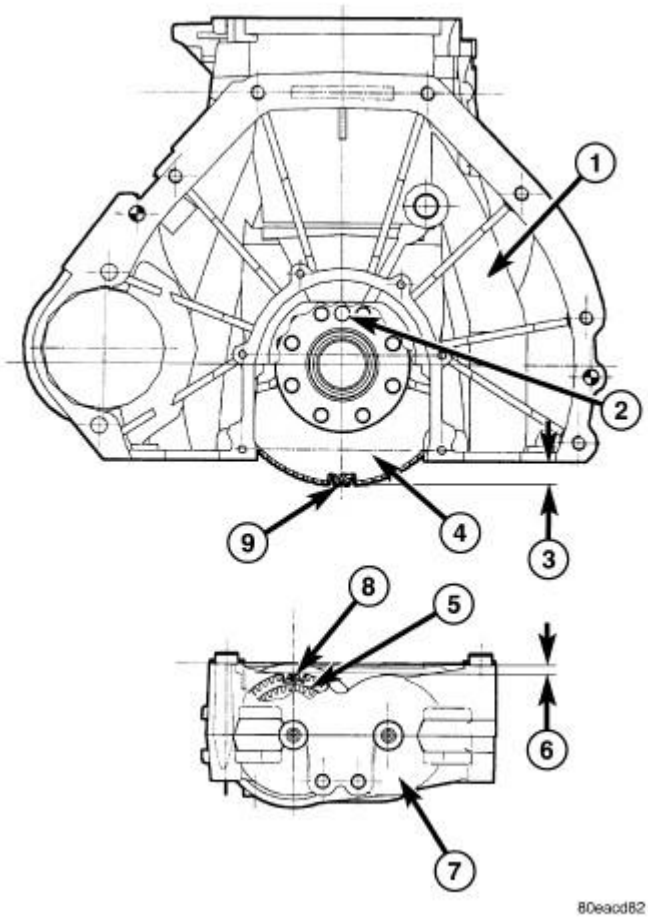

Fig. 163: Measurements for Determining Shim Thickness
Courtesy of CHRYSLER LLC

1 - ENGINE BLOCK
2 - CRANKSHAFT POSITION DURING MEASUREMENT
3 - DIMENSION B
4 - CRANKSHAFT
5 - BALANCE SHAFT SPROCKET
6 - DIMENSION A
7 - BALANCE SHAFT ASSEMBLY
8 - 2.5MM TEST BALL LOCATION
9 - 2.5MM TEST BALL LOCATION

1. Measure and determine dimensions A (6) and B (3) by measuring in the center of the gears. See **Fig. 163** . Measure 4 times approximately 90° apart. Determine mean of the 4 measurements.

BALANCE SHAFT SHIM THICKNESS CHART (SHOWN IN MM)												
		DIMENSION B										
		16.58	16.53	16.60	16.61	16.62	16.63	16.64	16.65	16.66	16.67	16.68
DIMENSION A	6.24	2.00 / 88	2.00 / 84	2.00 / 81	2.00 / 77	2.00 / 73	2.00 / 69	2.00 / 65				
	6.19		2.05 / 88	2.05 / 84	2.05 / 81	2.05 / 77	2.05 / 73	2.05 / 69	2.05 / 65			
	6.14			2.10 / 88	2.10 / 84	2.10 / 81	2.10 / 77	2.10 / 73	2.10 / 69	2.10 / 66		
	6.09				2.15 / 86	2.15 / 84	2.15 / 81	2.15 / 77	2.15 / 73	2.15 / 69	2.15 / 65	

80eacd7d

Fig. 164: Balance Shaft Shim Thickness Chart
Courtesy of CHRYSLER LLC

2. After measuring dimension A and B, use the balance shaft shim thickness chart to determine shims needed for balance shaft assembly. See **Fig. 164** .

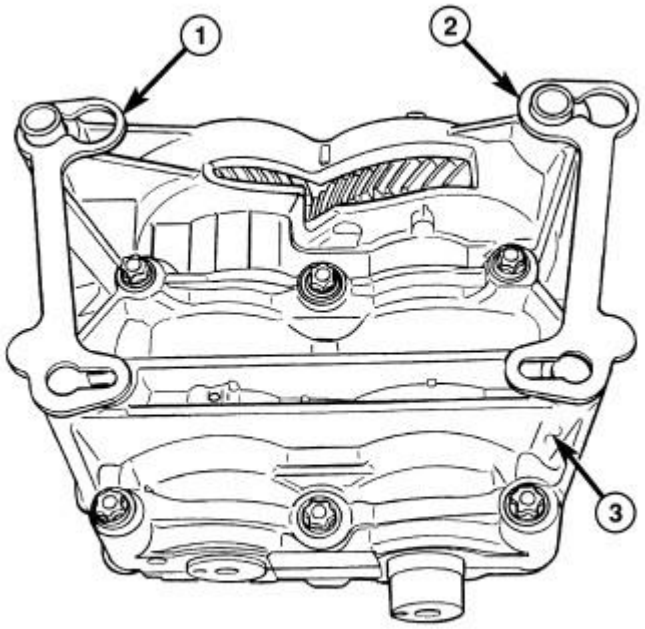

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Fig. 165: Balance Shaft Shim Position
Courtesy of CHRYSLER LLC

1 - BALANCE SHAFT SHIM 2 - BALANCE SHAFT SHIM 3 - BALANCE SHAFT ASSEMBLY

After selecting proper balance shaft shims. Install shims (1,2) on balance shaft assembly (3). See **Fig. 165**.

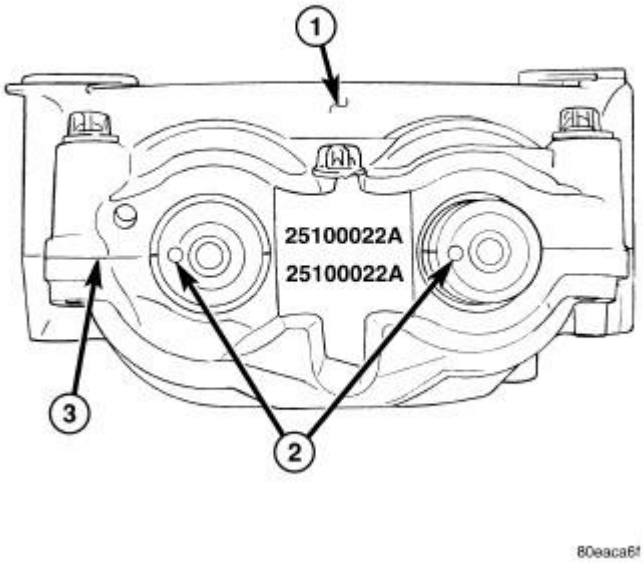

Fig. 166: Balance Shaft Position Before Installation
Courtesy of CHRYSLER LLC

1 - BALANCE SHAFT ASSEMBLY 2 - DRILL HOLES IN END OF BALANCE SHAFTS 3 - ASSEMBLY POINT OF CARRIER HALVES

3. Position #1 cylinder at Top Dead Center.
4. Align drill holes (2) at end of balance shafts with assembly point of carrier halves (3). See **Fig. 166** .

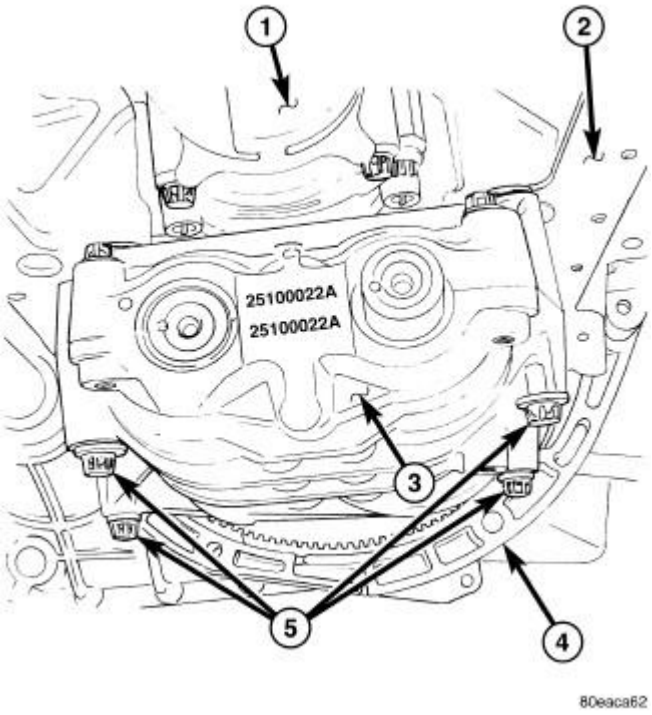

Fig. 167: Balance Shaft Location
Courtesy of CHRYSLER LLC

1 - CRANKSHAFT
2 - ENGINE BLOCK
3 - BALANCE SHAFT ASSEMBLY
4 - TRANSMISSION BELL HOUSING
5 - RETAINING BOLTS

5. Position balance shaft assembly (3) on engine block (2) and install retaining bolts (5). Tighten bolts to 25N.m, then to 45N.m.
6. Install oil pan. See **Engine/Lubrication/PAN, Oil - Installation**.

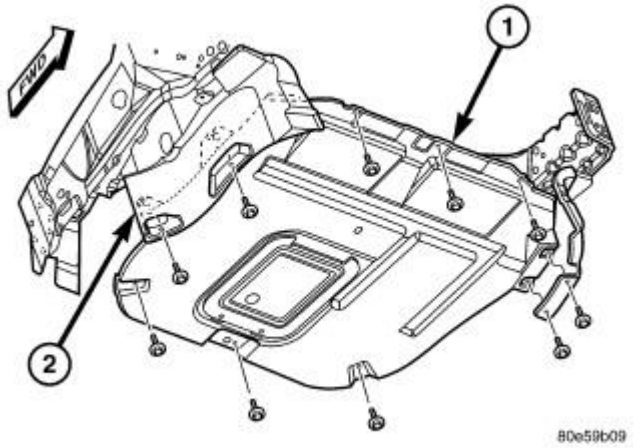

Fig. 168: Engine Compartment Lower Silencer
Courtesy of CHRYSLER LLC

1 - ENGINE COMPARTMENT SILENCER
2 - ACCESSORY DRIVE BELT SPLASH SHIELD

7. Install engine compartment lower silencer (1) and accessory drive belt splash shield (2). See **Fig. 168** .
8. Lower vehicle.
9. Refill engine oil and power steering fluid to proper specifications.
10. Connect negative battery cable.

PUMP, VACUUM

Description

DESCRIPTION

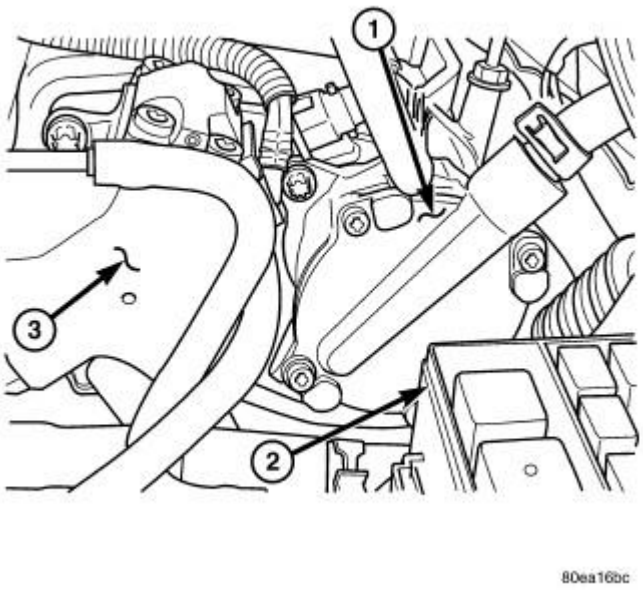

Fig. 169: Vacuum Pump Location
Courtesy of CHRYSLER LLC

1 - VACUUM PUMP 2 - Totally Integrated Power Module (TIPM) 3 - INJECTION PUMP

The vacuum pump (1) is mounted to the rear of the cylinder head next to the high pressure pump (3) . See **Fig. 169**. The vacuum pump (1) is of the vane type. The pump supplies vacuum to the brake booster, EGR system, turbocharger wastegate solenoid, and the swirl valve actuator.

Removal

REMOVAL

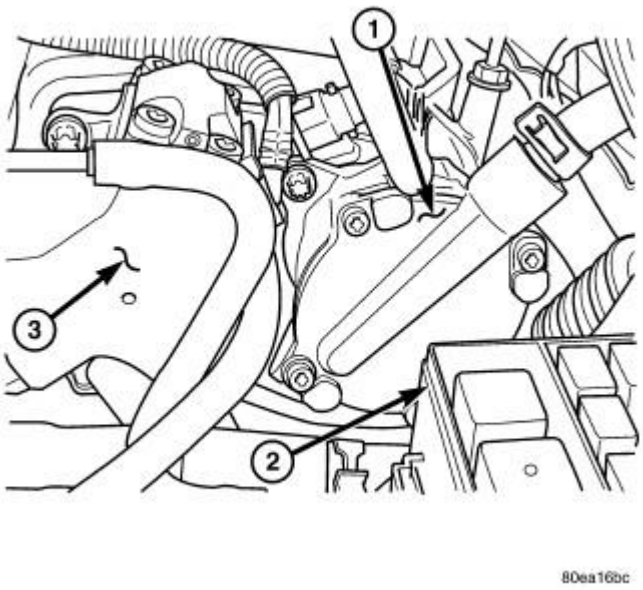

Fig. 170: Vacuum Pump Location
Courtesy of CHRYSLER LLC

1 - VACUUM PUMP 2 - Totally Integrated Power Module (TIPM) 3 - INJECTION PUMP

1. Disconnect negative battery cable.
2. Remove engine cover. See **Engine - Removal**.
3. Remove air cleaner housing assembly. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.
4. Disconnect vacuum hose from vacuum pump (1).
5. Disconnect the TIPM (2) from bracket and reposition out of way.
6. Remove vacuum pump (1) retaining bolts and remove pump from cylinder head.

Installation

INSTALLATION

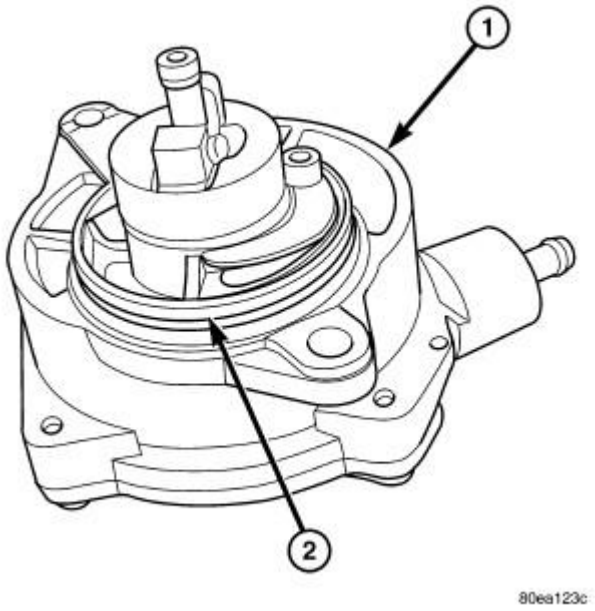

Fig. 171: Vacuum Pump O-ring
Courtesy of CHRYSLER LLC

1 - VACUUM PUMP 2 - O-RING

1. With O-ring (2) installed on vacuum pump (1) , align pump with pump drive on camshaft. See **Fig. 171**.
2. Slide vacuum pump (1) into cylinder head and install retaining bolts. Torque bolts to 14N.m (124 lbs. in.).

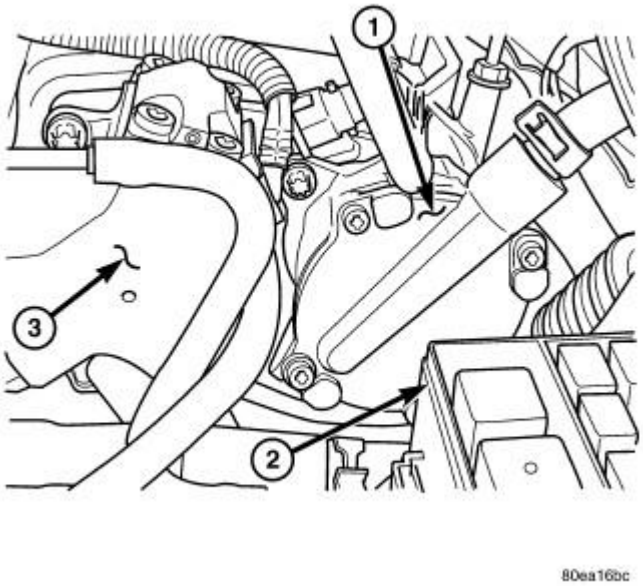

Fig. 172: Vacuum Pump Location
Courtesy of CHRYSLER LLC

1 - VACUUM PUMP 2 - TIPM 3 - INJECTION PUMP

3. Reposition and connect the TIPM (2) to mounting bracket.
4. Connect vacuum hose to vacuum pump (1).
5. Install air cleaner housing assembly. See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.
6. Install engine cover. See **Engine - Installation**.
7. Connect negative battery cable.

SEAL, CRANKSHAFT OIL, REAR

Removal

REMOVAL

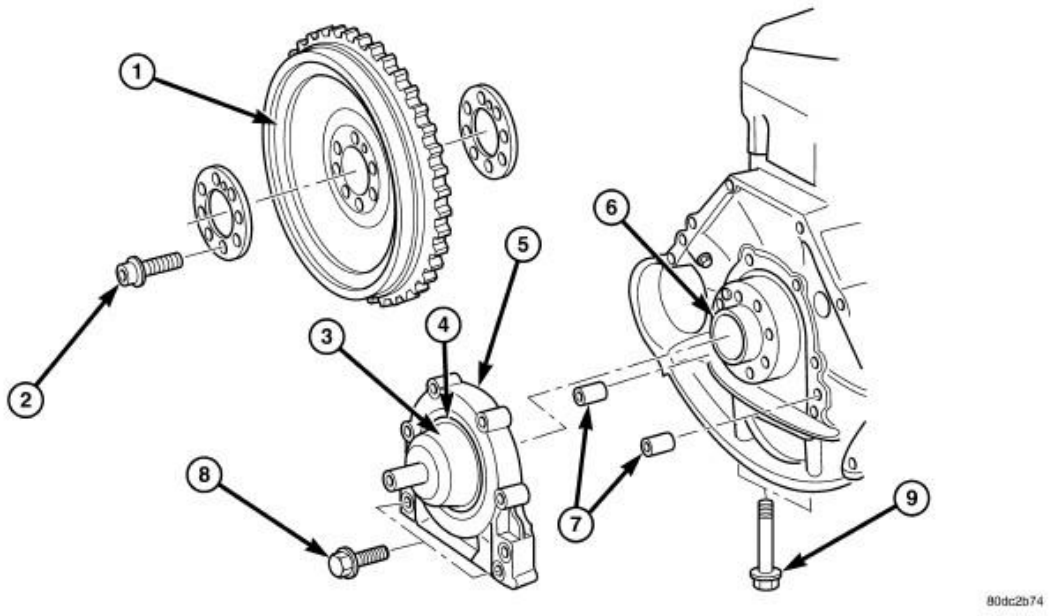

Fig. 173: Rear Crankshaft Seal/Adapter
Courtesy of CHRYSLER LLC

1 - FLYWHEEL
2 - FLYWHEEL BOLTS
3 - SPECIAL TOOL #8944
4 - REAR CRANKSHAFT OIL SEAL
5 - REAR CRANKSHAFT SEAL ADAPTER
6 - CRANKSHAFT
7 - ALIGNMENT DOWELS
8 - REAR CRANKSHAFT SEAL ADAPTER RETAINING BOLT
9 - OIL PAN TO REAR CRANKSHAFT SEAL ADAPTER RETAINING BOLT

This must be done with the transmission removed from the vehicle.

1. Disconnect the negative battery cable.
2. Raise and support the vehicle.
3. Remove transmission assembly. Refer to **Transmission and Transfer Case/Manual - Removal** .
4. Drain the engine oil.

NOTE: Loosen all of the oil pan bolts to assure that the oil pan gasket is not damaged when removing the rear main oil seal and adapter assembly.

NOTE: Inspect the oil pan gasket for damage. If the oil pan gasket is damaged, remove oil pan and replace oil pan gasket.

5. Loosen oil pan bolts.

6. Remove flywheel (1).

CAUTION: Care must be taken when removing the rear main seal and adaptor assembly. Failure to do so will result in damage to the oil pan gasket.

7. Remove the rear crankshaft seal adaptor retaining bolts (8) and carefully pry adaptor (5) from crankcase at adaptor shoulders . See **Fig. 173**.

Installation

INSTALLATION

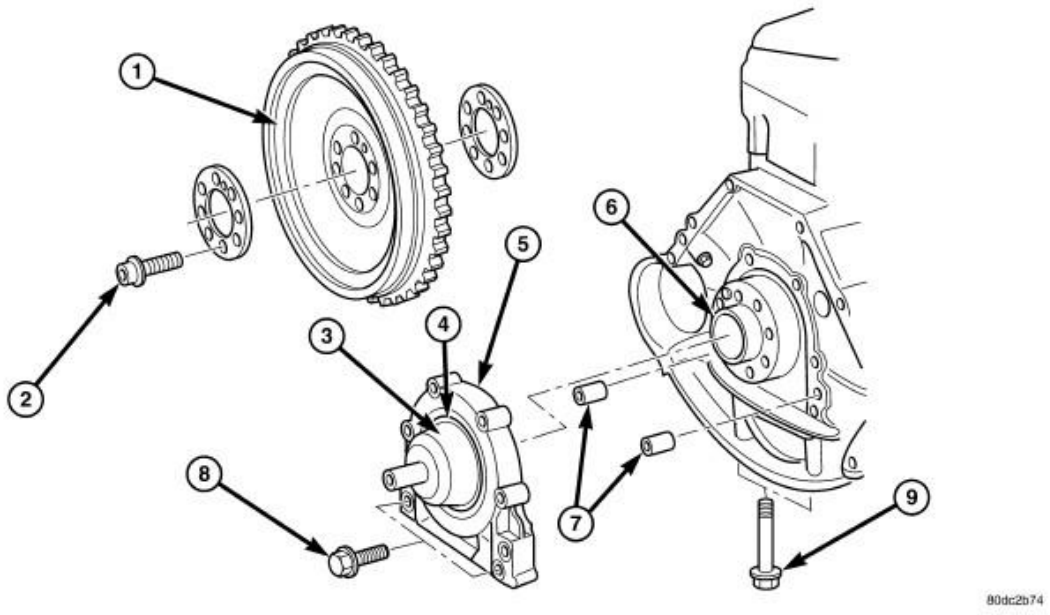

Fig. 174: Rear Crankshaft Seal/Adapter
Courtesy of CHRYSLER LLC

1 - FLYWHEEL
2 - FLYWHEEL BOLTS
3 - SPECIAL TOOL #8944
4 - REAR CRANKSHAFT OIL SEAL
5 - REAR CRANKSHAFT SEAL ADAPTER
6 - CRANKSHAFT
7 - ALIGNMENT DOWELS
8 - REAR CRANKSHAFT SEAL ADAPTER RETAINING BOLT
9 - OIL PAN TO REAR CRANKSHAFT SEAL ADAPTER RETAINING BOLT

NOTE: Thoroughly clean all mating surfaces with the appropriate solvents to assure that no grease or oil is present during reassembly.

NOTE: Carefully position the rear main seal/adaptor evenly onto the assembly sleeve. The rear main oil seal lip MUST NOT roll over the edge of the tool.

1. Position the rear crankshaft oil seal adaptor (5) with Assembly Sleeve 8944 on crankshaft so that the dowel sleeves fit into guide holes. Care must be taken so that oil pan gasket is not damaged.
2. Install the rear crankshaft seal/adaptor to crankcase bolts (8) and tighten to 9.N.m (80 lbs. in).
3. Tighten the M6 oil pan bolts to 9N.m (80 lbs in) and the M8 bolts to 20 N.m (15 lbs ft).
4. Install fly wheel (1) and tighten bolts (2) in two stages. Torque bolts to 45 N.m (33 lbs. ft.) then 90°.
5. Install transmission assembly. Refer to **Transmission and Transfer Case/Manual - Installation** .
6. Install the oil pan drain plug and tighten to 25 N.m (18 lbs ft).

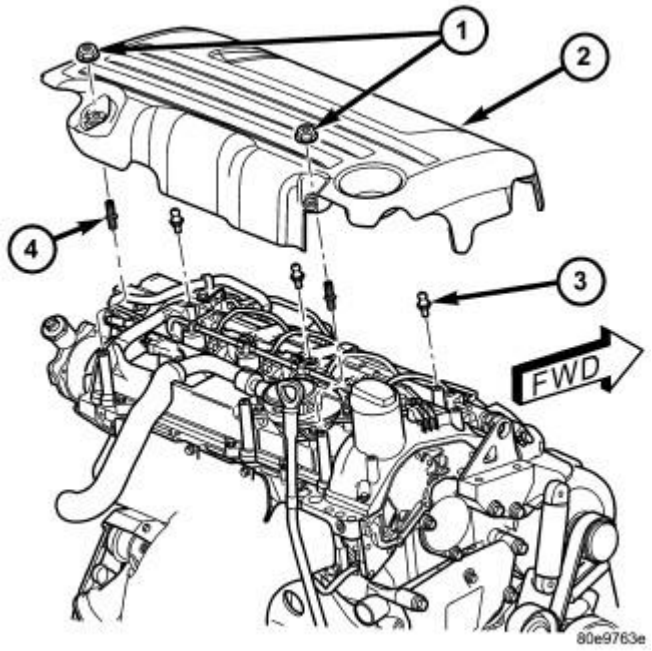

Fig. 175: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1 - ENGINE COVER RETAINING NUTS
2 - ENGINE COVER
3 - ENGINE COVER MOUNTS
4 - ENGINE COVER MOUNTING STUDS

7. Lower vehicle.
8. Fill crankcase with the correct engine oil, to the proper level. Refer to owner's manual for specifications.
9. Connect negative battery cable.

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

10. Start engine and inspect for leaks.
11. Install engine cover (2). See **Engine - Installation**.

ENGINE MOUNTING

DESCRIPTION

DESCRIPTION

The engine mounting system consists of a four-point system utilizing two load-carrying mounts and two torque struts. The load-carrying mounts are located on each frame rail. The right mount is a hydro-elastic mount and left mount is a conventional elastomeric isolator. The two torque controlling struts are attached at the front of the engine, straddling the right side load-carrying mount. The upper strut connects to the suspension strut tower and the lower to the suspension crossmember.

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 two struts absorbs torque reaction forces and torsional vibrations.

INSULATOR, ENGINE MOUNT, LEFT

Removal

REMOVAL

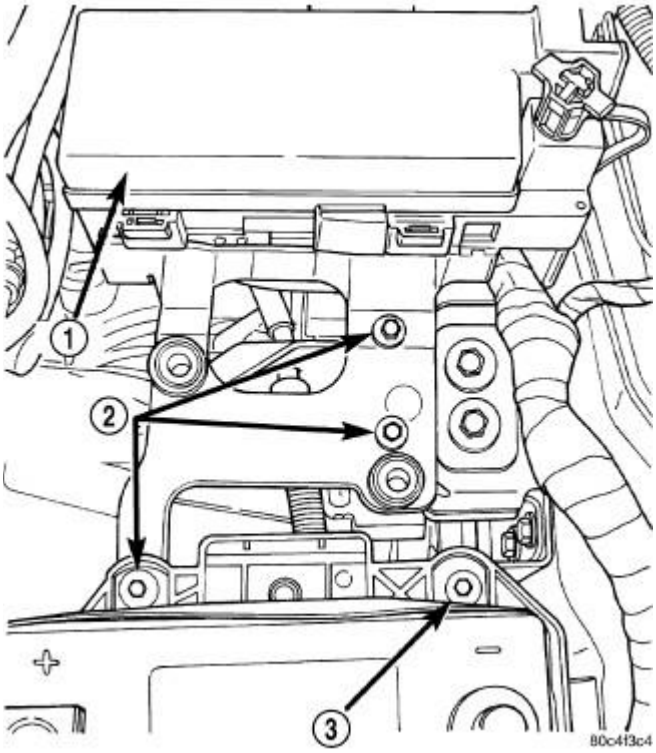

Fig. 176: TIPM Brackett Attaching Bolts - Typical
Courtesy of CHRYSLER LLC

1 - Totally Integrated Power Module (TIPM) 2 - TIPM BRACKET BOLTS 3 - BATTERY TRAY BOLT

1. Disconnect negative battery cable.
2. Remove air cleaner assembly.
3. Remove bolts attaching the TIPM bracket (2) to left mount and battery tray (3) . See **Fig. 176**.
4. Support transaxle with a suitable jack.

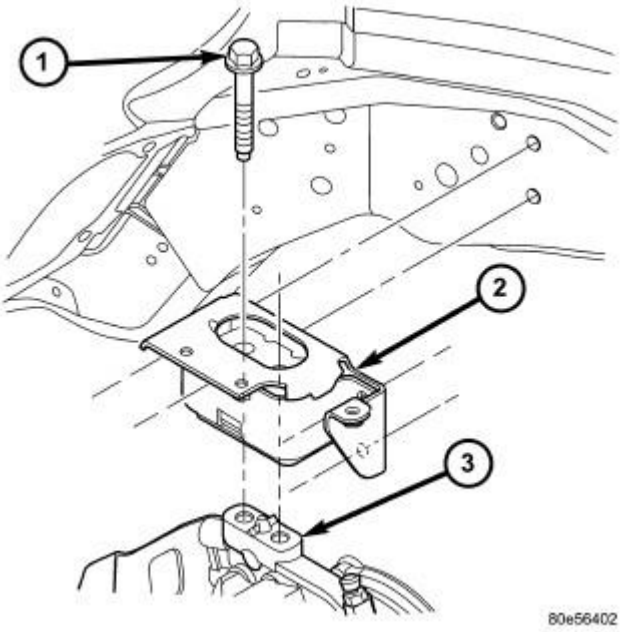

Fig. 177: LEFT MOUNT - TYPICAL
Courtesy of CHRYSLER LLC

1 - BOLT (2)
2 - MOUNT
3 - BRACKET

5. Remove mount to transaxle bolts (1).
6. Remove left mount bracket to body frame rail fasteners.
7. Remove mount (2).

Installation

INSTALLATION

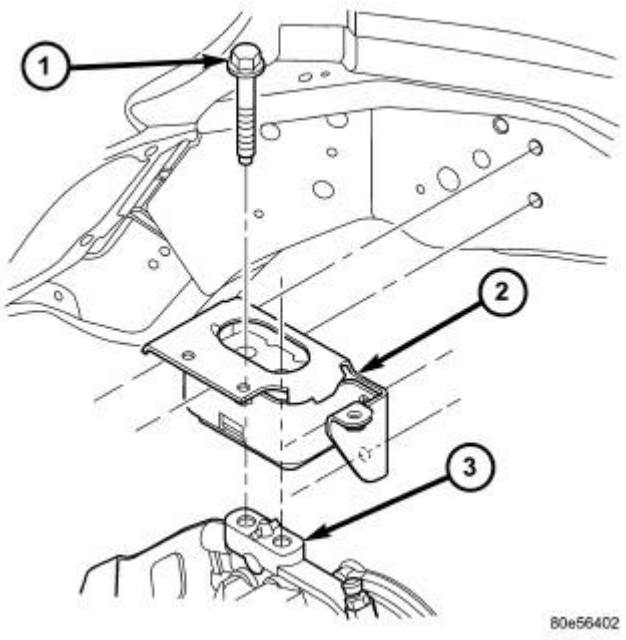

Fig. 178: LEFT MOUNT - TYPICAL
Courtesy of CHRYSLER LLC

1 - BOLT (2) 2 - MOUNT 3 - BRACKET

1. Install engine mount bracket to body frame rail and tighten fasteners to 28 N.m (250 in. lbs.) . See **Fig. 178**.
2. Position engine/transaxle for installation of mount to transaxle bolts (1). Install and tighten bolts to 68 N.m (50 ft. lbs.).
3. Remove jack from under transaxle.

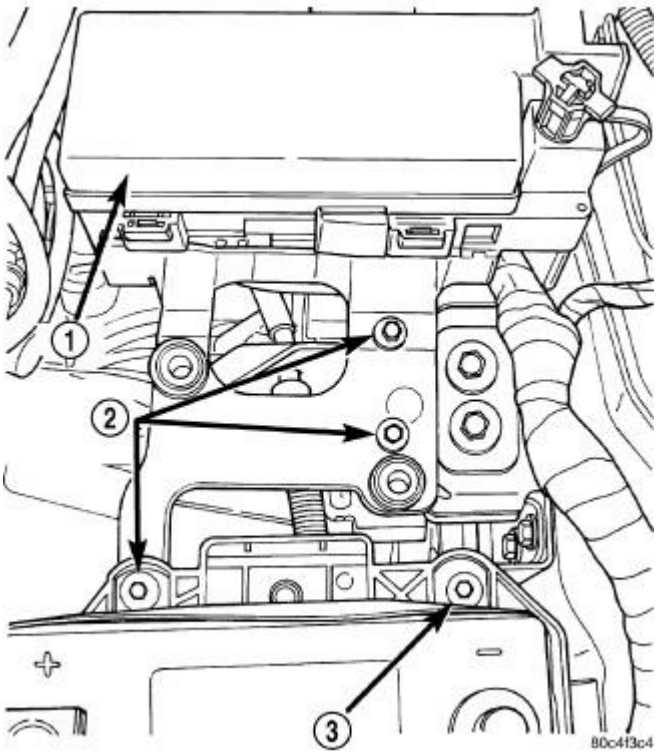

Fig. 179: TIPM Brackett Attaching Bolts - Typical
Courtesy of CHRYSLER LLC

1 - Totally Integrated Power Module (TIPM)
2 - TIPM BRACKET BOLTS
3 - BATTERY TRAY BOLT

4. Install bolts attaching the TIPM bracket to left mount and battery tray (3).
5. Install air cleaner assembly.
6. Connect negative battery cable.

INSULATOR, ENGINE MOUNT, RIGHT

Removal

REMOVAL

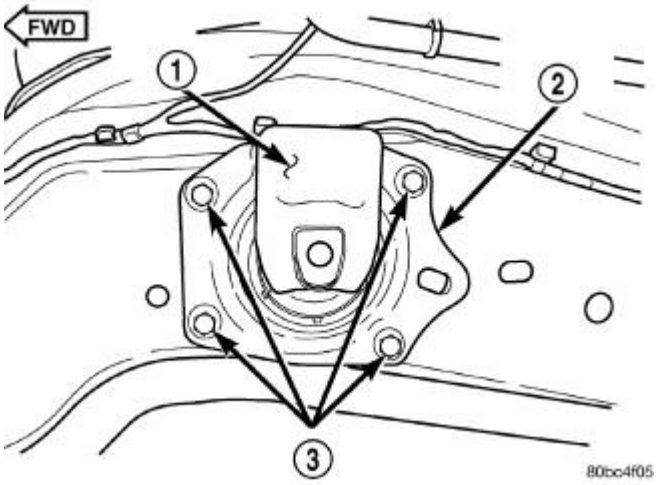

Fig. 180: Engine Mount-Right
Courtesy of CHRYSLER LLC

1 - SNUBBER PAD 2 - RIGHT ENGINE MOUNT 3 - BOLTS

1. Remove the engine assembly for the required clearance to access the engine mount. See **Engine - Removal**.

NOTE: The right engine mount attaching holes are slightly oversize to compensate for manufacturing tolerances. The mount has been set at the manufacturing plant for proper powertrain alignment. Therefore, it is necessary to mark the position of the mount before the attaching bolts are loosened.

2. Using a permanent ink marker or equivalent, mark the position of engine mount (2) to the body frame rail.
3. Remove bolts (3) attaching mount to body . See **Fig. 180**.
4. Remove mount (2).

Installation

INSTALLATION

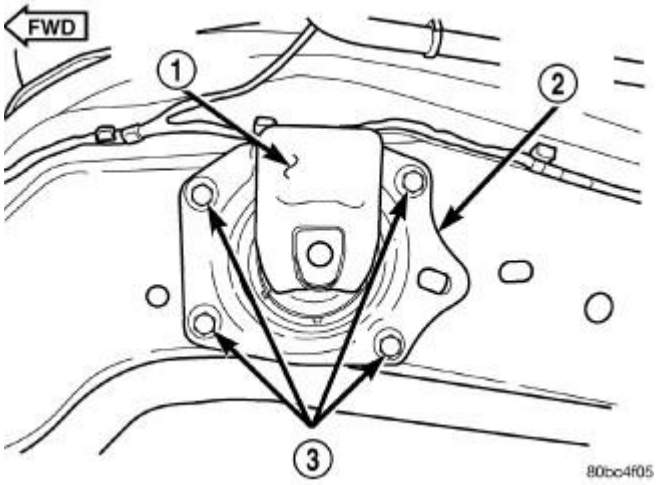

Fig. 181: Engine Mount-Right
Courtesy of CHRYSLER LLC

1 - SNUBBER PAD 2 - RIGHT ENGINE MOUNT 3 - BOLTS

1. Position mount (2) into the original position on body frame rail.

NOTE: Engine mount must be installed in the original position on body frame rail. If mount was not marked or frame rail was replaced, perform the following procedure.

2. Perform the following procedure if the mount position was not previously marked, or the frame rail was replaced:
   a. Insert new mount (2) loosely in frame rail.
   b. Align the four holes in the mount with the mating holes in the rail such that the holes are concentric (frame rail holes centered in the mount holes).
   c. Using a permanent ink marker or equivalent, mark the position of engine mount (2) to the body frame rail while maintaining mounting hole concentricity.
3. Ensure the mount (2) maintains originally marked position and install mount bolts. Tighten bolts to 28 N.m (250 in. lbs.).
4. Install the engine assembly. See **Engine - Installation**.

STRUT, TORQUE

Removal

UPPER

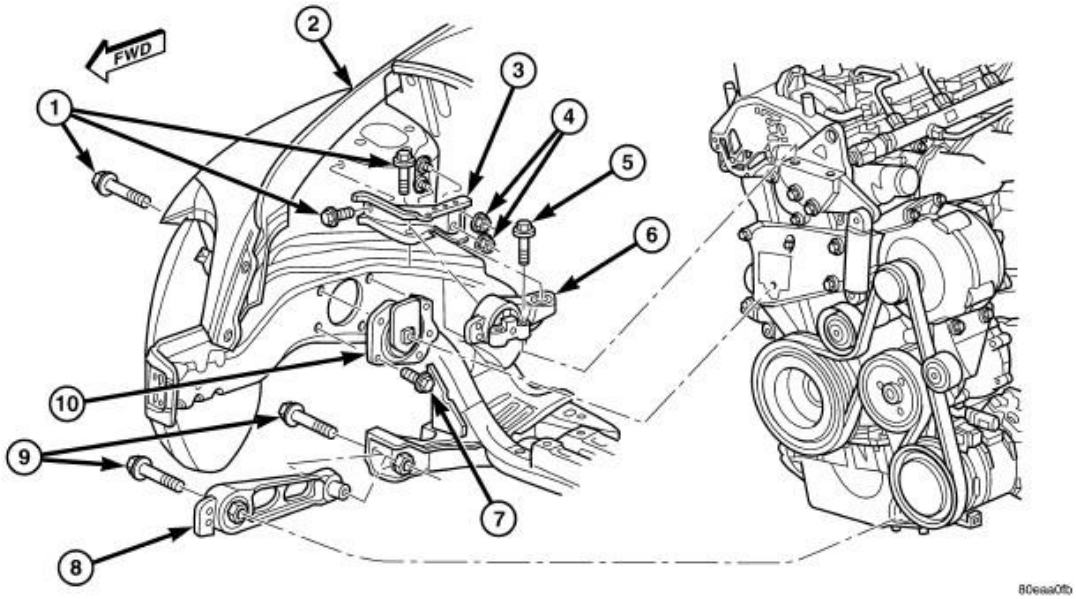

Fig. 182: Engine Mounting - Right Side
Courtesy of CHRYSLER LLC

1 - BOLT
2 - RIGHT FENDER
3 - UPPER TORQUE STRUT BRACKET
4 - NUTS
5 - BOLT
6 - UPPER TORQUE STRUT
7 - BOLT
8 - LOWER TORQUE STRUT
9 - BOLT
10 - RIGHT ENGINE MOUNT

1. Remove bolts attaching upper torque strut (6) to shock tower bracket (3) and engine mount bracket . See **Fig. 182**.
2. Remove the upper torque strut (6).

LOWER

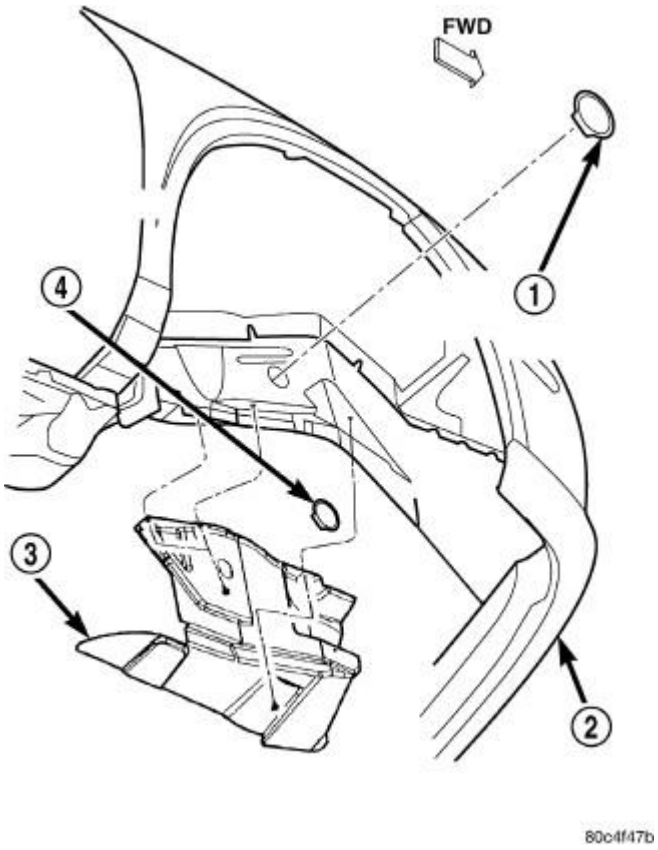

Fig. 183: Splash Shield
Courtesy of CHRYSLER LLC

1 - RIGHT MOUNT BOLT ACCESS PLUG
2 - FASCIA
3 - SPLASH SHIELD
4 - CRANKSHAFT BOLT ACCESS PLUG

1. Raise vehicle on hoist.
2. Remove accessory drive belt splash shield (3). See **Fig. 183** .

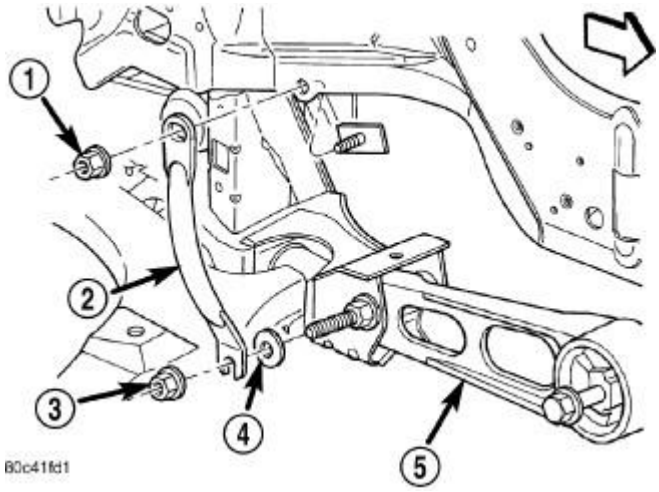

Fig. 184: Pencil Strut
Courtesy of CHRYSLER LLC

1 - NUT
2 - PENCIL STRUT
3 - NUT
4 - FLAT WASHER
5 - LOWER TORQUE STRUT

3. Remove pencil strut (2). See **Fig. 184** .
4. Remove bolts attaching lower torque strut (5) to crossmember and strut bracket.
5. Remove lower torque strut (5).

Installation

UPPER

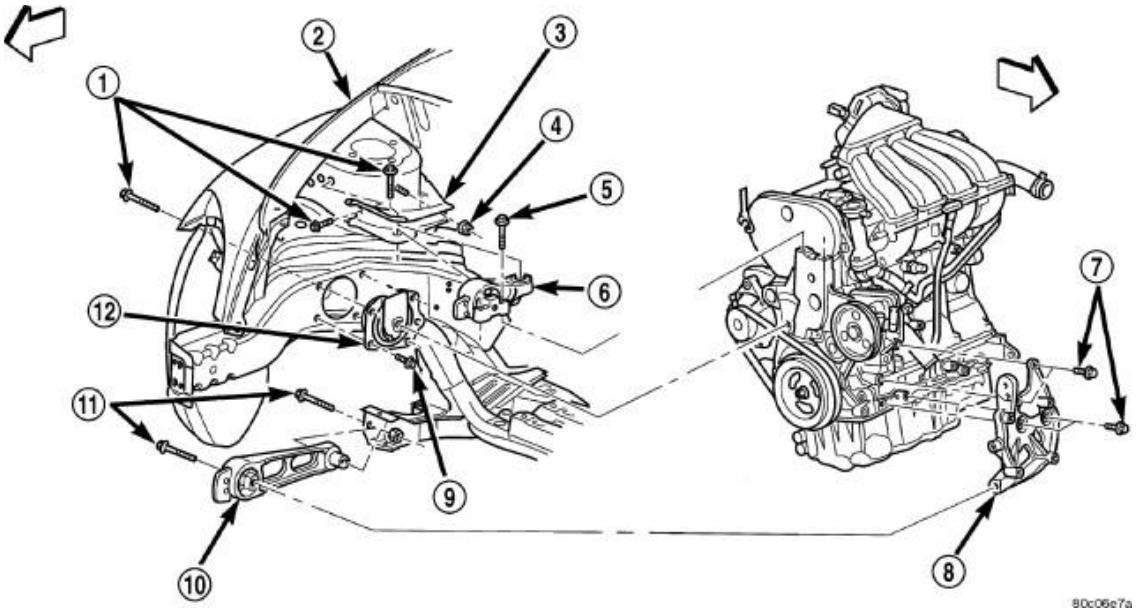

Fig. 185: Engine Mounting - Right Side
Courtesy of CHRYSLER LLC

1 - BOLT
2 - RIGHT FENDER
3 - UPPER TORQUE STRUT BRACKET
4 - NUT
5 - BOLT
6 - UPPER TORQUE STRUT
7 - BOLT
8 - LOWER TORQUE STRUT BRACKET
9 - BOLT
10 - LOWER TORQUE STRUT
11 - BOLT
12 - RIGHT ENGINE MOUNT

1. Position the upper torque strut (6) into mounting location.
2. Install the torque strut (6) mounting bolts and perform the torque strut adjustment procedure. See **Engine/Engine Mounting/STRUT, Torque - Adjustments**.

LOWER

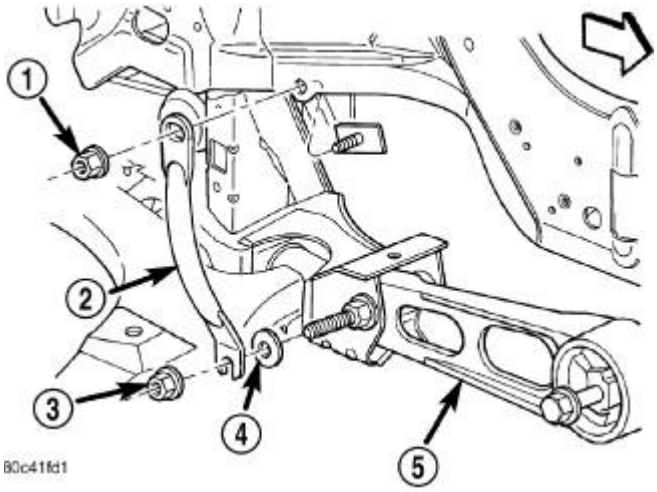

Fig. 186: Pencil Strut
Courtesy of CHRYSLER LLC

1 - NUT
2 - PENCIL STRUT
3 - NUT
4 - FLAT WASHER
5 - LOWER TORQUE STRUT

1. Position lower torque strut (5) into mounting locations.
2. Install mounting bolts and perform torque strut adjustment procedure. See **Engine/Engine Mounting/STRUT, Torque - Adjustments**.
3. Install pencil strut (2) and tighten nuts (3) to 58 N.m (43 ft. lbs.).

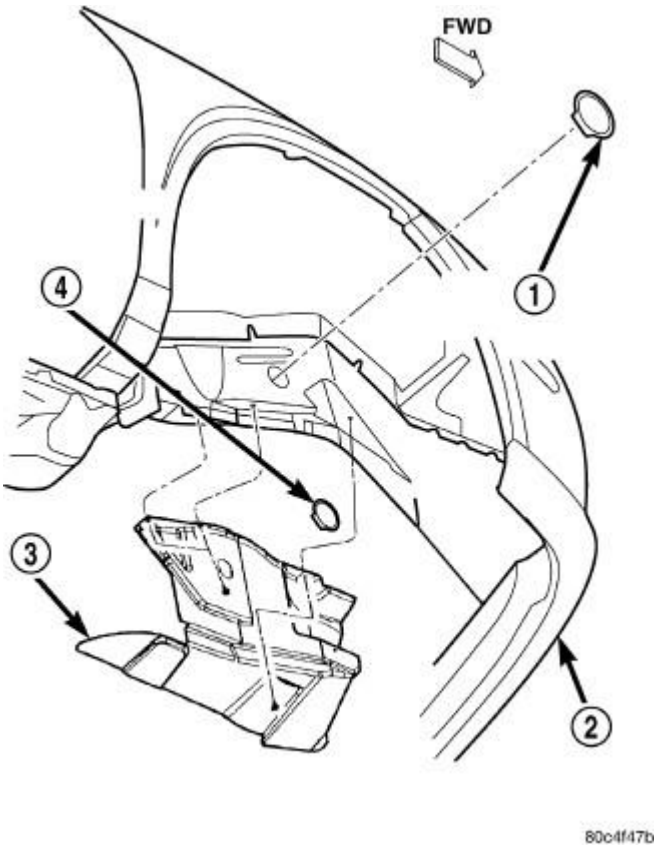

Fig. 187: Splash Shield
Courtesy of CHRYSLER LLC

1 - RIGHT MOUNT BOLT ACCESS PLUG
2 - FASCIA
3 - SPLASH SHIELD
4 - CRANKSHAFT BOLT ACCESS PLUG

4. Install accessory belt splash shield (3) and lower vehicle.

Adjustments

ENGINE TORQUE STRUT ADJUSTMENT

The upper and lower torque struts need to be adjusted together to assure proper engine positioning and engine mount loading. Whenever a torque strut bolt(s) is loosened, this procedure must be performed.

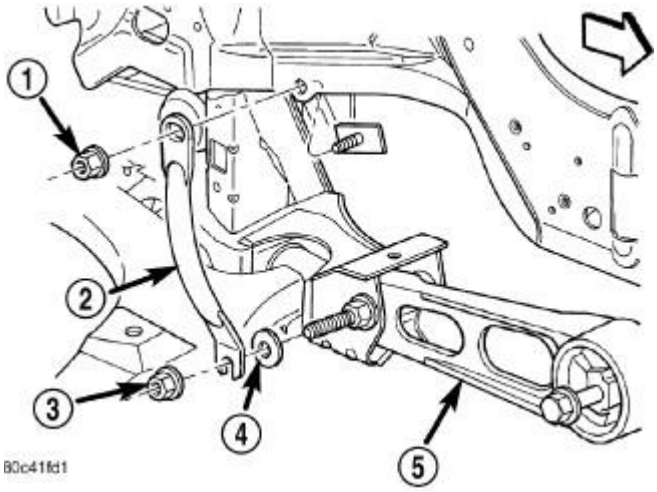

Fig. 188: Pencil Strut
Courtesy of CHRYSLER LLC

1 - NUT
2 - PENCIL STRUT
3 - NUT
4 - FLAT WASHER
5 - LOWER TORQUE STRUT

1. Remove accessory drive belt splash shield.
2. Remove pencil strut (2).
3. Loosen the upper and lower torque strut (5) attaching bolt at the suspension crossmember and shock tower bracket.

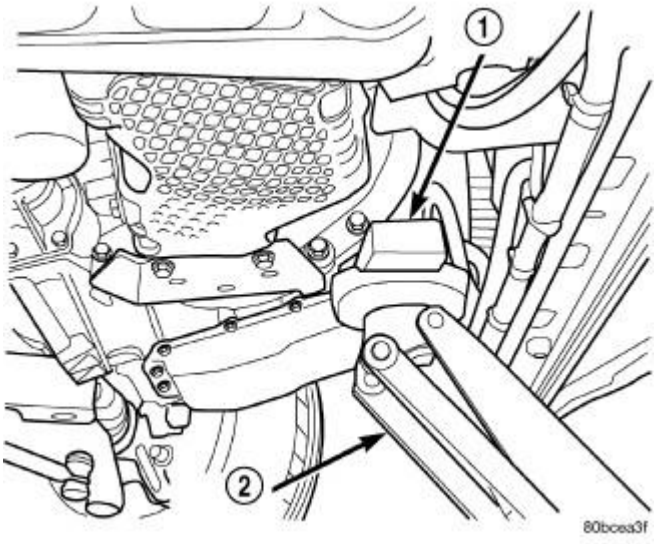

Fig. 189: Floor Jack Positioning
Courtesy of CHRYSLER LLC

1 - WOOD BLOCK 2 - FLOOR JACK

4. The engine position may now be adjusted by positioning a suitable floor jack on the forward edge of the transmission bell housing.

NOTE: The floor jack must be positioned as indicated, to prevent minimal upward lifting of the engine. See Fig. 189.

5. With the engine supported, remove the upper and lower torque strut attachment bolt(s) at shock tower bracket and suspension crossmember . See **Fig. 189**. Verify that the torque struts are free to move within the shock tower bracket and crossmember. Reinstall the torque strut bolt(s), but do not tighten.

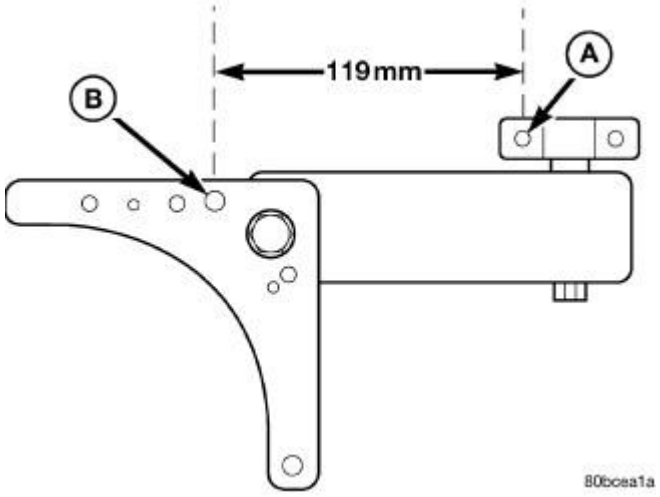

Fig. 190: Engine Position Measurement
Courtesy of CHRYSLER LLC

6. Carefully apply upward force, allowing the upper engine to rotate rearward until the distance between the center of the rearmost attaching bolt on the engine mount bracket (point "A") and the center of the hole on the shock tower bracket (point "B") is 119 mm (4.70 in.). See **Fig. 190** .

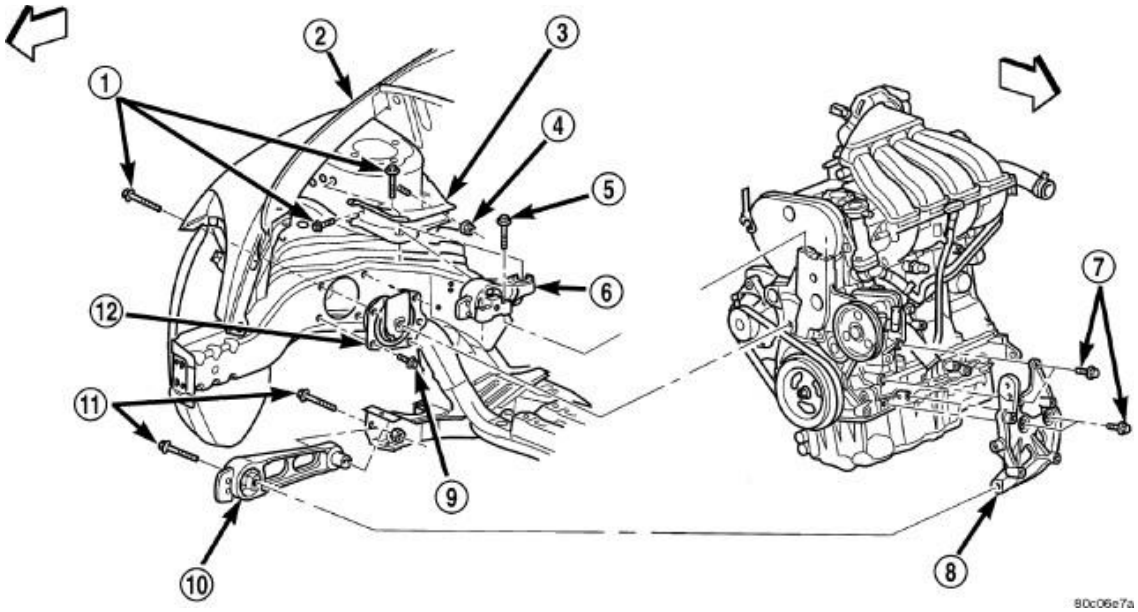

Fig. 191: Torque Strut Bolts
Courtesy of CHRYSLER LLC

1 - BOLT
2 - RIGHT FENDER
3 - UPPER TORQUE STRUT BRACKET
4 - NUT
5 - BOLT
6 - UPPER TORQUE STRUT
7 - BOLT
8 - LOWER TORQUE STRUT BRACKET
9 - BOLT
10 - LOWER TORQUE STRUT
11 - BOLT
12 - RIGHT ENGINE MOUNT

CAUTION: The engine must be held in position with jack until both the upper and lower torque strut bolts are tightened.

7. With the engine held at the proper position, tighten both the upper (6) and lower (10) torque strut bolts to 115 N.m (85 ft. lbs.).
8. Remove the floor jack.

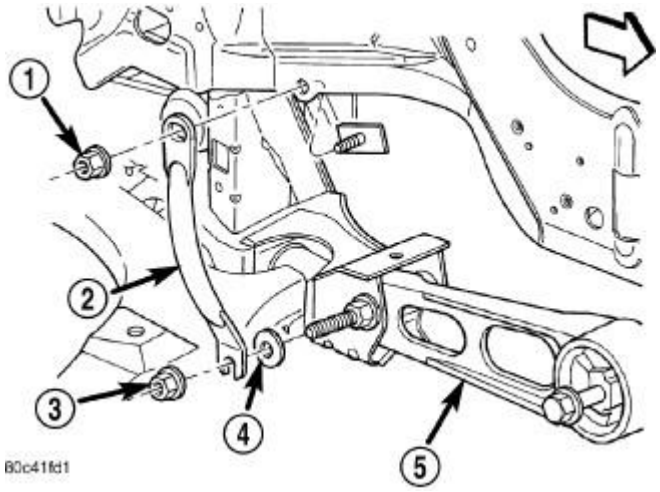

Fig. 192: Pencil Strut
Courtesy of CHRYSLER LLC

1 - NUT
2 - PENCIL STRUT
3 - NUT
4 - FLAT WASHER
5 - LOWER TORQUE STRUT

9. Install pencil strut (2) and tighten nuts (3) to 58 N.m (43 ft. lbs.).
10. Install accessory drive belt splash shield.

LUBRICATION

JET, PISTON OIL COOLER

Description

DESCRIPTION

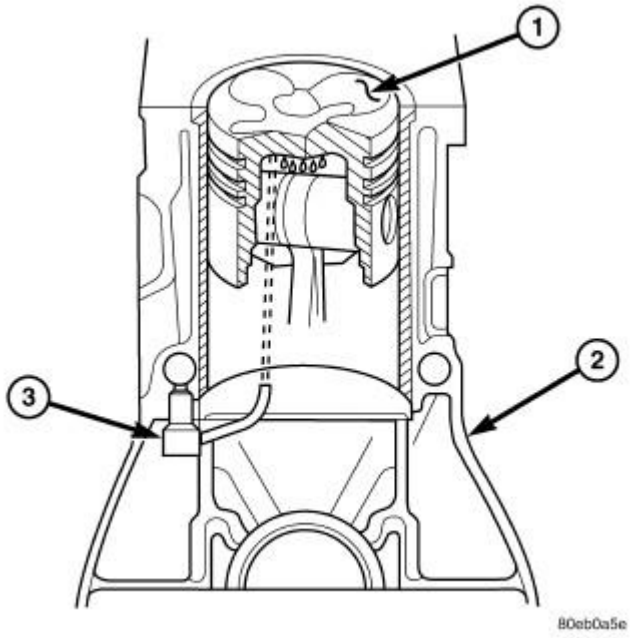

Fig. 193: Oil Jet Location
Courtesy of CHRYSLER LLC

1 - PISTON ASSEMBLY 2 - ENGINE BLOCK 3 - OIL JET

There are four oil jets (3) installed in the engine block (2). See **Fig. 193** . These oil jets are used to cool and lubricate the piston assemblies.

Removal

REMOVAL

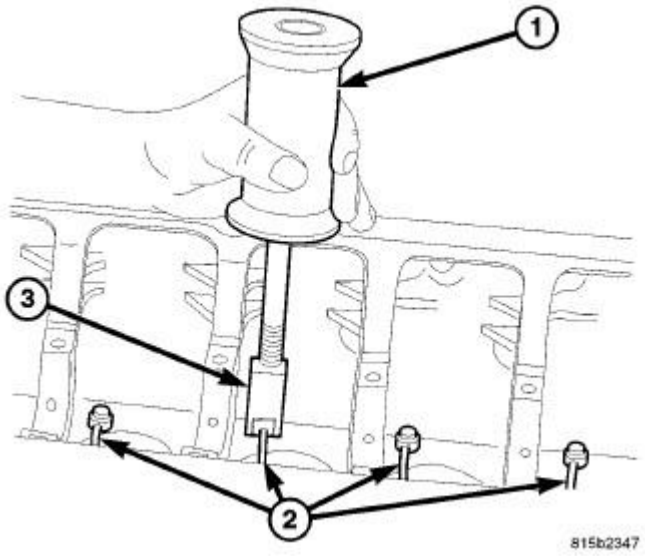

Fig. 194: Oil Jet Extraction Claw
Courtesy of CHRYSLER LLC

1 - SLIDE HAMMER - C-3752 2 - OIL JETS 3 - EXTRACTION CLAW 9746

The engine must be removed from the vehicle and completely disassembled to replace the oil jets (2).

1. Remove engine from vehicle.
2. Completely disassemble engine.
3. Using an Extraction Claw 9746 (3) and Slide Hammer C-3752 (1), remove the oil jets (2) from engine block.

Installation

INSTALLATION

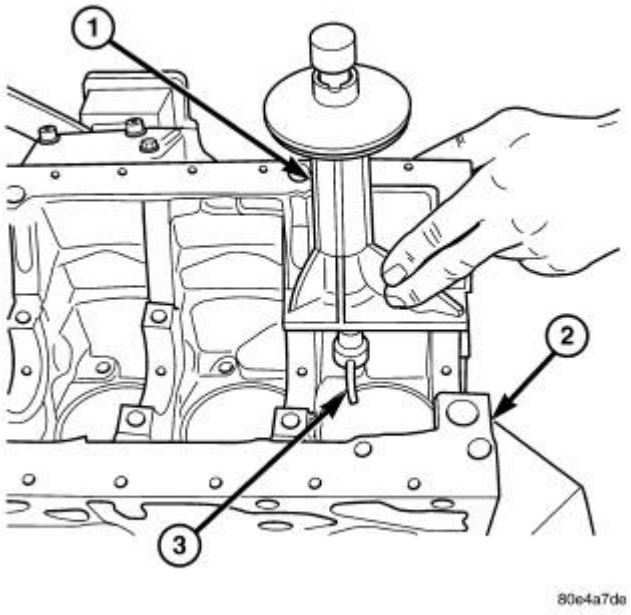

Fig. 195: Oil Jet Installation
Courtesy of CHRYSLER LLC

1 - OIL JET INSTALLER 8942 2 - ENGINE BLOCK 3 - OIL JET

1. Install oil jet (3) into Oil Jet Installer 8942 (1).
2. Align oil jet (3) in location in engine block (2).
3. Drive oil jets (3) into block (2) using Oil Jet Installer 8942 (1) until oil jet is fully seated into engine block. See **Fig. 195** .
4. Reassemble engine.
5. Install engine into vehicle.

PAN, OIL

Removal

REMOVAL

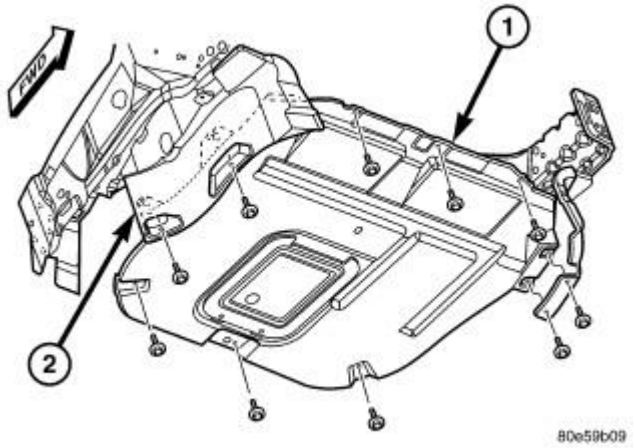

Fig. 196: Engine Compartment Lower Silencer
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Raise vehicle on hoist.
3. Remove right front wheel.
4. Remove engine compartment lower silencer (1) and accessory drive belt splash shield (2). See **Fig. 196** .
5. Drain engine oil.
6. Remove power steering line to oil pan retaining bolts.
7. Disconnect power steering line from steering gear and reposition out of way.

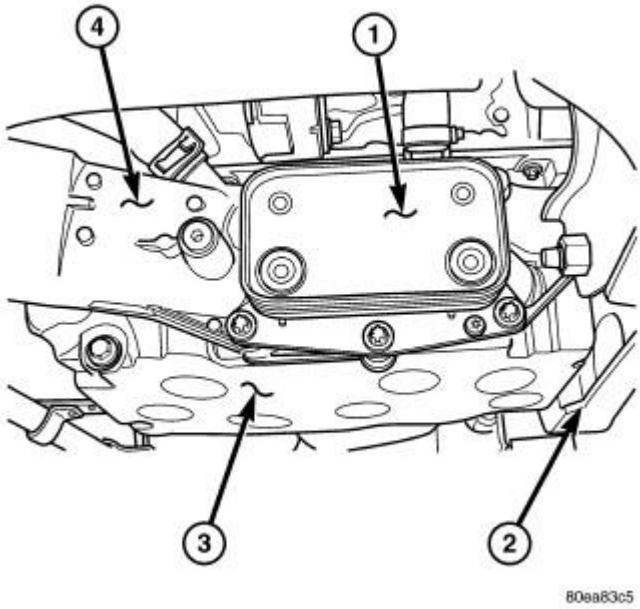

Fig. 197: Oil Cooler/Filter Assembly

Courtesy of CHRYSLER LLC

1 - OIL COOLER 2 - LOWER TORQUE STRUT 3 - OIL PAN 4 - OIL FILTER HOUSING

8. Remove charge air cooler pipe to oil pan retaining bolts.
9. Disconnect charge air cooler pipe from turbocharger and reposition out of way.
10. Remove oil cooler/filter assembly (1,4) retaining bolts and reposition assembly out of way. See **Fig. 197** .

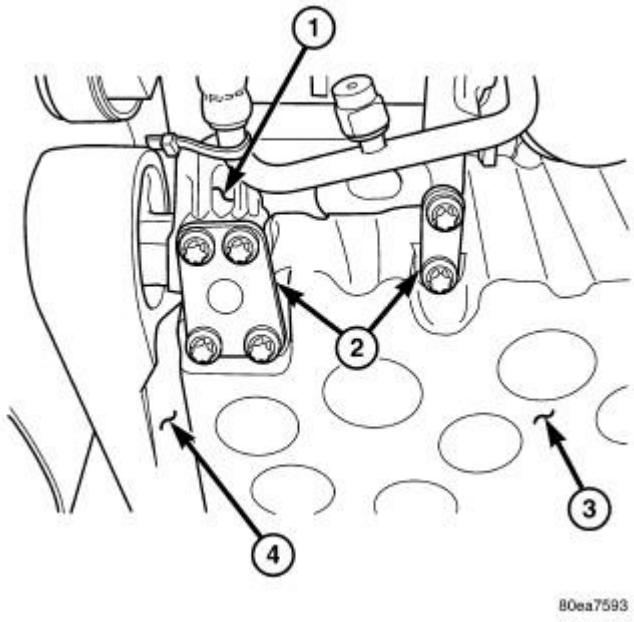

Fig. 198: A/C Compressor Mount to Oil Pan Brackets
Courtesy of CHRYSLER LLC

1 - A/C COMPRESSOR MOUNT 2 - A/C COMPRESSOR BRACKET TO OIL PAN BRACKETS 3 - OIL PAN 4 - LOWER TORQUE STRUT

11. Remove A/C compressor mount (1) to oil pan brackets. See **Fig. 198** .
12. Remove lower torque strut (4). See **Engine/Engine Mounting/STRUT, Torque - Removal**.
13. Remove oil pan fasteners and remove oil pan.

Installation

INSTALLATION

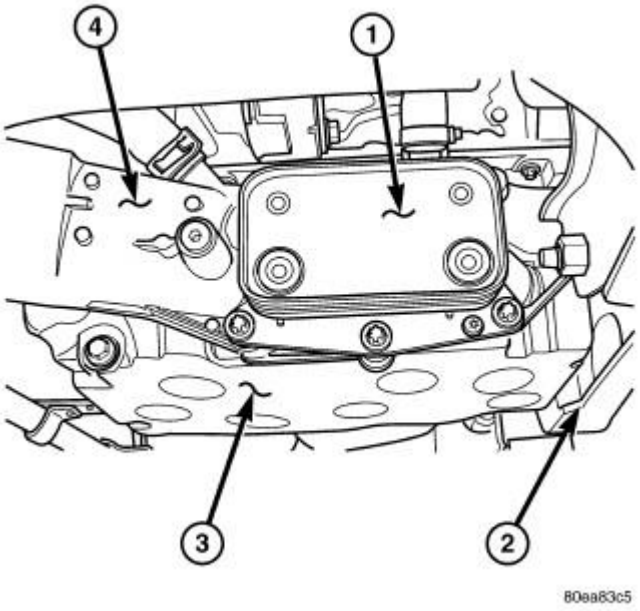

Fig. 199: Oil Cooler/FilterAssembly
Courtesy of CHRYSLER LLC

1 - OIL COOLER
2 - LOWER TORQUE STRUT
3 - OIL PAN
4 - OIL FILTER HOUSING

1. Clean oil pan and all sealing surfaces.
2. Position new oil pan gasket onto pan.
3. Install oil pan. Torque M6 bolts to 9N.m (80 lbs. in.). Torque M8 bolts to 20N.m (177 lbs. in.). Torque transmission to oil pan bolts to 40 N.m (30 lbs. ft.).
4. Reposition oil cooler assembly (1) and install retaining bolts. Torque bolts to 20N.m(177 lbs. in.).

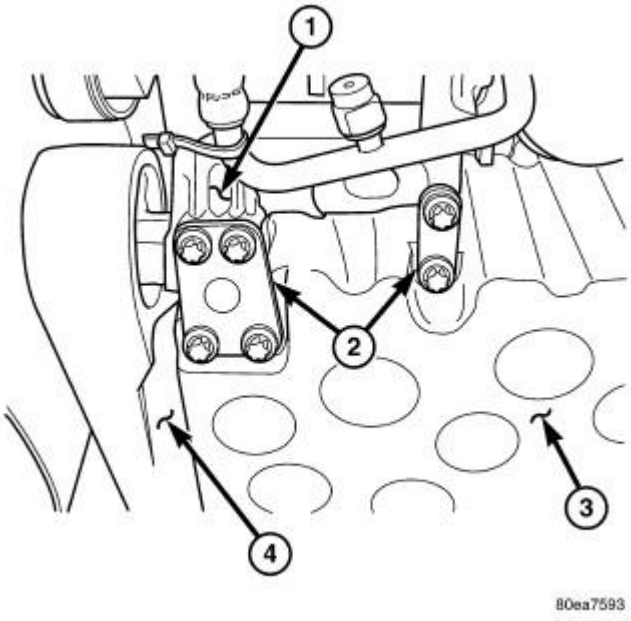

Fig. 200: A/C Compressor Mount to Oil Pan Brackets
Courtesy of CHRYSLER LLC

1 - A/C COMPRESSOR MOUNT 2 - A/C COMPRESSOR BRACKET TO OIL PAN BRACKETS 3 - OIL PAN 4 - LOWER TORQUE STRUT

5. Install lower torque strut (4). See **Engine/Engine Mounting/STRUT, Torque - Installation**.
6. Install A/C compressor mount (1) to oil pan brackets. See **Fig. 198** . Torque bolts to 20 N.m(177 lbs. in.).
7. Connect charge air cooler pipe to turbocharger.
8. Install charge air cooler pipe to oil pan retaining bolts.
9. Connect power steering line to steering gear.
10. Install power steering line to oil pan retaining bolts.

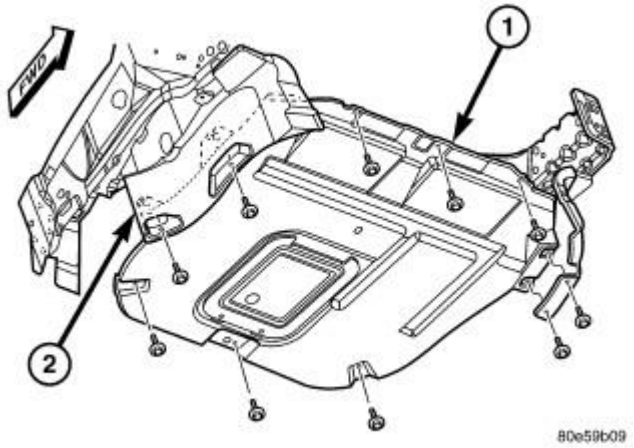

Fig. 201: Engine Compartment Lower Silencer
Courtesy of CHRYSLER LLC

1 - ENGINE COMPARTMENT SILENCER 2 - ACCESSORY DRIVE BELT SPLASH SHIELD

11. Install accessory drive belt splash shield (2) and engine compartment lower silencer (1). See **Fig. 196** .
12. Install right front wheel.
13. Lower vehicle.
14. Refill engine oil and power steering fluid to proper specifications.
15. Connect negative battery cable.

PUMP, ENGINE OIL

Removal

REMOVAL

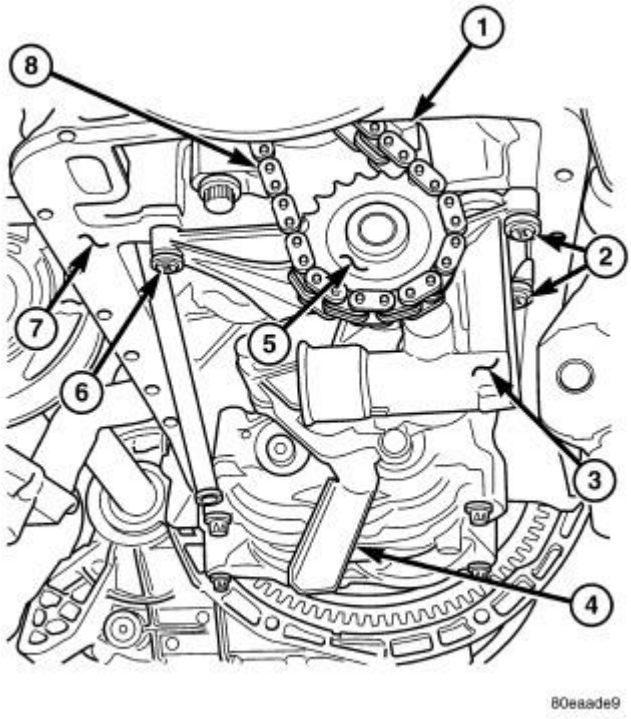

Fig. 202: Oil Pump Assembly
Courtesy of CHRYSLER LLC

1 - OIL PUMP CHAIN TENSIONER
2 - OIL PUMP RETAINING BOLTS
3 - OIL PUMP
4 - OIL PUMP PICKUP
5 - OIL PUMP SPROCKET
6 - OIL PUMP RETAINING BOLT
7 - CYLINDER BLOCK
8 - OIL PUMP CHAIN

1. Disconnect negative battery cable.
2. Raise vehicle on hoist.
3. Drain engine oil.
4. Remove oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.
5. Remove oil pump retaining bolts (2,6). See **Fig. 202** .
6. Push on oil pump chain tensioner (1) to release tension on chain and remove oil pump chain (8) from oil pump sprocket (5). See **Fig. 202** .
7. Remove oil pump (3).

Installation

INSTALLATION

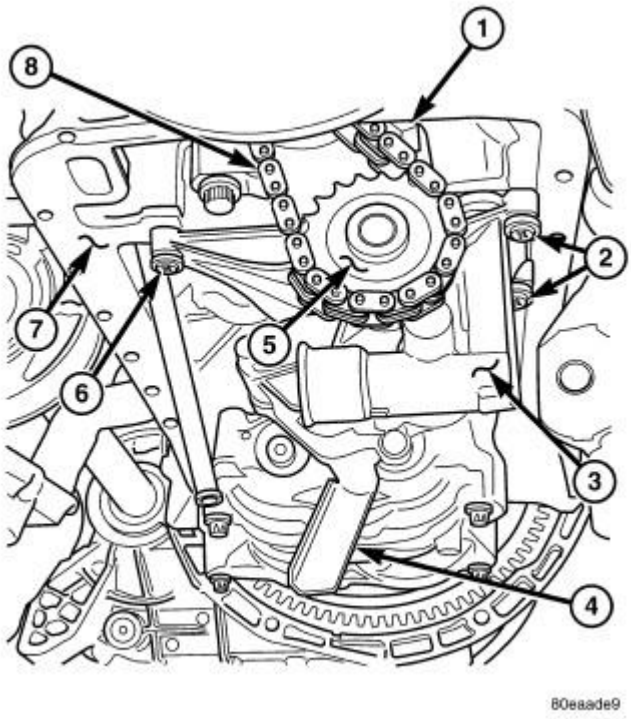

Fig. 203: Oil Pump Assembly
Courtesy of CHRYSLER LLC

1 - OIL PUMP CHAIN TENSIONER
2 - OIL PUMP RETAINING BOLTS
3 - OIL PUMP
4 - OIL PUMP PICKUP
5 - OIL PUMP SPROCKET
6 - OIL PUMP RETAINING BOLT
7 - CYLINDER BLOCK
8 - OIL PUMP CHAIN

1. Release tension from oil pump chain tensioner (1) and install chain (8) on oil pump sprocket (5).
2. Position oil pump (3) on cylinder block and install retaining bolts (2,6). Torque bolts to 18 N.m(13 lbs. ft.).
3. Install oil pan. See **Engine/Lubrication/PAN, Oil - Installation**.
4. Lower vehicle from hoist.
5. Refill engine oil to proper level.
6. Connect negative battery cable.

SWITCH, OIL PRESSURE

Description

DESCRIPTION

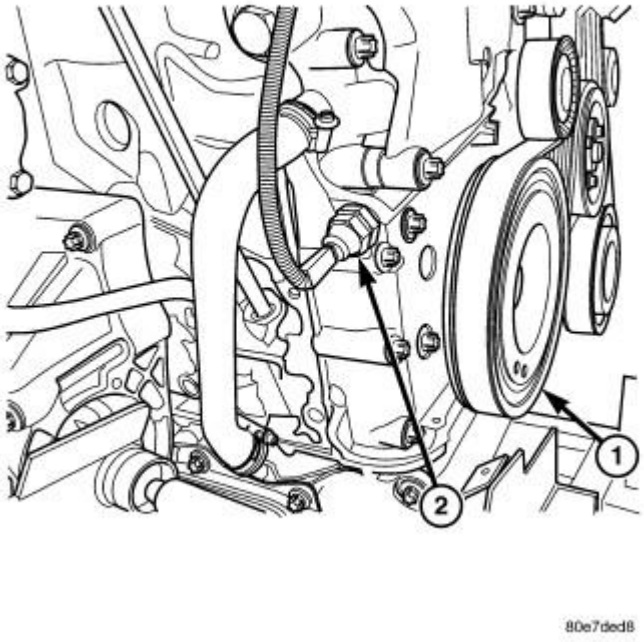

Fig. 204: Oil Pressure Sensor Location
Courtesy of CHRYSLER LLC

1 - VIBRATION DAMPER/CRANKSHAFT PULLEY 2 - OIL PRESSURE SWITCH

The oil pressure switch (2) is located on the right front side of the engine block. See **Fig. 204** . 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

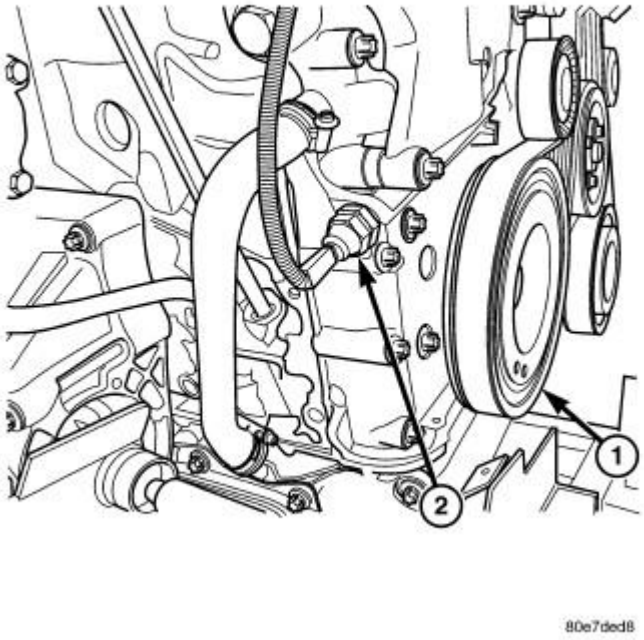

Fig. 205: Oil Pressure Sensor Location
Courtesy of CHRYSLER LLC

1 - VIBRATION DAMPER/CRANKSHAFT PULLEY 2 - OIL PRESSURE SWITCH

The oil pressure switch (2) 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.

MANIFOLDS

MANIFOLD, EXHAUST

Removal

REMOVAL

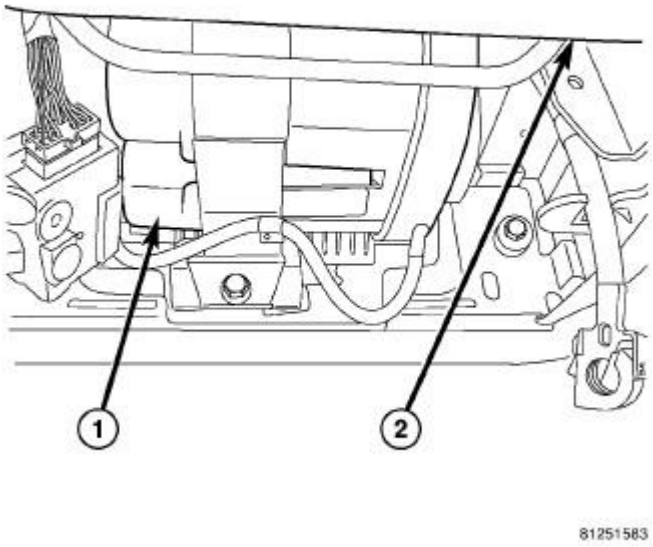

Fig. 206: Battery Location
Courtesy of CHRYSLER LLC

1. Disconnect negative battery (1) cable located under passenger seat.
2. Remove engine cover.

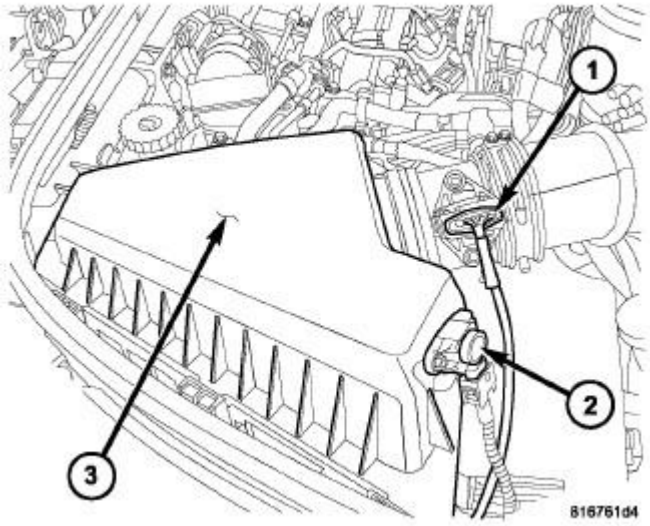

Fig. 207: AIR CLEANER HOUSING
Courtesy of CHRYSLER LLC

3. Disconnect mass air flow sensor connector (1) and inlet pressure sensor connector (2).

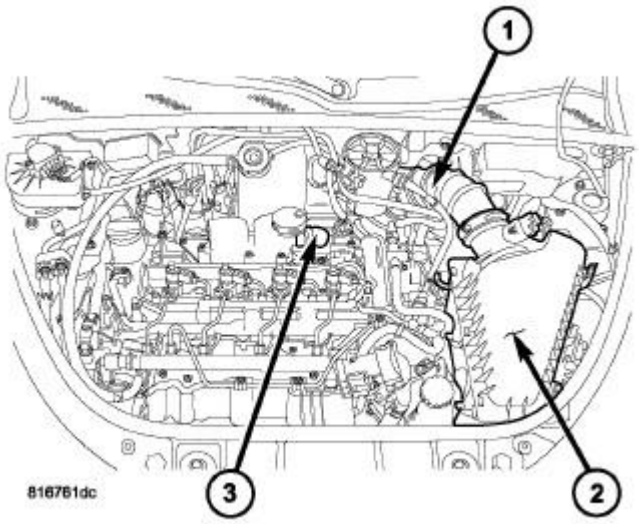

Fig. 208: AIR INLET HOSE
Courtesy of CHRYSLER LLC

4. Remove air inlet hose (1) from air cleaner housing and turbo charger.
5. Disconnect crankcase vent heater connector and remove crankcase vent hose.
6. Remove V-band clamp from turbocharger.
7. Raise vehicle. remove lower silencer shield.

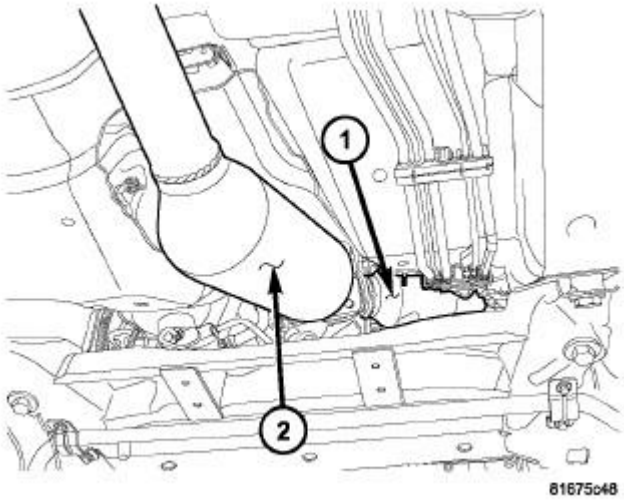

Fig. 209: PARTICULATE FILTER
Courtesy of CHRYSLER LLC

8. Remove pre-catalytic convertor (2).

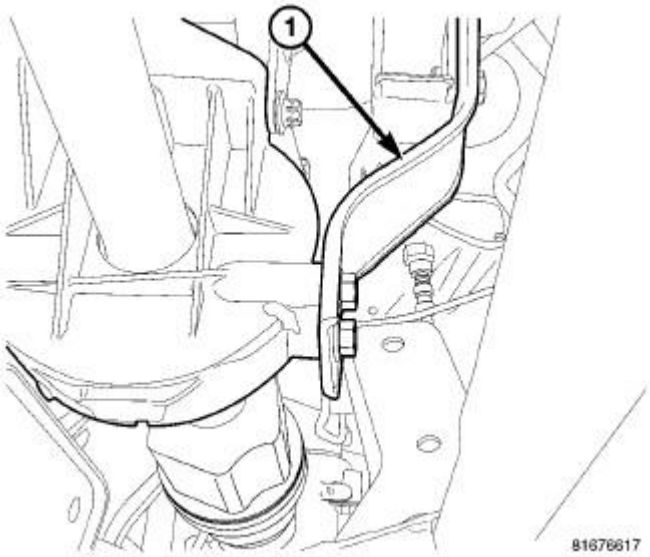

Fig. 210: CAT SUPPORT BRACKET
Courtesy of CHRYSLER LLC

9. Disconnect oxygen sensor connector.
10. Remove cat support bracket (1) and remove cat.

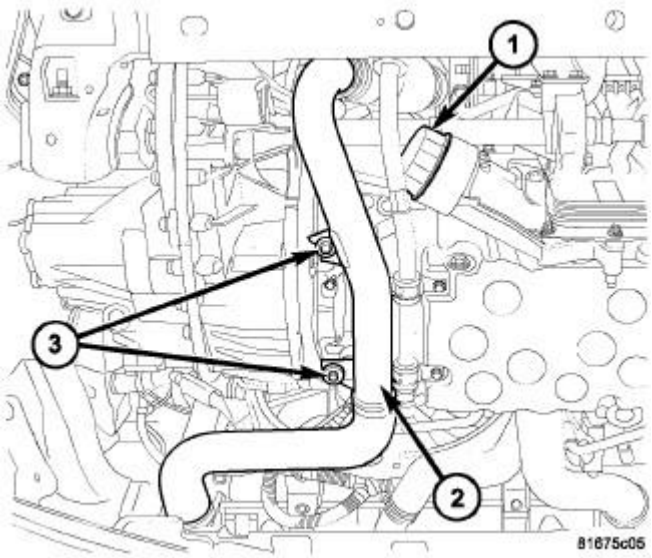

Fig. 211: CHARGE AIR PIPE MOUNT
Courtesy of CHRYSLER LLC

11. Remove charge air tube mounting bolts (3).

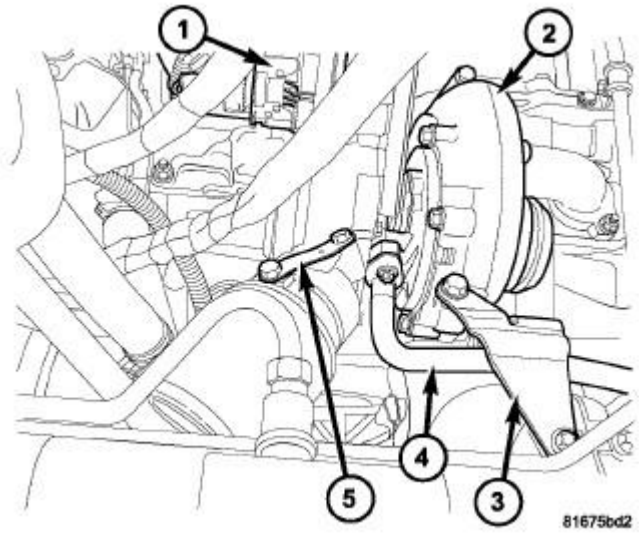

Fig. 212: CHARGE AIR PIPE
Courtesy of CHRYSLER LLC

12. Remove charge air tube bolts (5) at turbo charger and reposition tube.
13. Remove turbocharger support bracket (3).
14. Remove oil drain back tube.
15. Disconnect boost pressure servo motor connector.

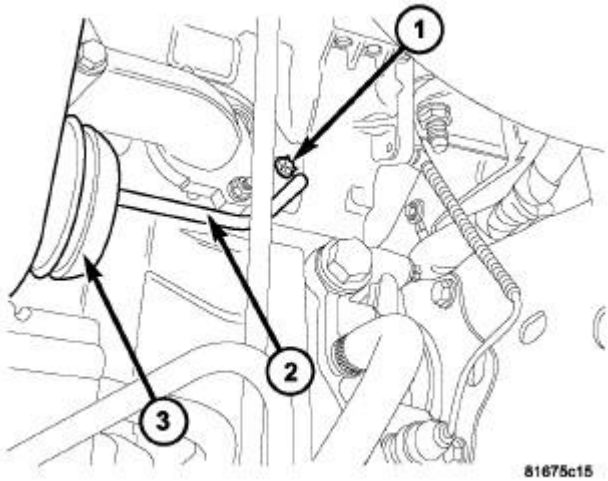

Fig. 213: TURBO OIL FEED
Courtesy of CHRYSLER LLC

16. Remove turbocharger oil feed tube retaining bolt (1). Remove oil feed tube (2) with turbocharger.

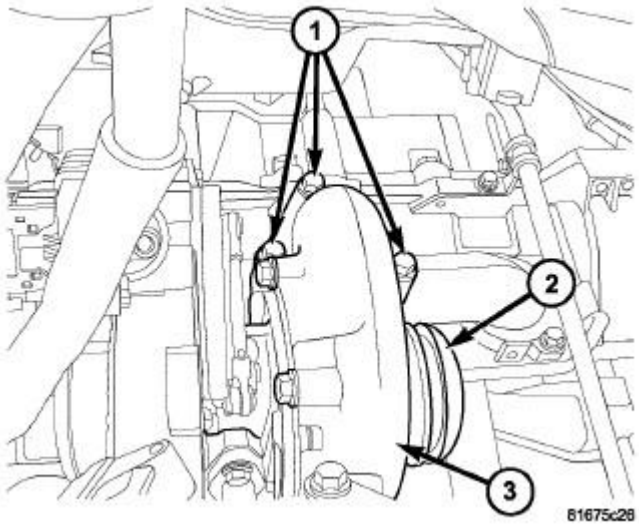

Fig. 214: TURBO
Courtesy of CHRYSLER LLC

17. Remove turbocharger mounting bolts (1) and remove turbocharger (3).

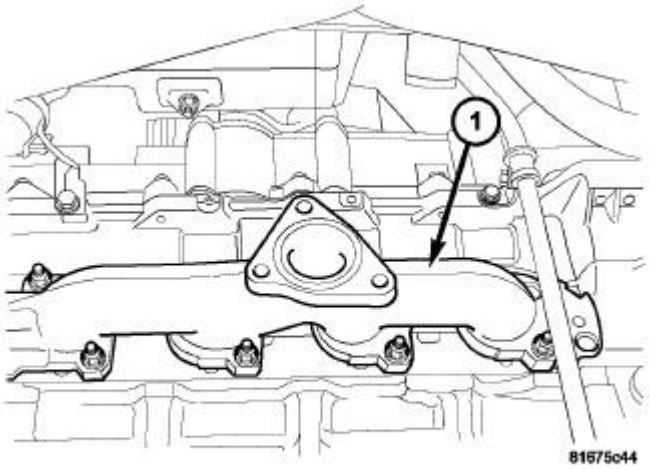

Fig. 215: EXHAUST MANIFOLD BOLTS
Courtesy of CHRYSLER LLC

18. Remove exhaust manifold retaining nuts and remove manifold (1).

Cleaning

CLEANING

1. Discard gasket (if equipped) and clean all surfaces of manifold and cylinder head.

Inspection

INSPECTION

1. Inspect manifold gasket surfaces for flatness with straight edge. Surface must be flat within 0.15 mm per 300 mm (0.006 in. per foot) of manifold length.
2. Inspect manifolds for cracks or distortion. Replace manifold as necessary.

Installation

INSTALLATION

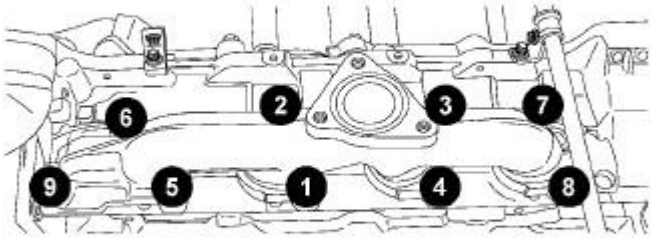

Fig. 216: EXHAUST MANIFOLD TORQUE SEQUENCE
Courtesy of CHRYSLER LLC

1. Install exhaust manifold and toque manifold retaining nuts to 23 N.m (200 in. lbs.) in proper sequence. See **Fig. 216**.

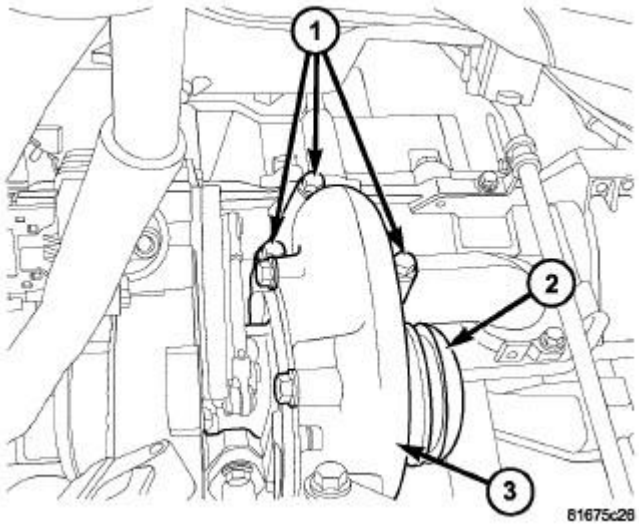

Fig. 217: Turbocharger
Courtesy of CHRYSLER LLC

2. Install turbocharger (3) and torque mounting bolts (1) to 23 N.m (200 in. lbs.).

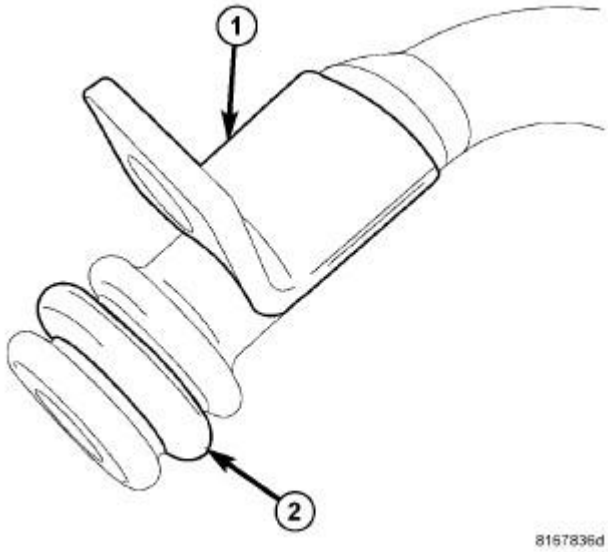

Fig. 218: Oil Feed Tube O-Ring
Courtesy of CHRYSLER LLC

3. Inspect oil feed tube O-ring (2) and replace if damaged.

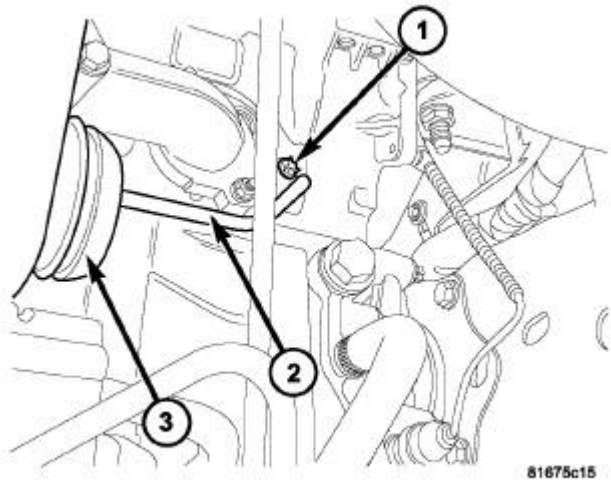

Fig. 219: Turbocharger Oil Feed
Courtesy of CHRYSLER LLC

4. Install turbocharger oil feed tube (2) and tighten retaining bolt (1).

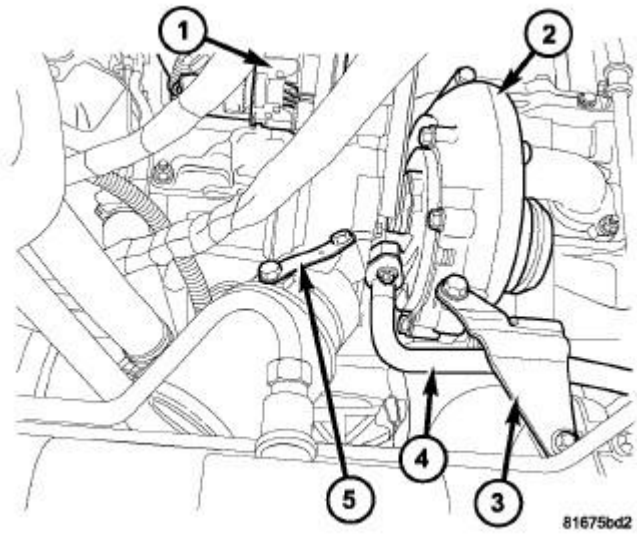

Fig. 220: CHARGE AIR PIPE
Courtesy of CHRYSLER LLC

5. Connect boost pressure servo motor connector (1).
6. Install oil drain back tube (4).
7. Install turbocharger support bracket (3).
8. Install charge air tube and tighten retaining bolts at turbocharger (5).

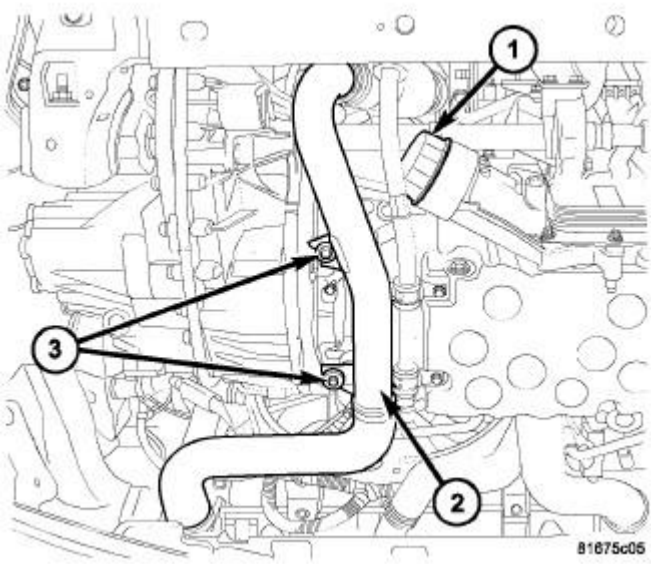

Fig. 221: CHARGE AIR PIPE MOUNT
Courtesy of CHRYSLER LLC

9. Install charge air tube mounting bolts (3).

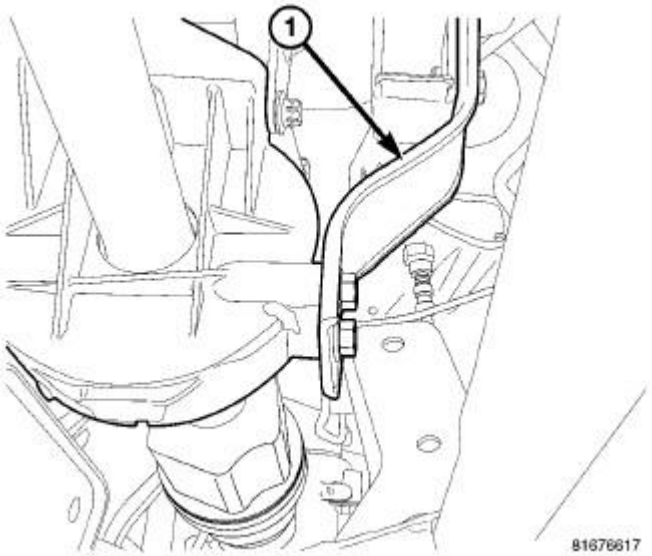

Fig. 222: Catalytic Converter Support Bracket
Courtesy of CHRYSLER LLC

10. Install cat and cat support bracket. Tighten cat support retaining bolts.
11. Connect oxygen sensor connector.

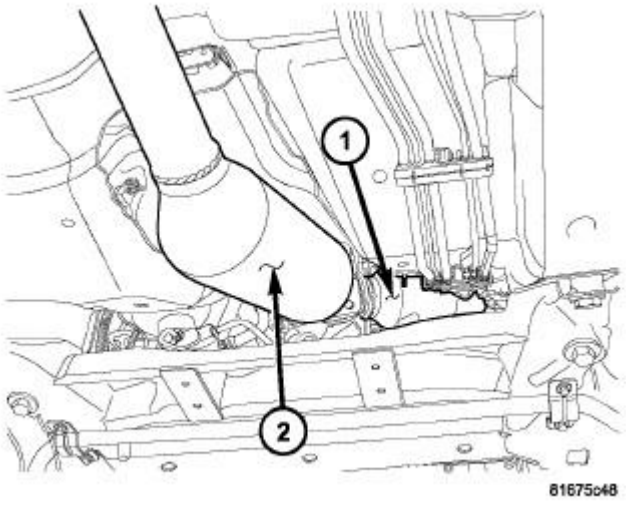

Fig. 223: Pre Catalytic Converter
Courtesy of CHRYSLER LLC

12. Install particulate filter.

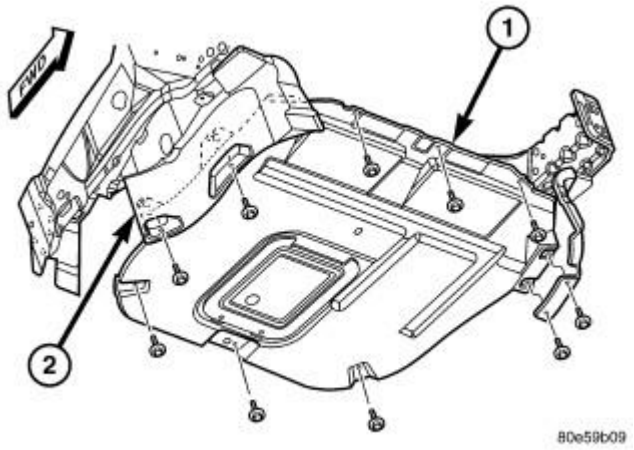

Fig. 224: LOWER SILENCER
Courtesy of CHRYSLER LLC

13. Install lower silencer shield (1) and lower vehicle.

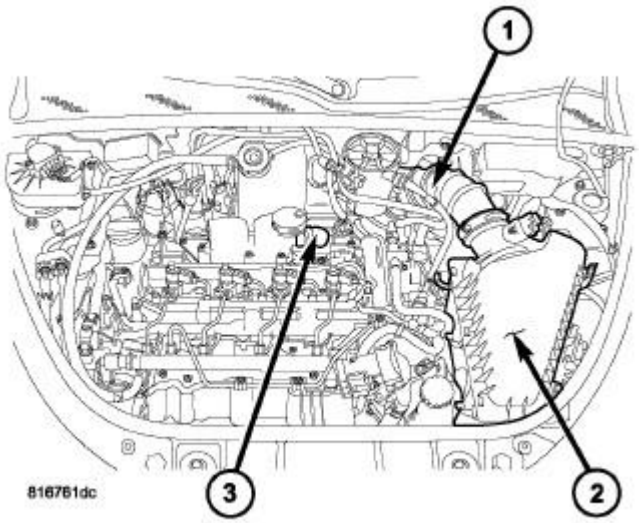

Fig. 225: AIR INLET HOSE
Courtesy of CHRYSLER LLC

14. Install and tighten V-band clamp at turbocharger.
15. Install crankcase vent hose (3) and connect crankcase vent heater connector.
16. Install air inlet hose (1) to air cleaner housing and turbocharger.

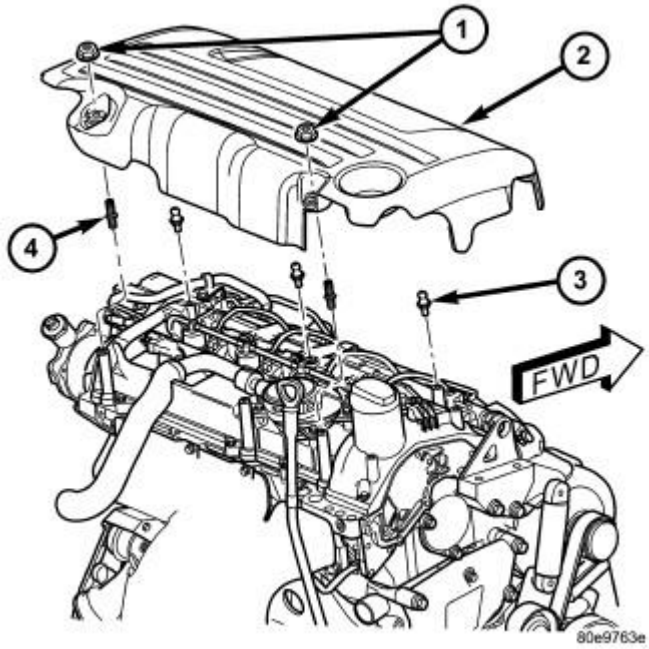

Fig. 226: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1 - ENGINE COVER RETAINING NUTS 2 - ENGINE COVER 3 - ENGINE COVER MOUNTS 4 - ENGINE COVER MOUNTING STUDS

17. Install engine cover (2).

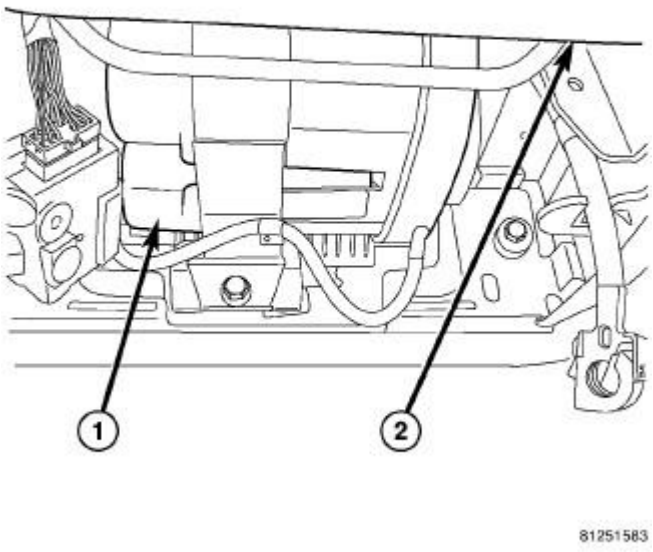

Fig. 227: Battery Location
Courtesy of CHRYSLER LLC

18. Connect negative battery (1) cable located under passenger seat.

MANIFOLD, INTAKE

Description

INTAKE MANIFOLD

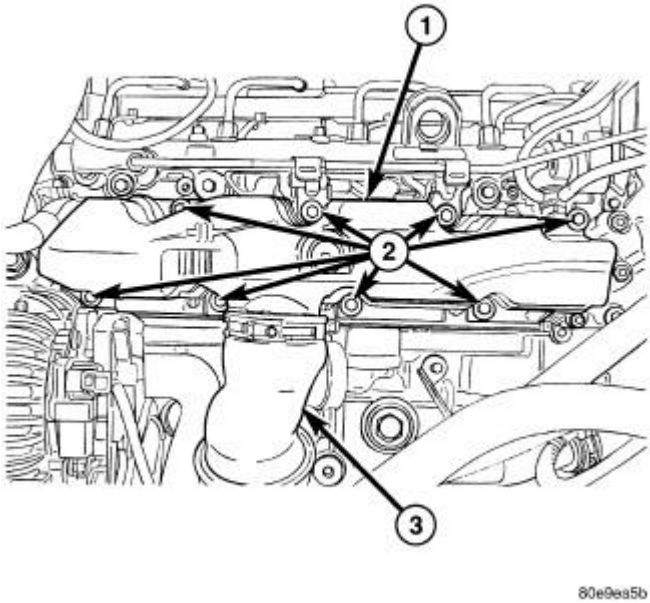

Fig. 228: INTAKE MANIFOLD
Courtesy of CHRYSLER LLC

The intake manifold is one-piece design and is made of a composite material. See **Fig. 228** .

INTAKE MANIFOLD SWIRL VALVE

The intake manifold swirl valve is located in the bottom of the intake manifold. See **Fig. 229** .

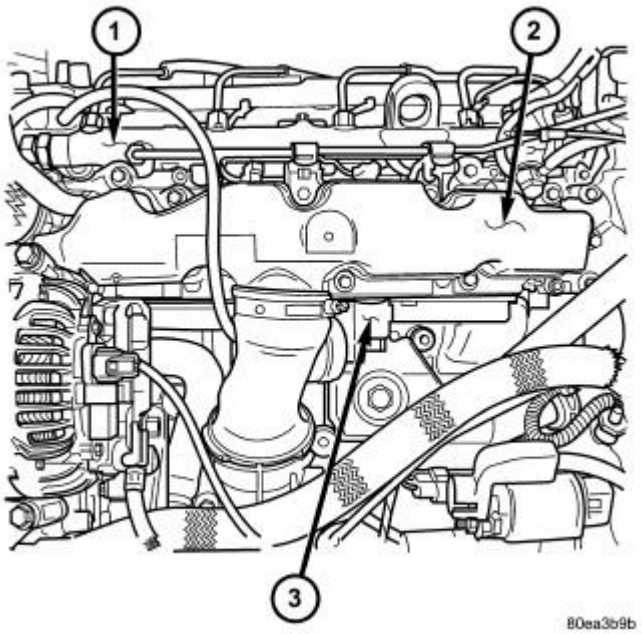

Fig. 229: INTAKE MANIFOLD SWIRL VALVE LOCATION
Courtesy of CHRYSLER LLC

1 - FUEL RAIL
2 - INTAKE MANIFOLD
3 - INTAKE MANIFOLD SWIRL VALVE

SWIRL VALVE ACTUATOR SOLENOID

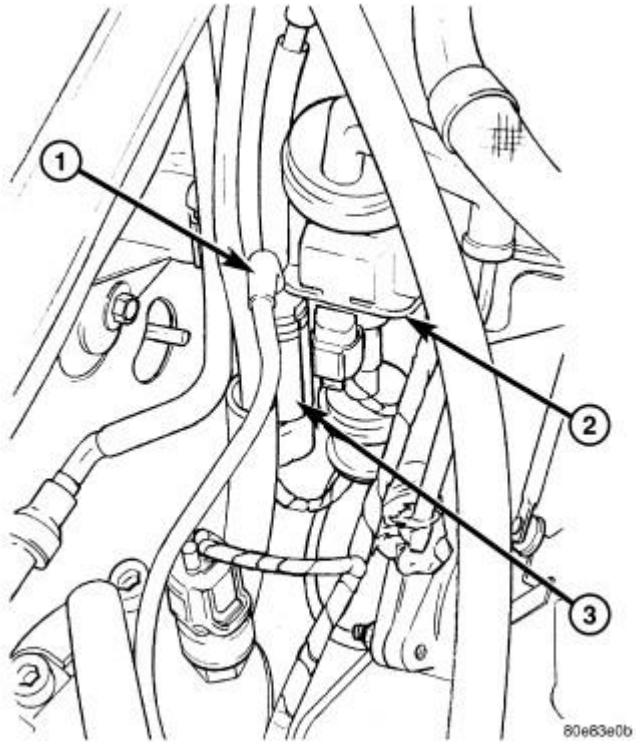

Fig. 230: SWIRL ACTUATOR SOLENOID
Courtesy of CHRYSLER LLC

1 - SWIRL ACTUATOR OUTPUT HOSE
2 - WASTEGATE SOLENOID
3 - SWIRL ACTUATOR SOLENOID

The swirl actuator solenoid (1) is mounted next to the coolant recovery pressure container behind the wastegate solenoid. See **Fig. 230** .

Operation

INTAKE MANIFOLD SWIRL VALVE

A swirl and a charge inlet port are provided in the intake manifold for each cylinder. See **Fig. 231** . The charge inlet port can be closed by means of flaps. The flaps are connected to each other by means of a linkage, which is operated by the swirl valve actuator . See **Fig. 231**. They are held in the open position by means of spring force.

In the lower engine speed and load range all the charge inlet ports are sealed off by the flaps. The entire air flows through the swirl inlet ports only. This results in high air swirling which in turn produces more effective mixing of the fuel with the air, which improves combustion and reduces the amount of soot particulants in the exhaust.

As engine speed and loads rise, the charge inlet ports are continuously opened to obtain the best possible ratio between air swirling and air mass for each engine operating point, which will optimize exhaust characteristics

and engine power output.

The position of the flaps in the charge inlet ports is determined by the map stored in the Engine Control Module (ECM). The swirl valve actuator is actuated by the swirl valve actuator solenoid. This is a PWM solenoid.

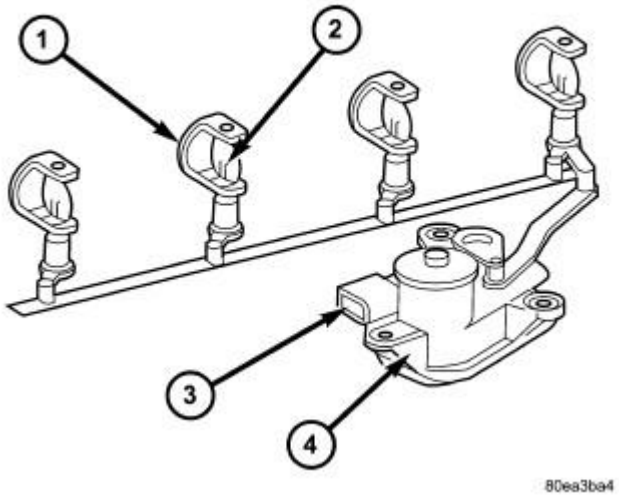

Fig. 231: INTAKE MANIFOLD SWIRL VALVE COMPONENTS
Courtesy of CHRYSLER LLC

1 - CHARGE INLET PORT
2 - FLAP
3 - VACUUM PORT FROM SOLENOID
4 - SWIRL VALVE ACTUATOR

SWIRL ACTUATOR SOLENOID

The swirl actuator solenoid is used to control the amount of vacuum supplied to the swirl valve actuator.

Removal

INTAKE MANIFOLD

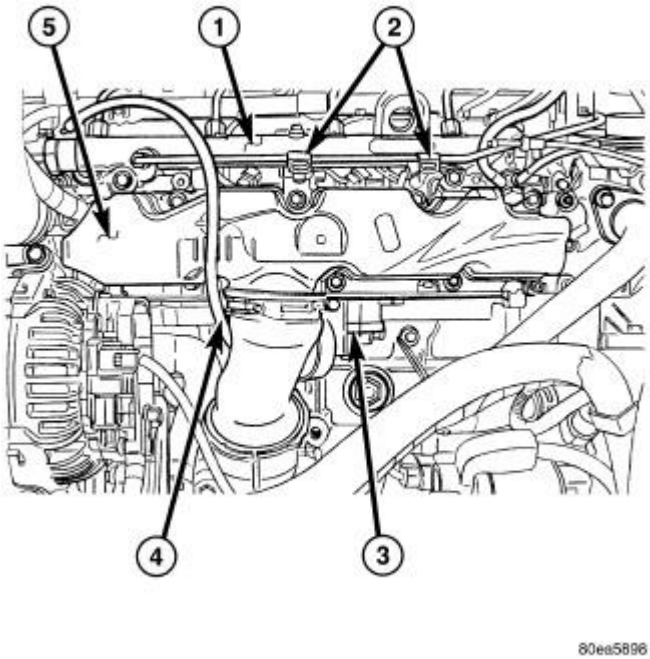

Fig. 232: Intake Manifold Components
Courtesy of CHRYSLER LLC

1 - FUEL RAIL
2 - HIGH PRESSURE FUEL LINE BRACKETS
3 - SWIRL VALVE ACTUATOR
4 - SWIRL VALVE ACTUATOR VACUUM HOSE
5 - INTAKE MANIFOLD

1. Disconnect negative battery cable.
2. Remove engine cover. See **Engine - Removal**.
3. Discharge air conditioning system (refer to **REFRIGERANT SYSTEM EVACUATE**).
4. Drain cooling system (refer to **SYSTEM DRAINING**).
5. Remove front grille assembly. Refer to **Body/Exterior/GRILLE - Removal** .
6. Remove radiator closure panel. Refer to **Body/Exterior/CROSSMEMBER, Radiator - Removal** .
7. Disconnect upper radiator hose from radiator.
8. Raise vehicle on hoist.
9. Disconnect lower radiator hose at radiator.
10. Disconnect cooling fan electrical connector.
11. Lower vehicle.
12. Disconnect both A/C lines at condenser.

13. Remove A/C condenser to radiator mounting screws and remove condenser.
14. Unclip charge air cooler from radiator.
15. Lift radiator and cooling fan assembly from vehicle.
16. Disconnect swirl valve actuator hose at actuator. See **Fig. 232** .

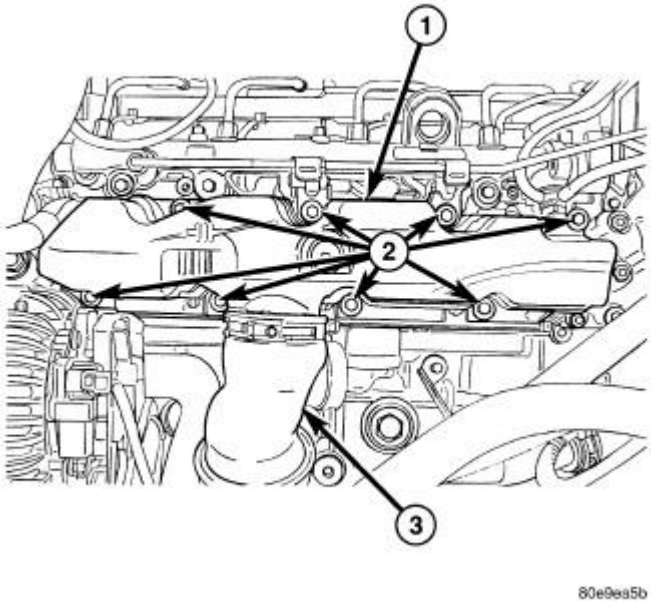

Fig. 233: Intake Manifold
Courtesy of CHRYSLER LLC

17. Disconnect air inlet hose (3) from intake manifold (1).

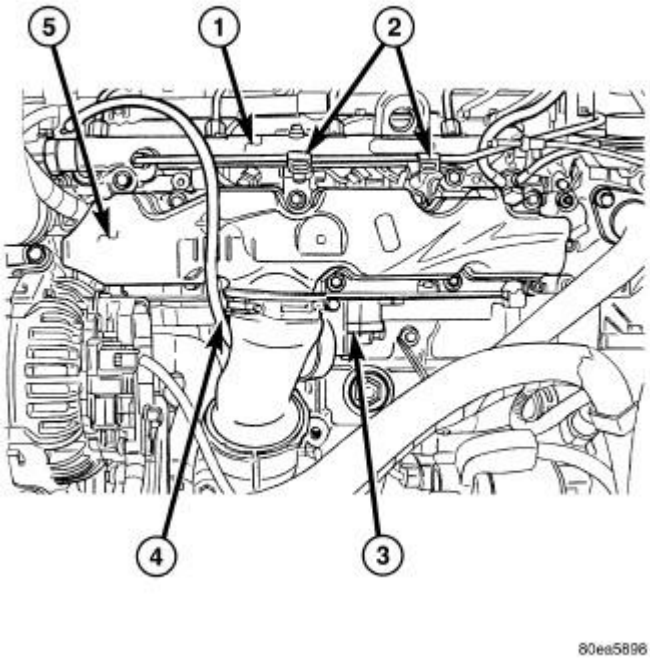

Fig. 234: Intake Manifold Components
Courtesy of CHRYSLER LLC

1 - FUEL RAIL
2 - HIGH PRESSURE FUEL LINE BRACKETS
3 - SWIRL VALVE ACTUATOR
4 - SWIRL VALVE ACTUATOR VACUUM HOSE
5 - INTAKE MANIFOLD

18. Remove high pressure fuel line to fuel rail retaining brackets (2). See **Fig. 232** .

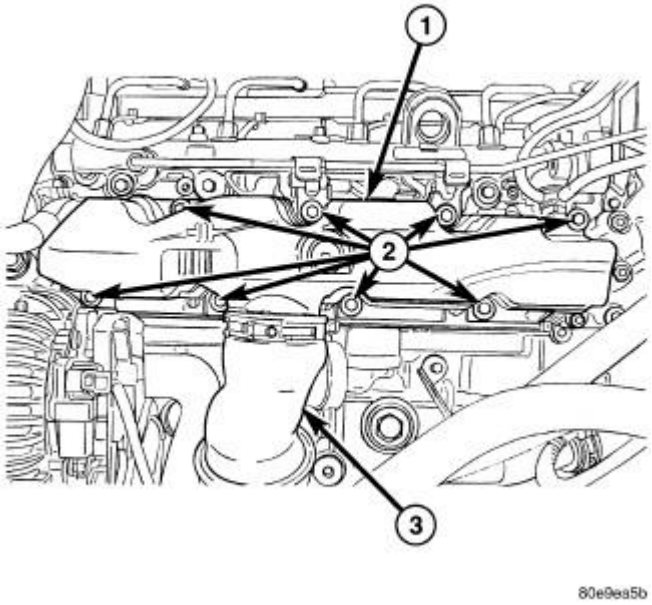

Fig. 235: Intake Manifold
Courtesy of CHRYSLER LLC

19. Remove remaining intake manifold retaining bolts and remove manifold from engine. See **Fig. 233** .

INTAKE MANIFOLD SWIRL VALVE

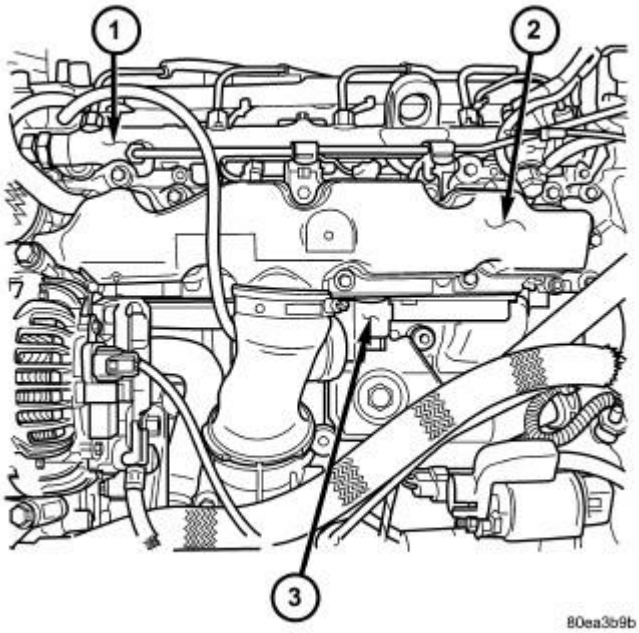

Fig. 236: INTAKE MANIFOLD SWIRL VALVE LOCATION

Courtesy of CHRYSLER LLC

1. Remove intake manifold (2). See **Engine/Manifolds/MANIFOLD, Intake - Removal**.
2. Remove swirl valve solenoid (3)

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

INTAKE MANIFOLD

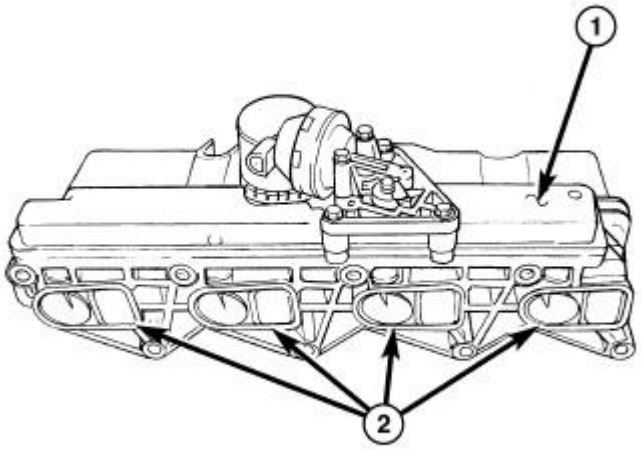

Fig. 237: Intake Manifold Seals
Courtesy of CHRYSLER LLC

1 - INTAKE MANIFOLD

2 - INTAKE MANIFOLD SEALS

1. Clean gaskets/seals mating surfaces.
2. Install new intake manifold seals on intake manifold. See **Fig. 237** .

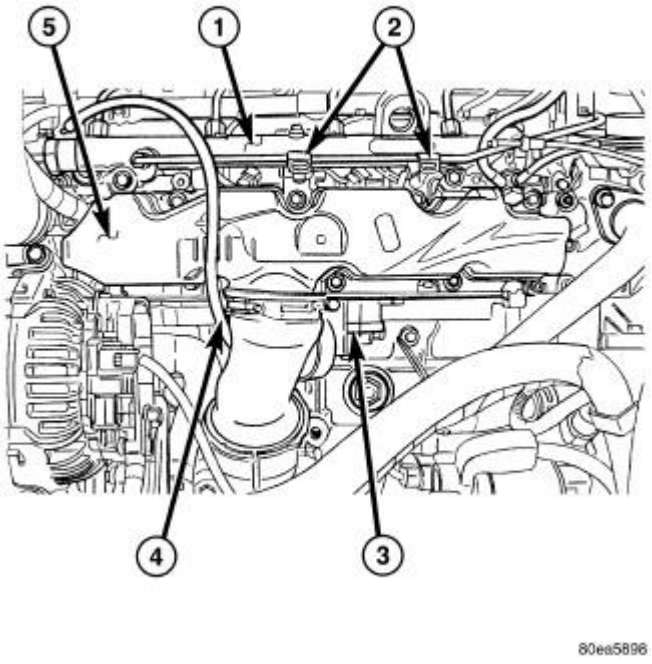

Fig. 238: Intake Manifold Components
Courtesy of CHRYSLER LLC

3. Place intake (5) on cylinder head and install retaining bolts. **Be sure to install high pressure fuel line brackets (2) in proper position.** Tighten bolts to 20 N.m (14.7 lbs. ft.).
4. Connect air inlet hose at intake manifold.
5. Connect swirl valve actuator hose at actuator.
6. Lower radiator and cooling fan assembly in vehicle. Attach charge air cooler to radiator.
7. Attach A/C condenser to radiator with retaining screws.
8. Connect both A/C lines at condenser.
9. Raise vehicle on hoist.
10. Connect cooling fan electrical connector.
11. Connect lower radiator hose at radiator.
12. Lower vehicle.
13. Connect upper radiator hose at radiator.
14. Install radiator closure panel. Refer to **Body/Exterior/CROSSMEMBER, Radiator - Installation** .

15. Install front grille assembly. Refer to **Body/Exterior/GRILLE - Installation** .
16. Refill cooling system. Refer to **SYSTEM FILLING - DIESEL ENGINE** .
17. Evacuate and recharge air conditioning system (refer to **STANDARD PROCEDURE**).
18. Install engine cover.
19. Connect negative battery cable.

INTAKE MANIFOLD SWIRL VALVE

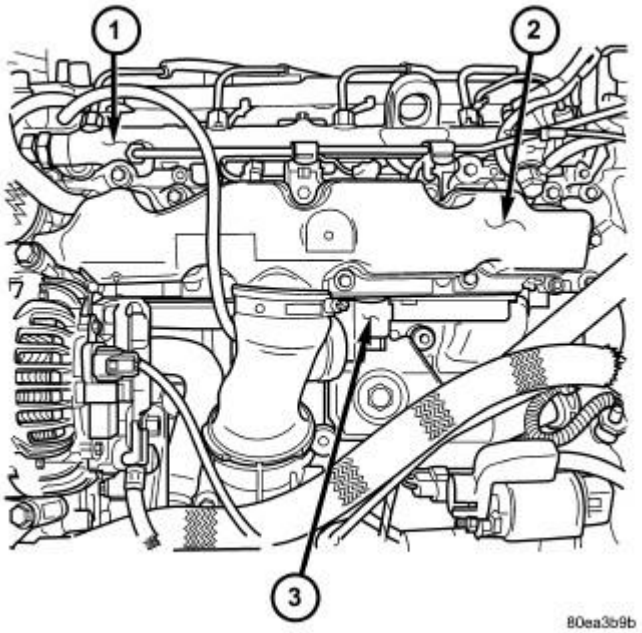

Fig. 239: INTAKE MANIFOLD SWIRL VALVE LOCATION
Courtesy of CHRYSLER LLC

1. Install swirl valve solenoid (3) to intake manifold (2).
2. Install intake manifold (2). See **Engine/Manifolds/MANIFOLD, Intake - Installation**.

TURBOCHARGER SYSTEM

DIAGNOSIS AND TESTING

TURBOCHARGER

Check for Diagnostic Trouble Codes (DTCs) stored in PCM memory. If any DTCs are present, refer to the appropriate Powertrain Diagnostic Information.

TURBOCHARGER DIAGNOSIS

CONDITION	POSSIBLE CAUSES
Low boost pressure, lack of power	Clogged air filter

	Leaks between engine and turbocharger Exhaust restriction Restriction in charge air cooler hose(s) Wastegate stuck open Wastegate actuator malfunction Seized turbocharger shaft
Overboost	Wastegate stuck shut Wastegate actuator malfunction
Noisy operation or vibration	Leak(s) in charge air cooler hose(s) Intake or exhaust leaks Oil starvation Worn turbocharger bearings Damaged turbine/compressor fins
Blue smoke from exhaust	Oil return line blocked Engine breather clogged Turbocharger shaft seals damaged

COOLER AND HOSES, CHARGE AIR

Removal

CHARGE AIR COOLER HOSES

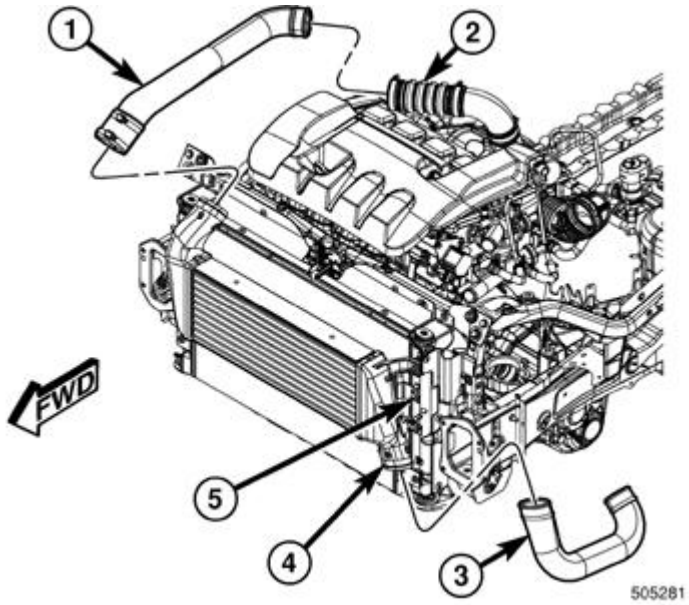

Fig. 240: Charge Air Cooler & Hoses
Courtesy of CHRYSLER LLC

NOTE: Fascia is removed for clarification.

1. Remove the upper radiator closure panel. Refer to **Body/Exterior/CROSSMEMBER, Radiator -**

Removal .

2. Remove the upper charge air inlet tube (1) from the charge air cooler (4) and the inlet elbow (2).
3. Remove the lower charge air outlet tube (3).

CHARGE AIR COOLER

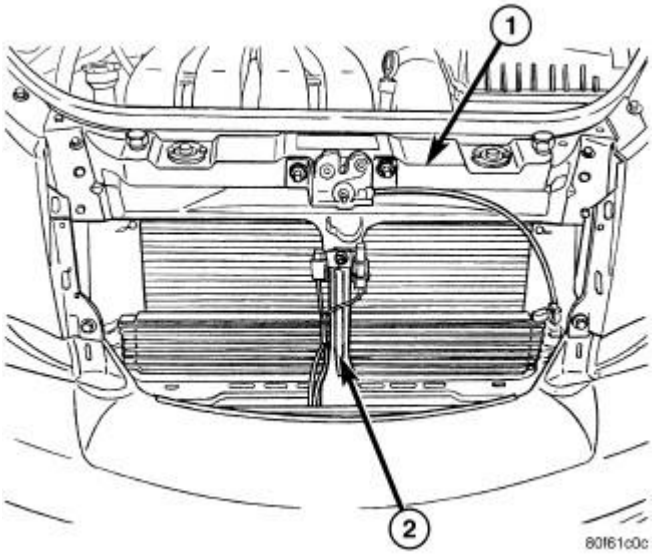

Fig. 241: Upper Radiator Closure Panel and Center Brace
Courtesy of CHRYSLER LLC

1 - UPPER RADIATOR CLOSURE PANEL 2 - CENTER BRACE

1. Drain cooling system (refer to **SYSTEM DRAINING**).
2. Remove air cleaner housing. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.
3. Disconnect negative battery cable.
4. Disconnect positive battery cable.
5. Remove battery and battery tray. Refer to **Electrical/Battery System/BATTERY - Removal** .
6. Remove grille. Refer to **Body/Exterior/GRILLE - Removal** .
7. Remove upper radiator closure panel (1) and center brace (2). Refer to **Body/Exterior/CROSSMEMBER, Radiator - Removal** .

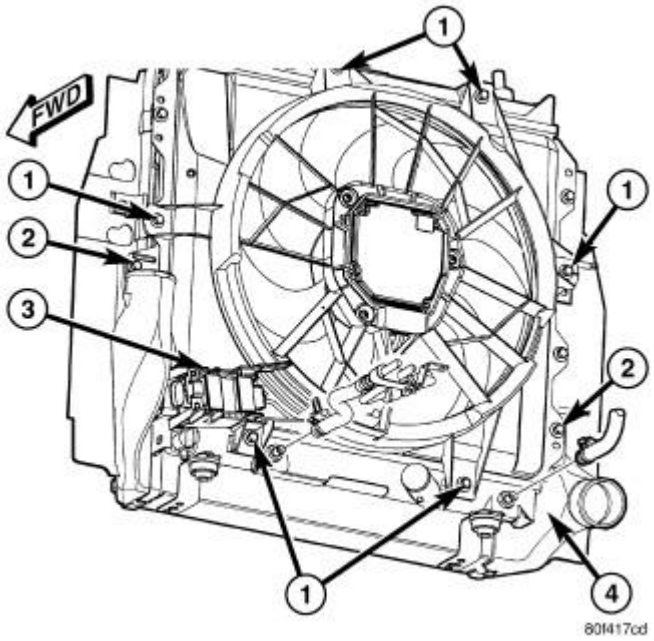

Fig. 242: Cooling Module - 2.4L Turbo
Courtesy of CHRYSLER LLC

1 - RADIATOR FAN FASTENERS
2 - CHARGE AIR COOLER FASTENERS
3 - RADIATOR FAN CONNECTOR
4 - CHARGE AIR COOLER

8. Remove front bumper fascia. Refer to **Frame and Bumpers/Bumpers/FASCIA, Front - Removal** .
9. Remove front bumper. Refer to **Frame and Bumpers/Bumpers/REINFORCEMENT, Bumper - Removal** .
10. Loosen charge air cooler hose clamps. Disconnect charge air cooler hoses.
11. Remove radiator fan. Refer to **Cooling/Engine/FAN, Cooling - Removal** .
12. Remove charge air cooler fasteners (2).
13. Remove radiator. Refer to **Cooling/Engine/RADIATOR, Engine Cooling - Removal** .
14. Remove charge air cooler.

Installation

CHARGE AIR COOLER HOSES

HOSE - CHARGE AIR COOLER TO THROTTLE BODY

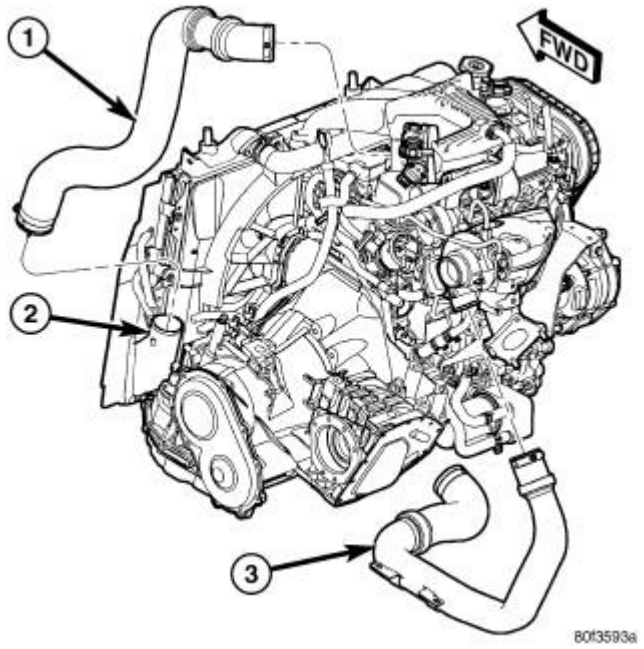

Fig. 243: Charge Air Cooler Hoses
Courtesy of CHRYSLER LLC

1 - HOSE - CHARGE AIR COOLER TO THROTTLE BODY
2 - CHARGE AIR COOLER
3 - HOSE - TURBOCHARGER TO CHARGE AIR COOLER

1. Position hose (1) to mounting location.
2. Connect hose (1) to throttle body.
3. Connect hose (1) to charge air cooler (2).
4. Tighten hose clamps to 1.7 N.m (15 in. lbs.).

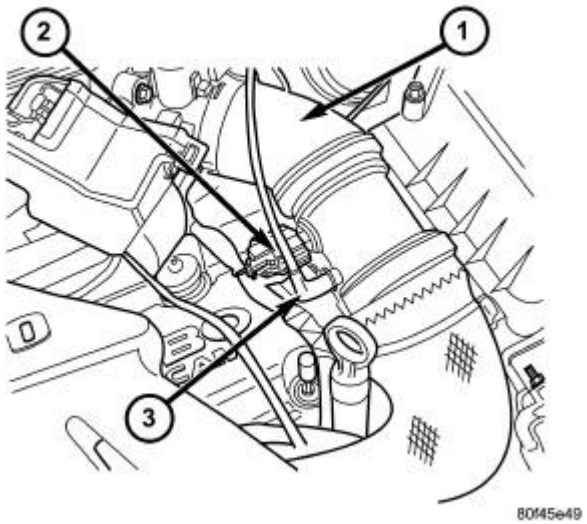

Fig. 244: IAT Sensor - 2.4L Turbo
Courtesy of CHRYSLER LLC

1 - HOSE - CHARGE AIR COOLER TO THROTTLE BODY 2 - IAT SENSOR 3 - TIP HOSE

5. Connect Throttle Inlet Pressure (TIP) hose (3) to charge air cooler hose.
6. Connect Inlet Air Temperature (IAT) sensor connector (2).
7. Install battery tray support bracket.
8. Install battery tray and battery. Refer to **Electrical/Battery System/BATTERY - Installation** .
9. Connect positive battery cable.
10. Connect negative battery cable.
11. Install air cleaner housing. See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.

HOSE - TURBOCHARGER TO CHARGE AIR COOLER

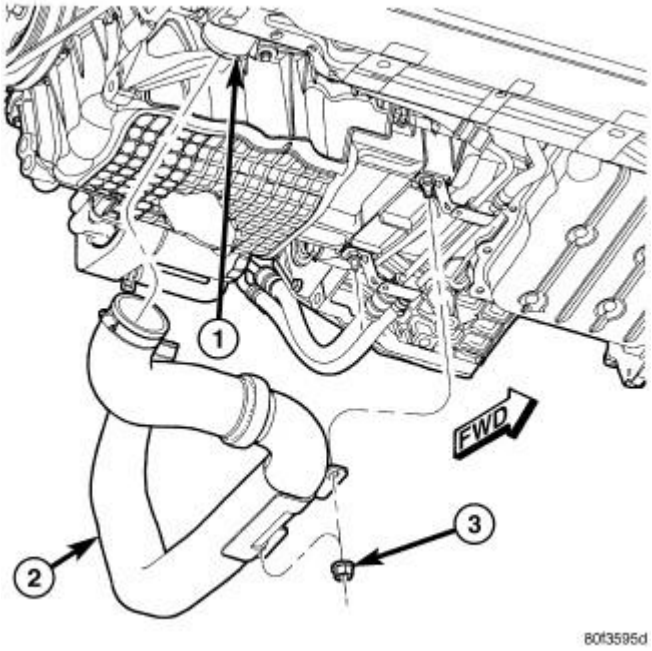

Fig. 245: Charge Air Cooler Hose
Courtesy of CHRYSLER LLC

1 - CHARGE AIR COOLER 2 - HOSE - TURBOCHARGER TO CHARGE AIR COOLER 3 - NUT

1. Position hose (2) to mounting location.
2. Temporarily install nuts (3) securing charge air cooler hose (2) to structural collar.
3. Connect hose (2) to turbocharger.
4. Connect hose (2) to charge air cooler.
5. Tighten hose clamps to 1.7 N.m (15 in. lbs.).
6. Tighten nuts (3) securing charge air cooler hose to structural collar.
7. Lower vehicle.

CHARGE AIR COOLER

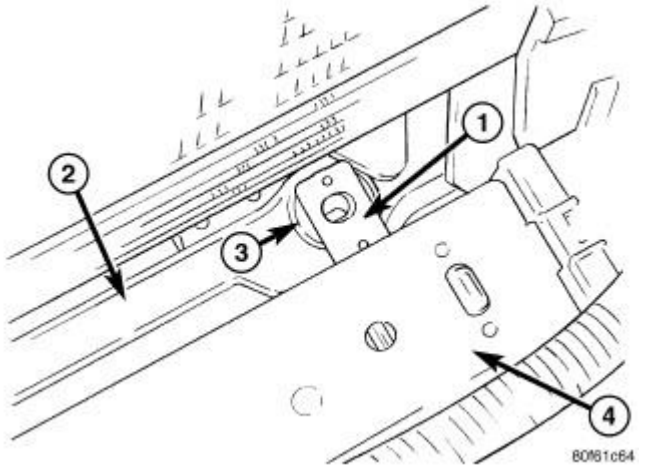

Fig. 246: Charge Air Cooler Locating Tab
Courtesy of CHRYSLER LLC

1 - LOCATING TAB
2 - LOWER RADIATOR SUPPORT CROSSMEMBER
3 - RADIATOR MOUNT BUSHING
4 - CHARGE AIR COOLER

1. Position charge air cooler to mounting location.

NOTE: When lowering radiator, make sure lower radiator pins engage properly through charge air cooler tabs. See Fig. 246 .

2. Install radiator. Refer to **Cooling/Engine/RADIATOR, Engine Cooling - Installation** .
3. Install fasteners attaching charge air cooler to radiator. Tighten fasteners to 8 N.m (70 in. lbs.).
4. Install radiator fan. Refer to **Cooling/Engine/FAN, Cooling - Installation** .
5. Connect charge air cooler hoses. Tighten hose clamps to 1.7 N.m (15 in. lbs.).
6. Install front bumper. Refer to **Frame and Bumpers/Bumpers/REINFORCEMENT, Bumper - Installation** .
7. Install front bumper fascia. Refer to **Frame and Bumpers/Bumpers/FASCIA, Front - Installation** .
8. Install upper radiator closure panel and center brace. Refer to **Body/Exterior/CROSSMEMBER, Radiator - Installation** .
9. Install grille. Refer to **Body/Exterior/GRILLE - Installation** .
10. Install battery tray and battery. Refer to **Electrical/Battery System/BATTERY - Installation** .
11. Connect positive battery cable.
12. Connect negative battery cable.
13. Install air cleaner housing. See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.
14. Fill cooling system. Refer to **Cooling - Standard Procedure** .

LINES AND HOSES, TURBOCHARGER, OIL AND COOLANT

Removal

TURBOCHARGER LINES

COOLANT SUPPLY LINE

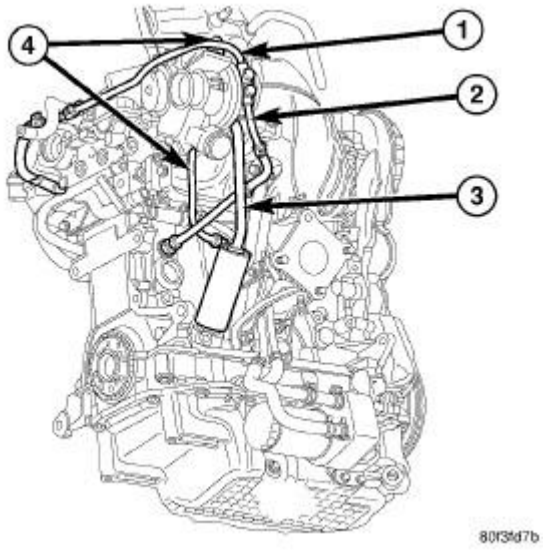

Fig. 247: Turbocharger Lines and Hoses
Courtesy of CHRYSLER LLC

1. Raise vehicle on hoist.

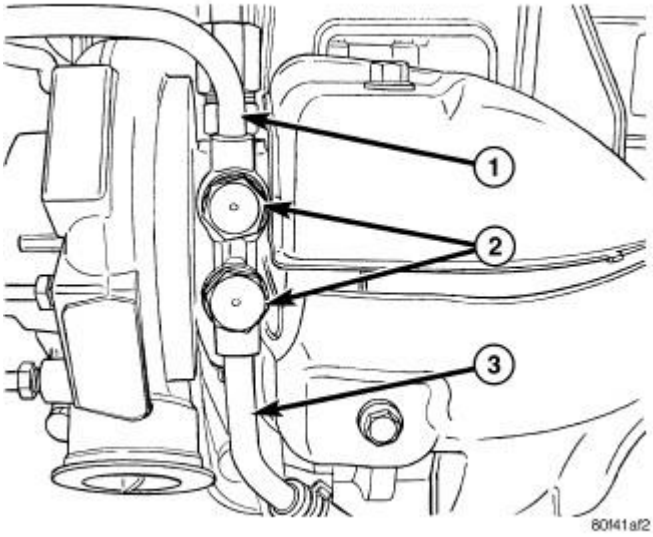

Fig. 248: Coolant Lines - Banjo Fittings

Courtesy of CHRYSLER LLC

1 - COOLANT RETURN LINE 2 - BANJO BOLTS - 30 N.m (22 ft. lbs.) 3 - COOLANT SUPPLY LINE

2. Drain cooling system (refer to **SYSTEM DRAINING**).
3. Remove banjo bolt (2) from coolant supply line (3) at turbocharger.

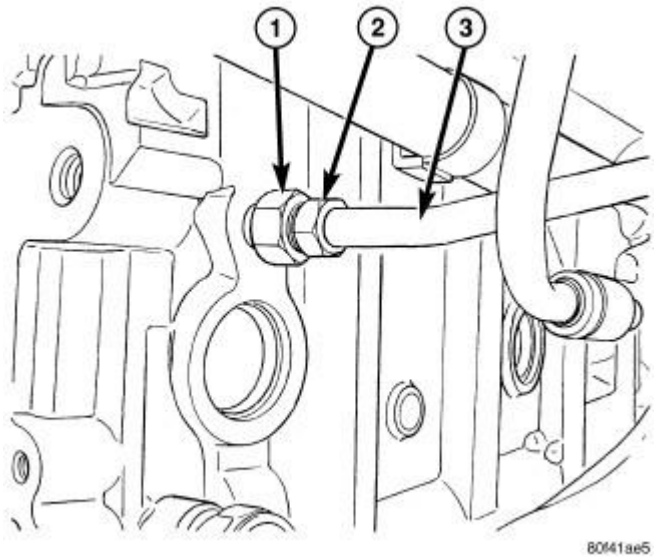

Fig. 249: Coolant Supply Line - Engine Block Fitting
Courtesy of CHRYSLER LLC

1 - BRASS FITTING - 41 N.m (30 ft. lbs.) 2 - FLARED FITTING - 31 N.m (23 ft. lbs.) 3 - COOLANT SUPPLY LINE

4. Disconnect coolant supply line (3) flared fitting (2) from brass fitting (1) at engine block.
5. Remove coolant supply line.

COOLANT RETURN LINE

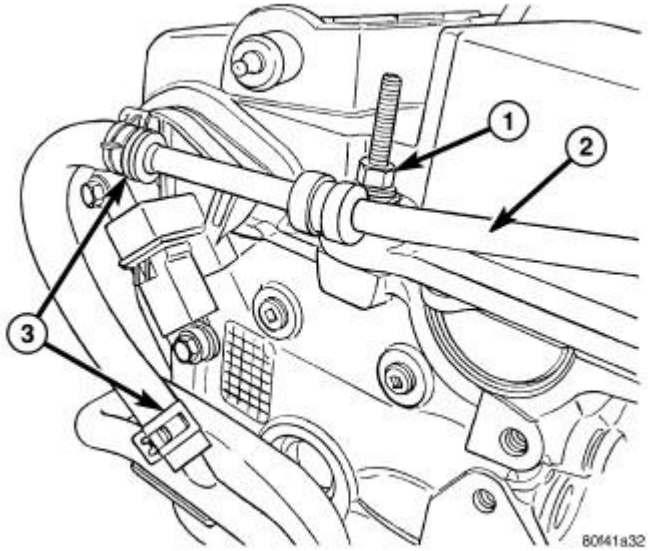

Fig. 250: Coolant Return Line Bracket
Courtesy of CHRYSLER LLC

1 - NUT 2 - COOLANT RETURN LINE 3 - HOSE CLAMPS

1. Drain cooling system (refer to **SYSTEM DRAINING**).
2. Remove air cleaner housing. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.
3. Disconnect Inlet Air Temperature (IAT) sensor connector.
4. Disconnect Throttle Inlet Pressure (TIP) hose from charge air cooler hose.
5. Loosen hose clamp at throttle body.
6. Disconnect charge air cooler hose from throttle body. Reposition charge air cooler hose.
7. Remove fastener securing coolant return line bracket to cylinder head cover stud.
8. Remove hose clamp from coolant return line (2) at heater tube. Disconnect hose from heater tube.
9. Remove banjo bolt from coolant return line at turbocharger.
10. Remove coolant return line.

OIL SUPPLY LINE

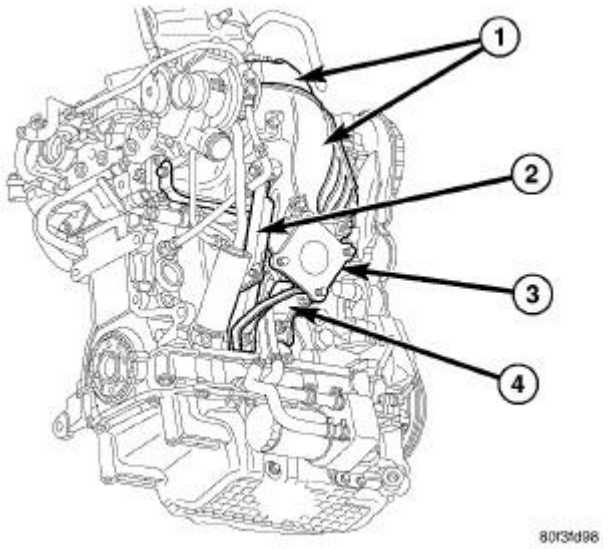

Fig. 251: Turbocharger Brackets and Heat Shields
Courtesy of CHRYSLER LLC

1 - UPPER/LOWER HEAT SHIELDS
2 - TURBOCHARGER SUPPORT BRACKET
3 - ELBOW
4 - ELBOW SUPPORT BRACKET

1. Raise vehicle on hoist.
2. Remove elbow support bracket (4).

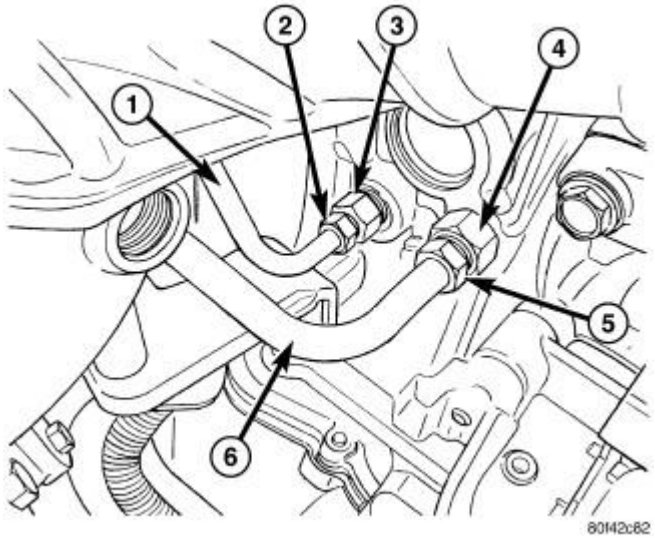

Fig. 252: Oil Supply Line - Engine Block Fitting
Courtesy of CHRYSLER LLC

1 - OIL SUPPLY LINE 2 - FLARED FITTING - 31 N.m (23 ft. lbs.) 3 - BRASS FITTING - 41 N.m (30 ft. lbs.) 4 - BRASS FITTING - 41 N.m (30 ft. lbs.) 5 - FLARED FITTING - 31 N.m (23 ft. lbs.) 6 - OIL COOLER COOLANT LINE

3. Disconnect oil supply line flared fitting (2) from brass fitting (3) at engine block.
4. Lower vehicle.
5. Disconnect oil supply line flared fitting (2) from brass fitting (3) at turbocharger.

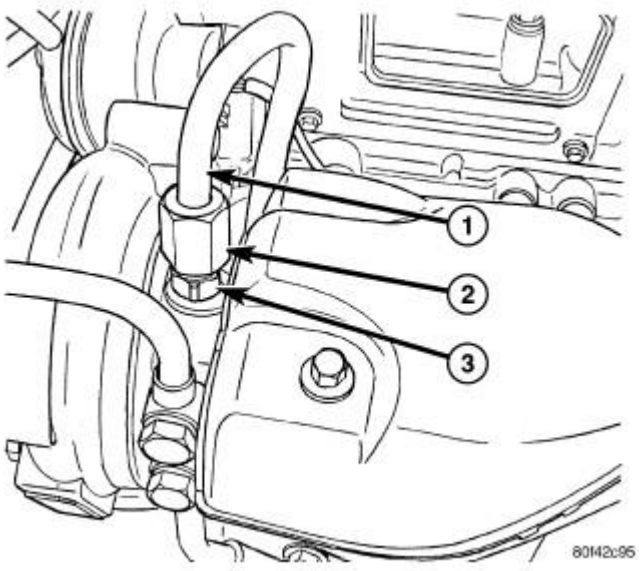

Fig. 253: Oil Supply Line - Turbocharger Fitting
Courtesy of CHRYSLER LLC

1 - OIL SUPPLY LINE 2 - FLARED FITTING - 31 N.m (23 ft. lbs.) 3 - BRASS FITTING - 41 N.m (30 ft. lbs.)

6. Remove oil supply line (1).

OIL RETURN LINE

1. Raise vehicle on hoist.
2. Remove the two fasteners securing the oil return line to the turbocharger.
3. Remove hose clamp from oil return line.
4. Remove oil return line from crankcase nipple.

Installation

TURBOCHARGER LINES

COOLANT SUPPLY LINE

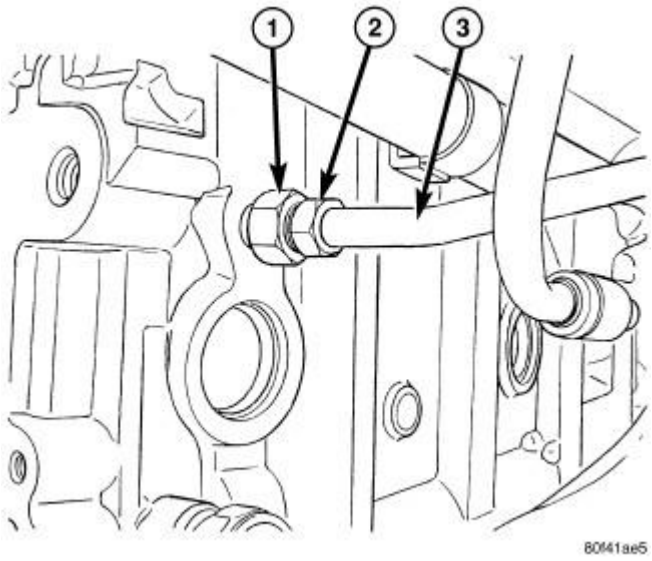

Fig. 254: Coolant Supply Line - Engine Block Fitting
Courtesy of CHRYSLER LLC

1 - BRASS FITTING - 41 N.m (30 ft. lbs.)
2 - FLARED FITTING - 31 N.m (23 ft. lbs.)
3 - COOLANT SUPPLY LINE

1. If the brass fitting (1) was removed from the engine block, apply thread sealer to the threads and install into the engine block. Tighten the brass fitting (1) to 41 N.m (30 ft. lbs.).
2. Position the coolant supply line tube (3) onto the brass fitting (1) at the engine block.
3. Install the after run pump hoses to the after run pump.
4. Install **NEW** washers on the banjo fitting of coolant supply line. Hand start the banjo bolt.
5. Tighten the flared fitting (2) to 31 N.m (23 ft. lbs.).

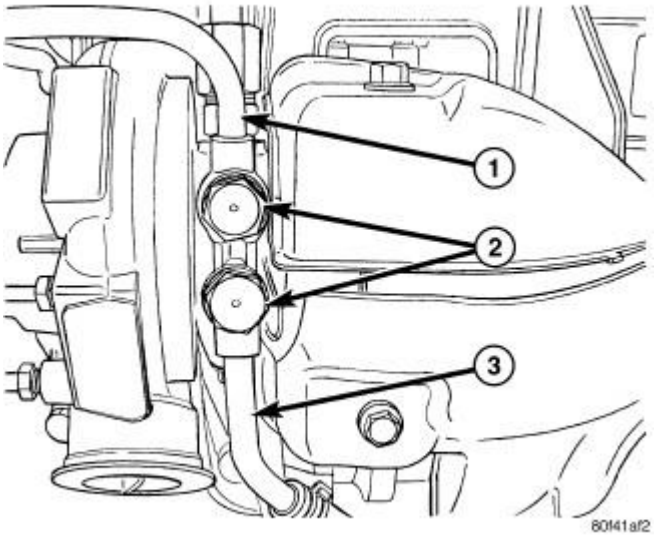

Fig. 255: Coolant Lines - Banjo Fittings
Courtesy of CHRYSLER LLC

1 - COOLANT RETURN LINE 2 - BANJO BOLTS - 30 N.m (22 ft. lbs.) 3 - COOLANT SUPPLY LINE

6. Tighten the banjo fitting bolts (2) to 30 N.m (22 ft. lbs.).
7. Lower the vehicle.
8. Fill the cooling system. Refer to **Cooling - Standard Procedure** .

COOLANT RETURN LINE

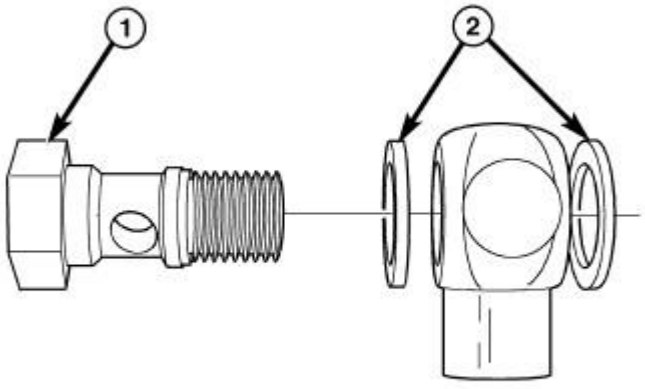

Fig. 256: Banjo Bolt and Washers
Courtesy of CHRYSLER LLC

1 - BANJO BOLT 2 - WASHERS

1. Position the coolant return line on the turbocharger.
2. Install **NEW** washers (2) onto the banjo fitting of the coolant return line. Hand start the banjo bolt.
3. Install the hose onto the thermostat housing.
4. Tighten the banjo bolt to 40 N.m (29.5 ft. lbs.).
5. Secure the coolant return line bracket to the turbocharger housing tighten to 12 N.m (9 ft. lbs.).
6. Fill the cooling system. Refer to **Cooling - Standard Procedure** .

OIL SUPPLY LINE

1. If the engine block brass fitting (3) or turbocharger brass fitting was removed, apply thread sealer to threads and install. Tighten the brass fittings (3) to 41 N.m (30 ft. lbs.).
2. Position the oil supply line (1) to the mounting location.

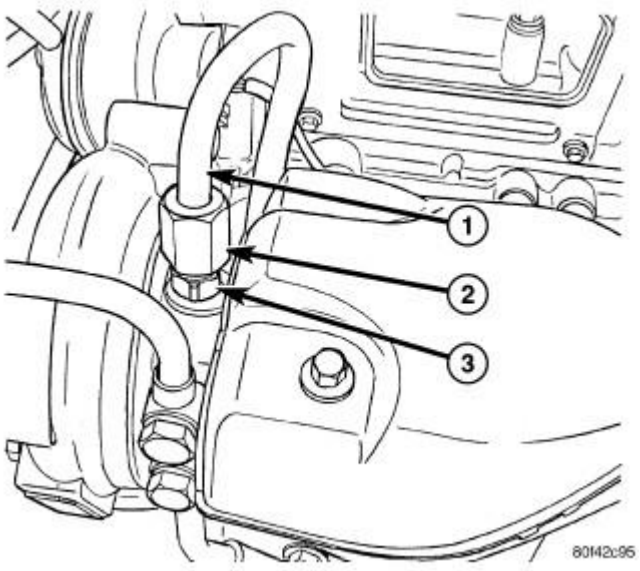

Fig. 257: Oil Supply Line - Turbocharger Fitting
Courtesy of CHRYSLER LLC

1 - OIL SUPPLY LINE 2 - FLARED FITTING - 31 N.m (23 ft. lbs.) 3 - BRASS FITTING - 41 N.m (30 ft. lbs.)

3. Hand start the flared fitting (2) at turbocharger.
4. Raise the vehicle on hoist.

5. Hand start the flared fitting (2) on the line to the engine block brass fitting (3).

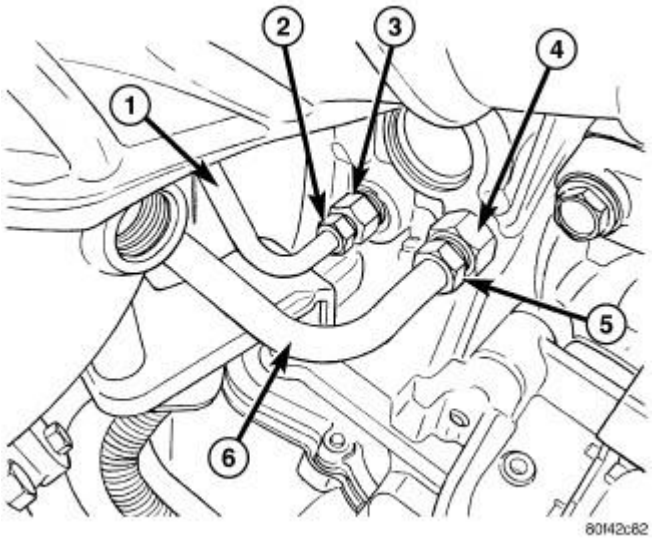

Fig. 258: Oil Supply Line - Engine Block Fitting
Courtesy of CHRYSLER LLC

1 - OIL SUPPLY LINE
2 - FLARED FITTING - 31 N.m (23 ft. lbs.)
3 - BRASS FITTING - 41 N.m (30 ft. lbs.)
4 - BRASS FITTING - 41 N.m (30 ft. lbs.)
5 - FLARED FITTING - 31 N.m (23 ft. lbs.)
6 - OIL COOLER COOLANT LINE

6. Tighten the flared fittings to 31 N.m (23 ft. lbs.).
7. Lower the vehicle.

OIL RETURN LINE

NOTE: If drain back nipple is not damaged or showing signs of leakage, steps 2, 3, 4, and 9 can be skipped.

1. Clean gasket surfaces.
2. Using a paint pen, mark the new drain back nipple to a depth of 17 mm (0.669in.) from the end to be installed in block.
3. Apply MOPAR® Stud'n Bearing mount and adhesive to the drain back nipple.
4. Using Bearing Installer 9723, install the drainback nipple.
5. Install the oil return line hose over the drain back nipple.
6. Install a new gasket.

7. Install the two fasteners securing the oil return tube to the turbocharger. Tighten the fasteners to 12 N.m (105 in. lbs.).
8. Perform oil change. Refer to **Engine/Lubrication/OIL - Standard Procedure** .
9. Lower the vehicle.

SOLENOID, WASTEGATE

Description

SOLENOIDS AND VACUUM HARNESS

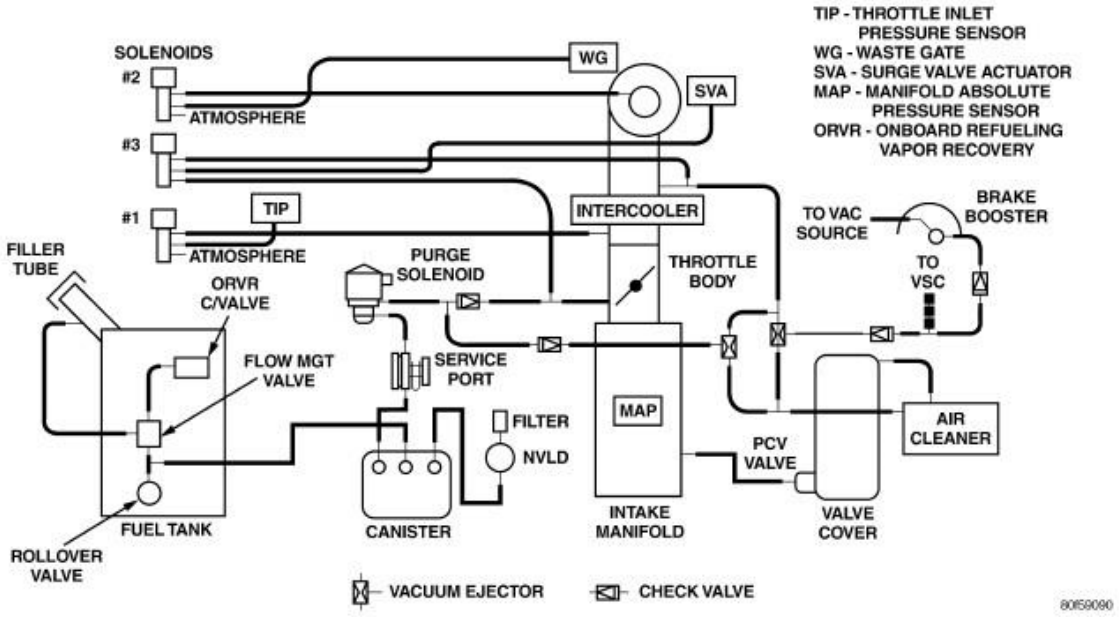

Fig. 259: Vacuum Harness Schematic
Courtesy of CHRYSLER LLC

Turbocharged vehicles are equipped with three solenoids that are PCM controlled. They are mounted to the right shock tower. A vacuum harness connects the solenoids to their respective component.

- Wastegate Actuator Solenoid
- Surge Valve Actuator Solenoid
- Throttle Inlet Pressure (TIP) Solenoid

Removal

WASTEGATE SOLENOID

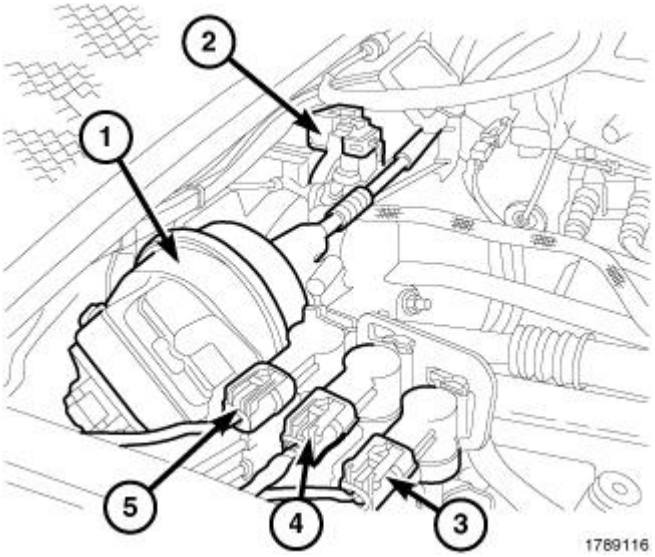

Fig. 260: Wastegate Solenoid & Electrical Connectors
Courtesy of CHRYSLER LLC

1. Disconnect the electrical connectors (3, 4 and 5).
2. Remove the nuts (1) the securing the solenoid mounting bracket to the shock tower.

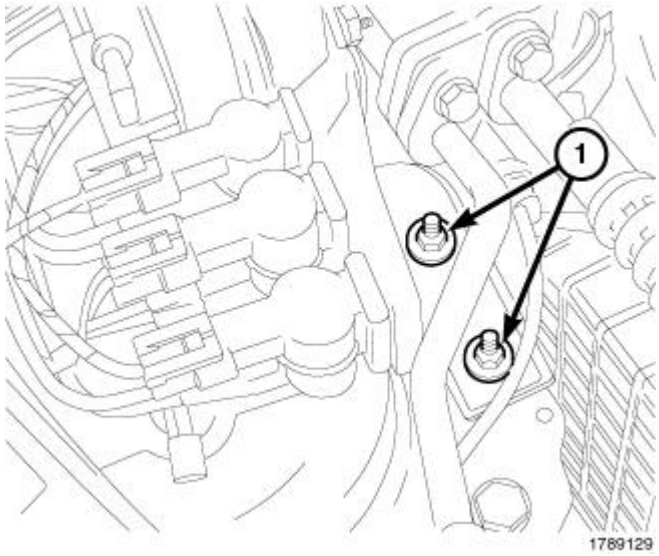

Fig. 261: Nuts Securing Solenoid Mounting Bracket
Courtesy of CHRYSLER LLC

3. Disconnect vacuum harness connector from solenoid.
4. Push on the solenoid lock tab and slide solenoid off the bracket.

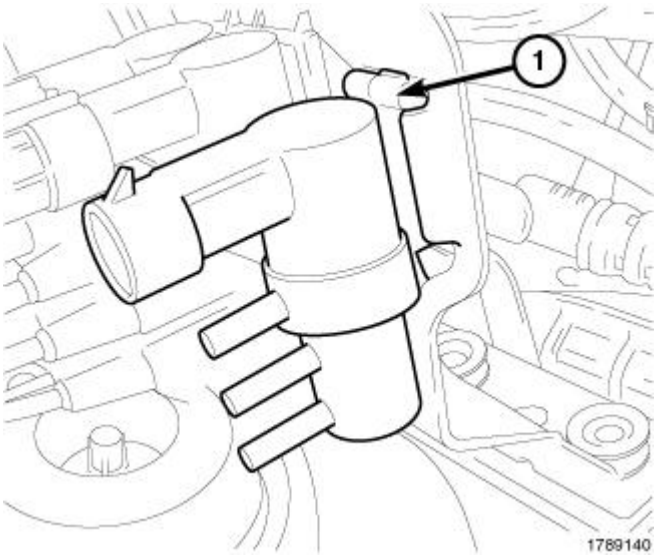

Fig. 262: Solenoid Mounting Bracket
Courtesy of CHRYSLER LLC

5. If necessary, remove the solenoid mounting bracket.

Installation

WASTEGATE SOLENOID

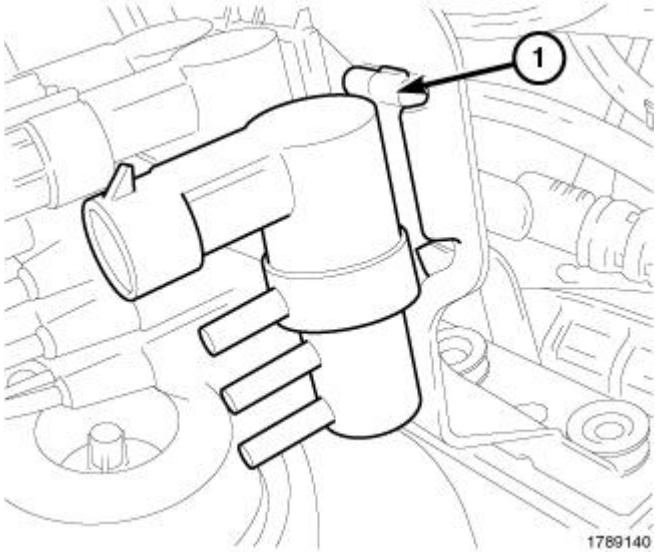

Fig. 263: Solenoid Mounting Bracket
Courtesy of CHRYSLER LLC

1. If removed, install the solenoid mounting bracket.
2. Slide the solenoids onto the mounting tab until the lock tab (1) engages.
3. Connect vacuum harness connector to solenoid.

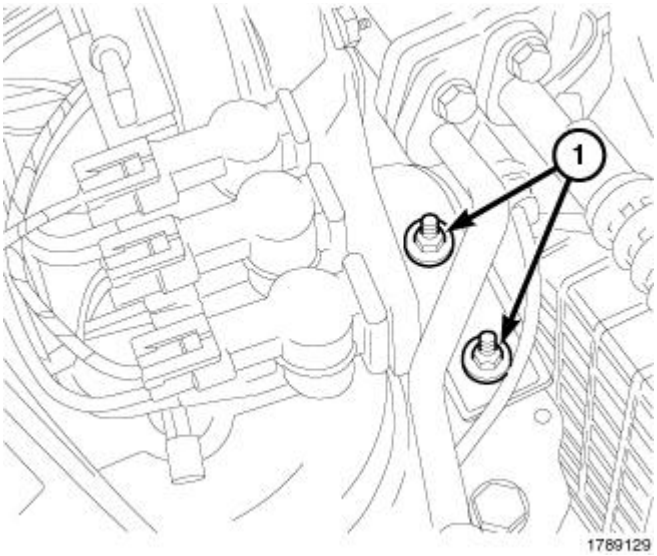

Fig. 264: Nuts Securing Solenoid Mounting Bracket
Courtesy of CHRYSLER LLC

4. Install the nuts securing the solenoid mounting bracket to the shock tower (1).

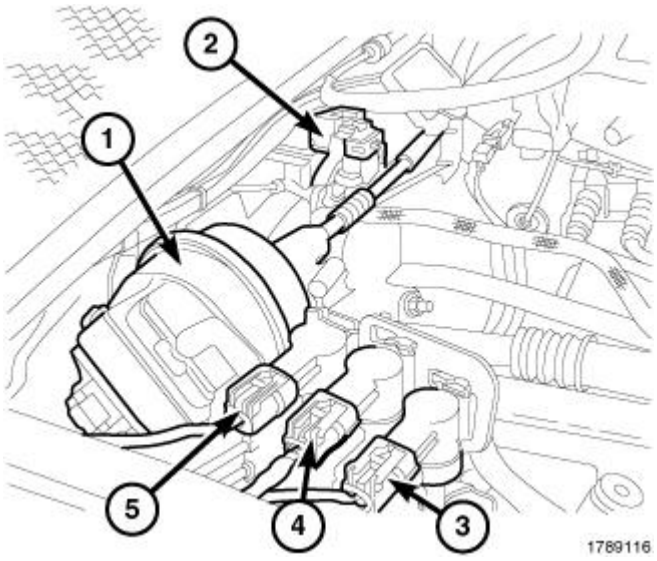

Fig. 265: Wastegate Solenoid & Electrical Connectors
Courtesy of CHRYSLER LLC

5. Connect solenoid electrical connectors (3, 4 and 5).

TURBOCHARGER

Description

TURBOCHARGER

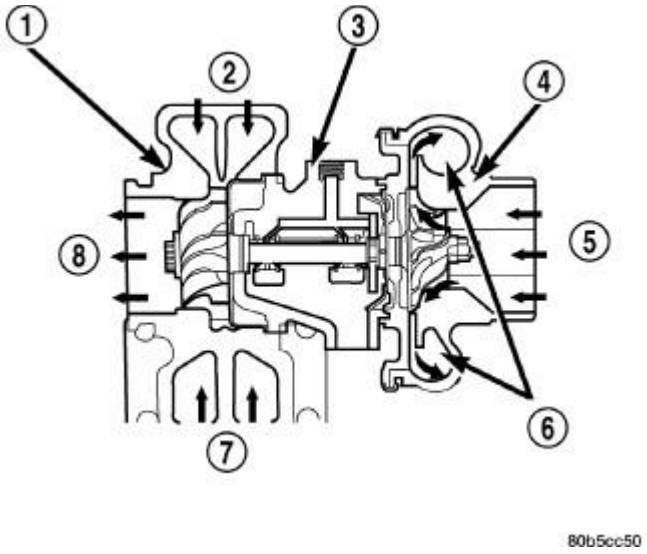

Fig. 266: Turbocharger - Typical
Courtesy of CHRYSLER LLC

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

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

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

The turbocharger assembly consists of four (4) major component systems:

- Turbine section (1)
- Compressor section (4)
- Bearing housing (3)
- Wastegate

Operation

OPERATION

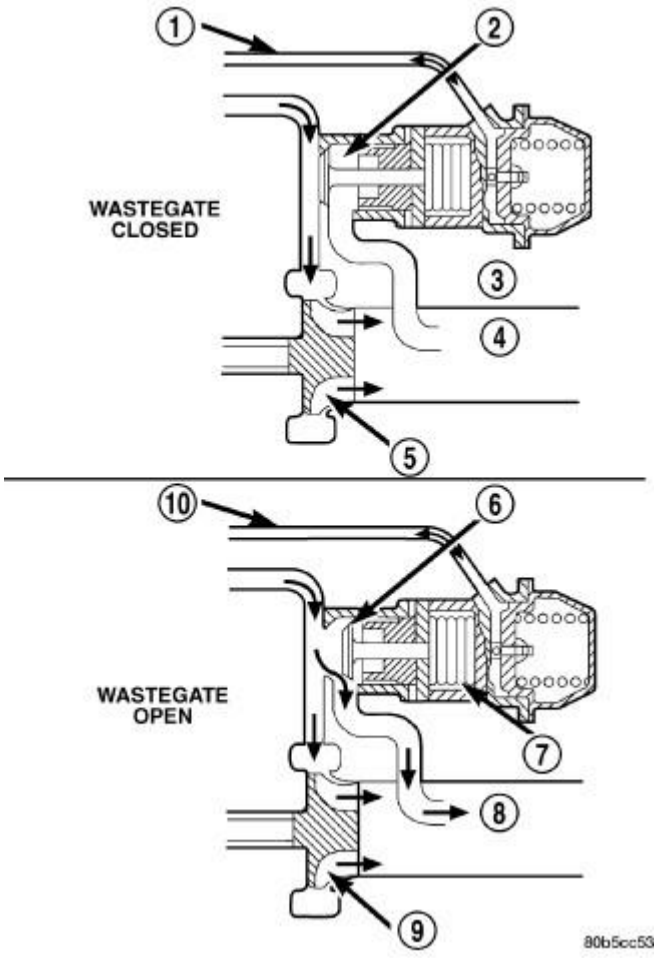

Fig. 267: Wastegate Operation
Courtesy of CHRYSLER LLC

1 - SIGNAL LINE
2 - EXHAUST BYPASS VALVE
3 - WASTEGATE
4 - EXHAUST
5 - TURBINE
6 - EXHAUST BYPASS VALVE
7 - WASTEGATE
8 - EXHAUST
9 - TURBINE
10 - SIGNAL LINE

Exhaust gas pressure and energy drive the turbine, which in turn drives a centrifugal compressor that

compresses the inlet air, and forces the air into the engine through the charge air cooler and plumbing. Since heat is a by-product of this compression, the air must pass through a charge air cooler to cool the incoming air and maintain power and efficiency.

Increasing air flow to the engine provides:

- Improved engine performance
- Improved operating economy
- Altitude compensation

The turbocharger also uses a wastegate (3), which regulates intake manifold air pressure and prevents over boosting at high engine speeds. When the wastegate valve is closed, all of the exhaust gases flow through the turbine wheel. As the intake manifold pressure increases, the wastegate actuator opens the valve, diverting some of the exhaust gases away from the turbine wheel. This limits turbine shaft speed and air output from the impeller.

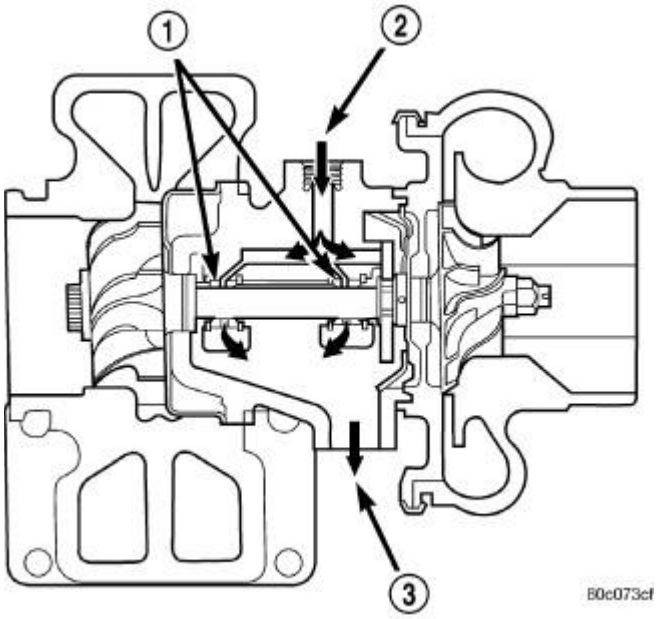

Fig. 268: Turbocharger Oil Supply and Drain
Courtesy of CHRYSLER LLC

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

The turbocharger is cooled by engine coolant. The coolant is delivered to the turbocharger by a supply line that connects from engine block to the turbocharger. A coolant return line connects the turbocharger to heater tubes.

The turbocharger is lubricated by engine oil that is pressurized, cooled, and filtered. The oil is delivered to the turbocharger by a supply line that is tapped into the cylinder block. The oil travels into the bearing housing, where it lubricates the shaft and bearings (1). A return pipe at the bottom of the bearing housing, routes the

engine oil back to the crankcase.

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

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

TURBOCHARGER "COOL DOWN" CHART	
Driving Conditions	Idle Time (in minutes) Before Shut Down
Normal Driving	Not required
Aggressive Driving or Heavily Loaded	3
Trailer Tow	5

Removal

DIESEL ENGINE

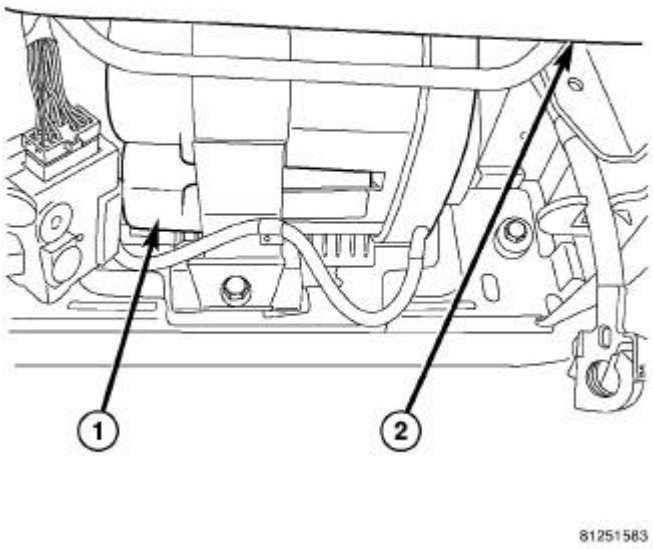

Fig. 269: Battery Location
Courtesy of CHRYSLER LLC

1 - BATTERY

2 - PASSENGER SEAT

1. Disconnect negative battery (1) cable located under passenger seat (2).

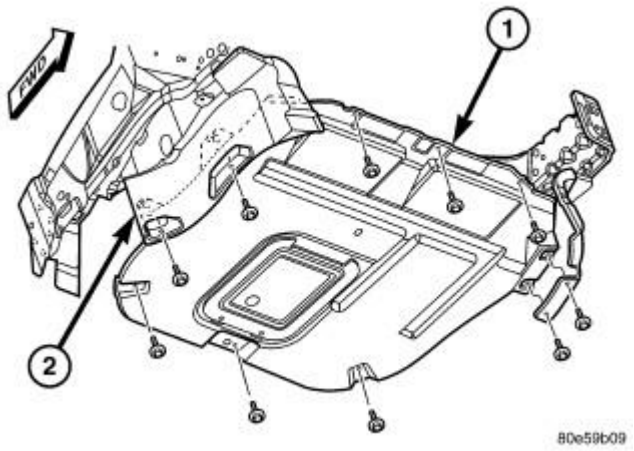

Fig. 270: LOWER SILENCER
Courtesy of CHRYSLER LLC

1 - ENGINE COMPARTMENT SILENCER
2 - ACCESSORY DRIVE BELT SPLASH SHIELD

2. Remove engine cover. See **Engine - Removal**.
3. Raise vehicle on hoist.
4. Remove engine compartment lower silencer (1).

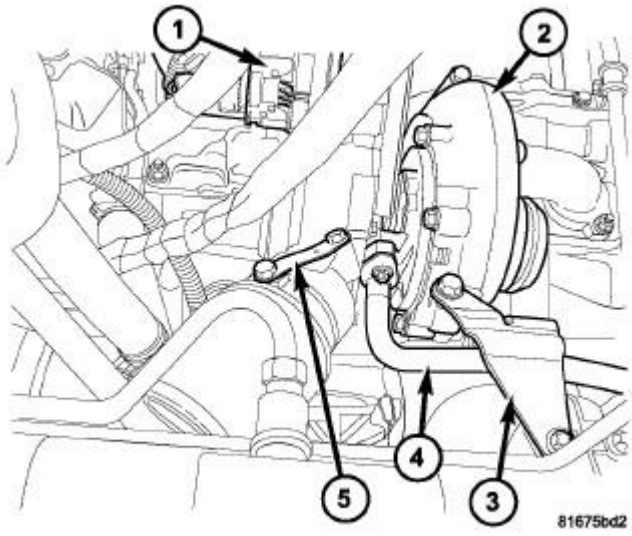

Fig. 271: CHARGE AIR PIPE

Courtesy of CHRYSLER LLC

5. Disconnect turbocharger outlet pipe to charge air cooler at turbocharger (2).
6. Disconnect exhaust pipe from turbocharger downpipe.
7. Remove turbocharger downpipe to turbo retaining bolts and remove downpipe.

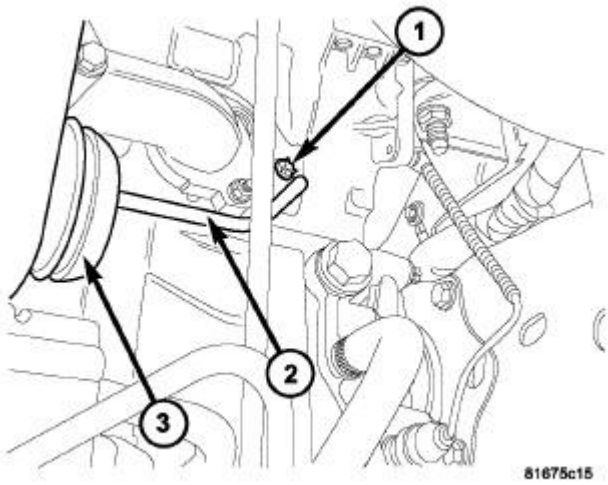

Fig. 272: TURBO OIL FEED
Courtesy of CHRYSLER LLC

8. Disconnect turbocharger oil return line at turbocharger.
9. Lower vehicle.
10. Remove coolant recovery pressure container. Refer to **Cooling/Engine/BOTTLE, Coolant Recovery - Removal** .
11. Disconnect air cleaner to turbocharger hose at turbocharger.
12. Remove exhaust manifold heat shield.
13. Disconnect turbocharger oil feed line at turbocharger and cylinder head. Remove exhaust manifold retaining nut holding oil feed line and remove line from engine.

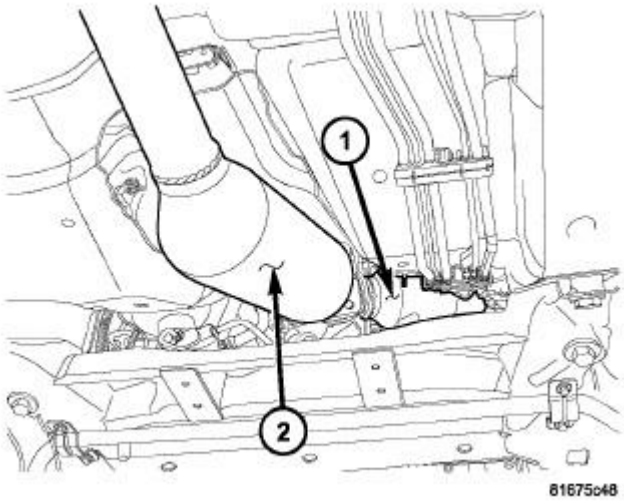

Fig. 273: PARTICULATE FILTER
Courtesy of CHRYSLER LLC

14. Disconnect wastegate actuator hose at actuator.
15. Remove exhaust manifold retaining nuts and remove exhaust manifold (2) and turbocharger assembly from cylinder head.
16. Clamp exhaust manifold/turbocharger assembly into a vise. Separate turbocharger from exhaust manifold.

Inspection

INSPECTION

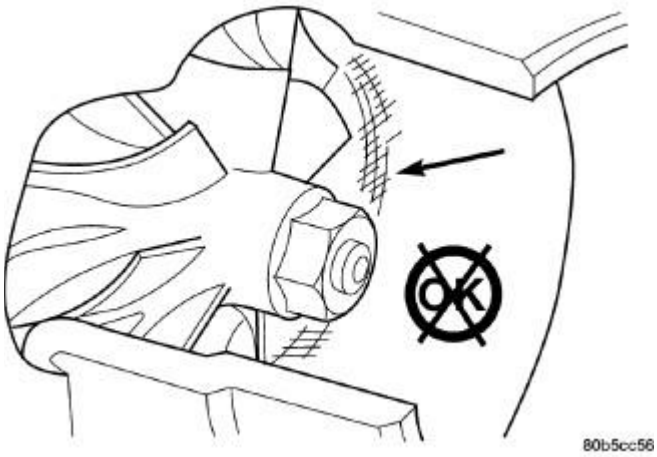

Fig. 274: Inspect Compressor Housing for Impeller Rubbing Condition
Courtesy of CHRYSLER LLC

Visually inspect the turbocharger and exhaust manifold gasket surfaces. Replace stripped or eroded mounting studs.

1. Visually inspect the turbocharger for cracks. The following cracks are NOT acceptable:
   - Cracks in the turbine and compressor housing that go completely through.
   - Cracks in the mounting flange that are longer than 15 mm (0.6 in.).
   - Cracks in the mounting flange that intersect bolt through-holes.
   - Two (2) Cracks in the mounting flange that are closer than 6.4 mm (0.25 in.) together.
2. Visually inspect the impeller and compressor wheel fins for nicks, cracks, or chips.
3. Visually inspect the turbocharger compressor housing for an impeller rubbing condition. Replace the turbocharger if the condition exists.

Installation

DIESEL ENGINE

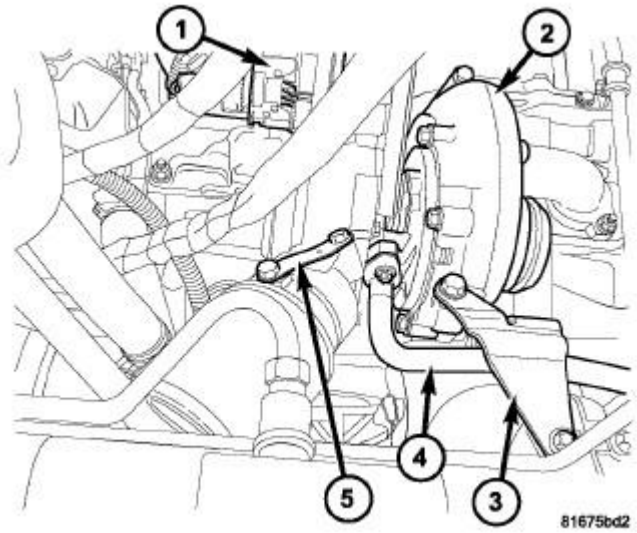

Fig. 275: CHARGE AIR PIPE
Courtesy of CHRYSLER LLC

1. Attach turbocharger assembly (2) to exhaust manifold. Torque bolts to 30 N.m (22 lbs. ft.).
2. Reposition exhaust manifold/turbocharger assembly (2) on cylinder head.
3. Install turbocharger oil feed line. Torque line at turbocharger to 30 N.m (22 lbs. ft.). Torque retaining bolts at cylinder head to 22 N.m(16 lbs. ft.).
4. Torque exhaust manifold nuts to 30 N.m (22 lbs. ft.).

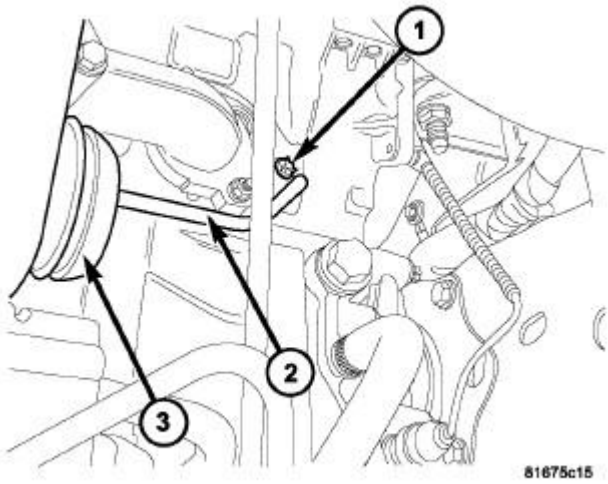

Fig. 276: TURBO OIL FEED
Courtesy of CHRYSLER LLC

5. Install exhaust manifold heat shield.
6. Install turbocharger inlet hose from air cleaner at turbocharger.
7. Connect wastegate actuator hose at actuator.
8. Install coolant recovery pressure container. Refer to **Cooling/Engine/BOTTLE, Coolant Recovery - Installation** .
9. Raise vehicle on hoist
10. Install oil return line at turbocharger. Torque bolts to 9 N.m (80 lbs. in.).
11. Install turbo downpipe to turbocharger. Torque bolts to 30 N.m (22 lbs. ft.).

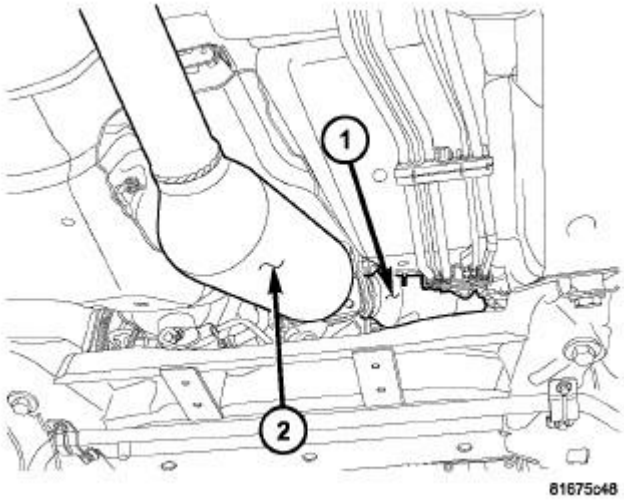

Fig. 277: PARTICULATE FILTER
Courtesy of CHRYSLER LLC

12. Connect exhaust pipe to turbocharger downpipe. Torque fasteners to 28 N.m (250 in. lbs.).
13. Connect turbocharger outlet pipe to charge air cooler at turbocharger.

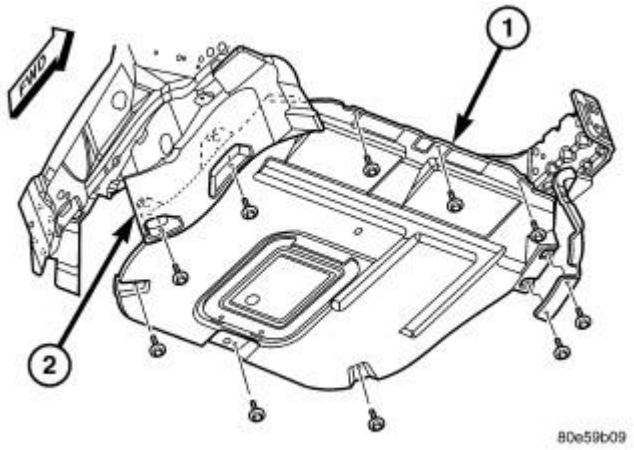

Fig. 278: LOWER SILENCER
Courtesy of CHRYSLER LLC

1 - ENGINE COMPARTMENT SILENCER
2 - ACCESSORY DRIVE BELT SPLASH SHIELD

14. Install engine compartment lower silencer (1).
15. Lower vehicle.
16. Refill cooling system. Refer to **SYSTEM FILLING - DIESEL ENGINE** .
17. Install engine cover. See **Engine - Installation**.

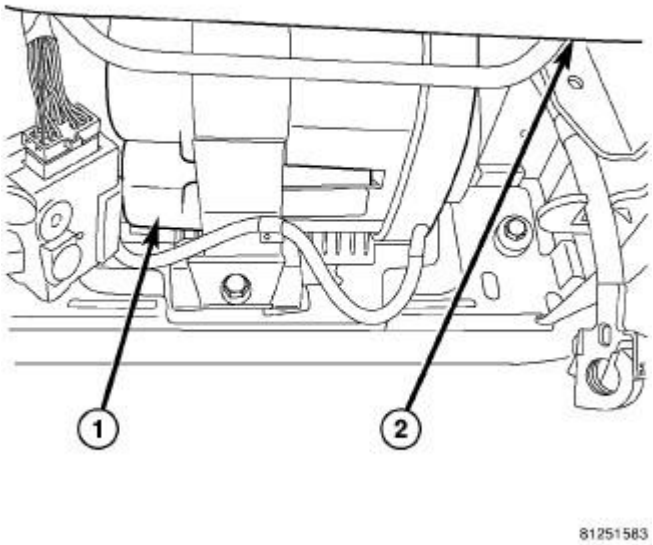

Fig. 279: Battery Location
Courtesy of CHRYSLER LLC

1 - BATTERY 2 - PASSENGER SEAT

18. Connect negative battery cable located under passenger seat (2).

VALVE TIMING

CHAIN, TIMING

Removal

BOTTOM GUIDE RAIL

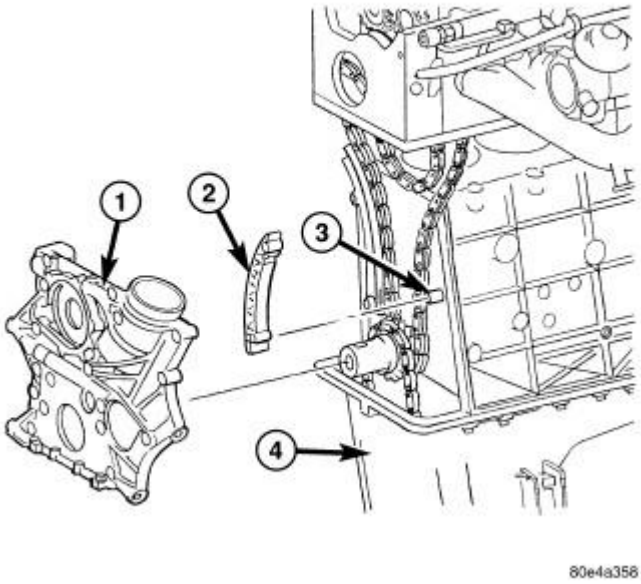

Fig. 280: Bottom Guide Rail
Courtesy of CHRYSLER LLC

1 - TIMING CHAIN COVER
2 - BOTTOM SLIDE RAIL
3 - BEARING PIN
4 - OIL PAN

The engine must be removed to service the bottom guide rail.

1. Disconnect negative battery cable.
2. Remove engine cover. See **Engine - Removal**.
3. Drain cooling system (refer to **SYSTEM DRAINING**).
4. Remove engine. See **Engine - Removal**.
5. Support engine on suitable engine stand.
6. Remove cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
7. Remove cylinder head front cover. See **Engine/Cylinder Head - Removal**.

NOTE: Oil pan DOES NOT need to be removed. Remove bolts in the area of timing case cover then loosen the remaining bolts.

NOTE: Remove timing case cover carefully. Care must be taken not to damage oil pan gasket.

8. Remove timing chain cover (1). See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.

9. Remove guide rail (2) from bearing pin (3). See **Fig. 281** .

INTERMEDIATE GEAR

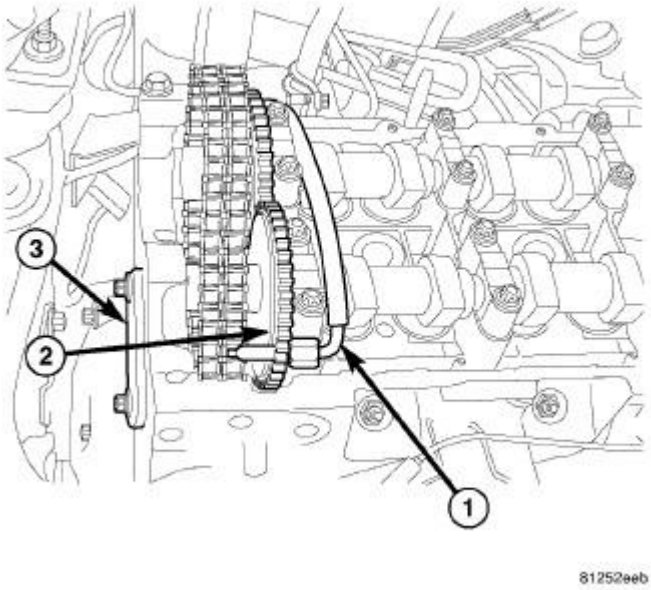

Fig. 281: Special Tool 8929-Camshaft Locking Pin
Courtesy of CHRYSLER LLC

1 - CAMSHAFT LOCKING PIN 8929
2 - INTAKE CAM SPROCKET
3 - INTERMEDIATE GEAR COVER

1. Disconnect negative battery cable located under the passenger seat.
2. Remove engine cover. See **Engine - Removal**.
3. Remove cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
4. Remove the intermediate gear cover (3). See **Fig. 281** .

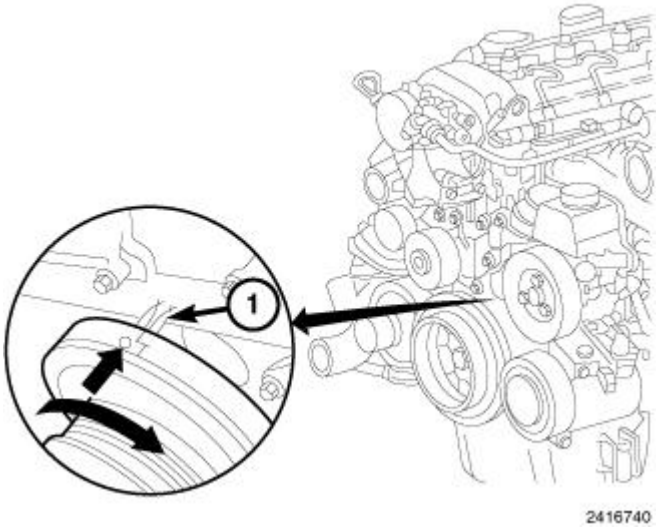

Fig. 282: Aligning Timing Mark
Courtesy of CHRYSLER LLC

NOTE: Rotate engine by the crankshaft bolt in a clockwise direction. DO NOT rotate the engine using the camshaft sprocket bolt.

NOTE: DO NOT rotate the engine backwards (counter clockwise).

5. Position piston of cylinder #1 to ignition TDC. **Markings on the camshaft bearing cap must be aligned.**

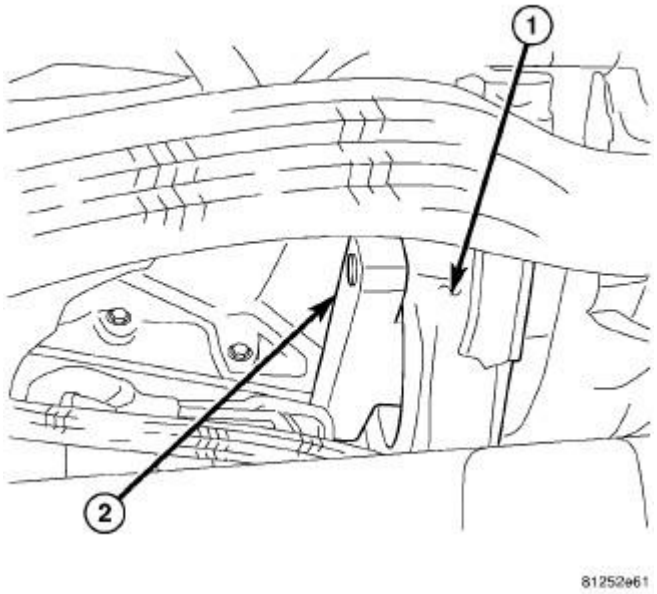

Fig. 283: Crankshaft Lock 8933

Courtesy of CHRYSLER LLC

1 - ENGINE BLOCK 2 - CRANKSHAFT LOCK 8933

6. Install crankshaft lock 8933 (2). See **Fig. 284** .

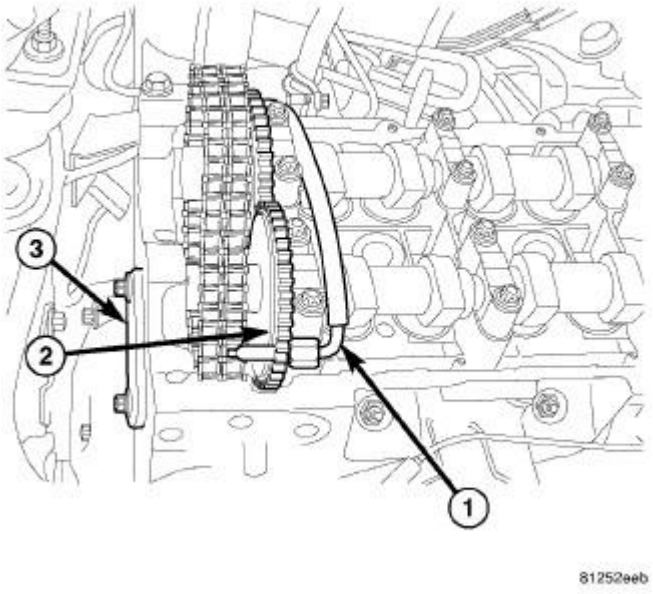

Fig. 284: Special Tool 8929-Camshaft Locking Pin
Courtesy of CHRYSLER LLC

1 - CAMSHAFT LOCKING PIN 8929 2 - INTAKE CAM SPROCKET 3 - INTERMEDIATE GEAR COVER

7. Install Camshaft Locking Pin 8929 (1) through first camshaft bearing cap into hole in the inlet camshaft sprocket to lock inlet camshaft. See **Fig. 285** .
8. Remove timing chain tensioner. See **Engine/Valve Timing/CHAIN, Timing - Removal**.
9. Remove cylinder head front cover. See **Engine/Cylinder Head - Removal**.
10. Remove top slide rail. See **Engine/Cylinder Head - Removal**.

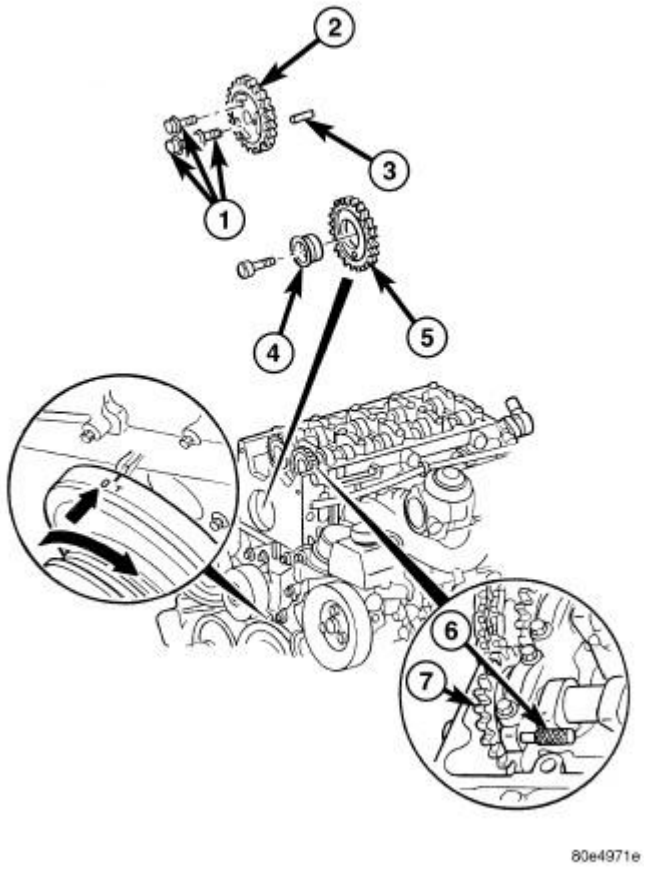

Fig. 285: Intermediate Gear
Courtesy of CHRYSLER LLC

1 - CAMSHAFT SPROCKET BOLTS
2 - INTAKE CAMSHAFT
3 - DOWEL PIN
4 - INTERMEDIATE GEAR BUSHING
5 - INTERMEDIATE GEAR
6 - CAMSHAFT LOCKING PIN
7 - INTAKE CAMSHAFT SPROCKET

11. Mark camshaft sprocket relative to timing chain.
12. Unbolt camshaft sprocket (1) from exhaust camshaft.

NOTE: Note position of dowel pin for camshaft sprocket alignment during reassembly.

13. Secure camshaft sprocket to timing chain with tie strap.

14. Remove camshaft sprocket.
15. Remove intermediate gear (5) and bushing (4). See **Fig. 286**. .

TIMING CHAIN TENSIONING RAIL

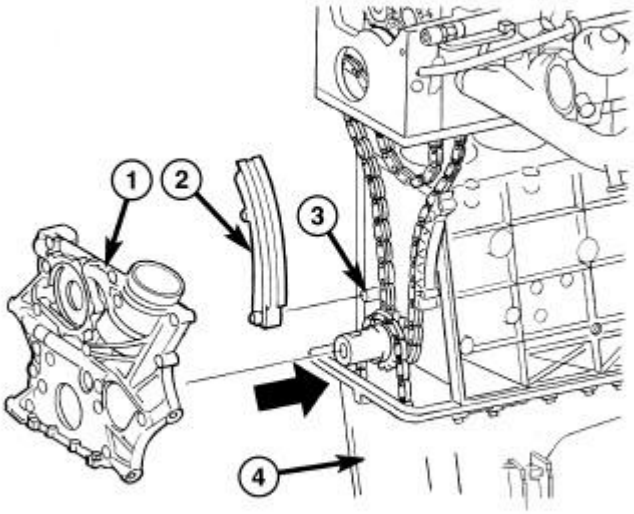

Fig. 286: Timing Chain Tensioning Rail
Courtesy of CHRYSLER LLC

1 - TIMING CHAIN COVER
2 - TENSIONING RAIL
3 - BEARING PIN
4 - OIL PAN

1. Disconnect negative battery cable.
2. Remove cylinder head cover.
3. Drain cooling system (refer to **SYSTEM DRAINING**).

NOTE: Oil pan DOES NOT need to be removed. Remove bolts in the area of timing case cover then loosen the remaining bolts.

NOTE: Remove timing case cover carefully. Care must be taken not to damage oil pan gasket.

4. Remove timing chain tensioner.
5. Remove timing chain cover (1). See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.
6. Remove tensioning rail (2) from bearing pin (3).

TIMING CHAIN

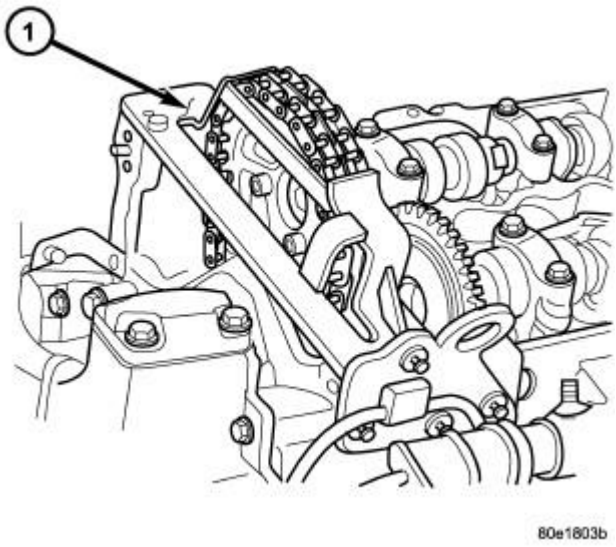

Fig. 287: Timing Chain Retainer 8931
Courtesy of CHRYSLER LLC

1 - TIMING CHAIN RETAINER 8931

1. Disconnect negative battery cable.
2. Remove engine cover. See **Engine - Removal**.
3. Remove cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
4. Remove cylinder head front cover and guide rail. See **Engine/Valve Timing/CHAIN, Timing - Removal**.
5. Remove timing chain tensioner. See **Engine/Valve Timing/TENSIONER, Engine Timing - Removal**.

CAUTION: Cover timing chain cover recess to prevent foreign material from entering engine.

6. Attach timing chain retainer 8931 (1) to cylinder head with bolts supplied. See **Fig. 288** .

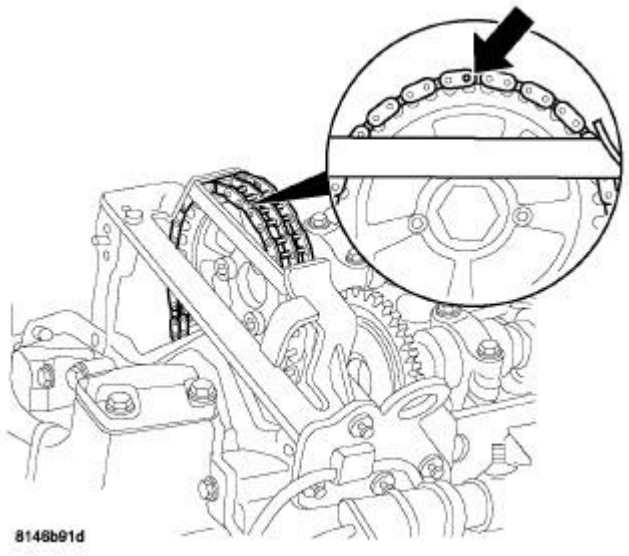

Fig. 288: PIN POSITION
Courtesy of CHRYSLER LLC

NOTE: When fitting the thrust spindle, ensure that the thrust pin is positioned at the left timing chain pin of a chain link. See Fig. 288 .

7. Assemble special tool #9312-1 (1) using 9312-3 (5) and 9312-4 (4). Install insert #9312-13 (3) and retain with screw provided. See **Fig. 289** .

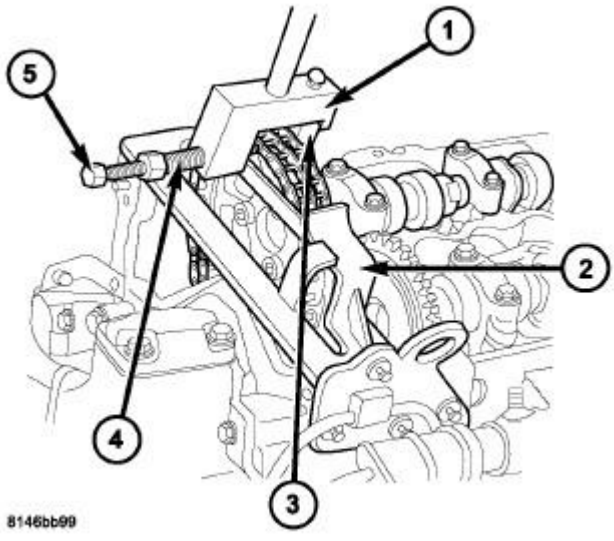

Fig. 289: CHAIN BREAKER
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL #9312-1

2 - SPECIAL TOOL #8931
3 - SPECIAL TOOL #9312-13
4 - SPECIAL TOOL #9312-4
5 - SPECIAL TOOL #9312-3

CAUTION: Care must be taken not to drop timing chain plates into the engine once the timing chain is separated.

NOTE: when installing special tool #9312-1 onto timing chain link, be sure to back off the smaller nut of the thrust pin #9312-3 until the pin is recessed inside of spindle 9312-4. Screw the thrust spindle #9312-4 in until it is seated and aligned properly over the left timing chain pin of a chain link, as viewed from behind the engine. See Fig. 289 .

8. Screw the thrust pin in and separate the timing chain. See **Fig. 289** .
9. Unscrew the thrust spindle and remove the tool.
10. Remove pressed - out timing chain pin from chain separation tool.

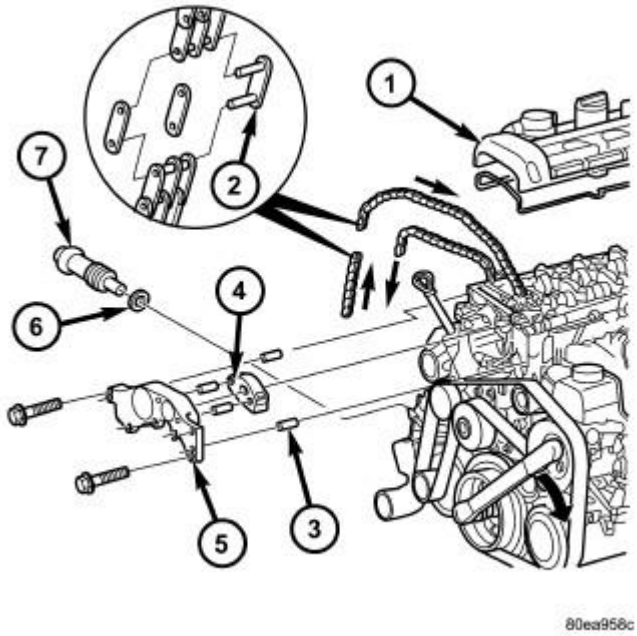

Fig. 290: Timing Chain Temporary Link - Typical
Courtesy of CHRYSLER LLC

1 - CYLINDER HEAD COVER
2 - TIMING CHAIN ASSEMBLY LINK
3 - ALIGNMENT PINS
4 - TOP GUIDE RAIL

5 - CYLINDER HEAD FRONT COVER 6 - TIMING CHAIN TENSIONER SEAL 7 - TIMING CHAIN TENSIONER

11. Connect new timing chain and old timing chain with assembly link, assembly plate and locking element, and secure. See **Fig. 289** .

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

Installation

BOTTOM GUIDE RAIL

NOTE: Carefully clean all mating surfaces with appropriate solvents to assure that no grease or oil is present during reassembly.

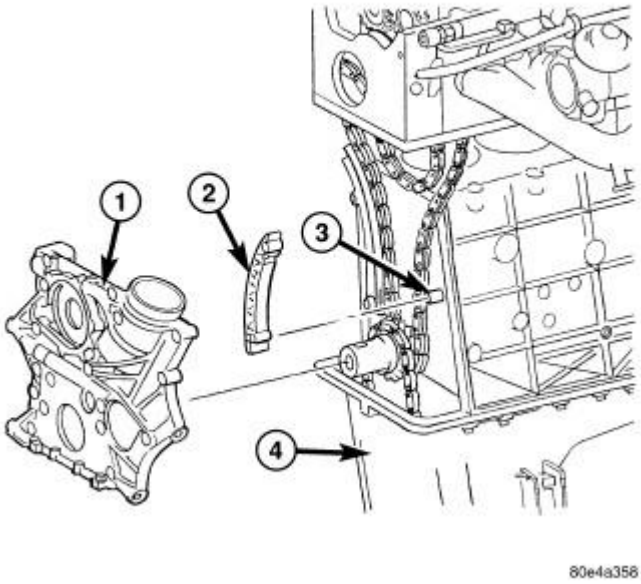

Fig. 291: Bottom Guide Rail
Courtesy of CHRYSLER LLC

1 - TIMING CHAIN COVER 2 - BOTTOM SLIDE RAIL 3 - BEARING PIN 4 - OIL PAN

1. Install bottom slide rail (2) on bearing pin (3).
2. Install timing chain cover (1). See **Engine/Valve Timing/COVER(S), Engine Timing - Installation**.
3. Install cylinder head front cover. See **Engine/Cylinder Head - Installation**.
4. Install cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.
5. Install engine. See **Engine - Installation**.
6. Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

7. Start the engine and inspect for leaks.
8. Install engine cover. See **Engine - Installation**.

INTERMEDIATE GEAR

NOTE: Refer to appropriate injector servicing procedures for cleaning of injectors and recesses.

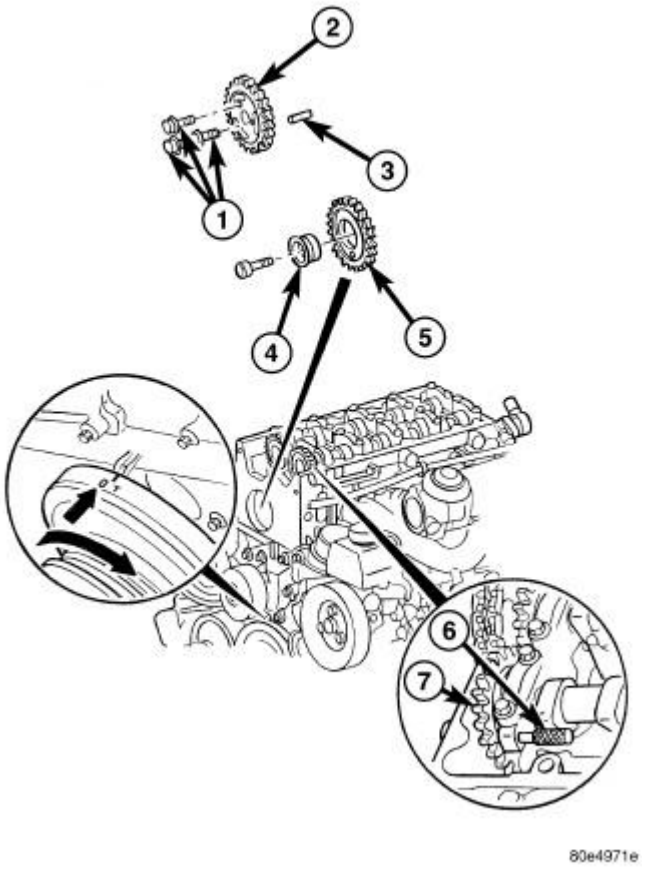

Fig. 292: Intermediate Gear
Courtesy of CHRYSLER LLC

1 - CAMSHAFT SPROCKET BOLTS
2 - INTAKE CAMSHAFT
3 - DOWEL PIN
4 - INTERMEDIATE GEAR BUSHING
5 - INTERMEDIATE GEAR
6 - CAMSHAFT LOCKING PIN
7 - INTAKE CAMSHAFT SPROCKET

1. Install intermediate gear (5) and bushing (4). Tighten bolt to 40N.m (30 lbs. ft.)
2. Install camshaft sprocket (1), noting dowel pin alignment. Tighten bolt to 18 N.m (159 lbs. in.).
3. Remove tie strap retaining timing chain to sprocket.

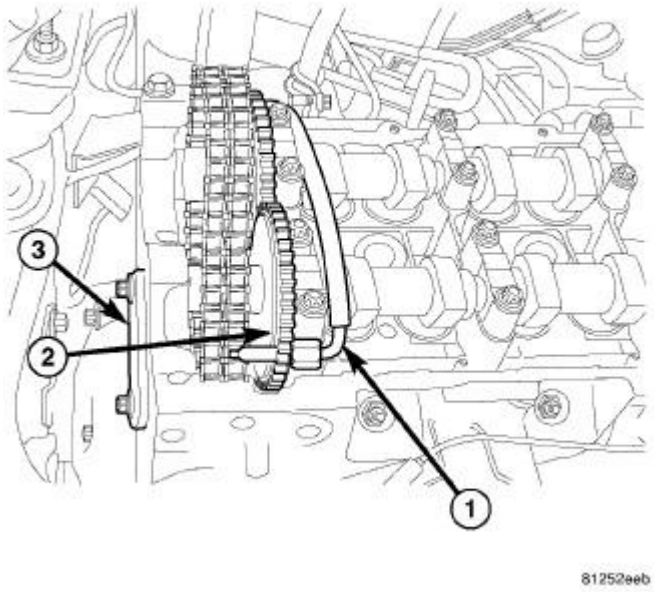

Fig. 293: Camshaft Locking Pin 8929
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL #8929
2 - INTAKE CAM SPROCKET
3 - INTERMEDIATE GEAR COVER

4. Install top slide rail. See **Engine/Valve Timing/CHAIN, Timing - Installation**.
5. Install intermediate gear cover (3).
6. Install cylinder head front cover. See **Engine/Cylinder Head - Installation**.
7. Install timing chain tensioner with new gasket. See **Engine/Valve Timing/CHAIN, Timing - Installation**.

NOTE: Inspect basic position of camshaft and reset if necessary.

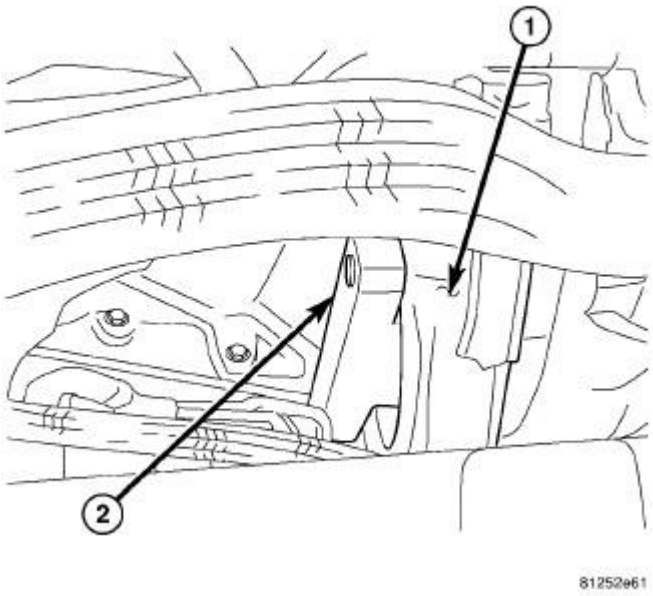

Fig. 294: Crankshaft Lock 8933
Courtesy of CHRYSLER LLC

1 - ENGINE BLOCK 2 - SPECIAL TOOL #8933

8. Remove crankshaft lock 8933 (2).

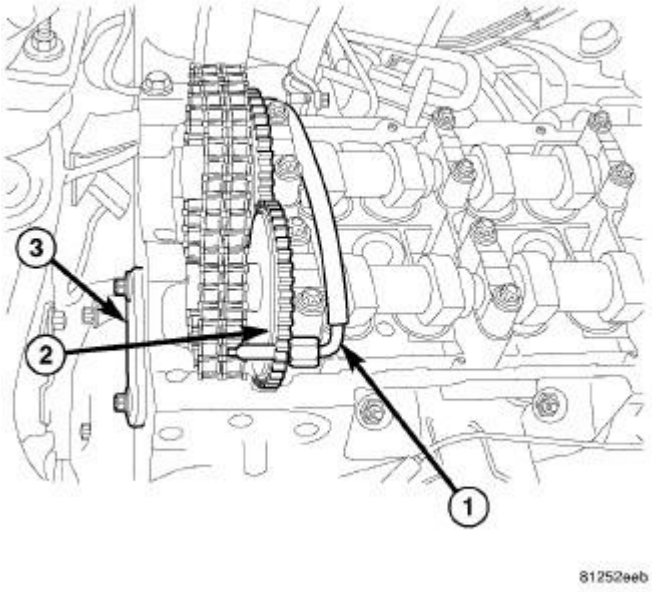

Fig. 295: Camshaft Locking Pin 8929
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL #8929 2 - INTAKE CAM SPROCKET 3 - INTERMEDIATE GEAR COVER

9. Remove camshaft locking pin 8929 (1).
10. Install cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

11. Start engine and inspect for leaks.
12. Install engine cover. See **Engine - Installation**.
13. Connect negative battery cable.

TIMING CHAIN TENSIONING RAIL

NOTE: Carefully clean all mating surfaces with appropriate solvents to assure that no grease or oil is present during reassembly.

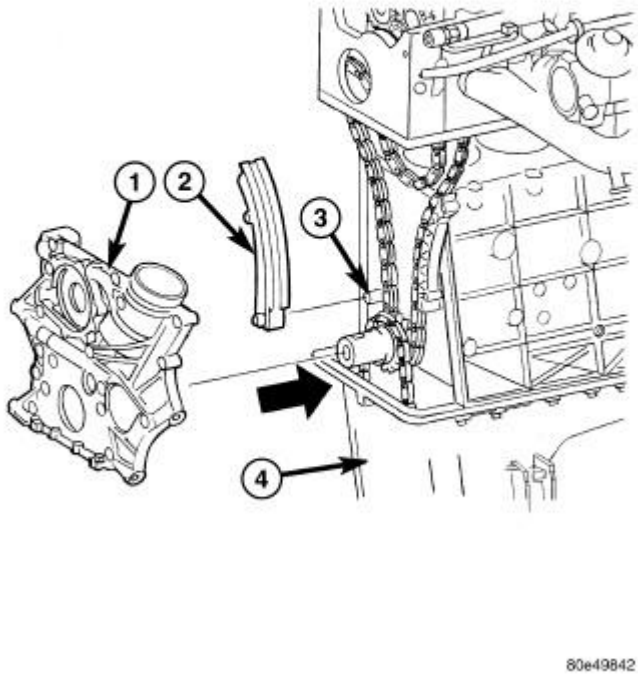

Fig. 296: Timing Chain Tensioning Rail
Courtesy of CHRYSLER LLC

1 - TIMING CHAIN COVER
2 - TENSIONING RAIL
3 - BEARING PIN
4 - OIL PAN

1. Install tensioning rail (2) on bearing pin (3).
2. Install timing chain tensioner with new seal.
3. Install timing chain cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Installation**.
4. Install cylinder head cover.
5. Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

6. Start the engine and inspect for leaks.
7. Install engine cover. See **Engine - Installation**.

Adjustments

TIMING CHAIN

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

CAUTION: Cover timing case recesses to prevent foreign material from entering engine.

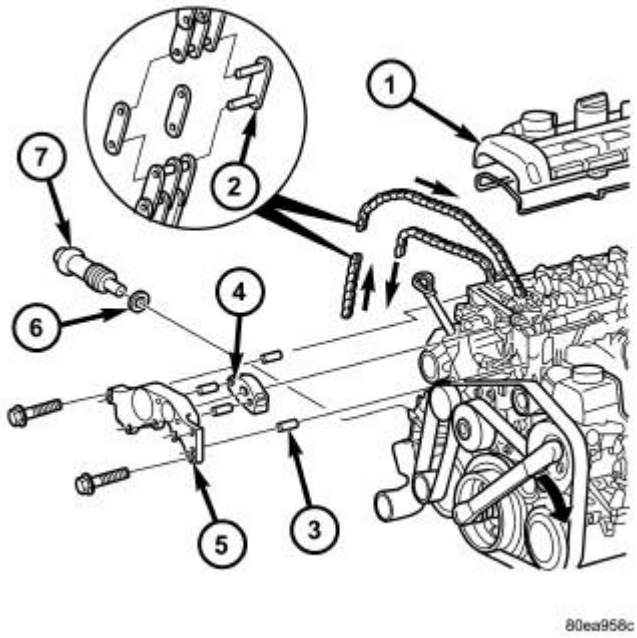

Fig. 297: Timing Chain Temporary Chain Link - Typical
Courtesy of CHRYSLER LLC

1 - CYLINDER HEAD COVER
2 - TIMING CHAIN ASSEMBLY LINK
3 - ALIGNMENT PINS
4 - TOP GUIDE RAIL
5 - CYLINDER HEAD FRONT COVER
6 - TIMING CHAIN TENSIONER SEAL
7 - TIMING CHAIN TENSIONER

1. Connect new timing chain and old timing chain with the assembly link (2), the assembly plate and the assembly locking element, and secure. See **Fig. 289** .

NOTE: Always keep new timing chain meshed with camshaft sprocket.

NOTE: Rotate engine at crankshaft only. DO NOT crank engine and DO NOT rotate engine backward. See Fig. 289 .

NOTE: Draw out the end of old timing chain evenly as it becomes free, to the same extent that new timing chain is drawn in. See Fig. 289 .

2. Draw in new timing chain by rotating the crankshaft slowly in direction of rotation of engine until the ends of the new timing chain meet and can be connected. See **Fig. 289** .

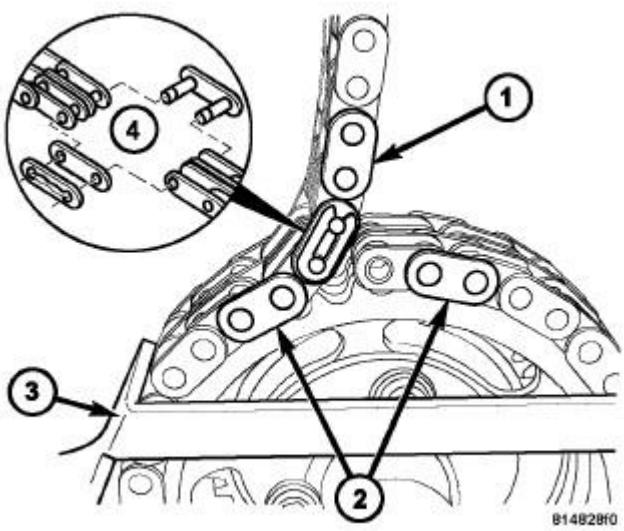

Fig. 298: NEW AND OLD CHAIN
Courtesy of CHRYSLER LLC

1 - OLD CHAIN
2 - NEW CHAIN
3 - SPECIAL TOOL 8931
4 - TEMPORARY LINK

NOTE: Assembly link is only an assembly aid and NOT designed for engine running.

3. Remove assembly link locking element (4), outer plate and link. See **Fig. 299** .
4. Engage both halves of the new timing chain into the timing chain gear.

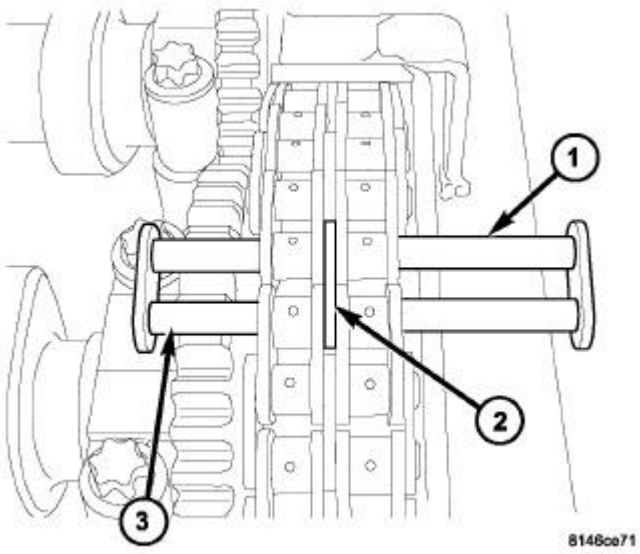

Fig. 299: LINK PLATE HOLDER
Courtesy of CHRYSLER LLC

1 - GUIDE LINK 2 - NEW CENTER LINK PLATE 3 - NEW LINK

NOTE: The guide link will hold the new center link plate in place while the link is pressed in place.

5. Install the new chain center link plate. Insert the guide link into the new center plate. See **Fig. 300** .

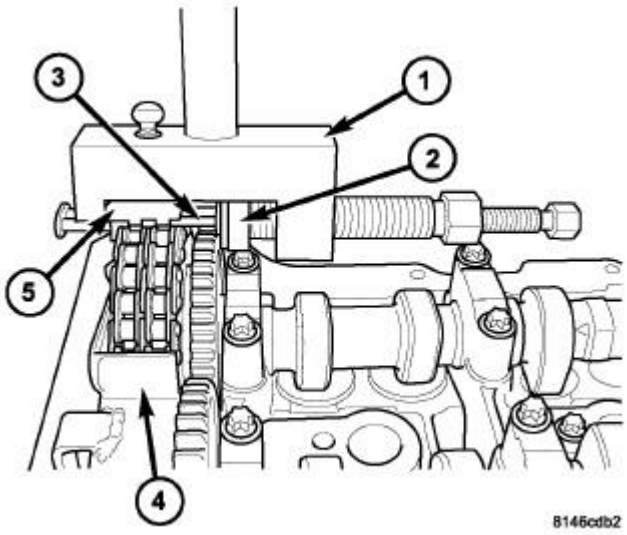

Fig. 300: LINK INSTALLER

Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL 9312-1
2 - SPECIAL TOOL 9312-10
3 - NEW LINK
4 - SPECIAL TOOL 8931
5 - SPECIAL TOOL 9312A-7

6. Assemble special tools 9312-1, 9312A-7, 9312-10 and install on new timing chain. See **Fig. 301** .

CAUTION: Cover voids in timing chain cover. Be careful not to allow the guide link to fall into the timing chain cover as the new link is pressed in.

7. Tighten spindle until link plate is fully seated against the timing chain. Remove special tool assembly.

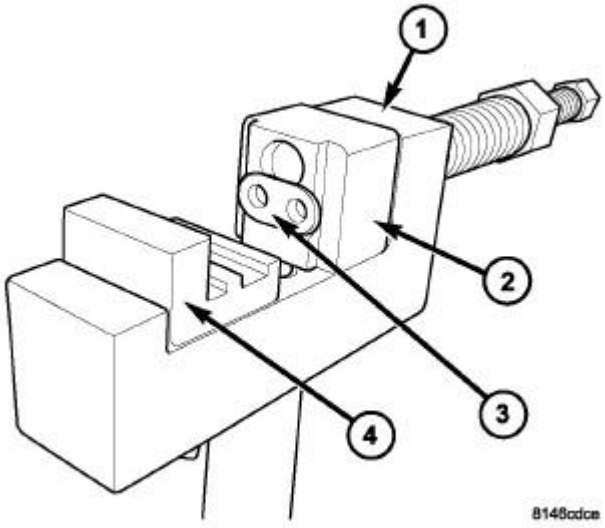

Fig. 301: LINK PLATE INSTALLER
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL 9312-1
2 - SPECIAL TOOL 9312-8A
3 - NEW LINK PLATE
4 - SPECIAL TOOL 9312-6

8. Assemble special tool 9312-1 with 9312-8A, and 9312-6. See **Fig. 302** .

NOTE: The outer plate is held magnetically by link plate installation tool.

9. Install new link plate into 9312-8A. See **Fig. 302** .

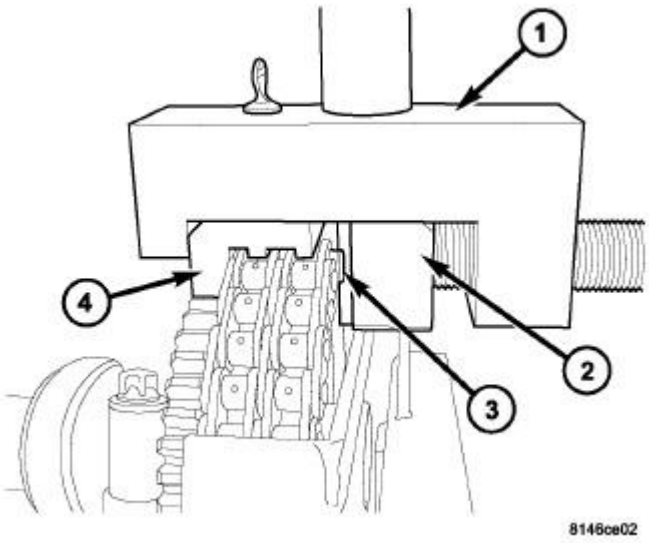

Fig. 302: INSTALLING LINK PLATE
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL 9312-1
2 - SPECIAL TOOL 9312-8A
3 - NEW LINK PLATE
4 - SPECIAL TOOL 9312-6

NOTE: When turning spindle of the link plate installation tool, be sure that pins of riveted link are inserted into holes of outer plate. See Fig. 303 .

10. Install special tool assembly onto the timing chain and tighten spindle until link plate is fully seated and remove tool. See **Fig. 303** .

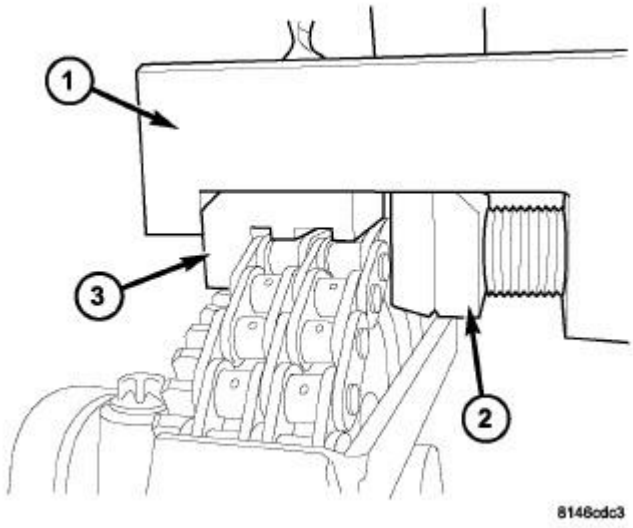

Fig. 303: PEEN TOOL
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL 9312-1 2 - SPECIAL TOOL 9312-11A 3 - SPECIAL TOOL 9312-6

11. Assemble special tool 9312-1 with 9312-11A, and 9312-6 and position onto the timing chain. See **Fig. 304** .

NOTE: Ensure that the riveted link and riveting tool are aligned.

12. Position riveting tool exactly over middle of pin.
13. Tighten spindle to firmly seat 9312-11A against chain. See **Fig. 304** . Repeat process for both link rivets.

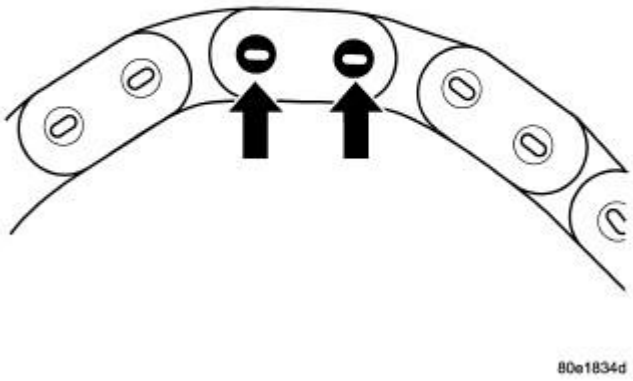

Fig. 304: Rivet Inspection
Courtesy of CHRYSLER LLC

14. Remove special tool and inspect rivets to ensure they have been properly peened. See **Fig. 304** . Repeat process if necessary.
15. Install cylinder head front cover and guide rail. See **Engine/Cylinder Head - Installation**.
16. Install timing chain tensioner. See **Engine/Valve Timing/CHAIN, Timing - Installation**.
17. Install cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.
18. Install engine cover. See **Engine - Installation**.
19. Connect negative battery cable.

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

COVER(S), ENGINE TIMING

Removal

REMOVAL

The engine must be removed from the vehicle to remove the timing chain cover.

WARNING: 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. Risk of injury to skin and eyes from scalding coolant. Wear protective gloves, clothing and eye wear.

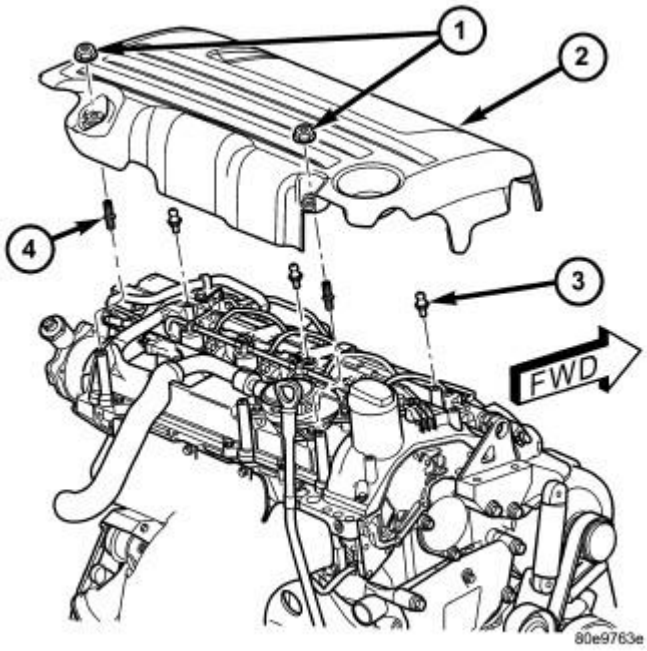

Fig. 305: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Drain cooling system (refer to **SYSTEM DRAINING**).
3. Remove engine cover (2). See **Engine - Removal**.
4. Remove engine. See **Engine - Removal**.
5. Support engine on suitable engine stand.

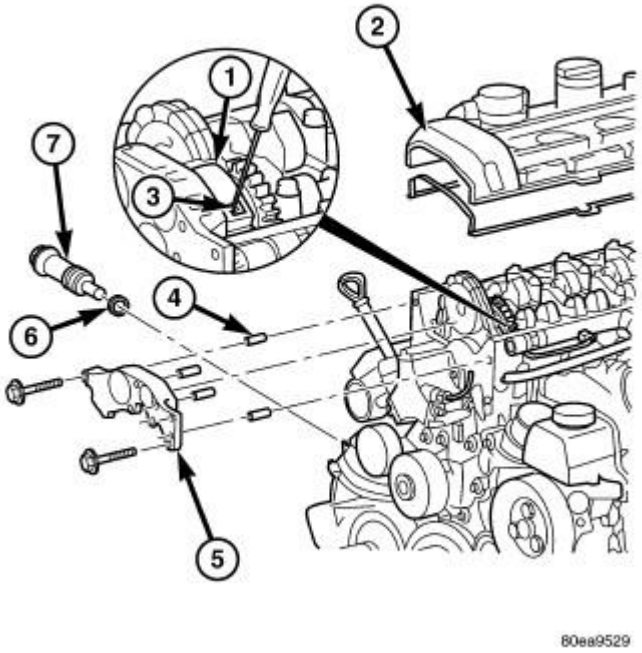

Fig. 306: Cylinder Head Front Cover - Typical
Courtesy of CHRYSLER LLC

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

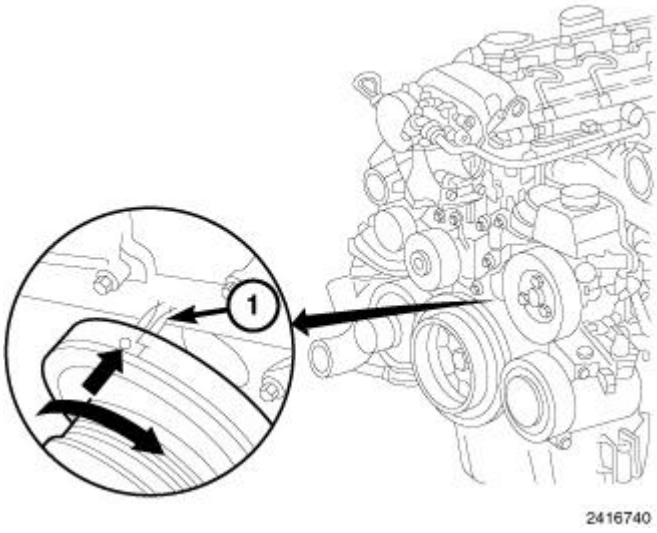

Fig. 307: Aligning Timing Mark
Courtesy of CHRYSLER LLC

NOTE: Rotate engine by the crankshaft bolt in a clockwise direction. DO NOT

crank the engine at the bolt of the camshaft sprocket.

NOTE: DO NOT rotate the engine backwards (counter clockwise).

7. Position piston of cylinder #1 to ignition TDC. **Markings on the camshaft bearing cap must be aligned.**

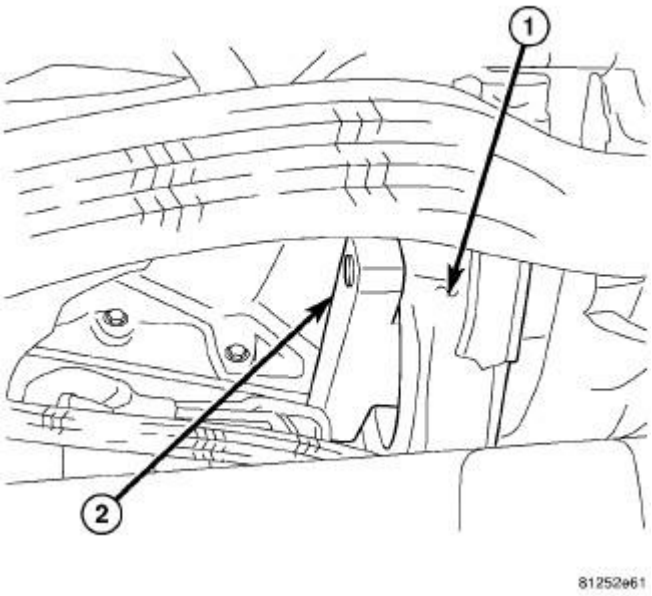

Fig. 308: Crankshaft Lock 8933
Courtesy of CHRYSLER LLC

8. Install crankshaft lock 8933 (2).

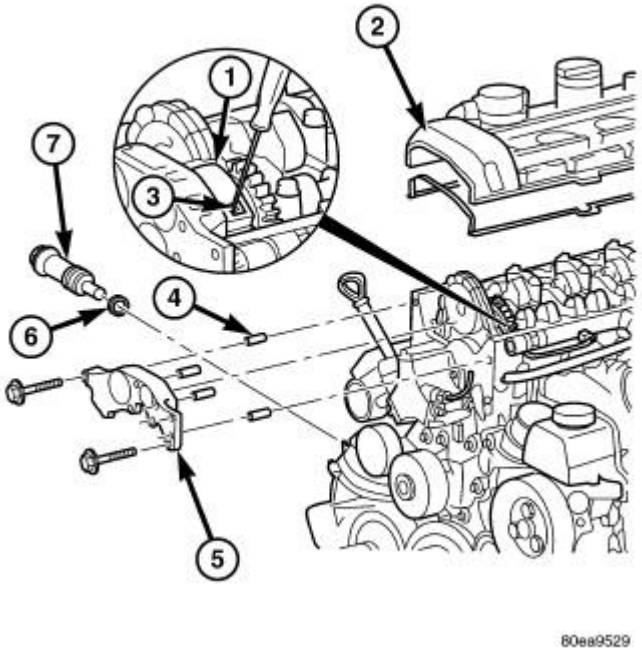

Fig. 309: Cylinder Head Front Cover - Typical
Courtesy of CHRYSLER LLC

9. Remove timing chain tensioner (7). See **Engine/Valve Timing/CHAIN, Timing - Removal**.
10. Remove cylinder head front cover (5). See **Engine/Cylinder Head - Removal**.
11. Remove vibration damper/crankshaft pulley. Refer to **Engine/Engine Block/DAMPER, Vibration - Removal** .
12. Drain engine oil.

NOTE: Remove the bolts in area of timing chain cover. Loosen all other oil pan bolts.

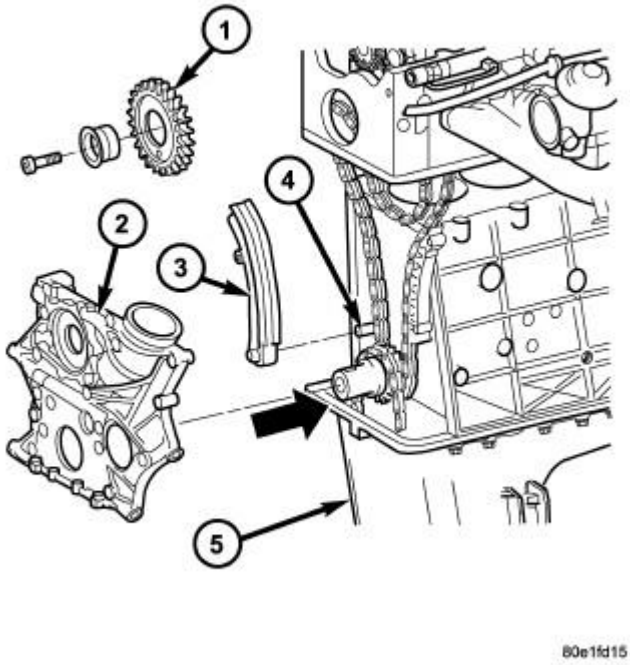

Fig. 310: Timing Chain Cover
Courtesy of CHRYSLER LLC

13. Remove oil pan bolts.
14. Remove M8 bolts of cylinder head on timing chain cover.
15. Remove timing chain cover retaining bolts and remove cover (2) from engine. See **Fig. 310** .
16. Remove remaining ancillary components attached to the timing chain cover.

Installation

INSTALLATION

NOTE: Thoroughly clean all mating surfaces with the appropriate solvents to assure that no grease or oil is present during assembly.

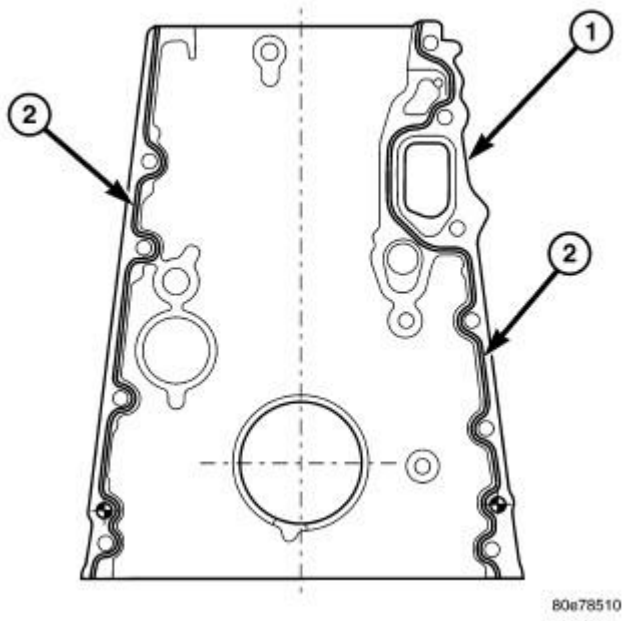

Fig. 311: Timing Chain Cover Sealing Surface
Courtesy of CHRYSLER LLC

1. Inspect cylinder head gasket and oil pan gasket. If damaged, replace.
2. Replace front crankshaft seal. Refer to **Engine/Engine Block/SEAL, Crankshaft Oil - Installation** .
3. Install ancillary components to timing case cover.
4. Apply sealant to the marked surfaces (2) with a bead thickness of 1.5 ± 0.5 mm. See **Fig. 312** .

NOTE: Install timing cover within 10 minutes after applying sealant. Do not spread sealant bead.

NOTE: Do not seal pressurized oil galleries to the crankcase. Sealant applied at these points is entrained by the oil flow and blocks the oil supply passages.

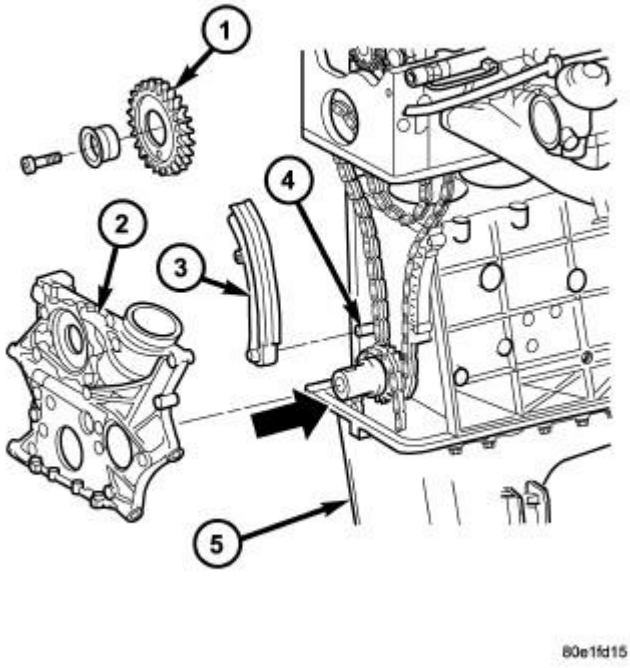

Fig. 312: Timing Chain Cover
Courtesy of CHRYSLER LLC

5. Position and install timing chain cover (2). Tighten bolts to 20 N.m (177 lbs in).
6. Install M8 bolts of cylinder head on timing case cover. Tighten bolts to 20 N.m (177 lbs in).
7. Position and install the oil pan. Tighten M6 bolts to 9 N.m (80 lbs in) and M8 bolts to 20 N.m (177 lbs in).
8. Install vibration damper/crankshaft pulley. Tighten M8.8 bolt in two stages, 200N.m (147 lbs ft.) then 90°, M10.9 bolt 325N.m (240 lbs ft) then 90°.

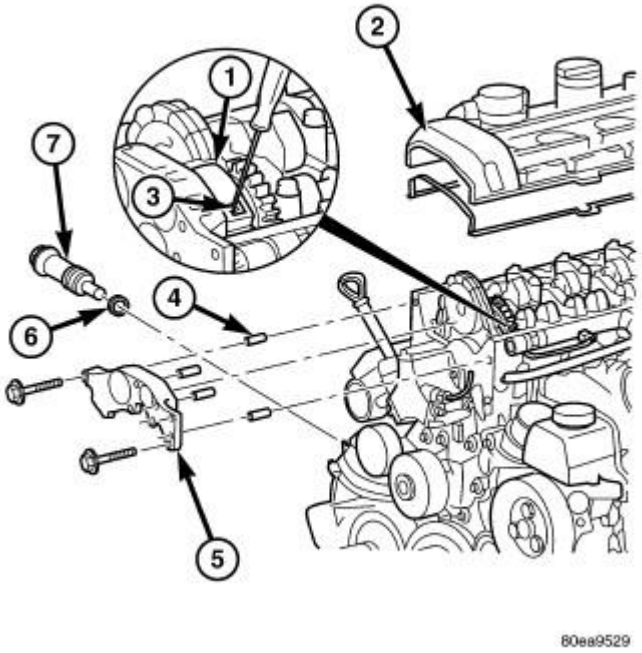

Fig. 313: Cylinder Head Front Cover - Typical
Courtesy of CHRYSLER LLC

9. Install cylinder head front cover (5). See **Engine/Cylinder Head - Installation**.
10. Install timing chain tensioner (7) with new seal (6). See **Engine/Valve Timing/CHAIN, Timing - Installation**.
11. Install cylinder head cover (2). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.

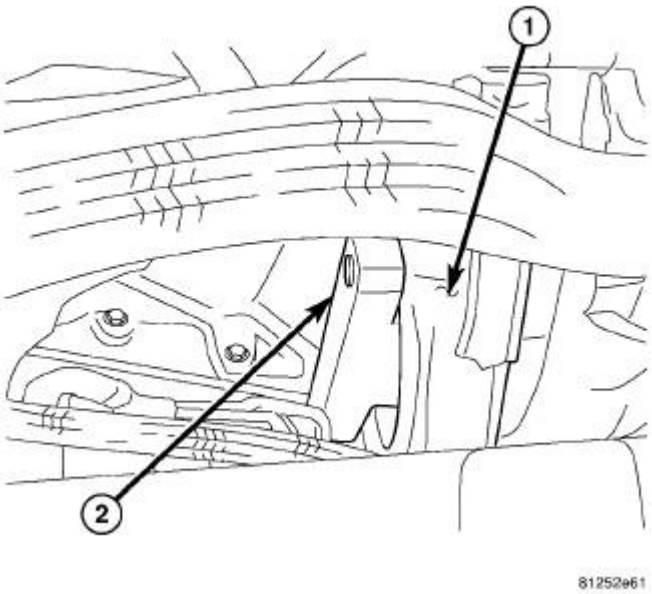

Fig. 314: Crankshaft Lock 8933
Courtesy of CHRYSLER LLC

12. Remove crankshaft lock 8933 (2).
13. Install engine. See **Engine - Installation**.

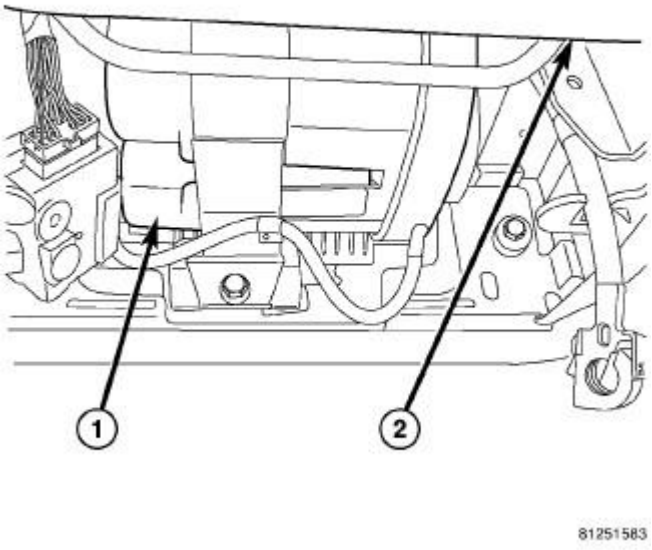

Fig. 315: Battery Location
Courtesy of CHRYSLER LLC

14. Fill coolant to the proper level, with the proper coolant.
15. Tighten oil drain plug to 30 N.m (265 lbs in).
16. Fill crankcase with the correct oil, to the proper level. Refer to owner's manual for specifications.
17. Connect negative battery (1) cable.

WARNING: Refer to Fuel System/Fuel Injection - Standard Procedure .

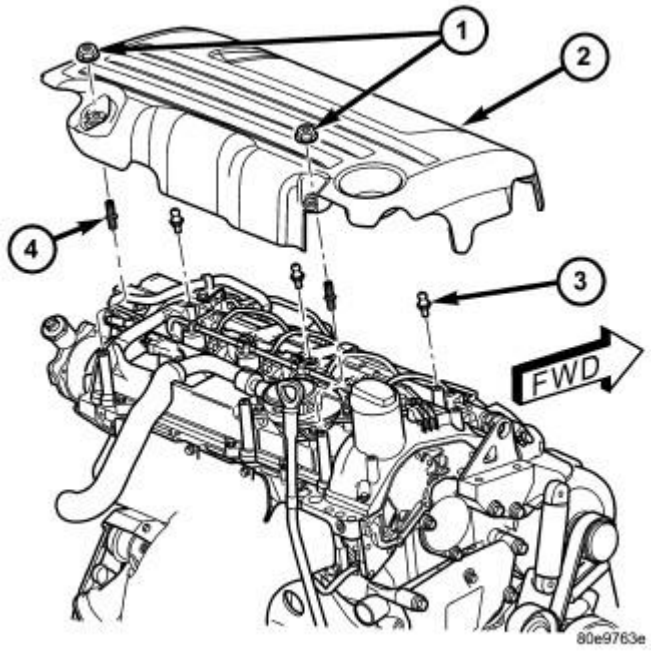

Fig. 316: Engine Cover Mounts
Courtesy of CHRYSLER LLC

1 - ENGINE COVER RETAINING NUTS
2 - ENGINE COVER
3 - ENGINE COVER MOUNTS
4 - ENGINE COVER MOUNTING STUDS

18. Start engine and inspect for leaks.
19. Install engine cover (2). See **Engine - Installation**.

TENSIONER, ENGINE TIMING

Removal

TIMING CHAIN TENSIONER

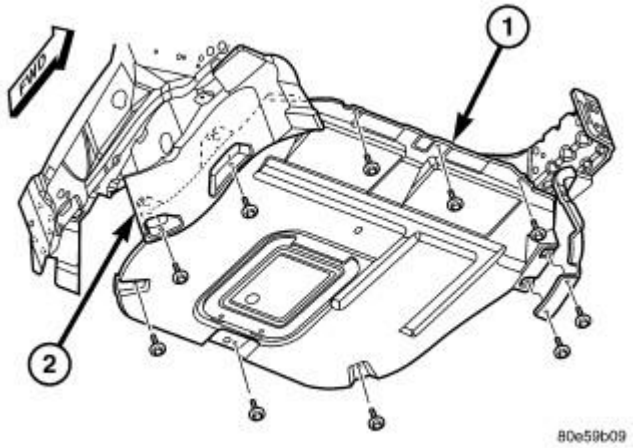

Fig. 317: ENGINE COMPARTMENT LOWER SILENCER
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Raise vehicle on hoist.
3. Remove engine compartment lower silencer (1) and accessory drive belt splash shield (2). See **Fig. 318** .

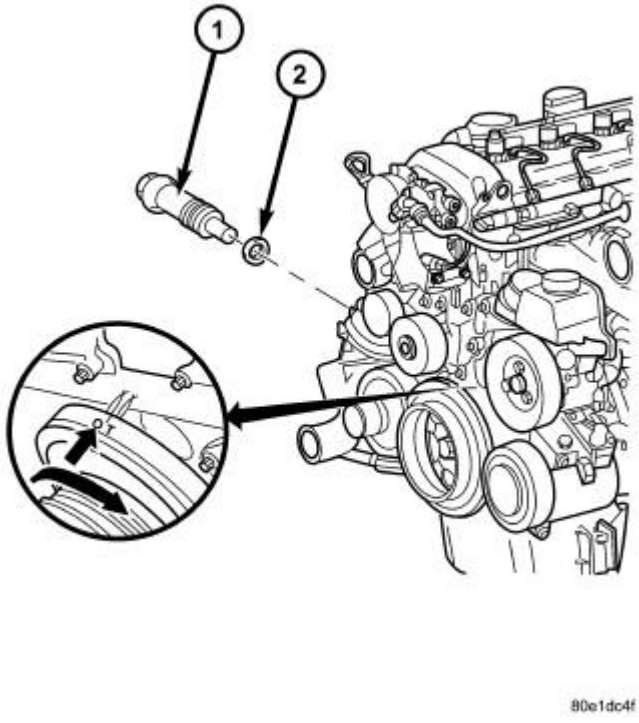

Fig. 318: TIMING CHAIN TENSIONER - TYPICAL
Courtesy of CHRYSLER LLC

1 - TIMING CHAIN TENSIONER 2 - TIMING CHAIN TENSIONER SEAL

CAUTION: Rotate engine at crankshaft only. DO NOT rotate the engine with the bolt of the camshaft sprocket. DO NOT rotate the engine counter clockwise.

4. Position piston of number #1 cylinder to ignition TDC.
5. Remove timing chain tensioner (1). See **Fig. 318** .

Installation

TIMING CHAIN TENSIONER

NOTE: Carefully clean all mating surfaces with appropriate solvents to assure that no grease or oil is present during reassembly.

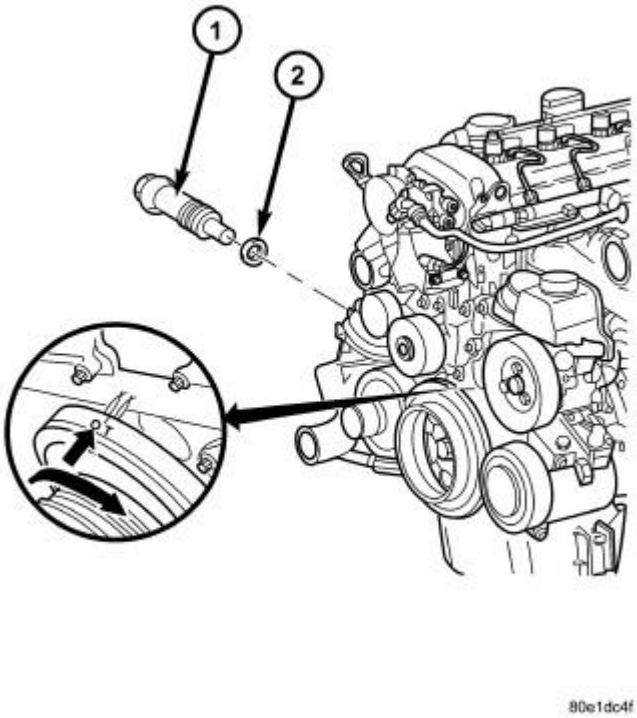

Fig. 319: TIMING CHAIN TENSIONER - TYPICAL
Courtesy of CHRYSLER LLC

1 - TIMING CHAIN TENSIONER 2 - TIMING CHAIN TENSIONER SEAL

1. Install timing chain tensioner (1) with new seal (2). Tighten to 80N.m (59 lbs. ft.).

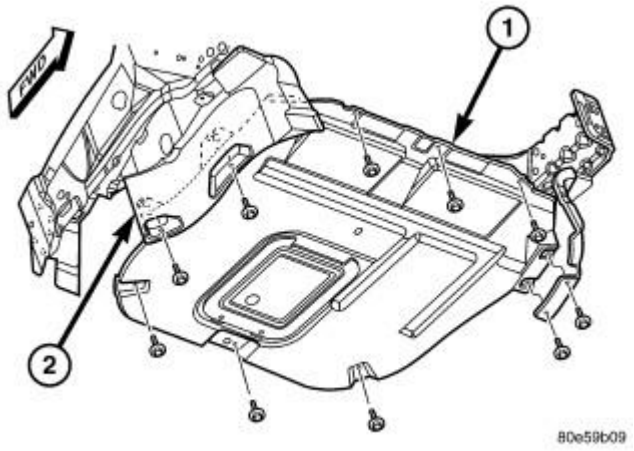

Fig. 320: ENGINE COMPARTMENT LOWER SILENCER
Courtesy of CHRYSLER LLC

1 - ENGINE COMPARTMENT SILENCER
2 - ACCESSORY DRIVE BELT SPLASH SHIELD

2. Install engine compartment lower silencer (1) and accessory drive belt splash shield (2).
3. Lower vehicle.
4. Connect negative battery cable.

