

2010 ENGINE**4.7L - Service Information - Dakota****DIAGNOSIS AND TESTING****INTRODUCTION**

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either performance (e.g., engine idles rough and stalls) or mechanical (e.g., a strange noise).

Refer to **PERFORMANCE** and **MECHANICAL** for possible causes and corrections of malfunctions.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that can not be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following diagnosis:

- Cylinder Compression Pressure Test: Refer to **CYLINDER COMPRESSION PRESSURE LEAKAGE**.
- Cylinder Combustion Pressure Leakage Test: Refer to **CYLINDER COMBUSTION PRESSURE LEAKAGE**.
- Engine Cylinder Head Gasket Failure Diagnosis: Refer to **CYLINDER HEAD GASKET**.
- Intake Manifold Leakage Diagnosis: Refer to **INTAKE MANIFOLD LEAKAGE**.

PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery 2. Corroded or loose battery connections. 3. Faulty starter. 4. Faulty coil or control unit. 5. Incorrect spark plug gap. 6. Dirt or water in fuel system. 7. Faulty fuel pump, relay or wiring.	1. Charge or replace as necessary. 2. Clean and tighten battery connections. Apply a coat of light mineral grease to the terminals. 3. Refer to <u>Electrical/Starting - Diagnosis and Testing</u> . 4. Refer to <u>Electrical/Ignition Control/COIL, Ignition - Removal</u> . 5. Correct as necessary. 6. Clean system and replace fuel filter. 7. Repair or replace as necessary.
ENGINE STALLS OR ROUGH	1. Dirty or incorrectly gapped	1. Correct as necessary.

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IDLE	- spark plugs. 2. Idle mixture too lean or too rich. 3. Vacuum leak. 4. Faulty coil. 5. Incorrect engine timing.	2. Refer to Powertrain Diagnosis Information. 3. Inspect intake manifold and vacuum hoses, repair or replace as necessary. 4. Refer to <u>Electrical/Ignition Control/COIL, Ignition - Removal</u>. 5. See <u>Engine/Valve Timing - Standard Procedure</u>.
ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped spark plugs. 2. Dirt or water in fuel system. 3. Faulty fuel pump. 4. Blown cylinder head gasket. 5. Low compression. 6. Burned, warped or pitted valves. 7. Plugged or restricted exhaust system. 8. Faulty coil.	1. Correct as necessary. 2. Clean system and replace fuel filter. 3. Refer to the Appropriate Diagnostic Information 4. Replace cylinder head gasket. 5. See <u>CYLINDER COMPRESSION PRESSURE LEAKAGE</u>. 6. Replace as necessary. 7. Inspect and replace as necessary. 8. Refer to <u>Electrical/Ignition Control/COIL, Ignition - Removal</u>.
ENGINE MISSES ON ACCELERATION	1. Spark plugs dirty or incorrectly gapped. 2. Dirt in fuel system. 3. Burned, warped or pitted valves. 4. Faulty coil.	1. Correct as necessary. 2. Clean fuel system. 3. Replace as necessary. 4. Refer to <u>Electrical/Ignition Control/COIL, Ignition - Removal</u>.
ENGINE MISSES AT HIGH SPEED	1. Spark plugs dirty or incorrectly gapped. 2. Faulty coil. 3. Dirt or water in fuel system.	1. Correct as necessary. 2. Refer to <u>Electrical/Ignition Control/COIL, Ignition - Removal</u>. 3. Clean system and replace fuel filter.

MECHANICAL

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CONDITION	POSSIBLE CAUSES	CORRECTIONS
NOISY VALVES	1. High or low oil level in crankcase. 2. Thin or diluted oil. 3. Low oil pressure. 4. Dirt in lash adjusters. 5. Worn rocker arms. 6. Worn lash adjusters 7. Worn valve guides. 8. Excessive runout of valve seats on valve faces.	1. Refer to <u>Vehicle Quick Reference/Capacities and Recommended Fluids - Specifications</u> . 2. Change oil and filter. 3. Check oil pump, if OK, check rod and main bearings for excessive wear. 4. Replace as necessary. 5. Replace as necessary. 6. Replace as necessary. 7. Inspect the valve guides for wear, cracks or looseness. If either condition exists, replace the cylinder head. See <u>Engine/Cylinder Head - Removal</u>. 8. See <u>Engine/Cylinder Head/VALVES, Intake and Exhaust - Standard Procedure</u>.
CONNECTING ROD NOISE	1. Insufficient oil supply. 2. Low oil pressure. 3. Thin or diluted oil. 4. Excessive bearing clearance. 5. Connecting rod journal out-of-round. 6. Misaligned connecting rods.	1. Refer to <u>Vehicle Quick Reference/Capacities and Recommended Fluids - Specifications</u> . 2. Check oil pump, if OK, check rod and main bearings for excessive wear. 3. Change oil and filter. 4. Replace as necessary. 5. Service or replace crankshaft. 6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply. 2. Low oil pressure. 3. Thin or diluted oil. 4. Excessive bearing clearance. 5. Excessive end play. 6. Crankshaft journal out-of-round. 7. Loose flywheel or torque	1. Refer to <u>Vehicle Quick Reference/Capacities and Recommended Fluids - Specifications</u> . 2. Check oil pump, if OK, check rod and main bearings for excessive wear. 3. Change oil and filter. 4. Replace as necessary. 5. Check thrust washers for wear. 6. Service or replace crankshaft. 7. Tighten to correct torque

converter.

LUBRICATION

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL LEAKS	1. Gaskets and O-Rings. Misaligned or damaged. - 2. Loose fasteners, broken or porous metal parts. 3. Crankshaft rear seal 4. Crankshaft seal flange. Scratched, nicked or grooved. 5. Oil pan flange cracked. 6. Timing chain cover seal, damaged or misaligned. 7. Scratched or damaged vibration damper hub.	1. Replace as necessary. - 2. Tighten fasteners, repair or replace metal parts. 3. Replace as necessary. See <u>Engine/Engine Block/SEAL, Crankshaft Oil - Removal.</u> 4. Polish or replace crankshaft. 5. Replace oil pan. See <u>Engine/Lubrication/PAN, Oil - Removal.</u> 6. Replace seal. See <u>Engine/Engine Block/SEAL, Crankshaft Oil - Removal.</u> 7. Polish or replace damper. See <u>Engine/Engine Block/DAMPER, Vibration - Removal.</u>
OIL PRESSURE DROP	1. Low oil level. 2. Faulty oil pressure sending unit. 3. Low oil pressure. 4. Clogged oil filter. 5. Worn oil pump. 6. Thin or diluted oil. 7. Excessive bearing clearance. 8. Oil pump relief valve stuck.	1. Check and correct oil level. See <u>Engine/Lubrication/OIL - Standard Procedure.</u> 2. Replace sending unit. See <u>Engine/Lubrication/SWITCH, Oil Pressure - Removal.</u> 3. Check oil pump and bearing clearance. See <u>Engine/Lubrication/PUMP, Engine Oil - Inspection.</u> 4. Replace oil filter. See <u>Engine/Lubrication/FILTER, Engine Oil - Removal.</u> 5. Replace oil pump. See <u>Engine/Lubrication/PUMP, Engine Oil - Removal.</u> 6. Change oil and filter. See <u>Engine/Lubrication/FILTER, Engine Oil - Removal.</u> 7. Replace as necessary. See <u>Engine/Engine Block/ROD, Piston and Connecting - Standard Procedure.</u> 8. Replace oil pump. See <u>Engine/Lubrication/PUMP, Engine Oil - Removal.</u>

	9. Oil pick up tube loose, damaged or clogged.	9. Replace as necessary. See <u>Engine/Lubrication/PAN, Oil - Removal.</u>
OIL PUMPING AT RINGS; SPARK PLUGS FOULING	1. Worn or damaged rings.	1. Hone cylinder bores and replace rings. See <u>Engine/Engine Block/RING(S), Piston - Standard Procedure.</u>
	2. Carbon in oil ring slots.	2. Replace rings. See <u>Engine/Engine Block/RING(S), Piston - Standard Procedure.</u>
	3. Incorrect ring size installed.	3. Replace rings. See <u>Engine/Engine Block/RING(S), Piston - Standard Procedure.</u>
	4. Worn valve guides.	4. Inspect the valve guides for wear, cracks or looseness. If either condition exist, replace the cylinder head. See <u>Engine/Cylinder Head - Removal.</u>
	5. Leaking valve guide seals.	5. Replace valve guide seals. Refer to <u>SEAL (S), Valve Guide.</u>

CYLINDER COMPRESSION PRESSURE LEAKAGE

NOTE: The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

NOTE: Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

1. Clean the spark plug recesses with compressed air.
2. Remove the spark plugs and record the cylinder number of each spark plug for future reference.
3. Inspect the spark plug electrodes for abnormal firing indicators such as fouled, hot, oily, etc.
4. Disable the fuel system and perform the fuel system pressure release procedure. Refer to **Fuel System/Fuel Delivery - Standard Procedure**.
5. Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.
6. Record the compression pressure on the 3rd revolution. Continue the test for the remaining cylinders.

NOTE: The recommended compression pressures are to be used only as a guide to diagnosing engine problems. An engine should not be disassembled to determine the cause of low compression unless some malfunction is present.

7. Compression should not be less than 689 kPa (100 psi) and not vary more than 25 percent from cylinder to cylinder.
8. If one or more cylinders have abnormally low compression pressures, repeat the compression test.

NOTE: If the same cylinder or cylinders repeat an abnormally low reading on the second compression test, it could indicate the existence of a problem in the cylinder in question.

9. If one or more cylinders continue to have abnormally low compression pressures, perform the cylinder combustion pressure leakage test. See **CYLINDER COMBUSTION PRESSURE LEAKAGE**.

CYLINDER COMBUSTION PRESSURE LEAKAGE

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
 - Leaks between adjacent cylinders or into water jacket.
 - Any causes for combustion/compression pressure loss.
1. Check the coolant level and fill as required. DO NOT install the radiator cap.
 2. Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.
 3. Remove the spark plugs.
 4. Remove the oil filler cap.
 5. Remove the air cleaner hose.
 6. Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.
 7. Perform the test procedures on each cylinder according to the tester manufacturer's instructions. Set piston of cylinder to be tested at TDC compression. While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

Refer to **CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART**.

CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
AIR ESCAPES THROUGH THROTTLE BODY	Intake valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH TAILPIPE	Exhaust valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as

		necessary.
AIR ESCAPES THROUGH RADIATOR	Head gasket leaking or cracked cylinder head or block	Remove cylinder head and inspect. Replace defective part
MORE THAN 50% LEAKAGE FROM ADJACENT CYLINDERS	Head gasket leaking or crack in cylinder head or block between adjacent cylinders	Remove cylinder head and inspect. Replace gasket, head, or block as necessary
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	Stuck or broken piston rings; cracked piston; worn rings and/or cylinder wall	Inspect for broken rings or piston. Measure ring gap and cylinder diameter, taper and out-of-round. Replace defective part as necessary

STANDARD PROCEDURE

ENGINE CORE AND OIL GALLERY PLUGS

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

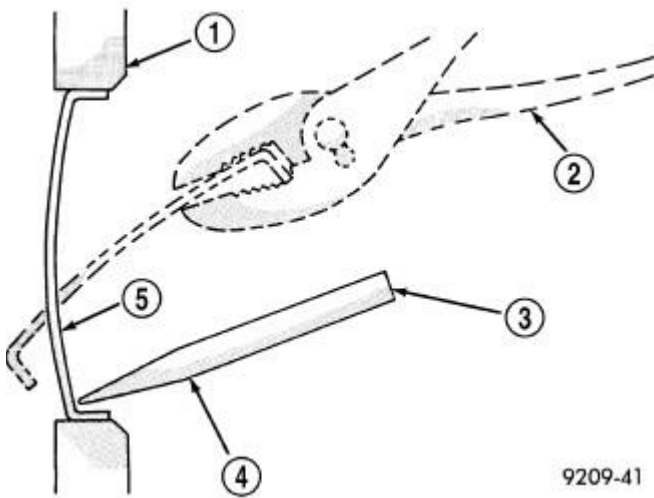


Fig. 1: Core Hole Plug Removal
Courtesy of CHRYSLER LLC

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.

ENGINE GASKET SURFACE PREPARATION

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 head gaskets require a scratch free sealing surface.

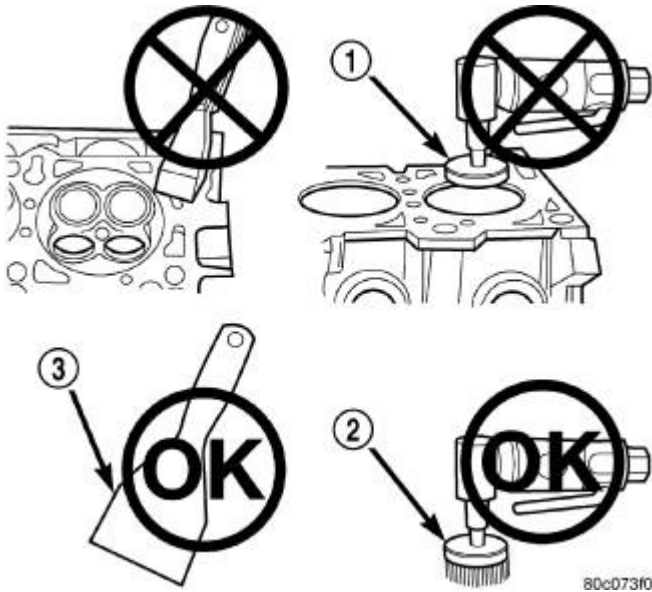


Fig. 2: Proper Tool Usage For Surface Preparation
Courtesy of CHRYSLER LLC

Never use the following to clean gasket surfaces:

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

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

Only use the following for cleaning gasket surfaces:

- Solvent or a commercially available gasket remover
- Plastic or wood scraper
- Drill motor with 3M Roloc™ Bristle Disc (white or yellow)

REPAIR DAMAGED OR WORN THREADS

CAUTION: Be sure that the tapped holes maintain the original center line.

Damaged or worn threads can be repaired. Essentially, this repair consists of:

- Drilling out worn or damaged threads.
- Tapping the hole with a special Heli-Coil Tap, or equivalent.
- Installing an insert into the tapped hole to bring the hole back to its original thread size.

FORM-IN-PLACE GASKETS AND SEALERS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket.

There are numerous types of form-in-place gasket materials that are used in the engine area. Mopar® Engine RTV GEN II, Mopar® ATF-RTV, and Mopar® Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

MOPAR® ENGINE RTV GEN II

Mopar® Engine RTV GEN II is used to seal components exposed to engine oil. This material is a specially designed black silicone rubber RTV that retains adhesion and sealing properties when exposed to engine oil. Moisture in the air causes the material to cure. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® ATF RTV

Mopar® ATF RTV is a specifically designed black silicone rubber RTV that retains adhesion and sealing properties to seal components exposed to automatic transmission fluid, engine coolants, and moisture. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER

Mopar® Gasket Maker is an anaerobic type gasket material. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR® GASKET SEALANT

Mopar® Gasket Sealant is a slow drying, permanently soft sealer. This material is recommended for sealing threaded fittings and gaskets against leakage of oil and coolant. Can be used on threaded and machined parts under all temperatures. This material is used on engines with multi-layer steel (MLS) cylinder head gaskets. This material also will prevent corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or 4oz./16 oz. can w/applicator.

FORM-IN-PLACE GASKET AND SEALER APPLICATION

Assembling parts using a form-in-place gasket requires care but it's easier than using precut gaskets.

Mopar® Gasket Maker material should be applied sparingly 1 mm (0.040 in.) diameter or less of sealant to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Engine RTV GEN II or ATF RTV gasket material should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. All mounting holes must be circled. For corner sealing, a 3.17 or 6.35 mm (1/8 or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Gasket Sealant in an aerosol can should be applied using a thin, even coat sprayed completely over both surfaces to be joined, and both sides of a gasket. Then proceed with assembly. Material in a can w/applicator can be brushed on evenly over the sealing surfaces. Material in an aerosol can should be used on engines with multi-layer steel gaskets.

REMOVAL

REMOVAL

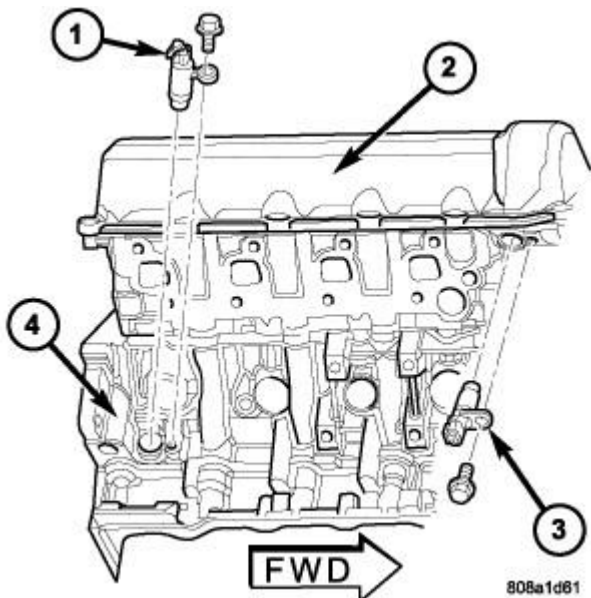
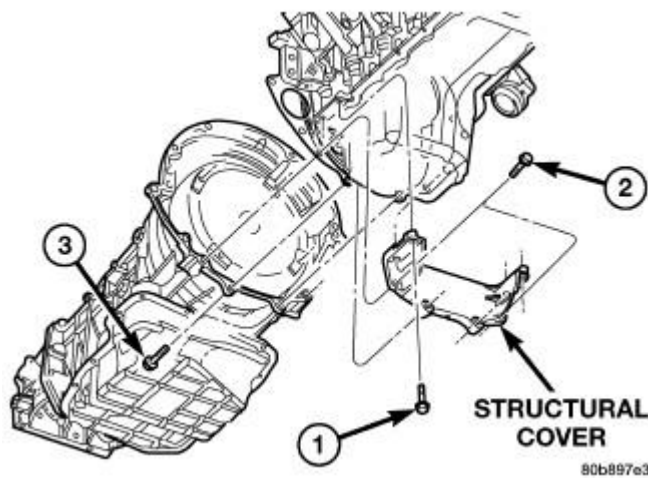


Fig. 3: Crankshaft Position Sensor

Courtesy of CHRYSLER LLC

1. Release fuel rail pressure, then disconnect the fuel supply quick connect fitting at the fuel rail. Refer to **Fuel System/Fuel Delivery - Standard Procedure** . Refer to **Fuel System/Fuel Delivery/FITTING, Quick Connect - Standard Procedure** .
2. Disconnect the battery negative and positive cables.
3. Disconnect two ground straps from the lower left hand side and one ground strap from the lower right hand side of the engine.
4. Remove the through bolt retaining nut and bolt (3) from both the left and right side engine mounts.
5. Disconnect crankshaft position sensor (1).

**Fig. 4: Structural Cover**

Courtesy of CHRYSLER LLC

6. Remove exhaust crossover pipe from exhaust manifolds.
7. Remove the pinion bracket.
8. Remove structural cover. See **Engine/Engine Block/COVER, Structural Dust - Removal**.

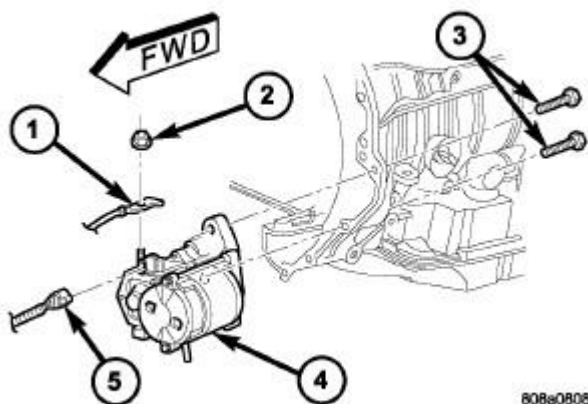


Fig. 5: Starter Motor Remove/Install - 4.7L Engine
Courtesy of CHRYSLER LLC

9. Remove starter (4). Refer to **Electrical/Starting/STARTER - Removal** .

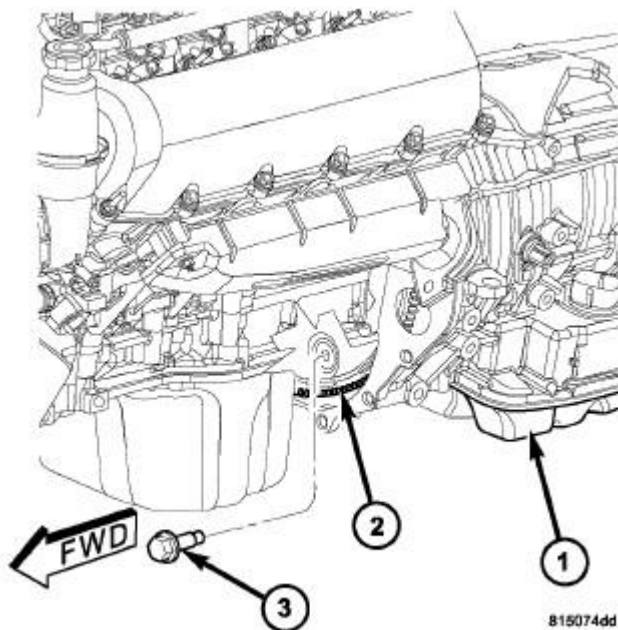


Fig. 6: Remove/Install Torque Converter Bolts
Courtesy of CHRYSLER LLC

10. Drain cooling system. Refer to **Cooling - Standard Procedure** .
11. Remove torque converter bolts (3) (Automatic Transmission Only).

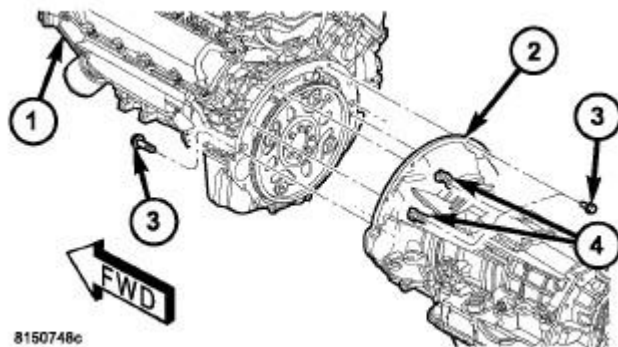


Fig. 7: Remove/Install Transmission to Engine Bolts
Courtesy of CHRYSLER LLC

12. Remove transmission to engine mounting bolts (3).
13. Disconnect the engine block heater power cable from the block heater, if equipped.
14. Lower vehicle.
15. Remove throttle body resonator assembly and air inlet hose.
16. Disconnect throttle and speed control cables.

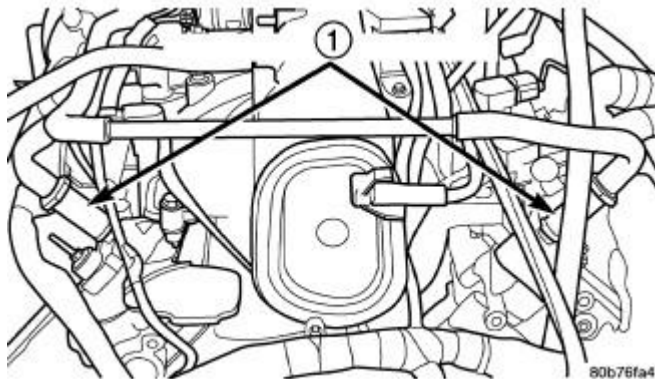


Fig. 8: Crankcase Breather Connection Points
Courtesy of CHRYSLER LLC

17. Disconnect tube from both the left and right side crankcase breathers (1). Remove breathers.

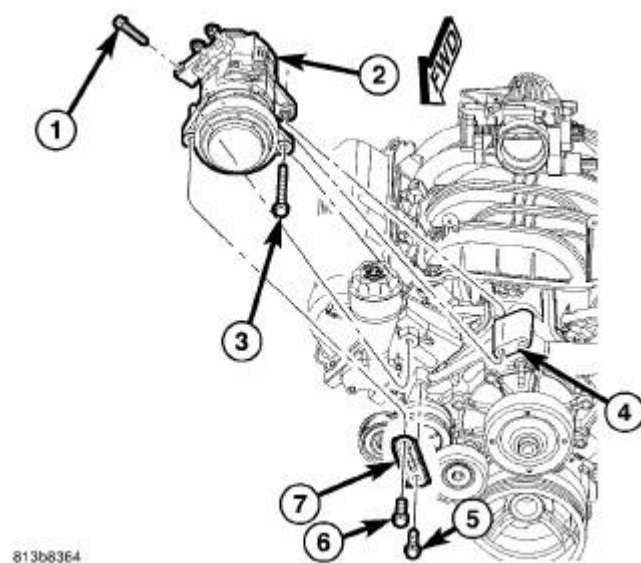


Fig. 9: A/C Compressor R and I
Courtesy of CHRYSLER LLC

18. Evacuate A/C system. Refer to Heating and Air Conditioning/Plumbing - Standard Procedure .
19. Remove A/C compressor (2). Refer to Heating and Air Conditioning/Plumbing/COMPRESSOR, A/C - Removal .

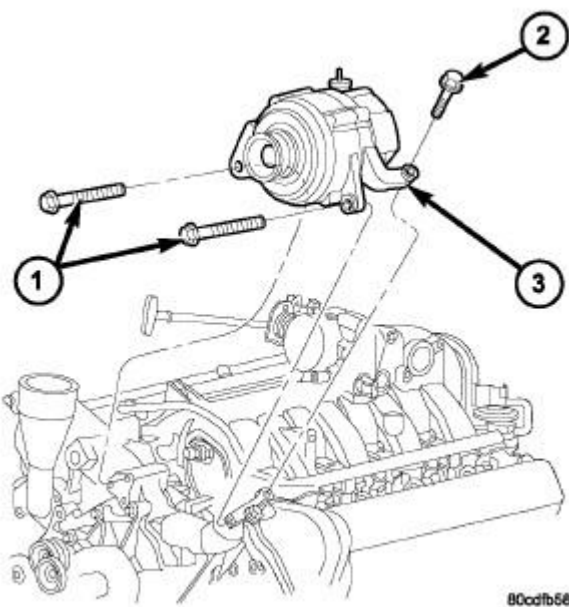


Fig. 10: REMOVE / INSTALL GENERATOR - 3.7L / 4.7L
Courtesy of CHRYSLER LLC

20. Remove shroud, fan assembly accessory drive belt. Refer to Cooling/Accessory Drive/BELT,

Serpentine - Removal .

21. Disconnect transmission oil cooler lines at the radiator.
22. Disconnect radiator upper and lower hoses.
23. Remove radiator, A/C condenser and transmission oil cooler. Refer to **Cooling/Engine/RADIATOR, Engine Cooling - Removal** . Refer to **Heating and Air Conditioning/Plumbing/CONDENSER, A/C - Removal** .
24. Remove generator (3). Refer to **Electrical/Charging/GENERATOR - Removal** .

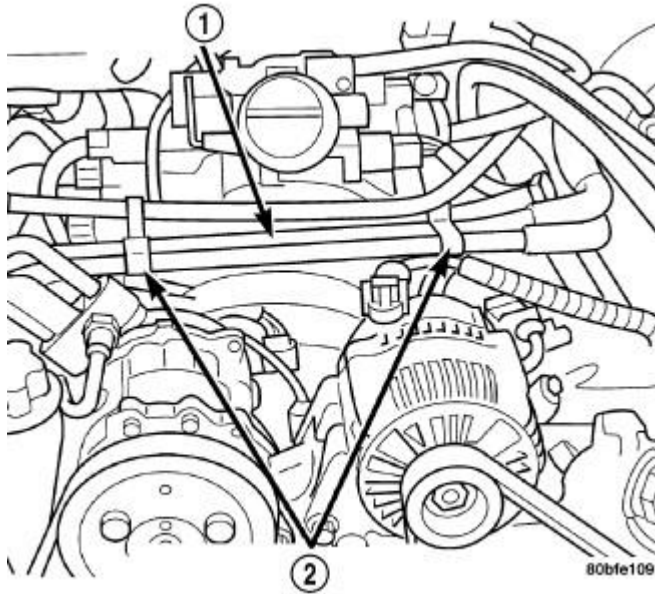


Fig. 11: Heater Hoses and Tubes Removal / Installation
Courtesy of CHRYSLER LLC

25. Disconnect the two heater hoses from the timing chain cover and heater core.
26. Unclip (2) and remove heater hoses (1) and tubes from the intake manifold.

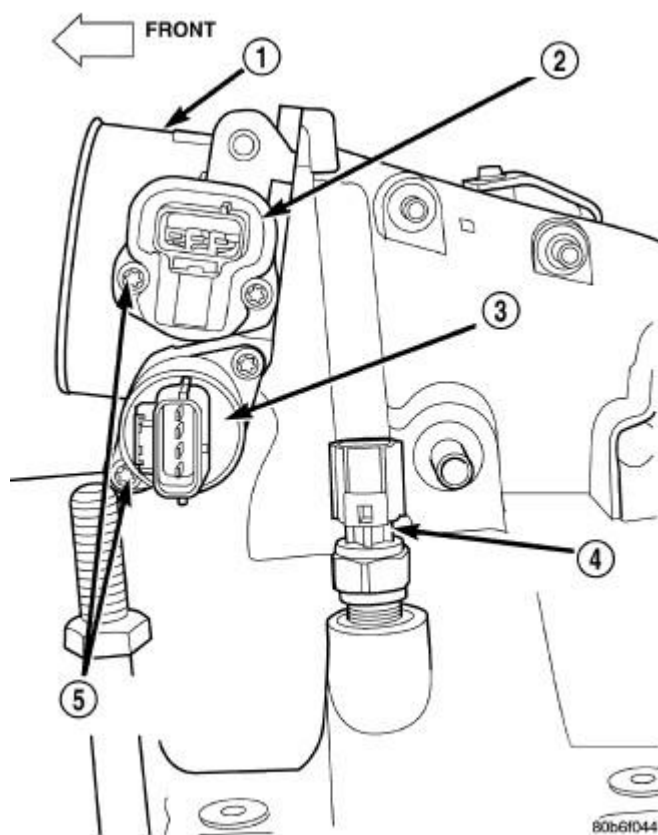


Fig. 12: Throttle Body Connection Points
Courtesy of CHRYSLER LLC

27. Disconnect engine harness at the following points :
- Intake air temperature (IAT) sensor (4)
 - Fuel Injectors
 - Throttle Position (TPS) Switch (2)
 - Idle Air Control (IAC) Motor (3)
 - Engine Oil Pressure Switch
 - Engine Coolant Temperature (ECT) Sensor
 - Manifold absolute pressure (MAP) Sensor
 - Camshaft Position (CMP) Sensor
 - Coil connectors
28. Disconnect the vacuum lines at the throttle body and intake manifold.
29. Remove power steering pump and position out of the way.

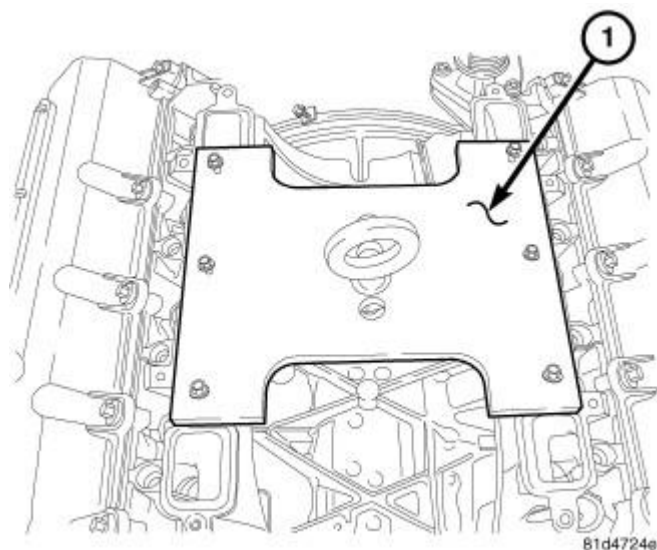


Fig. 13: Engine Lift Bracket 10101

Courtesy of CHRYSLER LLC

30. Remove the intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Removal**.
31. Install Engine Lift Plate 10101 in place of the intake manifold.

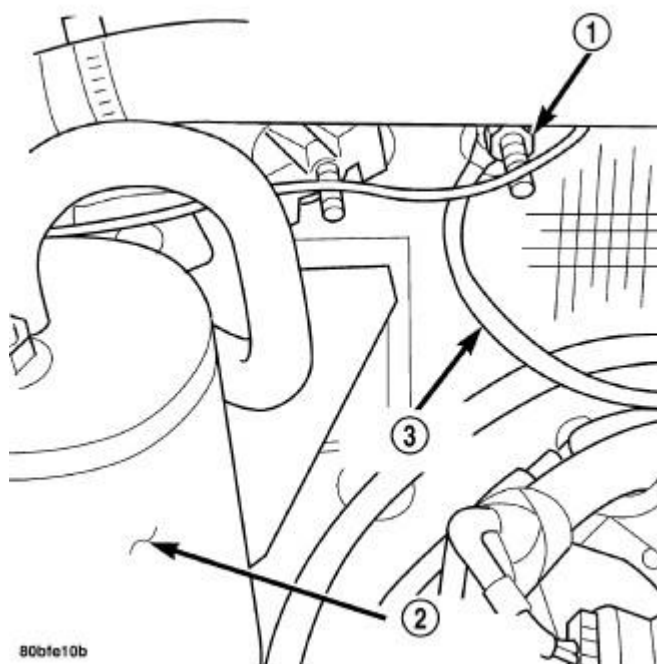


Fig. 14: Body Ground Strap-Right Side Removal / Installation

Courtesy of CHRYSLER LLC

32. Disconnect body ground strap (3) at the right side cowl.

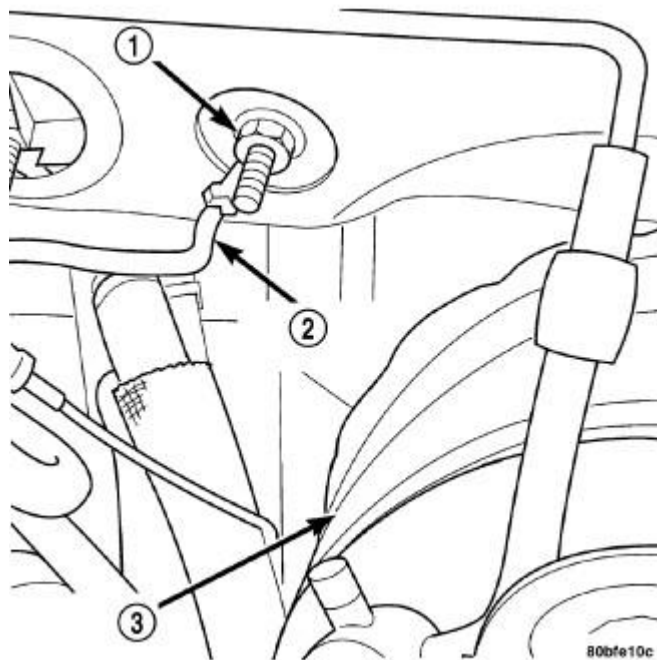


Fig. 15: Body Ground Strap-Left Side Removal / Installation

Courtesy of CHRYSLER LLC

33. Disconnect body ground strap (2) at the left side cowl.

NOTE: It will be necessary to support the transmission in order to remove the engine.

34. Position a suitable jack under the transmission.
35. Remove engine from the vehicle.

INSTALLATION

INSTALLATION

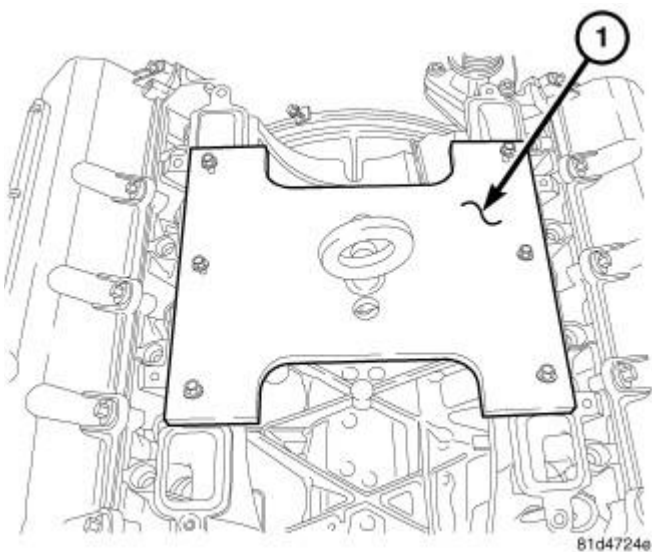


Fig. 16: Engine Lift Bracket 10101

Courtesy of CHRYSLER LLC

1. Position engine in the vehicle.
2. Remove jack from under the transmission.
3. Remove Engine Lifting Plate 10101 (1).
4. Position both the left and right side engine mount brackets and install the through bolts (3) and nuts. Tighten to 95 N.m (70 ft. lbs.)

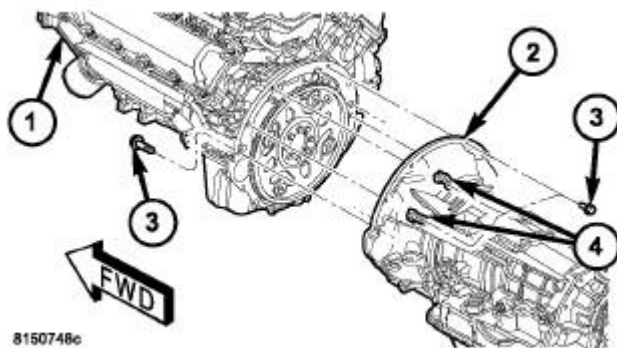


Fig. 17: Removing/Installing Transmission to Engine Bolts

Courtesy of CHRYSLER LLC

5. Install transmission to engine mounting bolts (3). Tighten the bolts to 41 N.m (30 ft. lbs.).

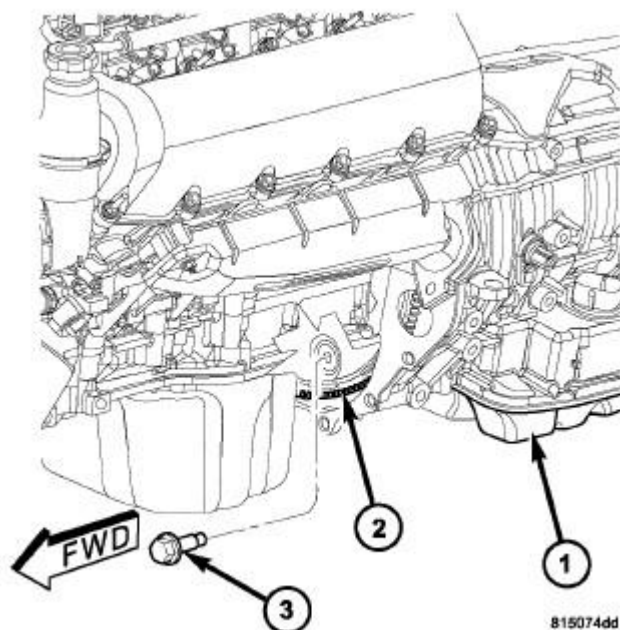


Fig. 18: Removing/Installing Torque Converter Bolts
Courtesy of CHRYSLER LLC

6. Install torque converter bolts (3).

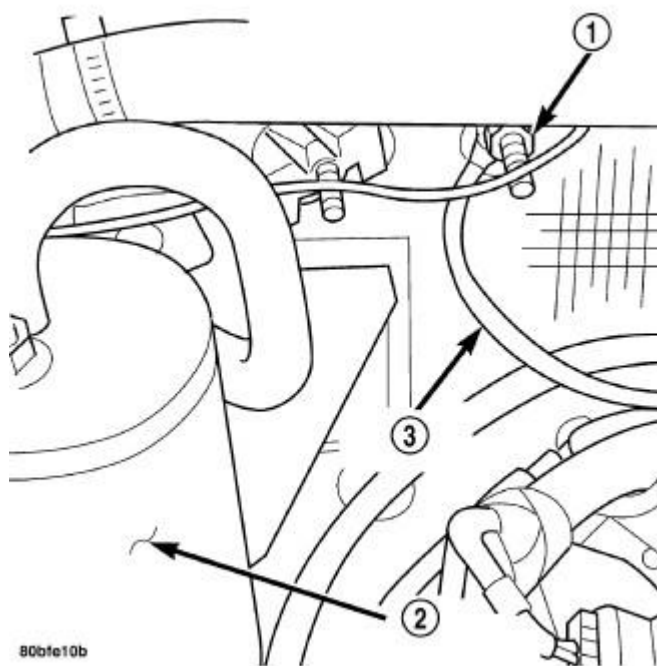


Fig. 19: Body Ground Strap-Right Side Removal / Installation
Courtesy of CHRYSLER LLC

7. Connect the right (1) side body ground strap.

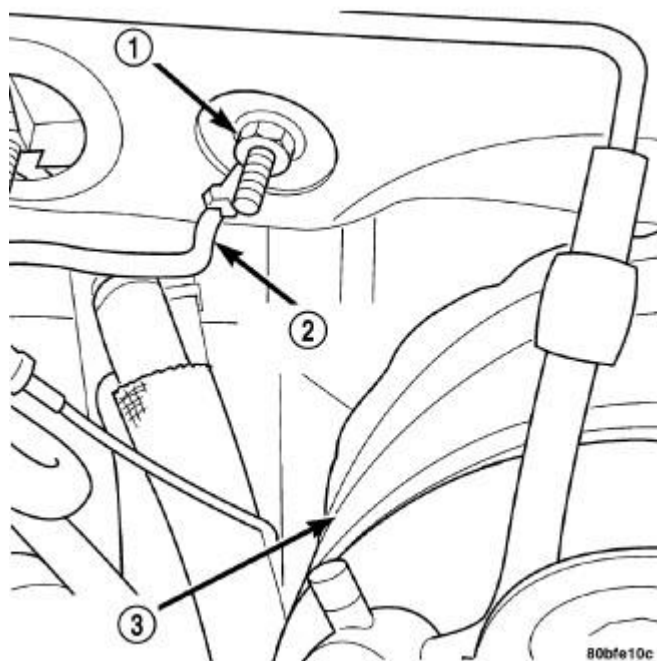


Fig. 20: Body Ground Strap-Left Side Removal / Installation
Courtesy of CHRYSLER LLC

8. Connect the left (1) side body ground strap.
9. Install the intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Installation**.
10. Position generator wiring behind the oil dipstick tube, then install the oil dipstick tube upper mounting bolt.
11. Install power steering pump.
12. Connect fuel supply line quick connect fitting. Refer to **Fuel System/Fuel Delivery/FITTING, Quick Connect - Standard Procedure**.
13. Connect the vacuum lines at the throttle body and intake manifold.

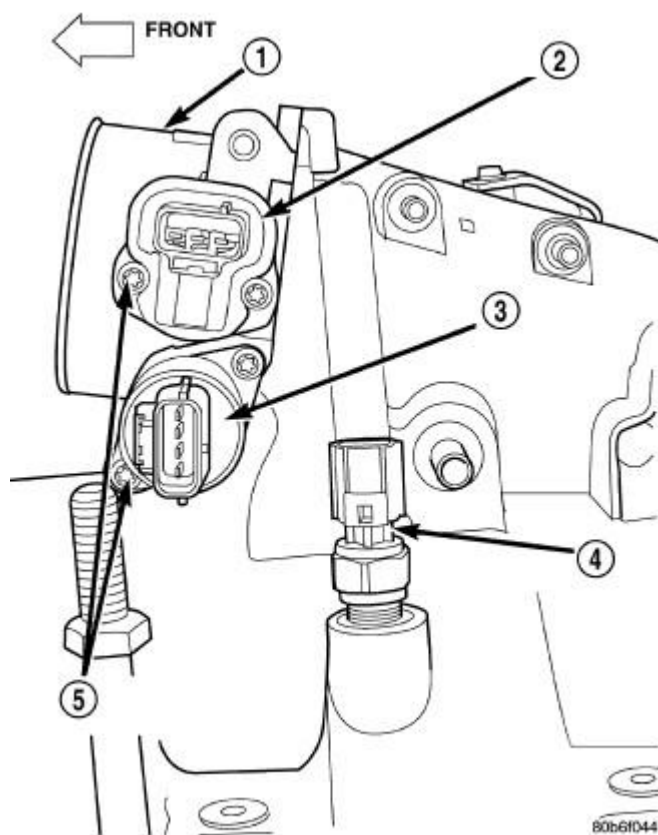


Fig. 21: Throttle Body Connection Points
Courtesy of CHRYSLER LLC

14. Connect engine harness at the following points:

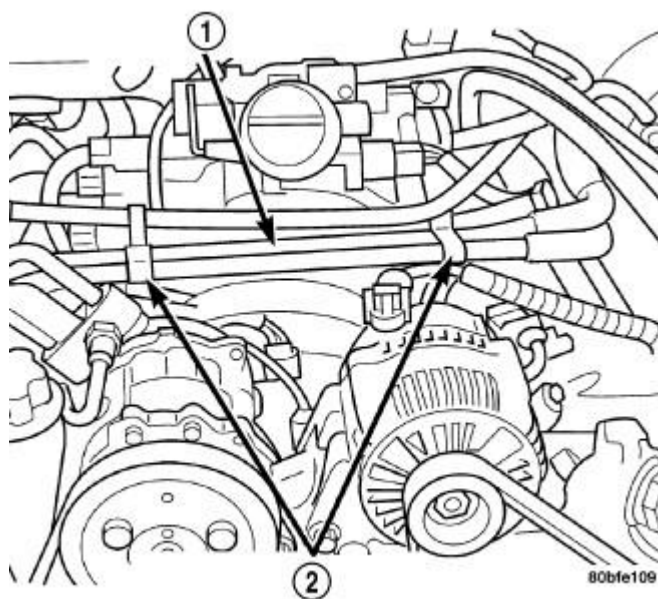
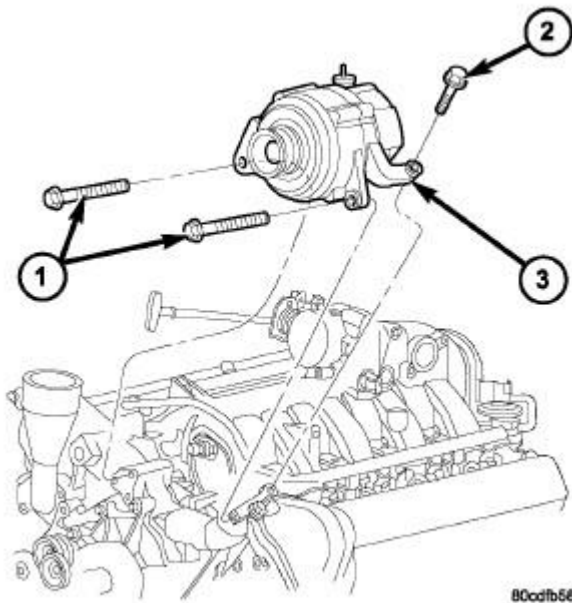


Fig. 22: Heater Hoses and Tubes Removal / Installation

Courtesy of CHRYSLER LLC

- Intake Air Temperature (IAT) Sensor (4)
 - Idle Air Control (IAC) Motor (3)
 - Fuel Injectors
 - Throttle Position (TPS) Switch (2)
 - Engine Oil Pressure Switch
 - Engine Coolant Temperature (ECT) Sensor
 - Manifold Absolute Pressure (MAP) Sensor
 - Camshaft Position (CMP) Sensor
 - Coil Over Plugs
15. Position and install heater hoses (1) and tubes onto intake manifold.
 16. Install the heater hoses onto the heater core and the engine front cover, and install clips (2).

**Fig. 23: REMOVE / INSTALL GENERATOR - 3.7L / 4.7L**

Courtesy of CHRYSLER LLC

17. Install generator (3). Refer to **Electrical/Charging/GENERATOR - Installation** .
18. Install A/C condenser, radiator and transmission oil cooler. Refer to **Heating and Air Conditioning/Plumbing/CONDENSER, A/C - Installation** . Refer to **Cooling/Engine/RADIATOR, Engine Cooling - Installation** .
19. Connect radiator upper and lower hoses.
20. Connect the transmission oil cooler lines to the radiator.

21. Install accessory drive belt, fan assembly and shroud. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation** . Refer to **Cooling/Engine/FAN, Cooling - Installation** .

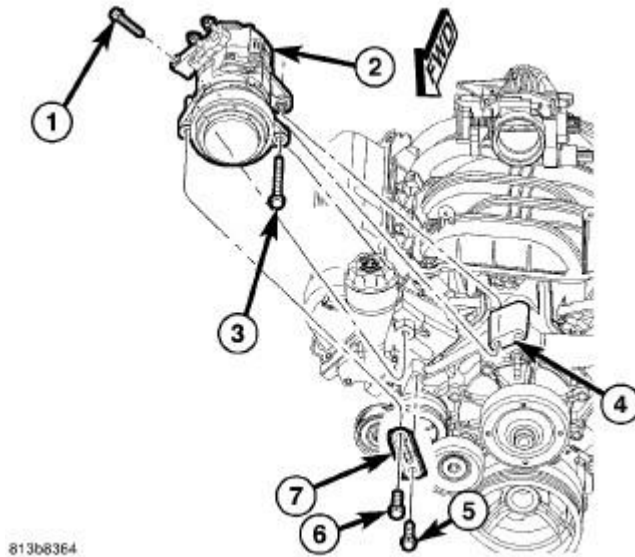


Fig. 24: A/C Compressor R and I
Courtesy of CHRYSLER LLC

22. Install A/C compressor (2). Refer to **Heating and Air Conditioning/Plumbing/COMPRESSOR, A/C - Installation** .

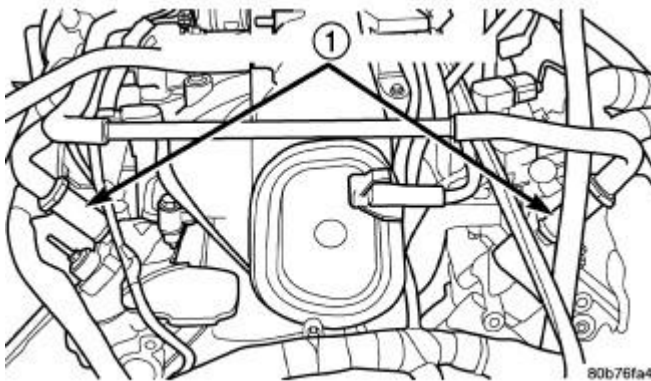


Fig. 25: Crankcase Breather Connection Points
Courtesy of CHRYSLER LLC

23. Install both breathers (1). Connect tube to both crankcase breathers.
24. Connect throttle and speed control cables.
25. Install throttle body resonator assembly and air inlet hose. Tighten clamps 4 N.m (35 in. lbs.).
26. Raise vehicle.

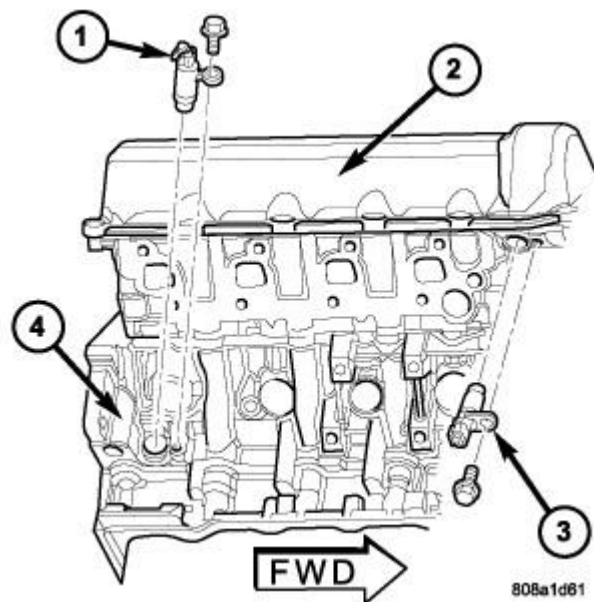


Fig. 26: Crankshaft Position Sensor
Courtesy of CHRYSLER LLC

27. Connect crankshaft position sensor (1).

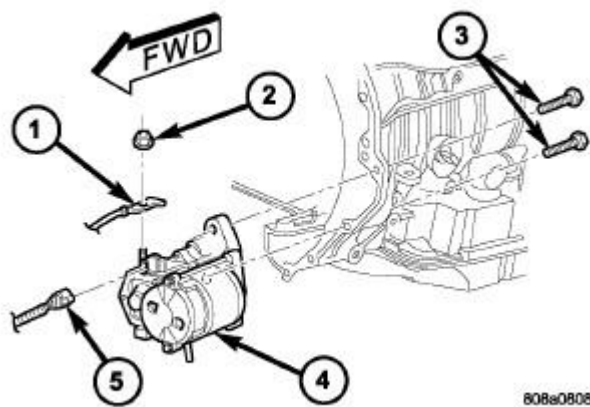


Fig. 27: Starter Motor Remove/Install - 4.7L Engine
Courtesy of CHRYSLER LLC

28. Install starter (4). Refer to **Electrical/Starting/STARTER - Installation** .

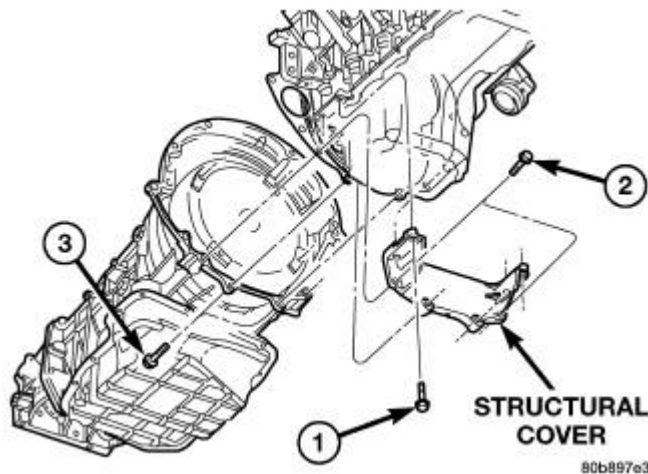


Fig. 28: Structural Cover
Courtesy of CHRYSLER LLC

CAUTION: The structural cover requires a specific torque sequence. Failure to follow this sequence may cause severe damage to the cover.

29. Install structural cover. See Engine/Engine Block/COVER, Structural Dust - Installation.
30. Install the pinion bracket.
31. Install exhaust crossover pipe.
32. Install engine block heater power cable, If equipped.
33. Check and fill engine oil.
34. Recharge the A/C system. Refer to Heating and Air Conditioning/Plumbing - Standard Procedure.
35. Refill the engine cooling system. Refer to Cooling - Standard Procedure.
36. Connect the battery positive and negative cables.
37. Start the engine and check for leaks.

SPECIFICATIONS

4.7L

GENERAL DESCRIPTION

DESCRIPTION	SPECIFICATION	
	Metric	Standard
-		
Displacement	4.7 Liters / 4701 cc	287 Cubic Inches
Bore	93.0 mm	3.66 in.
Stroke	86.5 mm	3.40 in.
Engine Type	90° SOHC V-8 16-Valve	
Compression Ratio	9.6:1	
Max. Variation Between Cylinders	25%	

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Horsepower	302 BHP @ 5650 RPM
Torque	329 LB-FT @ 3950 RPM
Lead Cylinder	#1 Left Bank
Firing Order	1-8-4-3-6-5-7-2

CYLINDER BLOCK

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bore Diameter	93.010 ±.0075 mm	3.6619 ± 0.0003 in.
Out of Round (MAX)	0.076 mm	0.003 in.
Taper (MAX)	0.051 mm	0.002 in.

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Diameter	92.975 mm	3.6605 in.
Weight	366 grams	12.9 oz
No. 1 Ring Groove Diameter	83.37 - 83.13 mm	3.282 - 3.273 in
No. 2 Ring Groove Diameter	82.833 - 83.033 mm	3.261 - 3.310 in.
No. 3 Ring Groove Diameter	83.88 - 84.08 mm	3.302 - 3.310 in.

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance In Piston	0.010 - 0.019 mm	0.0004 - 0.0008 in.
Diameter	24.013 - 24.016 mm	0.9454 - 0.9455 in.

PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Top Compression Ring Gap	0.20 - 0.36 mm	0.0079 - 0.0142 in.
Second Compression Ring Gap	0.37 - 0.63 mm	0.0146 - 0.0249 in.
Oil Control (Steel Rails) Ring Gap	0.25 - 0.76 mm	0.0099 - 0.30 in.
Top Compression Ring Side Clearance	.051 - .094 mm	0.0020 - 0.0037 in.
Second Compression Ring Side Clearance	0.040 - 0.080 mm	0.0016 - 0.0031 in.
Oil Ring (Steel Ring) Ring Side Clearance	.019 - .229 mm	.0007 - .0091 in.
Top Compression Ring Width	1.472 - 1.490 mm	0.057 - 0.058 in.
Second Compression Ring Width	1.472 - 1.490 mm	0.057 - 0.058 in.
Oil Ring (Steel Rails) Ring Width	0.445 - 0.470 mm	0.017 - 0.018 in.

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CONNECTING RODS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bearing Clearance	0.015 - 0.055 mm	0.0006 - 0.0022 in.
Side Clearance	0.10 - 0.35 mm	0.004 - 0.0138 in.
Piston Pin Bore Diameter	0.025 - 0.048 mm (Interference Fit)	0.001 - 0.0019 in. -
Bearing Bore Out of Round (MAX)	0.004 mm	0.0002 in.
Total Weight (Less Bearing)	555 grams	19.5771 ounces

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Main Bearing Journal Diameter	63.488 - 63.512 mm	2.4996 - 2.5005 in.
Bearing Clearance	0.004 - 0.034 mm	0.0002 - 0.0013 in.
Out of Round (MAX)	0.005 mm	0.0004 in.
Taper (MAX)	0.008 mm	0.0004 in.
End Play	0.052 - 0.282 mm	0.0021 - 0.0112 in.
End Play (MAX)	0.282 mm	0.0112 in.
Connecting Rod Journal Diameter	50.992 - 51.008 mm	2.0076 - 2.0082 in.
Bearing Clearance	0.010 - 0.048	0.0004 - 0.0019 in.
Out of Round (MAX)	0.005 mm	0.0002 in.
Taper (MAX)	0.008 mm	0.0004 in.

CAMSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bore Diameter	26.02 - 26.04 mm	1.0245 - 1.0252 in.
Bearing Journal Diameter	25.973 - 25.995 mm	1.0227 - 1.0235 in.
Bearing Clearance	0.025 - 0.065 mm	0.001 - 0.0026 in.
Bearing Clearance (MAX)	0.065 mm	0.0026 in.
End Play	0.075 - 0.200 mm	0.003 - 0.0079 in.
End Play (MAX)	0.200 mm	0.0079 in.

VALVE TIMING

DESCRIPTION	LOCATION	SPECIFICATION
Intake Valve Open	BTDC	4.4°
Intake Valve Closed	ATDC	239.1°
Exhaust Valve Open	BTDC	240.5°
Exhaust Valve Closed	ATDC	13.2°
Intake Valve Duration	243.5°	

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Exhaust Valve Duration	253.70°
Valve Overlap	17.6°

VALVES

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake Head Diameter	48.52 - 48.78 mm	1.9103 - 1.9205 in.
Exhaust Head Diameter	36.87 - 37.13 mm	1.4516 - 1.4618 in.
Intake Length (Overall)	113.45 - 114.21 mm	4.4666 - 4.4965
Exhaust Length (Overall)	114.92 - 115.68 mm	4.5244 - 4.5543 in.
Intake Stem Diameter	6.931 - 6.957 mm	0.2729 - 0.2739 in.
Exhaust Stem Diameter	6.902 - 6.928 mm	0.2717 - 0.2728 in.
Intake Stem-to-Guide Clearance	0.018 - 0.069 mm	0.0008 - 0.0028 in.
Exhaust Stem-to-Guide	0.047 - 0.098 mm	0.0019 - 0.0039 in.
Intake Maximum Stem-to-Guide Clearance (Rocking Method)	0.069 mm	0.0028 in.
Exhaust Maximum Stem-to-Guide Clearance (Rocking Method)	0.098 mm	0.0039 in.
Intake Valve Lift (Zero Lash)	11.25 mm	0.443 in.
Exhaust Valve Lift (Zero Lash)	10.90 mm	0.4292 in.
Face Angle	45° - 45.5°	

VALVE SPRING

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Intake Free Length (Approx)	49.0 mm	1.9291 in.
Exhaust Free Length (Approx)	49.0 mm	1.9291 in.
Intake and Exhaust Spring Force (Valve Closed)	313.0 - 354.0 N @ 40.12 mm	70.365 - 79.582 lbs. @ 1.5795 in.
Intake and Exhaust Spring Force (Valve Open)	776.0 - 870.0 N @ 28.88 mm	174.451 - 195.583 lbs. @ 1.137 in.
Intake and Exhaust Spring Wire Diameter	4.6 x 3.67 mm	0.1811 - 0.1445 in.
Intake and Exhaust Spring Nominal Installed Height (Spring Seat to Bottom of Retainer)	40.12 mm	1.579 in.
Intake and Exhaust Spring Number of Coils	7.3	

CYLINDER HEAD

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Gasket Thickness (Compressed)	0.7 mm	0.0276 in.

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Valve Seat Runout (MAX)	0.051 mm	0.002 in.
Intake Valve Seat Width	1.75 - 2.36 mm	0.0698 - 0.0928 in.
Exhaust Valve Seat Width	1.71 - 2.32 mm	(0.0673 - 0.0911 in.)
Guide Bore Diameter (Std.)	6.975 - 7.00 mm	(0.2747 - 0.2756 in.)
Cylinder Head Warpage (Flatness)	0.0508 mm	(0.002 in.)
Valve Seat Angle	44.5° - 45.0°	

OIL PUMP

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance Over Rotors/End Face (MAX)	0.095 mm	0.0038 in.
Cover Out - of - Flat (MAX)	0.025 mm	0.001 in.
Inner and Outer Rotor Thickness	12.02 mm	0.4731 in.
Outer Rotor to pocket (Diametral) clearance (MAX)	0.235 mm	0.0093 in.
Outer Rotor Diameter (MIN)	85.925 mm	0.400 in.
Tip Clearance Between Rotors (MAX)	0.150 mm	0.006 in.

OIL PRESSURE

DESCRIPTION	SPECIFICATION	
	Metric	Standard
At Curb Idle Speed (MIN)*	48 kPa	(7 psi)
@ 3000 RPM	240 - 725 kPa	(35 - 105 psi)

*** CAUTION: If pressure is zero at curb idle, DO NOT run engine at 3000 RPM.**

TORQUE

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Camshaft Position Sensor Bolt	12	9	-
Camshaft Sprocket Bolt	122	90	-
Camshaft Bearing Cap Bolts	11	8	-
Timing Chain Cover Bolts	58	43	-
Connecting Rod Cap Bolts	27 + 90°	20 + 90°	-
Bed Plate Bolts	Refer to Procedure. See <u>Engine/Engine Block/CRANKSHAFT - Installation.</u>		
Cylinder Head Bolts	Refer to Procedure. See <u>Engine/Cylinder Head - Installation.</u>		
Crankshaft Damper Bolt	175	130	-
Cylinder Head Cover Bolts	12	9	-
Exhaust Manifold Bolts	25	18	-

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Exhaust Manifold Heat Shield Nuts	8 - 45°	-	72 - 45°
Flexplate Bolts	60	45	-
Engine Mount Bracket to Block Bolts	61	45	-
Rear Mount to Transmission Bolts	46	34	-
Generator Mounting Bolts	-	-	-
M10 Bolts	54	40	-
M8 Bolts	28	21	-
Intake Manifold Bolts	12	9	-
Oil Pan Bolts	15	11	-
Oil Pan Drain Plug	34	25	-
Oil Pump Bolts	28	21	-
Oil Pump Cover Bolts	12	-	105
Oil Pickup Tube Bolt and Nut	28	-	250
Block Bolt	15	-	130
Oil Fill Tube Bolts	12	9	-
Timing Chain Guide Bolts	28	21	-
Timing Chain Tensioner Arm	28	21	-
Hydraulic Tensioner Bolts	28	21	-
Timing Chain Primary Tensioner Bolts	28	21	-
Timing Drive Idler Sprocket Bolt	34	25	-
Thermostat Housing Bolts	13	10	-
Water Pump Bolts	58	43	-

SPECIAL TOOLS

SPECIAL TOOLS

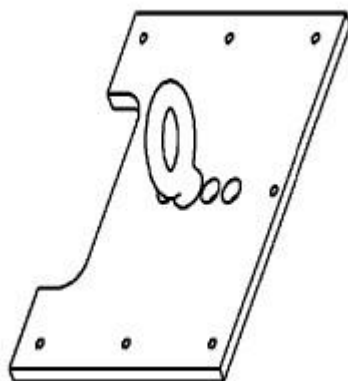


Fig. 29: Engine Lift Plate 10101
Courtesy of CHRYSLER LLC

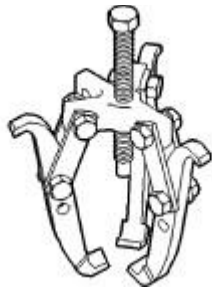


Fig. 30: Puller 1026

Courtesy of CHRYSLER LLC

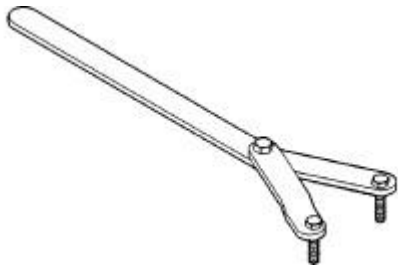


Fig. 31: Spanner Wrench 6958

Courtesy of CHRYSLER LLC

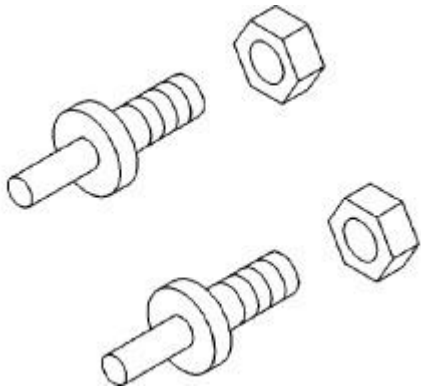


Fig. 32: Adapter Pins 8346

Courtesy of CHRYSLER LLC

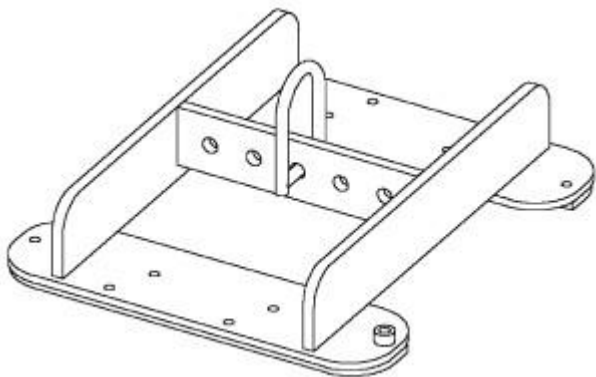


Fig. 33: Engine Lifting Fixture 8427

Courtesy of CHRYSLER LLC

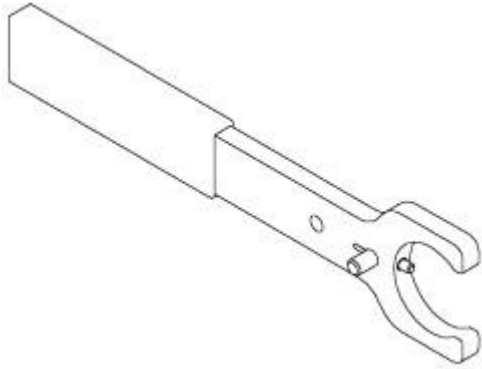


Fig. 34: Camshaft Holder 8428A
Courtesy of CHRYSLER LLC

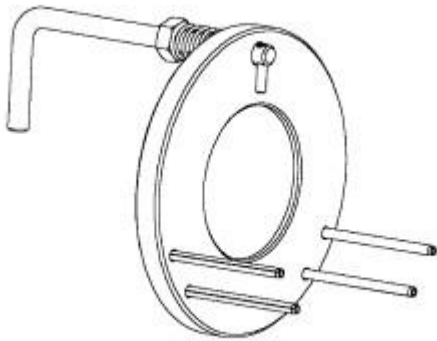


Fig. 35: Secondary Chain Holder 8429
Courtesy of CHRYSLER LLC

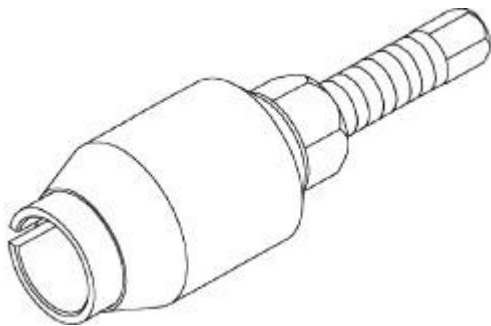


Fig. 36: Front Crankshaft Seal Remover 8511
Courtesy of CHRYSLER LLC

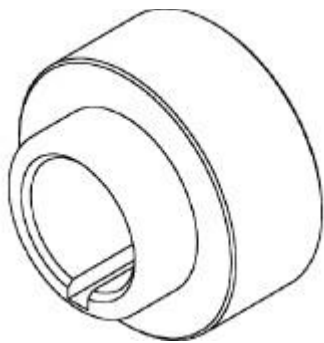


Fig. 37: Front Crankshaft Seal Installer 8348

Courtesy of CHRYSLER LLC

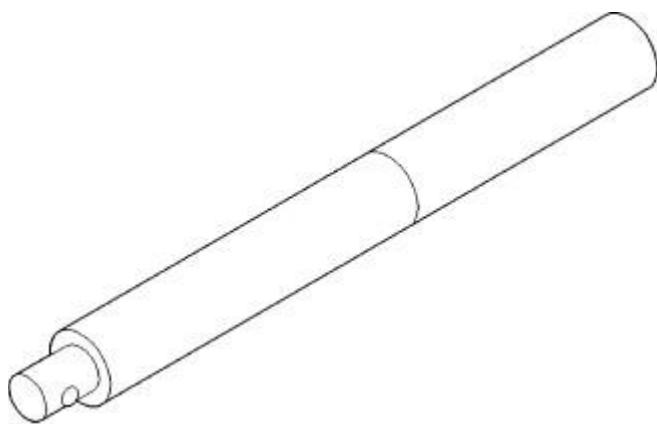


Fig. 38: Handle C-4171

Courtesy of CHRYSLER LLC

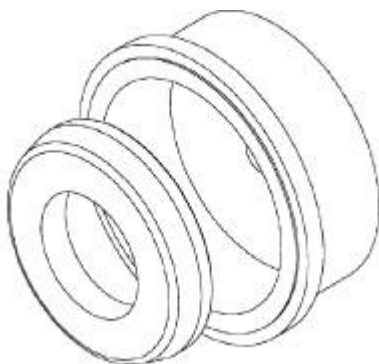


Fig. 39: Rear Crankshaft Seal Installer 8349

Courtesy of CHRYSLER LLC

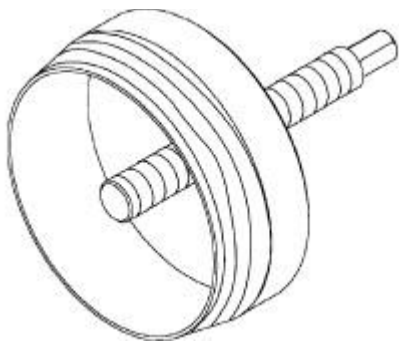


Fig. 40: Rear Crankshaft Seal Remover 8506

Courtesy of CHRYSLER LLC

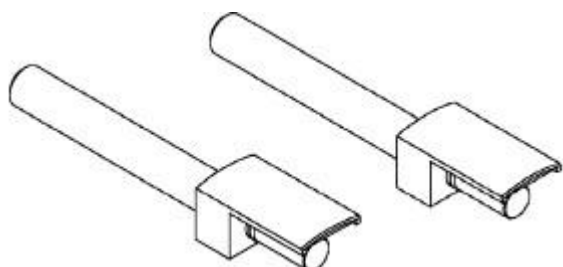


Fig. 41: Connecting Rod Guides 8507

Courtesy of CHRYSLER LLC



2065300

Fig. 42: Damper Installer 8512A

Courtesy of CHRYSLER LLC

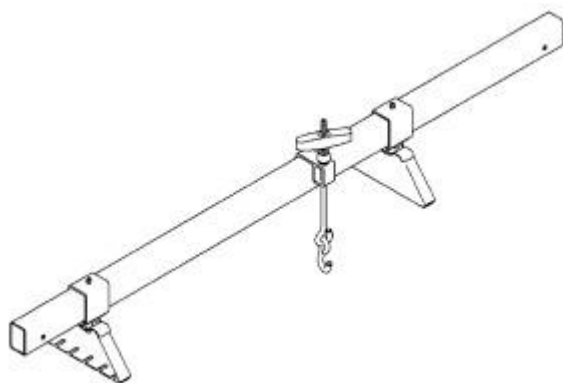


Fig. 43: Engine Support Fixture 8534B
Courtesy of CHRYSLER LLC

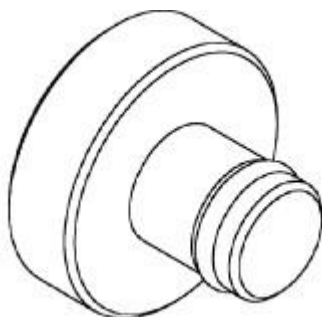


Fig. 44: Crankshaft Damper Removal Insert 8513A
Courtesy of CHRYSLER LLC

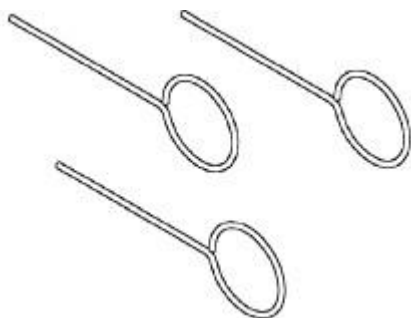


Fig. 45: Chain Tensioner Pins 8514
Courtesy of CHRYSLER LLC

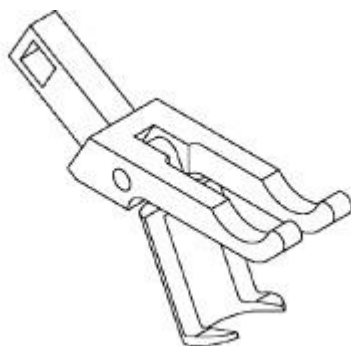


Fig. 46: Remover, Rocker Arm 8516A
Courtesy of CHRYSLER LLC



Fig. 47: Valve Spring Compressor 8426
Courtesy of CHRYSLER LLC

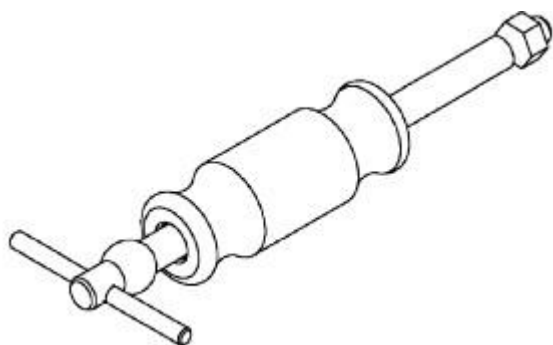


Fig. 48: Idler Shaft Remover 8517
Courtesy of CHRYSLER LLC

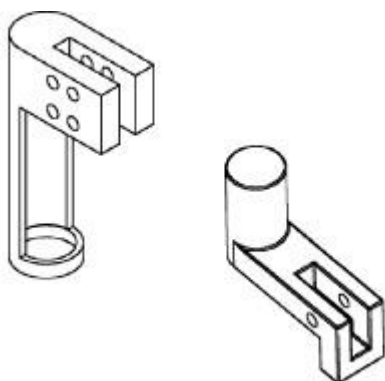


Fig. 49: Valve Spring Compressor Adapters 8519
Courtesy of CHRYSLER LLC

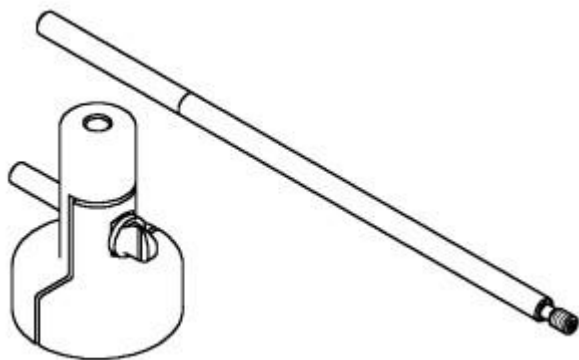


Fig. 50: Counter Balance Shaft Installer - Remover - 8641
Courtesy of CHRYSLER LLC

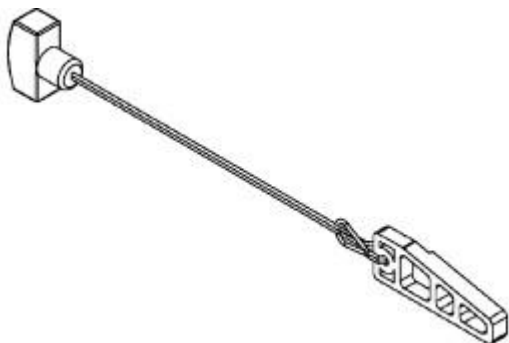


Fig. 51: Chain Tensioner Wedge 9867
Courtesy of CHRYSLER LLC

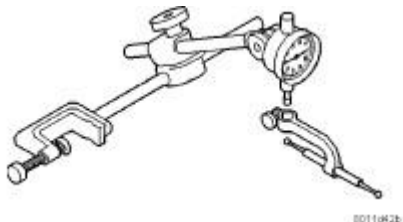


Fig. 52: Dial Indicator C-3339A
Courtesy of CHRYSLER LLC

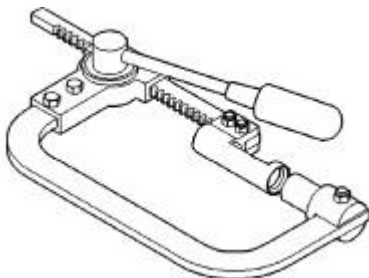
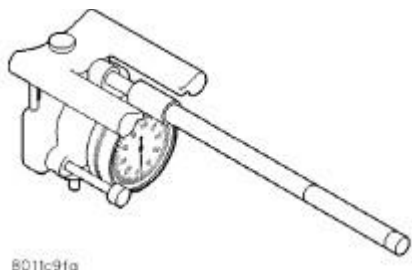


Fig. 53: Valve Spring Compressor C-3422-CF
Courtesy of CHRYSLER LLC



8011c9fa

Fig. 54: Indicator Cylinder Bore C-119
Courtesy of CHRYSLER LLC

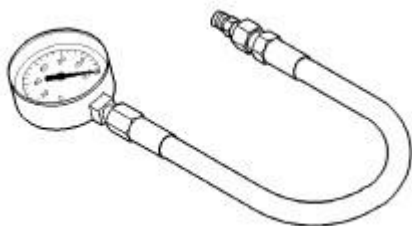


Fig. 55: Gauge Oil Pressure - C-3292A
Courtesy of CHRYSLER LLC

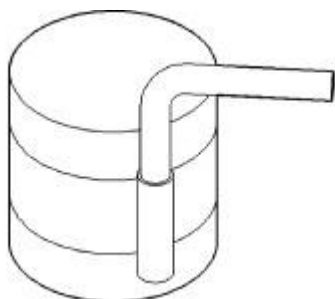


Fig. 56: Piston Ring Compressor C-385
Courtesy of CHRYSLER LLC

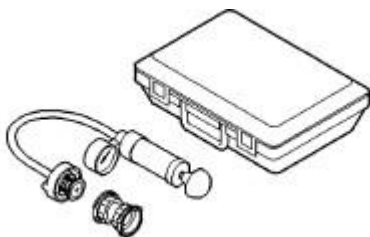


Fig. 57: Pressure Tester Kit 7700-A
Courtesy of CHRYSLER LLC

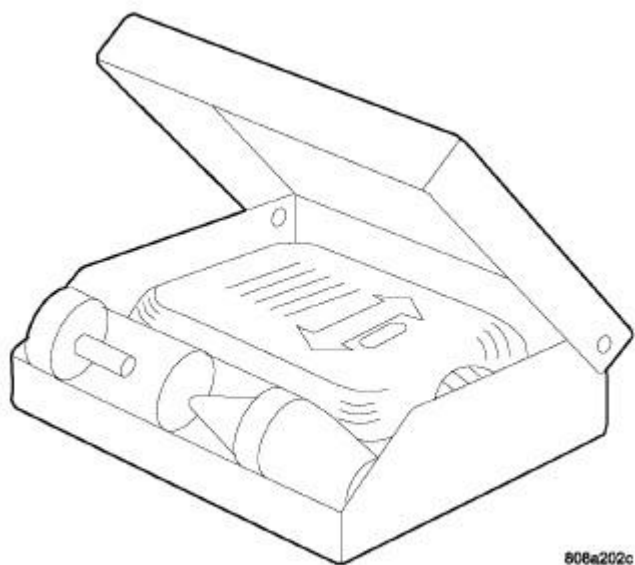


Fig. 58: Bloc-Chek Kit C-3685-A
Courtesy of CHRYSLER LLC

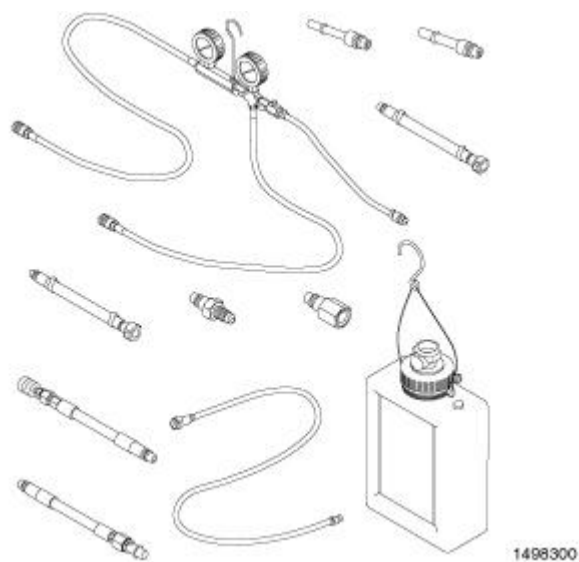


Fig. 59: Fuel Decay Tester - 8978
Courtesy of CHRYSLER LLC

AIR INTAKE SYSTEM

AIR CLEANER

Removal

REMOVAL

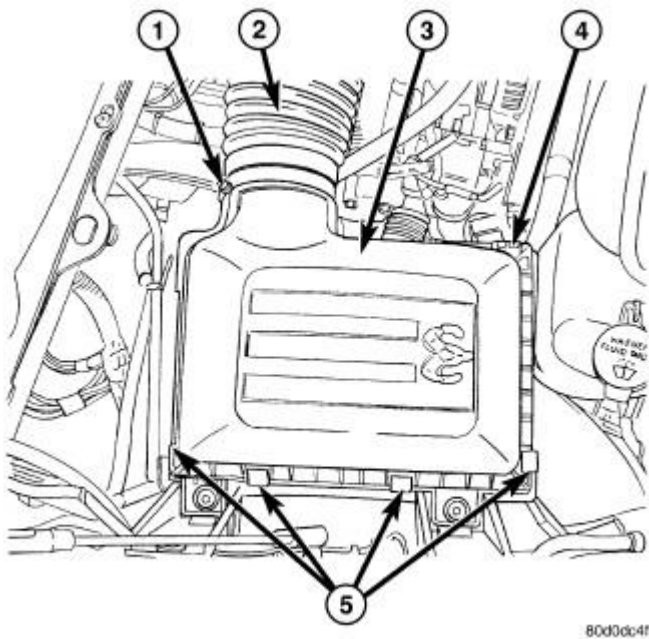


Fig. 60: AIR CLEANER HOUSING COVER

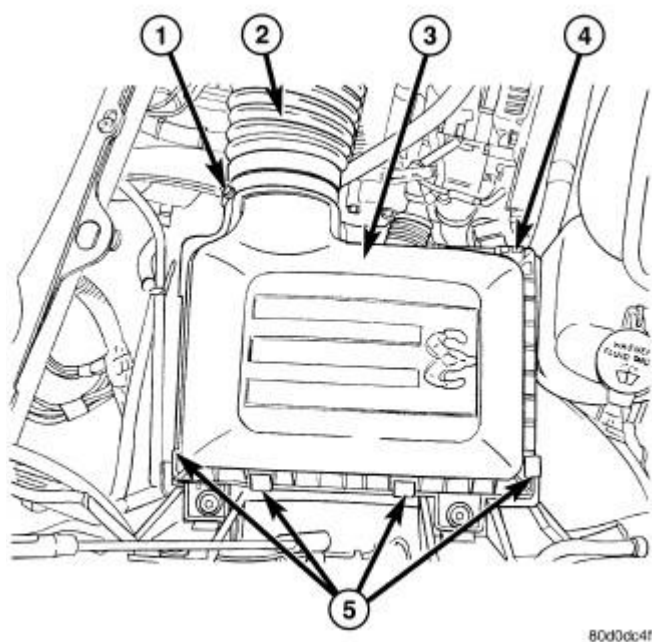
Courtesy of CHRYSLER LLC

- 1 - CLAMP
- 2 - AIR DUCT
- 3 - AIR CLEANER COVER
- 4 - LOCATING TABS
- 5 - CLIPS (4)

1. Loosen clamp and disconnect air duct at air cleaner cover.
2. Pry over 4 spring clips (5) from housing cover (3) (spring clips retain cover to housing).
3. Release housing cover (3) from locating tabs on housing and remove cover .
4. Remove air cleaner element (filter) from housing.
5. Clean inside of housing before replacing element.

Installation

INSTALLATION

**Fig. 61: AIR CLEANER HOUSING COVER**

Courtesy of CHRYSLER LLC

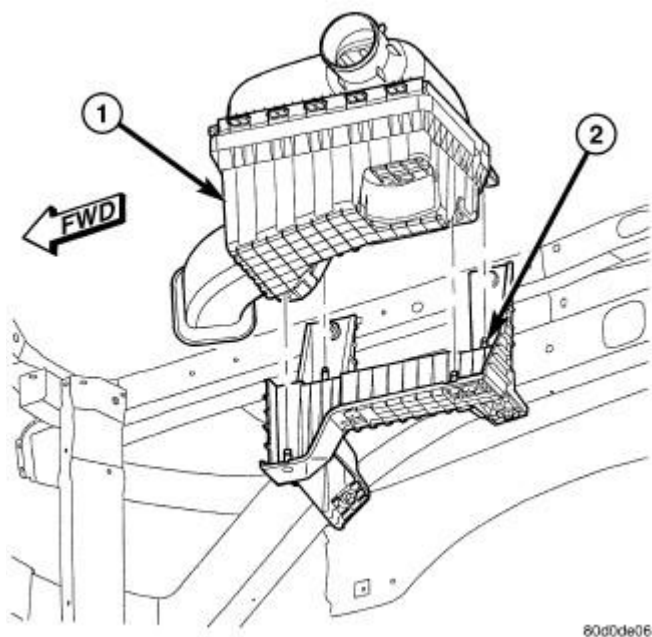
- 1 - CLAMP
- 2 - AIR DUCT
- 3 - AIR CLEANER COVER
- 4 - LOCATING TABS
- 5 - CLIPS (4)

1. Install filter element into housing.
2. Position housing cover into housing locating tabs.
3. Pry up 4 spring clips (6) and lock cover to housing.
4. Install air duct to air cleaner cover and tighten hose clamp to 3 N.m (30 in. lbs.) torque.
5. If any other hose clamps were removed from air intake system, tighten them to 3.4 N.m (30 in. lbs.) torque.
6. If any bolts were removed from air resonator housing or air intake tubing, tighten them to 4.5 N.m (40 in. lbs.) torque.

BODY, AIR CLEANER

Removal

REMOVAL

**Fig. 62: AIR CLEANER HOUSING**

Courtesy of CHRYSLER LLC

1 - AIR CLEANER HOUSING ASSEMBLY

2 - LOCATING PINS (4)

1. Loosen clamp and disconnect air duct at air cleaner cover.
2. Lift entire housing (1) assembly from 4 locating pins (2) .

Installation

INSTALLATION

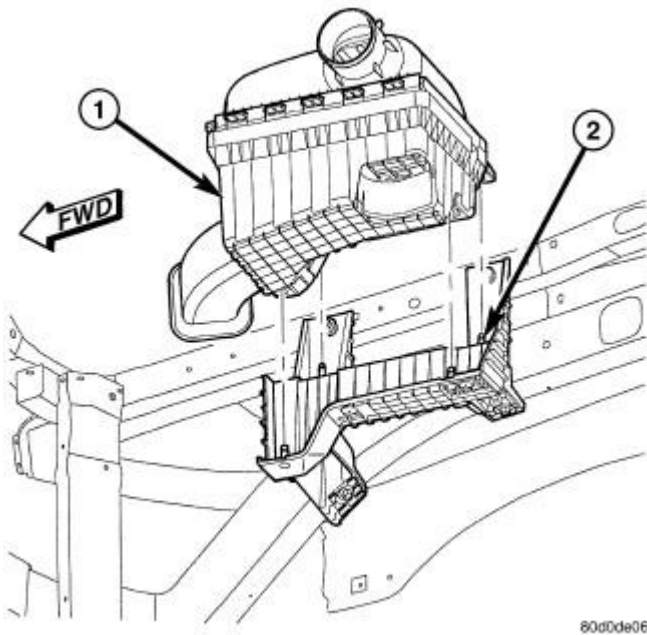


Fig. 63: AIR CLEANER HOUSING
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - AIR CLEANER HOUSING ASSEMBLY
2 - LOCATING PINS (4) |
|---|

1. Position housing assembly (1) into 4 locating pins (2).
2. Connect air duct at air cleaner cover and tighten clamp.

CYLINDER HEAD

DESCRIPTION

CYLINDER HEAD

The cylinder heads are made of an aluminum alloy. The cylinder head features two valves per cylinder with pressed in powdered metal valve guides. The cylinder heads also provide enclosures for the timing chain drain, necessitating unique left and right cylinder heads.

VALVE GUIDES

The valve guides are made of powdered metal and are pressed into the cylinder head. The guides are not replaceable or serviceable, and valve guide reaming is not recommended. If the guides are worn beyond acceptable limits, replace the cylinder heads.

DIAGNOSIS AND TESTING

CYLINDER HEAD GASKET

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

Possible indications of the cylinder head gasket leaking between adjacent cylinders are:

- Loss of engine power
- Engine misfiring
- Poor fuel economy

Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:

- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test. See **CYLINDER COMPRESSION PRESSURE LEAKAGE**. An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50 - 70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

CHEMICAL TEST METHOD

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

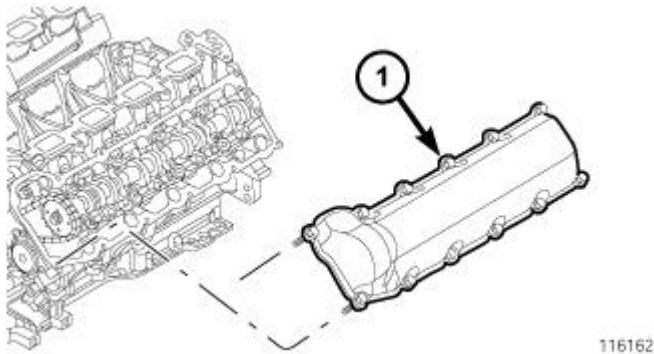
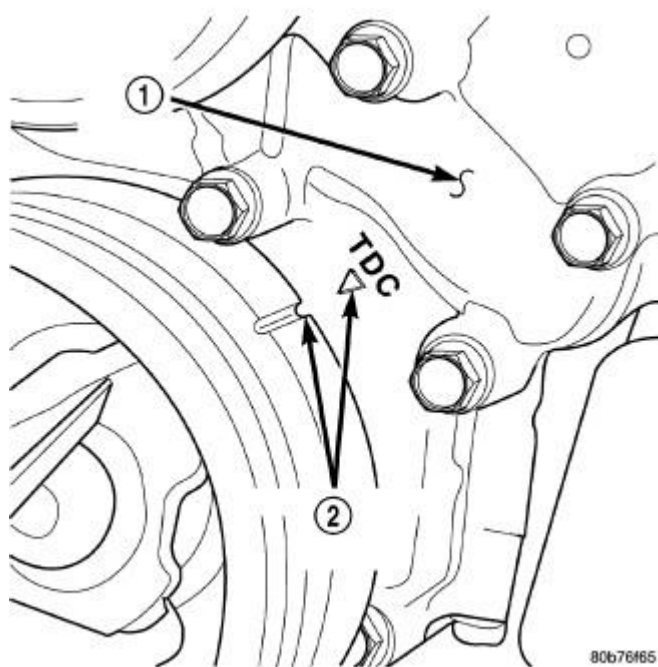
REMOVAL**LEFT**

Fig. 64: Cylinder Head Cover-Left
Courtesy of CHRYSLER LLC

ITEM	DESCRIPTION	TORQUE
1	Cover Fasteners	12 N.m (105 in. lbs.)

1. Disconnect the negative cable from the battery.
2. Raise the vehicle on a hoist.
3. Disconnect the exhaust pipe at the left side exhaust manifold.
4. Drain the engine coolant. Refer to **Cooling - Standard Procedure** .
5. Lower the vehicle.
6. Remove the intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Removal**.
7. Remove the master cylinder and booster assembly. Refer to **HYDRAULIC/MECHANICAL** .
8. Remove the cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.



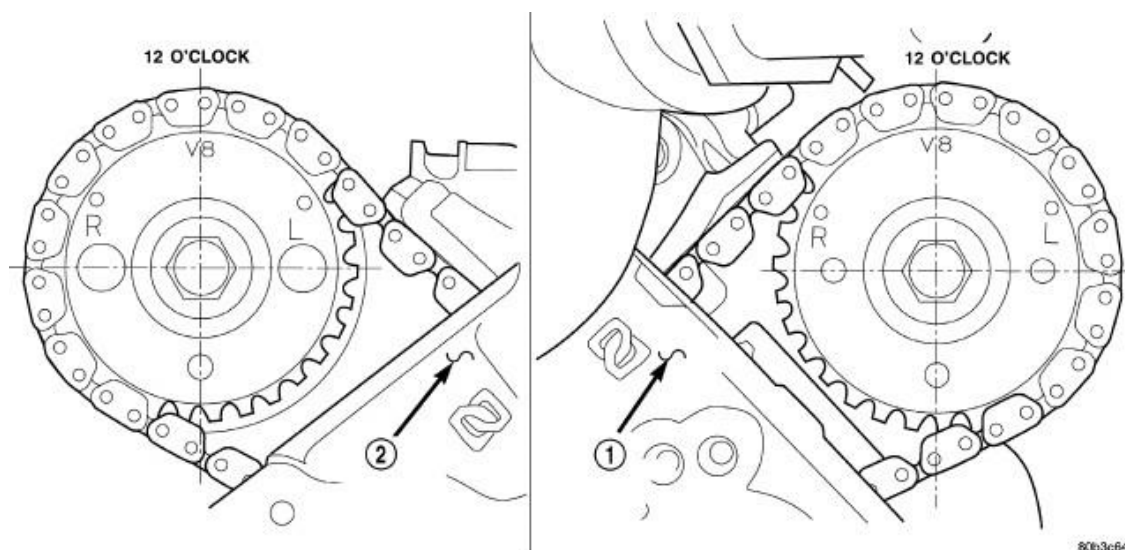
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Fig. 65: Engine Top Dead Center (TDC) Indicator Mark
 Courtesy of CHRYSLER LLC

1 - TIMING CHAIN COVER

2 - CRANKSHAFT TIMING MARKS

9. Remove the fan shroud and fan blade assembly.
10. Remove accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal**.
11. Remove the power steering pump and set aside.
12. Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark.



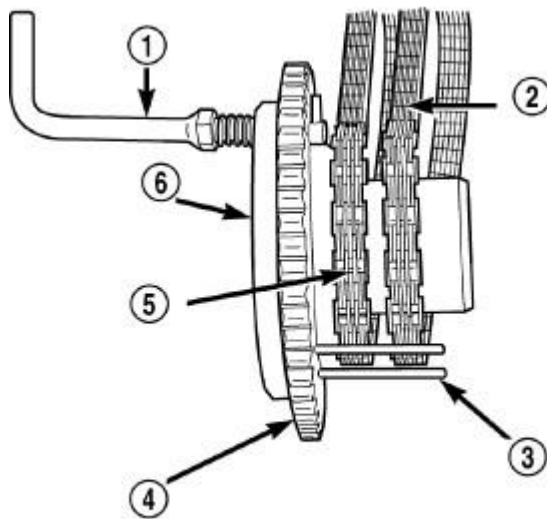
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Fig. 66: Camshaft Sprocket V8 Marks

Courtesy of CHRYSLER LLC

1 - LEFT CYLINDER HEAD
2 - RIGHT CYLINDER HEAD

13. Verify the V8 mark on the camshaft sprocket is at the 12 o'clock position. Rotate the crankshaft one turn if necessary.
14. Remove the crankshaft damper. See [Engine/Engine Block/DAMPER, Vibration - Removal](#).
15. Remove the timing chain cover. See [Engine/Valve Timing/COVER\(S\), Engine Timing - Removal](#).



80b77055

Fig. 67: Installing Secondary Timing Chains on Idler Sprocket

Courtesy of CHRYSLER LLC

1 - LOCK ARM
2 - RIGHT CAMSHAFT CHAIN
3 - SECONDARY CHAINS RETAINING PINS (4)
4 - IDLER SPROCKET
5 - LEFT CAMSHAFT CHAIN
6 - SPECIAL TOOL 8429

16. Lock the secondary timing chains to the idler sprocket using Special Tool 8429.

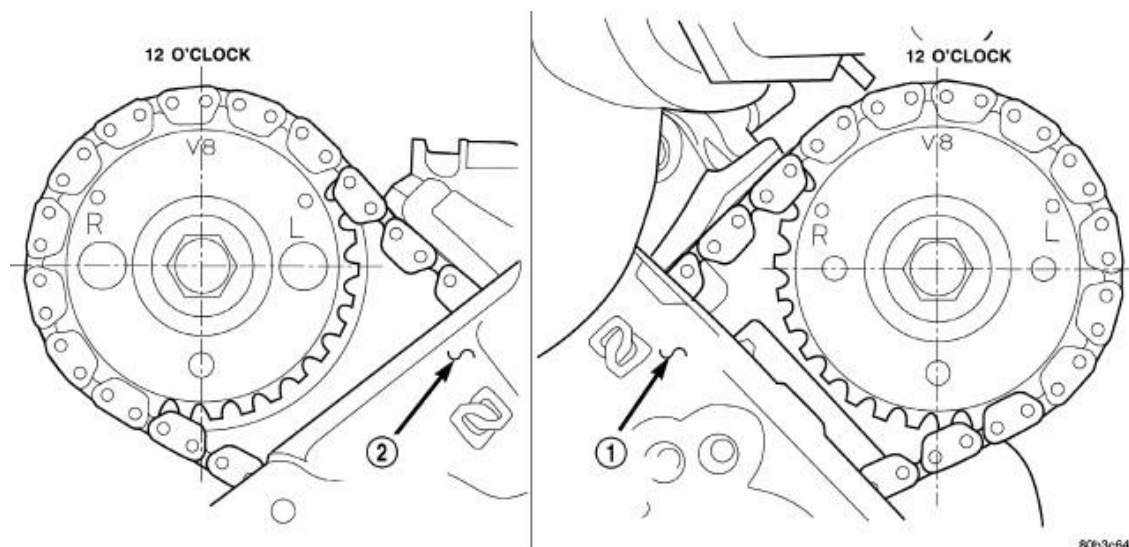


Fig. 68: Camshaft Sprocket V8 Marks
Courtesy of CHRYSLER LLC

- | |
|-------------------------|
| 1 - LEFT CYLINDER HEAD |
| 2 - RIGHT CYLINDER HEAD |

NOTE: Mark the secondary timing chain prior to removal to aid in installation.

17. Mark the secondary timing chain, one link on each side of the V8 mark on the camshaft drive gear.
18. Remove the left side secondary chain tensioner. See **Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Removal.**

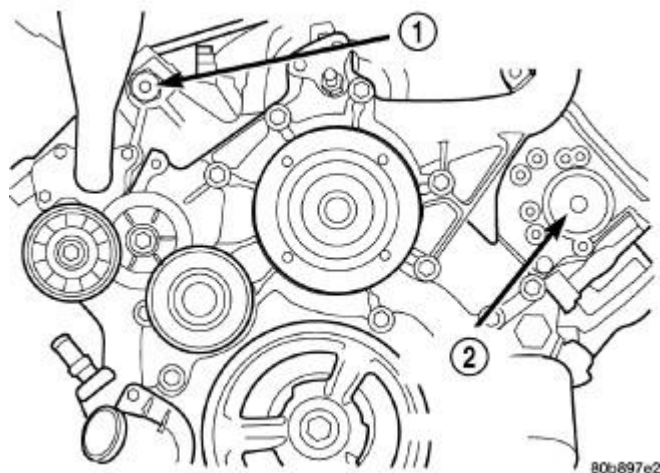


Fig. 69: Cylinder Head Access Plugs
Courtesy of CHRYSLER LLC

- | |
|-------------------------------------|
| 1 - RIGHT CYLINDER HEAD ACCESS PLUG |
| 2 - LEFT CYLINDER HEAD ACCESS PLUG |

19. Remove the cylinder head access plug (2).
20. Remove the left side secondary chain guide. See Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Removal.
21. Remove the retaining bolt and the camshaft drive gear.

CAUTION: Do not allow the engine to rotate. Severe damage to the valve train can occur.

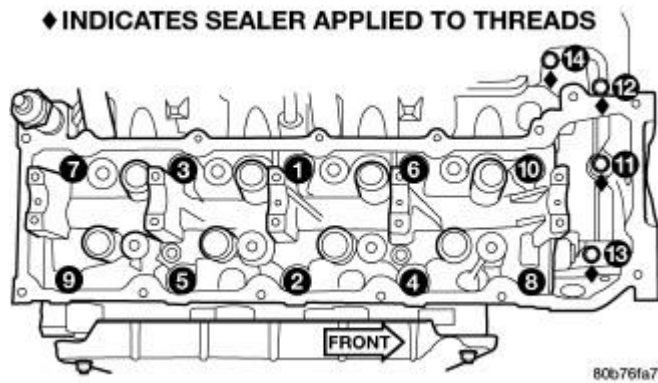


Fig. 70: Cylinder Head Tightening Sequence
Courtesy of CHRYSLER LLC

CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

NOTE: The cylinder head is attached to the cylinder block with fourteen bolts.

22. Remove the cylinder head retaining bolts using the sequence provided.
23. Remove the cylinder head and gasket. Discard the gasket.

CAUTION: Do not lay the cylinder head on its gasket sealing surface, due to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

RIGHT

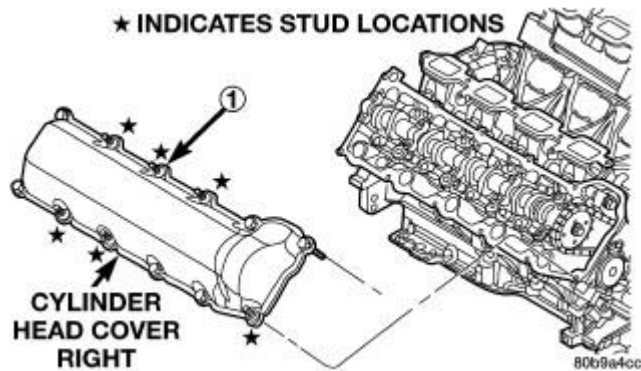


Fig. 71: Cylinder Head Cover - Right
Courtesy of CHRYSLER LLC

ITEM	DESCRIPTION	TORQUE
1	Cover Fasteners	12 N.m (105 in. lbs.)

1. Disconnect battery negative cable.
2. Raise the vehicle on a hoist.
3. Disconnect the exhaust pipe at the right side exhaust manifold.
4. Drain the engine coolant. Refer to **Cooling - Standard Procedure**.
5. Lower the vehicle.
6. Remove the intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Removal**.
7. Remove the cylinder head cover (1). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.

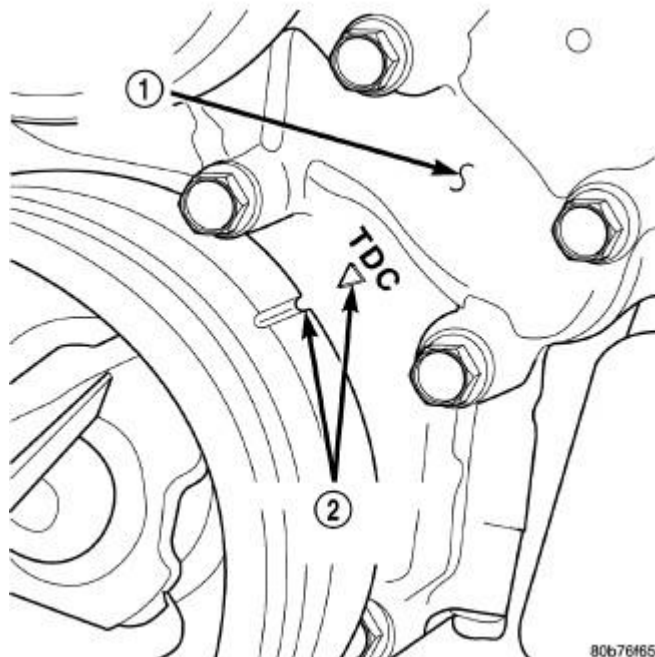


Fig. 72: Engine Top Dead Center (TDC) Indicator Mark
Courtesy of CHRYSLER LLC

- | |
|-----------------------------|
| 1 - TIMING CHAIN COVER |
| 2 - CRANKSHAFT TIMING MARKS |

8. Remove the fan shroud.
9. Remove oil fill housing from cylinder head.
10. Remove accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal**.
11. Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark (2).

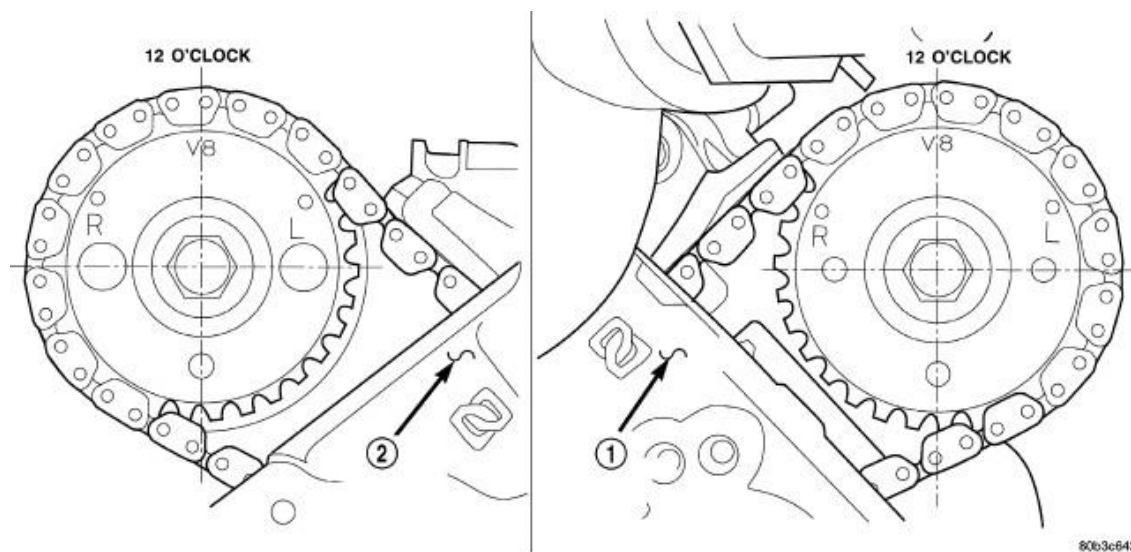


Fig. 73: Camshaft Sprocket V8 Marks
Courtesy of CHRYSLER LLC

- | |
|-------------------------|
| 1 - LEFT CYLINDER HEAD |
| 2 - RIGHT CYLINDER HEAD |

12. Verify the V8 mark on the camshaft sprocket is at the 12 o'clock position. Rotate the crankshaft one turn if necessary.
13. Remove the crankshaft damper. See **Engine/Engine Block/DAMPER, Vibration - Removal**.
14. Remove the timing chain cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.

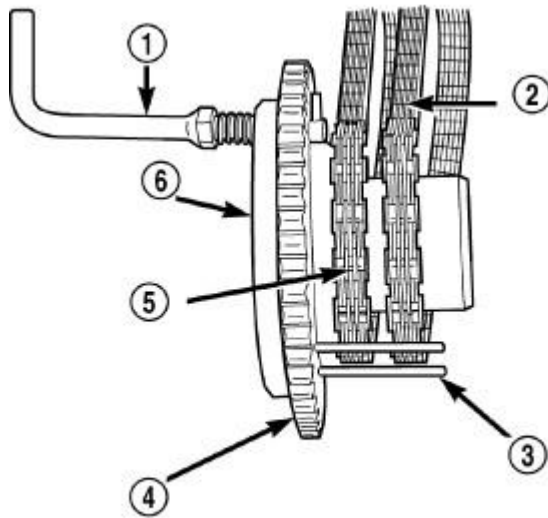


Fig. 74: Installing Secondary Timing Chains on Idler Sprocket
Courtesy of CHRYSLER LLC

1 - LOCK ARM
2 - RIGHT CAMSHAFT CHAIN
3 - SECONDARY CHAINS RETAINING PINS (4)
4 - IDLER SPROCKET
5 - LEFT CAMSHAFT CHAIN
6 - SPECIAL TOOL 8429

15. Lock the secondary timing chains to the idler sprocket using Special Tool 8429 (6).

NOTE: Mark the secondary timing chain prior to removal to aid in installation.

16. Mark the secondary timing chain, one link on each side of the V8 mark on the camshaft drive gear.
17. Remove the right side secondary chain tensioner. See Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Installation.

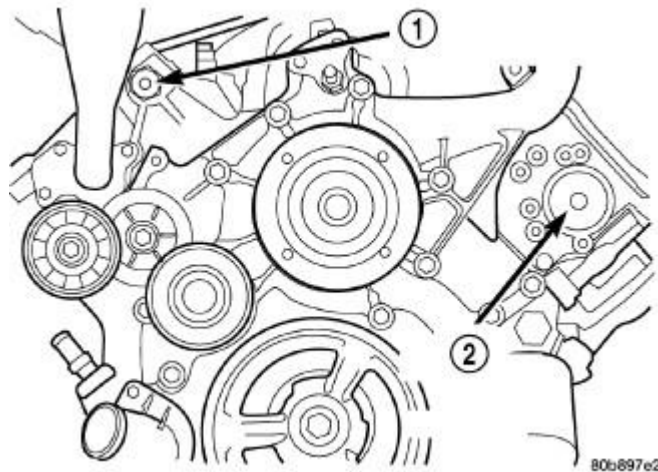


Fig. 75: Cylinder Head Access Plugs
Courtesy of CHRYSLER LLC

- | |
|-------------------------------------|
| 1 - RIGHT CYLINDER HEAD ACCESS PLUG |
| 2 - LEFT CYLINDER HEAD ACCESS PLUG |

18. Remove the cylinder head access plug (1).
19. Remove the right side secondary chain guide. See Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Installation.
20. Remove the retaining bolt and the camshaft drive gear.

CAUTION: Do not allow the engine to rotate. severe damage to the valve train can occur.

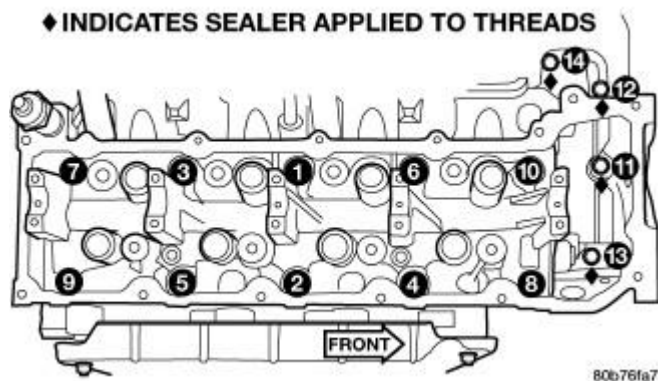


Fig. 76: Cylinder Head Tightening Sequence
Courtesy of CHRYSLER LLC

CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

CAUTION: Do not hold or pry on the camshaft target wheel for any reason. A damaged target wheel can result in a vehicle no start condition.

NOTE: The cylinder head is attached to the cylinder block with fourteen bolts.

21. Remove the cylinder head retaining bolts using the sequence provided.
22. Remove the cylinder head and gasket. Discard the gasket.

CAUTION: Do not lay the cylinder head on its gasket sealing surface, do to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

CLEANING

CLEANING

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components. See Engine - Standard Procedure.

INSPECTION

INSPECTION

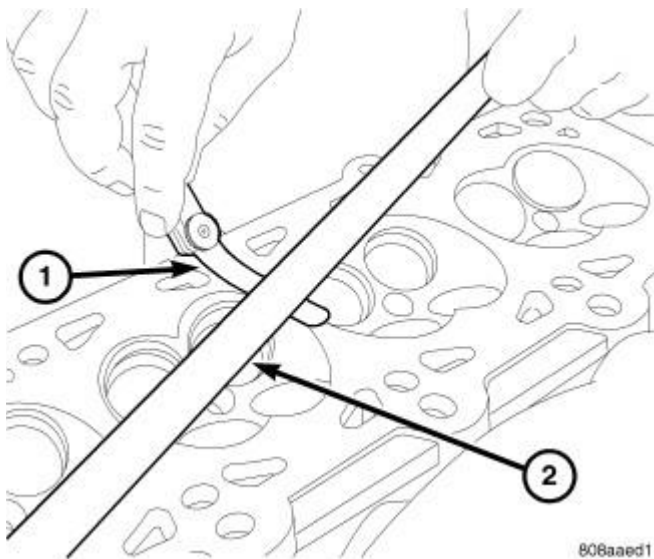


Fig. 77: Checking Cylinder Head Flatness
Courtesy of CHRYSLER LLC

1. Inspect the cylinder head for out-of-flatness, using a straightedge (2) and a feeler gauge (1). Check Cylinder head in several locations. If tolerances exceed 0.0508 mm (0.002 in.) replace the cylinder head.
2. Inspect the valve seats for damage. Service the valve seats as necessary.

3. Inspect the valve guides for wear, cracks or looseness. If either condition exist, replace the cylinder head.

INSTALLATION

LEFT

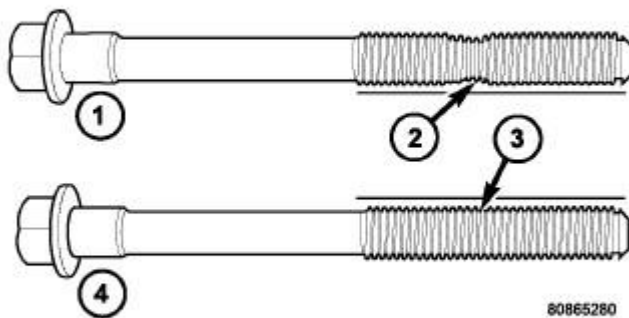


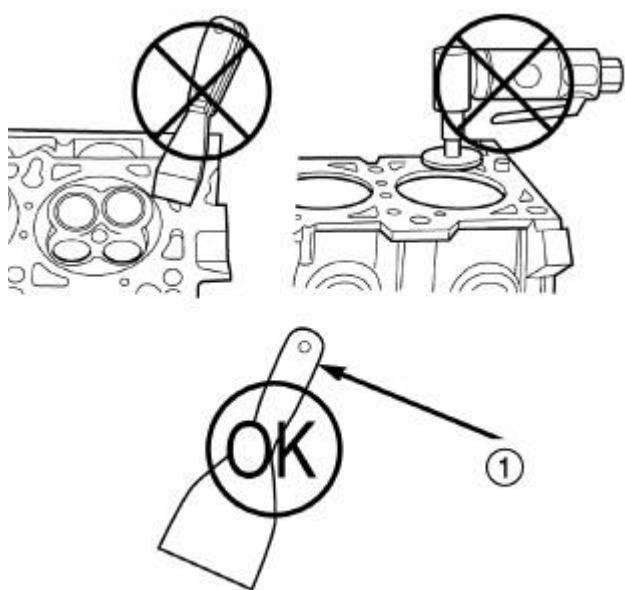
Fig. 78: Checking Cylinder Head Bolts for Stretching (Necking)

Courtesy of CHRYSLER LLC

- 1 - STRETCHED BOLT
- 2 - THREADS ARE NOT STRAIGHT ON LINE
- 3 - THREADS ARE STRAIGHT ON LINE
- 4 - UNSTRETCHED BOLT

NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined **BEFORE** reuse. If the threads are necked down (2) the bolts should be replaced.

Necking can be checked by holding a straight edge against the threads. If all the threads do not contact the scale, the bolt should be replaced.



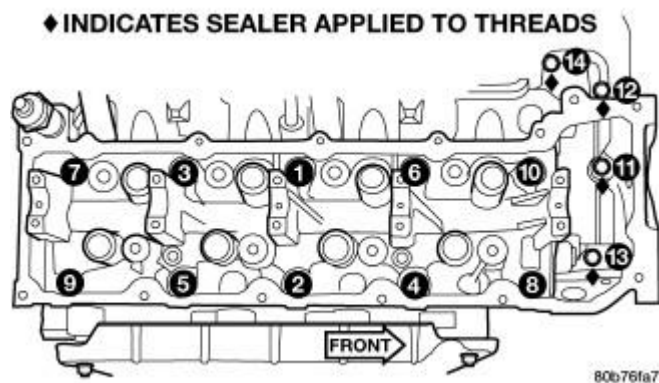
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Fig. 79: Proper Tool Usage For Surface Preparation
 Courtesy of CHRYSLER LLC

1 - PLASTIC/WOOD SCRAPER

CAUTION: When cleaning cylinder head and cylinder block surfaces, **DO NOT** use a metal scraper (1), high speed scotch brite (2) or rolock tool (3) because the surfaces could be cut or ground. Use only a wooden or plastic scraper (4).

1. Clean the cylinder head and cylinder block mating surfaces.



80b76fa7

Fig. 80: Cylinder Head Tightening Sequence
 Courtesy of CHRYSLER LLC

2. Position the new cylinder head gasket on the locating dowels.

CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

3. Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

NOTE: The four M8 cylinder head mounting bolts (11 - 14) require sealant to be added to them before installing. Failure to do so may cause leaks.

4. Lubricate the cylinder head bolt threads with clean engine oil and install the ten M11 bolts.
5. Coat the four M8 cylinder head bolts with **Mopar® Thread Sealant with PTFE** then install the bolts.

NOTE: The cylinder head bolts are tightened using an angle torque procedure.

6. Tighten the bolts in sequence using the following steps and torque values:

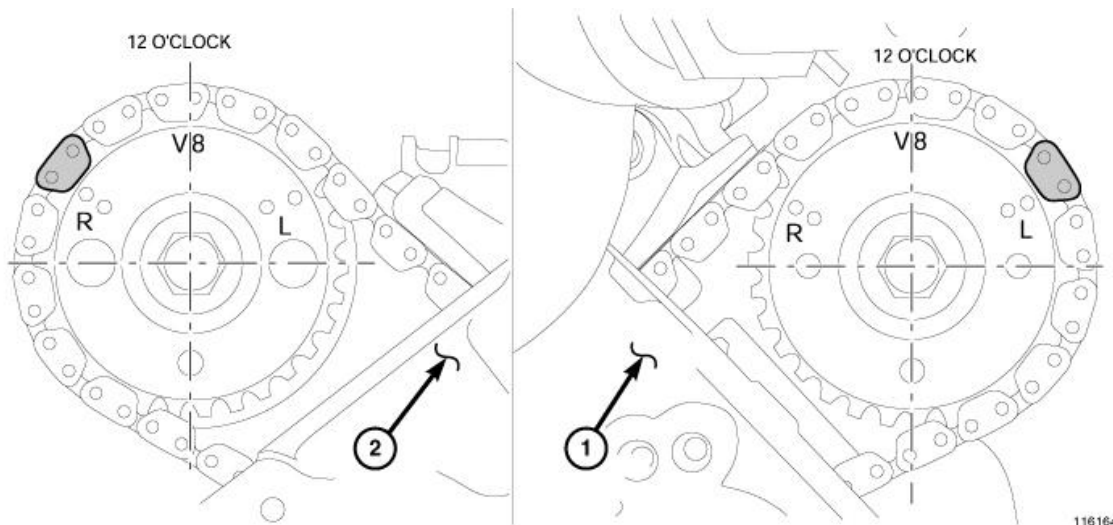


Fig. 81: Timing Chain to Sprocket Alignment
Courtesy of CHRYSLER LLC

- | |
|-------------------------|
| 1 - LEFT CYLINDER HEAD |
| 2 - RIGHT CYLINDER HEAD |

1. Tighten bolts 1 - 10 to 27 N.m (20 ft. lbs.).
2. Verify that bolts 1 - 10 have all reached 27 N.m (20 ft. lbs.), by repeating step 1 without loosening the bolts.
3. Tighten bolts 11 - 14 to 14 N.m (89 in. lbs.).
4. Rotate bolts 1 - 10 an additional 90°.
5. Rotate bolts 1 - 10 an additional 90° again.
6. Tighten bolts 11 - 14 to 26 N.m (19 ft. lbs.).

7. Position the secondary chain onto the camshaft drive gear, making sure one marked chain link is on either side of the V8 mark on the gear and position the gear onto the camshaft.
8. Install the camshaft drive gear retaining bolt.
9. Install the left side secondary chain guide. See **Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Installation**.

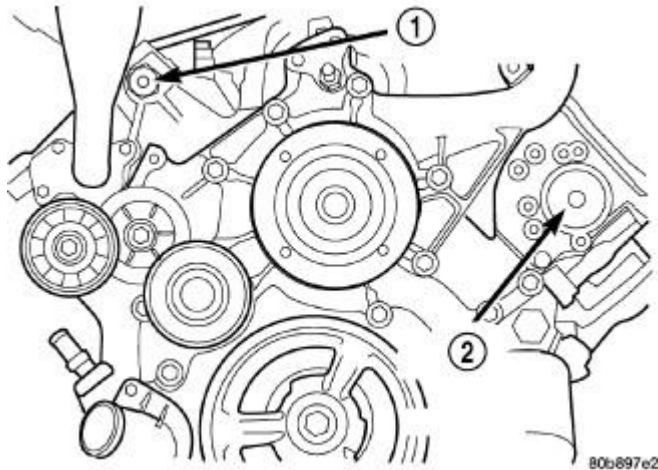
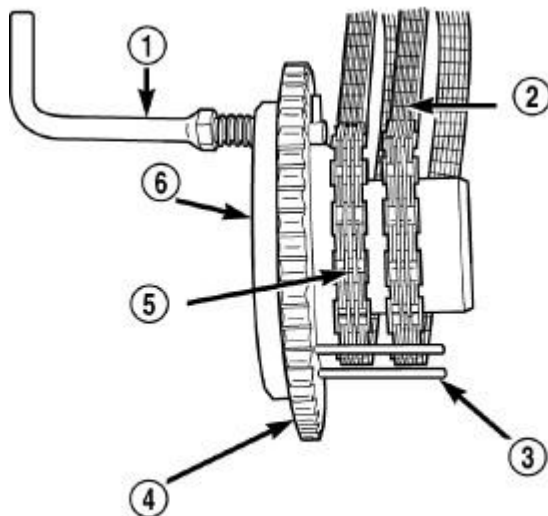


Fig. 82: Cylinder Head Access Plugs
Courtesy of CHRYSLER LLC

- | |
|-------------------------------------|
| 1 - RIGHT CYLINDER HEAD ACCESS PLUG |
| 2 - LEFT CYLINDER HEAD ACCESS PLUG |

10. Install the cylinder head access plug (2).
11. Reset and Install the left side secondary chain tensioner. See **Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Installation**.



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Fig. 83: Installing Secondary Timing Chains on Idler Sprocket
 Courtesy of CHRYSLER LLC

1 - LOCK ARM
2 - RIGHT CAMSHAFT CHAIN
3 - SECONDARY CHAINS RETAINING PINS (4)
4 - IDLER SPROCKET
5 - LEFT CAMSHAFT CHAIN
6 - SPECIAL TOOL 8429

12. Remove Special Tool 8429 (6).
13. Install the timing chain cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Installation.**
14. Install the crankshaft damper. See **Engine/Engine Block/DAMPER, Vibration - Installation.**
15. Install the power steering pump.
16. Install the fan blade assembly and fan shroud.

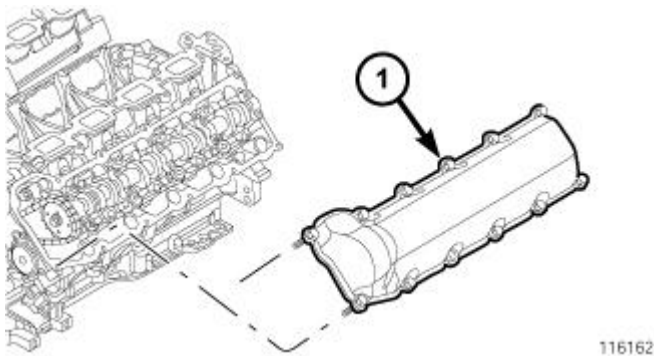


Fig. 84: Cylinder Head Cover - Left
 Courtesy of CHRYSLER LLC

ITEM	DESCRIPTION	TORQUE
1	Cover Fasteners	12 N.m (105 in. lbs.)

17. Install the cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation.**
18. Reinstall the master cylinder and booster assembly. Refer to **Brakes/Hydraulic/Mechanical/BOOSTER, Power Brake - Installation** . Refer to **Brakes/Hydraulic/Mechanical/MASTER CYLINDER, Brake - Installation** .
19. Install the intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Installation.**
20. Refill the cooling system. Refer to **Cooling - Standard Procedure** .
21. Raise the vehicle.
22. Install the exhaust pipe onto the left exhaust manifold.
23. Lower the vehicle.
24. Connect the negative cable to the battery.
25. Start the engine and check for leaks.

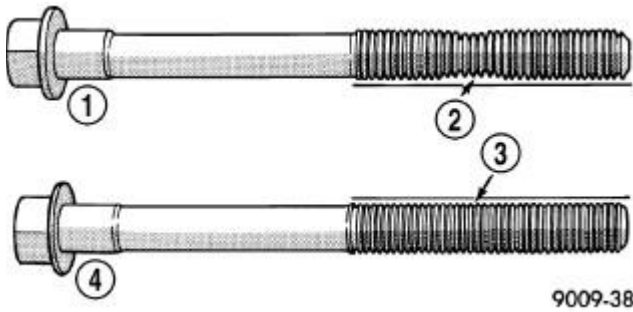
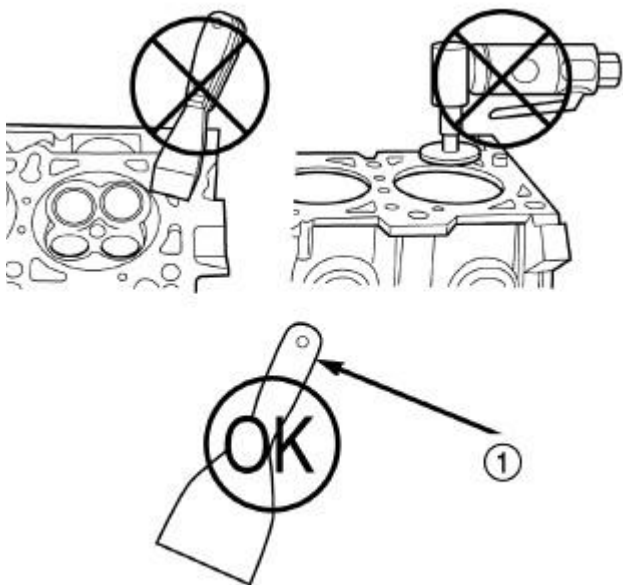
RIGHT

Fig. 85: Checking Cylinder Head Bolts for Stretching (Necking)
 Courtesy of CHRYSLER LLC

- | |
|--------------------------------------|
| 1 - STRETCHED BOLT |
| 2 - THREADS ARE NOT STRAIGHT ON LINE |
| 3 - THREADS ARE STRAIGHT ON LINE |
| 4 - UNSTRETCHED BOLT |

NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined **BEFORE** reuse. If the threads are necked down (2) the bolts should be replaced.

Necking (2) can be checked by holding a straight edge against the threads. If all the threads do not contact the scale (2), the bolt should be replaced.



80b76eba

Fig. 86: Proper Tool Usage For Surface Preparation
 Courtesy of CHRYSLER LLC

1 - PLASTIC/WOOD SCRAPER

CAUTION: When cleaning cylinder head and cylinder block surfaces, **DO NOT** use a metal scraper (1), high speed scotch brite (2) or rolock tool (3) because the surfaces could be cut or ground. Use only a wooden or plastic scraper (4).

1. Clean the cylinder head and cylinder block mating surfaces.

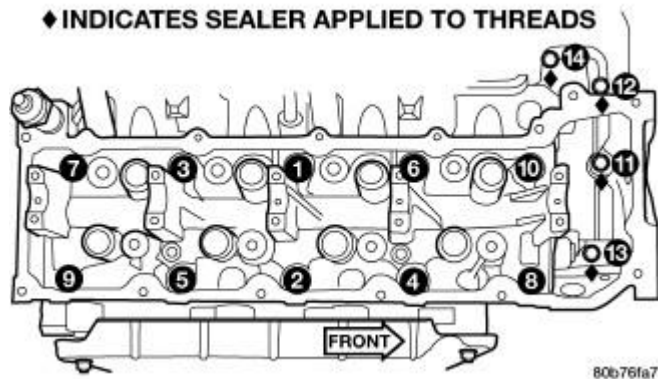


Fig. 87: Cylinder Head Tightening Sequence
Courtesy of CHRYSLER LLC

2. Position the new cylinder head gasket on the locating dowels.

CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

3. Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

NOTE: The four M8 cylinder head mounting bolts (11 - 14) require sealant to be added to them before installing. Failure to do so may cause leaks.

4. Lubricate the cylinder head bolt threads with clean engine oil and install the ten M10 bolts.
5. Coat the four M8 cylinder head bolts with **Mopar® Thread Sealant with PTFE** then install the bolts.

NOTE: The cylinder head bolts are tightened using an angle torque procedure.

6. Tighten the bolts in sequence using the following steps and torque values:

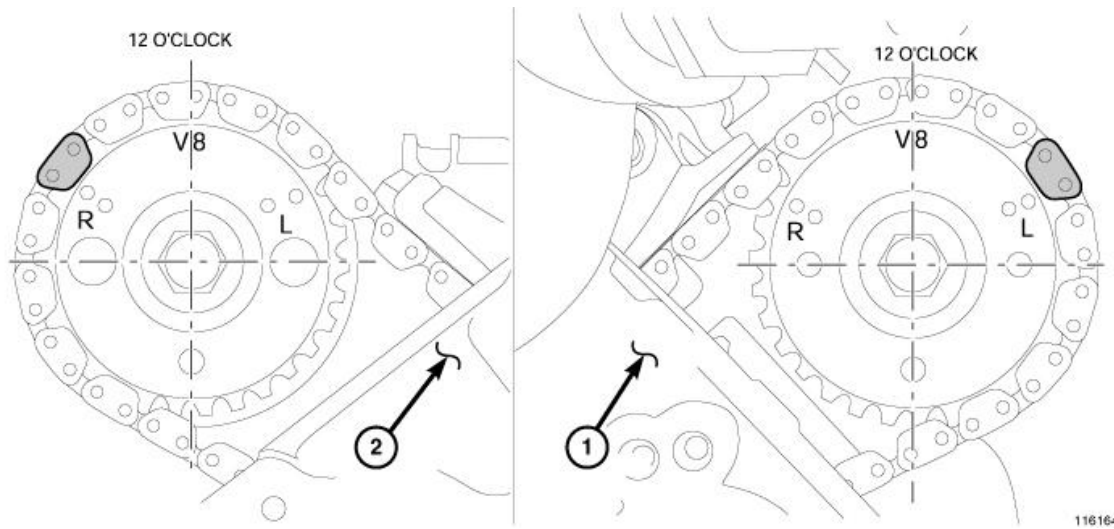


Fig. 88: Timing Chain to Sprocket Alignment
Courtesy of CHRYSLER LLC

- | |
|-------------------------|
| 1 - LEFT CYLINDER HEAD |
| 2 - RIGHT CYLINDER HEAD |

1. Tighten bolts 1 - 10 to 27 N.m (20 ft. lbs.).
2. Verify that bolts 1 - 10 have all reached 27 N.m (20 ft. lbs.), by repeating step 1 without loosening the bolts.
3. Tighten bolts 11 - 14 to 14 N.m (89 in. lbs.).
4. Rotate bolts 1 - 10 an additional 90°.
5. Rotate bolts 1 - 10 an additional 90° again.
6. Tighten bolts 11 - 14 to 26 N.m (19 ft. lbs.).
7. Position the secondary chain onto the camshaft drive gear, making sure one marked chain link is on either side of the V8 mark on the gear (2) and position the gear onto the camshaft.
8. Install the camshaft drive gear retaining bolt.
9. Install the right side secondary chain guide. See **Engine/Valve Timing/COVER(S), Engine Timing - Installation**.

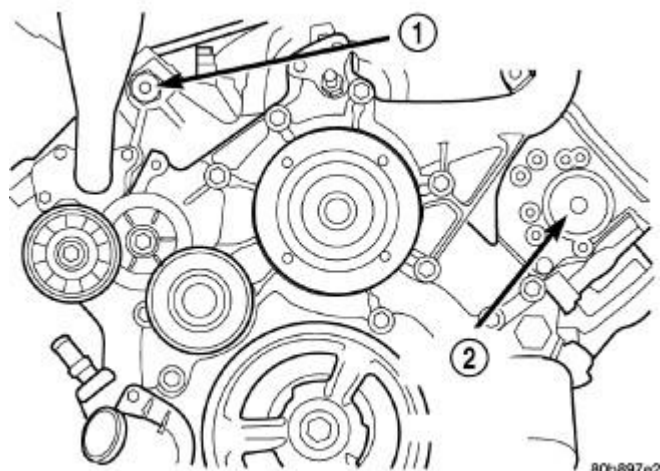


Fig. 89: Cylinder Head Access Plugs
Courtesy of CHRYSLER LLC

- | |
|-------------------------------------|
| 1 - RIGHT CYLINDER HEAD ACCESS PLUG |
| 2 - LEFT CYLINDER HEAD ACCESS PLUG |

10. Install the right side cylinder head access plug (1).
11. Reset and install the right side secondary chain tensioner.

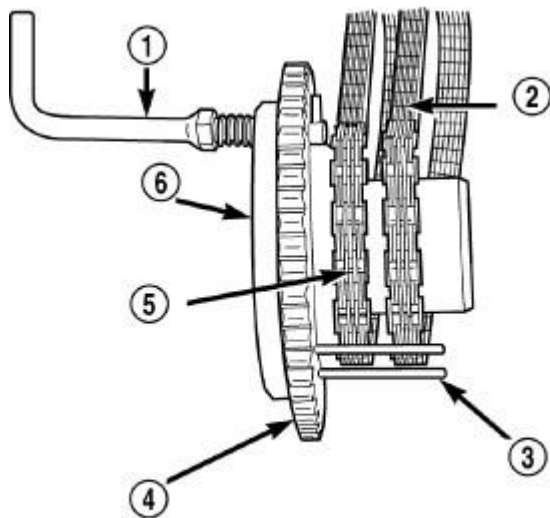


Fig. 90: Installing Secondary Timing Chains on Idler Sprocket
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - LOCK ARM |
| 2 - RIGHT CAMSHAFT CHAIN |
| 3 - SECONDARY CHAINS RETAINING PINS (4) |

4 - IDLER SPROCKET

5 - LEFT CAMSHAFT CHAIN

6 - SPECIAL TOOL 8429

12. Remove Special Tool 8429 (6).
13. Install the timing chain cover. See Engine/Valve Timing/COVER(S), Engine Timing - Installation.
14. Install the crankshaft damper. See Engine/Engine Block/DAMPER, Vibration - Installation.
15. Install accessory drive belt. Refer to Cooling/Accessory Drive/BELT, Serpentine - Installation.
16. Install the fan shroud.

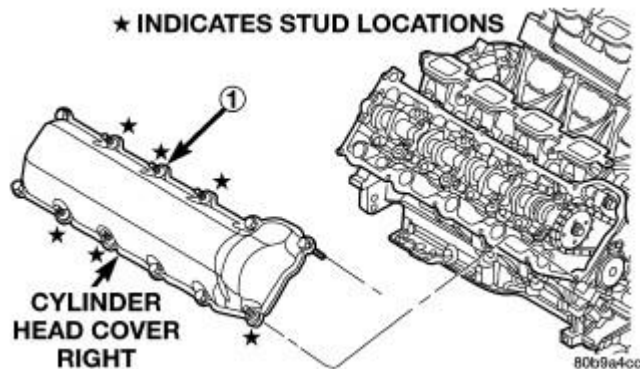


Fig. 91: Cylinder Head Cover-Right
 Courtesy of CHRYSLER LLC

ITEM	DESCRIPTION	TORQUE
1	Cover Fasteners	12 N.m (105 in. lbs.)

17. Install the cylinder head cover (1). See Engine/Cylinder Head/COVER(S), Cylinder Head - Installation.
18. Install the intake manifold. See Engine/Manifolds/MANIFOLD, Intake - Installation.
19. Install oil fill housing onto cylinder head.
20. Refill the cooling system. Refer to Cooling - Standard Procedure.
21. Raise the vehicle.
22. Install the exhaust pipe onto the right exhaust manifold.
23. Lower the vehicle.
24. Reconnect battery negative cable.
25. Start the engine and check for leaks.

CAMSHAFT, ENGINE

Description

DESCRIPTION

The camshafts consist of powdered metal steel lobes which are sinter-bonded to a steel tube. A steel post or nose piece is friction-welded to the steel camshaft tube. Five bearing journals are machined into the camshaft, four on the steel tube and one on the steel nose piece. Camshaft end play is controlled by two thrust walls that border the nose piece journal. Engine oil enters the hollow camshafts at the third journal and lubricates every intake lobe rocker through a drilled passage in the intake lobe.

Standard Procedure

CAMSHAFT END PLAY

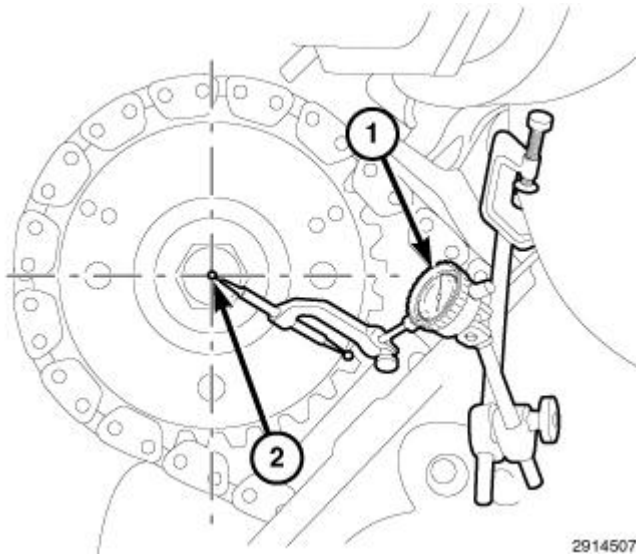


Fig. 92: Positioning Dial Indicator Tip Against Camshaft
Courtesy of CHRYSLER LLC

1. Remove the cylinder head cover. See Engine/Cylinder Head/COVER(S), Cylinder Head - Removal.
2. Mount Dial Indicator Set C-3339A (1) to a stationary point at the front of the engine.
3. Position the dial indicator tip against the camshaft (2).
4. Push the camshaft toward rear of engine and adjust the dial indicator to zero.
5. Move the camshaft forward and note reading.
6. Camshaft end play must be within specification, if end play is not within specification replace defective part as necessary. See Engine SPECIFICATIONS.

Removal

REMOVAL - RIGHT CAMSHAFT

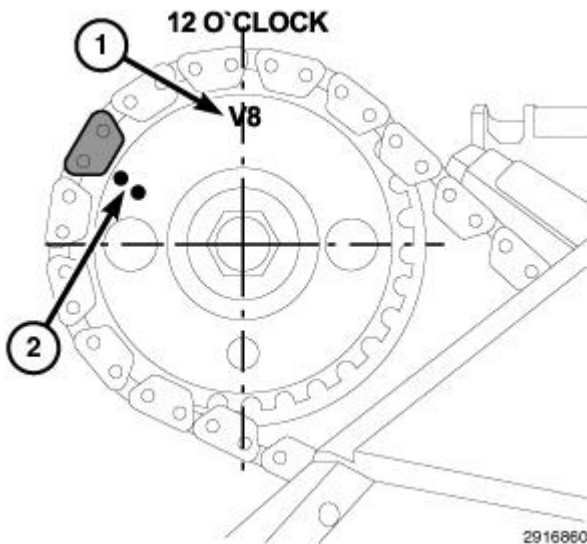


Fig. 93: Aligning Camshaft Sprocket V8 Mark & Identifying 2 Dots
 Courtesy of CHRYSLER LLC

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

CAUTION: When the timing chain is removed and the cylinder heads are still installed, Do not forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

2. Set #1 cylinder to TDC and align the camshaft sprocket V8 mark (1) to the 12 o'clock position.
3. Mark the link on the secondary timing chain that is aligned with the two dots (2) on the camshaft sprocket as shown in illustration to aid in installation.

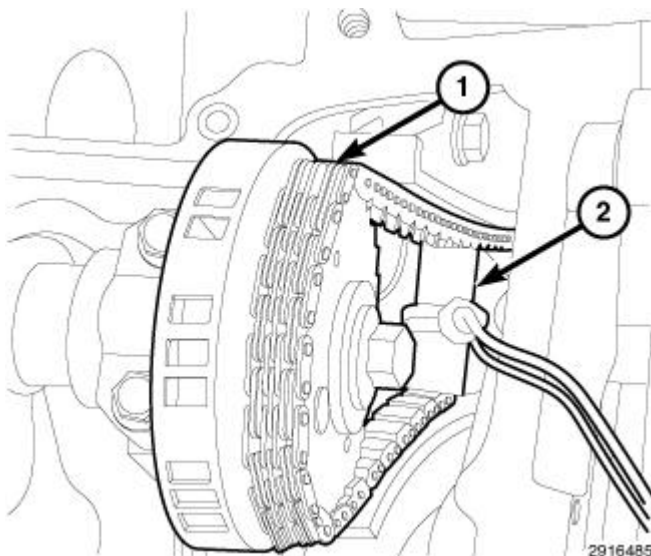


Fig. 94: Positioning Locking Wedge Between Timing Chain

Courtesy of CHRYSLER LLC

CAUTION: Do not hold or pry on the camshaft target wheel for any reason, severe damage will occur to the target wheel resulting in a vehicle no start condition.

CAUTION: When removing the camshaft sprocket, timing chains or camshaft, the timing chain tensioner must be secured, failure to use Locking Wedge 9867 will result in hydraulic tensioner ratchet over extension, requiring timing chain cover removal to reset the tensioner ratchet.

CAUTION: Do not force Locking Wedge 9867 past the narrowest point between the chain strands. Damage to the tensioners may occur.

4. Position Locking Wedge 9867 (2) between the timing chain strands (1), gently tap the wedge into position and secure the timing chain against the tensioner arm and guide.

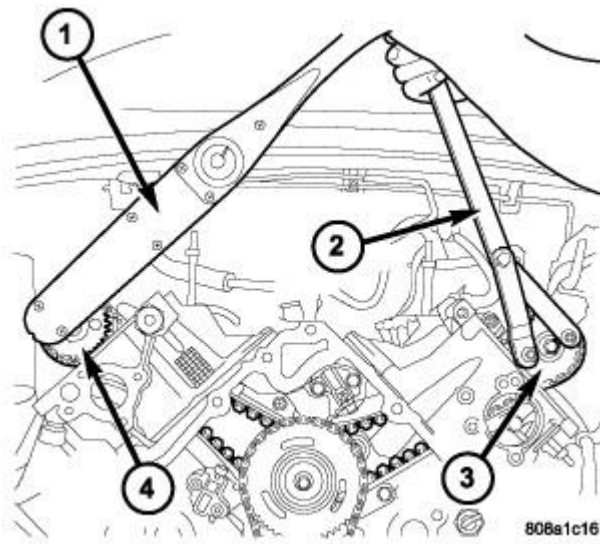


Fig. 95: Tightening Right Side Camshaft Sprocket Bolt

Courtesy of CHRYSLER LLC

5. Using Spanner Wrench 6958 (2) with Adapter Pins 8346, secure the camshaft sprocket (3) and remove the camshaft sprocket bolt.

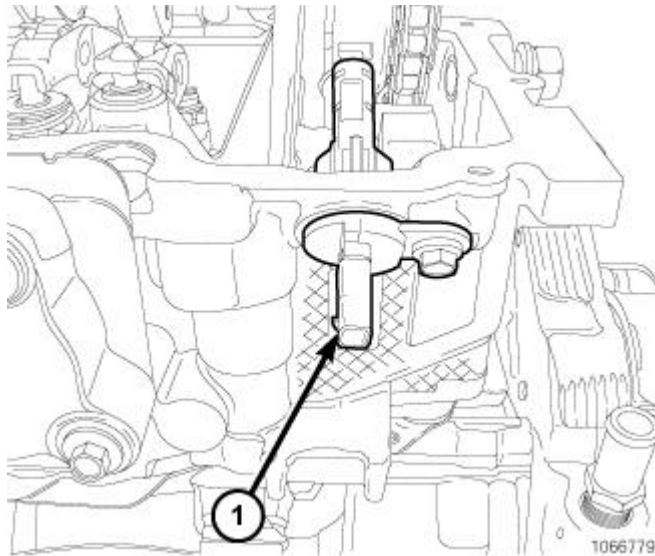


Fig. 96: Identifying Camshaft Position Sensor

Courtesy of CHRYSLER LLC

6. Disconnect the electrical connector to the Camshaft Position Sensor (CMP).
7. Remove the CMP sensor retaining bolt
8. Using a slight rocking motion, carefully remove the CMP sensor (1).
9. Check the condition of the CMP sensor O-ring, replace as necessary.

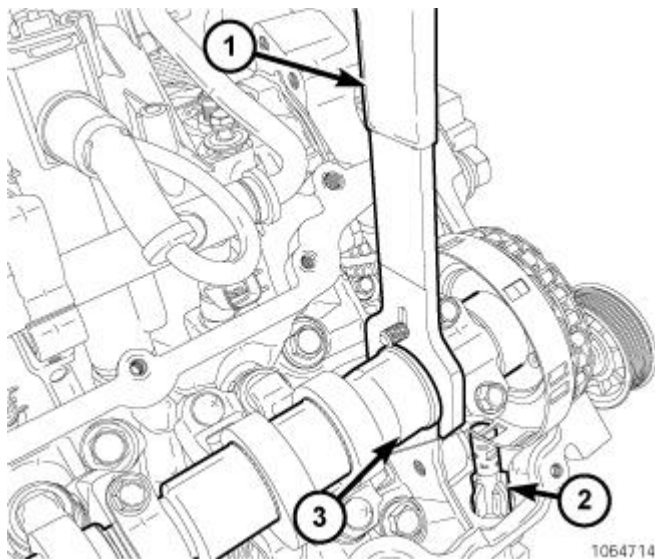


Fig. 97: Removing/Installing Cam Sensor And Camshaft Sprocket Bolt Using Spanner Wrench

Courtesy of CHRYSLER LLC

10. Position Camshaft Holder 8428A (1) onto the camshaft (3).

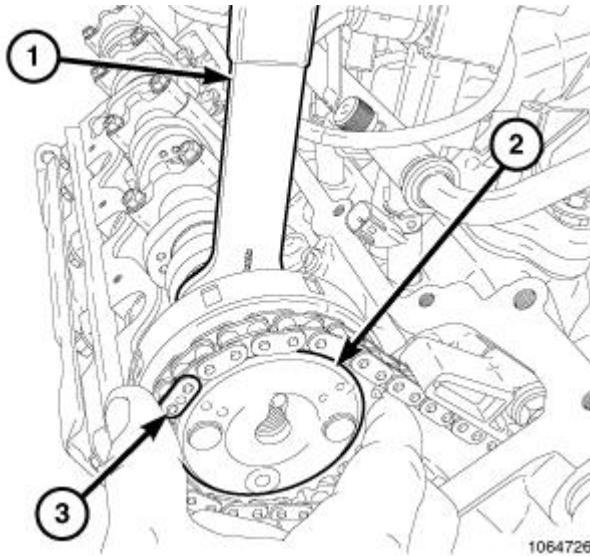


Fig. 98: Installing Camshaft Holder Onto Camshaft
Courtesy of CHRYSLER LLC

11. Using Camshaft Holder 8428A (1), hold the camshaft while removing the camshaft sprocket (2).
12. Using Camshaft Holder 8428A (1), gently allow the camshaft to rotate 45° counterclockwise until the camshaft is in the neutral position (no valve load).

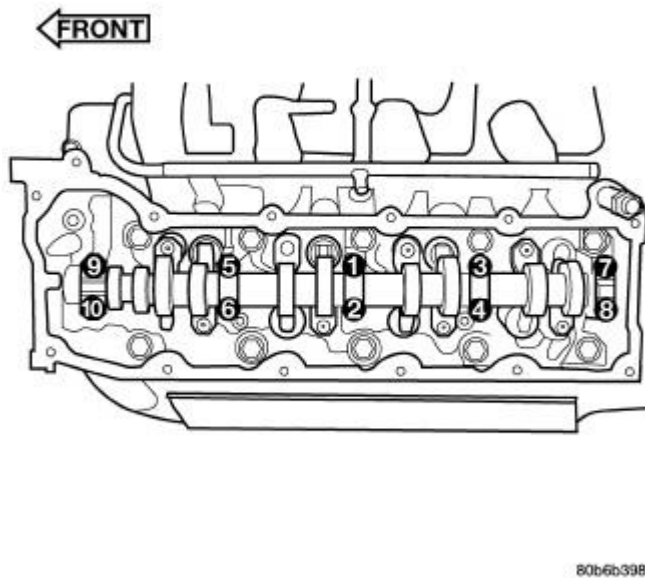


Fig. 99: Identifying Removal & Installation Sequence Of Camshaft Bearing Cap Retaining Bolts
Courtesy of CHRYSLER LLC

CAUTION: Do not stamp or strike the camshaft bearing caps or severe engine damage may result.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

13. Using the sequence shown in illustration, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time until all load is off the bearing caps and remove bolts.
14. Remove the camshaft bearing caps and the camshaft.

REMOVAL - LEFT CAMSHAFT

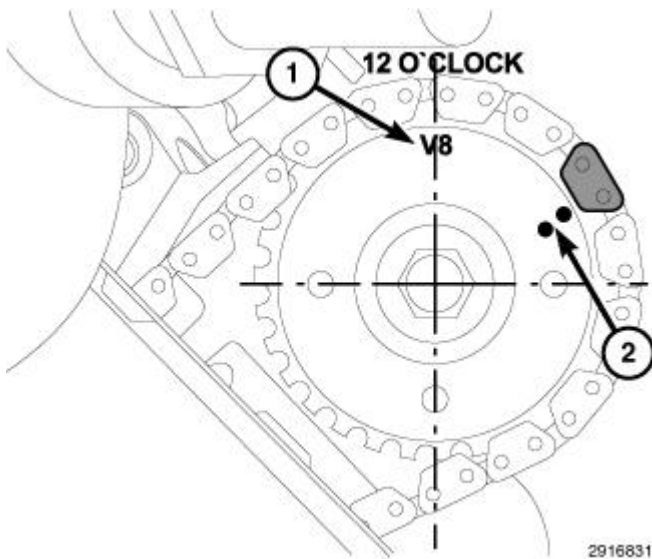


Fig. 100: Aligning Camshaft Sprocket V8 Mark & Identifying 2 Dots
Courtesy of CHRYSLER LLC

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

CAUTION: When the timing chain is removed and the cylinder heads are still installed, Do not forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

2. Set #1 cylinder to TDC and align the camshaft sprocket V8 mark (1) to the 12 o'clock position.
3. Mark the link on the secondary timing chain that is aligned with the two dots (2) on the camshaft sprocket as shown in illustration to aid in installation.

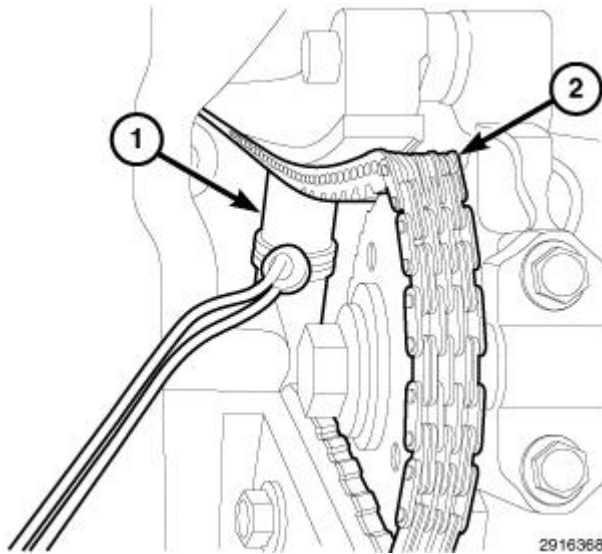


Fig. 101: Positioning Locking Wedge Between Timing Chain Strands
 Courtesy of CHRYSLER LLC

CAUTION: When removing the camshaft sprocket, timing chains or camshaft, the timing chain tensioner must be secured, failure to use Locking Wedge 9867 will result in hydraulic tensioner ratchet over extension, requiring timing chain cover removal to reset the tensioner ratchet.

CAUTION: Do not force Locking Wedge 9867 past the narrowest point between the chain strands. Damage to the tensioners may occur.

4. Position Locking Wedge 9867 (1) between the timing chain strands (2), gently tap the wedge into position and secure the timing chain against the tensioner arm and guide.

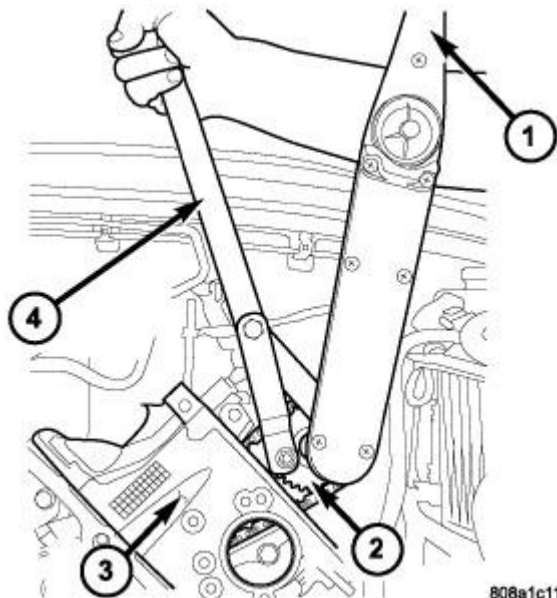


Fig. 102: Tightening Left Side Camshaft Sprocket Bolt
Courtesy of CHRYSLER LLC

5. Using Spanner Wrench 6958 (4) with Adapter Pins 8346, secure the camshaft sprocket (2) and remove the camshaft sprocket bolt.

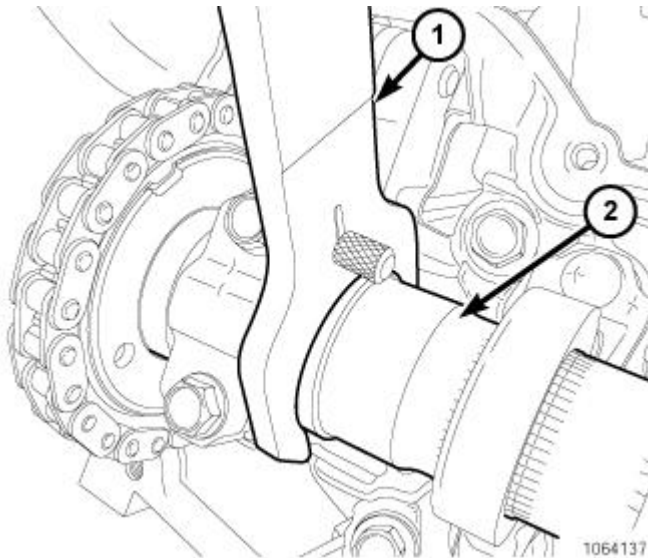


Fig. 103: Removing/Installing Camshaft Sprocket Bolt Using Spanner Wrench
Courtesy of CHRYSLER LLC

6. Position Camshaft Holder 8428A (1) onto the camshaft (2).

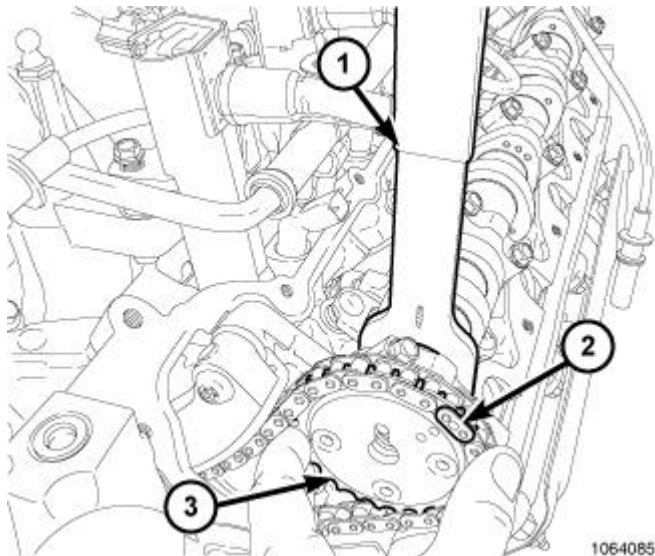
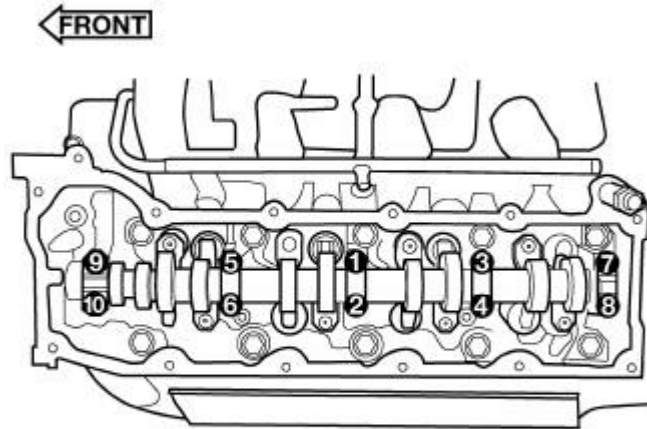


Fig. 104: Removing/Installing Camshaft Holder On Camshaft
Courtesy of CHRYSLER LLC

7. Using Camshaft Holder 8428A (1), hold the camshaft while removing the camshaft sprocket (3).
8. Using Camshaft Holder 8428A (1), gently allow the camshaft to rotate 15° clockwise until the camshaft is

in the neutral position (no valve load).



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Fig. 105: Camshaft Bearing Caps Tightening Sequence
Courtesy of CHRYSLER LLC

CAUTION: Do not stamp or strike the camshaft bearing caps or severe engine damage may result.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

9. Using the sequence shown in illustration, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time until all load is off the bearing caps and remove bolts.
10. Remove the camshaft bearing caps and the camshaft.

Installation

INSTALLATION - RIGHT CAMSHAFT

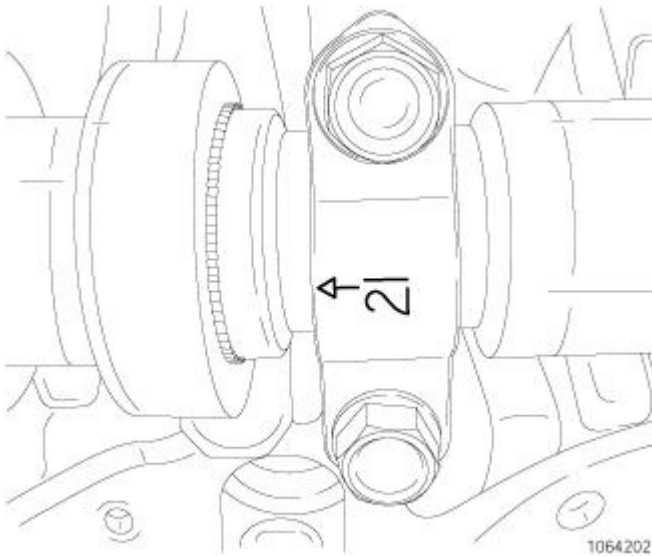


Fig. 106: Positioning Camshaft Cap Arrow Toward Front Of Engine
 Courtesy of CHRYSLER LLC

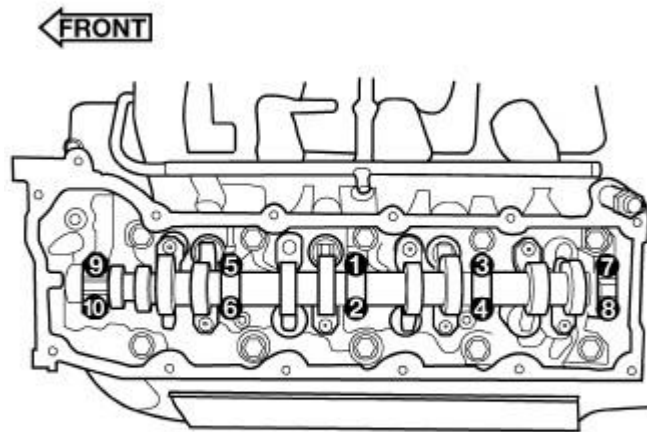
1. Lubricate the camshaft journals with clean engine oil.

NOTE: Position the right side camshaft so that the camshaft sprocket dowel is near the 10 o'clock position, this will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

2. Install the camshaft into the cylinder head while aligning the camshaft sprocket dowel near the 10 o'clock position.

NOTE: The camshaft caps are marked for location. The arrow must point to the front of the engine.

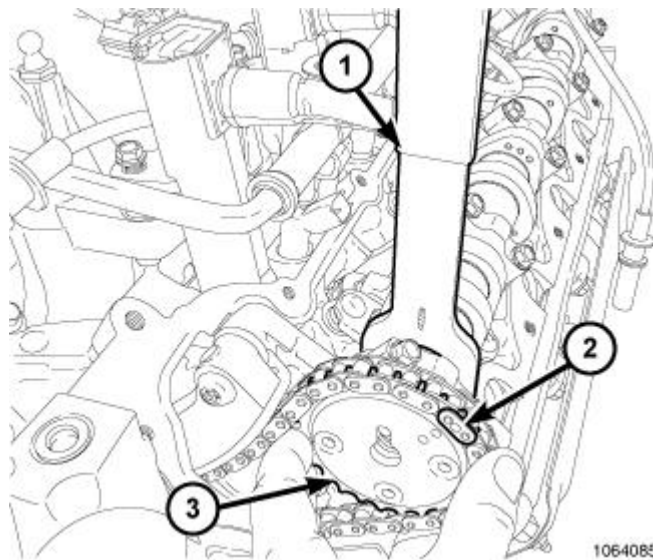
3. Install the camshaft bearing caps in the same position as noted during removal.
4. Install the camshaft bearing cap retaining bolts hand tight.



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Fig. 107: Camshaft Bearing Caps Tightening Sequence
Courtesy of CHRYSLER LLC

5. Using the sequence shown in illustration, working in 1/2 turn increments, tighten the bearing cap retaining bolts to 11 N.m (8 ft. lbs.).
6. Check the camshaft end play. See **Engine/Cylinder Head/CAMSHAFT, Engine - Standard Procedure.**



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Fig. 108: Removing/Installing Camshaft Holder On Camshaft
Courtesy of CHRYSLER LLC

7. Position the camshaft drive gear into the timing chain while aligning the two dots on the camshaft

sprocket with the chain link (2) marked during removal.

8. Using Camshaft Holder 8428A (1), rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket.
9. Position the sprocket onto the camshaft.

CAUTION: Remove excess oil from the camshaft sprocket retaining bolt, failure to do so can cause bolt over-torque resulting in bolt failure.

10. Remove excess oil from the camshaft sprocket retaining bolt.
11. Install the camshaft sprocket retaining bolt hand tight.

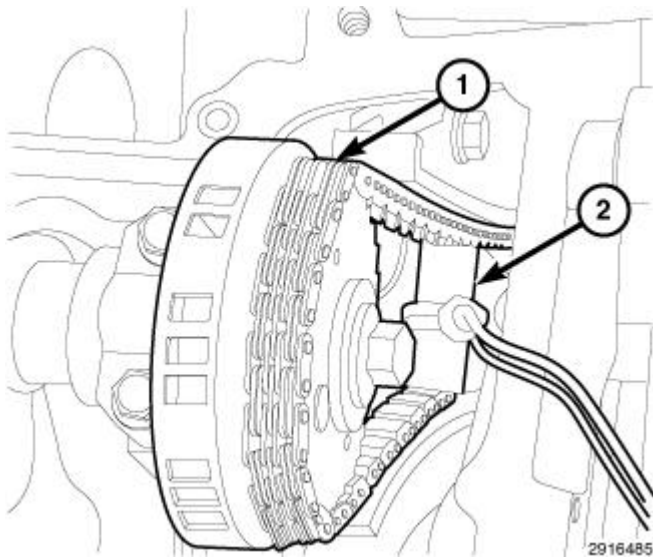


Fig. 109: Positioning Locking Wedge Between Timing Chain
Courtesy of CHRYSLER LLC

12. Remove the timing chain (1) Locking Wedge 9867 (2).

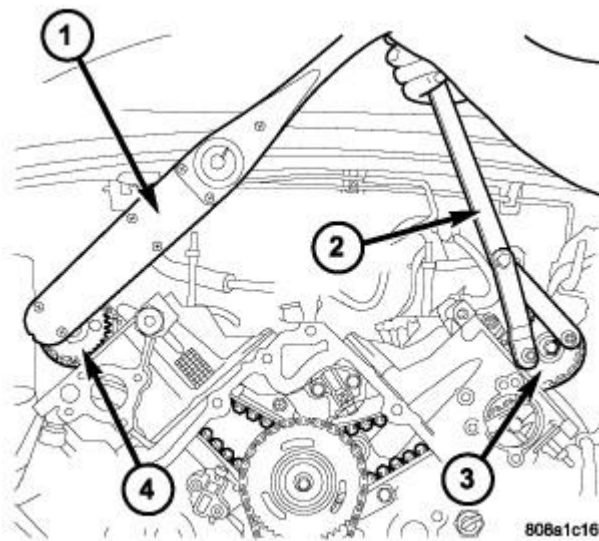


Fig. 110: Tightening Right Side Cam Sprocket Retaining Bolt
 Courtesy of CHRYSLER LLC

13. Using Spanner Wrench 6958 (2) with Adapter Pins 8346, secure the camshaft sprocket (3) and tighten the retaining bolt (1) to 122 N.m (90 ft. lbs.).

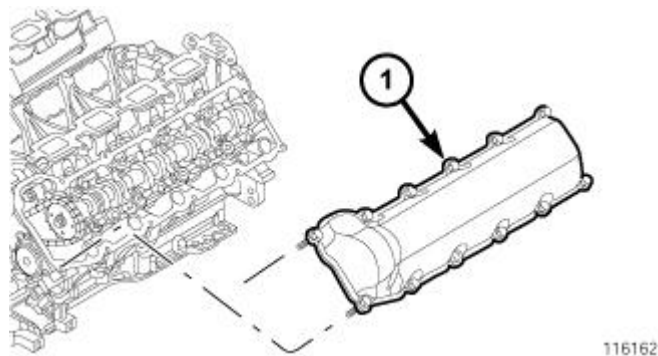


Fig. 111: Cylinder Head Cover-Left
 Courtesy of CHRYSLER LLC

14. Install the cylinder head cover (1). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation.**

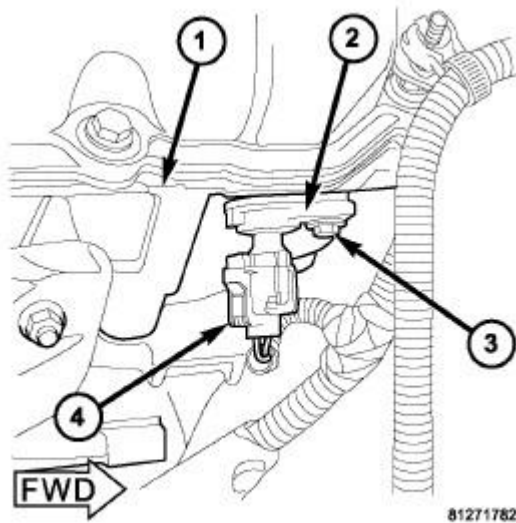


Fig. 112: CMP Sensor - 4.7L Engine
Courtesy of CHRYSLER LLC

NOTE: Before installing the CMP sensor into the cylinder head, the machined hole must be clean of any dirt or debris.

15. Clean machined hole in the cylinder head (1).
16. Apply a small amount of engine oil to CMP sensor O-ring.
17. Install the CMP sensor (2) into the cylinder head with a slight rocking motion. Do not twist sensor into position as damage to O-ring may result.

CAUTION: Before tightening sensor mounting bolt, be sure sensor is completely flush to cylinder head. If sensor is not flush, damage to sensor mounting tang may result.

18. Install the retaining bolt (3) and tighten to 12 N.m (9 ft. lbs.).
19. Connect the electrical connector (4) to the CMP sensor.

INSTALLATION - LEFT CAMSHAFT

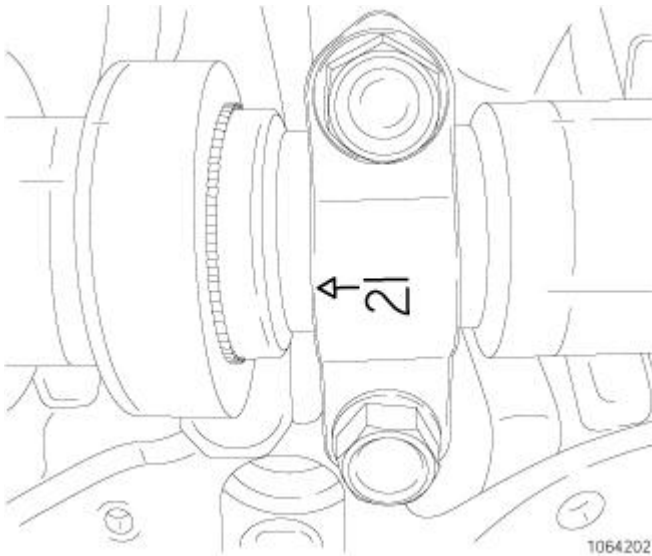


Fig. 113: Positioning Camshaft Cap Arrow Toward Front Of Engine
Courtesy of CHRYSLER LLC

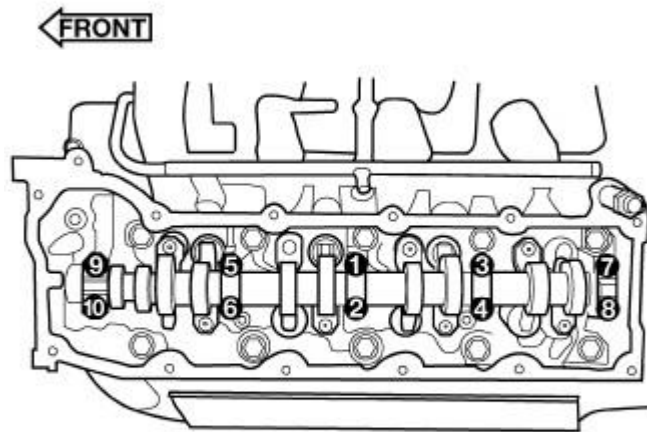
1. Lubricate the camshaft journals with clean engine oil.

NOTE: Position the left side camshaft so that the camshaft sprocket dowel is near the 1 o'clock position, this will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

2. Install the camshaft into the cylinder head while aligning the camshaft sprocket dowel near the 1 o'clock position.

NOTE: The camshaft caps are marked for location. The arrow must point to the front of the engine.

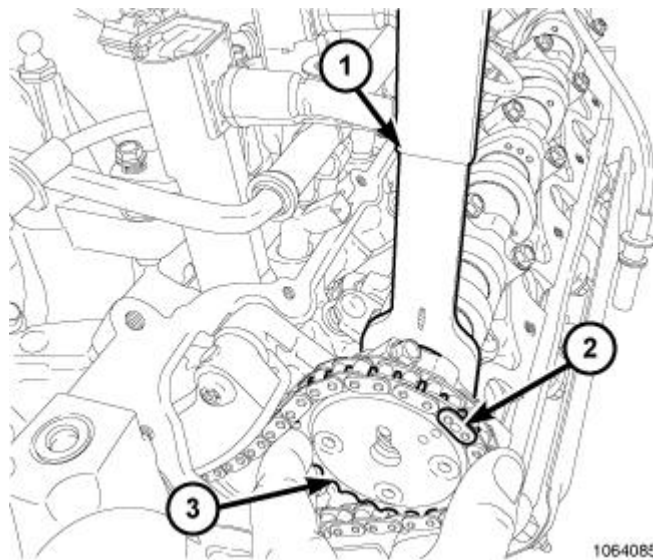
3. Install the camshaft bearing caps in the same position as noted during removal.
4. Install the camshaft bearing cap retaining bolts hand tight.



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Fig. 114: Camshaft Bearing Caps Tightening Sequence
Courtesy of CHRYSLER LLC

5. Using the sequence shown in illustration, working in 1/2 turn increments, tighten the bearing cap retaining bolts to 11 N.m (8 ft. lbs.).
6. Check the camshaft end play. See **Engine/Cylinder Head/CAMSHAFT, Engine - Standard Procedure.**



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Fig. 115: Removing/Installing Camshaft Holder On Camshaft
Courtesy of CHRYSLER LLC

7. Position the camshaft drive gear into the timing chain while aligning the two dots on the camshaft

sprocket with the chain link (2) marked during removal.

8. Using Camshaft Holder 8428A (1), rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket.
9. Position the sprocket onto the camshaft.

CAUTION: Remove excess oil from the camshaft sprocket retaining bolt, failure to do so can cause bolt over-torque resulting in bolt failure.

10. Remove excess oil from the camshaft sprocket retaining bolt.
11. Install the camshaft sprocket retaining bolt hand tight.

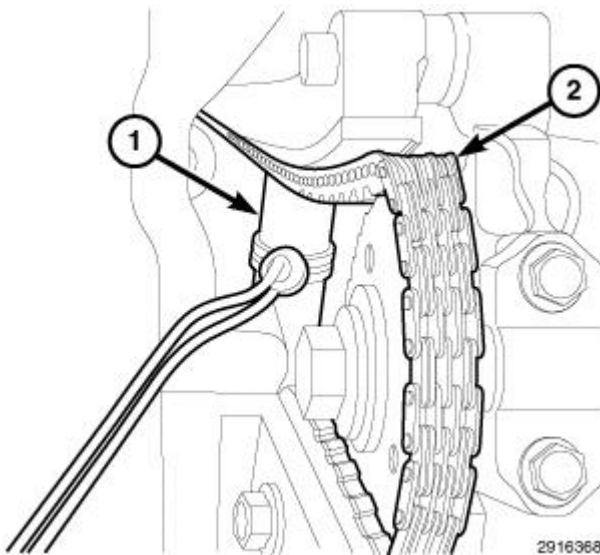


Fig. 116: Positioning Locking Wedge Between Timing Chain Strands
Courtesy of CHRYSLER LLC

12. Remove the timing chain (2) Locking Wedge 9867 (1).

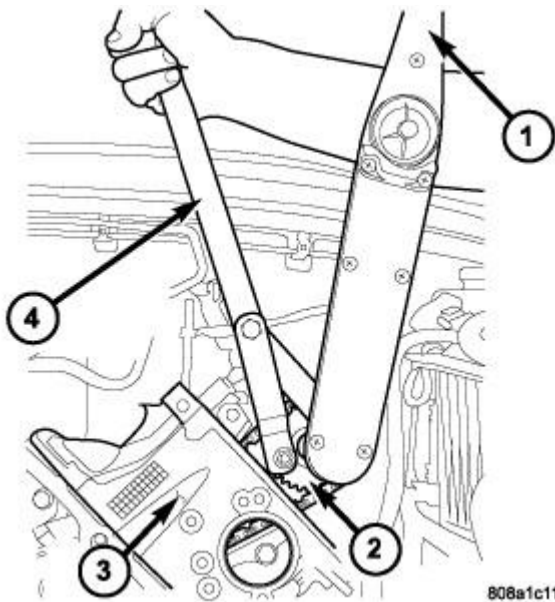


Fig. 117: Tightening Left Side Cam Sprocket Retaining Bolt
Courtesy of CHRYSLER LLC

13. Using Spanner Wrench 6958 (4) with Adapter Pins 8346, secure the camshaft sprocket (2) and tighten the retaining bolt (1) to 122 N.m (90 ft. lbs.).

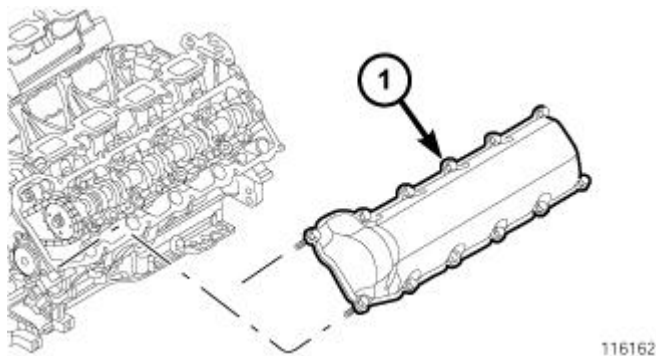


Fig. 118: Cylinder Head Cover - Left
Courtesy of CHRYSLER LLC

14. Install the cylinder head cover (1). See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation.**

COVER(S), CYLINDER HEAD

Description

DESCRIPTION

The cylinder head covers are made of injection molded thermo-set plastic, and are not interchangeable from side-to-side. It is imperative that nothing rest on the cylinder head covers. Prolonged contact with other items may wear a hole in the cylinder head cover.

Removal

RIGHT SIDE

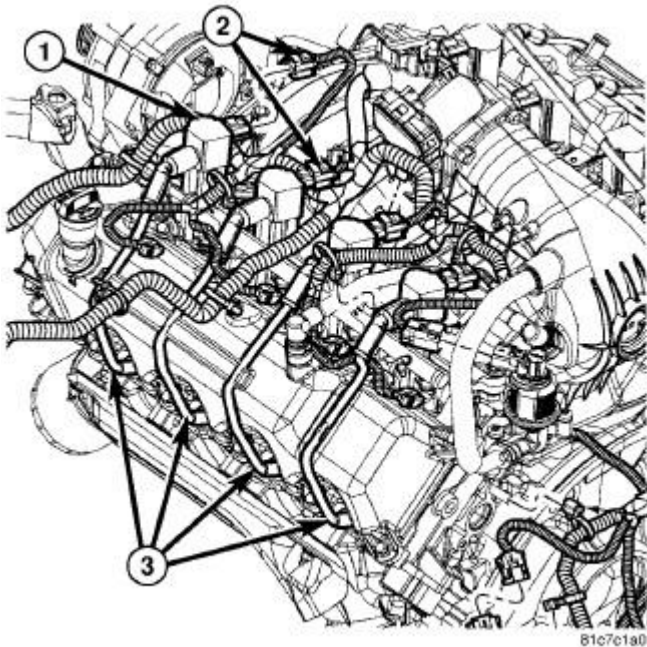


Fig. 119: IGNITION COIL - 4.7L
Courtesy of CHRYSLER LLC

1. Disconnect battery negative cable.
2. Remove air cleaner assembly, resonator assembly and air inlet hose.
3. Drain cooling system. Refer to **Cooling - Standard Procedure**.
4. Remove accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal**.
5. Remove air conditioning compressor retaining bolts and move compressor to the left.
6. Remove heater hoses.
7. Disconnect and remove positive crankcase ventilation (PCV) hose.
8. Remove oil fill tube.
9. Remove spark plug wires (3).
10. Remove right rear breather tube and filter assembly.
11. Remove cylinder head cover retaining bolts.
12. Remove cylinder head cover.

NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.

LEFT SIDE

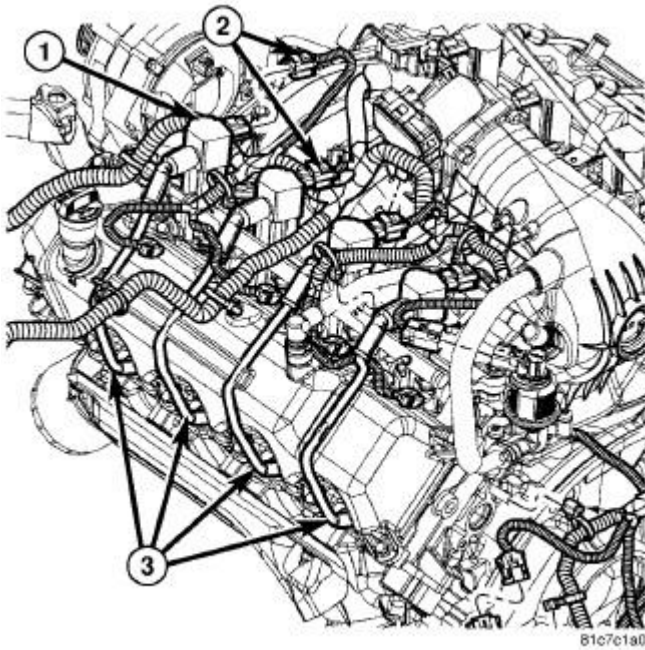


Fig. 120: IGNITION COIL - 4.7L

Courtesy of CHRYSLER LLC

1. Disconnect negative cable from battery.
2. Remove the resonator assembly and air inlet hose.
3. Remove the spark plug wires (3).
4. Route injector harness in front of cylinder head cover.
5. Disconnect the left side breather tube and remove the breather tube.
6. Remove the cylinder head cover mounting bolts.
7. Remove cylinder head cover and gasket.

NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.

Cleaning

CLEANING

Clean cylinder head cover gasket surface.

Clean head rail, if necessary.

Installation

RIGHT SIDE

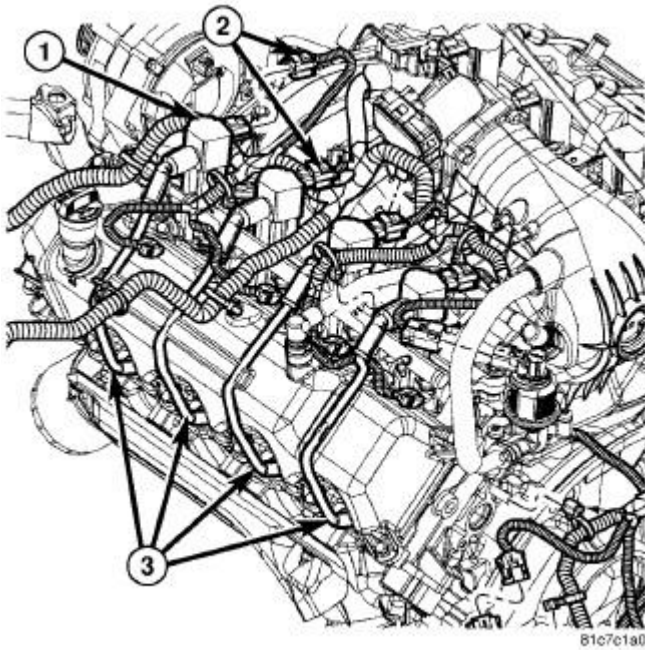


Fig. 121: IGNITION COIL - 4.7L

Courtesy of CHRYSLER LLC

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.

1. Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.
2. Install cylinder head cover and hand start all fasteners.
3. Tighten cylinder head cover bolts and double ended studs to 12 N.m (105 in. lbs).
4. Install right rear breather tube and filter assembly.
5. Install spark plug wires (3).
6. Install the oil fill tube.
7. Install PCV hose.
8. Install heater hoses.
9. Install air conditioning compressor retaining bolts.
10. Install accessory drive belt. Refer to Cooling/Accessory Drive/BELT, Serpentine - Installation .
11. Fill Cooling system. Refer to Cooling - Standard Procedure .
12. Install air cleaner assembly, resonator assembly and air inlet hose.
13. Connect battery negative cable.

LEFT SIDE

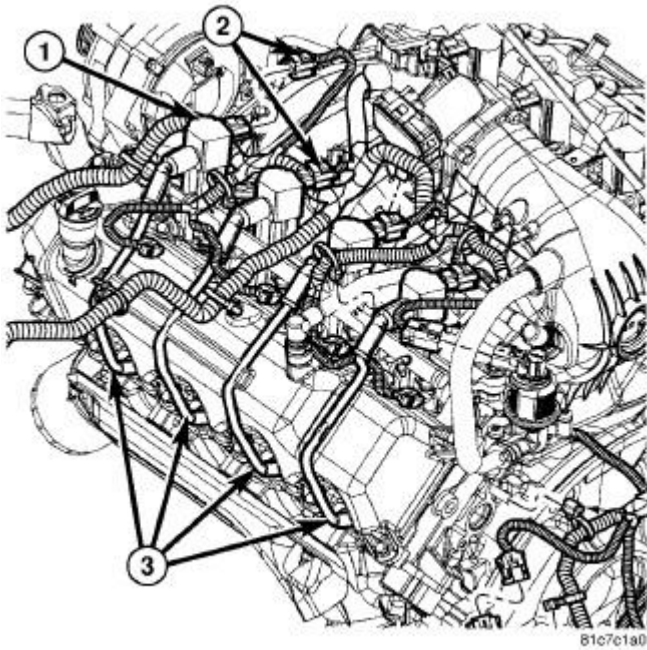


Fig. 122: IGNITION COIL - 4.7L
Courtesy of CHRYSLER LLC

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.

1. Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.
2. Install cylinder head cover and hand start all fasteners. Verify that all studs are in the correct location as shown in illustration.
3. Tighten cylinder head cover bolts and double ended studs to 12 N.m (105 in. lbs.).
4. Install left side breather and connect breather tube.
5. Install the spark plug wires (3).
6. Install the resonator and air inlet hose.
7. Connect negative cable to battery.

ROCKER ARM, VALVE

Description

DESCRIPTION

The rocker arms are steel stampings with an integral roller bearing. The rocker arms incorporate an 0.5 mm (0.019 inch) oil hole in the ball socket for roller and camshaft lubrication.

Diagnosis and Testing

HYDRAULIC LASH ADJUSTER

A tappet-like noise may be produced from several items. Check the following items.

1. Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.
2. Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.
3. Turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.
4. Low oil pressure.
5. The oil restrictor in cylinder head gasket or the oil passage to the cylinder head is plugged with debris.
6. Air ingested into oil due to broken or cracked oil pump pick up.
7. Worn valve guides.
8. Rocker arm ears contacting valve spring retainer.
9. Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.
10. Oil leak or excessive cam bore wear in cylinder head.
11. Faulty lash adjuster.
 - a. Check lash adjusters for sponginess while installed in cylinder head and cam on camshaft at base circle. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Spongy adjusters can be bottomed out easily.
 - b. Remove suspected lash adjusters, and replace.
 - c. Before installation, make sure adjusters are at least partially full of oil. This can be verified by little or no plunger travel when lash adjuster is depressed.

Removal**REMOVAL**

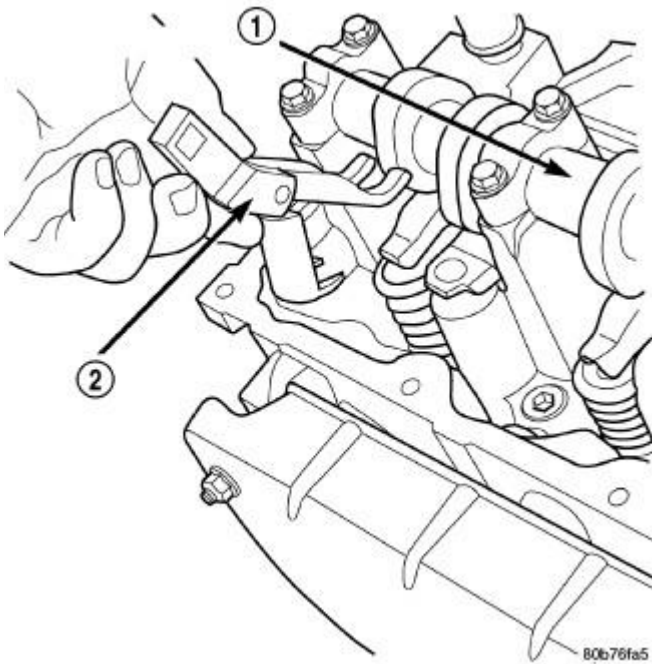


Fig. 123: Rocker Arm Removal/Installation
Courtesy of CHRYSLER LLC

1 - CAMSHAFT
2 - VALVE SPRING COMPRESSOR 10102

NOTE: **Disconnect the battery negative cable to prevent accidental starter engagement.**

1. Remove the cylinder head cover. See Engine/Cylinder Head/COVER(S), Cylinder Head - Removal.
2. For rocker arm removal on cylinders 3 and 5 Rotate the crankshaft until cylinder #1 is at TDC exhaust stroke.
3. For rocker arm removal on cylinders 2 and 8 Rotate the crankshaft until cylinder #1 is at TDC compression stroke.
4. For rocker arm removal on cylinders 4 and 6 Rotate the crankshaft until cylinder #3 is at TDC compression stroke.
5. For rocker arm removal on cylinders 1 and 7 Rotate the crankshaft until cylinder #2 is at TDC compression stroke.
6. Using special tool 8516A Rocker Arm Remover (2), press downward on the valve spring, remove rocker arm.

Installation

INSTALLATION

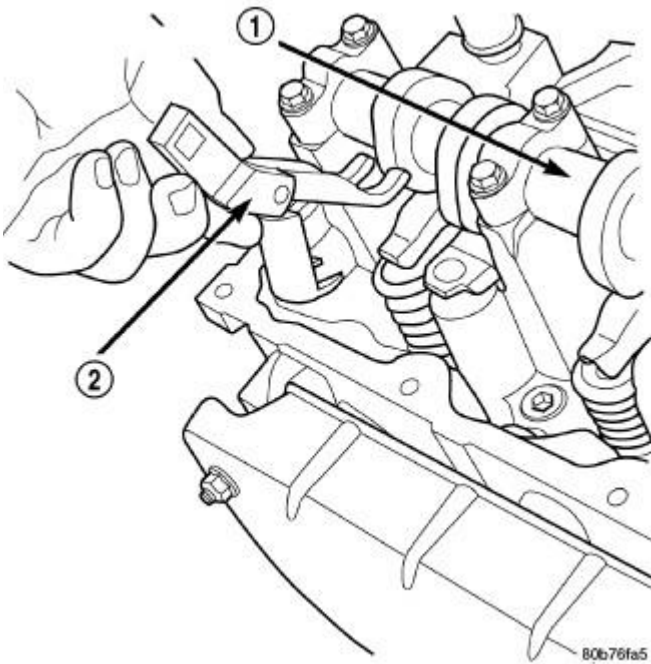


Fig. 124: Rocker Arm Removal/Installation
Courtesy of CHRYSLER LLC

1 - CAMSHAFT
2 - VALVE SPRING COMPRESSOR 10102

CAUTION: Make sure the rocker arms are installed with the concave pocket over the lash adjusters. Failure to do so may cause severe damage to the rocker arms and/or lash adjusters.

NOTE: Coat the rocker arms with clean engine oil prior to installation.

1. For rocker arm installation on cylinders 3 and 5 Rotate the crankshaft until cylinder #1 is at TDC exhaust stroke.
2. For rocker arm installation on cylinders 2 and 8 Rotate the crankshaft until cylinder #1 is at TDC compression stroke.
3. For rocker arm installation on cylinders 4 and 6 Rotate the crankshaft until cylinder #3 is at TDC compression stroke.
4. For rocker arm installation on cylinders 1 and 7 Rotate the crankshaft until cylinder #2 is at TDC compression stroke.
5. Using valve spring compressor 10102 press downward on the valve spring, install rocker arm.
6. Install the cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation.**

SEAL(S), VALVE GUIDE

Description**DESCRIPTION**

The valve stem seals are made of rubber and incorporate an integral steel valve spring seat. The integral garter spring maintains consistent lubrication control to the valve stems.

Removal**REMOVAL**

The valve stem seal is integral with the valve spring seat. For removal, see **Engine/Cylinder Head/SPRING(S), Valve - Removal**.

Installation**INSTALLATION**

The valve stem seal is integral with the valve spring seat. For installation, see **Engine/Cylinder Head/SPRING(S), Valve - Installation**.

SPRING(S), VALVE**Description****DESCRIPTION**

The valve springs are made from high strength chrome silicon steel. The springs are common for intake and exhaust applications. The valve spring seat is integral with the valve stem seal, which is a positive type seal to control lubrication.

Removal**REMOVAL**

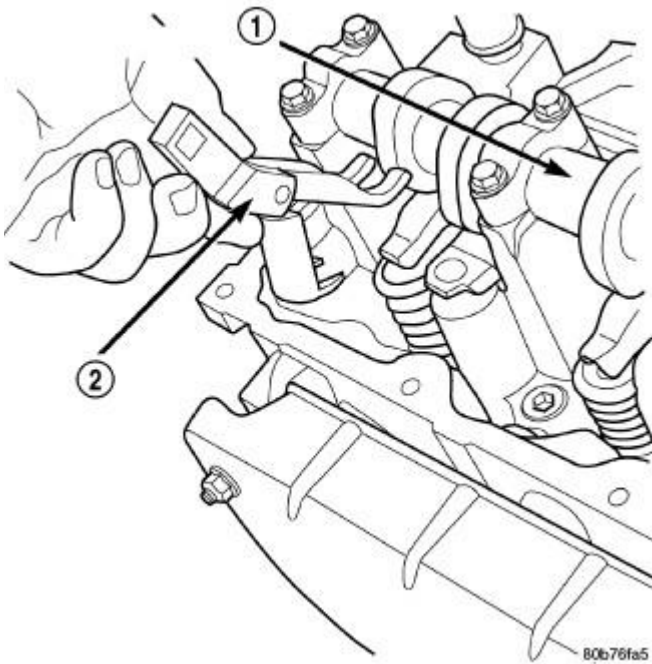


Fig. 125: Rocker Arm Removal/Installation
Courtesy of CHRYSLER LLC

1 - CAMSHAFT

2 - VALVE SPRING COMPRESSOR 10102

1. Remove the cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
2. Using Valve Spring Compressor 10102 (2), remove the rocker arms and the hydraulic lash adjusters.
3. Remove the spark plug for the cylinder the valve spring and seal are to be removed from.
4. Apply shop air to the cylinder to hold the valves in place when the spring is removed

NOTE: All eight valve springs and seals are removed in the same manner; this procedure only covers one valve seal and valve spring.

5. Using Valve Spring Compressor 10102, compress the valve spring.

NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.

6. Remove the two spring retainer lock halves.

NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

7. Remove the valve spring compressor.

8. Remove the spring retainer, and the spring.
9. Remove the valve stem seal.

Installation

INSTALLATION

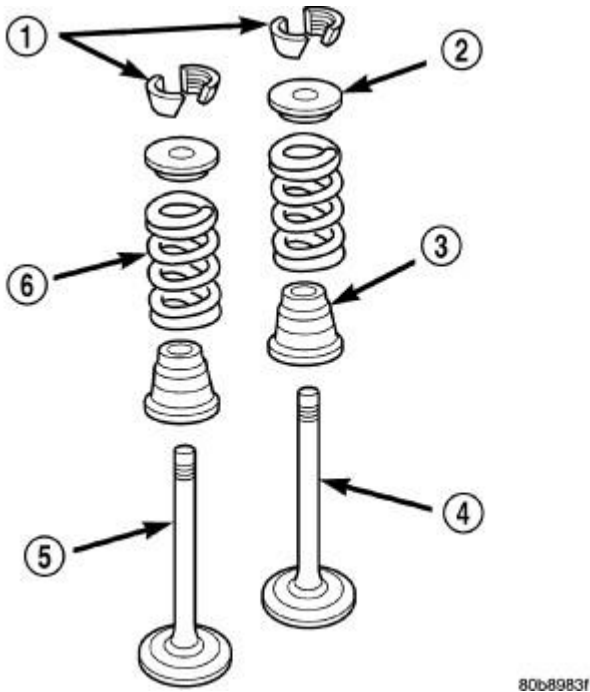


Fig. 126: Valve Assembly Configuration

Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - VALVE LOCKS (3-BEAD)
2 - RETAINER
3 - VALVE STEM OIL SEAL
4 - INTAKE VALVE
5 - EXHAUST VALVE
6 - VALVE SPRING |
|--|

1. Coat the valve stem with clean engine oil and install the valve stem seal. Make sure the seal is fully seated and that the garter spring at the top of the seal is intact.
2. Install the spring (6) and the spring retainer (2).
3. Using Valve Spring Compressor 10102, compress the spring and install the two valve spring retainer halves.
4. Release the valve spring compressor and make sure the two spring retainer halves and the spring retainer are fully seated.
5. Position the hydraulic lash adjusters and rocker arms.
6. Install the cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation.**

7. Install spark plugs and plug wires.

VALVES, INTAKE AND EXHAUST

Description

DESCRIPTION

The valves are made of heat resistant steel and have chrome plated stems to prevent scuffing. Each valve is actuated by a roller rocker arm which pivots on a stationary lash adjuster. All valves use three bead lock keepers to retain the springs and promote valve rotation.

Standard Procedure

REFACING

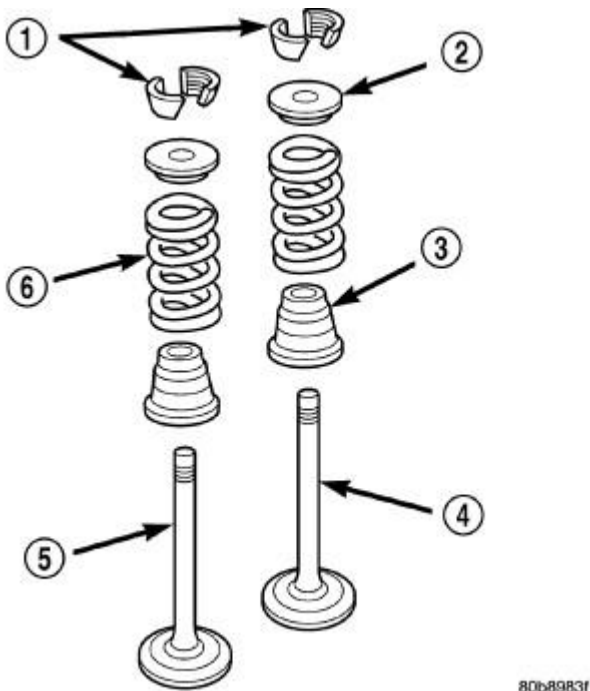


Fig. 127: Valve Assembly Configuration
Courtesy of CHRYSLER LLC

- 1 - VALVE LOCKS (3-BEAD)
- 2 - RETAINER
- 3 - VALVE STEM OIL SEAL
- 4 - INTAKE VALVE
- 5 - EXHAUST VALVE
- 6 - VALVE SPRING

NOTE: Valve seats that are worn or burned can be reworked, provided that correct

angle and seat width are maintained. Otherwise the cylinder head must be replaced.

NOTE: When refacing valves (4) and valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.

1. Using a suitable dial indicator measure the center of the valve seat. Total run out must not exceed 0.051 mm (0.002 in.).
2. Apply a small amount of Prussian blue to the valve seat, insert the valve into the cylinder head, while applying light pressure on the valve rotate the valve. Remove the valve and examine the valve face. If the blue is transferred below the top edge of the valve face, lower the valve seat using a 15 degree stone. If the blue is transferred to the bottom edge of the valve face, raise the valve seat using a 65 degree stone.
3. When the seat is properly positioned the width of the intake seat must be 1.75 - 2.36 mm (0.0689 - 0.0928 in.) and the exhaust seat must be 1.71 - 2.32 mm (0.0673 - 0.0911 in.).
4. Check the valve spring (6) installed height after refacing the valve and seat. The installed height for both intake and exhaust valve springs must not exceed 40.74 mm (1.6039 in.).
5. The valve seat and valve face must maintain a face angle of 44.5 - 45 ° angle.

ENGINE BLOCK

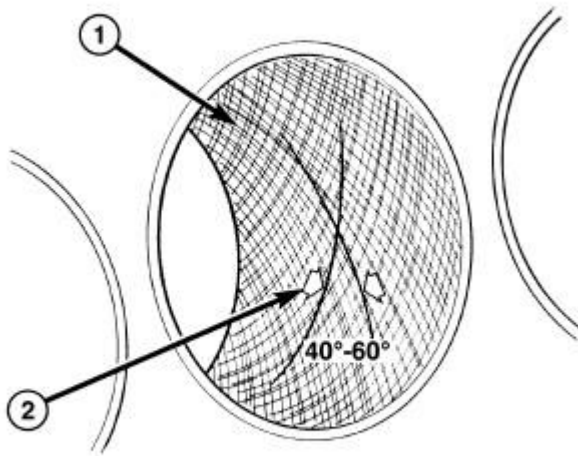
DESCRIPTION

DESCRIPTION

The cylinder block is made of cast iron. The block is a closed deck design with the left bank forward. To provide high rigidity and improved NVH an enhanced compacted graphite bedplate is bolted to the block. The block design allows coolant flow between the cylinders bores, and an internal coolant bypass to a single poppet inlet thermostat is included in the cast aluminum front cover.

STANDARD PROCEDURE

CYLINDER BORE HONING



80861d41

Fig. 128: CYLINDER BORE CROSSHATCH PATTERN
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - CROSSHATCH PATTERN
2 - INTERSECT ANGLE |
|---|

Before honing, stuff plenty of clean shop towels under the bores and over the crankshaft to keep abrasive materials from entering the crankshaft area.

1. Used carefully, the Cylinder Bore Sizing Hone C-823, equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round, as well as removing light scuffing, scoring and scratches. Usually, a few strokes will clean up a bore and maintain the required limits.

CAUTION: DO NOT use rigid type hones to remove cylinder wall glaze.

2. Deglazing of the cylinder walls may be done if the cylinder bore is straight and round. Use a cylinder surfacing hone, Honing Tool C-3501, equipped with 280 grit stones (C-3501-3810). about 20-60 strokes, depending on the bore condition, will be sufficient to provide a satisfactory surface. Using honing oil C-3501-3880, or a light honing oil, available from major oil distributors.

CAUTION: DO NOT use engine or transmission oil, mineral spirits, or kerosene.

3. Honing should be done by moving the hone up and down fast enough to get a crosshatch pattern (1). The hone marks should INTERSECT at 50° to 60° for proper seating of rings (2).

4. A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle. The number of up and down strokes per minute can be regulated to get the desired 50° to 60° angle. Faster up and down strokes increase the crosshatch angle.
5. After honing, it is necessary that the block be cleaned to remove all traces of abrasive. Use a brush to wash parts with a solution of hot water and detergent. Dry parts thoroughly. Use a clean, white, lint-free cloth to check that the bore is clean. Oil the bores after cleaning to prevent rusting.

CLEANING

CLEANING

Thoroughly clean the oil pan and engine block gasket surfaces.

Use compressed air to clean out:

- The galley at the oil filter adaptor hole.
- The front and rear oil galley holes.
- The feed holes for the crankshaft main bearings.

Once the block has been completely cleaned, apply Loctite PST pipe sealant with Teflon 592 to the threads of the front and rear oil galley plugs. Tighten the plugs to 34 N.m (25 ft. lbs.) torque.

BEARING(S), CONNECTING ROD

Standard Procedure

CONNECTING ROD BEARING FITTING

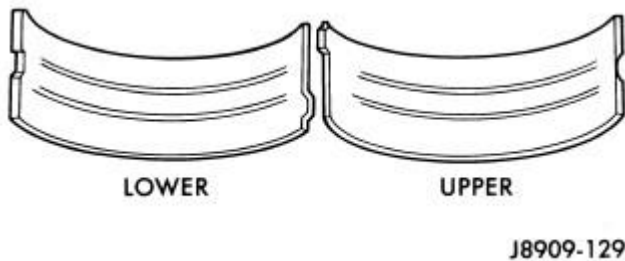


Fig. 129: Inspecting Connecting Rod Bearing
 Courtesy of CHRYSLER LLC

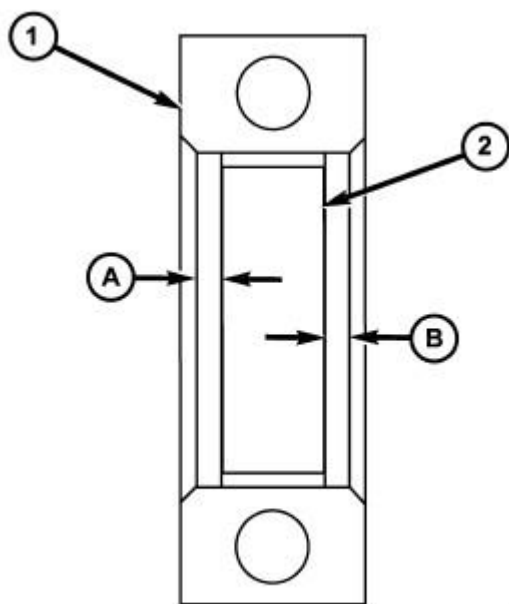
Inspect the connecting rod bearings for scoring. Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting. Replace any bearing that shows abnormal wear.

Inspect the connecting rod journals for signs of scoring, nicks and burrs.

Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod alignment.

Replace misaligned, bent or twisted connecting rods.

1. Wipe the oil from the connecting rod journal.



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Fig. 130: Bearing Insert Location
Courtesy of CHRYSLER LLC

1 - Connecting Rod 2 - Bearing Insert - A, B less than .50 mm (.0196 in.)

2. Lubricate the upper bearing insert (2) and install in connecting rod (1). **Center bearing insert (2) in connecting rod.**

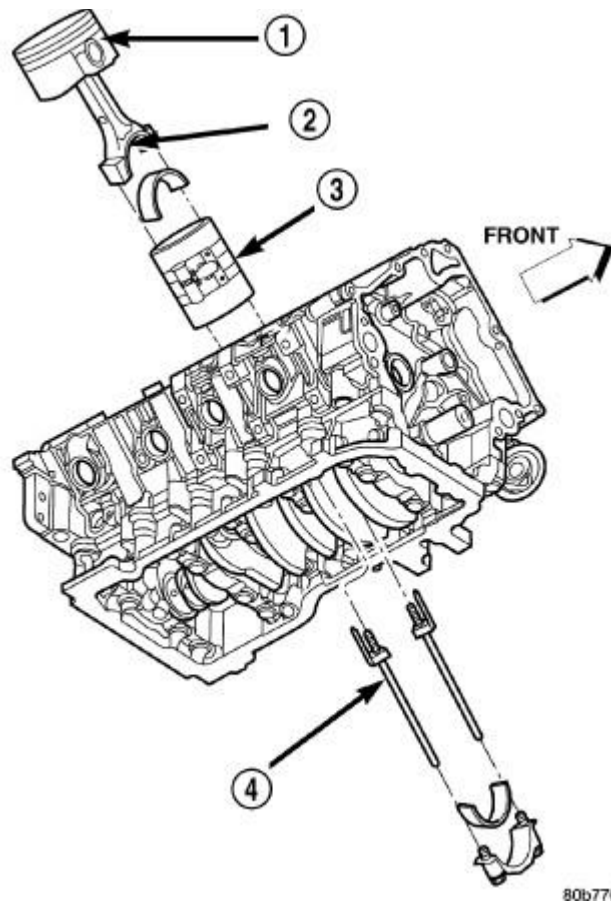
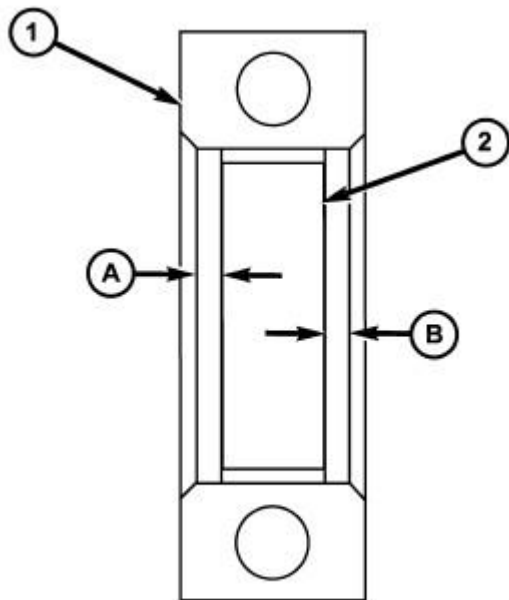


Fig. 131: Piston and Connecting Rod - Installation
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - "F" TOWARD FRONT OF ENGINE
2 - OIL SLINGER SLOT
3 - RING COMPRESSOR
4 - SPECIAL TOOL 8507 |
|--|

3. Use piston ring compressor (3) and Guide Pins Special Tool 8507 (4) to install the rod and piston assemblies. The oil slinger slots in the rods must face front of the engine. The "F"s near the piston wrist pin bore should point to the front of the engine.

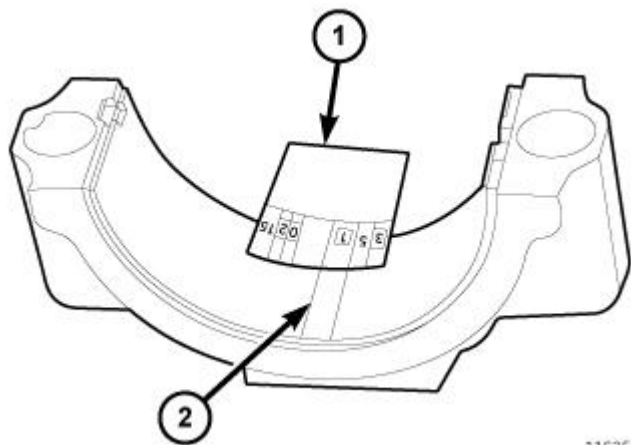


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Fig. 132: Bearing Insert Location
Courtesy of CHRYSLER LLC

1 - Connecting Rod
2 - Bearing Insert
- A, B less than .50 mm (.0196 in.)

4. Install the lower bearing insert in the bearing cap **Center bearing insert (2) in connecting rod (1)**. . The lower insert must be dry. Place strip of Plastigage across full width of the lower insert at the center of bearing cap. Plastigage must not crumble in use. If brittle, obtain fresh stock.



116256

Fig. 133: Measuring Bearing Clearance with Plastigage
Courtesy of CHRYSLER LLC

5. Install bearing cap and connecting rod on the journal and tighten bolts to 27 N.m (20 ft. lbs.) plus a 90° turn. DO NOT rotate crankshaft. Plastigage will smear, resulting in inaccurate indication.
6. Remove the bearing cap and determine amount of bearing-to-journal clearance by measuring the width of compressed Plastigage (2). Refer to Engine **SPECIFICATIONS** for the proper clearance. **Plastigage should indicate the same clearance across the entire width of the insert. If the clearance varies, it may be caused by either a tapered journal, bent connecting rod or foreign material trapped between the insert and cap or rod.**
7. If the correct clearance is indicated, replacement of the bearing inserts is not necessary. Remove the Plastigage (2) from crankshaft journal and bearing insert. Proceed with installation.

Bearing Mark	SIZE	USED WITH JOURNAL SIZE
025 US	025 mm	50.983-50.967 mm
-	(.001 in.)	(2.0073-2.0066 in.)
Std.	STANDARD	50.992-51.008 mm (2.0076-2.0082 in.)
250 US	250 mm (.010 in.)	50.758-50.742 mm (1.9984-1.9978 in.)

8. If bearing-to-journal clearance exceeds the specification, determine which service bearing set to use, using the chart above.

CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.

9. Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.
10. Once you have selected the proper insert, install the insert and cap. Tighten the connecting rod bolts to 27 N.m (20 ft. lbs.) plus a 90° turn.

Slide snug-fitting feeler gauge between the connecting rod and crankshaft journal flange. Refer to Engine **SPECIFICATIONS** for the proper clearance. Replace the connecting rod if the side clearance is not within specification.

BEARING(S), CRANKSHAFT, MAIN

Standard Procedure

CRANKSHAFT MAIN BEARING - FITTING

MAIN BEARING JOURNAL DIAMETER (CRANKSHAFT REMOVED)

Crankshaft removed from the cylinder block.

Clean the oil off the main bearing journal.

Determine the maximum diameter of the journal with a micrometer. Measure at two locations 90° apart at each end of the journal.

The maximum allowable taper is 0.008 mm (0.0004 inch.) and maximum out of round is 0.005 mm (0.002 inch). Compare the measured diameter with the journal diameter specification (Main Bearing Fitting Chart). Select inserts required to obtain the specified bearing-to-journal clearance.

CRANKSHAFT MAIN BEARING SELECTION

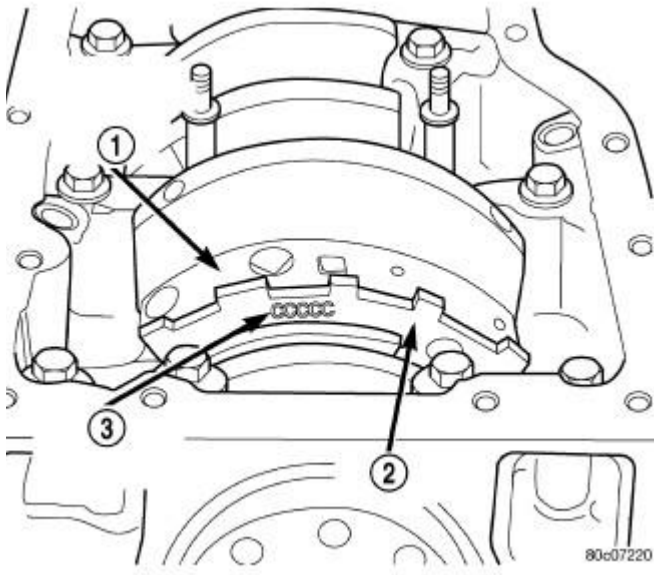


Fig. 134: Main Bearing Markings on Target Wheel
Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - REARMOST CRANKSHAFT COUNTER WEIGHT |
| 2 - TARGET WHEEL |
| 3 - MAIN BEARING SELECT FIT MARKINGS |

The main bearings are "select fit" to achieve proper oil clearances. For main bearing selection, the crankshaft position sensor target wheel has grade identification marks stamped into it (3). These marks are read from left to right, corresponding with journal number 1, 2, 3, 4 and 5. The crankshaft position sensor target wheel (2) is mounted to the number 8 counter weight (1) on the crankshaft.

NOTE: Service main bearings are coded. These codes identify what size (grade) the bearing is.

MAIN BEARING SELECTION CHART - 4.7L		
GRADE MARKING	SIZE mm (in.) JOURNAL SIZE	FOR USE WITH
A	0.008 mm U/S	63.488-63.496 mm
-	(0.0004 in.) U/S	(2.4996-2.4999 in.)

2010 Dodge Dakota

2010 ENGINE 4.7L - Service Information - Dakota

B	NOMINAL	63.496-63.504 mm (2.4999-2.5002 in.)
-	-	
C	0.008 mm O/S (0.0004 in.) O/S	63.504-63.512 mm (2.5002-2.5005 in.)
-		

Inspection

INSPECTION

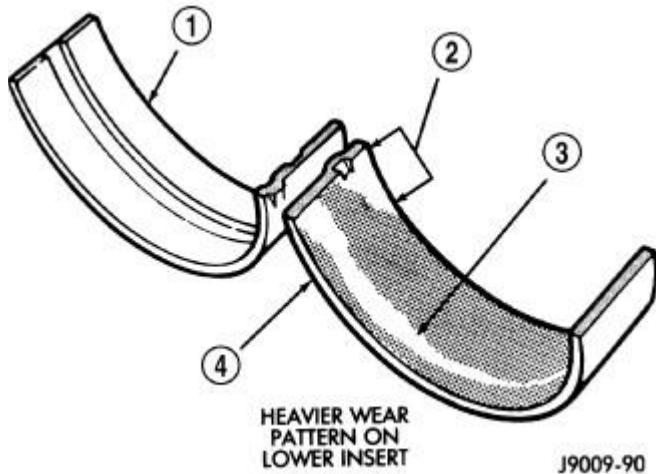


Fig. 135: Main Bearing Wear Patterns
Courtesy of CHRYSLER LLC

- | |
|--------------------------------|
| 1 - UPPER INSERT |
| 2 - NO WEAR IN THIS AREA |
| 3 - LOW AREA IN BEARING LINING |
| 4 - LOWER INSERT |

Wipe the inserts clean and inspect for abnormal wear patterns and for metal or other foreign material imbedded in the lining. Normal main bearing insert wear patterns are illustrated.

NOTE: If any of the crankshaft journals are scored, the crankshaft must be repaired or replaced.

Inspect the back of the inserts for fractures, scrapings or irregular wear patterns.

Inspect the upper insert locking tabs for damage.

Replace all damaged or worn bearing inserts.

COVER, STRUCTURAL DUST

Description

DESCRIPTION

The structural dust cover is made of die cast aluminum and joins the lower half of the transmission bell housing to the engine bedplate.

Operation**OPERATION**

The structural cover provides additional powertrain stiffness and reduces noise and vibration.

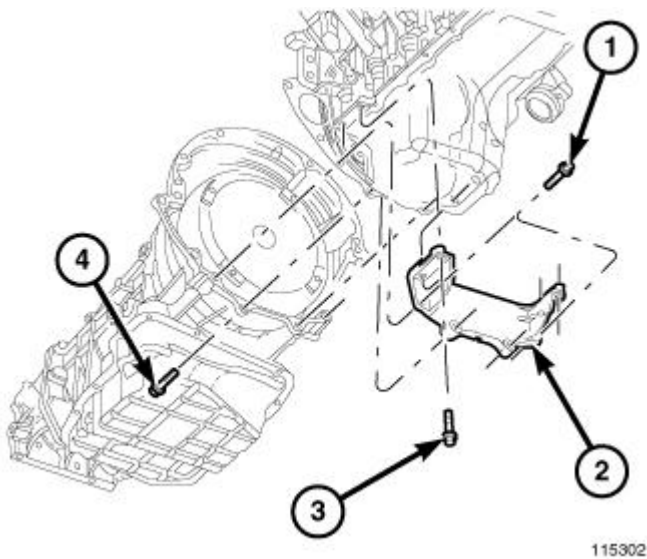
Removal**REMOVAL**

Fig. 136: Structural Cover
Courtesy of CHRYSLER LLC

- 1 - BOLT
- 2 - BOLT
- 3 - BOLT

1. Raise vehicle on hoist.
2. Remove the left hand exhaust pipe from exhaust manifold.
3. Loosen the right hand exhaust manifold-to-exhaust pipe retaining bolts.
4. Remove the eight bolts (1,2,3) retaining structural cover in the sequence shown in illustration.
5. Pivot the exhaust pipe downward and remove the structural cover.

Installation**INSTALLATION**

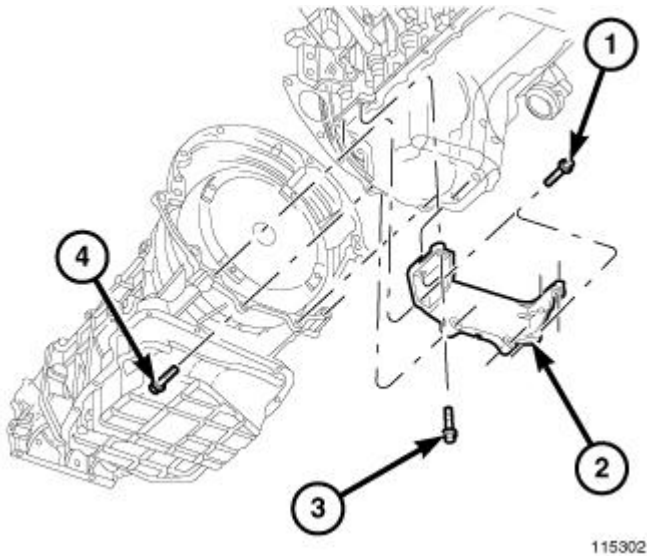


Fig. 137: Structural Cover
Courtesy of CHRYSLER LLC

- | |
|----------|
| 1 - BOLT |
| 2 - BOLT |
| 3 - BOLT |

CAUTION: The structural dust cover must be installed as described in the following steps. Failure to do so may cause severe damage to the cover.

1. Position the structural cover in the vehicle.
2. Install all four bolts retaining the cover-to-engine. DO NOT tighten the bolts at this time.
3. Install the four cover-to-transmission bolts. Do NOT tighten at this time.

CAUTION: The structural dust cover must be held tightly against both the engine and the transmission bell housing during the tightening sequence. Failure to do so may cause severe damage to the cover.

4. Starting with the two rear cover-to-engine bolts, tighten bolts (1) to 54 N.m (40 ft. lbs.), then tighten bolts (2) and (3) to 54 N.m (40 ft. lbs.) in the sequence shown in illustration . See **Fig. 136**.
5. Install the exhaust pipe on left hand exhaust manifold.
6. Tighten exhaust manifold-to-exhaust pipe retaining bolts to 20-26 N.m (15-20 ft. lbs.).

CRANKSHAFT

Description

DESCRIPTION

The crankshaft is constructed of nodular cast iron. The crankshaft is a cross shaped four throw design with eight counterweights for balancing purposes. The crankshaft is supported by five select fit main bearings with the number three serving as the thrust washer location. The main journals of the crankshaft are cross drilled to improve rod bearing lubrication. The number eight counterweight has provisions for crankshaft position sensor target wheel mounting. The select fit main bearing markings are located on the rear side of the target wheel. The crankshaft oil seals are one piece design. The front oil seal is retained in the timing chain cover, and the rear seal is pressed in to a bore formed by the cylinder block and the bedplate assembly.

Removal

REMOVAL

NOTE: To remove the crankshaft from the engine, the engine must be removed from the vehicle.

1. Remove the engine. See Engine - Removal.
2. Remove the engine oil pump. See Engine/Lubrication/PUMP, Engine Oil - Removal.

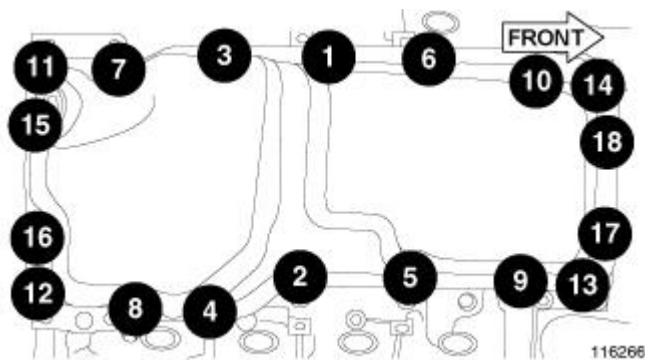


Fig. 138: Oil Pan Tightening Sequence
Courtesy of CHRYSLER LLC

CAUTION: DO NOT pry on the oil pan gasket when removing the oil pan, The oil pan gasket is mounted to the cylinder block in three locations and will remain attached to block when removing oil pan. Gasket can not be removed with oil pan.

3. Remove oil pan. See Engine/Lubrication/PAN, Oil - Removal.
4. Remove the oil pump pickup tube and oil pan gasket/windage tray.
5. Remove the bedplate mounting bolts. Note the location of the three stud bolts for installation.
6. Remove the connecting rods from the crankshaft.

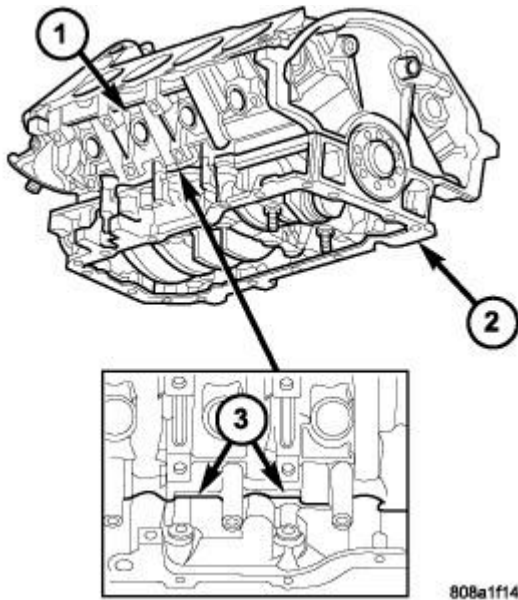


Fig. 139: Bedplate Pry Point Location
Courtesy of CHRYSLER LLC

CAUTION: The bedplate to cylinder block mating surface is a critical sealing surface. Do not pry on or damage this surface in any way.

NOTE: The bedplate contains the lower main bearing halves. Use care when handling bedplate as not to drop or damage bearing halves. Installing main bearing halves in the wrong position will cause severe damage to the crankshaft.

NOTE: The bedplate has pry points cast into it. Use these points only. The pry points are on both the left and right sides, only the left side is shown in illustration.

7. Carefully pry on the pry points (3) to loosen the bedplate (2) then remove the bedplate.

CAUTION: When removing the crankshaft, use care not to damage bearing surfaces on the crankshaft.

8. Remove the crankshaft.

Inspection

INSPECTION

NOTE: Thoroughly inspect the connecting rod bearing bores and main bearing bores for scoring, blueing or severe scratches. Further disassembly may be required.

If connecting rod bearing bores show damage, the cylinder heads must be removed to service the piston and rod assemblies. If the bedplate or the cylinder block main bearing bores show damage the engine must be replaced.

1. If required, remove the main bearing halves from the cylinder block and bedplate.
2. Thoroughly clean the bedplate to cylinder block sealing surfaces and main bearing bores. Remove all oil and sealant residue.
3. Inspect the bedplate main bearing bores for cracks, scoring or severe blueing. If either condition exists the engine must be replaced.
4. Inspect the crankshaft thrust washers for scoring, scratches, wear or blueing. If either condition exist replace the thrust washer.
5. Inspect the oil pan gasket/windage tray for splits, tears or cracks in the gasket sealing surfaces. Replace gasket as necessary.

Installation

INSTALLATION

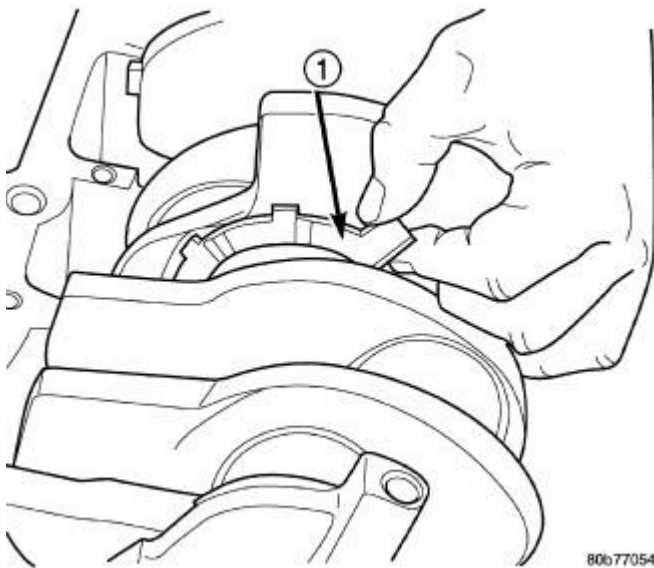


Fig. 140: Crankshaft Thrust Washer Installation
Courtesy of CHRYSLER LLC

CAUTION: Main bearings are select fit. See Engine/Engine Block/BEARING(S), Crankshaft - Standard Procedure for proper bearing selections.

1. Lubricate upper main bearing halves with clean engine oil.

CAUTION: When installing crankshaft, use care not to damage bearing surfaces on the crankshaft.

2. Position crankshaft in cylinder block.
3. Install the thrust washers (1).

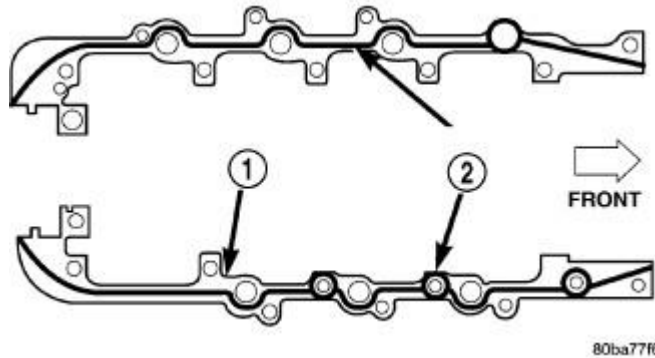


Fig. 141: Cylinder Block-to-Bedplate Sealant Bead Location
Courtesy of CHRYSLER LLC

CAUTION: The bedplate to cylinder block mating surface must be coated with sealant prior to installation. Failure to do so will cause severe oil leaks.

NOTE: The parts must assembled and tightened within 10 after applying sealer.

NOTE: Make sure that the bedplate and cylinder block sealing surfaces are clean and free of oil or other contaminants. Contaminants on the sealing surfaces may cause main bearing distortion and/or oil leaks.

4. Apply a 2.5 mm (0.100 inch) bead of Mopar® Silicone Rubber RTV (2) to the cylinder block-to-bedplate mating surface (1) as shown in illustration.
5. Coat the crankshaft main bearing journals with clean engine oil and position the bedplate onto the cylinder block.

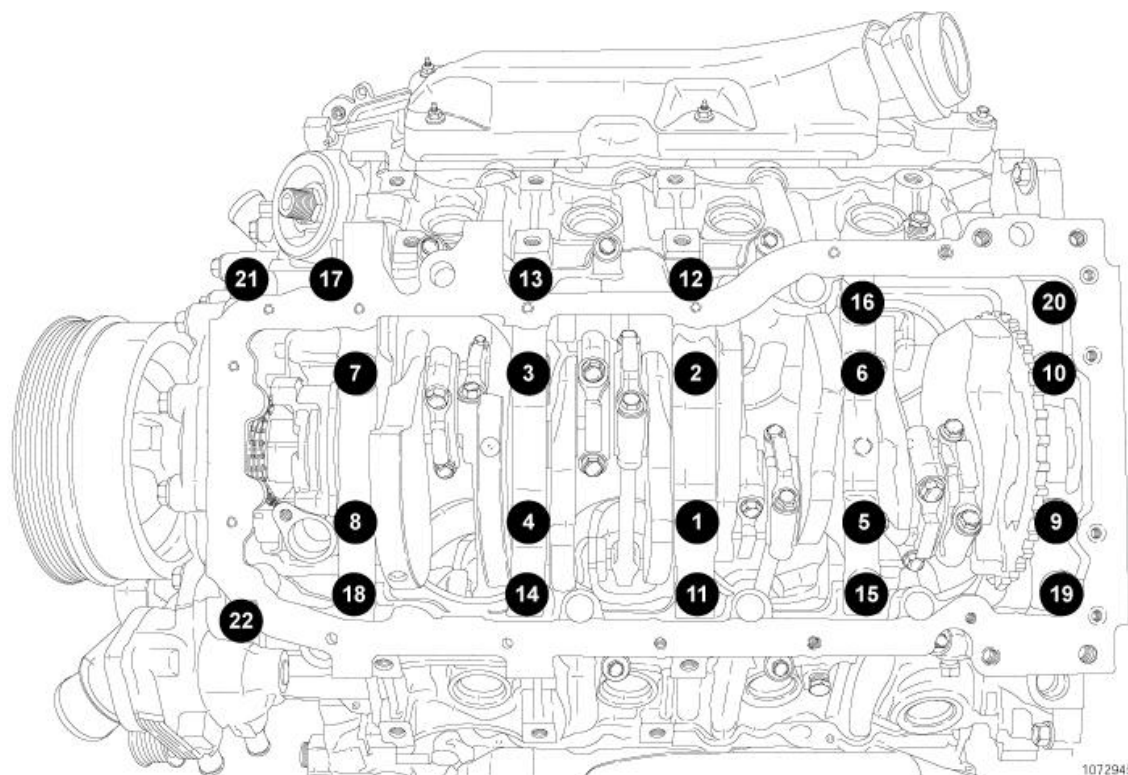


Fig. 142: Tightening Bedplate Bolts (1 Of 4)

Courtesy of CHRYSLER LLC

NOTE: Lubricate the bedplate retaining bolts with clean engine oil prior to installation.

NOTE: Install the studs in locations three, five, and six.

6. Install the bedplate retaining bolts.
7. Tighten bolts to 3 N.m (26 in. lbs.) in the sequence shown in illustration.

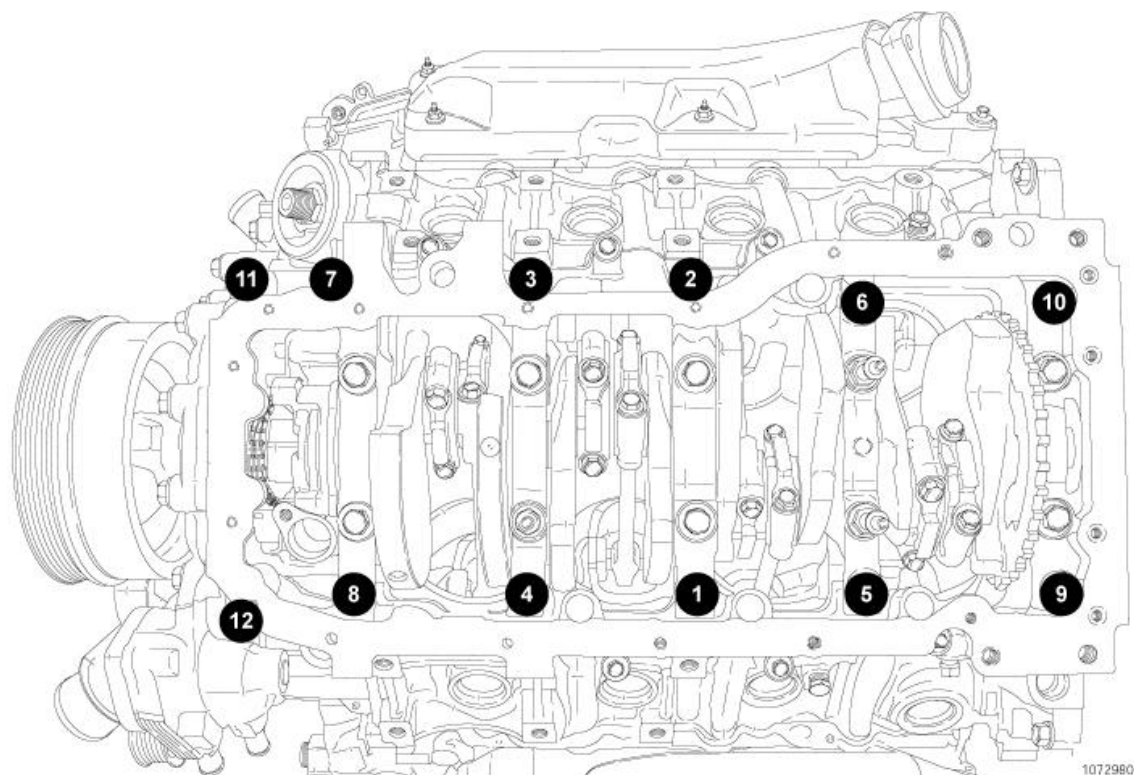


Fig. 143: Tightening Bedplate Bolts (2 Of 4)
Courtesy of CHRYSLER LLC

8. Tighten bolts to 54 N.m (40 ft. lbs.) in the sequence shown in illustration.

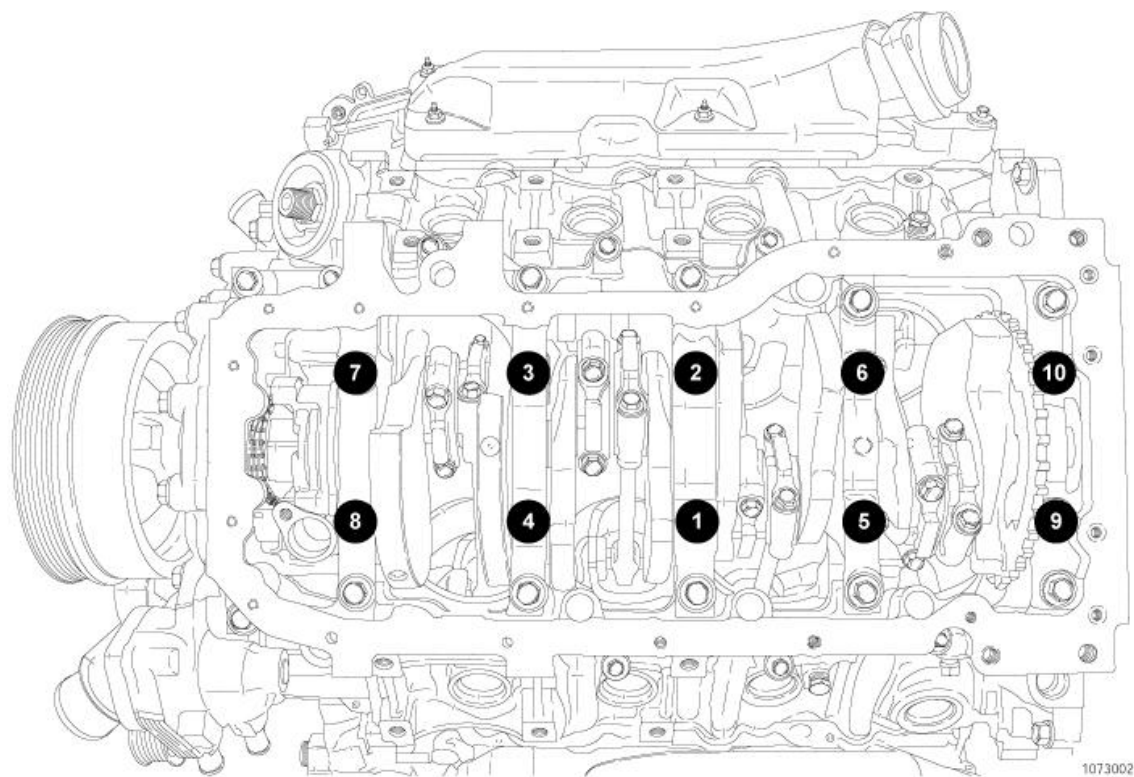
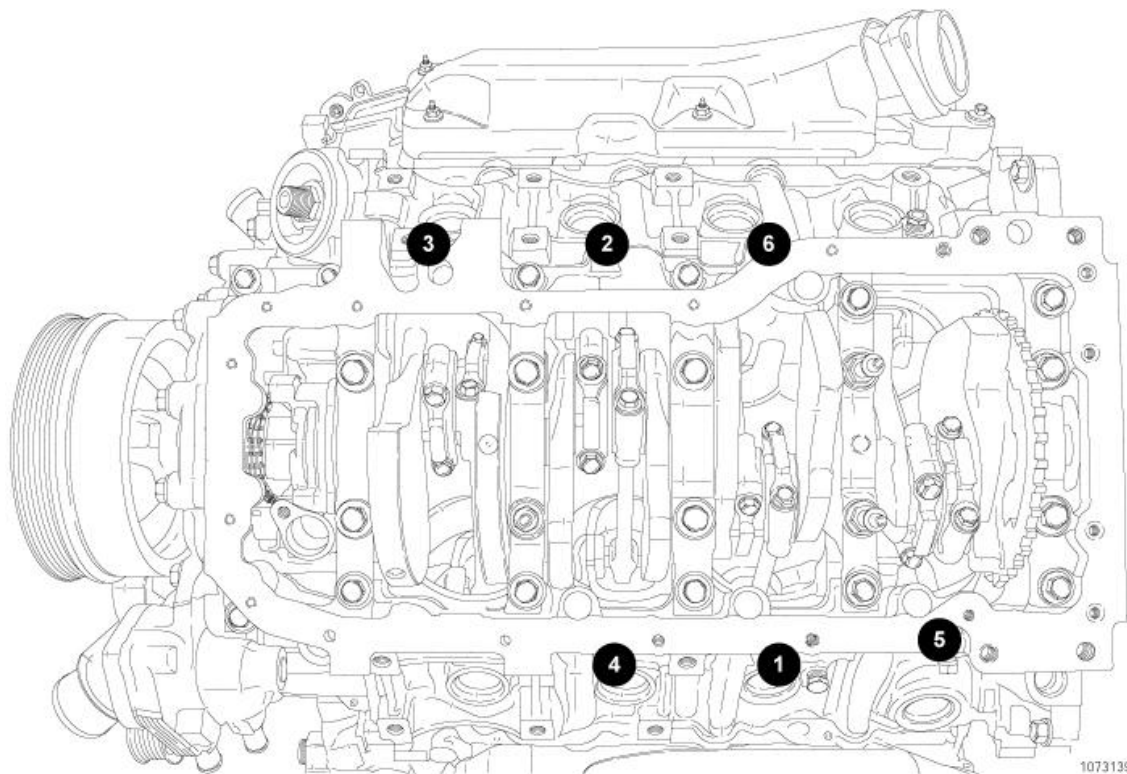


Fig. 144: Tightening Bedplate Bolts (3 Of 4)

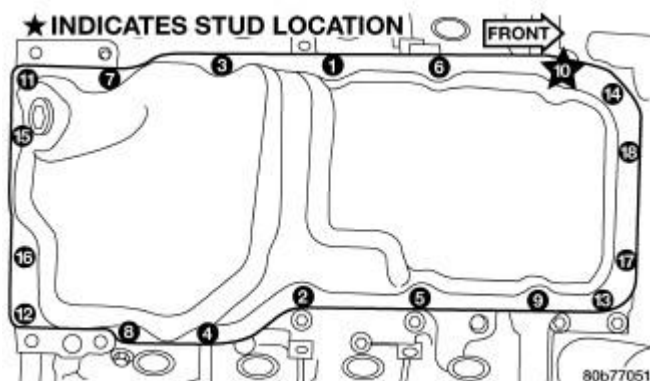
Courtesy of CHRYSLER LLC

9. Rotate bolts 90° in the sequence shown in illustration.

**Fig. 145: Tightening Bedplate Bolts (4 Of 4)**

Courtesy of CHRYSLER LLC

10. Tighten bolts to 23 N.m (20 ft. lbs.) in the sequence shown in illustration.
 11. Measure crankshaft end play. See Engine **SPECIFICATIONS**.
 12. Install the connecting rods and measure side clearance. See **Engine/Engine Block/BEARING(S), Connecting Rod - Standard Procedure**.

**Fig. 146: Oil Pan Tightening Sequence**

Courtesy of CHRYSLER LLC

NOTE: Install the stud in location 10.

13. Position the oil pan gasket/windage tray.
14. Install the oil pickup tube with a new O-ring and tighten the fasteners to 28 N.m (20 ft. lbs.).
15. Position oil pan in place and install bolts.
16. Tighten the oil pan bolts to 15 N.m (11 ft. lbs.) in the sequence shown in illustration.
17. Install the engine. See Engine - Installation.

DAMPER, VIBRATION

Removal

REMOVAL

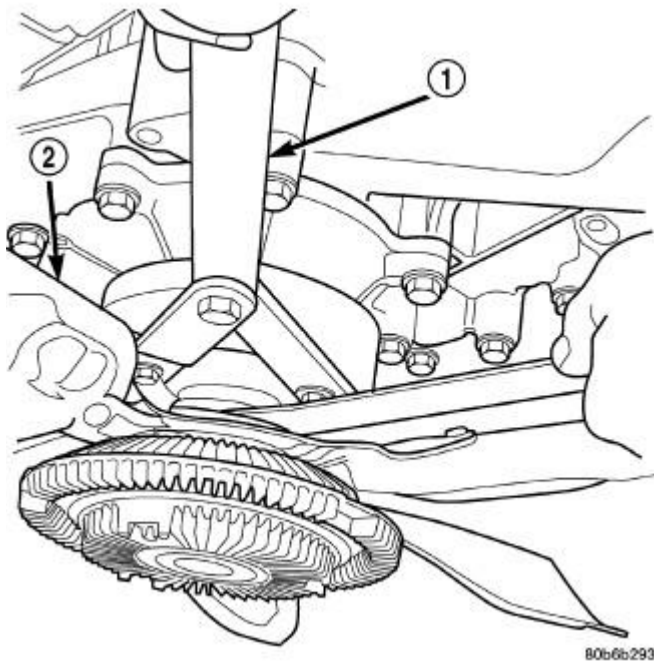
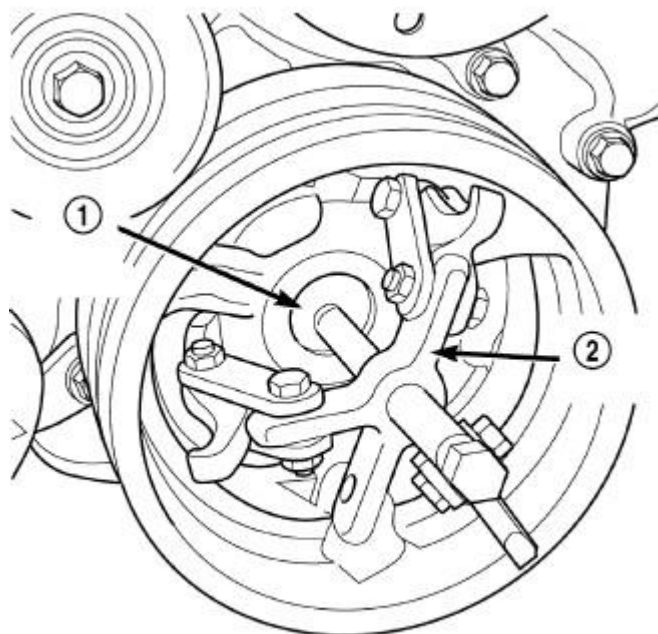


Fig. 147: Fan Assembly-Removal/Installation
Courtesy of CHRYSLER LLC

1. Disconnect negative cable from battery.
2. Remove accessory drive belt. Refer to Cooling/Accessory Drive/BELT, Serpentine - Removal.
3. Drain cooling system. Refer to Cooling - Standard Procedure.
4. Remove radiator upper hose.
5. Remove upper fan shroud.
6. Using Spanner Wrench 6958 with Adapter Pins 8346 (1), loosen fan and viscous assembly from water

pump.

7. Remove fan and viscous assembly.
8. Disconnect electrical connector for fan mounted inside radiator shroud.



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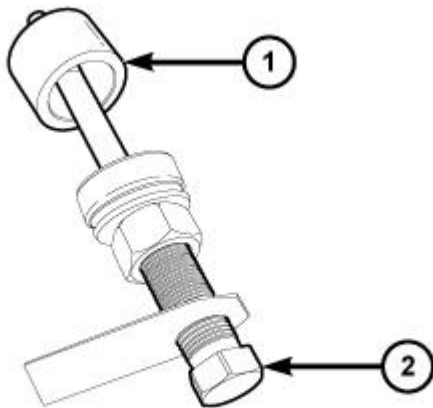
Fig. 148: VIBRATION DAMPER - REMOVAL
Courtesy of CHRYSLER LLC

NOTE: Transmission cooler line snaps into shroud lower right hand corner.

9. Remove vibration damper bolt.
10. Remove damper using Special Tools 8513A Insert and 1023 Three Jaw Puller (2).

Installation

INSTALLATION

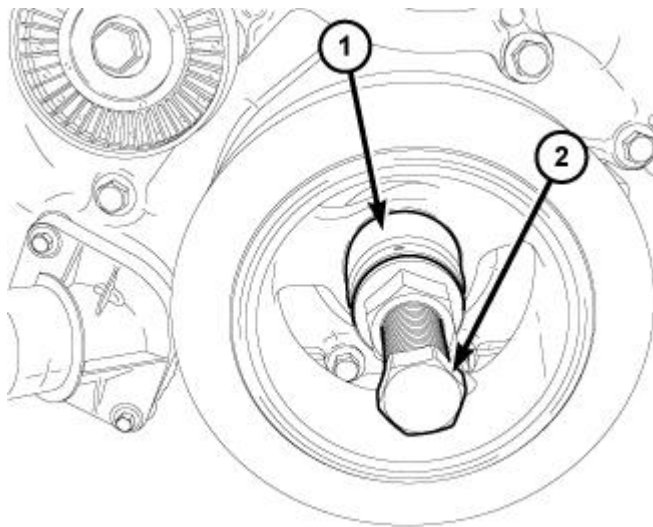


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Fig. 149: Identifying Damper Installer & A/C Hub Installer Cup
Courtesy of CHRYSLER LLC

CAUTION: To prevent severe damage to the crankshaft, damper, and damper installer 8512A, thoroughly clean the damper bore and the crankshaft nose before installing damper.

1. Position the damper onto the crankshaft.
2. Assemble the damper installer 8512A (2) and the A/C hub installer cup 6871 (1).



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Fig. 150: Pressing Damper Onto Crankshaft
Courtesy of CHRYSLER LLC

3. Using the damper installer 8512A (2) and the A/C hub installer cup 6871 (1), press the damper onto the crankshaft.
4. Coat the vibration damper bolt threads with Mopar ® Nickel Anti-Seize or equivalent, install and tighten

the bolt to 175 N.m (130 ft. lbs.).

5. Install the cooling fan assembly. Refer to Cooling/Engine/FAN, Cooling - Installation .
6. Install the radiator upper shroud and tighten fasteners to 11 N.m (95 in. lbs.).
7. Install the radiator upper hose.
8. Install the accessory drive belt. Refer to Cooling/Accessory Drive/BELT, Serpentine - Installation .
9. Refill the cooling system. Refer to Cooling - Standard Procedure .
10. Connect the negative battery cable.

FLEXPLATE

Removal

REMOVAL

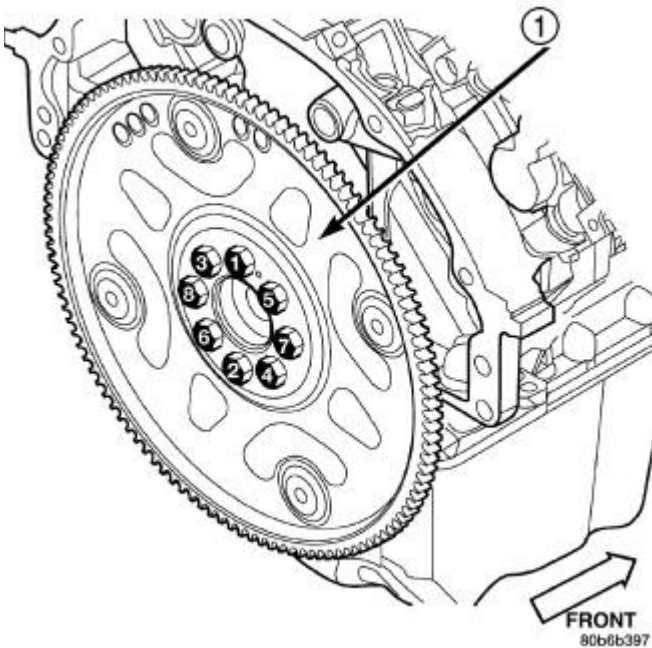


Fig. 151: Flexplate Tightening Sequence

Courtesy of CHRYSLER LLC

1 - FLEXPLATE

1. Remove the transmission. Refer to Transmission and Transfer Case/Automatic - 545RFE - Removal .
2. Remove the bolts and flexplate (1).

Installation

INSTALLATION

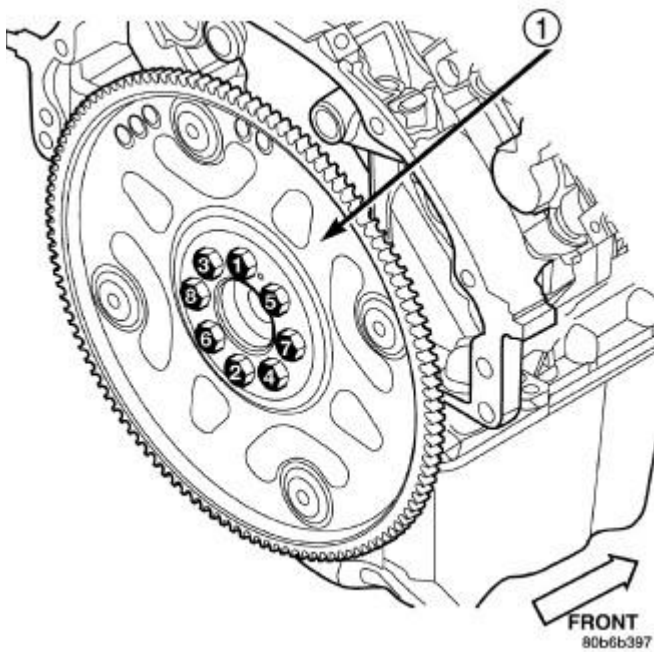


Fig. 152: Flexplate Tightening Sequence

Courtesy of CHRYSLER LLC

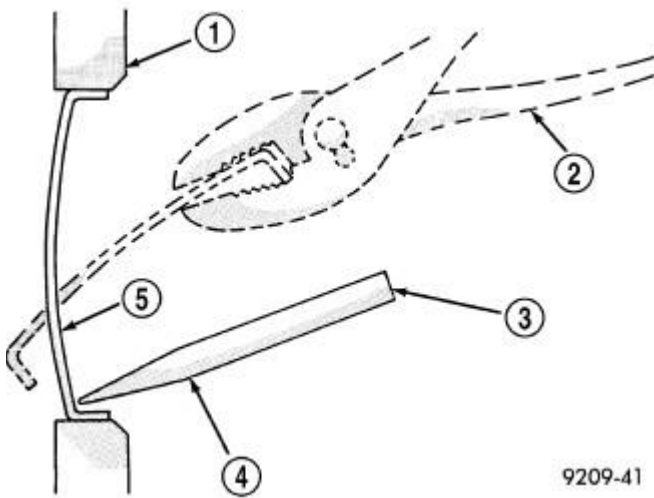
1 - FLEXPLATE

1. Position the flexplate onto the crankshaft and install the bolts hand tight.
2. Tighten the flexplate retaining bolts to 60 N.m (45 ft. lbs.) in the sequence shown in illustration.
3. Install the transmission. Refer to **Transmission and Transfer Case/Automatic - 545RFE - Installation** .

PLUG, CORE

Removal

REMOVAL

**Fig. 153: Engine Core 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

1. Drain the cooling system. Refer to **Cooling - Standard Procedure** .
2. Using a blunt tool such as a drift or a screw driver and a hammer, strike the bottom edge of the cup plug (5).
3. Using a suitable pair of pliers, grasp the core plug (5) and remove.

Installation**INSTALLATION****NOTE:** Thoroughly clean core plug bore, remove all of the old sealer.

1. Coat the edges of the engine core plug and the core plug bore with Mopar Gasket Maker, or equivalent.

NOTE: It is not necessary to wait for the sealant to cure on the core plugs. The cooling system can be filled and the vehicle returned to service immediately.

2. Using proper plug driver, drive core plug into the core plug bore. The sharp edge of the core plug should be at least 0.50 mm (0.020 in.) inside the lead in chamfer.
3. Refill the cooling system. Refer to **Cooling - Standard Procedure** .

RING(S), PISTON

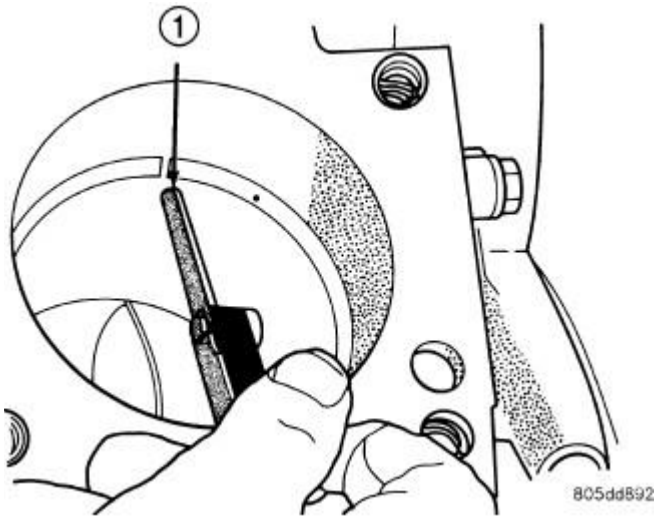
Standard Procedure**PISTON RING FITTING**

Fig. 154: Ring End Gap Measurement - Typical
Courtesy of CHRYSLER LLC

1 - FEELER GAUGE

Before reinstalling used rings or installing new rings, the ring clearances must be checked.

1. Wipe the cylinder bore clean.
2. Insert the ring in the cylinder bore.

NOTE: **The ring gap measurement must be made with the ring positioned at least 12 mm (0.50 inch.) from bottom of cylinder bore.**

3. Using a piston, to ensure that the ring is squared in the cylinder bore, slide the ring downward into the cylinder.
4. Using a feeler gauge (1) check the ring end gap. Replace any rings not within specification.

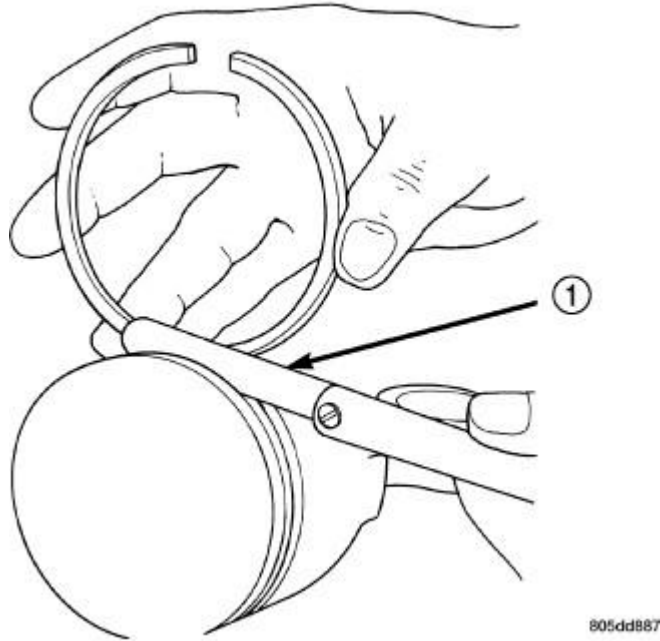


Fig. 155: Measuring Piston Ring Side Clearance
 Courtesy of CHRYSLER LLC

1 - FEELER GAUGE

NOTE: Make sure the piston ring grooves are clean and free of nicks and burrs.

PISTON RING SIDE CLEARANCE

5. Measure the ring side clearance as shown in illustration. Make sure the feeler gauge (1) fits snugly between the ring land and the ring. Replace any ring not within specification.
6. Rotate the ring around the piston, the ring must rotate in the groove with out binding.

PISTON RING SPECIFICATION CHART (1 OF 2)

Ring Position	Groove Clearance	Maximum Clearance
Upper Ring	0.051 - 0.094 mm (0.0020 - 0.0037 in.)	0.11 mm (0.004 in.)
Intermediate Ring	0.04 - 0.08 mm (0.0016 - 0.0031 in.)	0.10 mm (0.004 in.)
Oil Control Ring (Steel Rails)	0.019 - 0.229 mm (0.0007-.0090 in.)	0.25 mm (0.010 in.)

PISTON RING SPECIFICATION CHART (2 OF 2)

Ring Position	Ring Gap	Wear Limit
Upper Ring	0.20 - 0.36 mm (0.0079 - 0.0142 in.)	0.43 mm (0.017 in.)
Intermediate Ring	0.37 - 0.63 mm (0.0146 - 0.0249 in.)	0.74 mm (0.029 in.)
Oil Control Ring (Steel Rail)	0.025 - 0.76 mm (0.0099 - 0.03 in.)	1.55 mm (0.061 in.)

7. The No. 1 and No. 2 piston rings have a different cross section. Ensure No. 2 ring is installed with manufacturers I.D. mark (Dot) facing up, towards top of the piston.

NOTE: Piston rings are installed in the following order:

- Oil ring expander.
- Upper oil ring side rail.
- Lower oil ring side rail.
- No. 2 Intermediate piston ring.
- No. 1 Upper piston ring.

8. Install the oil ring expander.
9. Install upper side rail (1) by placing one end between the piston ring groove and the expander ring. Hold end firmly and press down the portion to be installed until side rail is in position. Repeat this step for the lower side rail.

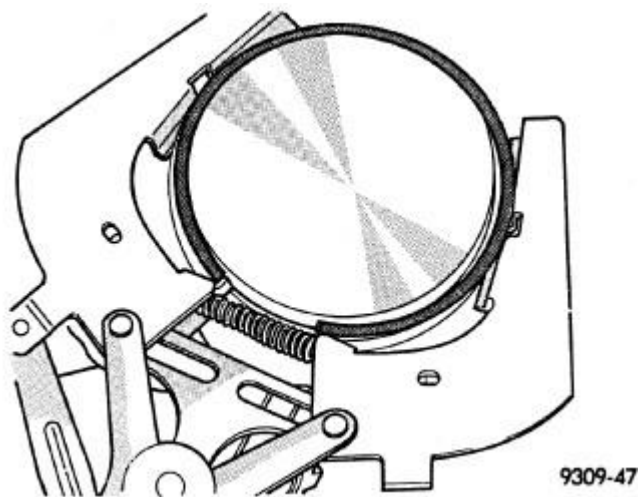
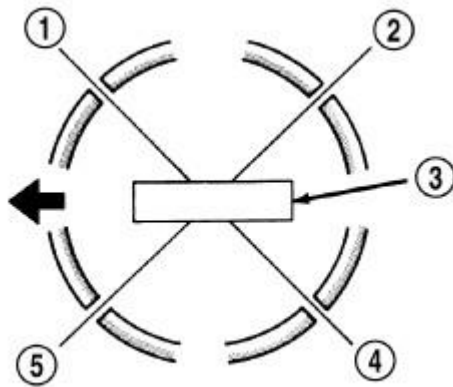


Fig. 156: Upper and Intermediate Rings - Installation
Courtesy of CHRYSLER LLC

10. Install No. 2 intermediate piston ring using a piston ring installer.
11. Install No. 1 upper piston ring using a piston ring installer.



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Fig. 157: Piston Ring End Gap Position
 Courtesy of CHRYSLER LLC

- | |
|--|
| 1 - SIDE RAIL UPPER
2 - NO. 1 RING GAP
3 - PISTON PIN
4 - SIDE RAIL LOWER
5 - NO. 2 RING GAP AND SPACER EXPANDER GAP |
|--|

12. Position piston ring end gaps as shown in illustration. It is important that expander ring gap (5) is at least 45° from the side rail gaps, but not on the piston pin center or on the thrust direction.

ROD, PISTON AND CONNECTING

Description

DESCRIPTION

CAUTION: Do not use a metal stamp to mark connecting rods as damage may result, instead use ink or a scratch awl.

The pistons are made of a high strength aluminum alloy. The anodized top ring groove and crown has been replaced with a coated top ring that is blue in color on the bottom surface. Piston skirts are coated with a solid lubricant (Molykote) to reduce friction and provide scuff resistance. The connecting rods are made of forged powdered metal, with a "fractured cap" design. A pressed fit piston pin is used to attach the piston and connecting rod.

Standard Procedure

PISTON FITTING

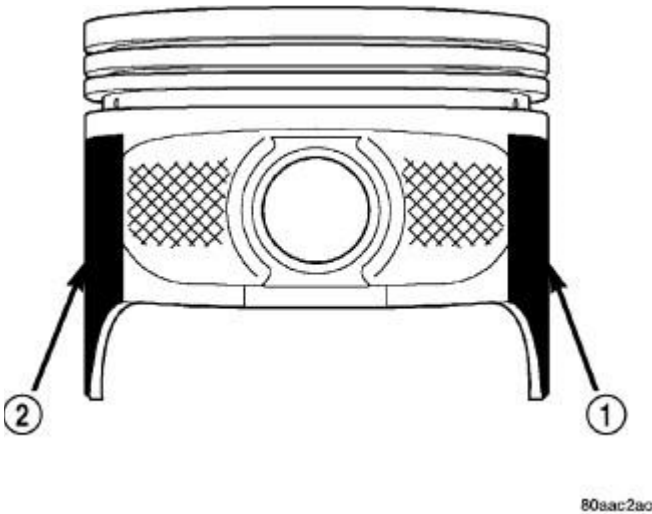


Fig. 158: Identifying Moly Coated Piston
 Courtesy of CHRYSLER LLC

1 - MOLY COATED

2 - MOLY COATED

1. To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.
2. Measure the inside diameter of the cylinder bore at a point 38.0 mm (1.5 inches) below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft at point A and then take an additional bore reading 90 degrees to that at point B.

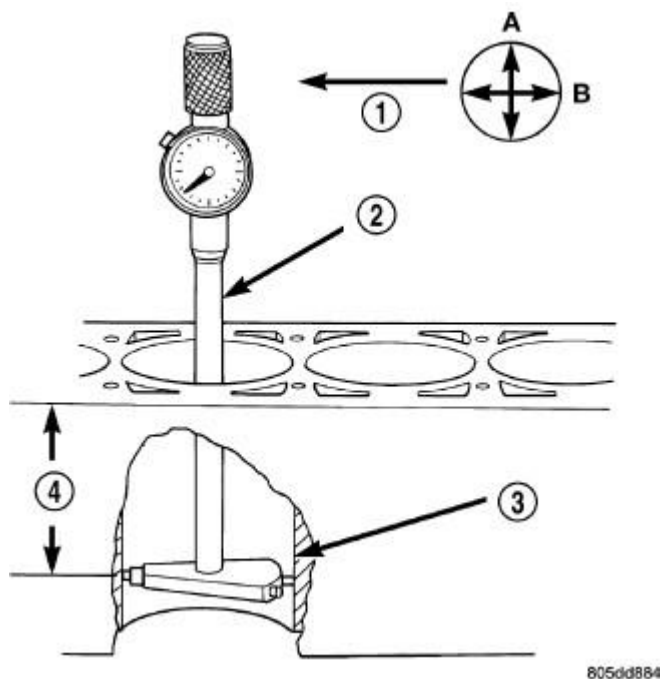


Fig. 159: BORE GAUGE - TYPICAL

Courtesy of CHRYSLER LLC

1 - FRONT
2 - BORE GAUGE
3 - CYLINDER BORE
4 - 38 MM (1.5 in)

3. The coated pistons will be serviced with the piston pin and connecting rod pre-assembled.
4. The coating material is applied to the piston after the final piston machining process. Measuring the outside diameter of a coated piston will not provide accurate results . Therefore measuring the inside diameter of the cylinder bore with a dial Bore Gauge is **MANDATORY** . To correctly select the proper size piston, a cylinder bore gauge capable of reading in 0.003 mm (.0001 in.) increments is required.
5. Piston installation into the cylinder bore requires slightly more pressure than that required for non-coated pistons. The bonded coating on the piston will give the appearance of a line-to-line fit with the cylinder bore.

Removal**REMOVAL**

1. Disconnect negative cable from battery.
2. Remove the following components:
 - Oil pan and gasket/windage tray. See Engine/Lubrication/PAN, Oil - Removal.
 - Cylinder head covers. See Engine/Cylinder Head/COVER(S), Cylinder Head - Removal.
 - Timing chain cover. See Engine/Valve Timing/COVER(S), Engine Timing - Removal.
 - Cylinder head(s). See Engine/Cylinder Head - Removal.
3. If necessary, remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation.** Pistons and connecting rods must be removed from top of cylinder block. When removing piston and connecting rod assemblies from the engine, rotate crankshaft so the each connecting rod is centered in cylinder bore.

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods or caps, as damage to connecting rods could occur

NOTE: Connecting rods and bearing caps are not interchangeable and should be marked before removing to ensure correct reassembly.

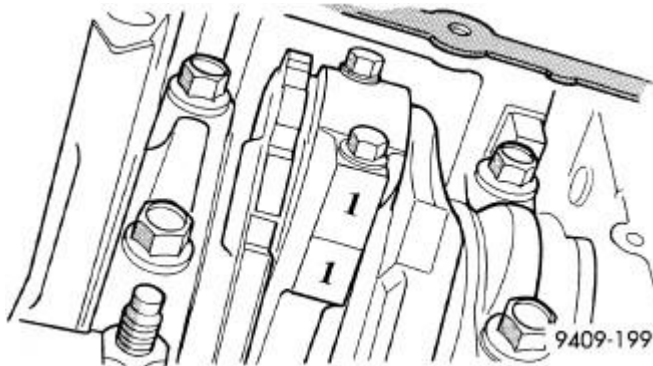


Fig. 160: Identify Connecting Rod To Cylinder Position - Typical
Courtesy of CHRYSLER LLC

4. Mark connecting rod and bearing cap positions using a permanent ink marker or scribe tool .

CAUTION: Care must be taken not to damage the fractured rod and cap joint face surfaces, as engine damage may occur.

5. Remove connecting rod cap. Install Special Tool 8507 Connecting Rod Guides into the connecting rod being removed. Remove piston from cylinder bore. Repeat this procedure for each piston being removed.

CAUTION: Care must be taken not to nick crankshaft journals, as engine damage may occur

6. Immediately after piston and connecting rod removal, install bearing cap on the mating connecting rod to prevent damage to the fractured cap and rod surfaces.
7. Carefully remove piston rings from piston(s), starting from the top ring down.

Cleaning

CLEANING

CAUTION: DO NOT use a wire wheel or other abrasive cleaning device to clean the pistons or connecting rods. The pistons have a Moly coating, this coating must not be damaged.

1. Using a suitable cleaning solvent clean the pistons in warm water and towel dry.
2. Use a wood or plastic scraper to clean the ring land grooves.

CAUTION: Do not remove the piston pin from the piston and connecting rod assembly.

Inspection

INSPECTION

Check the connecting rod journal for excessive wear, taper and scoring. See **Engine/Engine Block/BEARING (S), Connecting Rod - Standard Procedure**.

Check the connecting rod for signs of twist or bending.

Check the piston for taper and elliptical shape before it is fitted into the cylinder bore. See **Engine/Engine Block/ROD, Piston and Connecting - Standard Procedure**.

Check the piston for scoring, or scraping marks in the piston skirts. Check the ring lands for cracks and/or deterioration.

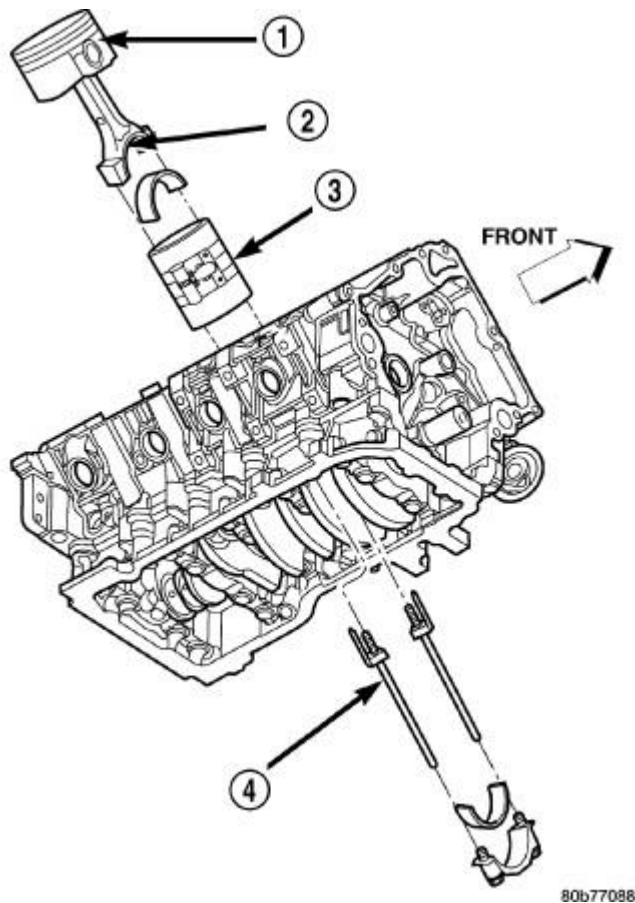
Installation**INSTALLATION**

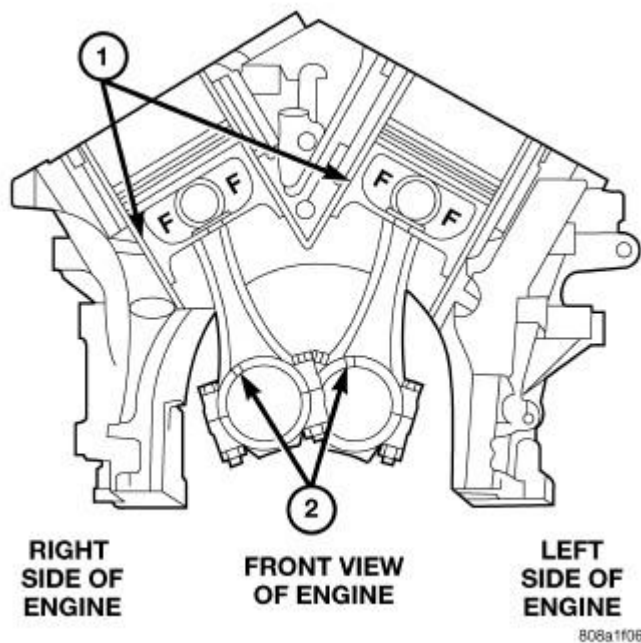
Fig. 161: Piston and Connecting Rod - Installation
Courtesy of CHRYSLER LLC

- 1 - "F" TOWARD FRONT OF ENGINE
- 2 - OIL SLINGER SLOT

3 - RING COMPRESSOR

4 - SPECIAL TOOL 8507

1. Before installing piston and connecting rod assemblies into the bore, install the piston rings.
2. Immerse the piston head and rings in clean engine oil. Position a ring compressor (3) over the piston and rings. Tighten ring compressor. **Ensure position of rings do not change during this operation.**
3. Position bearing onto connecting rod. Ensure that hole in bearing shell aligns with hole in connecting rod. Lubricate bearing surface with clean engine oil.
4. Install Special Tool 8507 Connecting Rod Guides (4) into connecting rod bolt threads.

**Fig. 162: PISTON AND CONNECTING ROD ORIENTATION**

Courtesy of CHRYSLER LLC

1 - MAJOR THRUST SIDE OF PISTON

2 - OIL SLINGER SLOT

5. The pistons are marked on the piston pin bore surface with an raised "F" indicating installation position (1). This mark must be pointing toward the front of engine on both cylinder banks. The connecting rod oil slinger slot faces the front of the engine.
6. Wipe cylinder bore clean and lubricate with engine oil.
7. Rotate crankshaft until connecting rod journal is on the center of cylinder bore. Insert rod and piston into cylinder bore and carefully position connecting rod guides over crankshaft journal.
8. Tap piston down in cylinder bore using a hammer handle. While at the same time, guide connecting rod into position on rod journal.

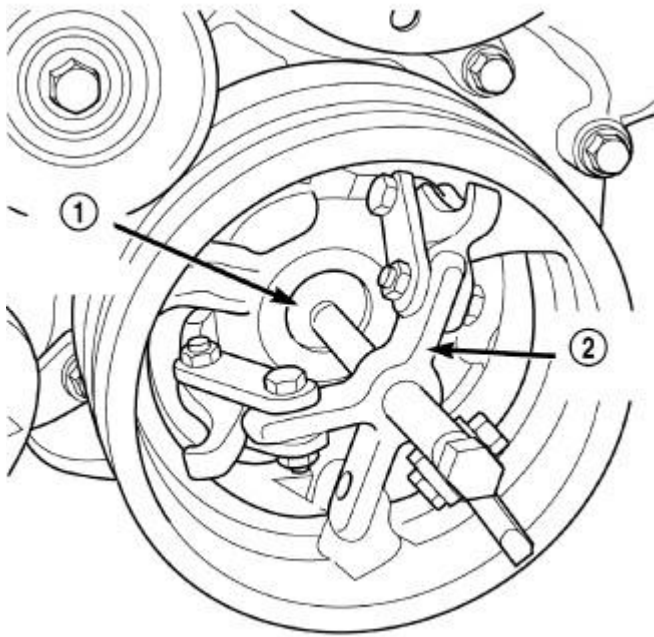
CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.

9. Lubricate rod bolts and bearing surfaces with engine oil. Install connecting rod cap and bearing. Tighten bolts to 27 N.m (20 ft. lbs.) plus 90°.
10. Install the following components:
 - Cylinder head(s). See **Engine/Cylinder Head - Installation**.
 - Timing chain and cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Installation**.
 - Cylinder head covers. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.
 - Oil pan and gasket/windage tray. See **Engine/Lubrication/PAN, Oil - Installation**.
11. Fill crankcase with proper engine oil to correct level.
12. Connect negative cable to battery.

SEAL, CRANKSHAFT OIL, FRONT

Removal

REMOVAL



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Fig. 163: Crankshaft Damper Removal
Courtesy of CHRYSLER LLC

1. Disconnect negative cable from battery.
2. Remove accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal**.
3. Remove A/C compressor mounting fasteners and set compressor aside.

4. Drain cooling system. Refer to **Cooling - Standard Procedure** .
5. Remove upper radiator hose.
6. Disconnect electrical connector for fan mounted inside radiator shroud.
7. Remove radiator shroud attaching fasteners.

NOTE: **Transmission cooler line snaps into shroud lower right hand corner.**

8. Remove radiator cooling fan and shroud. Refer to **Cooling/Engine/FAN, Cooling - Removal** .
9. Remove crankshaft damper bolt.
10. Remove damper using Crankshaft Insert 8513A (1) and 1023 Three Jaw Puller (2).

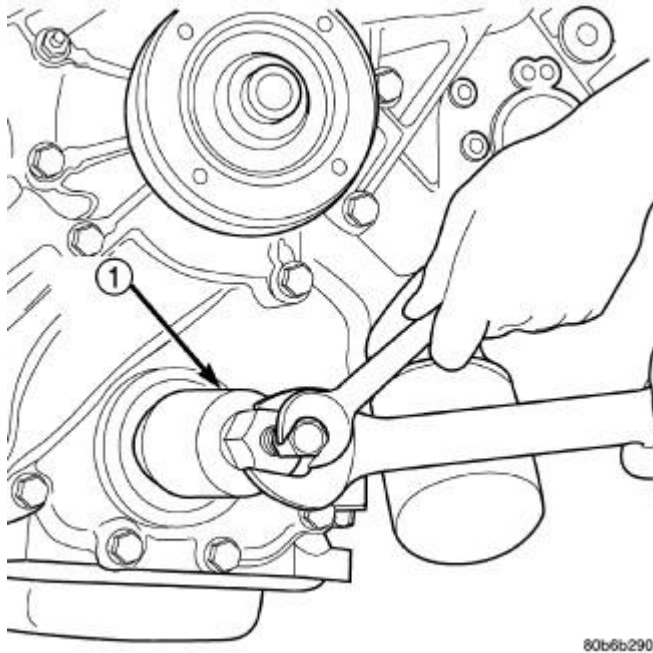


Fig. 164: Crankshaft Front Seal Removal
Courtesy of CHRYSLER LLC

11. Using Crankshaft Front Seal Remover 8511 (1), remove crankshaft front seal.

Installation

INSTALLATION

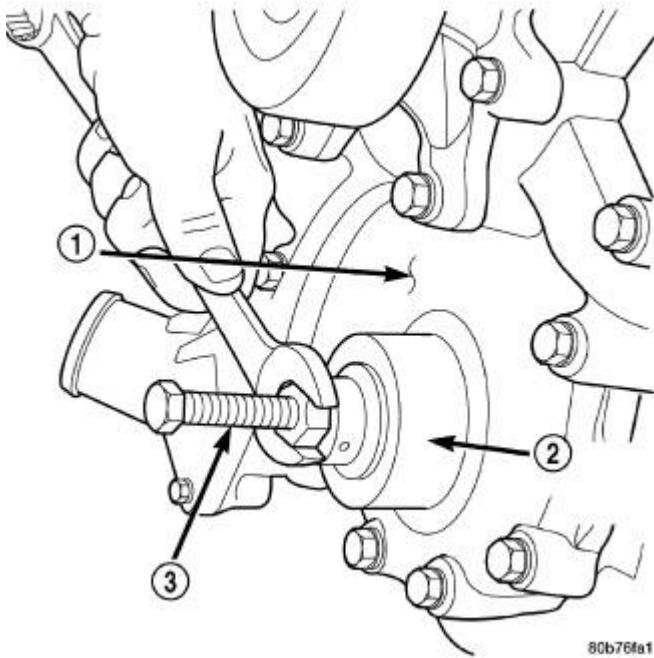


Fig. 165: Crankshaft Front Seal Installation
Courtesy of CHRYSLER LLC

CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool 8512A, thoroughly clean the damper bore and the crankshaft nose before installing Damper.

1. Using Seal Installer 8348 and Damper Installer 8512A (2,3), install crankshaft front seal.
2. Install vibration damper. See Engine/Engine Block/DAMPER, Vibration - Installation.
3. Install radiator cooling fan and shroud. Refer to Cooling/Engine/FAN, Cooling - Installation.
4. Install upper radiator hose.
5. Install A/C compressor and tighten fasteners to 54 N.m (40 ft. lbs.).
6. Install accessory drive belt refer. Refer to Cooling/Accessory Drive/BELT, Serpentine - Installation.
7. Refill cooling system. Refer to Cooling - Standard Procedure.
8. Connect negative cable to battery.

SEAL, CRANKSHAFT OIL, REAR

Diagnosis and Testing

REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
 - a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
 - b. Where leakage tends to run straight down, possible causes are a porous block, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See appropriate Engine component service information for proper repair procedures of these items.
4. If no leaks are detected, pressurize the crankcase as outlined in **AIR LEAK DETECTION TEST METHOD**.

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. See OIL LEAKS row under **LUBRICATION** for components inspections on possible causes and corrections.
7. After the oil leak root cause and appropriate corrective action have been identified. See **Engine/Engine Block/SEAL, Crankshaft Oil - Removal**.

Removal

REMOVAL

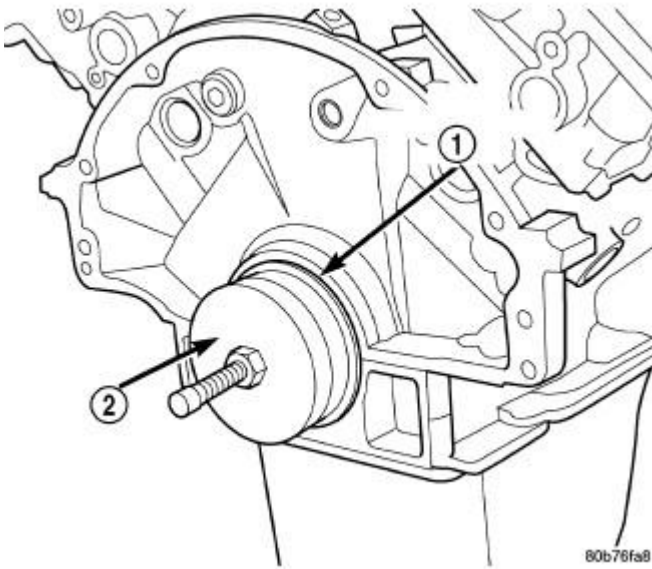


Fig. 166: Crankshaft Rear Oil Seal Removal
Courtesy of CHRYSLER LLC

NOTE: This procedure can be performed in vehicle.

1. If being performed in vehicle, remove the transmission.
2. Remove the flexplate. See **Engine/Engine Block/FLEXPLATE - Removal**.

NOTE: The crankshaft oil seal **CANNOT** be reused after removal.

NOTE: The crankshaft rear oil seal remover 8506 must be installed deeply into the seal. Continue to tighten the removal tool into the seal until the tool can not be turned farther. Failure to install tool correctly the first time will cause tool to pull free of seal without removing seal from engine.

3. Using Seal Remover 8506 (2), remove the crankshaft rear oil seal (1).

Installation

INSTALLATION

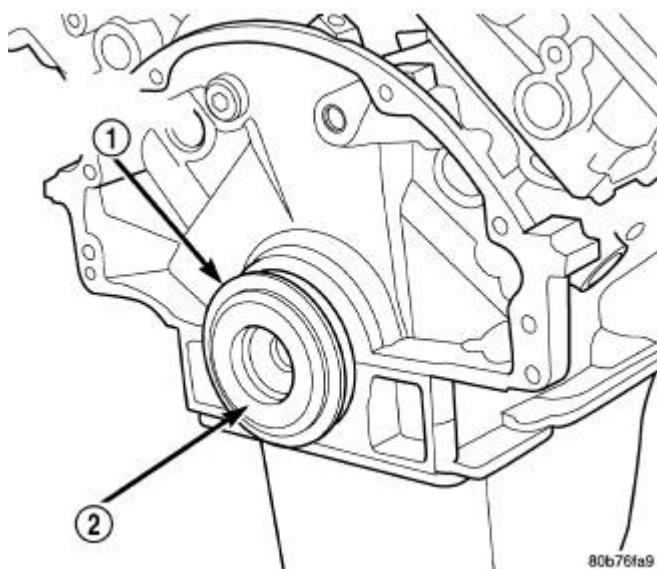


Fig. 167: Crankshaft Rear Oil Seal Guide Special Tool 8349-2 and Oil
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - REAR CRANKSHAFT SEAL
2 - SPECIAL TOOL 8349-2 GUIDE |
|---|

1. Lubricate the crankshaft flange with engine oil.
2. Position the magnetic seal guide 8349-2 onto the crankshaft rear face. Then position the crankshaft rear oil seal (1) onto the guide (2).

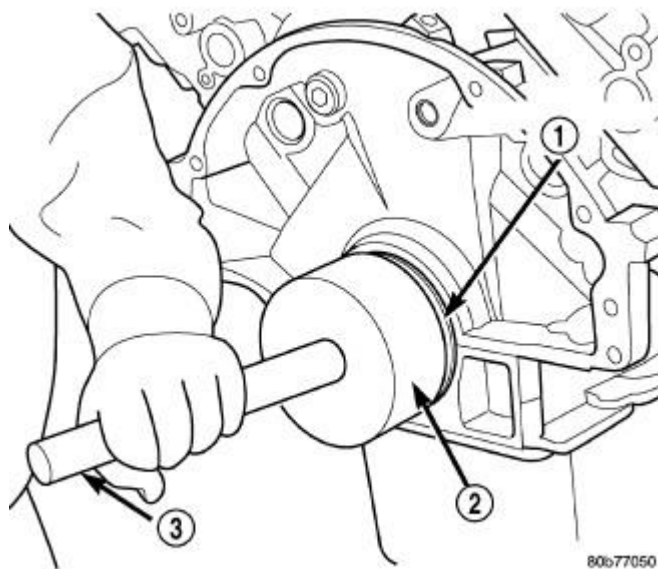


Fig. 168: Crankshaft Rear Oil Seal Installation
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - REAR CRANKSHAFT SEAL
2 - SPECIAL TOOL 8349-1 INSTALLER
3 - SPECIAL TOOL C-4171 HANDLE |
|---|

3. Using Crankshaft Rear Oil Seal Installer 8349 (2) and Driver Handle C-4171 (3), with a hammer, tap the seal (1) into place. Continue to tap on the driver handle until the seal installer seats against the cylinder block crankshaft bore.
4. Install the flexplate.
5. Install the transmission.

ENGINE MOUNTING

INSULATOR, ENGINE MOUNT, FRONT

Removal

REMOVAL

2WD

1. Disconnect the negative cable from the battery.

CAUTION: Remove the viscous fan before raising engine. Failure to do so may cause damage to the fan blade, fan clutch and fan shroud.

2. Remove the cooling fan.
3. Raise the vehicle.
4. Remove the engine oil filter.
5. Remove the oil drain trough.
6. Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.
7. Support the front axle with a suitable jack.
8. Remove the bolts that attach the engine mounts to the front axle.
9. Remove the bolts that attach the front axle to the left engine bracket.
10. Lower the front axle.
11. Remove the through bolts
12. Raise the engine far enough to be able to remove the left and right engine mounts.
13. Remove the mount to engine attaching bolts
14. Remove the engine mounts.

4WD

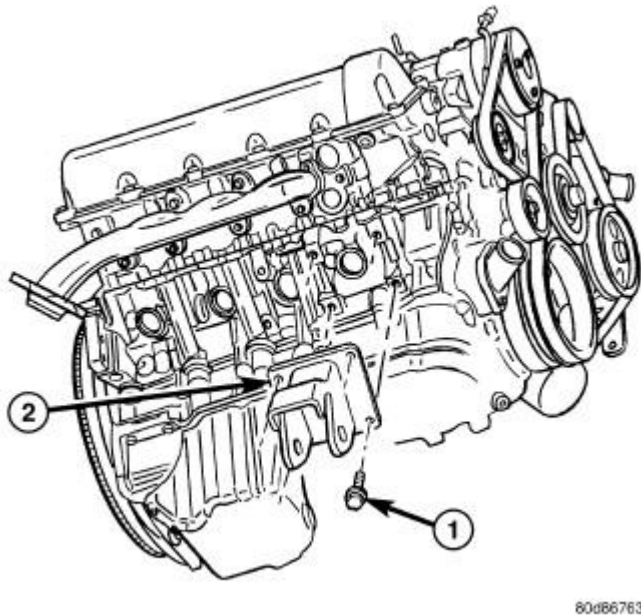


Fig. 169: ENGINE MOUNT SUPPORT BRACKET RH
Courtesy of CHRYSLER LLC

1 - BOLT

2 - ENGINE MOUNT SUPPORT BRACKET

1. Disconnect the negative cable from the battery.
2. Remove the viscous fan.
3. Raise the vehicle.
4. Remove the skid plate.
5. Remove the front crossmember.
6. Remove the engine oil filter.
7. Remove the oil drain trough.
8. Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.
9. Support the front axle with a suitable jack.
10. Remove the bolts that attach the engine mounts to the front axle.
11. Remove the bolts that attach the front axle to the left engine bracket.
12. Lower the front axle.
13. Remove the through bolts

CAUTION: Remove the viscous fan before raising engine. Failure to do so may cause damage to the fan blade, fan clutch and fan shroud.

14. Remove the cooling fan.
15. Raise the engine far enough to be able to remove the left and right engine mounts (2).
16. Remove the engine mount bolts (1), and the mounts (2).

Installation**INSTALLATION****2WD**

NOTE: For mount to engine block and left engine bracket to front axle bolts, apply **Mopar® Lock and Seal Adhesive, Medium Strength Threadlocker.**

1. Install the right and left side engine mounts to the engine block bolts. Torque bolts to 54 N.m (40 ft. lbs.).
2. Insert the through bolts into the right and left side engine mounts and loose assemble the two nuts onto the through bolts.
3. Lower the engine until the through bolts rest onto the slots in the frame brackets.
4. Tighten the through bolt nuts to 94 N.m (70 ft. lbs.).
5. Install the oil drain trough.
6. Install the engine oil filter.
7. Lower the vehicle.
8. Install the cooling fan.
9. Reconnect the negative battery cable.

4WD

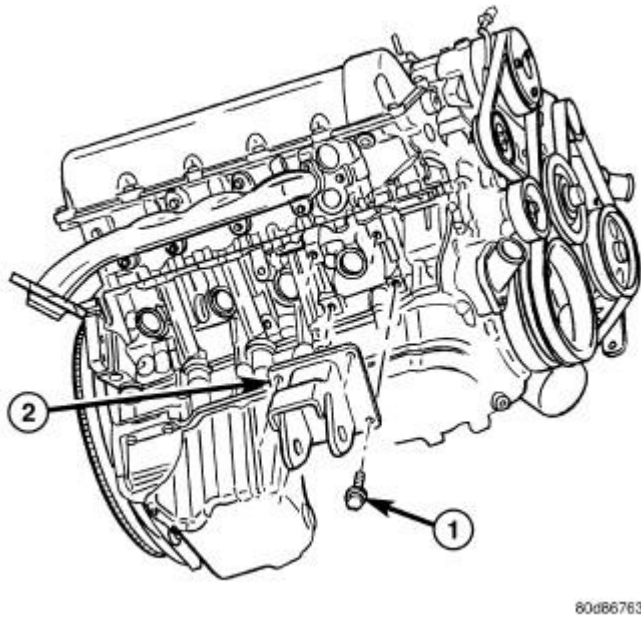


Fig. 170: ENGINE MOUNT SUPPORT BRACKET RH
Courtesy of CHRYSLER LLC

- 1 - BOLT
2 - ENGINE MOUNT SUPPORT BRACKET

NOTE: For mount to engine block and left engine bracket to front axle bolts, apply Mopar® Lock and Seal Adhesive, Medium Strength Threadlocker.

1. Install the right and left side engine mount brackets (2) to the engine.
2. Install the right and left side engine mounts to the front axle. Torque nuts to 94 N.m (70 ft. lbs.).
3. Raise the front axle into the frame and install the left and right side through bolts. Torque nuts to 94 N.m (70 ft. lbs.).
4. Insert the two upper through bolts into the right and left side engine mounts and loose assemble the two nuts onto the through bolts.
5. Lower the engine until the left and right side engine brackets rest on the through bolts, and the lower engine bracket through holes align with the engine mounts, and the left engine bracket holes align with the front axle slots.
6. Loose assemble the bolts that attach the front axle to the left engine bracket.
7. Loose assemble the lower through bolts.
8. Torque the nuts for the through bolts to 101 N.m (75 ft. lbs.).
9. Torque the bolts that attach the front axle to the left engine bracket to 101 N.m (75 ft. lbs.).
10. Install the oil drain trough.
11. Install the engine oil filter.

12. Lower the vehicle.
13. Install the cooling fan.
14. Reconnect the negative battery cable.

INSULATOR, ENGINE MOUNT, REAR

Removal

REMOVAL

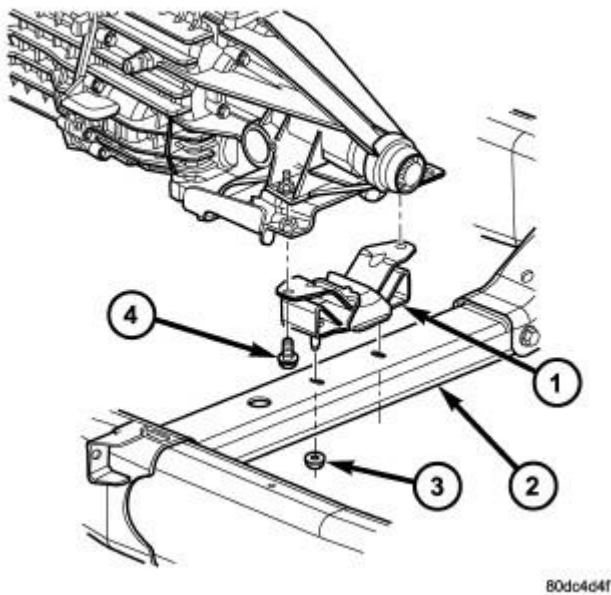


Fig. 171: TRANSMISSION MOUNT
Courtesy of CHRYSLER LLC

- 1 - MOUNT
- 2 - CROSSMEMBER
- 3 - NUT
- 4 - BOLT

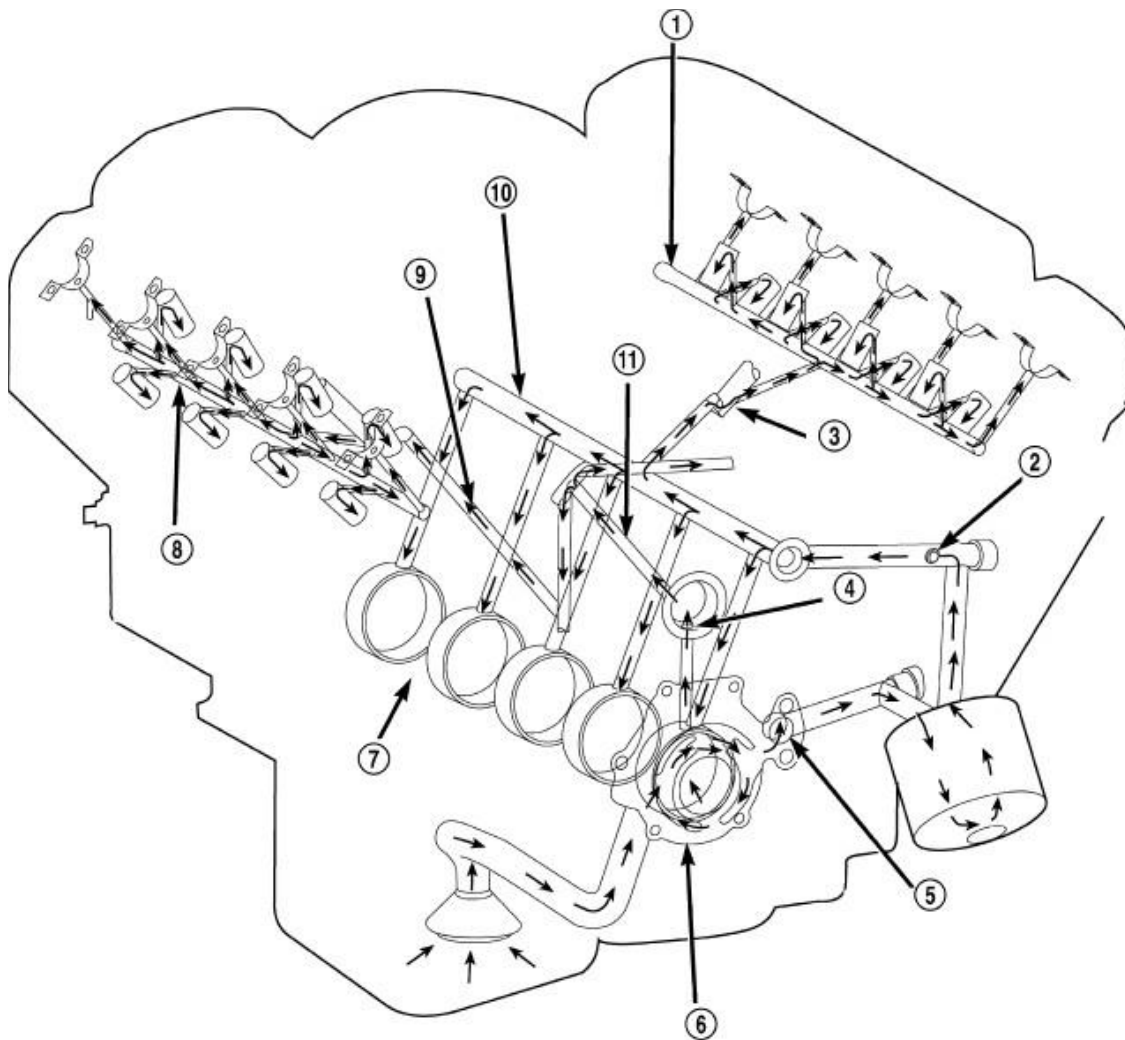
1. Raise the vehicle on a hoist.
2. Using a suitable jack, support transmission.
3. Remove the nuts from the transmission mount (1).
4. Remove the two bolts that attach the transmission mount to the engine bracket.
5. Raise the transmission enough to remove the mount from the crossmember (2).
6. Remove the mount (1).

Installation**INSTALLATION**

NOTE: Threadlocking compound must be applied to the bolts before installation.

1. Install the two bolts that attach the transmission mount to the transmission bracket.
2. Torque the bolts to 61 N.m (45 ft. lbs.) torque.
3. Lower the transmission so the transmission mount rests on the crossmember, and the studs of the transmission mount are aligned in the slots in the crossmember.
4. Install the nuts onto the transmission mount studs through the crossmember access slot.
5. Torque the nuts to 54 N.m (40 ft. lbs.).

LUBRICATION**DESCRIPTION****DESCRIPTION**



80b3c714

Fig. 172: Engine Oil Lubrication System
Courtesy of CHRYSLER LLC

- 1 - LEFT CYLINDER HEAD OIL GALLERY
- 2 - OIL PRESSURE SENSOR LOCATION
- 3 - TO LEFT CYLINDER HEAD
- 4 - OIL FEED TO IDLER SHAFT
- 5 - OIL PUMP OUTLET TO BLOCK
- 6 - OIL PUMP
- 7 - TO CRANKSHAFT MAIN JOURNALS
- 8 - RIGHT CYLINDER HEAD OIL GALLERY
- 9 - TO RIGHT CYLINDER HEAD
- 10 - CYLINDER BLOCK MAIN GALLERY
- 11 - OIL FEED TO BOTH SECONDARY TENSIONERS

The lubrication system is a full flow filtration pressure feed type.

OPERATION**OPERATION**

Oil from the oil pan is pumped by a gerotor type oil pump directly mounted to the crankshaft nose. Oil pressure is controlled by a relief valve mounted inside the oil pump housing.

The camshaft exhaust valve lobes and rocker arms are lubricated through a small hole in the rocker arm; oil flows through the lash adjuster then through the rocker arm and onto the camshaft lobe. Due to the orientation of the rocker arm, the camshaft intake lobes are not lubed in the same manner as the exhaust lobes. The intake lobes are lubed through internal passages in the camshaft. Oil flows through a bore in the number 3 camshaft bearing bore, and as the camshaft turns, a hole in the camshaft aligns with the hole in the camshaft bore allowing engine oil to enter the camshaft tube. The oil then exits through 1.6 mm (0.063 in.) holes drilled into the intake lobes, lubricating the lobes and the rocker arms.

ENGINE BLOCK LUBRICATION FLOW CHART : TABLE 1

FROM	TO
Oil Pickup Tube	Oil Pump
Oil Pump	Oil Filter
Oil Filter	Block Main Oil Gallery
Block Main Oil Gallery	• 1. Crankshaft Main Journal • 2. Left Cylinder Head* • 3. Right Cylinder Head*
Crankshaft Main Journals	Crankshaft Rod Journals
Crankshaft Number One Main Journal	• 1. Front Timing Chain Idler Shaft • 2. Both Secondary Chain Tensioners
Left Cylinder Head	See <u>CYLINDER HEADS LUBRICATION FLOW CHART: TABLE 2.</u>
Right Cylinder Head	See <u>CYLINDER HEADS LUBRICATION FLOW CHART: TABLE 2.</u>
* The cylinder head gaskets have an oil restricter to control oil flow to the cylinder heads.	

CYLINDER HEADS LUBRICATION FLOW CHART: TABLE 2

FROM	TO
Cylinder Head Oil Port (in bolt hole)	Diagonal Cross Drilling to Main Oil Gallery
Main Oil Gallery (drilled through head from rear to front)	• 1. Base of Camshaft Towers • 2. Lash Adjuster Towers
Base of Camshaft Towers	Vertical Drilling Through Tower to Camshaft Bearings**
Lash Adjuster Towers	Diagonal Drillings to Hydraulic Lash Adjuster Pockets
** The number three camshaft bearing journal feeds oil into the hollow camshaft tubes. Oil is routed to the intake lobes, which have oil passages drilled into them to lubricate the rocker arms.	

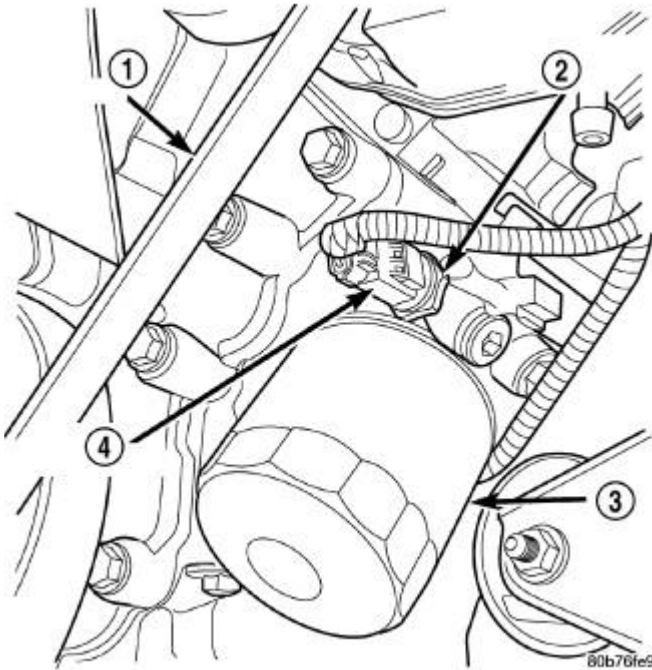
DIAGNOSIS AND TESTING**ENGINE OIL PRESSURE**

Fig. 173: Oil Pressure Sending Unit
Courtesy of CHRYSLER LLC

- | |
|---|
| <p>1 - BELT
2 - OIL PRESSURE SENSOR
3 - OIL FILTER
4 - ELECTRICAL CONNECTOR</p> |
|---|

1. Remove oil pressure sending unit and install gauge assembly C-3292A.
2. Run engine until thermostat opens.
3. Oil Pressure:
 - Curb Idle-25 kPa (4 psi) minimum
 - 3000 RPM-170 - 550 kPa (25 - 80 psi)
4. If oil pressure is 0 at idle, shut off engine. Check for a clogged oil pick-up screen or a pressure relief valve stuck open.

ENGINE OIL LEAK

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

1. Do not clean or degrease the engine at this time because some solvents may cause rubber to swell,

temporarily stopping the leak.

2. Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.
3. Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service information instructions.
4. If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.

If the oil leak source is not positively identified at this time, proceed with the AIR LEAK DETECTION TEST METHOD.

AIR LEAK DETECTION TEST METHOD

1. Disconnect the breather cap to air cleaner hose at the breather cap end. Cap or plug breather cap nipple.
2. Remove the PCV valve from the cylinder head cover. Cap or plug the PCV valve grommet.
3. Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kPa (3 PSI) of test pressure.

4. Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service information procedures.
5. If the leakage occurs at the rear oil seal area, refer to **INSPECTION FOR REAR SEAL AREA LEAKS**.
6. If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve and breather cap hose.
7. Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
 - a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
 - b. Where leakage tends to run straight down, possible causes are a porous block, oil galley pipe plugs,

oil filter runoff, and main bearing cap to cylinder block mating surfaces.

4. If no leaks are detected, pressurize the crankcase as outlined in **AIR LEAK DETECTION TEST METHOD**.

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

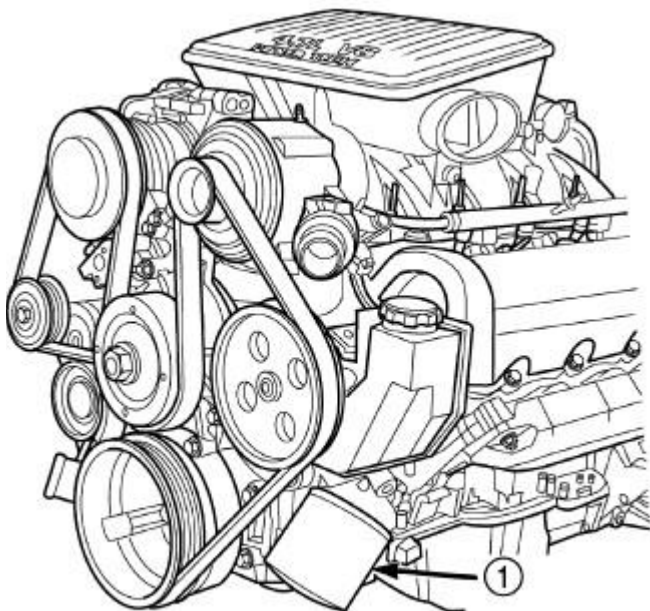
CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

FILTER, ENGINE OIL

Removal

REMOVAL



80b76f81

Fig. 174: Oil Filter - 4.7L Engine
Courtesy of CHRYSLER LLC

1 - ENGINE OIL FILTER

All engines are equipped with a high quality full-flow, disposable type oil filter. Chrysler Corporation recommends a Mopar® or equivalent oil filter be used.

1. Position a drain pan under the oil filter.
2. Using a suitable oil filter wrench loosen filter.
3. Rotate the oil filter counterclockwise to remove it from the cylinder block oil filter boss.
4. When filter separates from cylinder block oil filter boss, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

NOTE: Make sure filter gasket was removed with filter.

5. With a wiping cloth, clean the gasket sealing surface of oil and grime.

Installation

INSTALLATION

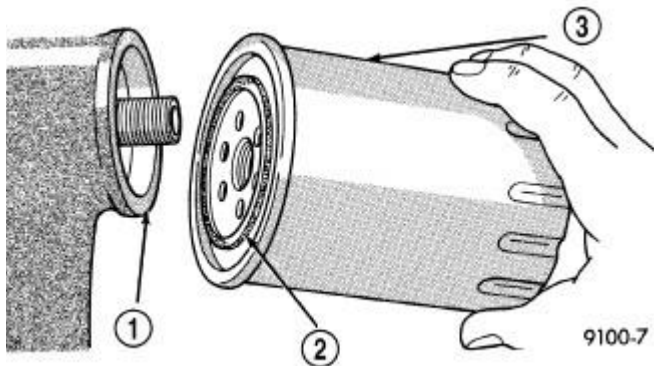


Fig. 175: Oil Filter Sealing Surface-Typical
Courtesy of CHRYSLER LLC

- 1 - SEALING SURFACE
- 2 - RUBBER GASKET
- 3 - OIL FILTER

1. Lightly lubricate oil filter gasket (2) with engine oil.
2. Thread filter (3) onto adapter nipple. When gasket makes contact with sealing surface, hand tighten filter one full turn, do not over tighten.
3. Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.

OIL

Standard Procedure

ENGINE OIL SERVICE

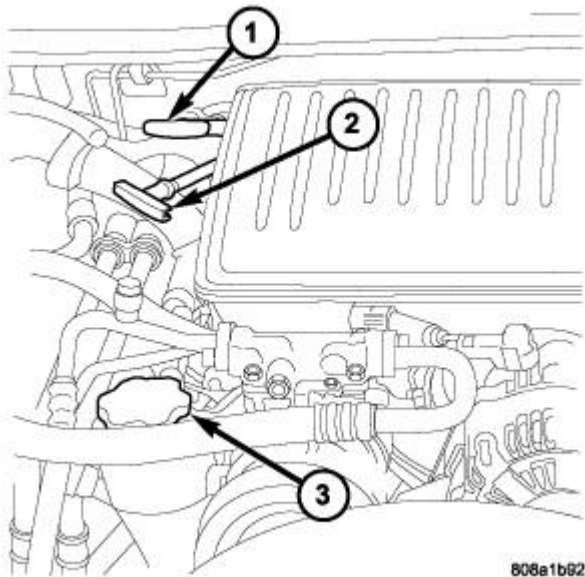


Fig. 176: ENGINE OIL DIPSTICK
Courtesy of CHRYSLER LLC

- | |
|---------------------------|
| 1 - TRANSMISSION DIPSTICK |
| 2 - ENGINE OIL DIPSTICK |
| 3 - ENGINE OIL FILL CAP |

The engine oil level indicator is located at the right rear of the engine on the 4.7L engines. .

CRANKCASE OIL LEVEL INSPECTION

CAUTION: Do not overfill crankcase with engine oil, pressure loss or oil foaming can result.

Inspect engine oil level approximately every 800 kilometers (500 miles). Unless the engine has exhibited loss of oil pressure, run the engine for about five minutes before checking oil level. Checking engine oil level on a cold engine is not accurate.

To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable levels are indicated between the ADD and SAFE marks on the engine oil dipstick.

1. Position vehicle on level surface.
2. With engine OFF, allow approximately ten minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.
3. Wipe dipstick clean.
4. Install dipstick and verify it is seated in the tube.
5. Remove dipstick, with handle held above the tip, take oil level reading.

6. Add oil only if level is below the ADD mark on dipstick.

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in Maintenance Schedules.

Run engine until achieving normal operating temperature.

1. Position the vehicle on a level surface and turn engine off.
2. Hoist and support vehicle on safety stands.
3. Remove oil fill cap.
4. Place a suitable drain pan under crankcase drain.
5. Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.
6. Install drain plug in crankcase.
7. Lower vehicle and fill crankcase with specified type and amount of engine oil.
8. Install oil fill cap.
9. Start engine and inspect for leaks.
10. Stop engine and inspect oil level.

NOTE: Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the **WARNING** at beginning of this section.

PAN, OIL**Removal****REMOVAL**

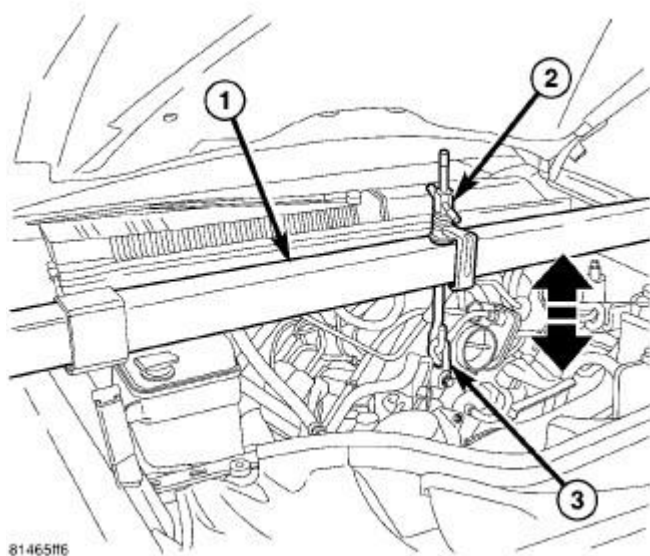


Fig. 177: ENGINE SUPPORT TOOL

Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Install engine support fixture (1) special tool 8534B **Do not raise engine at this time.**
3. Remove both left and right side engine mount through bolts.

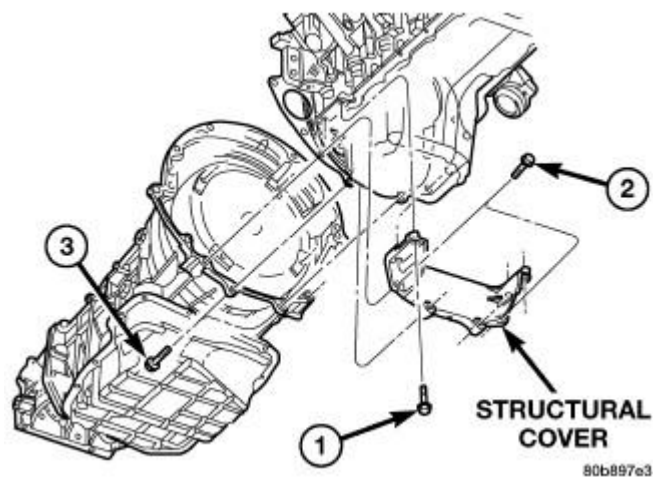


Fig. 178: Structural Cover

Courtesy of CHRYSLER LLC

4. Remove the structural dust cover.
5. Drain engine oil.

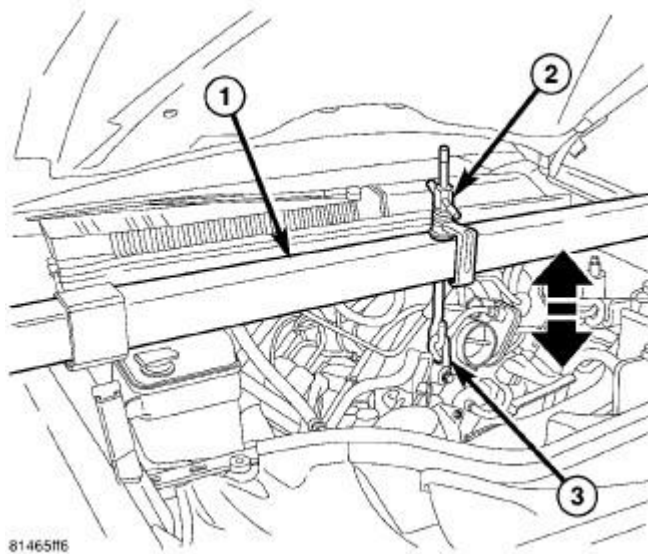


Fig. 179: ENGINE SUPPORT TOOL
Courtesy of CHRYSLER LLC

CAUTION: Only raise the engine enough to provide clearance for oil pan removal. Check for proper clearance at fan shroud to fan and cowl to intake manifold.

6. Raise engine using special tool (1) 8534B to provide clearance to remove oil pan.

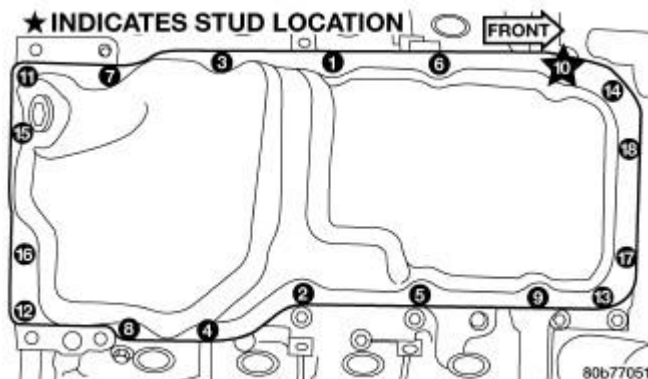


Fig. 180: Oil Pan Mounting Bolts and Oil Pan
Courtesy of CHRYSLER LLC

NOTE: On 4WD vehicles, the front axle must be lowered, to provide clearance for oil pan removal. It is not necessary to remove the front axle from the vehicle, or remove the axle shafts.

7. **For 4WD Vehicles** Remove the pinion bracket.
8. **For 4WD Vehicles** Disconnect the front driveshaft at the front axle.

9. **For 4WD Vehicles** Remove the front axle mounting bolts.
10. **For 4WD Vehicles** Lower axle using suitable jack enough to provide clearance to remove oil pan.

NOTE: Do not pry on oil pan or oil pan gasket. Gasket is integral to engine windage tray and does not come out with oil pan.

11. Remove the oil pan mounting bolts and oil pan.
12. Unbolt oil pump pickup tube and remove tube.
13. Inspect the integral windage tray and gasket and replace as needed.

Installation

INSTALLATION

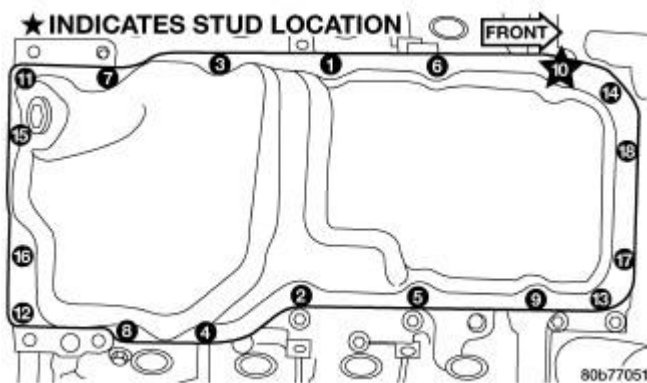


Fig. 181: Oil Pan Mounting Bolts and Oil Pan

Courtesy of CHRYSLER LLC

1. Clean the oil pan gasket mating surface of the bedplate and oil pan.
2. Position the oil pan gasket and pickup tube with new o-ring. Install the mounting bolt and nuts. Tighten bolt and nuts to 28 N.m (20 ft. lbs.).
3. Position the oil pan and install the mounting bolts. Tighten the mounting bolts to 15 N.m (11 ft. lbs.) in the sequence shown in illustration.

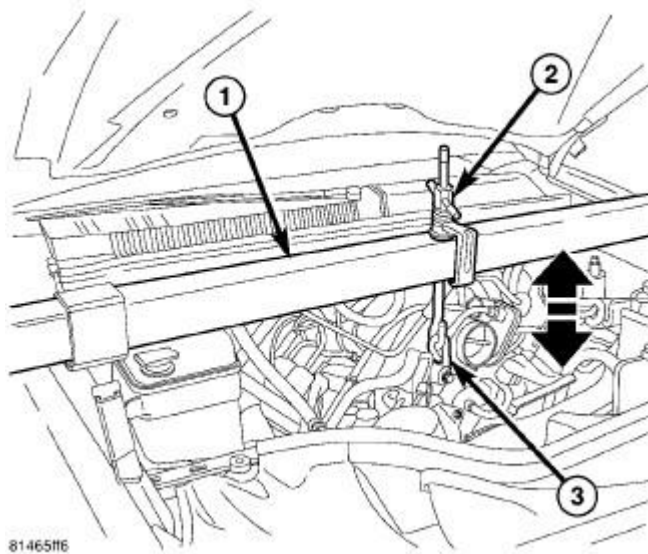


Fig. 182: ENGINE SUPPORT TOOL
Courtesy of CHRYSLER LLC

4. Lower the engine into mounts using special tool (1) 8534B
5. Install both the left and right side engine mount through bolts. Tighten the bolts to 68 N.m (50 ft. lbs.).
6. Remove special tool 8534B

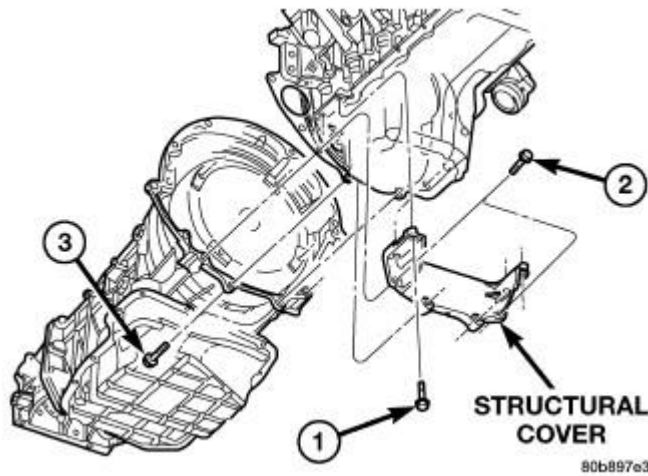


Fig. 183: Structural Cover
Courtesy of CHRYSLER LLC

7. Install structural dust cover.

NOTE: On 4WD vehicles, the front axle must be lowered, to provide clearance for oil pan removal. It is not necessary to remove the front axle from the vehicle, or remove the axle shafts.

8. **For 4WD Vehicles** Raise axle using suitable jack.
9. **For 4WD Vehicles** Install the front axle mounting bolts.
10. **For 4WD Vehicles** Install the pinion bracket.
11. **For 4WD Vehicles** Install the front driveshaft to the front axle.
12. Fill engine oil.
13. Reconnect the negative battery cable.
14. Start engine and check for leaks.

PUMP, ENGINE OIL

Removal

REMOVAL

1. Remove the oil pan and pick-up tube. See **Engine/Lubrication/PAN, Oil - Removal**.
2. Remove the timing chain cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.
3. Remove the timing chains and tensioners. See **Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Removal**.
4. Remove the four bolts, primary timing chain tensioner and the oil pump.

Disassembly

DISASSEMBLY

1. Remove oil pump cover screws and lift off cover plate.
2. Remove pump inner and outer rotors.

NOTE: Once the oil pressure relief valve, cup plug, and pin are removed, the pump assembly must be replaced.

3. If it is necessary to remove the pressure relief valve, drive the roll pin from pump housing and remove cup plug, spring and valve.

Cleaning

CLEANING

1. Wash all parts in a suitable solvent.

Inspection

INSPECTION

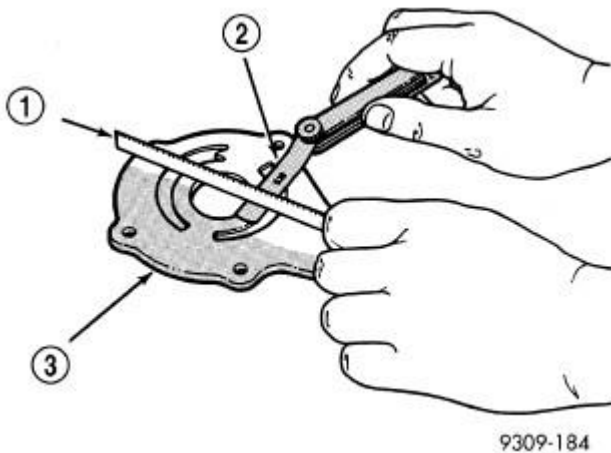


Fig. 184: Checking Oil Pump Cover Flatness
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - STRAIGHT EDGE
2 - FEELER GAUGE
3 - OIL PUMP COVER |
|---|

CAUTION: The oil pump pressure relief valve and spring should not be removed from the oil pump. If these components are disassembled and or removed from the pump the entire oil pump assembly must be replaced.

1. Clean all parts thoroughly. Mating surface of the oil pump housing should be smooth. If the pump cover is scratched or grooved the oil pump assembly should be replaced.
2. Lay a straight edge across the pump cover surface (3). If a 0.025 mm (0.001 in.) feeler gauge (2) can be inserted between the cover and the straight edge the oil pump assembly should be replaced.

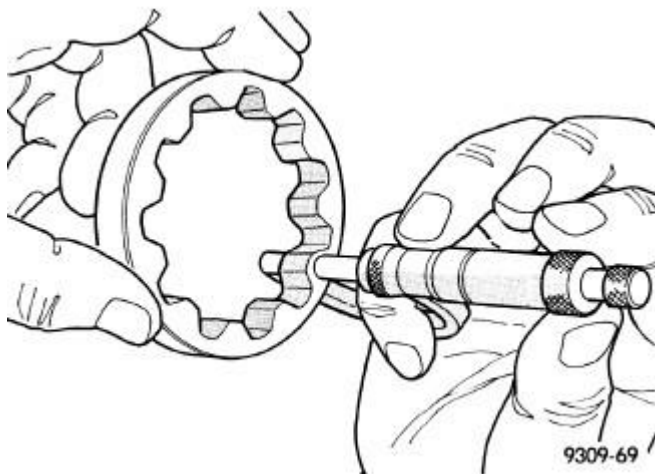
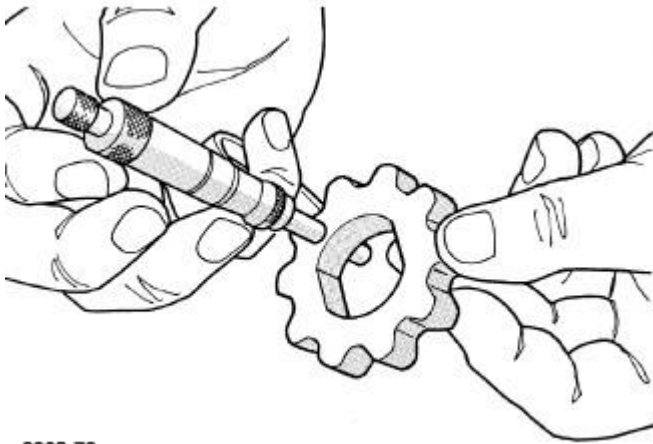


Fig. 185: Measuring Outer Rotor Thickness
Courtesy of CHRYSLER LLC

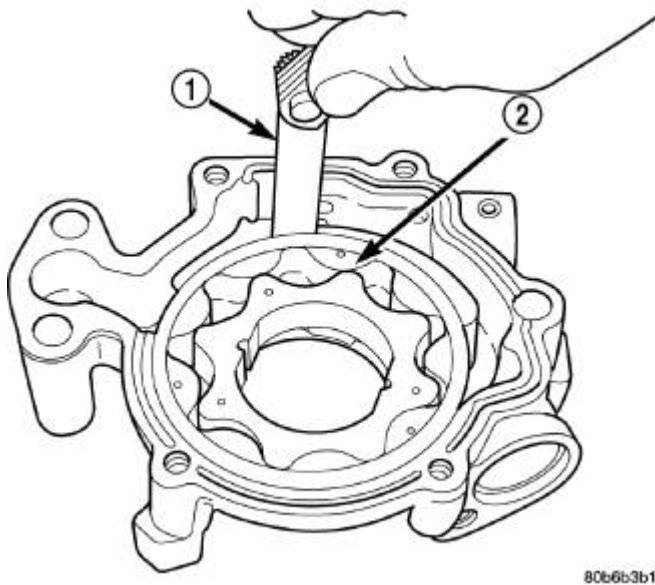
3. Measure the thickness of the outer rotor. If the outer rotor thickness measures at 12.005 mm (0.472 in.) or less the oil pump assembly must be replaced.
4. Measure the diameter of the outer rotor. If the outer rotor diameter measures at 85.925 mm (3.382 in.) or less the oil pump assembly must be replaced.



9309-70

Fig. 186: Measuring Inner Rotor Thickness
Courtesy of CHRYSLER LLC

5. Measure the thickness of the inner rotor. If the inner rotor thickness measures at 12.005 mm (0.472 in.) or less then the oil pump assembly must be replaced.



80b6b3b1

Fig. 187: Measuring Outer Rotor Clearance
Courtesy of CHRYSLER LLC

1 -
FEELER

GAUGE
2 - OUTER ROTOR

6. Slide outer rotor (2) into the body of the oil pump. Press the outer rotor to one side of the oil pump body and measure clearance between the outer rotor and the body. If the measurement is 0.235 mm (0.009 in.) or more the oil pump assembly must be replaced.

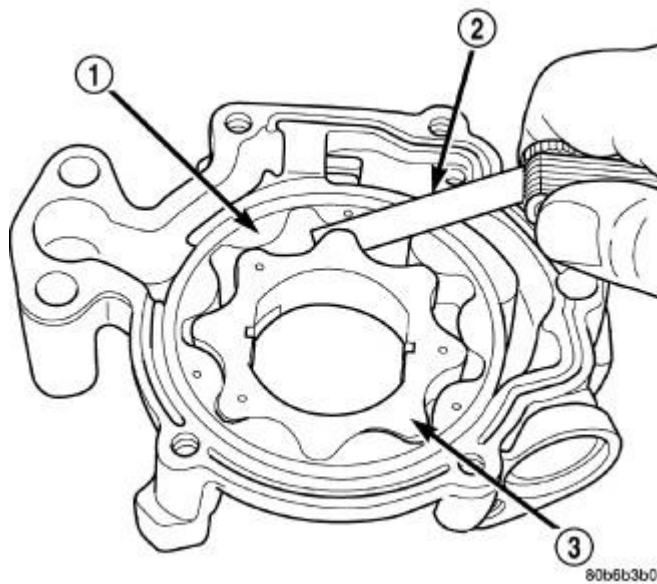


Fig. 188: Measuring Clearance Between Rotors
Courtesy of CHRYSLER LLC

1 - OUTER ROTOR
2 - FEELER GAUGE
3 - INNER ROTOR

7. Install the inner rotor into the oil pump body. Measure the clearance between the inner (3) and outer (1) rotors. If the clearance between the rotors is .150 mm (0.006 in.) or more the oil pump assembly must be replaced.

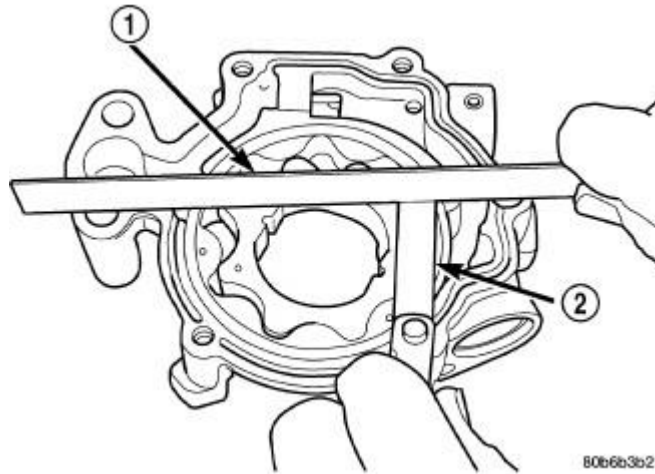


Fig. 189: Measuring Clearance Over Rotors
Courtesy of CHRYSLER LLC

1 - STRAIGHT EDGE
2 - FEELER GAUGE

- Place a straight edge (1) across the body of the oil pump (between the bolt holes), if a feeler gauge (2) of .095 mm (0.0038 in.) or greater can be inserted between the straightedge and the rotors, the pump must be replaced.

NOTE: The 3.7L/4.7L Oil pump is released as an assembly. There are no Chrysler part numbers for Sub-Assembly components. In the event the oil pump is not functioning or out of specification it must be replaced as an assembly.

Assembly

ASSEMBLY

- Wash all parts in a suitable solvent and inspect carefully for damage or wear.
- Install inner and outer rotors
- Install oil pump cover plate and install cover bolts and tighten them to 12 N.m (105 in. lbs.).
- Prime oil pump before installation by filling rotor cavity with engine oil.
- If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other causes for oil pressure loss.

Installation

INSTALLATION

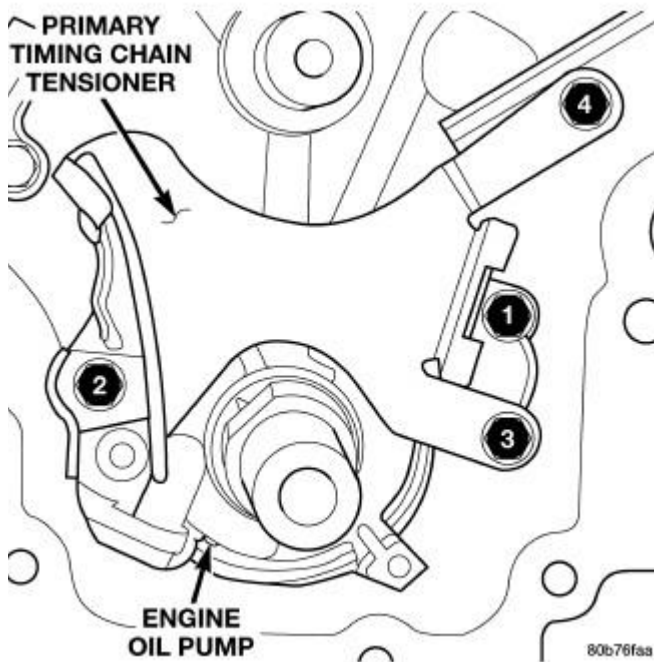


Fig. 190: Oil Pump And Primary Timing Chain Tensioner Tightening Sequence
Courtesy of CHRYSLER LLC

1. Position the oil pump onto the crankshaft and install one oil pump retaining bolt.
2. Position the primary timing chain tensioner and install three retaining bolts.
3. Tighten the oil pump and primary timing chain tensioner retaining bolts to 28 N.m (250 in. lbs.) in the sequence shown in illustration.
4. Install the secondary timing chain tensioners and timing chains. See **Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Installation**.

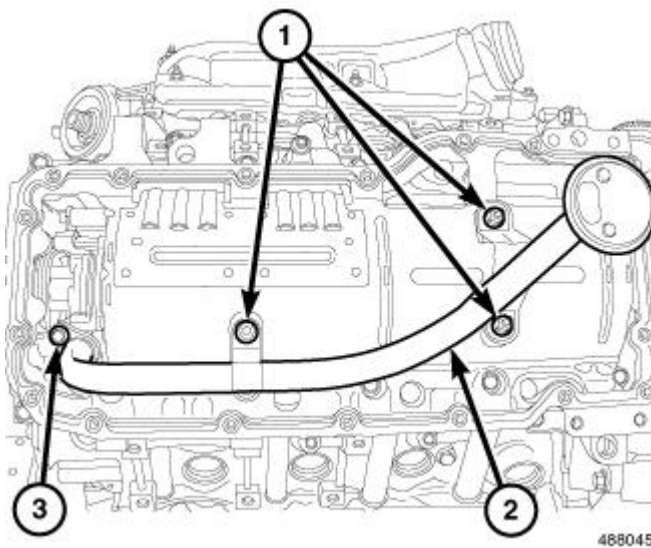


Fig. 191: Identifying Oil Pickup Tube
Courtesy of CHRYSLER LLC

5. Install the timing chain cover. See Engine/Valve Timing/COVER(S), Engine Timing - Installation.
6. Install the pick-up tube and oil pan. See Engine/Lubrication/PAN, Oil - Installation.

SWITCH, OIL PRESSURE

Description

DESCRIPTION

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 two terminal device (one terminal is provided to the wiring harness and the other terminal is the switch's metal housing that screws into the engine block).

Operation

OPERATION

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

Removal

REMOVAL

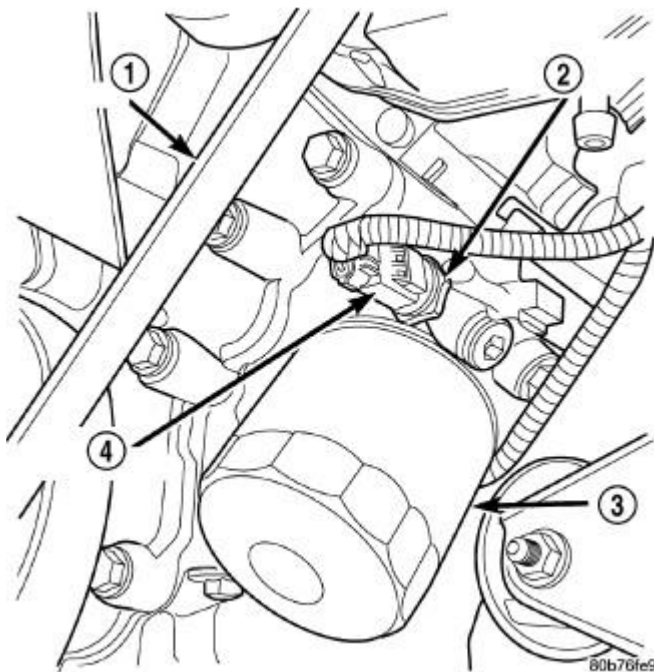


Fig. 192: Oil Pressure Sending Unit
Courtesy of CHRYSLER LLC

1. Disconnect the negative cable from the battery.
2. Raise vehicle on hoist.
3. Remove front splash shield.
4. Disconnect oil pressure sender wire (4).
5. Remove the pressure sender (2).

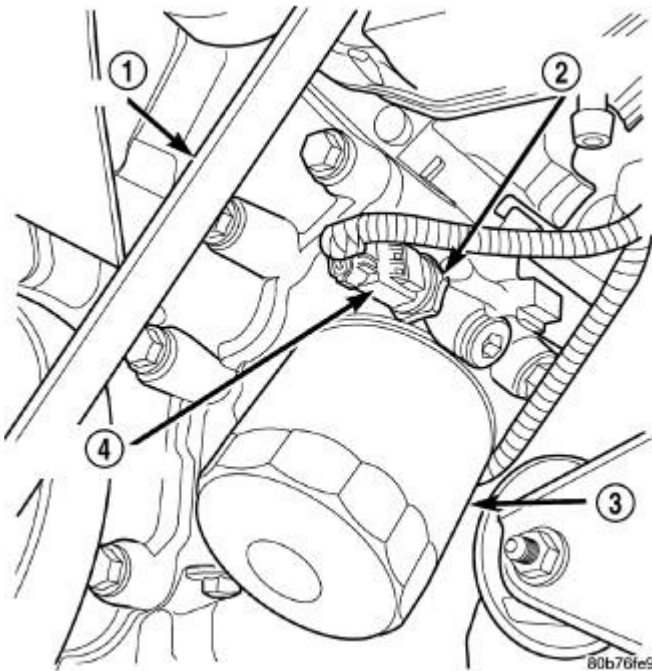
Installation**INSTALLATION**

Fig. 193: Identifying Engine Oil Pressure Sensor
Courtesy of CHRYSLER LLC

1. Install oil pressure sender (2).
2. Connect oil pressure sender wire (4).
3. Install front splash shield.
4. Lower vehicle.
5. Connect the negative battery cable.

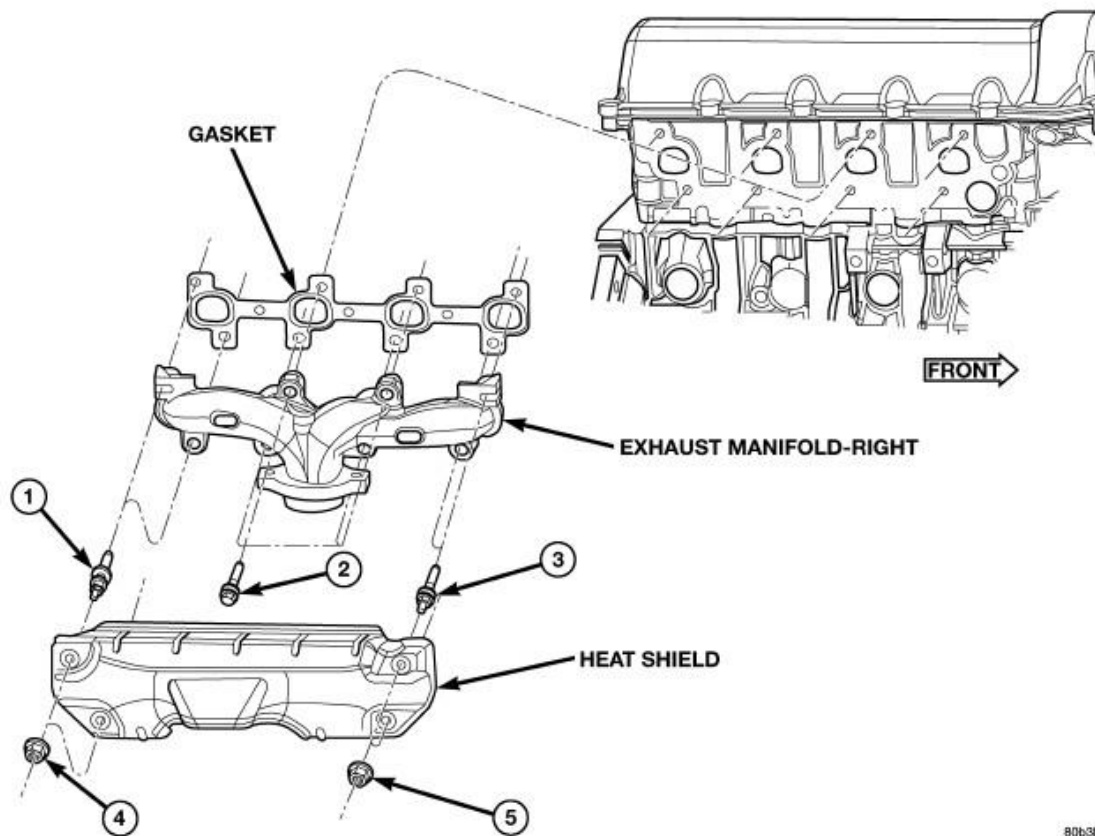
MANIFOLDS**MANIFOLD, EXHAUST****Description****DESCRIPTION**

The exhaust manifolds are log style with a patented flow enhancing design to maximize performance. The exhaust manifolds are made of high silicon molybdenum cast iron. A perforated core graphite exhaust manifold gasket is used to improve sealing to the cylinder head. The exhaust manifolds are covered by a three layer laminated heat shield for thermal protection and noise reduction. The heat shields are fastened with a torque prevailing nut that is backed off slightly to allow for the thermal expansion of the exhaust manifold.

Removal

REMOVAL

RIGHT EXHAUST MANIFOLD



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Fig. 194: Exhaust Manifold-Right
Courtesy of CHRYSLER LLC

RIGHT EXHAUST MANIFOLD

ITEM	DESCRIPTION	TORQUE	ITEM	DESCRIPTION	TORQUE
1	Stud (Qty 2)	25 N.m (18 ft. lbs.)	4	Nut (Qty 2)	8 N.m (72 in. lbs.), then loosen 45 degrees
2	Bolt (Qty 4)		5	Nut (Qty 2)	
3	Stud (Qty 2)				

1. Disconnect the negative battery cable.
2. Remove the air cleaner assembly. See **Engine/Air Intake System/BODY, Air Cleaner - Removal**.
3. Remove the accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal**.
4. Remove A/C compressor. Refer to **Heating and Air Conditioning/Plumbing/COMPRESSOR, A/C - Removal**.
5. Remove A/C accumulator support bracket retainers.
6. Drain the coolant below heater hose level. Refer to **Cooling - Standard Procedure**.
7. Remove the heater hoses at the engine and position aside.
8. Remove the exhaust manifold heat shield retaining nuts (4,5) and remove the heat shield.
9. Remove the upper exhaust manifold retaining bolts (1, 2, 3).
10. Raise and support the vehicle.

CAUTION: When servicing or replacing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust to hang by the oxygen sensor wires will damage the harness and/or sensor.

11. Saturate the exhaust pipe/catalytic converter assembly flanged nuts at the exhaust manifold with heat valve lubricant, allow 5 minutes for penetration.
12. Disconnect the exhaust pipe/catalytic converter at the exhaust manifold. Refer to **Exhaust System/CONVERTER, Catalytic - Removal**.
13. Remove the starter. Refer to **Electrical/Starting/STARTER - Removal**.
14. Remove the lower exhaust manifold retaining bolts (1, 2, 3).

NOTE: The exhaust manifold is removed from below the engine compartment.

15. Remove the exhaust manifold and gasket.

LEFT EXHAUST MANIFOLD

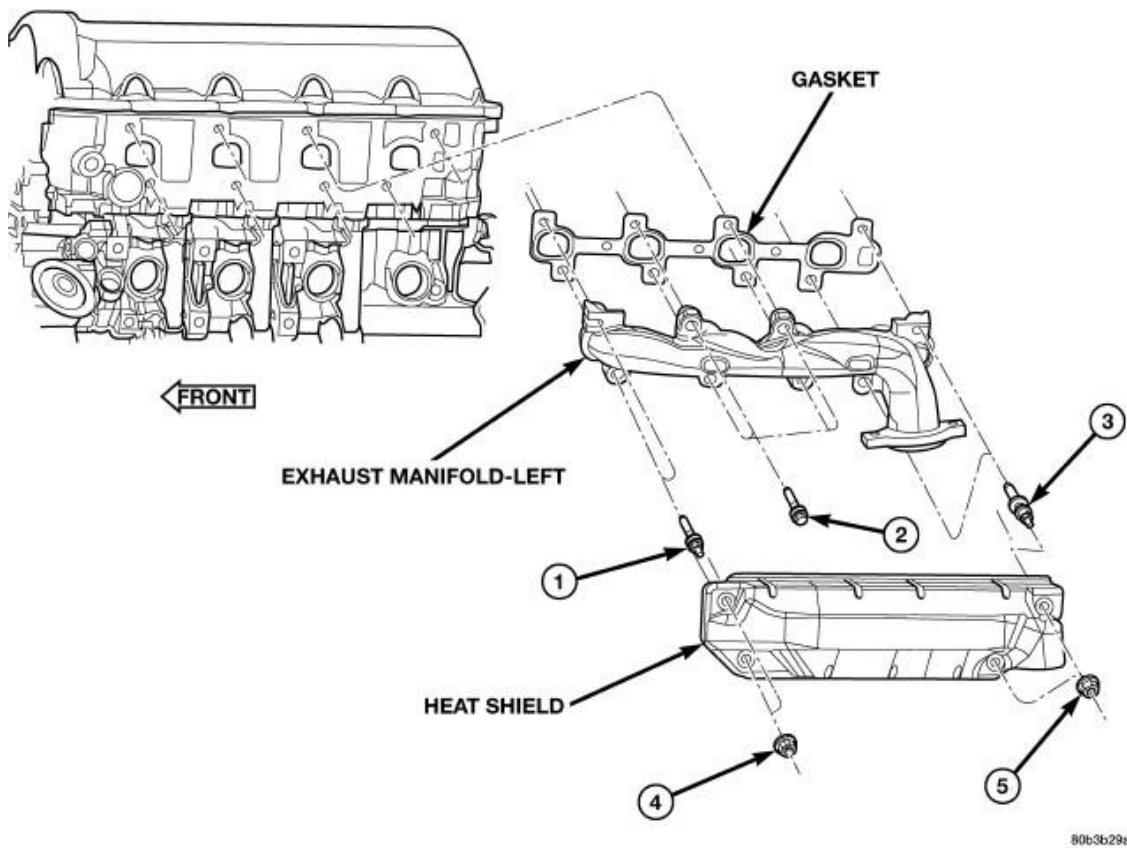


Fig. 195: Exhaust Manifold-Left
Courtesy of CHRYSLER LLC

LEFT EXHAUST MANIFOLD

ITEM	DESCRIPTION	TORQUE	ITEM	DESCRIPTION	TORQUE
1	Stud (Qty 2)	25 N.m (18 ft. lbs.)	4	Nut (Qty 2)	8 N.m (72 in. lbs.), then loosen 45 degrees
2	Bolt (Qty 4)		5	Nut (Qty 2)	
3	Stud (Qty 2)				

1. Disconnect the negative battery cable.
2. Remove the engine cover.
3. Remove the front two exhaust manifold heat shield retaining nuts (4).
4. Raise and support the vehicle.

CAUTION: When servicing or replacing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust to hang by the oxygen sensor wires will damage the harness and/or sensor.

5. Saturate the exhaust pipe/catalytic converter assembly flanged nuts at the exhaust manifold with heat

valve lubricant, allow 5 minutes for penetration.

6. Disconnect the exhaust pipe at the exhaust manifold. Refer to **Exhaust System/CONVERTER, Catalytic - Removal**.
7. Remove the rear heat shield (5) retaining nuts and remove the heat shield.
8. Lower the vehicle.
9. Remove the upper exhaust manifold retaining bolts (1, 2, 3).

NOTE: **The exhaust manifold is removed from below the engine compartment.**

10. Raise and support the vehicle.
11. Remove the lower exhaust manifold retaining bolts (1, 2, 3).
12. Remove the exhaust manifold and gasket.
13. Clean the mating surfaces.

Cleaning

CLEANING

1. Clean the exhaust manifold using a suitable cleaning solvent, then allow to air dry.
2. Clean all gasket residue from the manifold mating surface.

Inspection

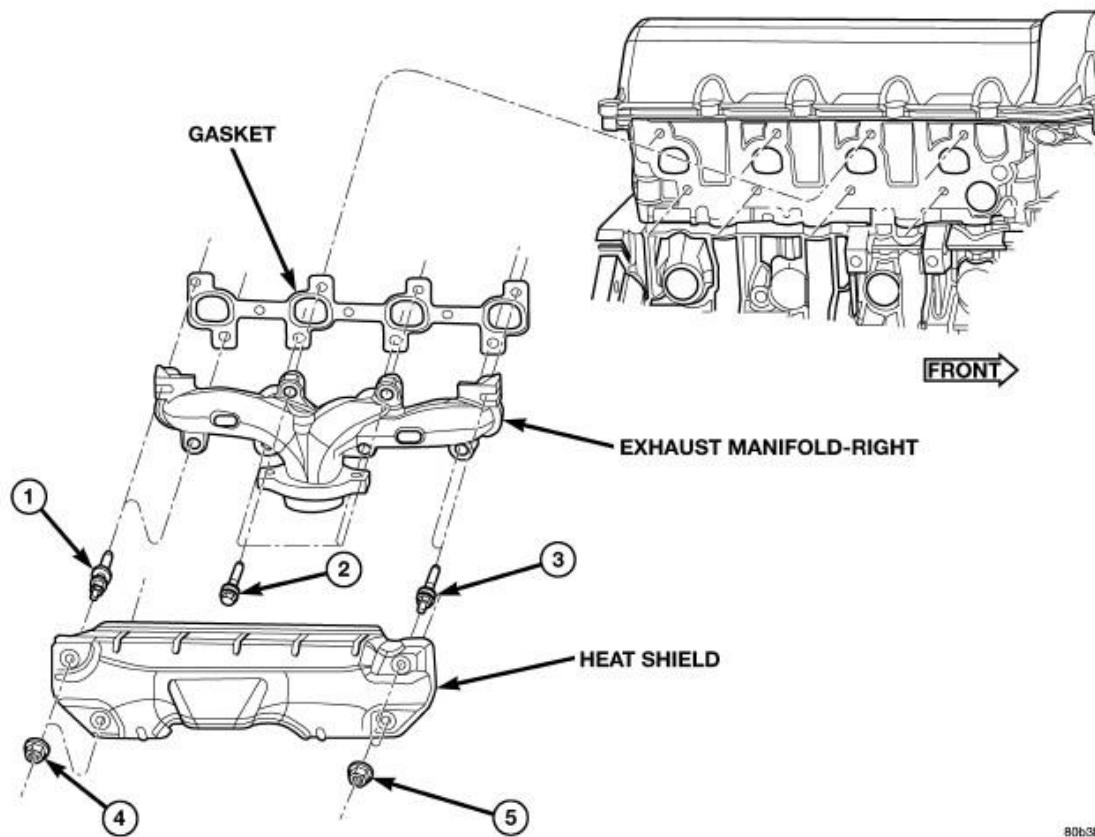
INSPECTION

1. Inspect the exhaust manifold for cracks in the mating surface and at every mounting bolt hole.
2. Using a straight edge and a feeler gauge, check the mating surface for warp and twist.
3. Inspect the manifold to exhaust pipe mating surface for cracks, gouges, or other damage that would prevent sealing.

Installation

INSTALLATION

RIGHT EXHAUST MANIFOLD



80b3b29e

Fig. 196: Exhaust Manifold-Right
Courtesy of CHRYSLER LLC

RIGHT EXHAUST MANIFOLD

ITEM	DESCRIPTION	TORQUE	ITEM	DESCRIPTION	TORQUE
1	Stud (Qty 2)	25 N.m (18 ft. lbs.)	4	Nut (Qty 2)	8 N.m (72 in. lbs.), then loosen 45 degrees
2	Bolt (Qty 4)		5	Nut (Qty 2)	
3	Stud (Qty 2)				

1. Prior to installation, make sure all gasket mating surfaces are clean and free of any debris.

NOTE: The exhaust manifold is installed from below the engine compartment.

2. Position the exhaust manifold and gasket.

NOTE: Do not tighten exhaust manifold retainers until all retainers are in place.

3. Install the lower exhaust manifold retaining bolts (1,2,3).
4. Install the starter. Refer to [Electrical/Starting/STARTER - Installation](#).
5. Lower the vehicle.

6. Install the upper exhaust manifold retaining bolts and tighten starting at center and working outward to 25 N.m (18 ft. lbs.).

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

7. Install the exhaust manifold heat shield and tighten retaining nuts (4,5) to 8 N.m (72 in. lbs.), then loosen 45 degrees.
8. Connect the heater hoses at the engine.
9. Install the A/C accumulator support bracket retainers.
10. Install the A/C compressor. Refer to **Heating and Air Conditioning/Plumbing/COMPRESSOR, A/C - Installation** .
11. Install the accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation** .
12. Raise and support the vehicle.
13. Connect the exhaust pipe/catalytic converter to the exhaust manifold. Refer to **Exhaust System/CONVERTER, Catalytic - Installation** .
14. Lower the vehicle.
15. Install air cleaner assembly. See **Engine/Air Intake System/BODY, Air Cleaner - Installation**.
16. Connect the negative battery cable.
17. Fill the cooling system. Refer to **Cooling - Standard Procedure** .
18. Start the engine and check for leaks.

LEFT EXHAUST MANIFOLD

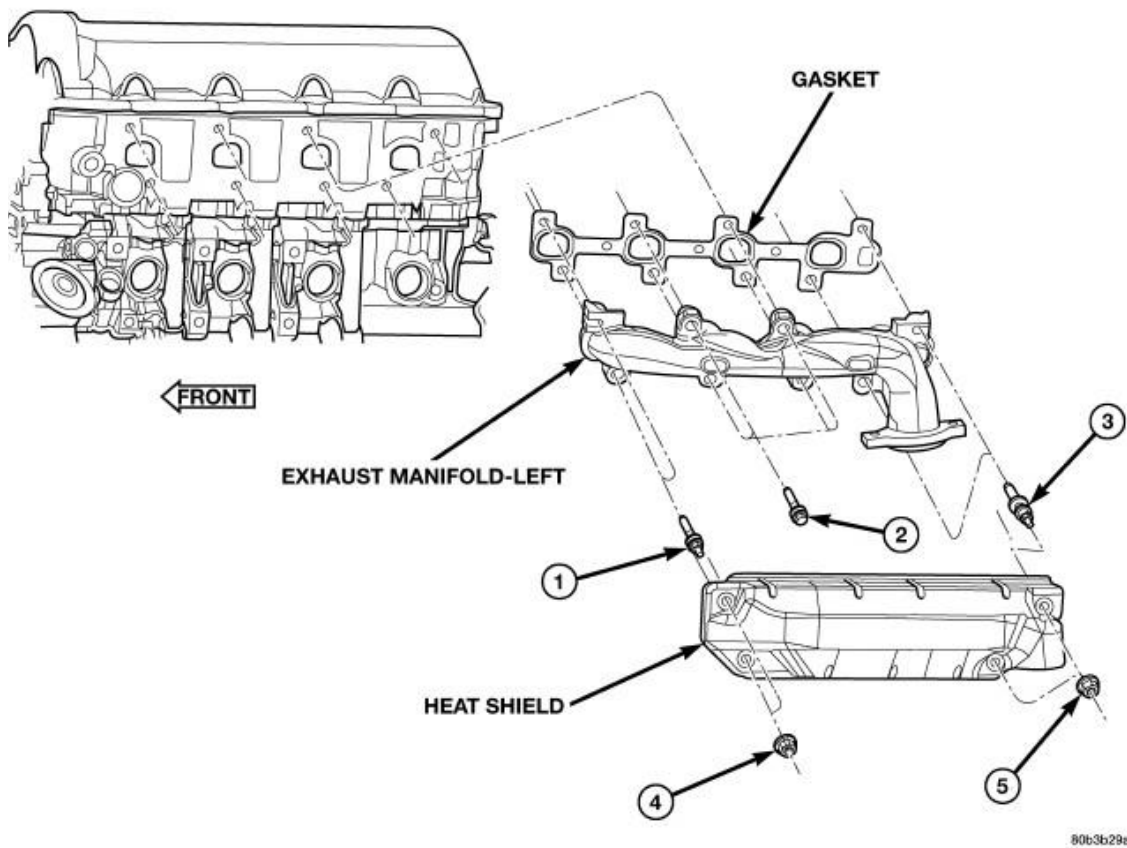


Fig. 197: Exhaust Manifold-Left
 Courtesy of CHRYSLER LLC

LEFT EXHAUST MANIFOLD

ITEM	DESCRIPTION	TORQUE	ITEM	DESCRIPTION	TORQUE
1	Stud (Qty 2)	25 N.m (18 ft. lbs.)	4	Nut (Qty 2)	8 N.m (72 in. lbs.), then loosen 45 degrees
2	Bolt (Qty 4)		5	Nut (Qty 2)	
3	Stud (Qty 2)				

1. Prior to installation, make sure all gasket mating surfaces are clean and free of any debris.

NOTE: The exhaust manifold is installed from below the engine compartment.

2. Position the exhaust manifold and gasket.

NOTE: Do not tighten exhaust manifold retainers until all retainers are in place.

3. Install the lower exhaust manifold retaining bolts (1,2,3).
4. Lower the vehicle.
5. Install the upper exhaust manifold retaining bolts and tighten starting at center and working outward to 25

N.m (18 ft. lbs.).

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

6. Install the front two exhaust manifold heat shield retaining nuts (4).
7. Raise and support the vehicle.
8. Install the rear heat shield (5) retaining nuts and tighten all retaining nuts to 8 N.m (72 in. lbs.), then loosen 45 degrees.
9. Connect the exhaust pipe/catalytic converter to the exhaust manifold. Refer to **Exhaust System/CONVERTER, Catalytic - Installation** .
10. Lower the vehicle.
11. Install the engine cover.
12. Connect the negative battery cable.
13. Start the engine and check for leaks.

MANIFOLD, INTAKE

Description

DESCRIPTION

The intake manifold is made of a composite material and features long runners which maximizes low end torque. The intake manifold uses single plane sealing which consist of eight individual press in place port gaskets to prevent leaks.

Diagnosis and Testing

INTAKE MANIFOLD LEAKAGE

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

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 the fan. Do not wear loose clothing.

1. Start the engine.
2. Spray a small stream of water at the suspected leak area.
3. If a change in RPM is observed the area of the suspected leak has been found.
4. Repair as required.

Removal

REMOVAL

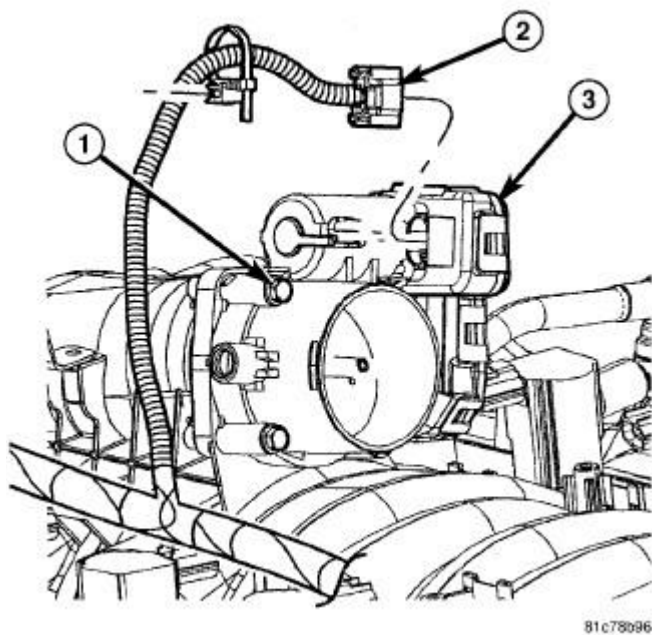


Fig. 198: THROTTLE BODY-4.7L

Courtesy of CHRYSLER LLC

1. Remove resonator assembly and air inlet hose.
2. Bleed fuel system. Refer to **Fuel System/Fuel Delivery - Standard Procedure** .
3. Disconnect negative cable from battery.
4. Disconnect electrical connectors for the following components:

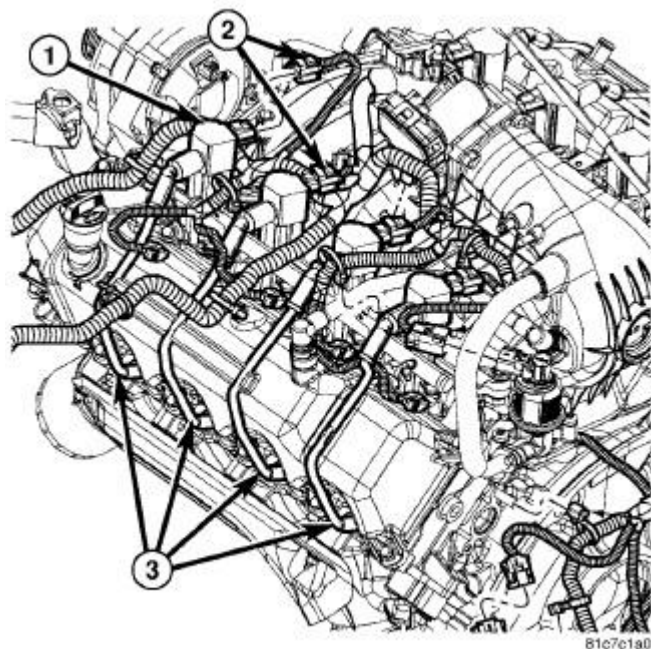


Fig. 199: IGNITION COIL - 4.7L**Courtesy of CHRYSLER LLC**

- Electronic Throttle Control (ETC) (2)
 - Coolant Temperature (CTS) Sensor
5. remove spark plug wires (3).
 6. Disconnect generator electrical connections.
 7. Disconnect and remove ignition coils (1,2) and manifold retaining bolts.
 8. Remove top oil dipstick tube retaining bolt and ground strap.
 9. Remove fuel rail. Refer to **Fuel System/Fuel Delivery/RAIL, Fuel - Removal** .
 10. Remove intake manifold.

Cleaning**CLEANING**

NOTE: **There is NO approved repair procedure for the intake manifold. If severe damage is found during inspection, the intake manifold must be replaced.**

Before installing the intake manifold thoroughly clean the mating surfaces. Use a suitable cleaning solvent, then air dry.

Inspection**INSPECTION**

1. Inspect the intake sealing surface for cracks, nicks and distortion.
2. Inspect the intake manifold vacuum hose fittings for looseness or blockage.
3. Inspect the manifold to throttle body mating surface for cracks, nicks and distortion.

Installation**INSTALLATION**

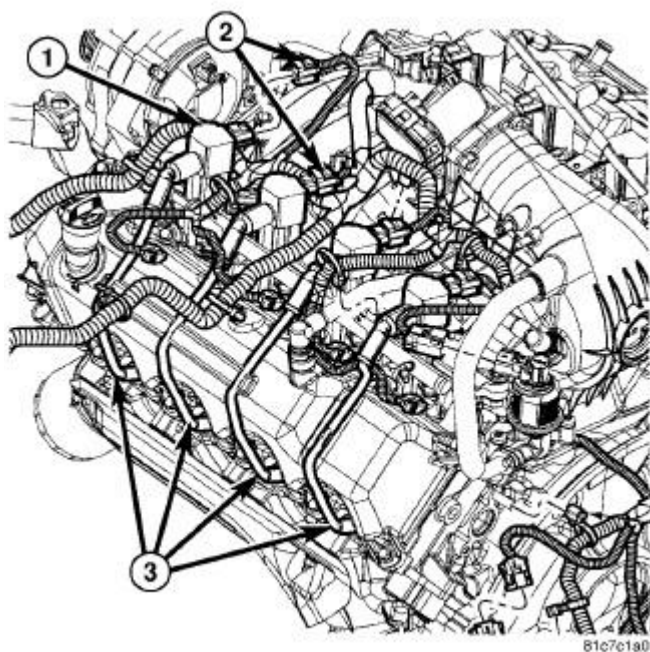


Fig. 200: IGNITION COIL - 4.7L

Courtesy of CHRYSLER LLC

1. Install intake manifold gaskets.
2. Position intake manifold.
3. Install the ignition coils (1,2) and manifold retaining bolts and torque from the center bolts, moving front to back in a crisscross pattern to 12 N.m (106 in. lbs.).

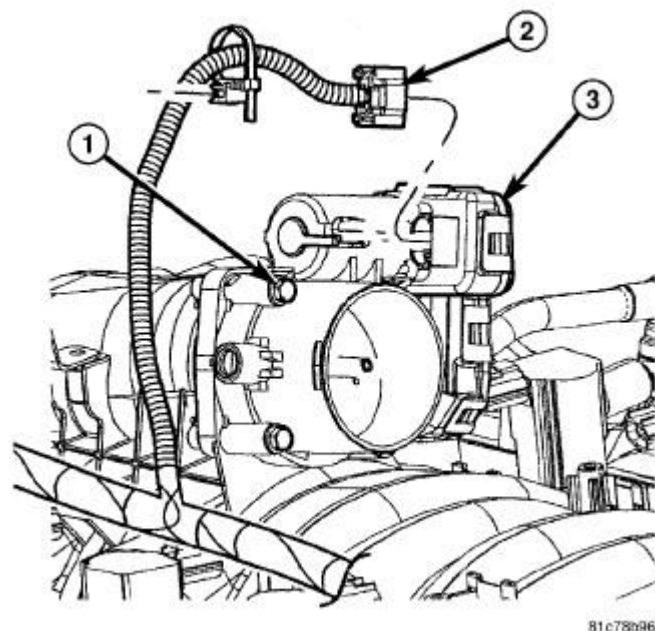
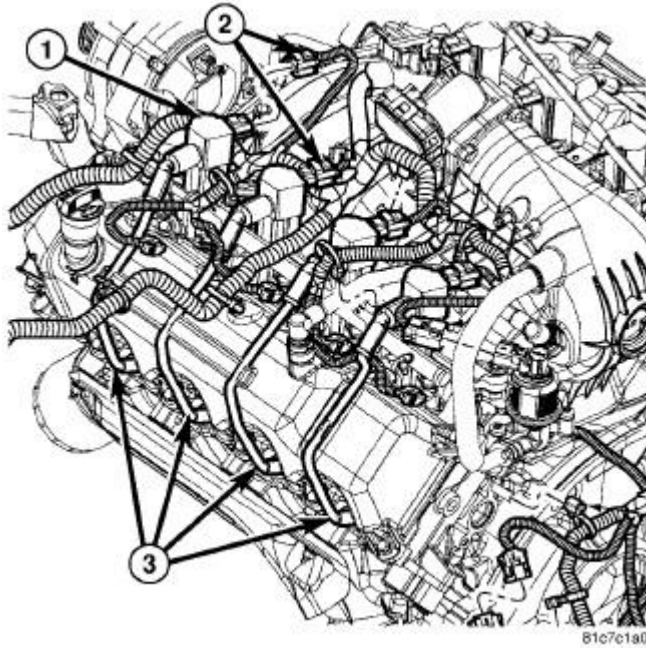


Fig. 201: THROTTLE BODY-4.7L

Courtesy of CHRYSLER LLC

4. Install throttle body assembly (3), if removed.
5. Install fuel rail. Refer to **Fuel System/Fuel Delivery/RAIL, Fuel - Installation** .
6. Connect electrical connectors for the following components:

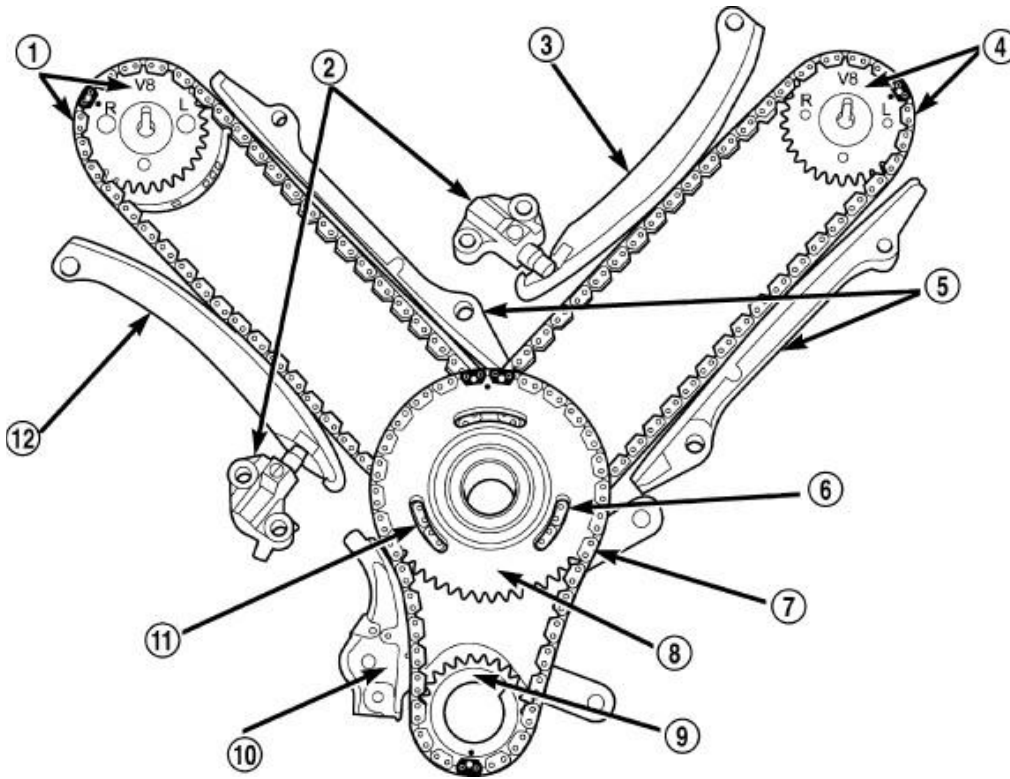
**Fig. 202: IGNITION COIL - 4.7L**

Courtesy of CHRYSLER LLC

- Manifold Absolute Pressure (MAP) Sensor
 - Electronic Throttle Control (ETC) (2)
 - Coolant Temperature (CTS) Sensor
 - Ignition coil
 - Fuel injectors
7. Install top oil dipstick tube retaining bolt and ground strap.
 8. Install spark plug wires (3).
 9. Connect generator electrical connections.
 10. Install resonator assembly and air inlet hose.
 11. Connect negative cable to battery.

VALVE TIMING**DESCRIPTION**

DESCRIPTION



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Fig. 203: Timing Drive System
Courtesy of CHRYSLER LLC

1 - RIGHT CAMSHAFT SPROCKET AND SECONDARY CHAIN
2 - SECONDARY TIMING CHAIN TENSIONER (LEFT AND RIGHT SIDE NOT COMMON)
3 - SECONDARY TENSIONER ARM
4 - LEFT CAMSHAFT SPROCKET AND SECONDARY CHAIN
5 - CHAIN GUIDE
6 - TWO PLATED LINKS ON RIGHT CAMSHAFT CHAIN
7 - PRIMARY CHAIN
8 - IDLER SPROCKET
9 - CRANKSHAFT SPROCKET
10 - PRIMARY CHAIN TENSIONER
11 - TWO PLATED LINKS ON LEFT CAMSHAFT CHAIN
12 - SECONDARY TENSIONER ARM

The timing drive system has been designed to provide quiet performance and reliability to support a **non-free wheeling** engine. Specifically the intake valves are non-free wheeling and can be easily damaged with forceful engine rotation if camshaft-to-crankshaft timing is incorrect. The timing drive system consists of a primary chain and two secondary timing chain drives.

OPERATION

OPERATION

The primary timing chain is a single inverted tooth type. The primary chain drives the large fifty tooth idler sprocket directly from a 25 tooth crankshaft sprocket. Primary chain motion is controlled by a pivoting leaf spring tensioner arm and a fixed guide. The arm and the guide both use nylon plastic wear faces for low friction and long wear. The primary chain receives oil splash lubrication from the secondary chain drive and oil pump leakage. The idler sprocket assembly connects the primary and secondary chain drives. The idler sprocket assembly consists of two integral 26 tooth sprockets and a fifty tooth sprocket that is splined to the assembly. The spline joint is a non - serviceable press fit anti rattle type. The idler sprocket assembly spins on a stationary idler shaft. The idler shaft is press-fit into the cylinder block. A large washer on the idler shaft bolt and the rear flange of the idler shaft are used to control sprocket thrust movement. Pressurized oil is routed through the center of the idler shaft to provide lubrication for the two bushings used in the idler sprocket assembly.

There are two secondary drive chains, one to drive the camshaft in each SOHC cylinder head. There are no shaft speed changes in the secondary chain drive system. Each secondary chain drives a 26 tooth cam sprocket directly from the 26 tooth sprocket on the idler sprocket assembly. A fixed chain guide and a hydraulic oil damped tensioner are used to maintain tension in each secondary chain system. The hydraulic tensioners for the secondary chain systems are fed pressurized oil from oil reservoir pockets in the block. Each tensioner also has a mechanical ratchet system that limits chain slack if the tensioner piston bleeds down after engine shut down. The tensioner arms and guides also utilize nylon wear faces for low friction and long wear. The secondary timing chains receive lubrication from a small orifice in the tensioners. This orifice is protected from clogging by a fine mesh screen which is located on the back of the hydraulic tensioners.

STANDARD PROCEDURE

MEASURING TIMING CHAIN WEAR

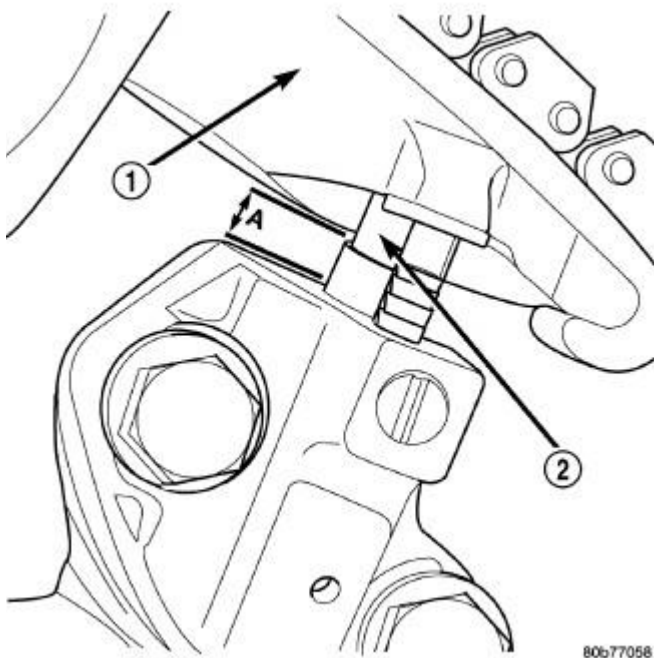


Fig. 204: Measuring Secondary Timing Chains For Wear

Courtesy of CHRYSLER LLC

1 - SECONDARY TENSIONER ARM

2 - SECONDARY CHAIN TENSIONER PISTON

NOTE: This procedure must be performed with the timing chain cover removed.

1. Remove the timing chain cover. See Engine/Valve Timing/COVER(S), Engine Timing - Removal.
2. To determine if the secondary timing chains are worn, rotate the engine clockwise until maximum tensioner piston (2) extension is obtained. Measure the distance between the secondary timing chain tensioner housing and the step ledge on the piston. The measurement at point (A) must be less than 15 mm (0.5906 inches).
3. If the measurement exceeds the specification the secondary timing chains are worn and require replacement. See Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Removal.

NOTE: If the secondary chains are to be replaced the primary chain must also be replaced.

ENGINE TIMING VERIFICATION

CAUTION: The 4.7L is a non free-wheeling design engine. Therefore, correct engine timing is critical.

NOTE: Components referred to as left hand or right hand are as viewed from the drivers position inside the vehicle.

NOTE: The blue link plates on the chains and the dots on the camshaft drive sprockets may not line up during the timing verification procedure. The blue link plates are lined up with the sprocket dots only when re-timing the complete timing drive. Once the timing drive is rotated blue link-to-dot alignment is no longer valid.

Engine base timing can be verified by the following procedure:

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

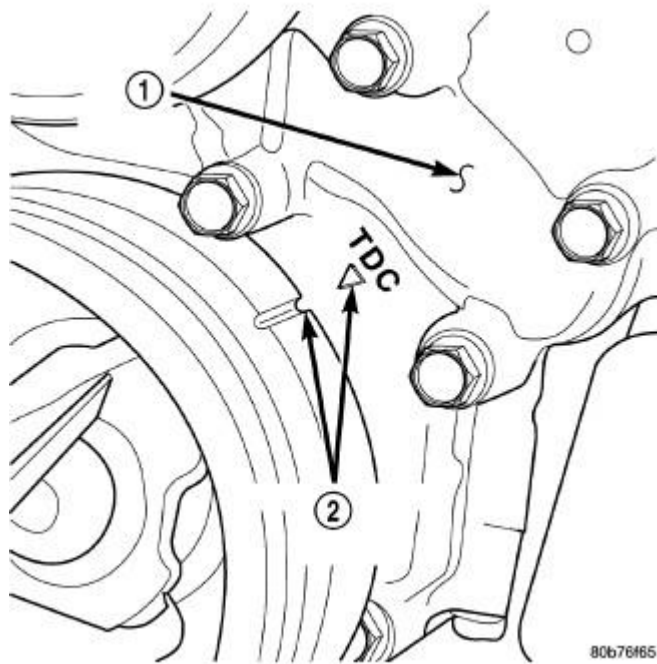


Fig. 205: Engine Top Dead Center (TDC) Indicator Mark
Courtesy of CHRYSLER LLC

2. Using a mirror, locate the TDC arrow on the front cover. Rotate the crankshaft until the mark on the crankshaft damper is aligned with the TDC arrow on the front cover. The engine is now at TDC.

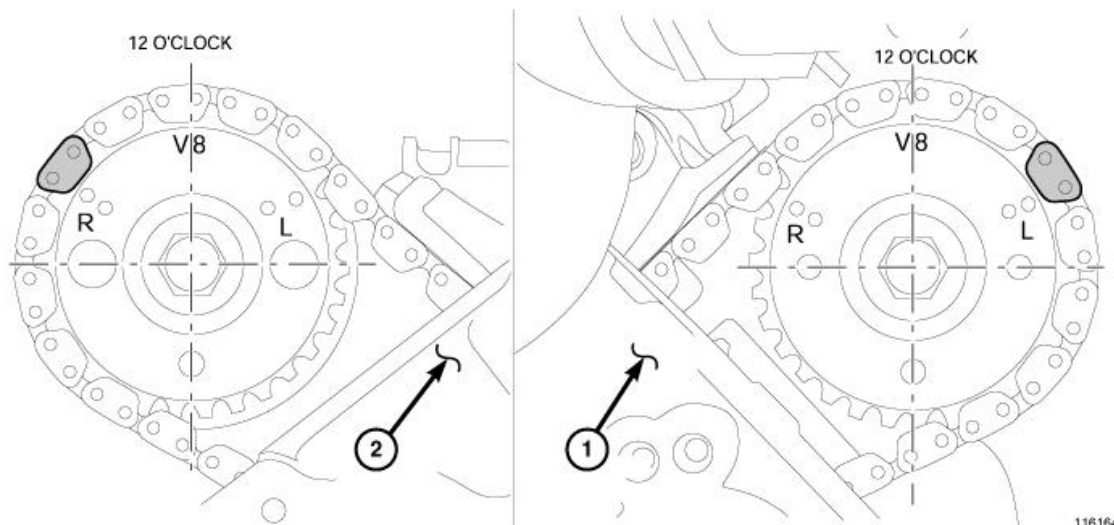


Fig. 206: Camshaft Sprocket V8 Marks
Courtesy of CHRYSLER LLC

3. Note the location of the V8 mark stamped into the camshaft drive gears. If the V8 mark on each camshaft drive gear is at the twelve o'clock position, the engine is at TDC (cylinder #1) on the exhaust stroke. If the V8 mark on each gear is at the six o'clock position, the engine is at TDC (cylinder #1) on the compression stroke.

4. If both of the camshaft drive gears are off in the same or opposite directions, the primary chain or both secondary chains are at fault. Refer to **CHAIN and SPROCKETS, Timing**.
5. If only one of the camshaft drive gears is off and the other is correct, the problem is confined to one secondary chain. Refer to **SINGLE CAMSHAFT TIMING**.
6. If both camshaft drive gear V8 marks are at the twelve o'clock or the six o'clock position the engine base timing is correct. Reinstall the cylinder head covers.

SINGLE CAMSHAFT TIMING

NOTE: to adjust the timing on one camshaft, perform the following procedure.

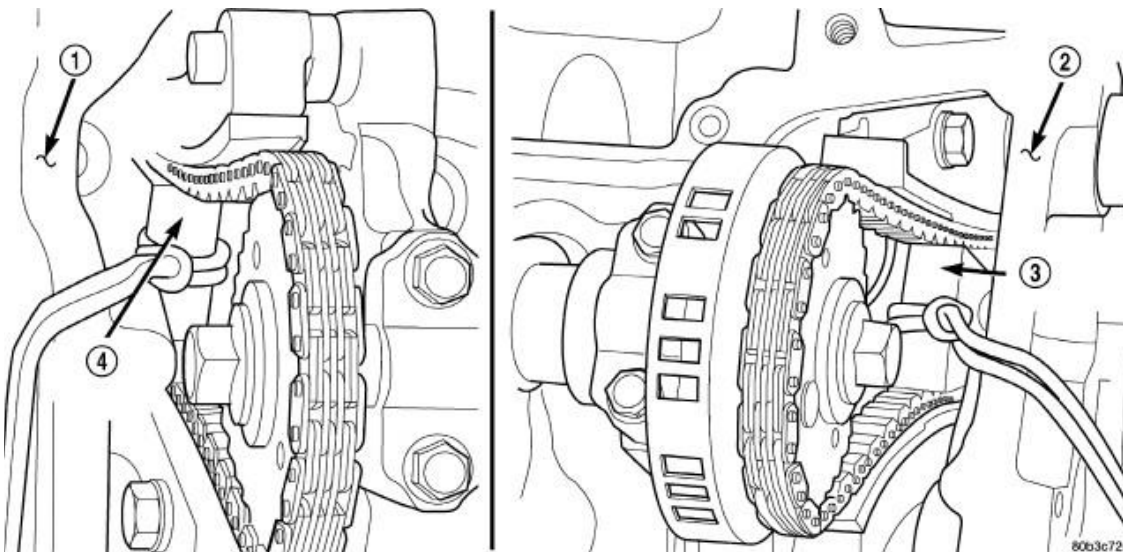


Fig. 207: Securing Timing Chain Tensioners Using Timing Chain Wedge
Courtesy of CHRYSLER LLC

1. Using Chain Tensioner Wedge 9867 (3), stabilize the secondary chain drive. For reference purposes, mark the chain-to-sprocket position.

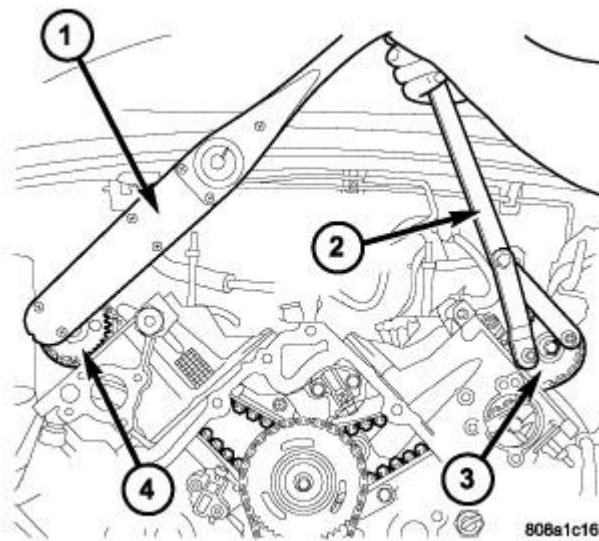


Fig. 208: Tightening Right Side Camshaft Sprocket Bolt
Courtesy of CHRYSLER LLC

2. Remove the camshaft drive gear retaining bolt using Spanner Wrench 6958 (2) with Adapter Pins 8346.
3. Carefully remove the camshaft drive gear from the camshaft.

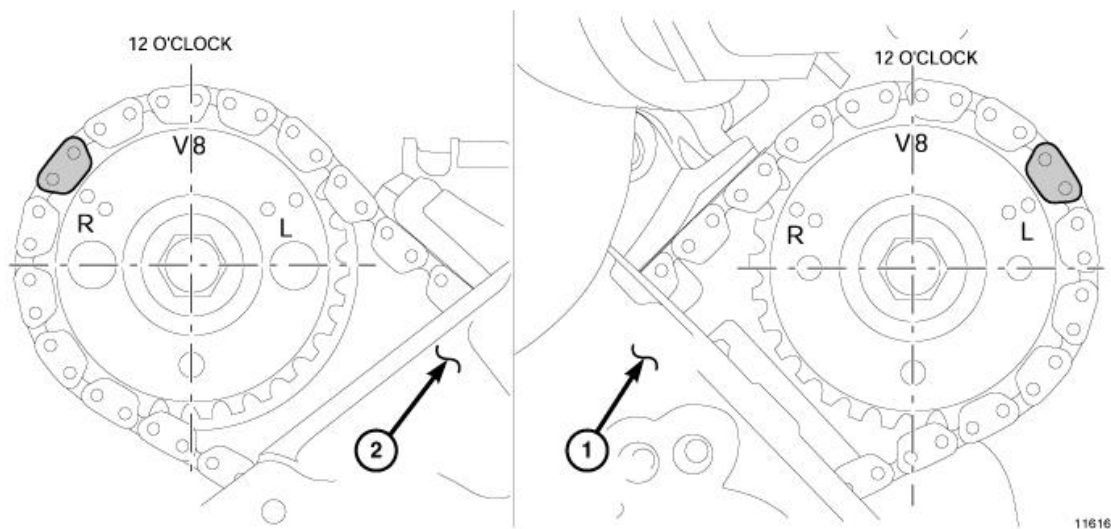


Fig. 209: Timing Chain to Sprocket Alignment
Courtesy of CHRYSLER LLC

4. Re-index the camshaft drive gear in the chain until the V8 mark is at the same position as the V8 mark on the opposite camshaft drive gear.

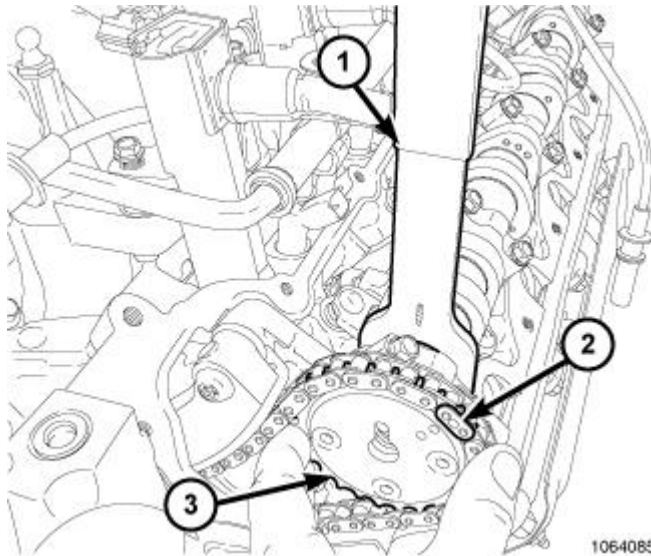


Fig. 210: Removing/Installing Camshaft Holder On Camshaft
Courtesy of CHRYSLER LLC

NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

5. Using a Camshaft Holder 8428A (1), rotate the camshaft until the alignment dowel on the camshaft is aligned with the slot in the camshaft drive gear.

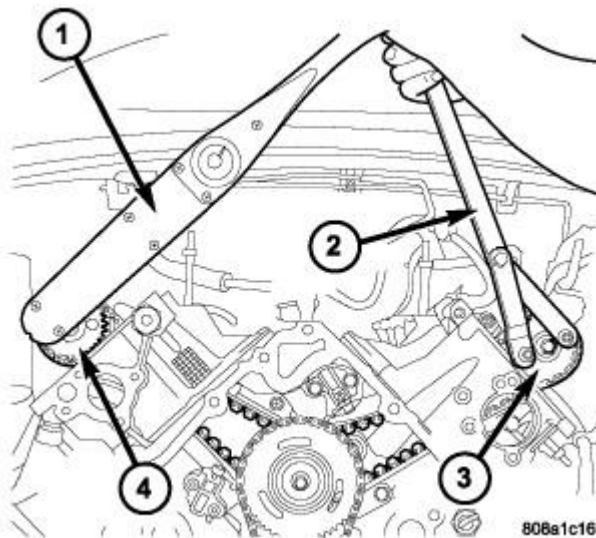


Fig. 211: Camshaft Sprocket Installation-Right Cylinder Head
Courtesy of CHRYSLER LLC

CAUTION: Remove excess oil from camshaft sprocket retaining bolt before reinstalling bolt. Failure to do so may cause over-torquing of bolt

resulting in bolt failure.

6. Position the camshaft drive gear onto the camshaft, remove oil from bolt then install the retaining bolt. Using Spanner Wrench 6958 (2) with Adapter Pins 8346 and a suitable torque wrench (1), Tighten retaining bolt to 122 N.m (90 ft. lbs.).

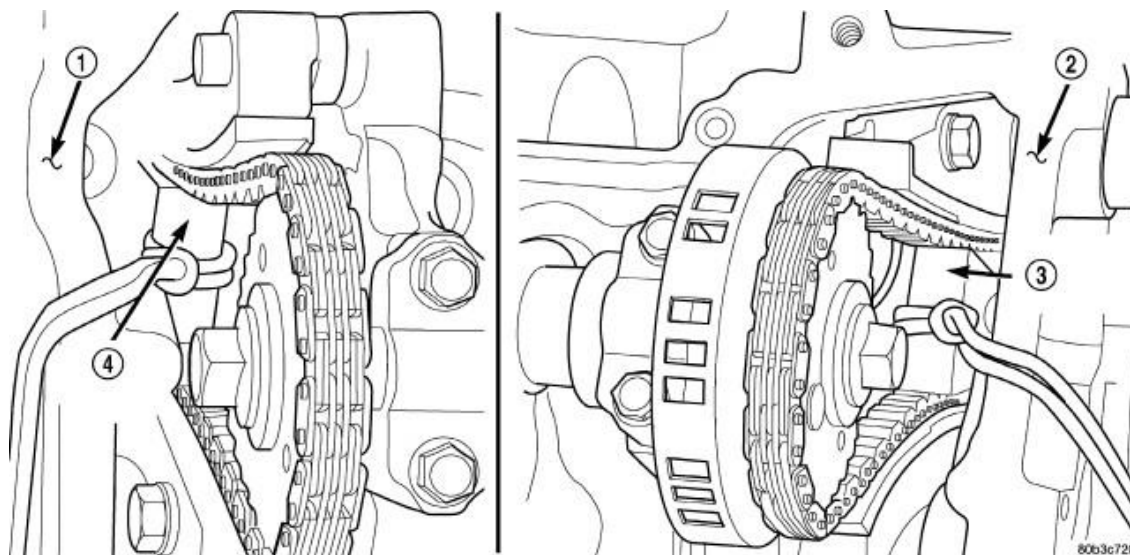


Fig. 212: Securing Timing Chain Tensioners Using Timing Chain Wedge
Courtesy of CHRYSLER LLC

7. Remove special tool 9867(3,4).

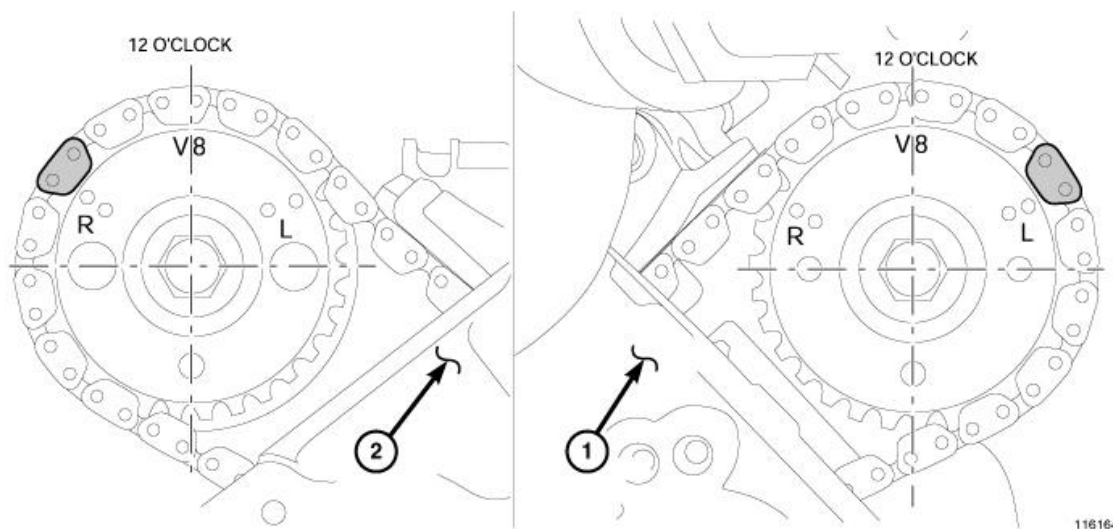


Fig. 213: Camshaft Sprocket V8 Marks
Courtesy of CHRYSLER LLC

8. Rotate the crankshaft two full revolutions, then re-verify that the camshaft drive gear V8 marks are in fact aligned.
9. Install the cylinder head covers. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.

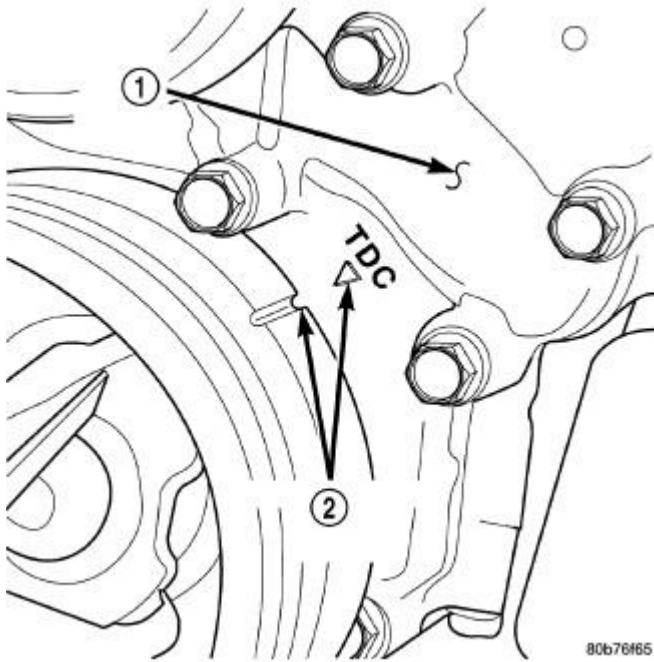
CHAIN AND SPROCKETS, TIMING**Removal****REMOVAL**

Fig. 214: Engine Top Dead Center (TDC) Indicator Mark
Courtesy of CHRYSLER LLC

1. Disconnect negative cable from battery.
2. Drain cooling system. Refer to **Cooling - Standard Procedure**.
3. Remove right and left cylinder head covers. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
4. Remove radiator fan shroud.
5. Rotate engine until timing mark (2) on crankshaft damper aligns with TDC mark on timing chain cover (2) (#1 cylinder exhaust stroke).

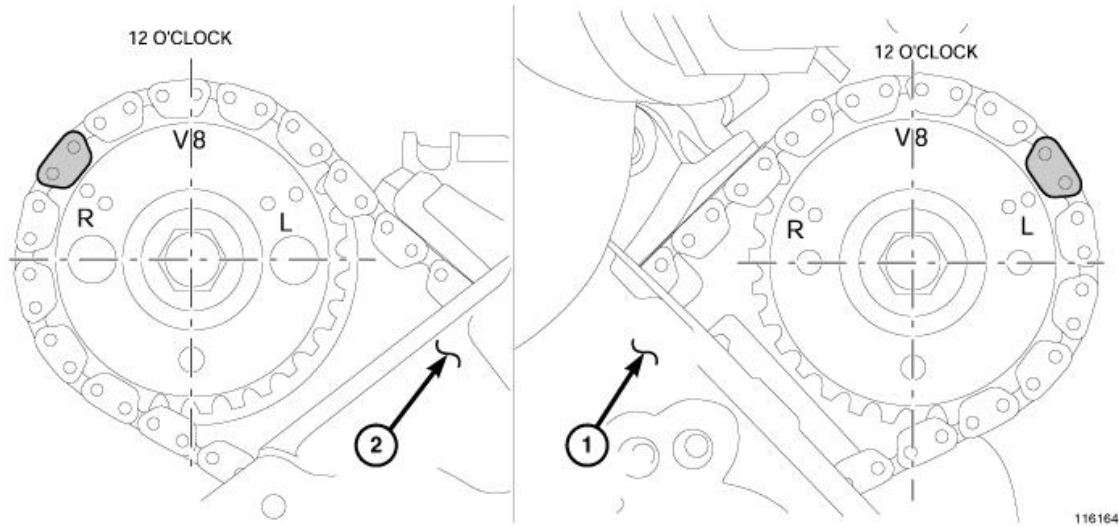


Fig. 215: Camshaft Sprocket V8 Marks
Courtesy of CHRYSLER LLC

NOTE: With the crankshaft damper timing mark aligned as in the previous step, the camshaft sprocket "V8" marks should also be at the 12 o'clock position (1, 2).

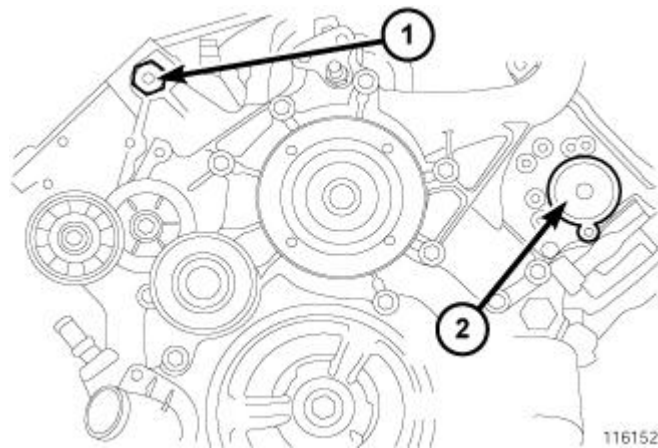


Fig. 216: Cylinder Head Access Plugs
Courtesy of CHRYSLER LLC

6. Remove power steering pump. Refer to **Steering/Pump - Removal**.
7. Remove access plugs (1,2) from left and right cylinder heads for access to chain guide fasteners.
8. Remove the oil fill housing to gain access to the right side tensioner arm fastener.
9. Remove crankshaft damper and timing chain cover. See **Engine/Engine Block/DAMPER, Vibration - Removal**. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.

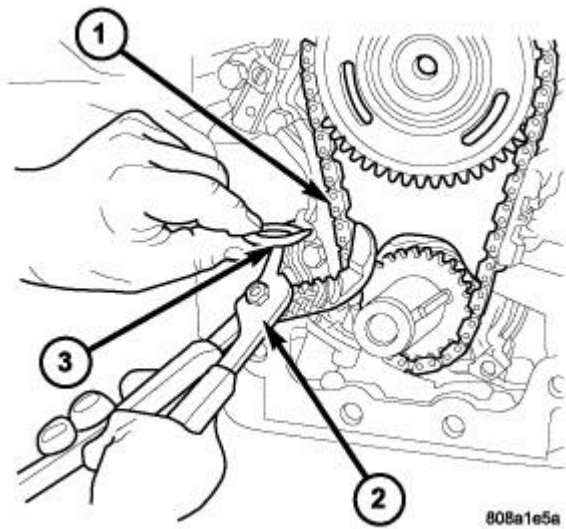


Fig. 217: Collapsing And Pinning Primary Chain Tensioner
Courtesy of CHRYSLER LLC

10. Collapse and pin primary chain tensioner (1).

CAUTION: Plate behind left secondary chain tensioner could fall into oil pan.
Therefore, cover pan opening.

11. Remove secondary chain tensioners.

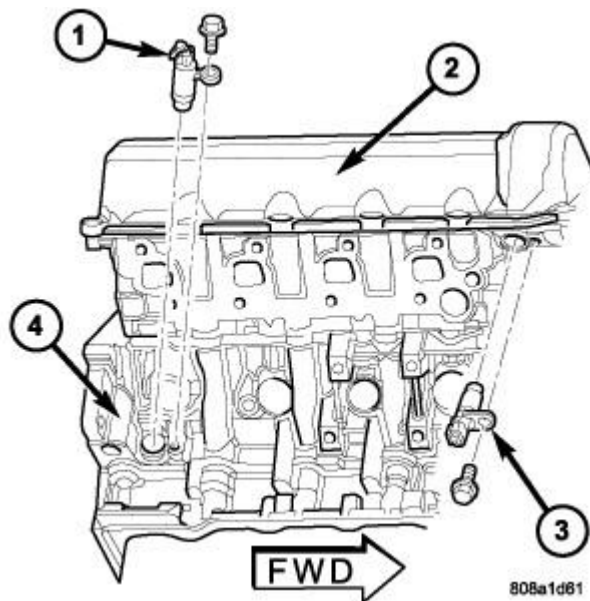


Fig. 218: Camshaft Position Sensor-Removal
Courtesy of CHRYSLER LLC

12. Remove camshaft position sensor (3) from right cylinder head.

CAUTION: Care should be taken not to damage the camshaft target wheel. Do not hold the target wheel while loosening or tightening the camshaft sprocket. Do not place the target wheel near a magnetic source of any kind. A damaged or magnetized target wheel could cause a vehicle no start condition.

CAUTION: Do not forcefully rotate the camshafts or crankshaft independently of each other. Damaging intake valve to piston contact will occur. Ensure the negative battery cable is disconnected and isolated to guard against accidental starter engagement.

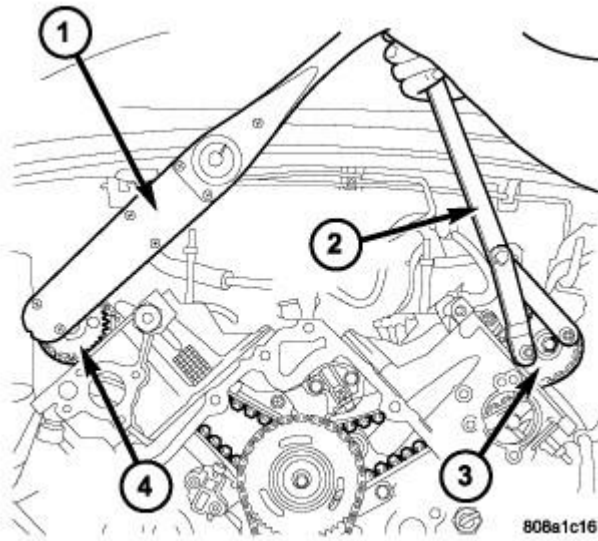


Fig. 219: Tightening Right Side Camshaft Sprocket Bolt
Courtesy of CHRYSLER LLC

13. Use Spanner Wrench 6958 (2) with Adapter Pins 8346 and remove left and right camshaft sprocket bolts.

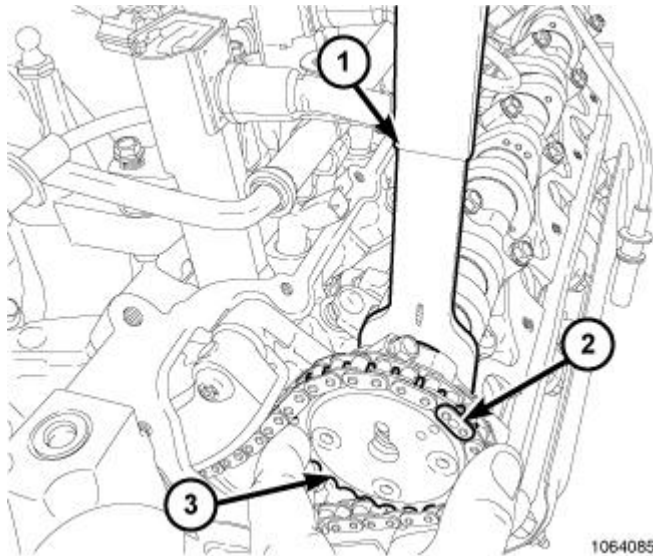


Fig. 220: Removing/Installing Camshaft Holder On Camshaft
Courtesy of CHRYSLER LLC

14. While holding the left camshaft with Camshaft Holder 8428A (1), remove the left camshaft sprocket (3). Slowly rotate the camshaft approximately 15 degrees clockwise to a neutral position.

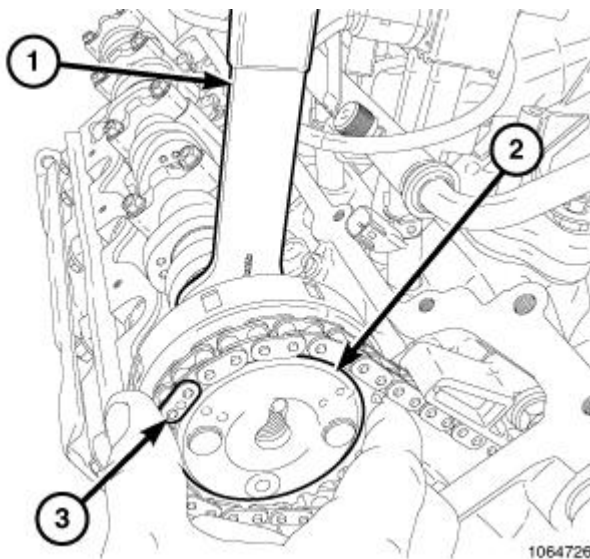


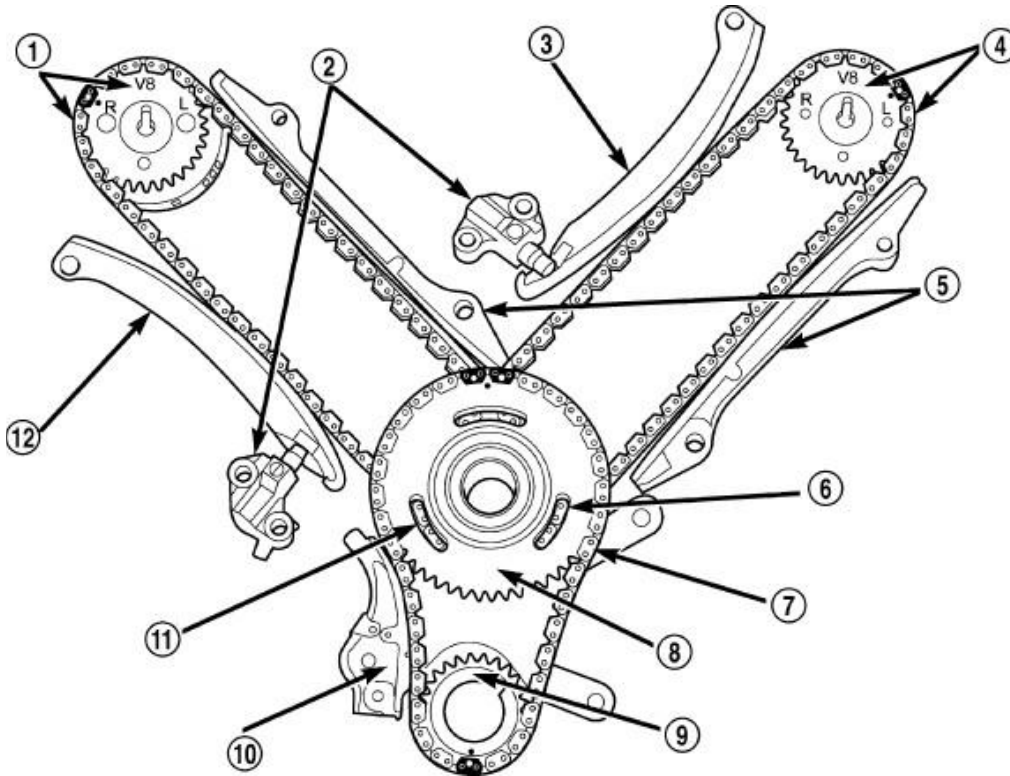
Fig. 221: Installing Camshaft Holder Onto Camshaft
Courtesy of CHRYSLER LLC

15. While holding the right camshaft with Camshaft Holder 8428A (1), remove the right camshaft sprocket (2). Slowly rotate the camshaft approximately 45 degrees counterclockwise to a neutral position.
16. Remove idler sprocket assembly bolt.
17. Slide the idler sprocket assembly and crank sprocket forward simultaneously to remove the primary and secondary chains.
18. Remove both pivoting tensioner arms and chain guides.

19. Remove chain tensioner.

Inspection

INSPECTION



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Fig. 222: Timing Chain System
Courtesy of CHRYSLER LLC

1 - RIGHT CAMSHAFT SPROCKET AND SECONDARY CHAIN
2 - SECONDARY TIMING CHAIN TENSIONER (LEFT AND RIGHT SIDE NOT COMMON)
3 - SECONDARY TENSIONER ARM
4 - LEFT CAMSHAFT SPROCKET AND SECONDARY CHAIN
5 - CHAIN GUIDE
6 - TWO PLATED LINKS ON RIGHT CAMSHAFT CHAIN
7 - PRIMARY CHAIN
8 - IDLER SPROCKET
9 - CRANKSHAFT SPROCKET
10 - PRIMARY CHAIN TENSIONER
11 - TWO PLATED LINKS ON LEFT CAMSHAFT CHAIN
12 - SECONDARY TENSIONER ARM

Inspect the following components:

- Sprockets for excessive tooth wear. Some tooth markings are normal and not a cause for sprocket replacement.
- Idler sprocket assembly bushing and shaft for excessive wear.
- Idler sprocket assembly spline joint. The joint should be tight with no backlash or axial movement.
- Chain guides and tensioner arms. Replace these parts if grooving in plastic face is more than 1 mm (0.039 in.) deep. If plastic face is severely grooved or melted, the tensioner lube jet may be clogged. The tensioner should be replaced.
- Secondary chain tensioner piston and ratcheting device. Inspect for evidence of heavy contact between tensioner piston and tensioner arm. If this condition exist the tensioner and tensioner arm should be replaced.
- Primary chain tensioner plastic faces. Replace as required.

Installation

INSTALLATION

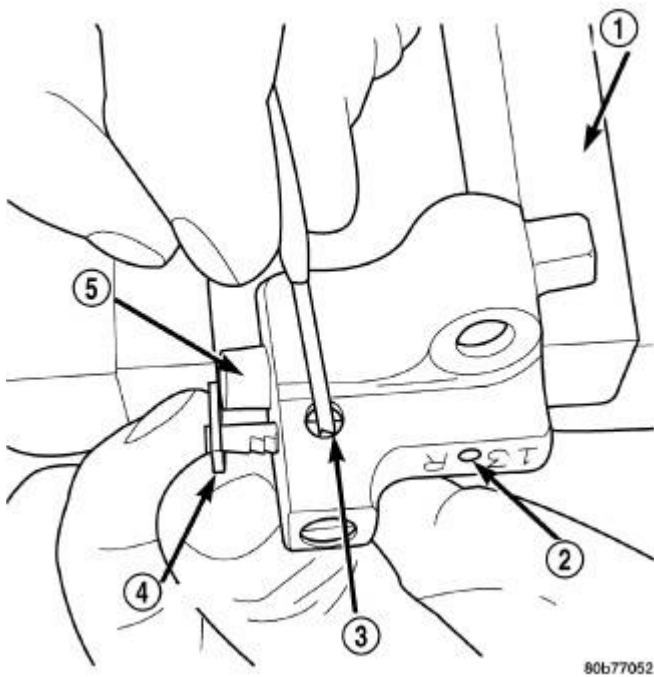


Fig. 223: Resetting Secondary Chain Tensioners
Courtesy of CHRYSLER LLC

- 1 - VISE
- 2 - TENSIONER BODY
- 3 - INSERT LOCK PIN
- 4 - RATCHET
- 5 - PISTON

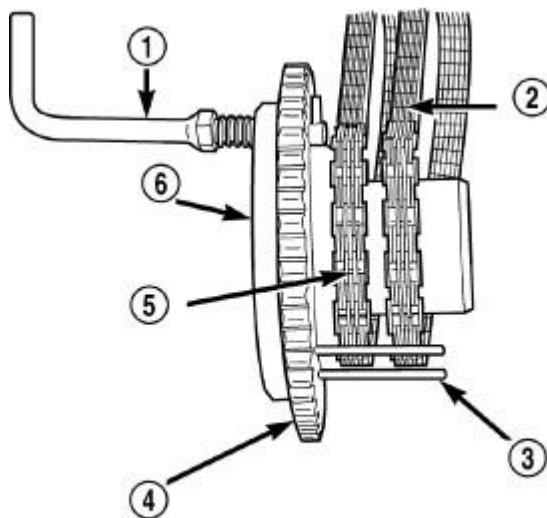
1. Using a vise, lightly compress the secondary chain tensioner piston until the piston step is flush with the tensioner body. Using a pin or suitable tool, release ratchet pawl by pulling pawl back against spring force through access hole on side of tensioner. While continuing to hold pawl back, Push ratchet device to approximately 2 mm from the tensioner body. Install Special Tool 8514 lock pin (3) into hole on front of tensioner (2). Slowly open vise to transfer piston spring force to lock pin.
2. Position primary chain tensioner over oil pump and insert bolts into lower two holes on tensioner bracket. Tighten bolts to 28 N.m (250 in. lbs.).
3. Install right side chain tensioner arm. Apply Mopar® Lock N, Seal to Torx® bolt, tighten bolt to 28 N.m (250 in. lbs.).

NOTE: The silver bolts retain the guides to the cylinder heads and the black bolts retain the guides to the engine block.

4. Install the left side chain guide. Tighten the bolts to 28 N.m (250 in. lbs.).

CAUTION: Overtightening the tensioner arm Torx® bolt can cause severe damage to the cylinder head. Tighten Torx® bolt to specified torque only.

5. Install left side chain tensioner arm. Apply Mopar® Lock N, Seal to Torx® bolt, tighten bolt to 28 N.m (250 in. lbs.).
6. Install the right side chain guide. Tighten the bolts to 28 N.m (250 in. lbs.).



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Fig. 224: Installing Secondary Timing Chains on Idler Sprocket
Courtesy of CHRYSLER LLC

1 - LOCK ARM
2 - RIGHT CAMSHAFT CHAIN

3 - SECONDARY CHAINS RETAINING PINS (4)
4 - IDLER SPROCKET
5 - LEFT CAMSHAFT CHAIN
6 - SPECIAL TOOL 8429

7. Install both secondary chains onto the idler sprocket. Align two plated links on the secondary chains to be visible through the two lower openings on the idler sprocket (4 o'clock and 8 o'clock). Once the secondary timing chains are installed, position special tool 8429 (6) to hold chains in place for installation.

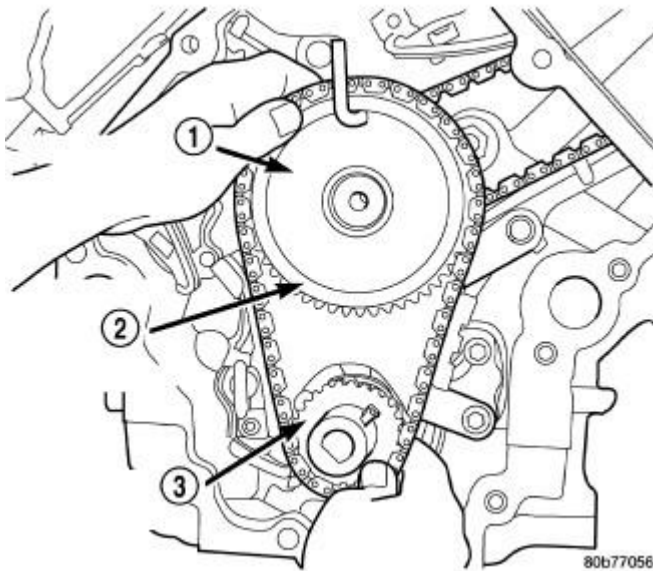


Fig. 225: Installing Idler Gear, Primary and Secondary Timing Chains
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL 8429
2 - PRIMARY CHAIN IDLER SPROCKET
3 - CRANKSHAFT SPROCKET

8. Align primary chain double plated links with the timing mark at 12 o'clock on the idler sprocket (1). Align the primary chain single plated link with the timing mark at 6 o'clock on the crankshaft sprocket (3).
9. Lubricate idler shaft and bushings with clean engine oil.
10. Install all chains, crankshaft sprocket, and idler sprocket as an assembly. After guiding both secondary chains through the block and cylinder head openings, affix chains with a elastic strap or the equivalent, This will maintain tension on chains to aid in installation.

NOTE: It will be necessary to slightly rotate camshafts for sprocket installation.

11. Align left camshaft sprocket "L" dot to plated link on chain.

12. Align right camshaft sprocket "R" dot to plated link on chain.

CAUTION: Remove excess oil from the camshaft sprocket bolt. Failure to do so can result in over-torque of bolt resulting in bolt failure.

13. Remove Special Tool 8429, then attach both sprockets to camshafts. Remove excess oil from bolts, then install sprocket bolts, but do not tighten at this time.
14. Verify that all plated links are aligned with the marks on all sprockets and the "V8" marks on camshaft sprockets are at the 12 o'clock position.

CAUTION: Ensure the plate between the left secondary chain tensioner and block is correctly installed.

NOTE: Left and right secondary chain tensioners are not common.

15. Install both secondary chain tensioners. Tighten bolts to 28 N.m (250 in. lbs.).
16. Before installing idler sprocket bolt, lubricate washer with oil, and tighten idler sprocket assembly retaining bolt to 34 N.m (25 ft. lbs.).

CAUTION: After pulling locking pins out of each tensioner, DO NOT manually extend the tensioner(s) ratchet. Doing so will over tension the chains, resulting in noise and/or high timing chain loads.

17. Remove all locking pins from tensioners.

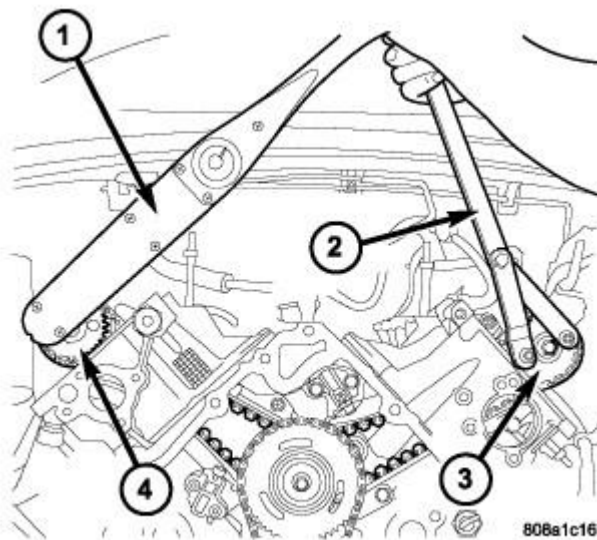


Fig. 226: Tightening Right Side Camshaft Sprocket Bolt
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - TORQUE WRENCH
2 - SPANNER WRENCH 6958 WITH ADAPTER PINS
8346
3 - LEFT CAMSHAFT SPROCKET
4 - RIGHT CAMSHAFT SPROCKET |
|---|

18. Using Special Tool 6958, Spanner with Adaptor Pins 8346, tighten left (3) and right (4), camshaft sprocket bolts to 122 N.m (90 ft. lbs.).
19. Rotate engine two full revolutions. Verify timing marks are at the follow locations:
 - primary chain idler sprocket dot is at 12 o'clock
 - primary chain crankshaft sprocket dot is at 6 o'clock
 - secondary chain camshaft sprockets "V8" marks are at 12 o'clock
20. Lubricate all three chains with engine oil.

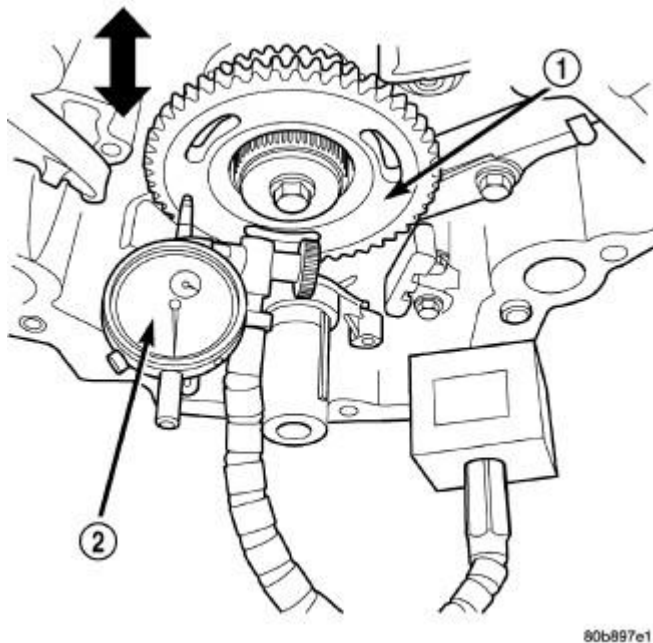


Fig. 227: Measuring Idler Gear End Play
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - IDLER SPROCKET ASSEMBLY
2 - DIAL INDICATOR |
|---|

21. After installing all chains, it is recommended that the idler gear (1) end play be checked. The end play must be within 0.10-0.25 mm (0.004-0.010 in.). If not within specification, the idler gear must be replaced.
22. Install timing chain cover and crankshaft damper. See **Engine/Valve Timing/COVER(S), Engine Timing - Installation**. See **Engine/Engine Block/DAMPER, Vibration - Installation**.

23. Install cylinder head covers. See Engine/Cylinder Head/COVER(S), Cylinder Head - Installation.

NOTE: Before installing threaded plug in right cylinder head, the plug must be coated with sealant to prevent leaks.

24. Coat the large threaded access plug with **Mopar® Thread Sealant with Teflon**, then install into the right cylinder head and tighten to 81 N.m (60 ft. lbs.).
25. Install the oil fill housing.
26. Install access plug in left cylinder head.
27. Install power steering pump. Refer to Steering/Pump - Installation.
28. Install radiator fan shroud.
29. Fill cooling system. Refer to Cooling - Standard Procedure.
30. Connect negative cable to battery.

COVER(S), ENGINE TIMING

Removal

REMOVAL

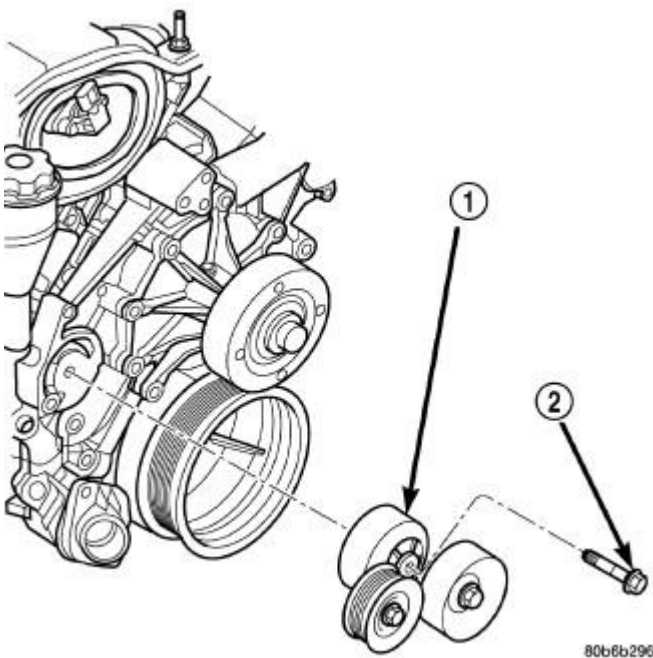


Fig. 228: Accessory Drive Belt Tensioner
Courtesy of CHRYSLER LLC

1 - TENSIONER ASSEMBLY

2 - FASTENER TENSIONER TO FRONT COVER

1. Disconnect the battery negative cable.
2. Drain cooling system. Refer to **Cooling - Standard Procedure**.
3. Disconnect both heater hoses at timing cover.
4. Disconnect lower radiator hose at engine.
5. Remove crankshaft damper. See **Engine/Engine Block/DAMPER, Vibration - Removal**.
6. Remove accessory drive belt tensioner assembly (1).
7. Remove the generator and A/C compressor.

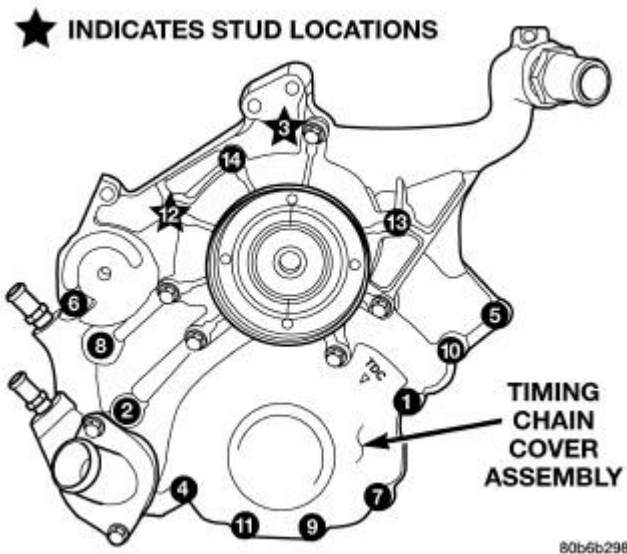


Fig. 229: Timing Chain Cover Fasteners
Courtesy of CHRYSLER LLC

CAUTION: The 4.7L engine uses an RTV sealer instead of a gasket to seal the front cover to the engine block, from the factory. For service, Mopar® Grey Engine RTV sealant must be substituted.

NOTE: It is not necessary to remove the water pump for timing cover removal.

8. Remove the bolts holding the timing cover to engine block.
9. Remove cover.

Installation

INSTALLATION

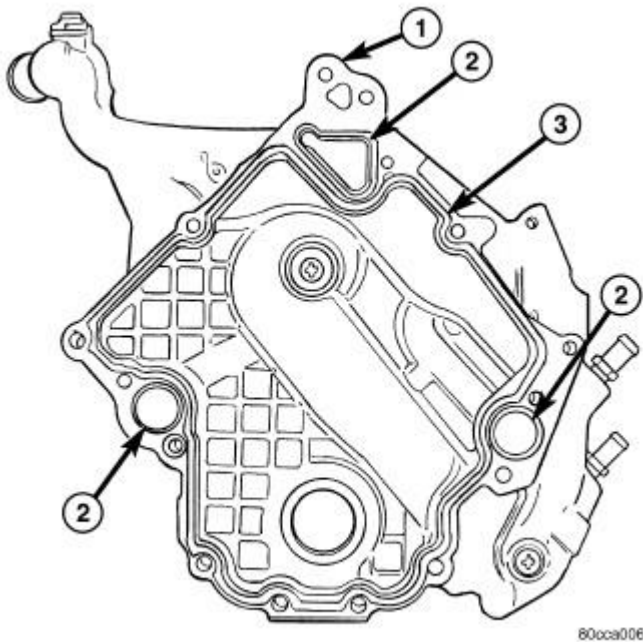


Fig. 230: Timing Cover Sealant
Courtesy of CHRYSLER LLC

- | |
|---|
| 1 - TIMING CHAIN COVER
2 - WATER PASSAGE O-RING
3 - MOPAR® GREY ENGINE RTV SEALER |
|---|

CAUTION: Do not use oil based liquids to clean timing cover or block surfaces. Use only rubbing alcohol, along with plastic or wooden scrapers. Use no wire brushes or abrasive wheels or metal scrapers, or damage to surfaces could result.

1. Clean timing chain cover and block surface using rubbing alcohol.

CAUTION: The 4.7L can use a special RTV sealer instead of a carrier gasket to seal the timing cover to the engine block, from the factory. For service repairs, Mopar® Grey Engine RTV must be used as a substitute, if RTV is present. If the front cover being used has no provisions for the water passage o-rings, then Mopar® Grey Engine RTV must be applied around the water passages.

2. Inspect the water passage o-rings, if equipped for any damage, and replace as necessary.
3. Apply Mopar® Grey Engine RTV sealer to the front cover following the path above, using a 3 to 4 mm thick bead.

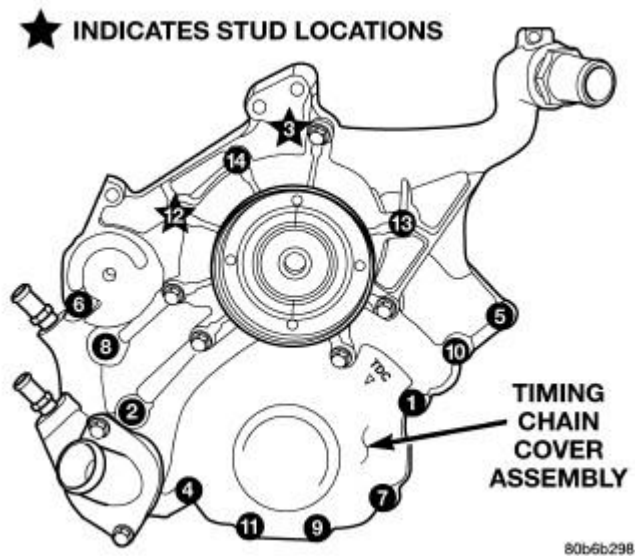


Fig. 231: Timing Chain Cover Fasteners
Courtesy of CHRYSLER LLC

4. Install cover. Tighten flange head fasteners in sequence as shown in illustration to 58 N.m (43 ft. lbs.).
5. Install the A/C compressor and generator.
6. Install crankshaft damper. See Engine/Engine Block/DAMPER, Vibration - Installation.
7. Install accessory drive belt tensioner assembly. Tighten fastener to 54 N.m (40 ft. lbs.).
8. Install lower radiator hose.
9. Install both heater hoses.
10. Fill cooling system. Refer to Cooling - Standard Procedure.
11. Connect the battery negative cable.

SHAFT, IDLER

Removal

REMOVAL

1. Remove the primary and secondary timing chains and sprockets. See Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Removal.

NOTE: To remove the idler shaft, it is necessary to tap threads into the shaft, to install the removal tool.

2. Using a 12 mm X 1.75 tap, cut threads in the idler shaft center bore.
3. Cover the radiator core with a suitable cover.

CAUTION: Use care when removing the idler shaft, Do not strike the radiator

cooling fins with the slide hammer.

4. Using Special Tool 8517 Slide Hammer, remove the idler shaft.

Installation**INSTALLATION**

1. Thoroughly clean the idler shaft bore.
2. Position the idler shaft in the bore.

NOTE: **The two lubrication holes in the idler shaft do not require any special alignment.**

NOTE: **Before using the retaining bolt to install the idler shaft, coat the threads and the pilot on the idler shaft, with clean engine oil.**

3. Using the primary idler sprocket retaining bolt and washer, carefully draw the idler shaft into the bore until fully seated.
4. Coat the idler shaft with clean engine oil.
5. Install the timing chains and sprockets. See **Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Installation**.