2009 ENGINE

3.7L - Service Information - Grand Cherokee

DESCRIPTION

DESCRIPTION

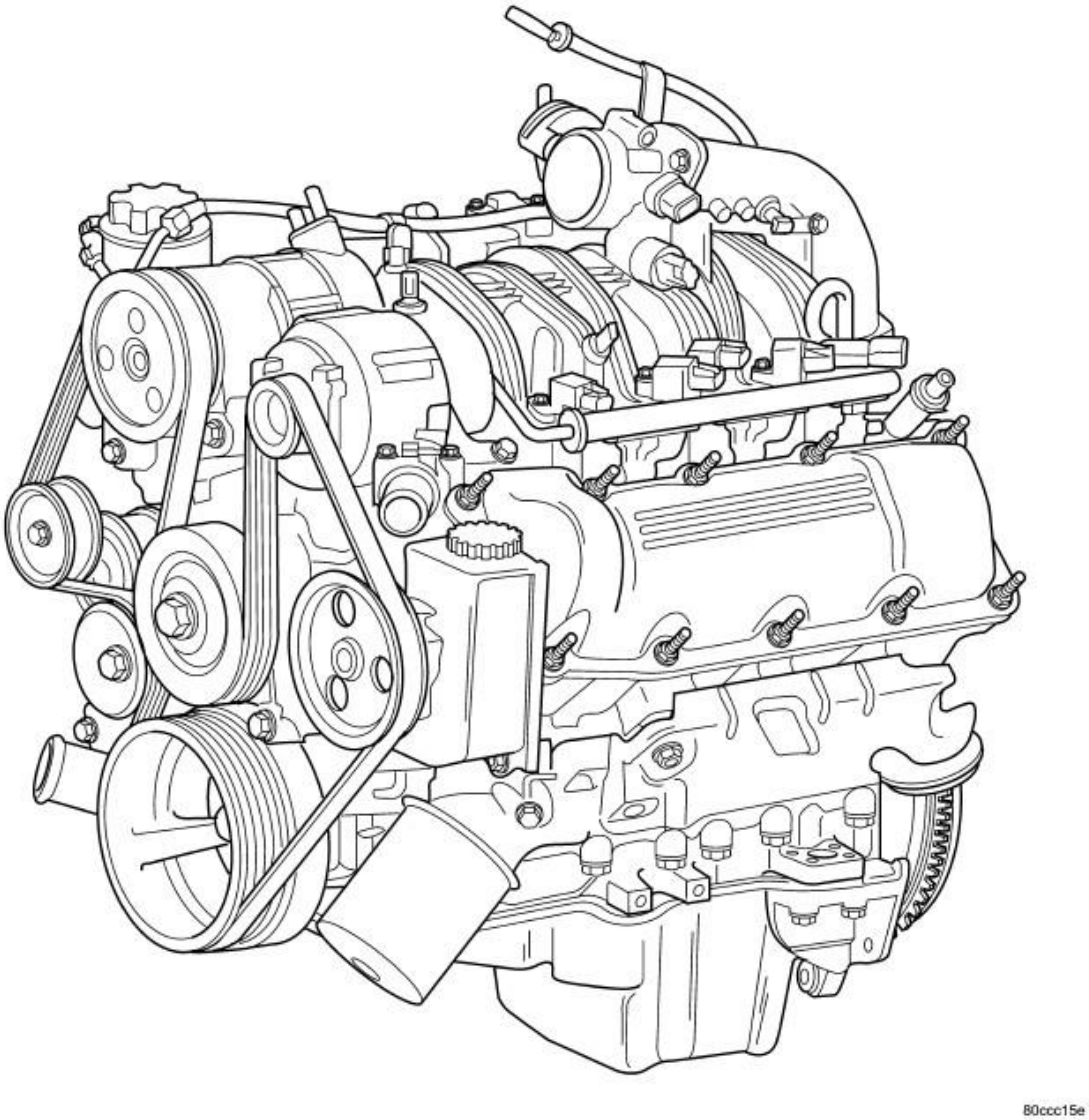


Fig. 1: Identifying 3.7L Engine
Courtesy of CHRYSLER LLC

The 3.7 liter (226 CID) six-cylinder engine is an 90° single overhead camshaft engine. The cast iron cylinder block is made up of two different components; the first component is the cylinder bore and upper block, the second component is the bed plate that comprises the lower portion of the cylinder block and houses the lower half of the crankshaft main bearings. The cylinders are numbered from front to rear with the left bank being numbered 1,3, and 5 and the right bank being numbered 2,4, and 6. The firing order is 1-6-5-4-3-2. The engine

serial number is located at the right front side of the engine block

DIAGNOSIS AND TESTING

ENGINE DIAGNOSIS - 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).

See **ENGINE PERFORMANCE DIAGNOSTIC TABLE** and **ENGINE MECHANICAL DIAGNOSTIC TABLE** for possible causes and corrections of malfunctions. Refer to **FUEL SYSTEM** for the fuel system diagnosis.

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. See **CYLINDER COMPRESSION PRESSURE LEAKAGE**.
- Cylinder Combustion Pressure Leakage Test. See **CYLINDER COMBUSTION PRESSURE LEAKAGE**.
- Engine Cylinder Head Gasket Failure Diagnosis. See **Engine/Cylinder Head - Diagnosis and Testing**.
- Intake Manifold Leakage Diagnosis. See **Engine/Manifolds/MANIFOLD, Intake - Diagnosis and Testing**.

ENGINE PERFORMANCE DIAGNOSTIC TABLE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery	1. Charge or replace as necessary.
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Apply a coat of light mineral grease to the terminals.
	3. Faulty starter.	3. Refer to **Electrical - Engine Systems/Starting - Diagnosis and Testing**
	4. Faulty coil or control unit.	4. Refer to **Electrical - Ignition Control/Ignition Control/COIL, Ignition - Removal**
	5. Incorrect spark plug gap.	5. Correct as necessary.
	6. Incorrect right bank cam timing.	6. Refer to **COVER(S), Engine Timing**.
	7. Dirt or water in fuel system.	7. Clean system and replace fuel filter.
	8. Faulty fuel pump, relay or wiring.	8. Repair or replace as necessary.

	9. Faulty cam or crank sensor	9. Refer to **IGNITION CONTROL - SERVICE INFORMATION** .
ENGINE STALLS OR ROUGH IDLE	1. Vacuum leak.	1. Inspect intake manifold and vacuum hoses, repair or replace as necessary.
	2. Faulty crank position sensor	2. Replace crank position sensor
	3. Faulty coil.	3. Refer to **Electrical - Ignition Control/Ignition Control/COIL, Ignition - Removal**
	4. Incorrect cam timing.	4. See **Engine/Valve Timing - Standard Procedure**
ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped spark plugs.	1. Correct as necessary.
	2. Dirt or water in fuel system.	2. Clean system and replace fuel filter.
	3. Faulty fuel pump.	3. Refer to **Fuel System/Fuel Delivery/MODULE, Fuel Pump - Removal** .
	4. Blown cylinder head gasket.	4. Replace cylinder head gasket.
	5. Low compression.	5. See **CYLINDER COMPRESSION PRESSURE LEAKAGE**, repair as necessary.
	6. Burned, warped or pitted valves.	6. Replace as necessary.
	7. Plugged or restricted exhaust system.	7. Inspect and replace as necessary.
	8. Faulty coil.	8. Refer to **Electrical - Ignition Control/Ignition Control/COIL, Ignition - Removal** .
	9. Incorrect cam timing.	9. Refer to **COVER(S), Engine Timing**.
ENGINE MISSES ON ACCELERATION	1. Spark plugs dirty or incorrectly gapped.	1. Correct as necessary.
	2. Dirt in fuel system.	2. Clean fuel system.
	3. Burned, warped or pitted valves.	3. Replace as necessary.
	4. Faulty coil.	4. Refer to **Electrical - Ignition Control/Ignition Control/COIL, Ignition - Removal** .
ENGINE MISSES AT HIGH SPEED	1. Spark plugs dirty or incorrectly gapped.	1. Correct as necessary.
	2. Faulty coil.	2. Refer to **Electrical - Ignition Control/Ignition Control/COIL, Ignition - Removal** .
	3. Dirt or water in fuel system.	3. Clean system and replace fuel filter.

ENGINE MECHANICAL DIAGNOSTIC TABLE

CONDITION	POSSIBLE CAUSES	CORRECTIONS
NOISY VALVES	1. High or low oil level in	1. See **Engine/Lubrication/OIL -**

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

ENGINE LUBRICATION DIAGNOSTIC TABLE

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL LEAKS	1. Gaskets and O-Rings. Misaligned or damaged.	1. Replace as necessary.
	(a) Loose fasteners, broken or porous metal parts.	(a) Tighten fasteners, Repair or replace metal parts.
	2. Crankshaft rear seal	2. Replace as necessary. See **Engine/Engine Block/SEAL, Crankshaft Oil - Removal**.
	3. Crankshaft seal flange.	3. Polish or replace crankshaft.

	Scratched, nicked or grooved.	
	4. Oil pan flange cracked.	4. Replace oil pan. See **Engine/Lubrication/PAN, Oil - Removal**.
	5. Timing chain cover seal, damaged or misaligned.	5. Replace seal. See **Engine/Engine Block/SEAL, Crankshaft Oil - Removal**.
	6. Scratched or damaged vibration damper hub.	6. Polish or replace damper.
OIL PRESSURE DROP	1. Low oil level.	1. Check and correct oil level.
	2. Faulty oil pressure sending unit.	2. Replace sending unit. See **Engine/Lubrication/SWITCH, Oil Pressure - Removal**.
	3. Low oil pressure.	3. Check oil pump and bearing clearance.
	4. Clogged oil filter.	4. Replace oil filter. See **Engine/Lubrication/FILTER, Engine Oil - Removal**.
	5. Worn oil pump.	5. Replace oil pump. See **Engine/Lubrication/PUMP, Engine Oil - Removal**.
	6. Thin or diluted oil.	6. Change oil and filter.
	7. Excessive bearing clearance.	7. Replace as necessary.
	8. Oil pump relief valve stuck.	8. Replace oil pump. See **Engine/Lubrication/PUMP, Engine Oil - Removal**.
	9. Oil pick up tube loose, damaged or clogged.	9. Replace as necessary.
OIL PUMPING AT RINGS; SPARK PLUGS FOULING	1. Worn or damaged rings.	1. Hone cylinder bores and replace rings.
	2. Carbon in oil ring slots.	2. Replace rings. See **Engine/Engine Block/ROD, Piston and Connecting - Removal**.
	3. Incorrect ring size installed.	3. Replace rings. See **Engine/Engine Block/ROD, Piston and Connecting - Removal**.
	4. Worn valve guides.	4. Ream guides and replace valves. See **Engine/Cylinder Head/VALVES, Intake and Exhaust - Removal**.
	5. Leaking valve guide seals.	5. Replace valve guide seals.

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. Refer to **Fuel System/Fuel Delivery - Standard Procedure** and perform the fuel system pressure release 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

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

NOTE: All of the sealants mentioned below are not used on every engine, they are listed as a general reference guide. See service information for specific sealer usage.

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. All sealing surfaces that use form-in-place gaskets and sealers **must** free of grease or oil. Surfaces should be cleaned with Mopar® brake parts cleaner prior to sealer application. After the sealer is applied, the parts should be assembled in no more than 10 minutes.

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 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 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 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® BED PLATE SEALANT is a unique (green-in-color) anaerobic type gasket material that is specially made to seal the area between the bed plate and cylinder block without disturbing the bearing clearance or alignment of these components. The material cures slowly in the absence of air when torqued between two metallic surfaces, and will rapidly cure when heat is applied.

SEALER APPLICATION

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 and "T" joint locations, 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.

ENGINE GASKET SURFACE PREPARATION

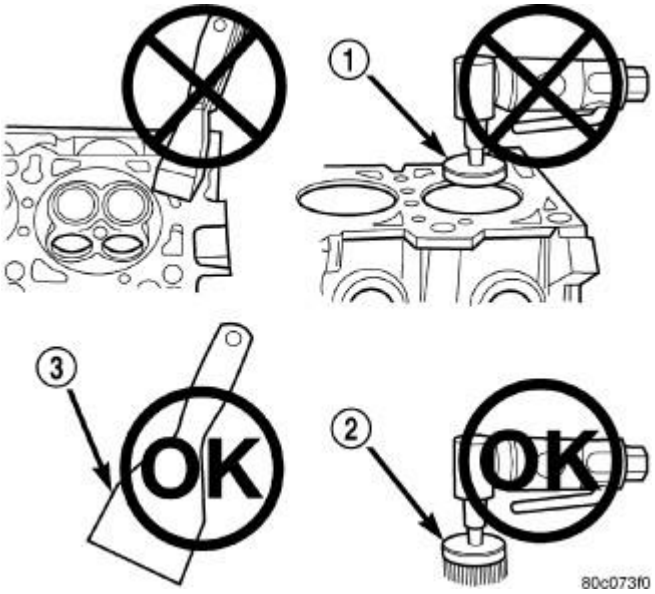


Fig. 2: Engine Gasket Surface Preparation
Courtesy of CHRYSLER LLC

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

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

Never use the following to clean gasket surfaces:

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

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

Only use the following for cleaning gasket surfaces:

- Solvent or a commercially available gasket remover

- Plastic or wood scraper (3).
- Drill motor with 3M Roloc™ Bristle Disc (white or yellow) (2).

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

REMOVAL

REMOVAL

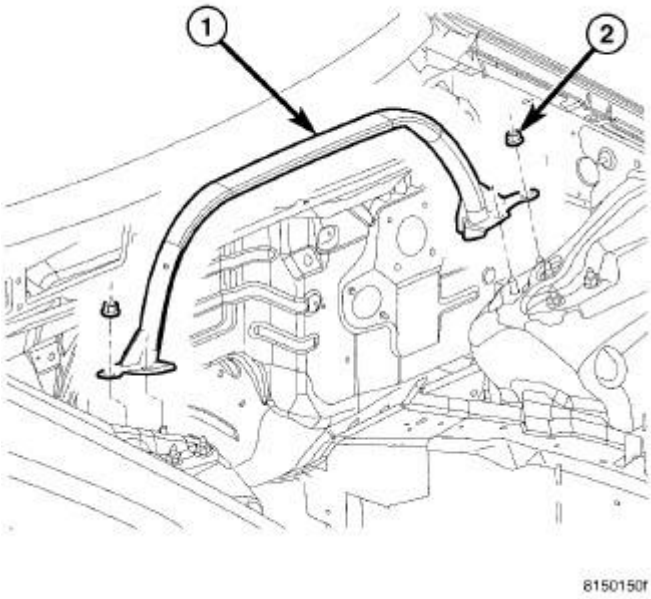


Fig. 3: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

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. Remove the strut tower support (1).

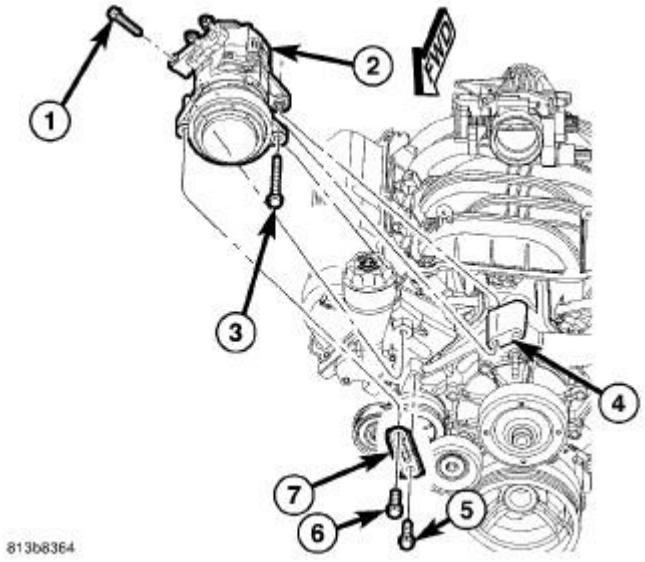


Fig. 4: A/C Compressor Removal/Installation
Courtesy of CHRYSLER LLC

3. Disconnect the battery negative cable.
4. Remove air cleaner assembly.
5. Remove fan shroud with viscous fan assembly.
6. Remove drive belt.
7. Remove A/C compressor (2) and secure away from engine.

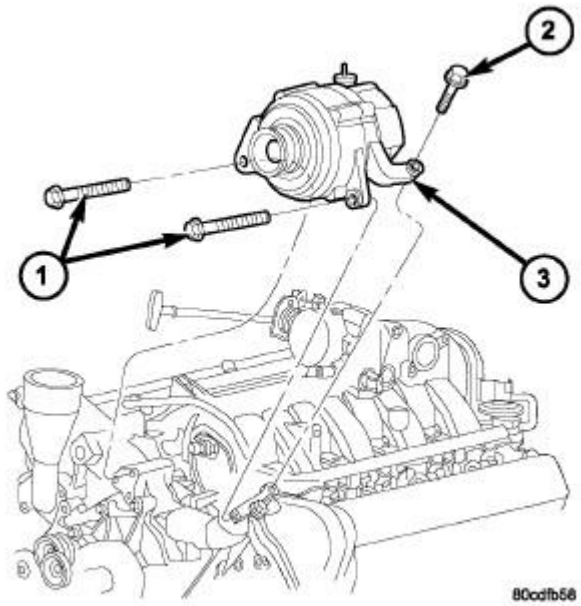


Fig. 5: Generator Removal/Installation

Courtesy of CHRYSLER LLC

8. Remove generator (3) and secure away from engine.

NOTE: Do NOT remove the phenolic pulley from the P/S pump. It is not required for P/S pump removal.

9. Remove power steering pump with lines attached and secure away from engine.
10. Drain cooling system.
11. Disconnect the heater hoses from the engine.
12. Disconnect heater hoses from heater core and remove hose assembly.
13. Remove upper radiator hose from engine.
14. Remove lower radiator hose from engine.
15. Remove radiator/cooling module assembly.
16. Disconnect the engine to body ground straps at the left side of cowl.

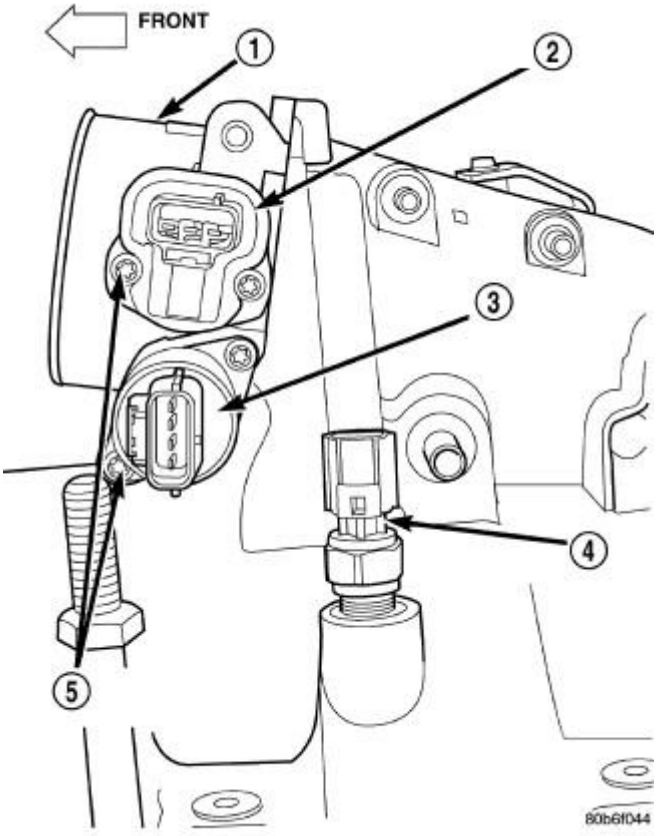


Fig. 6: Throttle Body Connection Points
Courtesy of CHRYSLER LLC

1 - THROTTLE BODY

2 - TPS
3 - IAC MOTOR
4 - IAT SENSOR (THREADED TYPE)
5 - MOUNTING SCREWS

17. Disconnect the engine wiring harness at the following points:
    - Intake air temperature (IAT) sensor (4)
    - Fuel Injectors
    - Throttle Body (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 Over Plugs
    - Crankshaft Position Sensor
18. Remove coil over plugs.

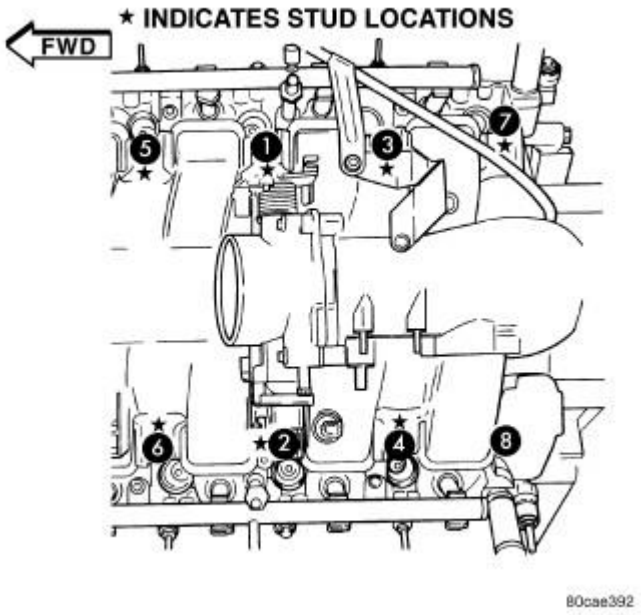


Fig. 7: Intake Manifold Tightening Sequence
Courtesy of CHRYSLER LLC

19. Remove fuel rail and secure away from engine.

NOTE: It is not necessary to release the quick connect fitting from the fuel supply

line for engine removal.

20. Remove the PCV hose.
21. Remove the breather hoses.
22. Remove the vacuum hose for the power brake booster.
23. Disconnect knock sensors.
24. Remove engine oil dipstick tube.
25. Remove the intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Removal**.
26. Install Engine Lifting Fixture 8427 using original fasteners from the removed intake manifold, and fuel rail. Torque to factory specifications.

NOTE: Recheck bolt torque on the Engine Lift Fixture before removing engine.

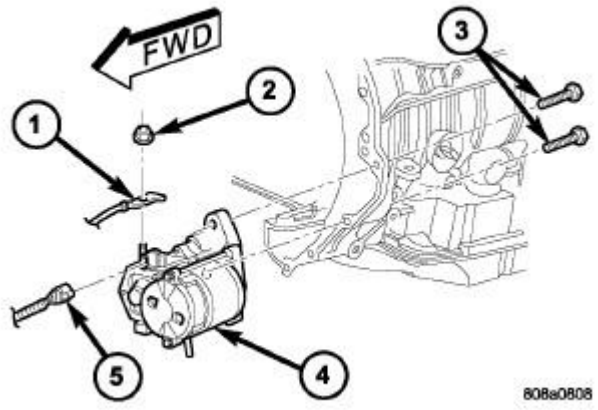


Fig. 8: STARTER REMOVAL/INSTALLATION - 3.7L/4.7L - AUTOMATIC TRANSMISSION
Courtesy of CHRYSLER LLC

27. Disconnect oxygen sensor wiring.
28. Disconnect crankshaft position sensor.
29. Disconnect the engine block heater power cable, if equipped.
30. Disconnect the front propshaft at the front differential and secure out of way.

NOTE: It is necessary to disconnect the front propshaft for access to the starter and left side exhaust flange.

31. Remove the starter (4).

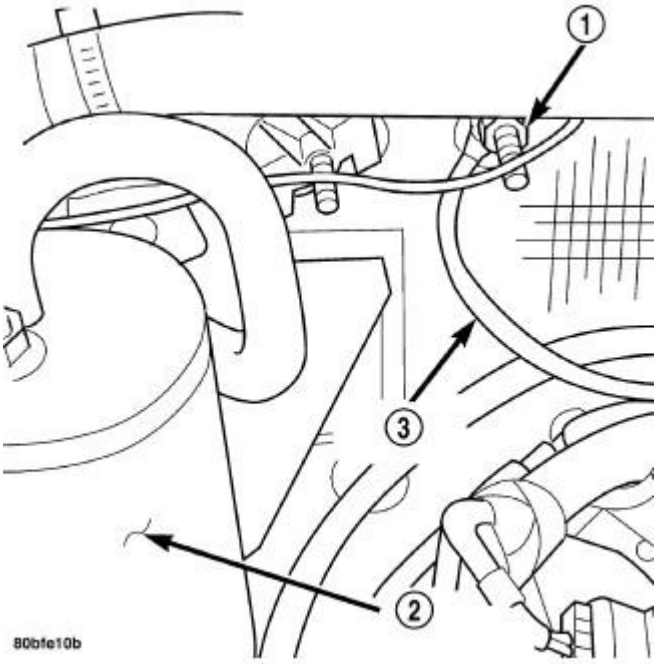


Fig. 9: Body Ground Strap-Right Side Removal / Installation
Courtesy of CHRYSLER LLC

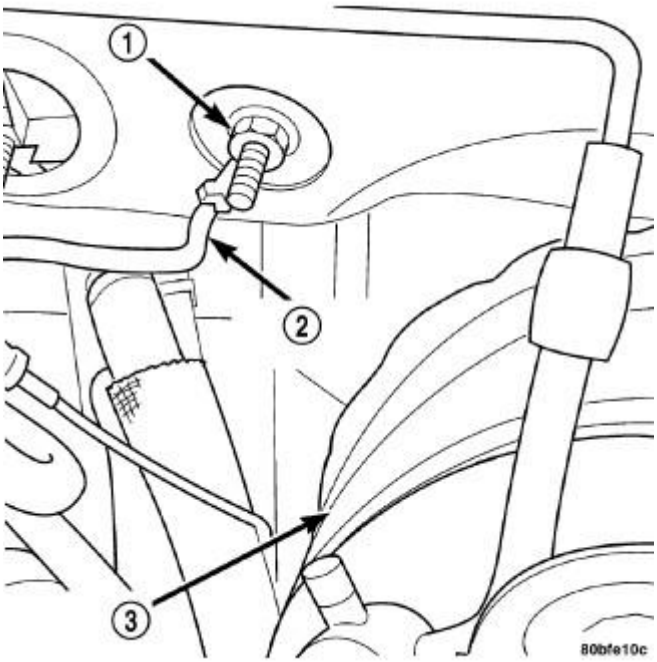


Fig. 10: Body Ground Strap-Left Side Removal / Installation
Courtesy of CHRYSLER LLC

32. Remove the ground straps from the left (2) and right (3) side of the block.

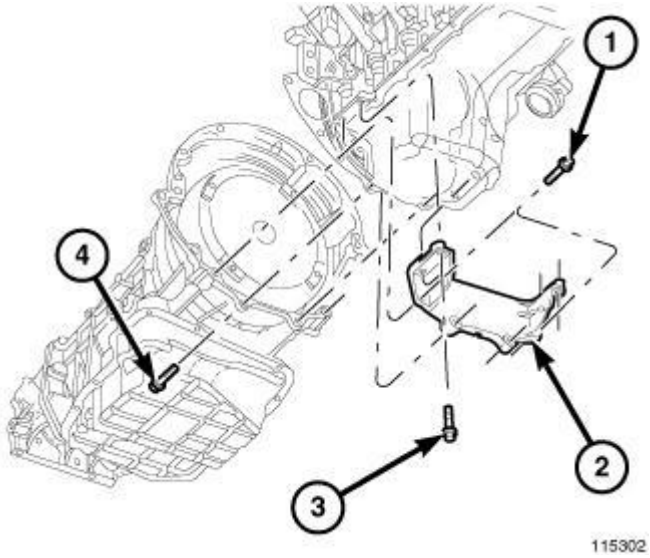


Fig. 11: Structural Cover
Courtesy of CHRYSLER LLC

33. Remove the structural cover.
34. Disconnect the right and left exhaust pipes at the manifolds and from the crossover, and remove from the vehicle.

NOTE: The exhaust clamps at the manifolds cannot be reused. New clamps must be used or leaks may occur.

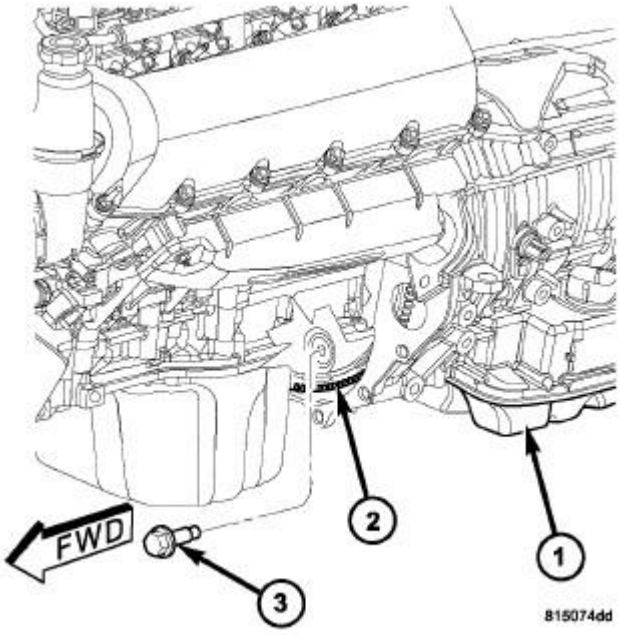


Fig. 12: Removing/Installing Torque Converter Bolts
Courtesy of CHRYSLER LLC

1 - TRANSMISSION 2 - DRIVE PLATE 3 - TORQUE CONVERTER BOLTS

35. Remove torque convertor bolts (3), and mark location for reassembly.

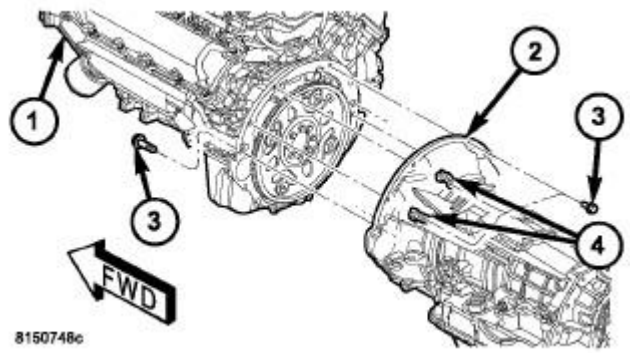


Fig. 13: Removing/Installing Transmission to Engine Bolts
Courtesy of CHRYSLER LLC

36. Remove transmission bellhousing to engine bolts (3).

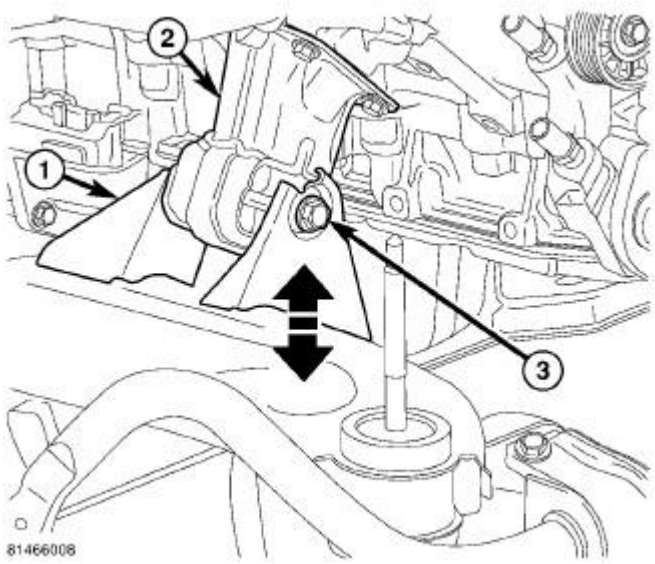


Fig. 14: ENGINE MOUNT BOLT
Courtesy of CHRYSLER LLC

37. Remove left and right engine mount thru bolts (3).
38. Lower the vehicle.
39. Support the transmission with a suitable jack.
40. Connect a suitable engine hoist to the Engine Lifting Fixture 8427.

41. Remove engine from vehicle.

INSTALLATION

INSTALLATION

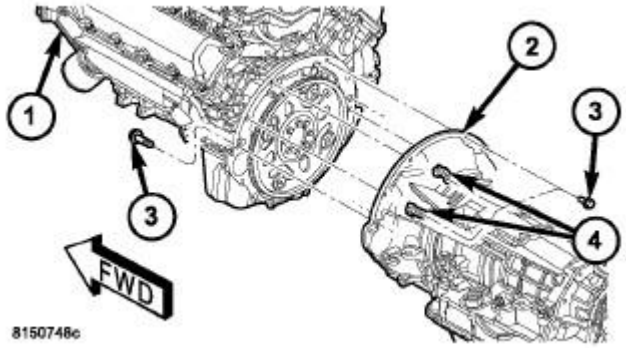


Fig. 15: Removing/Installing Transmission to Engine Bolts
Courtesy of CHRYSLER LLC

1 - ENGINE
2 - TRANSMISSION
3 - BOLTS
4 - WIRING HARNESS CLIPS

1. Position the engine in the vehicle.
2. Install the transmission bellhousing to engine mounting bolts (3). Tighten the bolts to 41 N.m (30ft. lbs.)

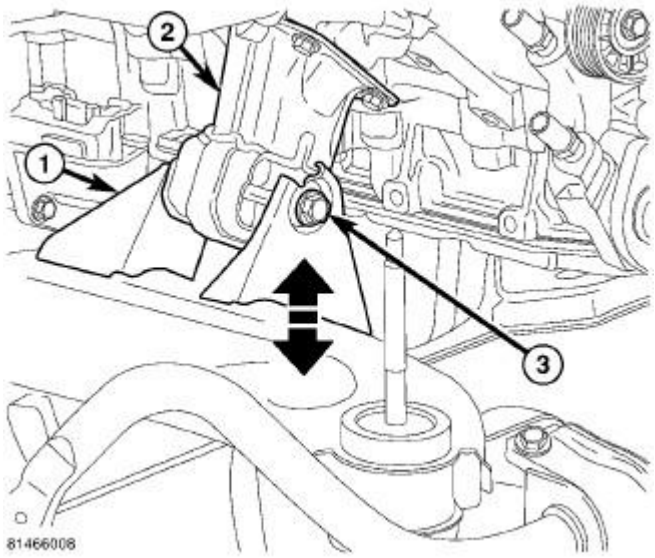


Fig. 16: ENGINE MOUNT BOLT

Courtesy of CHRYSLER LLC

3. Install the engine mount thru bolts (3).

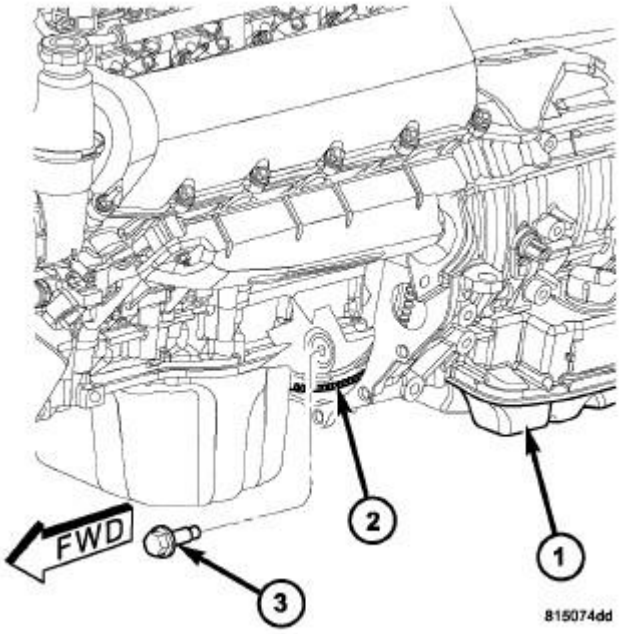


Fig. 17: Removing/Installing Torque Converter Bolts
Courtesy of CHRYSLER LLC

1 - TRANSMISSION
2 - DRIVE PLATE
3 - TORQUE CONVERTER BOLTS

4. Install the torque convertor bolts (3).

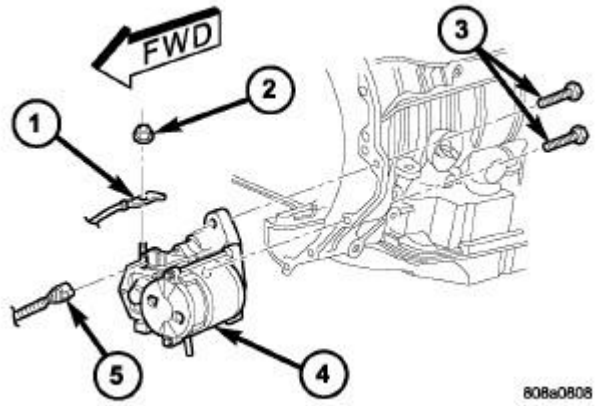


Fig. 18: STARTER REMOVAL/INSTALLATION - 3.7L/4.7L - AUTOMATIC TRANSMISSION
Courtesy of CHRYSLER LLC

5. Install the starter(4).
6. Connect the crankshaft position sensor.
7. Install the engine block heater power cable, if equipped.

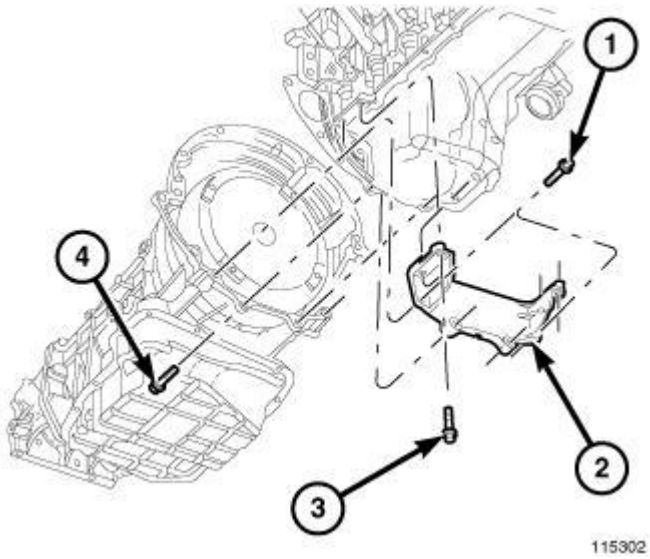


Fig. 19: Structural Cover
Courtesy of CHRYSLER LLC

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

8. Install the structural cover.

NOTE: New clamps must be used on exhaust manifold flanges. Failure to use new clamps may result in exhaust leaks.

9. Install the left and right exhaust pipes.
10. Connect the left and right oxygen sensors.
11. Remove the engine lift plate.
12. Connect the knock sensors.
13. Connect the engine to body ground straps at the left side of the cowl.

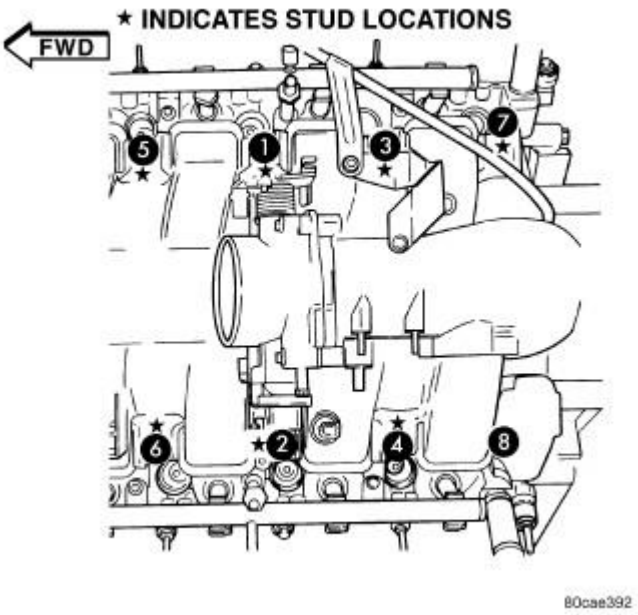


Fig. 20: Intake Manifold Tightening Sequence
Courtesy of CHRYSLER LLC

14. Install the intake manifold using the sequence provided.
15. Install the engine oil dipstick tube.
16. Install the power brake booster vacuum hose.
17. Install the breather hoses.
18. Install the PCV hose.
19. Install the fuel rail.
20. Install the coil over plugs.

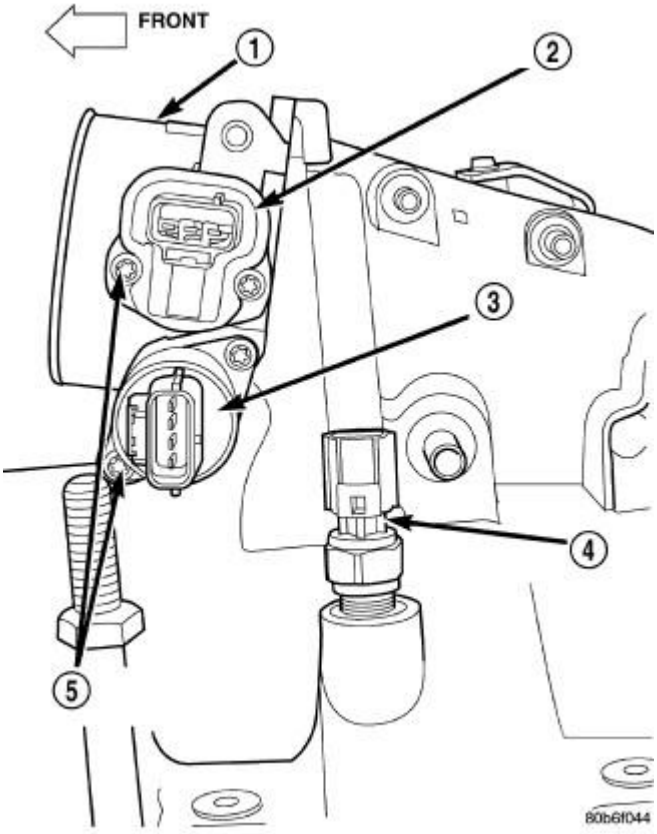


Fig. 21: Throttle Body Connection Points
Courtesy of CHRYSLER LLC

1 - THROTTLE BODY
2 - TPS
3 - IAC MOTOR
4 - IAT SENSOR (THREADED TYPE)
5 - MOUNTING SCREWS

21. Connect the engine wiring harness at the following points:

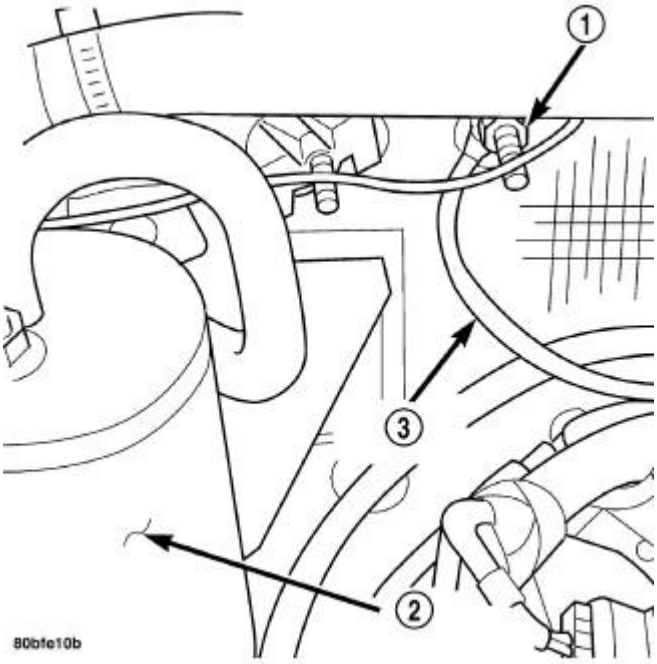


Fig. 22: Body Ground Strap-Right Side Removal / Installation
Courtesy of CHRYSLER LLC

- 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 Over Plugs
- Crankshaft Position Sensor

22. Connect the ground straps on the right (3)side of the engine.

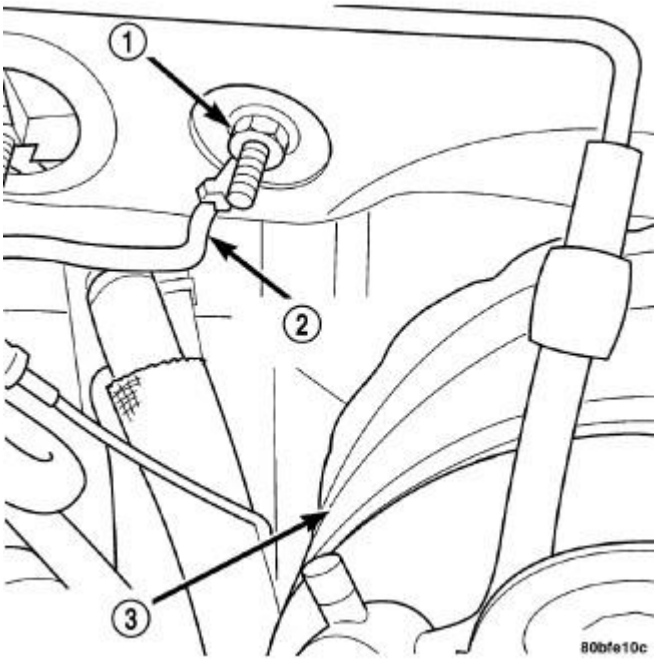


Fig. 23: Body Ground Strap-Left Side Removal / Installation
Courtesy of CHRYSLER LLC

23. Connect the ground straps on the left (2) side of the engine.

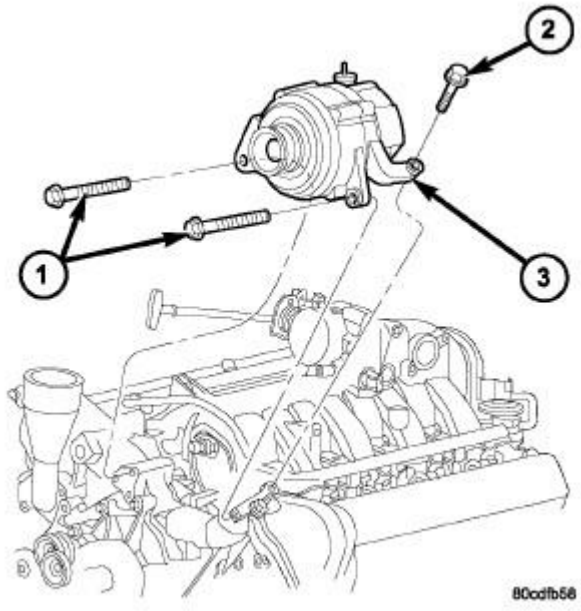


Fig. 24: Generator Removal/Installation
Courtesy of CHRYSLER LLC

24. Reinstall the radiator/cooling module assembly.
25. Connect lower radiator hose.
26. Connect upper radiator hose.
27. Connect throttle and speed control cables.
28. Install the heater hose assembly.
29. Install coolant recovery bottle.
30. Install the power steering pump.
31. Install the generator (3).

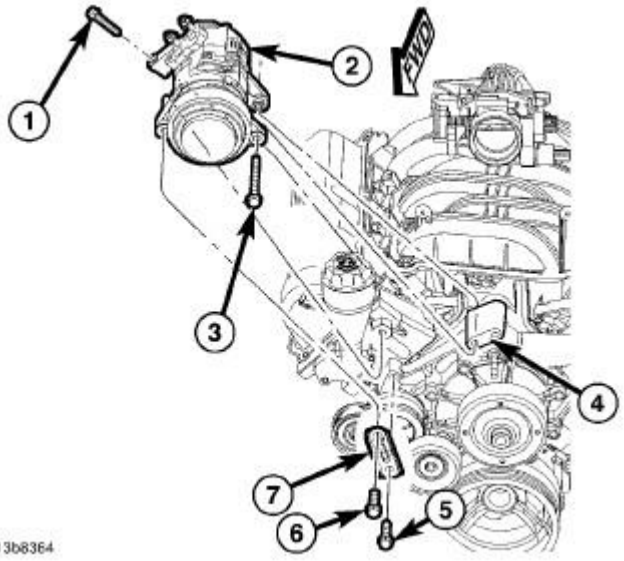


Fig. 25: A/C Compressor Removal/Installation
Courtesy of CHRYSLER LLC

32. Install the A/C compressor (2).
33. Install the drive belt.
34. Install the fan shroud with the viscous fan assembly.
35. Install the radiator core support bracket.
36. Recharge the A/C system. Refer to **Heating and Air Conditioning/Plumbing - Standard Procedure** .

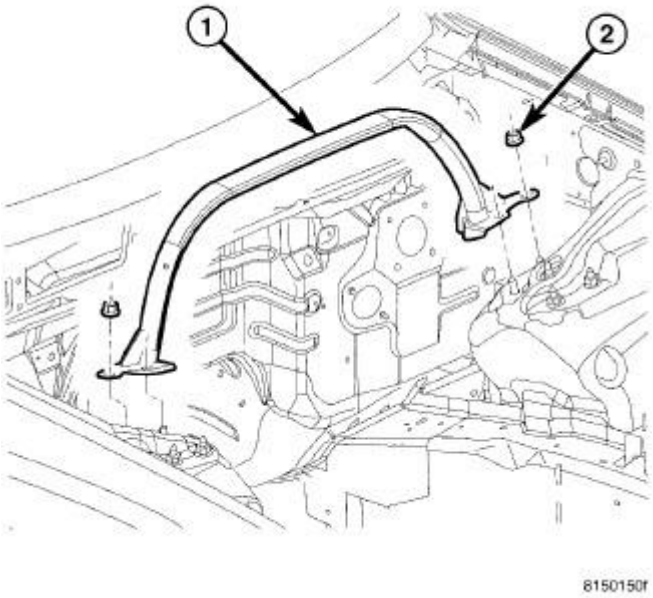


Fig. 26: STRUT TOWER SUPPORT
Courtesy of CHRYSLER LLC

37. Install the strut tower support (1).
38. Install the air cleaner assembly.
39. Refill the engine cooling system.
40. Check and fill engine oil.
41. Connect the battery negative cable.
42. Start the engine and check for leaks.

SPECIFICATIONS

3.7L ENGINE

GENERAL SPECIFICATIONS

DESCRIPTION	SPECIFICATION	
Type	90° SOHC V6 12 Valve	
Number of Cylinders	6	
Firing Order	1-6-5-4-3-2	
Lead Cylinder	No. 1 Left Bank	
Compression Ratio	9.6:1	
Max. Variation Between Cylinders	25%	
-	**Metric**	**Standard**
Displacement	3.7 Liters	226 Cubic Inches
Bore	93.0 mm	3.66 in.

Stroke	90.8 mm	3.40 in.
Horsepower	211 @ 5200 RPM	
Torque	236 ft. lbs.@ 4000 RPM	
Compression Pressure	1172-1551 kPa	170-225 psi

CYLINDER BLOCK

DESCRIPTION	SPECIFICATION	
-	**Metric**	**Standard**
Bore Diameter	93.013 ± 0.0075 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	365.0 grams	12.87 oz.
Ring Groove Diameter	-	-
No. 1	85.37 - 83.13 mm	3.282 - 3.273 in
No. 2	82.833 - 83.033 mm	3.261 - 3.310 in.
No. 3	83.88 - 84.08 mm	3.302 - 3.310 in.

PISTON PINS

DESCRIPTION	SPECIFICATION	
-	**Metric**	**Standard**
Clearance In Piston	0.006 - 0.015 mm	0.0002 - 0.0005 in.
Diameter	24.017 - 24.020 mm	0.9455 - 0.9456 in.

PISTON RINGS

DESCRIPTION	SPECIFICATION	
-	**Metric**	**Standard**
Ring Gap	-	-
Top Compression Ring	0.20 - 0.36 mm	0.0079 - 0.0142 in.
Second Compression Ring	0.37 - 0.63 mm	0.0146 - 0.0249 in.
Oil Control (Steel Rails)	0.25 - 0.76 mm	0.0099 - 0.30 in.
Side Clearance	-	-
Top Compression Ring	0.051 - 0.094 mm	0.0020 - 0.0037 in.
Second Compression Ring	0.040 - 0.080 mm	0.0016 - 0.0031 in.
Oil Ring (Steel Ring)	0.019 - 0.229 mm	0.0007 - 0.0091 in.
Ring Width	-	-
Top Compression Ring	1.472 - 1.490 mm	0.057 - 0.058 in.
Second Compression Ring	1.472 - 1.490 mm	0.057 - 0.058 in.

Oil Ring (Steel Rails)	0.445 - 0.470 mm	0.017 - 0.018 in.

CONNECTING RODS

DESCRIPTION	SPECIFICATION	
-	**Metric**	**Standard**
Bearing Clearance	0.006 - 0.044 mm	0.0002 - 0.0017 in.
Side Clearance	0.10 - 0.35 mm	0.004 - 0.0138 in.
Piston Pin Clearance	0.015 - 0.028 mm	0.0006 - 0.0011 in.
Bearing Bore Out of Round (MAX)	0.004 mm	0.0002 in.
Total Weight (Less Bearing)	612 grams	21.588 ounces

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
-	**Metric**	**Standard**
Main Bearing Journal Diameter	63.488 - 63.512 mm	2.4996 - 2.5005 in.
Bearing Clearance	0.002 - 0.046 mm	0.00008 - 0.0018 in.
Out of Round (MAX)	0.005 mm	0.0002 in.
Taper (MAX)	0.006 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	57.908 - 57.892 mm	2.2798 - 2.2792 in.
Bearing Clearance	0.006 - 0.044	0.0002 - 0.0011 in.
Out of Round (MAX)	0.005 mm	0.0002 in.
Taper (MAX)	0.006 mm	0.0002 in.

CAMSHAFT

DESCRIPTION	SPECIFICATION	
-	**Metric**	**Standard**
Bore Diameter	26.02 - 26.04 mm	1.0245 - 1.0252 in.
Bearing Journal Diameter	25.975 - 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	SPECIFICATION
Intake	
Opens (BTDC)	5.6°
Closes (ATDC)	240.1°
Duration	245.7°

Exhaust	
Opens (BTDC)	241.5°
Closes (ATDC)	20.1°
Duration	261.6°
Valve Overlap	25.7°

VALVES

DESCRIPTION	SPECIFICATION	
-	**Metric**	**Standard**
Face Angle	45° - 45.5°	-
Head Diameter	-	-
Intake	48.52 - 48.78 mm	1.9103 - 1.9205 in.
Exhaust	36.87 - 37.13 mm	1.4516 - 1.4618 in.
Length (Overall)	-	-
Intake	113.45 - 114.21 mm	4.4666 - 4.4965 in.
Exhaust	114.92 - 115.68 mm	4.5244 - 4.5543 in.
Stem Diameter	-	-
Intake	6.931 - 6.957 mm	0.2729 - 0.2739 in.
Exhaust	6.902 - 6.928 mm	0.2717 - 0.2728 in.
Stem-to-Guide Clearance	-	-
Intake	0.018 - 0.069 mm	0.0008 - 0.0028 in.
Exhaust	0.047 - 0.098 mm	0.0019 - 0.0039 in.
Max. Allowable Stem-to-Guide Clearance (Rocking Method)	-	-
Intake	0.069 mm	0.0028 in.
Exhaust	0.098 mm	0.0039 in.
Valve Lift (Zero Lash)	-	-
Intake	12.00 mm	0.472 in.
Exhaust	12.00 mm	0.472 in.

VALVE SPRING

DESCRIPTION	SPECIFICATION	
-	**Metric**	**Standard**
Free Length (Approx)	-	-
Intake	48.18 mm	1.896 in.
Exhaust - w/damper	49.2 mm	1.973 in.
Spring Force (Valve Closed)	-	-
Intake	332.0 - 368.0 N @ 40.12 mm	74.63 - 82.72 lbs. @ 1.5795 in.
Exhaust - (without damper)	356 - 394 N @ 39.12 mm	80.031 - 88.57 lbs. @ 1.54 in.
Spring Force (Valve Open)	-	-
Intake	948.0 - 1038.0 N @ 28.12 mm	213.2 - 233.8 lbs. @ 1.107 in.
Exhaust - without damper	874 - 956 N @ 27.12 mm	196.5 - 214.9 lbs. @ 1.067 in.

Number of Coils	-	-
Intake	7.30	
Exhaust	7.15	
Wire Diameter	-	-
Intake	4.77 x 3.80 mm	0.1878 x 0.1496 in.
Exhaust	4.66 x 3.72 mm	0.1843 x.1464 in.
Installed Height (Spring Seat to Bottom of Retainer)	-	-
Nominal	-	-
Intake	40.12 mm	1.579 in.
Exhaust - w/damper	40.12 mm	1.579 in.

CYLINDER HEAD

DESCRIPTION	SPECIFICATION	
-	**Metric**	**Standard**
Gasket Thickness (Compressed)	0.7 mm	(0.0276 in.)
Valve Seat Angle	44.5° - 45.0°	
Valve Seat Runout (MAX)	0.051 mm	0.002 in.
Valve Seat Width	-	-
Intake	1.75 - 2.36 mm	0.0698 - 0.0928 in.
Exhaust	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.

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 (Diameter) clearance (MAX)	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

SPECIFICATION	SPECIFICATION	
-	**Metric**	**Standard**
At Curb Idle Speed (MIN)*	25 kPa	4 psi
@ 3000 RPM	170 - 758 kPa	25 - 110 psi

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

TORQUE

TORQUE

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Camshaft	-	-	-
Non - Oiled Sprocket Bolt	122	90	-
Bearing Cap Bolts	11	-	100
Counterbalance Shaft Retaining Bolt	28	-	250
Timing Chain Cover Bolts	58	43	-
Connecting Rod Cap Bolts	27	20	-
-	**PLUS 90° TURN**		
Bed Plate Bolts	Refer to Procedure		
Crankshaft Damper Bolt	175	130	-
Cylinder Head Bolts	-	-	-
M11 Bolts	Refer To Procedure		
M8 Bolts	Refer To Procedure		
Cylinder Head Cover Bolts and Studs	12	-	105
Exhaust Manifold Bolts	25	18	-
Exhaust Manifold Heat Shield Nuts	8	-	72
-	Then loosen 45°		
Flexplate Bolts	95	70	-
Engine Mount Bracket to Block Bolts	61	45	-
Engine to Transmission Bellhousing Bolts	41	30	-
Rear Mount to Transmission Bolts	46	34	-
Generator Mounting Bolts	-	-	-
M10 Bolts	54	40	-
M8 Bolts	28	-	250
Intake Manifold Bolts	12	-	105
-	Refer to Procedure for Tightening Sequence		
Oil Pan Bolts	16	-	140
Oil Pan Drain Plug	34	25	-
Oil Pump Bolts	28	-	250
Oil Pump Cover Bolts	12	-	105
Oil Pickup Tube Bolt and Nut	28	-	250
Oil Dipstick Tube to Engine Block Bolt	15	-	130
Oil Fill Tube Bolts	12	-	105
Timing Chain Guide Bolts	28	-	250
Timing Chain Tensioner Arm	28	-	250
Hydraulic Tensioner Bolts	28	-	250
Timing Chain Primary Tensioner Bolts	28	-	250

Timing Drive Idler Sprocket Bolt	34	25	-
Thermostat Housing Bolts	12	-	105
Water Pump Bolts	58	43	-

SPECIAL TOOLS

SPECIAL TOOLS

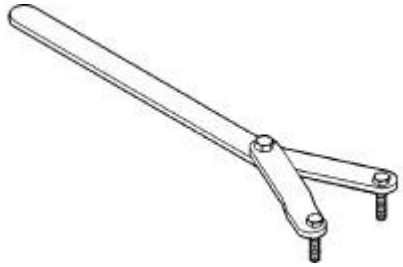


Fig. 27: SPANNER WRENCH - 6958
Courtesy of CHRYSLER LLC

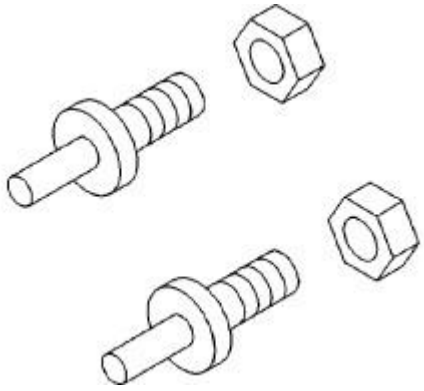


Fig. 28: PINS, ADAPTER - 8346
Courtesy of CHRYSLER LLC

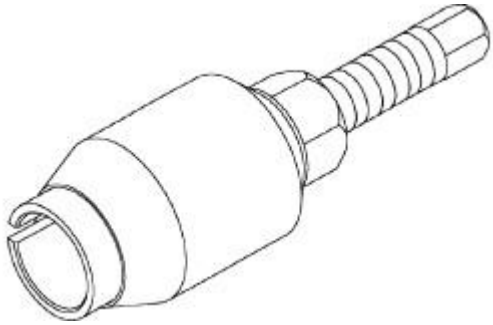


Fig. 29: REMOVER, SEAL - 8511
Courtesy of CHRYSLER LLC

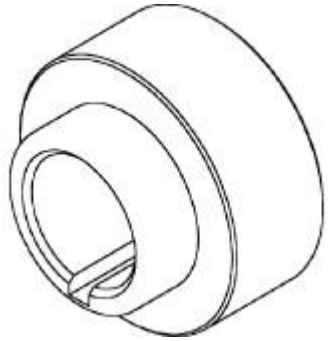


Fig. 30: INSTALLER, SEAL - 8348
Courtesy of CHRYSLER LLC

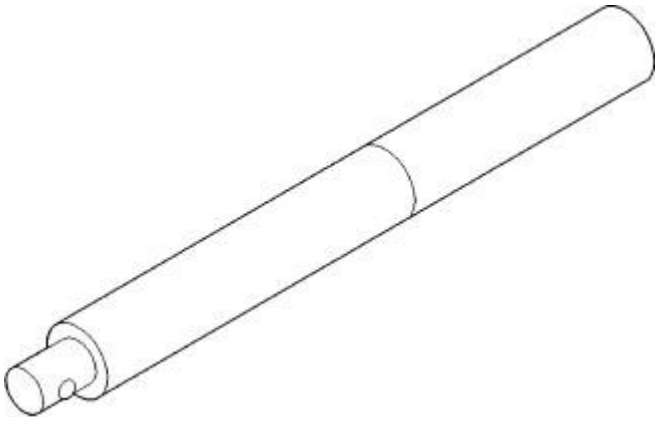


Fig. 31: DRIVER HANDLE, UNIVERSAL - C-4171
Courtesy of CHRYSLER LLC

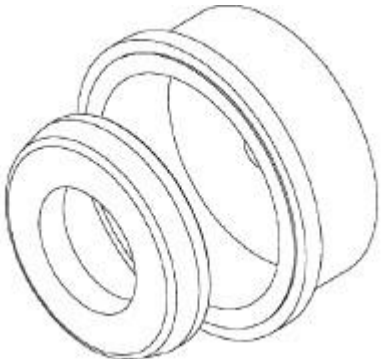


Fig. 32: INSTALLER, SEAL - 8349
Courtesy of CHRYSLER LLC

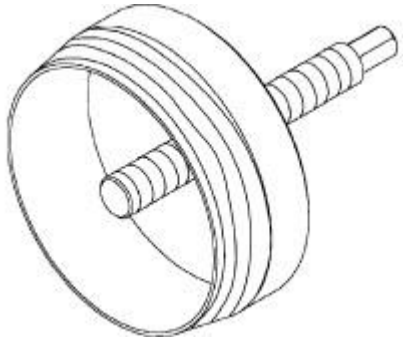


Fig. 33: REMOVER, SEAL - 8506
Courtesy of CHRYSLER LLC

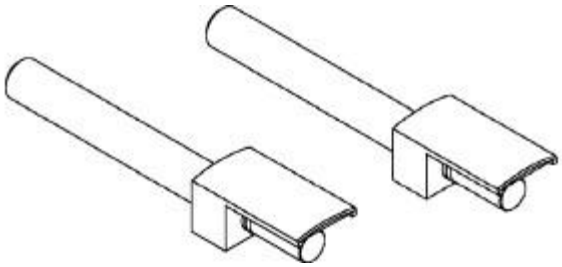


Fig. 34: GUIDES, CONNECTING ROD - 8507
Courtesy of CHRYSLER LLC

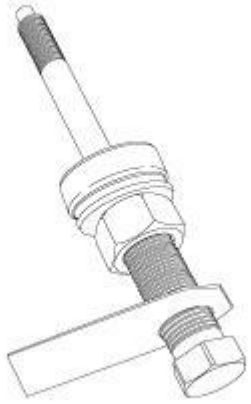


Fig. 35: INSTALLER, DAMPER - 8512A
Courtesy of CHRYSLER LLC

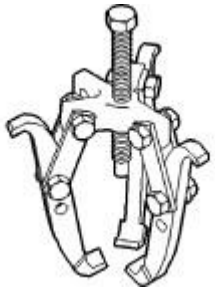


Fig. 36: PULLER -1026
Courtesy of CHRYSLER LLC

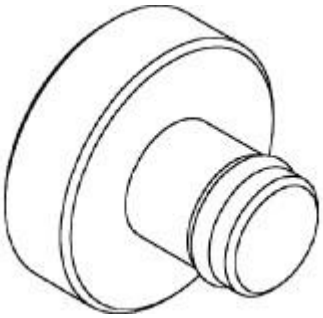


Fig. 37: INSERT, CRANKSHAFT - 8513A
Courtesy of CHRYSLER LLC

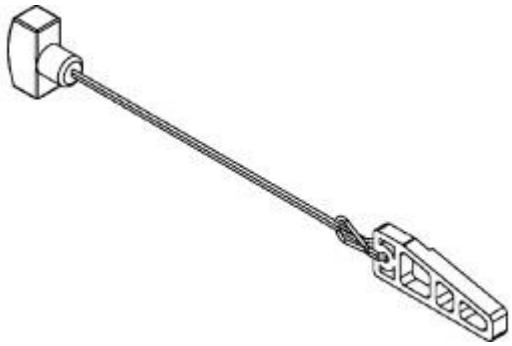


Fig. 38: LOCKING TOOL, WEDGE - 8379
Courtesy of CHRYSLER LLC

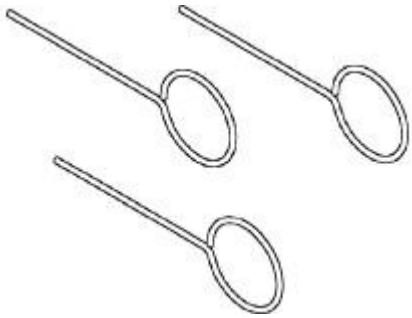


Fig. 39: PINS, TENSIONER - 8514
Courtesy of CHRYSLER LLC

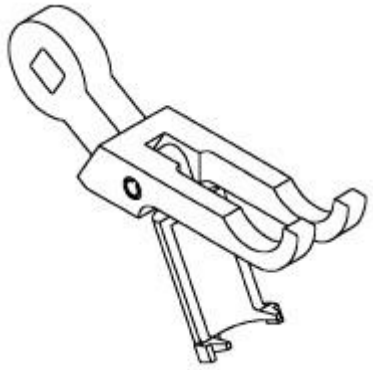


Fig. 40: COMPRESSOR, VALVE SPRING - 8426
Courtesy of CHRYSLER LLC

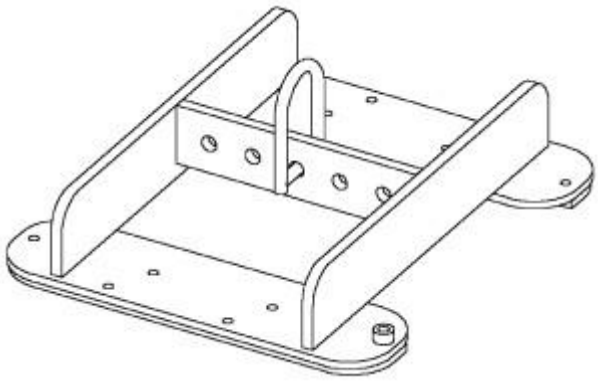


Fig. 41: FIXTURE, ENGINE LIFTING - 8427
Courtesy of CHRYSLER LLC

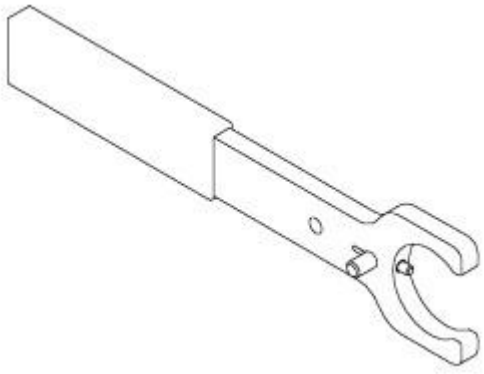


Fig. 42: Holder, Camshaft - 8428A
Courtesy of CHRYSLER LLC

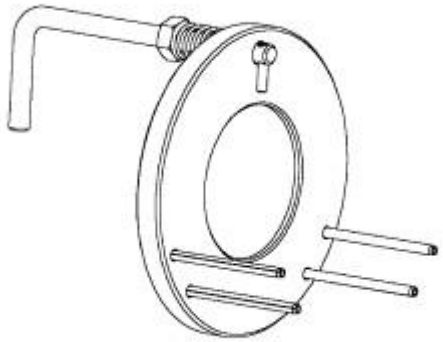


Fig. 43: HOLDER, SECONDARY CAMSHAFT CHAIN - 8429
Courtesy of CHRYSLER LLC

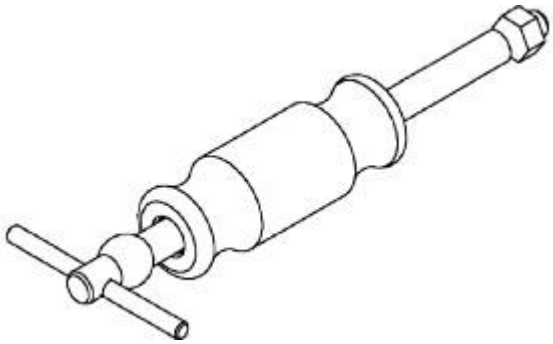


Fig. 44: REMOVER - 8517
Courtesy of CHRYSLER LLC

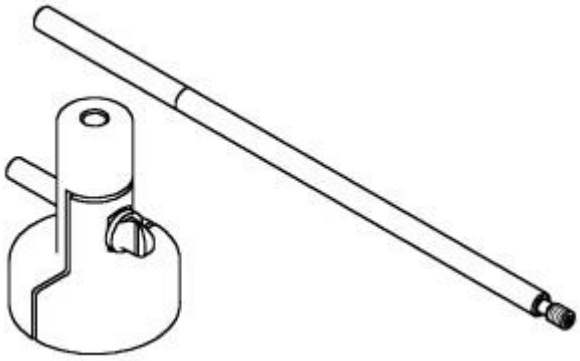


Fig. 45: REMOVER/INSTALLER - 8641
Courtesy of CHRYSLER LLC

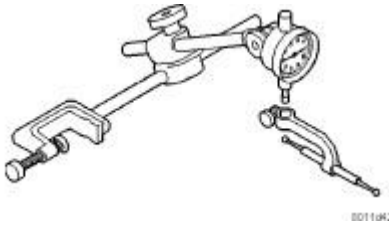


Fig. 46: SET, DIAL INDICATOR - C-3339A
Courtesy of CHRYSLER LLC

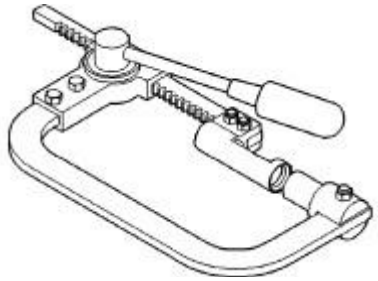


Fig. 47: COMPRESSOR, VALVE SPRING - C-3422CF
Courtesy of CHRYSLER LLC

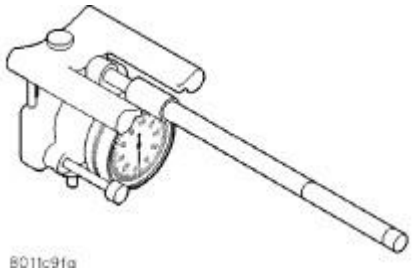


Fig. 48: CYLINDER INDICATOR - C-119
Courtesy of CHRYSLER LLC

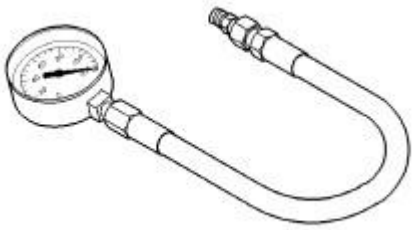


Fig. 49: GAUGE, PRESSURE - C-3292A
Courtesy of CHRYSLER LLC

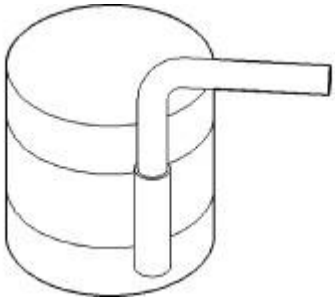


Fig. 50: COMPRESSOR, PISTON - C-385
Courtesy of CHRYSLER LLC

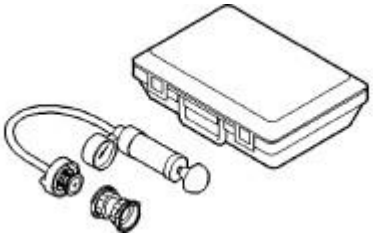


Fig. 51: TESTER, COOLING SYSTEM - 7700-A
Courtesy of CHRYSLER LLC

Fig. 52: BLOC-CHEK-KIT - C-3685-A
Courtesy of CHRYSLER LLC

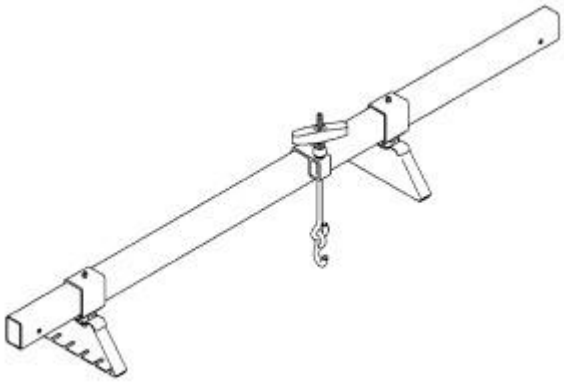


Fig. 53: SUPPORT FIXTURE, ENGINE - 8534B
Courtesy of CHRYSLER LLC

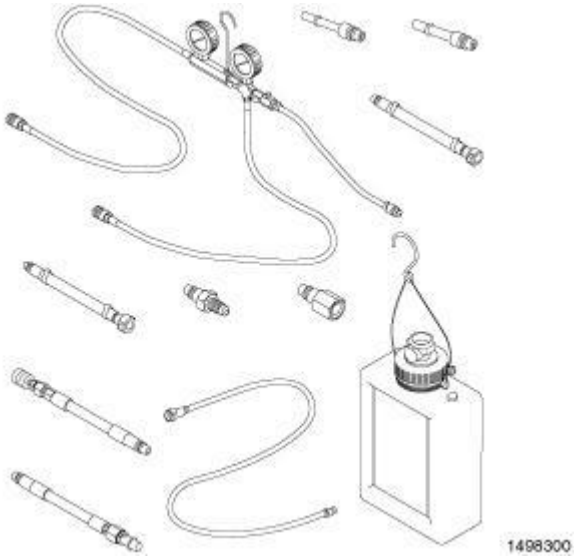


Fig. 54: DECAY TOOL, FUEL - 8978A
Courtesy of CHRYSLER LLC

AIR INTAKE SYSTEM

AIR CLEANER

Removal

REMOVAL

Filter Element Only

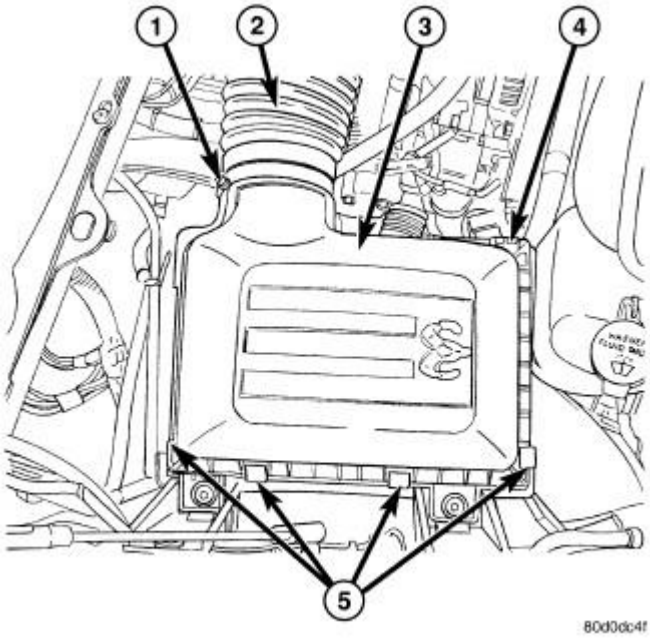


Fig. 55: Removing/Installing Air Cleaner Housing Cover
Courtesy of CHRYSLER LLC

Housing removal is not necessary for element (filter) replacement.

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

Housing Assembly

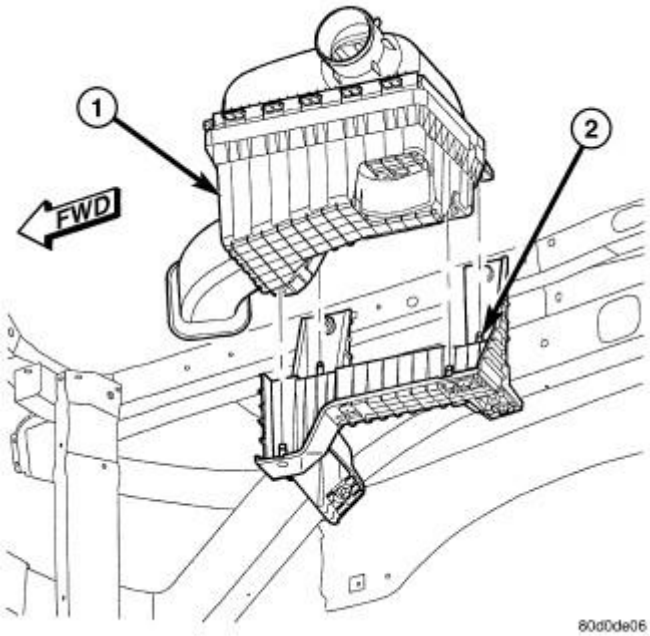


Fig. 56: Removing/Installing Air Cleaner Housing
Courtesy of CHRYSLER LLC

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

Installation

INSTALLATION

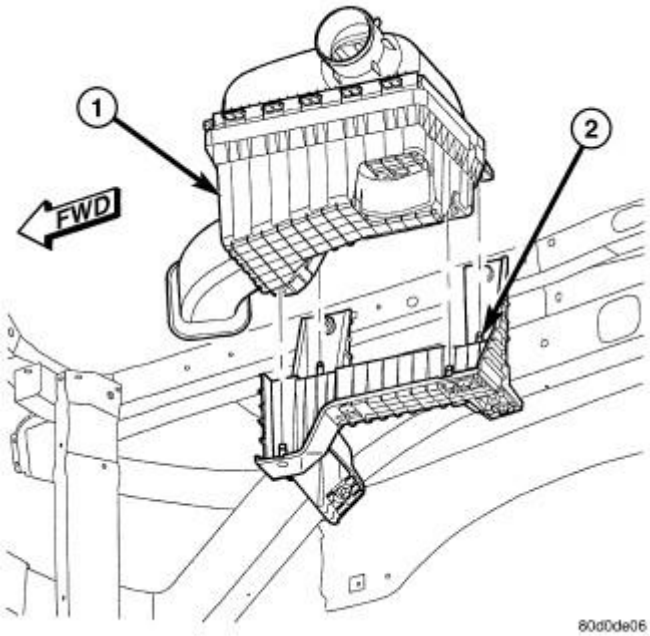


Fig. 57: Removing/Installing Air Cleaner Housing
Courtesy of CHRYSLER LLC

1. Install filter element into housing (1).
2. Position housing cover into housing locating tabs.
3. Pry up 4 spring clips 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 N.m (30 in. lbs.) torque.
6. If any bolts were removed from air resonator housing or air intake tubing, tighten them to 4 N.m (40 in. lbs.) torque.

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 GUIDE SEALS

The valve guide 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.

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 Block-Check Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

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 restricted 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 firm when pressed quickly. When pressed very slowly, lash adjusters should collapse.
b. Remove suspected lash adjusters, and replace.
c. Before installation, make sure adjusters are full of oil. This can be verified by little plunger travel when lash adjuster is depressed quickly.

REMOVAL

LEFT

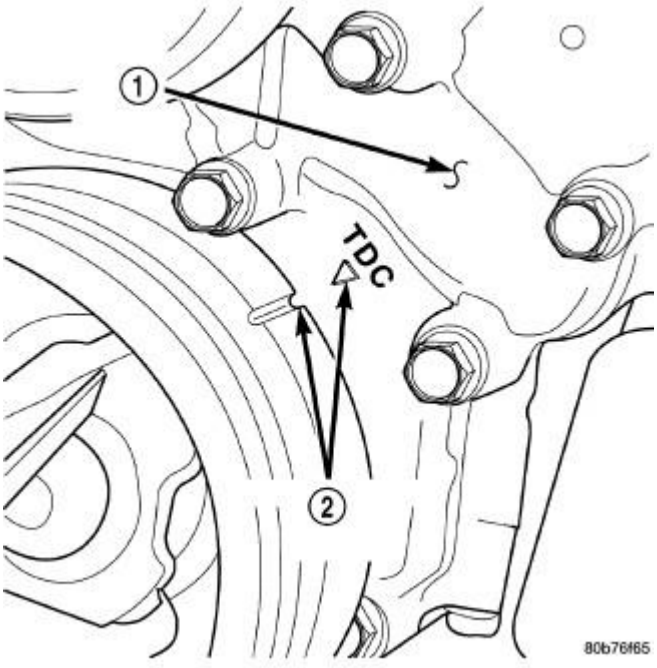


Fig. 58: Identifying TDC Indicator Marks
Courtesy of CHRYSLER LLC

1. Disconnect the negative battery cable.
2. Raise and support the vehicle.
3. Disconnect the exhaust pipe at the left 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 **Brakes/Hydraulic/Mechanical/BOOSTER, Power Brake - Removal** .
8. Remove the cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
9. Remove the fan shroud and fan blade assembly. Refer to **Cooling/Engine/FAN, Cooling - Removal** .
10. Remove the accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal** .
11. Remove the power steering pump. Refer to **Steering/Pump - Removal** .
12. Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark (2).

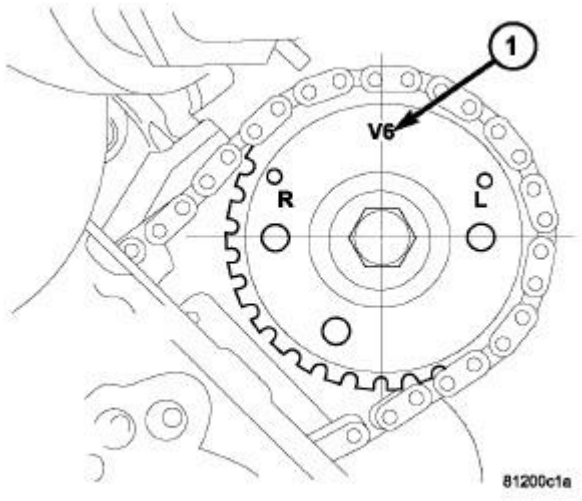


Fig. 59: Identifying V6 Mark On Camshaft Sprocket
Courtesy of CHRYSLER LLC

13. Verify the V6 timing mark (1) on the camshaft sprocket is at the 12 o'clock position, with the No. 1 cylinder at TDC on the exhaust stroke. Rotate the crankshaft one turn if necessary.
14. Remove the vibration damper. See **Engine/Engine Block/DAMPER, Vibration - Removal**.
15. Remove the timing chain cover. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.

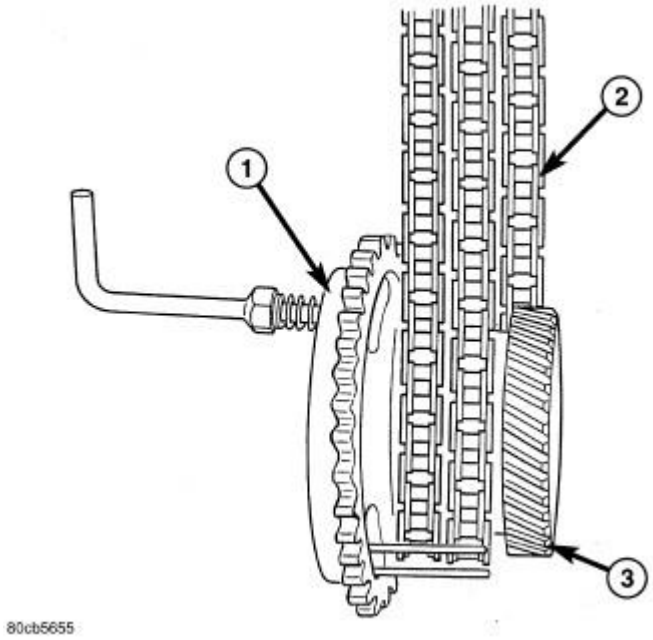


Fig. 60: Locking Secondary Timing Chains
Courtesy of CHRYSLER LLC

16. Lock the secondary timing chains (2) to the idler sprocket using the Secondary Camshaft Chain Holder 8429 (1).

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

17. Mark the secondary timing chain (2), one link on each side of the V6 timing mark on the camshaft drive gear.
18. Remove the left side secondary chain tensioner. See **Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Removal**.

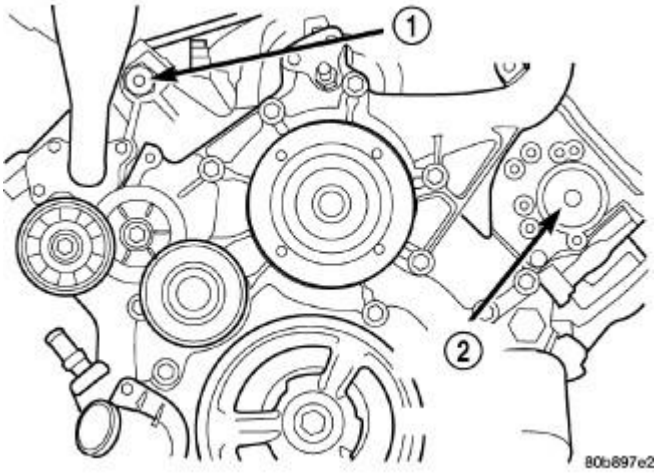


Fig. 61: Removing/Installing Cylinder Head Access Plug
Courtesy of CHRYSLER LLC

19. Remove the cylinder head access plug (1) and (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.

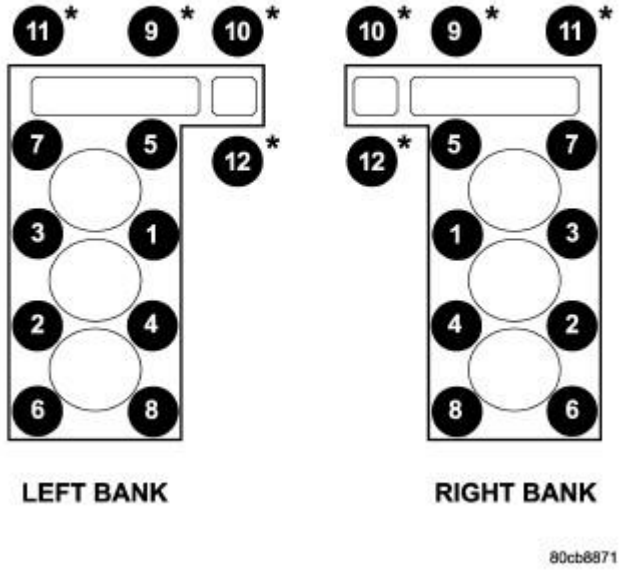


Fig. 62: Cylinder Head Tightening Sequence
Courtesy of CHRYSLER LLC

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

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. The locations are identified with an *.

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

22. Using the sequence shown in **Fig. 62**, remove the cylinder head retaining bolts.
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

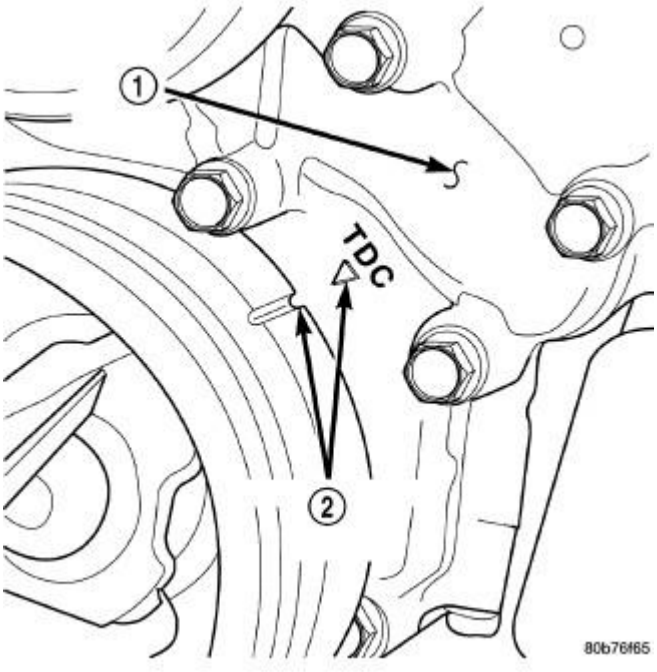


Fig. 63: Engine Top Dead Center (TDC) Indicator Mark
Courtesy of CHRYSLER LLC

1 - TIMING CHAIN COVER 2 - CRANKSHAFT TIMING MARKS

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. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
8. Remove the fan shroud. Refer to **Cooling/Engine/FAN, Cooling - Removal** .
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).

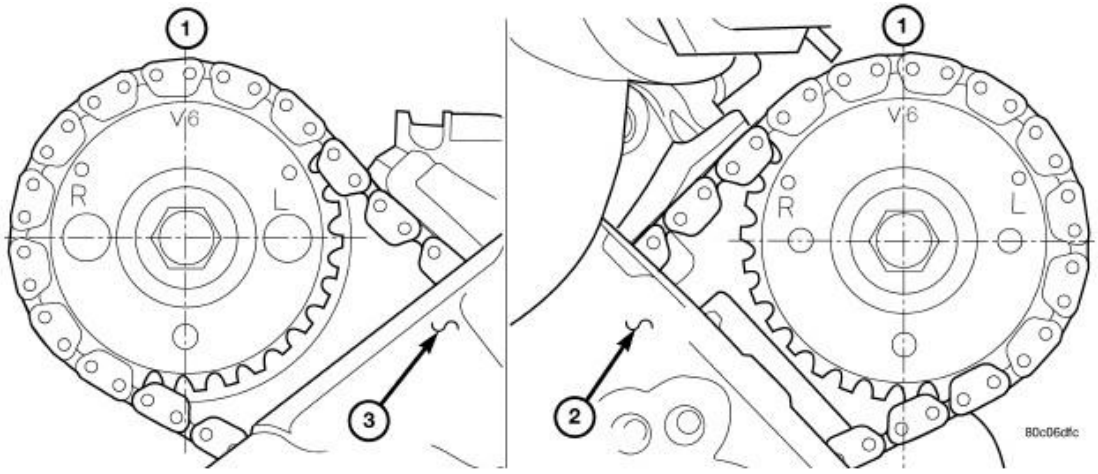


Fig. 64: Camshaft Sprocket V6 Marks
Courtesy of CHRYSLER LLC

12. Verify the V6 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**.

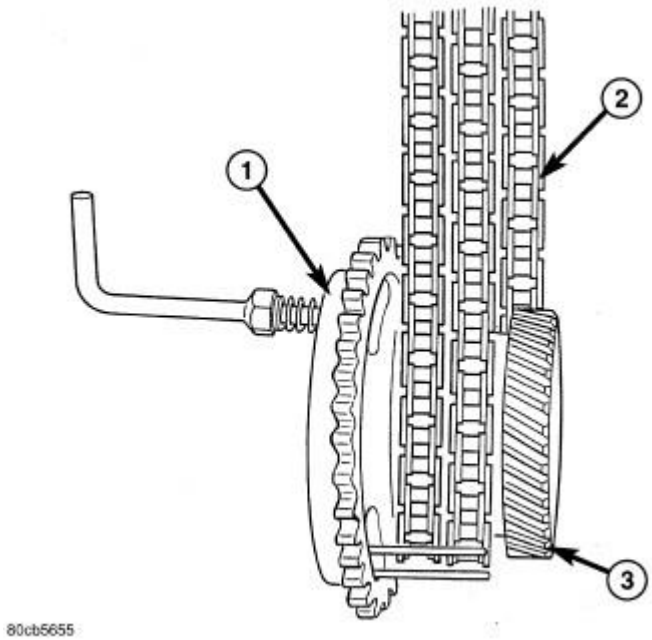


Fig. 65: Using Special Tool 8429
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL 8429 2 - CAMSHAFT CHAIN

3 - CRANKSHAFT TIMING GEAR

15. Lock the secondary timing chains to the idler sprocket using the Secondary Camshaft Chain Holder 8429 (1).

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 V6 mark on the camshaft drive gear.
17. Remove the right side secondary chain tensioner. See **Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Removal**.

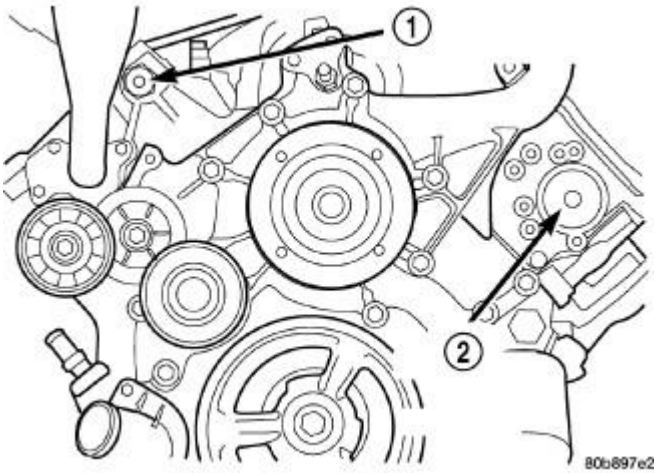


Fig. 66: Cylinder Head Access Plugs
Courtesy of CHRYSLER LLC

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

18. Remove the cylinder head access plug (1,2).
19. Remove the right side secondary chain guide. See **Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Removal**.

CAUTION: The nut on the right side camshaft sprocket should not be removed for any reason, as the sprocket and camshaft sensor target wheel is serviced as an assembly. If the nut was removed, tighten nut to 5 N.m (44 in. lbs.).

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.

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.

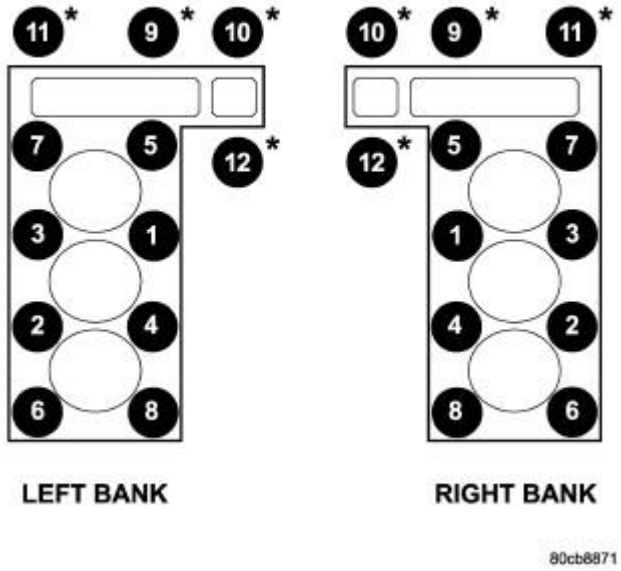


Fig. 67: Cylinder Head Tightening Sequence
Courtesy of CHRYSLER LLC

* - INDICATES SEALANT ON THREADS

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

21. Remove the cylinder head retaining bolts .
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.

INSPECTION

INSPECTION

1. Inspect the cylinder head for out-of-flatness, using a straightedge and a feeler gauge. 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

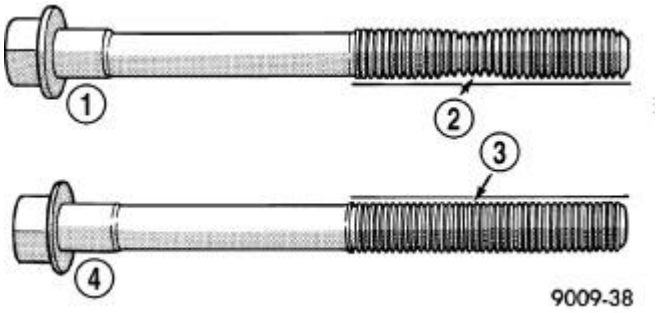


Fig. 68: Identifying Cylinder Head Bolts
Courtesy of CHRYSLER LLC

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 the bolts should be replaced.

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

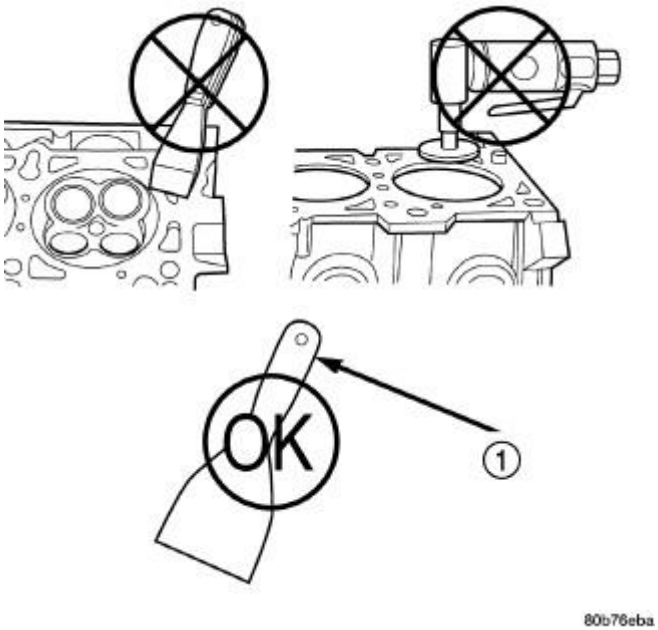


Fig. 69: Illustrating How To Clean Cylinder Head And Cylinder Block Surfaces
Courtesy of CHRYSLER LLC

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.

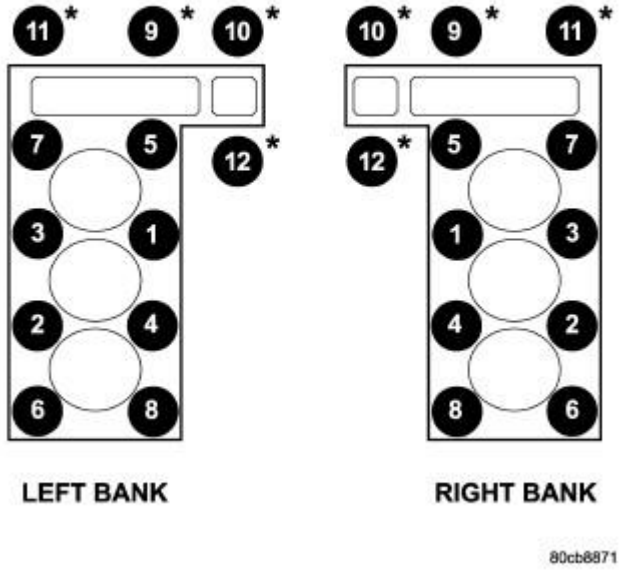


Fig. 70: Cylinder Head Tightening Sequence
Courtesy of CHRYSLER LLC

* - INDICATES SEALANT ON THREADS

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 smaller cylinder head mounting bolts require sealant to be added to them before installing. Failure to do so may cause leaks. The locations are identified with an *.

4. Lubricate the cylinder head bolt threads with clean engine oil and install the eight M11 bolts.
5. Coat the four M8 cylinder head bolts with **Mopar® Lock and Seal Adhesive** then install the bolts.

NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.

6. Tighten the bolts in sequence using the following steps and torque values:
   - Step 1: Tighten bolts 1-8, 27 N.m (20 ft. lbs.).
   - Step 2: Verify that bolts 1-8, all reached 27 N.m (20 ft. lbs.), by repeating step 1 without loosening the bolts. Tighten bolts 9 thru 12 to 14 N.m (10 ft. lbs.).
   - Step 3: Tighten bolts 1-8, 90 degrees.
   - Step 4: Tighten bolts 1-8, 90 degrees, again. Tighten bolts 9-12, 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 V6 mark on the gear then using Camshaft Holder 8428 position the gear onto the camshaft.

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

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**.
10. Install the cylinder head access plug.
11. Re-set and install the left side secondary chain tensioner. See **Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Installation**.
12. Remove Secondary Camshaft Chain Holder 8429.
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**. Tighten damper bolt 175 N.m (130 ft. lbs.).
15. Install the power steering pump.
16. Install the fan blade assembly and fan shroud. Refer to **Cooling/Engine/FAN, Cooling - Installation** .
17. Install the cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.
18. Install the master cylinder and booster assembly. Refer to **Brakes/Hydraulic/Mechanical/BOOSTER, Power Brake - Installation** .
19. Install the intake manifold. See **Engine/Cylinder Head/COVER(S), Cylinder Head - 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

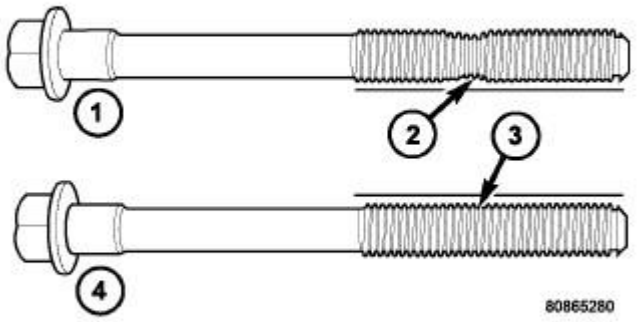


Fig. 71: Checking Cylinder Head Bolts for Stretching (Necking)
Courtesy of CHRYSLER LLC

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 .

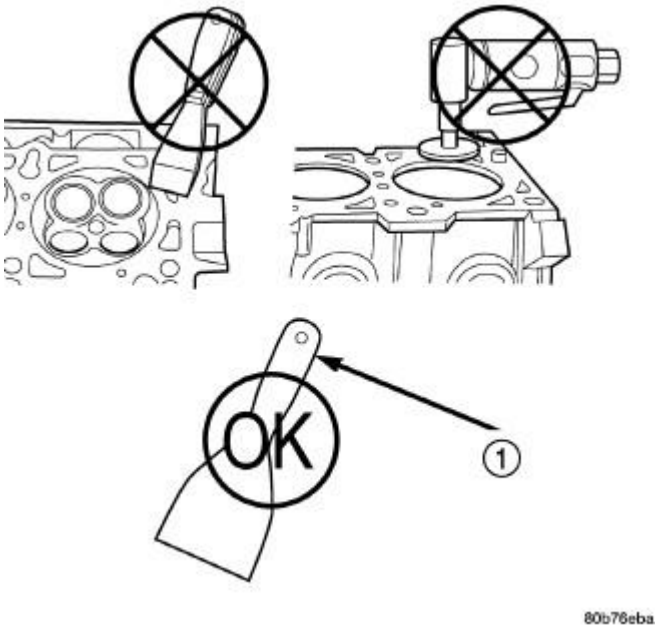


Fig. 72: Proper Tool Usage For Surface Preparation
Courtesy of CHRYSLER LLC

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 .

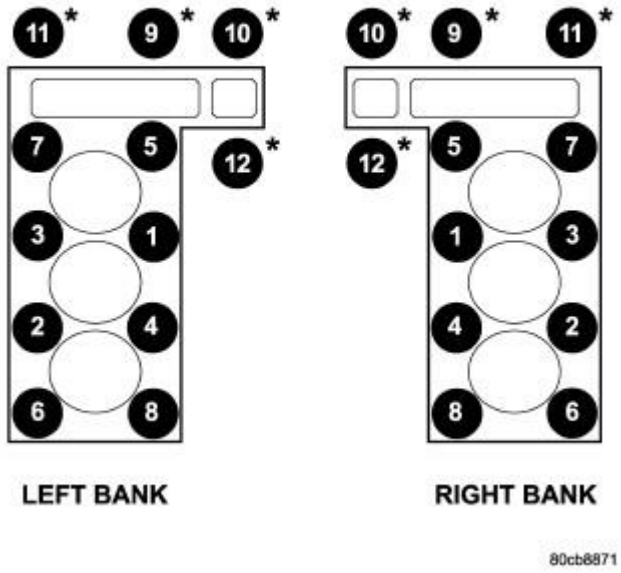


Fig. 73: Cylinder Head Tightening Sequence
Courtesy of CHRYSLER LLC

* - INDICATES SEALANT ON THREADS

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 (1) 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 eight M10 bolts.
5. Coat the four M8 cylinder head bolts with **Mopar Lock and Seal Adhesive** then install the bolts.

NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.

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

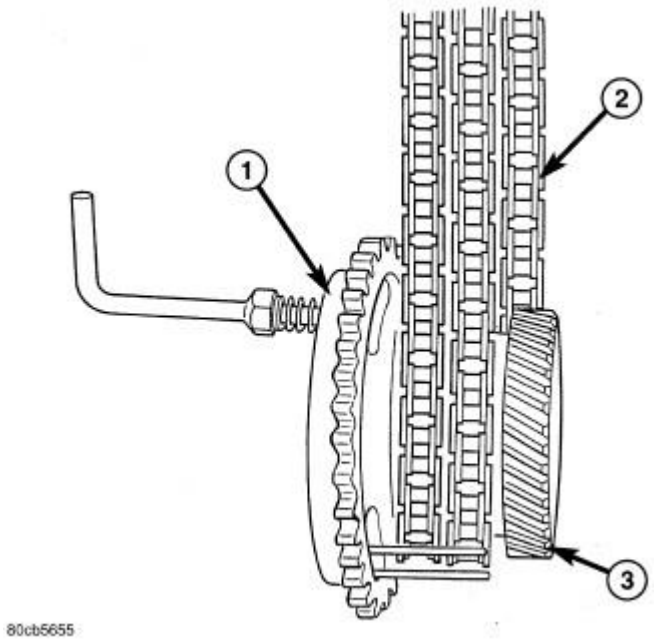


Fig. 74: Using Special Tool 8429
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL 8429
2 - CAMSHAFT CHAIN
3 - CRANKSHAFT TIMING GEAR

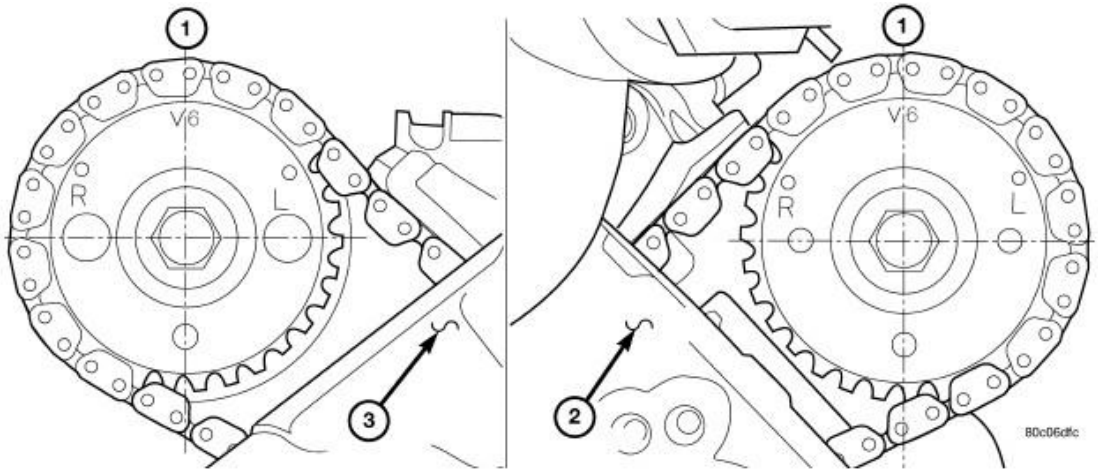


Fig. 75: Camshaft Sprocket V6 Marks
Courtesy of CHRYSLER LLC

- Step 1: Tighten bolts 1-8, 27 N.m (20 ft. lbs.).
- Step 2: Verify that bolts 1-8, all reached 27 N.m (20 ft. lbs.), by repeating step 1 without loosening the bolts. Tighten bolts 9 thru 12 to 14 N.m (10 ft. lbs.).
- Step 3: Tighten bolts 1-8, 90 °.
- Step 4: Tighten bolts 1-8, 90 °, again. Tighten bolts 9-12, 26 N.m (19 ft. lbs.)

7. Position the secondary chain (2) onto the camshaft drive gear, making sure one marked chain link is on either side of the V6 mark (1) on the gear then using the Camshaft Holder 8428, position the gear onto the camshaft.

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.

8. Install the camshaft drive gear retaining bolt.
9. Install the right side secondary chain guide. See **Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Installation**.

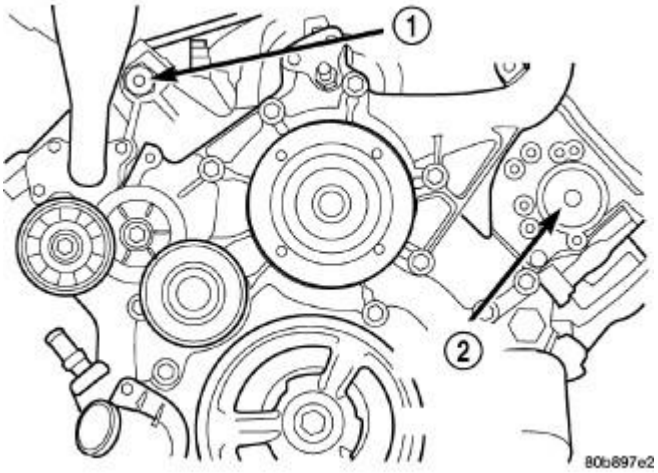


Fig. 76: Cylinder Head Access Plugs
Courtesy of CHRYSLER LLC

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

10. Install the cylinder head access plug (1,2).
11. Re-set and install the right side secondary chain tensioner. See **Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Installation**.

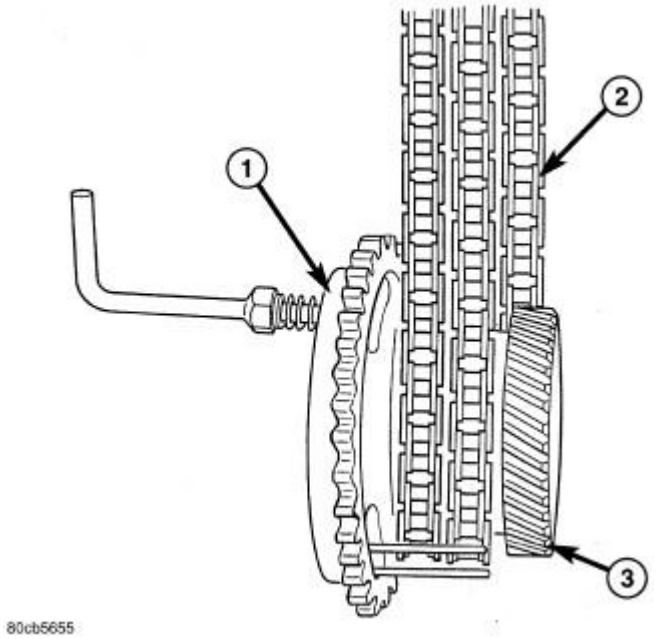


Fig. 77: Using Special Tool 8429
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL 8429
2 - CAMSHAFT CHAIN
3 - CRANKSHAFT TIMING GEAR

12. Remove the Camshaft Holder 8429 (1).
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**. Tighten damper bolt 175 N.m (130 Ft. Lbs.).
15. Install accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation** .
16. Install the fan shroud. Refer to **Cooling/Engine/FAN, Cooling - Installation** .
17. Install the cylinder head cover. 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. Four bearing journals are machined into the camshaft. Camshaft end play is controlled by two thrust walls that border the nose piece journal.

Removal

CAMSHAFT - LEFT

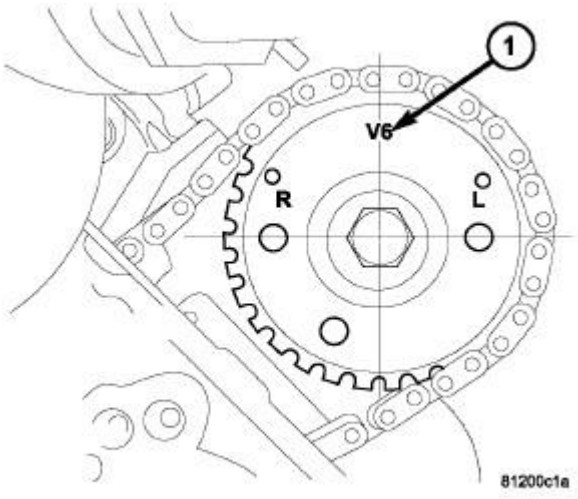


Fig. 78: CAMSHAFT SPROCKET V6 MARKS
Courtesy of CHRYSLER LLC

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.

CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use Wedge Locking Tool 8379 will result in hydraulic tensioner ratchet over extension, requiring timing chain cover removal to reset the tensioner ratchet.

1. Remove cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
2. Set engine to TDC cylinder No. 1, camshaft sprocket V6 marks (1) at the 12 o'clock position.
3. Mark one link on the secondary timing chain on both sides of the V6 mark on the camshaft sprocket to aid in installation.

CAUTION: Do not hold or pry on the camshaft target wheel (Located on the right side camshaft sprocket) for any reason, Severe damage will occur to the target wheel resulting in a vehicle no start condition.

4. Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave the bolt snug against the sprocket.

NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.

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

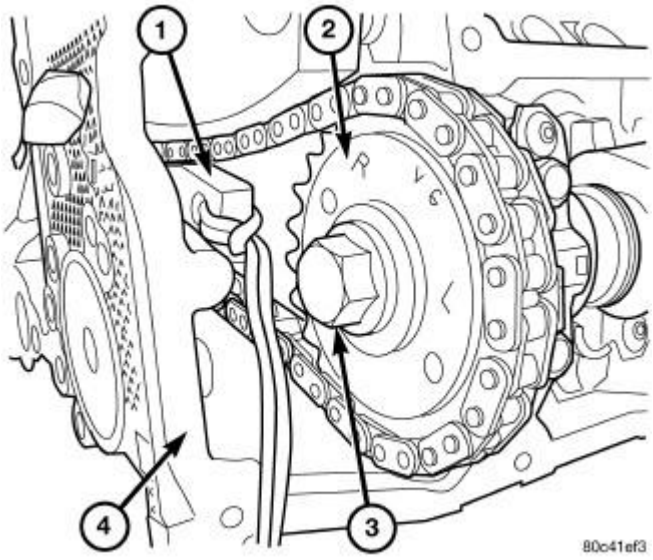


Fig. 79: SECURING TIMING CHAIN TENSIONERS USING TIMING CHAIN WEDGE
Courtesy of CHRYSLER LLC

5. Position Wedge Locking Tool 8379 (1) between the timing chain strands, tap the tool to securely wedge the timing chain against the tensioner arm and guide.

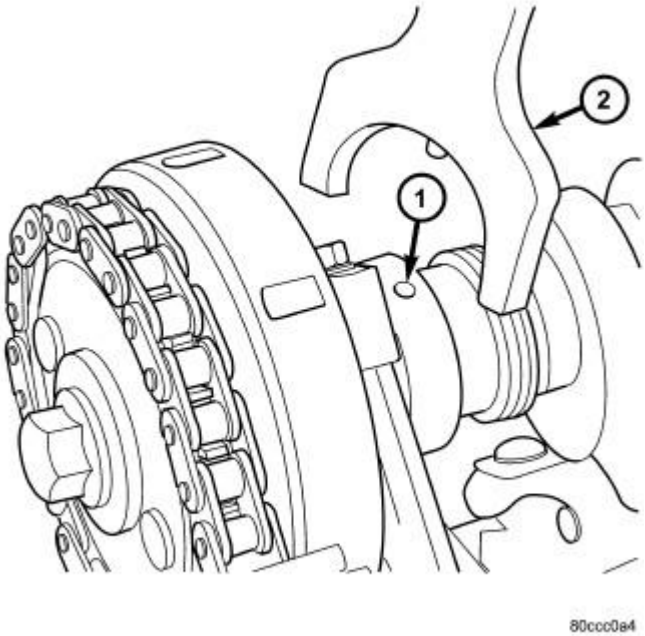


Fig. 80: Special Tool 8428

Courtesy of CHRYSLER LLC

6. Hold the camshaft with the Spanner Wrench 6958 and Adapter Pins 8346 while removing the camshaft sprocket bolt.
7. Using Camshaft Holder 8428 (2), remove the sprocket and gently allow the camshaft to rotate 5° clockwise until the camshaft is in the neutral position (no valve load).
8. Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.

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

9. Remove the camshaft bearing caps and the camshaft.

CAMSHAFT - RIGHT

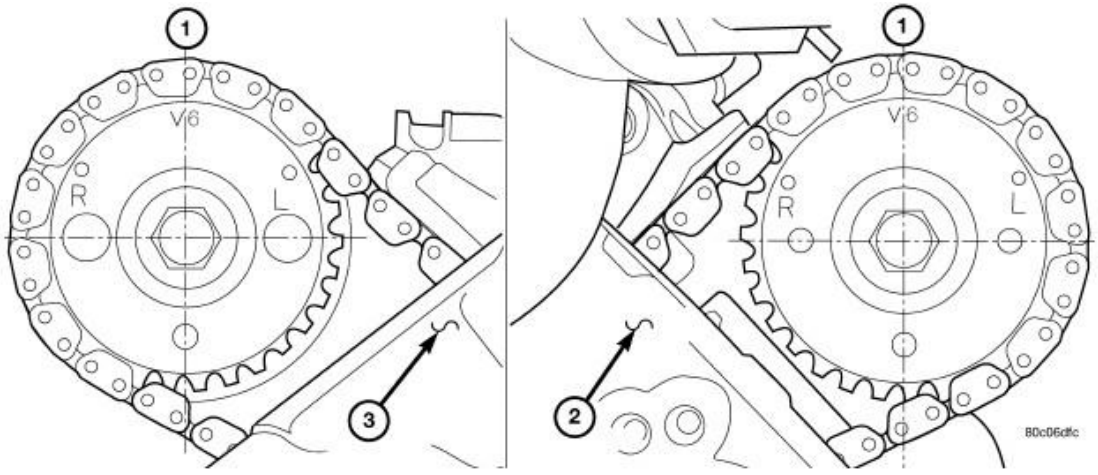


Fig. 81: Camshaft Sprocket V6 Marks
Courtesy of CHRYSLER LLC

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.

CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use special tool 8379 will result in hydraulic tensioner ratchet over extension, Requiring timing chain cover removal to re-set the tensioner ratchet.

1. Remove the cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
2. Set engine to TDC cylinder No. 1, camshaft sprocket V6 marks at the 12 o'clock position (1).
3. Mark one link on the secondary timing chain on both sides of the V6 mark on the camshaft sprocket to aid in installation.

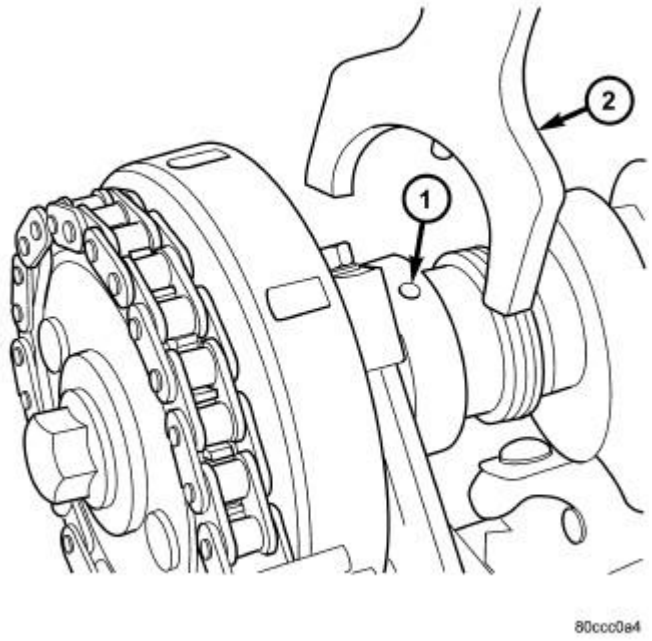


Fig. 82: Special Tool 8428
Courtesy of CHRYSLER LLC

1 - Camshaft hole 2 - Special Tool 8428

CAUTION: Do not hold or pry on the camshaft target wheel for any reason, Severe damage will occur to the target wheel. A damaged target wheel could cause a vehicle no start condition.

4. Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave bolt snug against sprocket.

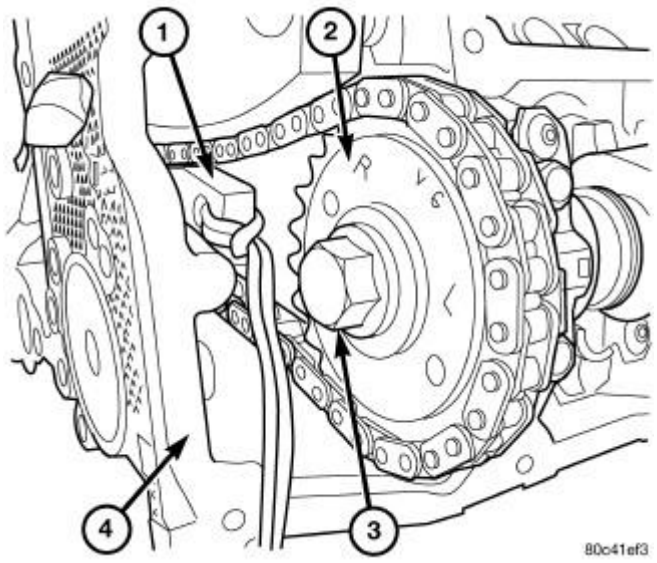


Fig. 83: SECURING TIMING CHAIN TENSIONERS USING TIMING CHAIN WEDGE - Typical
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL 8379
2 - CAMSHAFT SPROCKET
3 - CAMSHAFT SPROCKET BOLT
4 - CYLINDER HEAD

NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.

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

5. Position the Wedge Locking Tool 8379 (1) between the timing chain strands. Tap the tool to securely wedge the timing chain against the tensioner arm and guide.

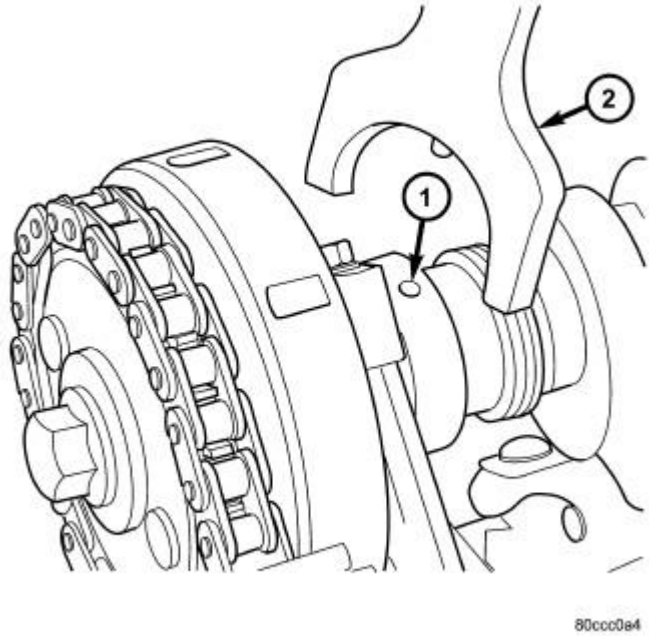
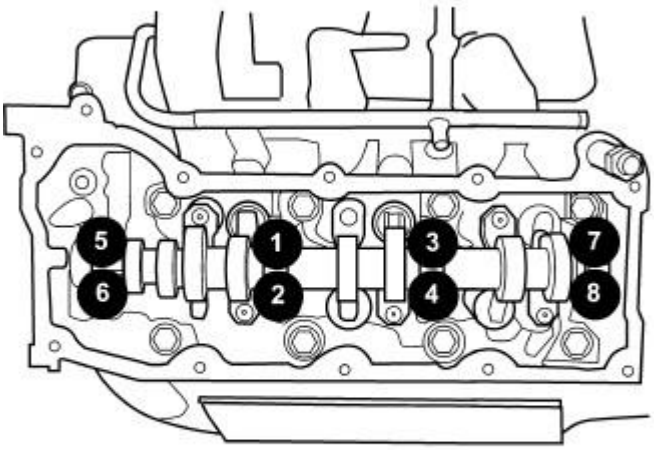


Fig. 84: Special Tool 8428
Courtesy of CHRYSLER LLC

1 - Camshaft hole 2 - Special Tool 8428

6. Remove the camshaft position sensor.
7. Hold the camshaft with Spanner Wrench 8428 (2), while removing the camshaft sprocket bolt and sprocket.



808a1e9b

Fig. 85: CAMSHAFT BEARING CAPS TIGHTENING
Courtesy of CHRYSLER LLC

8. Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.

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

9. Remove the camshaft bearing caps and the camshaft.

Installation

CAMSHAFT - LEFT

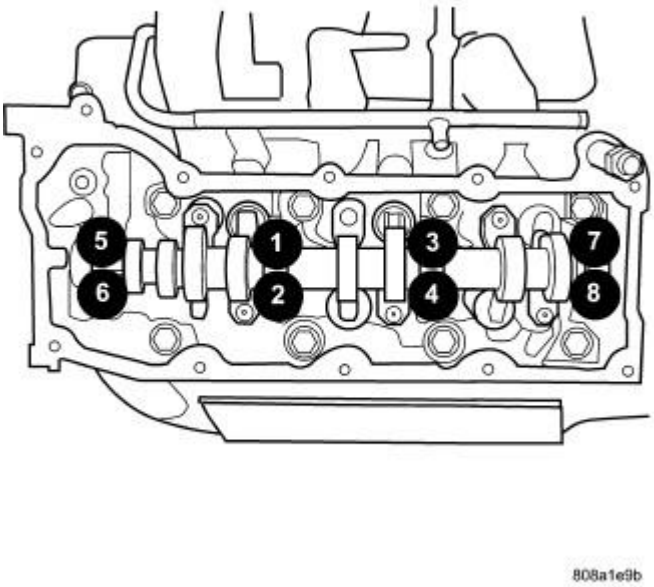


Fig. 86: Identifying Camshaft Bearing Caps Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

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. Position the camshaft into the cylinder head.
3. Install the camshaft bearing caps, hand tighten the retaining bolts.

NOTE: Caps should be installed so that the stamped numbers on the caps are in numerical order, (1 through 4) from the front to the rear of the engine. All caps should be installed so that the stamped arrows on the caps point toward the front of the engine.

4. Working in 1/2 turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward.
5. Tighten the camshaft bearing cap retaining bolts to 11 N.m (100 in. lbs.).
6. Position the camshaft drive gear into the timing chain aligning the V6 mark between the two marked chain links (Two links marked during removal).
7. Using the Camshaft Holder 8428A, rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft.

CAUTION: Remove excess oil from the camshaft sprocket bolt. Failure to do so

can cause bolt over-torque resulting in bolt failure.

8. Remove excess oil from bolt, then install the camshaft sprocket retaining bolt and hand tighten.
9. Remove the Wedge Locking Tool 8379.
10. Using Spanner Wrench 6958 with adapter pins 8346, tighten the camshaft sprocket retaining bolt to 122 N.m (90 ft. lbs.).
11. Install the cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.

CAMSHAFT - RIGHT

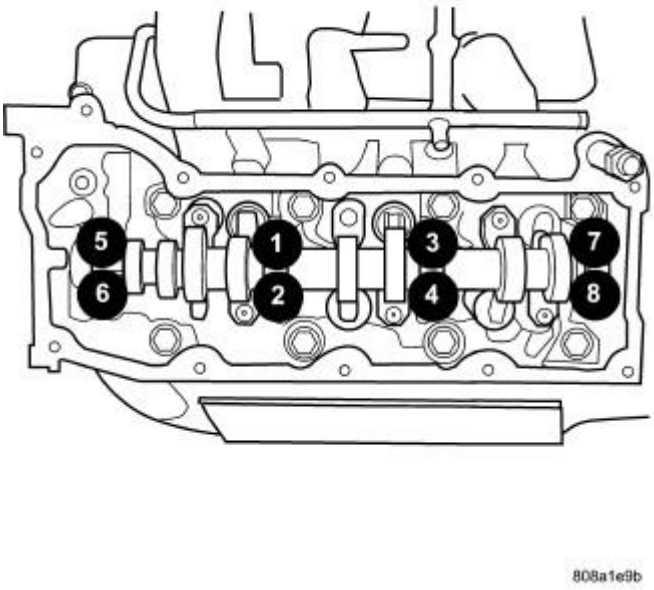


Fig. 87: CAMSHAFT BEARING CAPS TIGHTENING
Courtesy of CHRYSLER LLC

1. Lubricate 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. Position the camshaft into the cylinder head.
3. Install the camshaft bearing caps, hand tighten the retaining bolts.

NOTE: Caps should be installed so that the stamped numbers on the caps are in numerical order, (1 thru 4) from the front to the rear of the engine. All caps should be installed so that the stamped arrows on the caps point toward the front of the engine.

4. Working in 1/2 turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward.
5. Tighten the camshaft bearing cap retaining bolts to 11 N.m (100 in. lbs.).

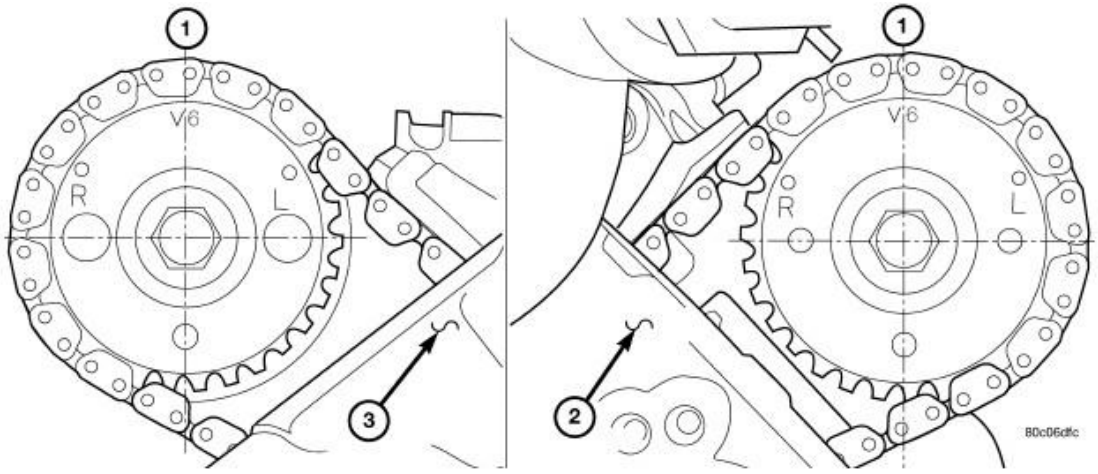


Fig. 88: Camshaft Sprocket V6 Marks
Courtesy of CHRYSLER LLC

6. Position the camshaft drive gear into the timing chain aligning the V6 mark between the two marked chain links (Two links marked during removal).

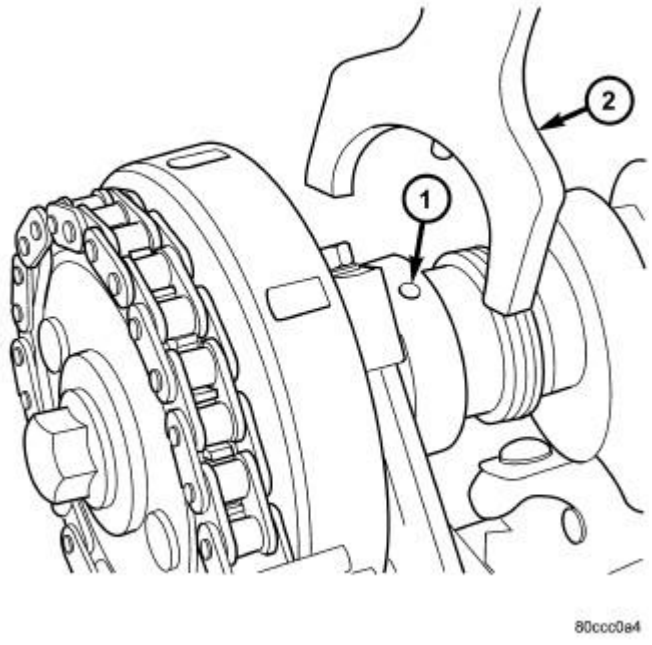


Fig. 89: Special Tool 8428
Courtesy of CHRYSLER LLC

1 - Camshaft hole

2 - Special Tool 8428

7. Using Camshaft Holder 8428 (2), rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft.

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

8. Remove excess oil from camshaft sprocket bolt, then install the camshaft sprocket retaining bolt and hand tighten.

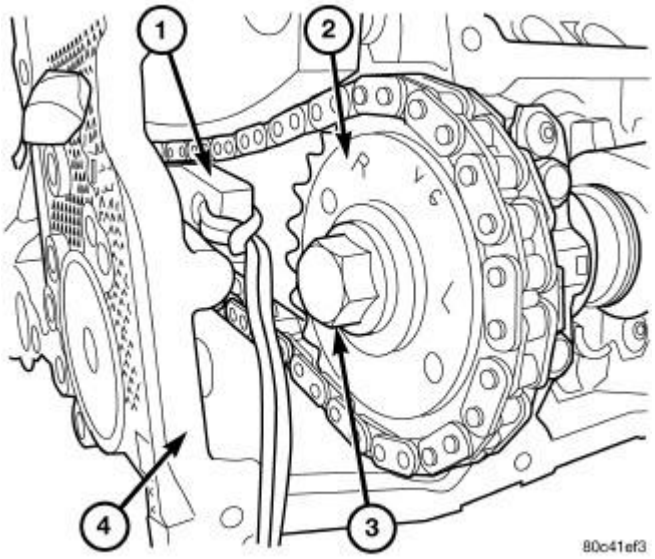


Fig. 90: SECURING TIMING CHAIN TENSIONERS USING TIMING CHAIN WEDGE - Typical
Courtesy of CHRYSLER LLC

1 - SPECIAL TOOL 8379 2 - CAMSHAFT SPROCKET 3 - CAMSHAFT SPROCKET BOLT 4 - CYLINDER HEAD

9. Remove the Wedge Locking Tool 8379 (1).
10. Using Spanner Wrench 6958 with adapter pins 8346, tighten the camshaft sprocket retaining bolt to 122 N.m (90 ft. lbs.).
11. Install the camshaft position sensor.
12. Install the cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.

COVER(S), CYLINDER HEAD

Description

DESCRIPTION

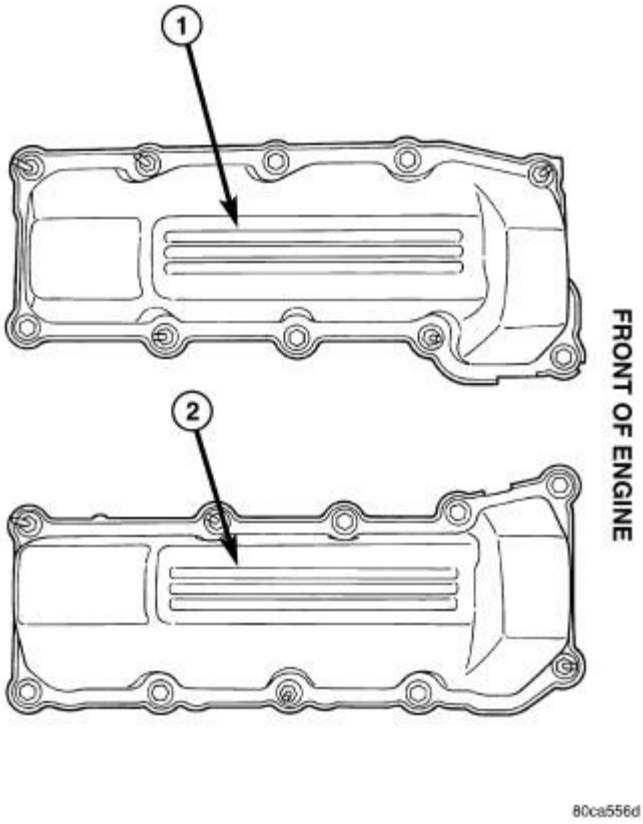


Fig. 91: CYLINDER HEAD COVERS
Courtesy of CHRYSLER LLC

1 - LEFT SIDE CYLINDER HEAD COVER 2 - RIGHT SIDE CYLINDER HEAD COVER

The cylinder head covers (1,2) are made of glass re-enforced thermoset plastic, and are not interchangable from side-to-side.

Removal

REMOVAL

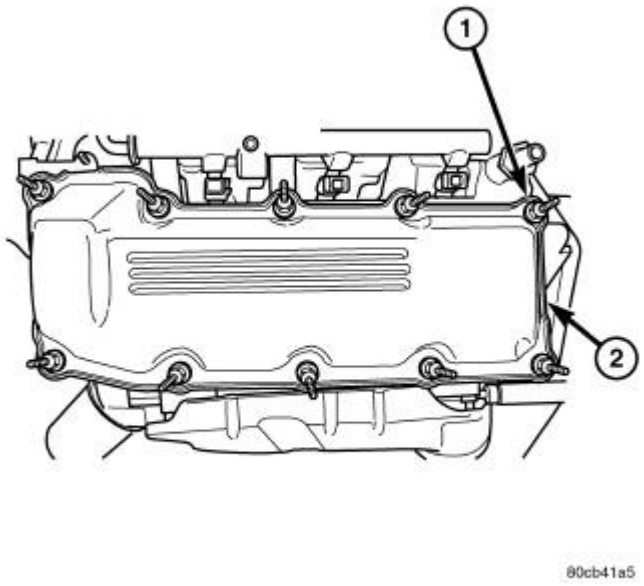


Fig. 92: Identifying Cylinder Head Cover And Cylinder Head Cover Mounting Bolt
Courtesy of CHRYSLER LLC

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

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

Installation

INSTALLATION

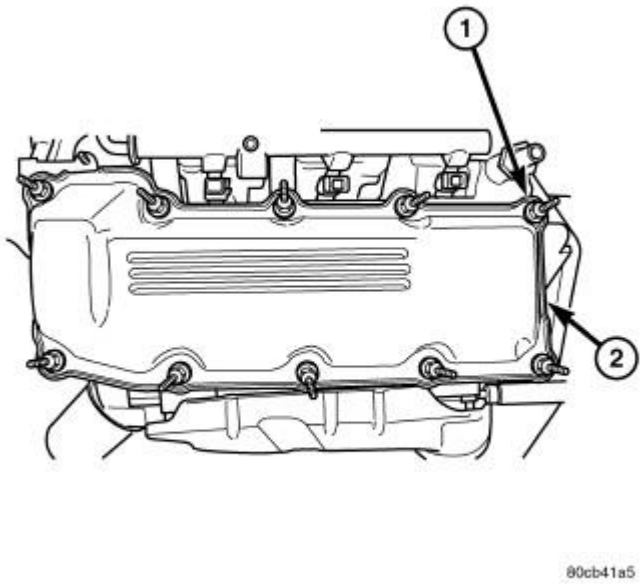


Fig. 93: CYLINDER HEAD COVER - TYPICAL
Courtesy of CHRYSLER LLC

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

NOTE: Left side shown in illustration, right side similar.

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

1. Clean the cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.
2. Install the cylinder cover (2).
3. Tighten the cylinder head cover bolts and double ended studs (1) to 12 N.m (9 ft. lbs.).
4. Install the left side breather and connect breather tube.
5. Connect the fuel injector electrical connectors and injector harness retaining clips.
6. Install the resonator and air inlet hose.
7. Connect negative battery cable.

ROCKER ARM, VALVE

Description

DESCRIPTION

The rocker arms are steel stamping with an integral roller bearing. The rocker arms incorporate a 0.5 mm oil hole in the lash adjuster socket for roller and camshaft lubrication.

Removal

REMOVAL

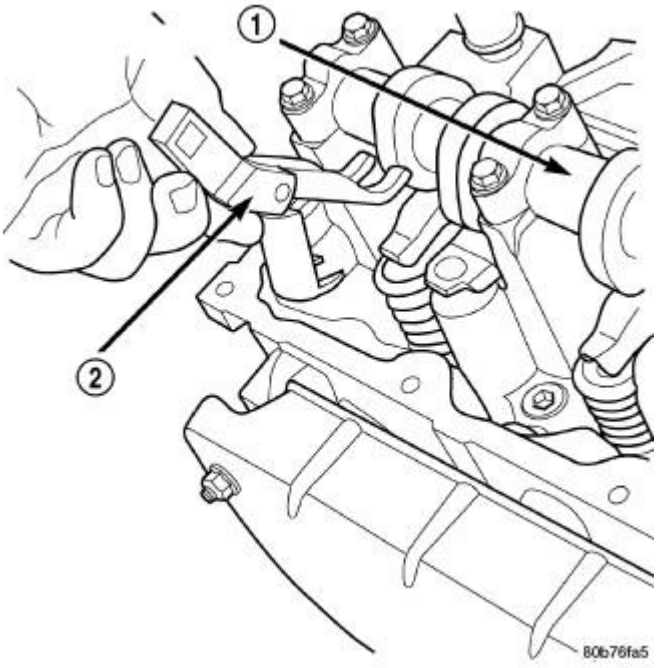


Fig. 94: Removing/Installing Rocker Arm
Courtesy of CHRYSLER LLC

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 cylinder No. 4, Rotate the crankshaft until cylinder No. 1 is at BDC intake stroke.
3. For rocker arm removal on cylinder No. 1, Rotate the crankshaft until cylinder No. 1 is at BDC combustion stroke.
4. For rocker arm removal on cylinders No. 3 and No. 5, Rotate the crankshaft until cylinder No. 1 is at TDC exhaust stroke.
5. For rocker arm removal on cylinders No. 2 and No. 6, Rotate the crankshaft until cylinder No. 1 is at TDC ignition stroke.
6. Using the Remover/Installer 8516A (2), press downward on the valve spring, remove rocker arm.

Installation

INSTALLATION

1. Using the Remover/Installer 8516A (2) press downward on the valve spring and install the rocker arm.

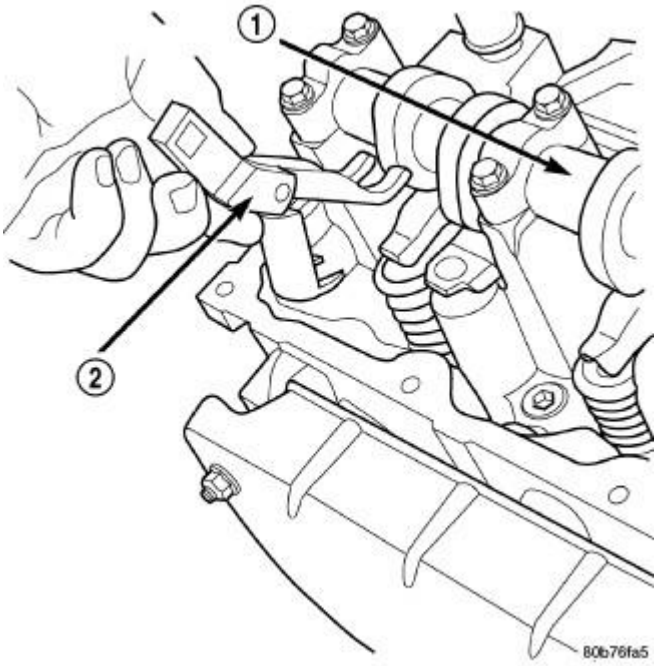


Fig. 95: Removing/Installing Rocker Arms
Courtesy of CHRYSLER LLC

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.

2. For rocker arm installation on cylinders No. 4, Rotate the crankshaft until cylinder No. 1 is at BDC intake stroke.
3. For rocker arm installation on cylinder No. 1, Rotate the crankshaft until cylinder No. 1 is at BDC combustion stroke.
4. For rocker arm installation on cylinders No. 3 and No. 5, Rotate the crankshaft until cylinder No. 1 is at TDC exhaust stroke.
5. For rocker arm installation on cylinders No. 2 and No. 6, Rotate the crankshaft until cylinder No. 1 is at TDC ignition stroke.
6. Install the cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.

SEAL(S), VALVE GUIDE

Description

DESCRIPTION

The valve guide 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 NOT 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

1. Remove the cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
2. Use the Valve Spring Compressor 8426 to 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 six 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 8426, 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.

NOTE: The valve springs are NOT common between intake and exhaust.

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

NOTE: The valve stem seals are common between intake and exhaust.

Installation

INSTALLATION

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

1. Apply shop air to the cylinder to hold the valves in place while the spring is installed.

NOTE: The valve stem seals are common between intake and exhaust.

2. Install the valve stem seal.

NOTE: The valve springs are NOT common between intake and exhaust.

3. Install the spring retainer, and the spring.
4. Using the Valve Spring Compressor 8426, compress the valve spring.
5. Install the two spring retainer lock halves.

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

6. Remove the valve spring compressor.
7. Disconnect the shop air to the cylinder.
8. Install the spark plug for the cylinder the valve spring and seal was installed on.
9. Using the Valve Spring Compressor 8426, install the rocker arms and the hydraulic lash adjusters.
10. Install the cylinder head cover. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Installation**.

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

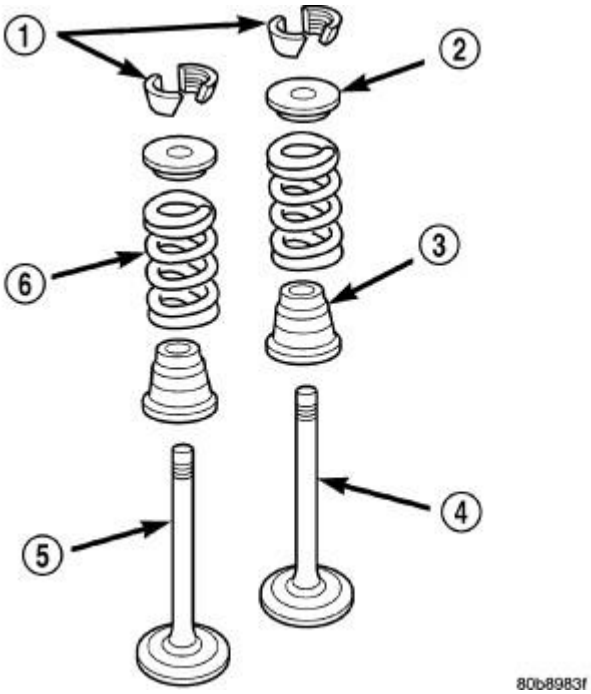


Fig. 96: Identifying Valve Components
Courtesy of CHRYSLER LLC

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 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 (4) or (5) 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 installed height after refacing the valve (4) and (5) 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.

Removal

REMOVAL

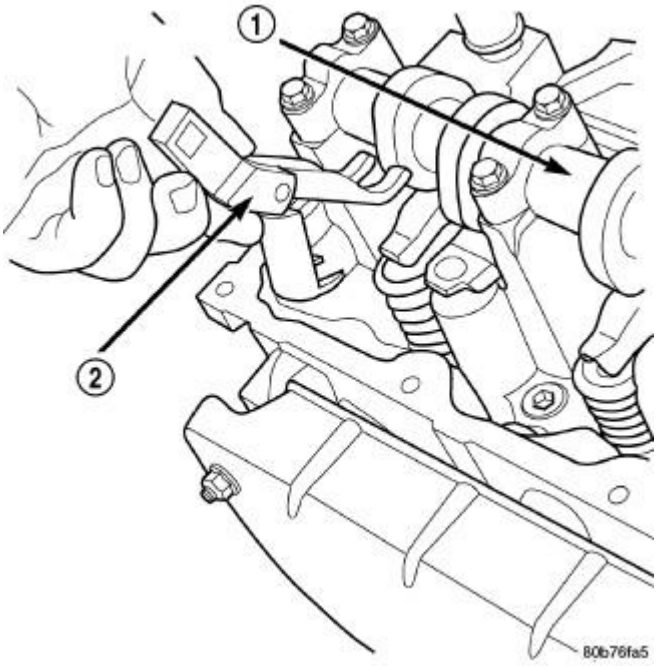


Fig. 97: Removing/Installing Rocker Arms
Courtesy of CHRYSLER LLC

NOTE: The cylinder head(s) must be removed in order to perform this procedure.

1. Remove and isolate the negative battery cable.
2. Remove the cylinder head covers. See **Engine/Cylinder Head/COVER(S), Cylinder Head - Removal**.
3. Remove the rocker arms and lash adjusters. See **Engine/Cylinder Head/ROCKER ARM, Valve - Removal**.
4. Remove the camshaft bearing caps and the camshaft. See **Engine/Cylinder Head/CAMSHAFT, Engine - Removal**.
5. Remove the cylinder head(s). See **Engine/Cylinder Head - Removal**.

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

6. Using Tool C-3422-D or C-3422-C Valve Spring Compressor and Tool 8519 Adapter (2), 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.

7. Remove the two spring retainer lock halves.

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

8. Remove the valve spring compressor (2).
9. Remove the spring retainer, and the spring.

NOTE: Check for sharp edges on the keeper grooves. Remove any burrs from the valve stem before removing the valve from the cylinder head.

10. Remove the valve from the cylinder head.

NOTE: The valve stem seals are common between intake and exhaust.

11. Remove the valve stem seal. Mark the valve for proper installation.

TESTING VALVE SPRINGS

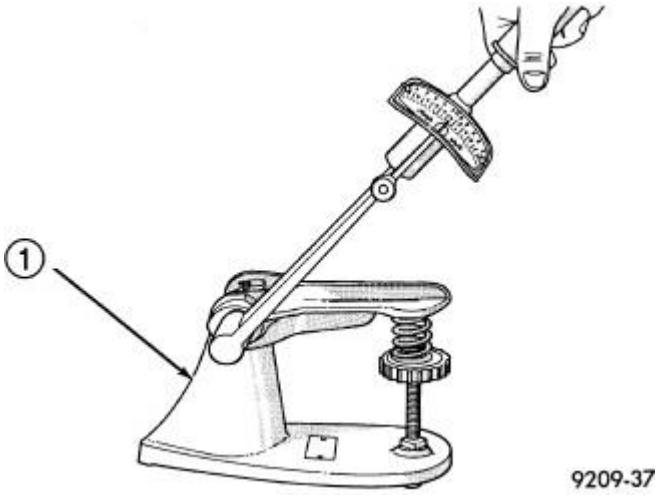


Fig. 98: Testing Valve Spring with Tool C-647
Courtesy of CHRYSLER LLC

NOTE: Whenever the valves springs are removed from the cylinder head it is recommended that the valve springs be inspected and tested for reuse.

Inspect the valve springs for physical signs of wear or damage. Using a suitable valve spring tester (1), test the following;

- Specified Valve Spring Height
- Specified Spring Force (Valve Open)
- Specified Spring Force (Valve Closed)

Replace any springs that do not meet specifications. See **Engine - Specifications**.

Installation

INSTALLATION

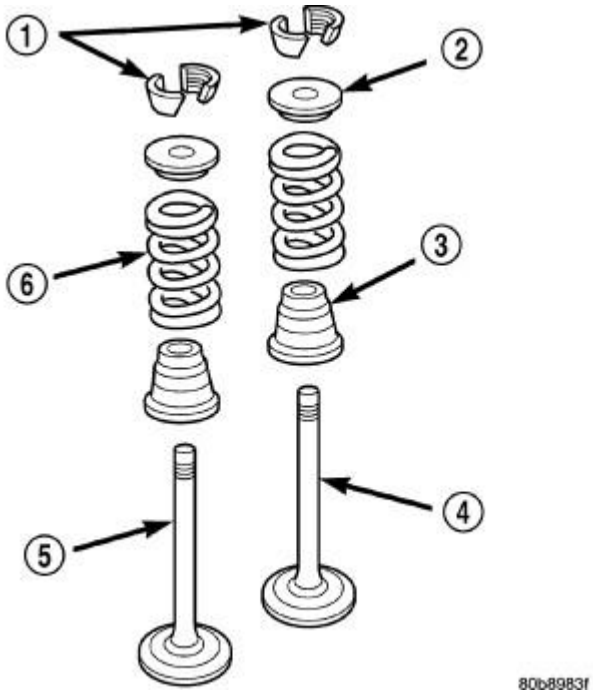


Fig. 99: Identifying Valve Components
Courtesy of CHRYSLER LLC

1. Coat the valve stem with clean engine oil and insert it into the cylinder head.
2. Install the valve stem seal (3). Make sure the seal is fully seated and that the garter spring at the top of the seal is intact.
3. Install the spring and the spring retainer (2).
4. Using the valve spring compressor, compress the spring (6) and install the two valve spring retainer halves (1).
5. Release the valve spring compressor and make sure the two spring retainer halves (1) and the spring retainer (2) are fully seated.
6. Lubricate the camshaft journal with clean engine oil then position the camshaft, with the sprocket dowel on the left camshaft at 11 o'clock and the right camshaft at 12 o'clock, then position the camshaft bearing caps.

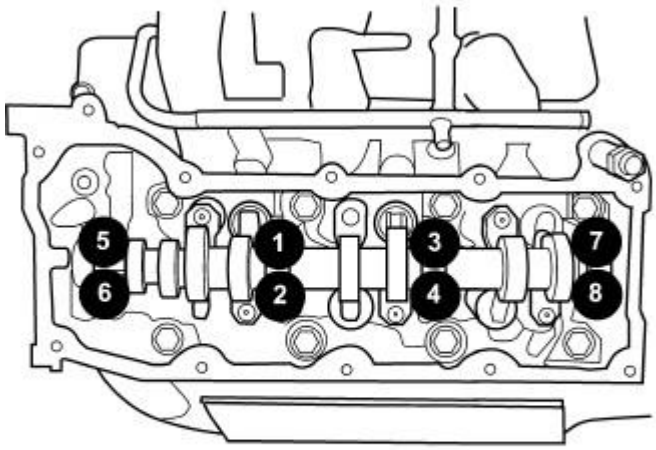


Fig. 100: Identifying Camshaft Bearing Caps Bolt Tightening Sequence
Courtesy of CHRYSLER LLC

7. Install the camshaft bearing cap retaining bolts. Tighten the bolts 11 N.m (100 in. lbs.) in 1/2 turn increments in the sequence shown in **Fig. 100**.
8. Position the hydraulic lash adjusters and rocker arms. See **Engine/Cylinder Head/ROCKER ARM, Valve - Installation**.

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 bed plate 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

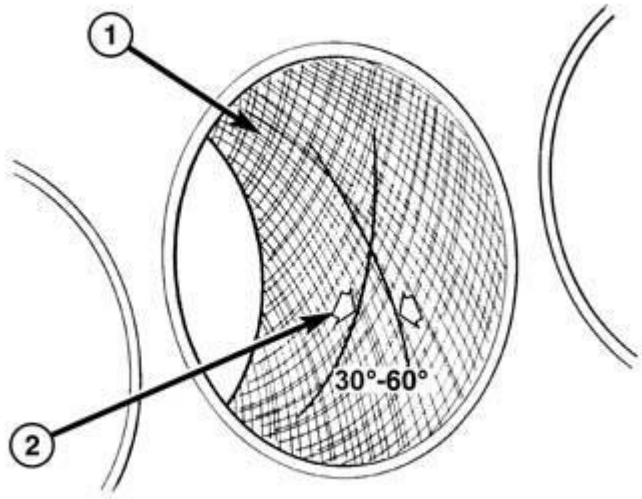


Fig. 101: Identifying Cylinder Bore Crosshatch Pattern
Courtesy of CHRYSLER LLC

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. The hone marks should INTERSECT at 50° to 60° for proper seating of rings .
4. A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle (1). The number of up and down strokes per minute can be regulated to get the desired 50° to 60° angle (2). 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 1/4 inch NPT plugs to 20 N.m (177 in. lbs.) torque. Tighten the 3/8 inch NPT plugs to 27 N.m (240 in. lbs.) torque.

INSPECTION

INSPECTION

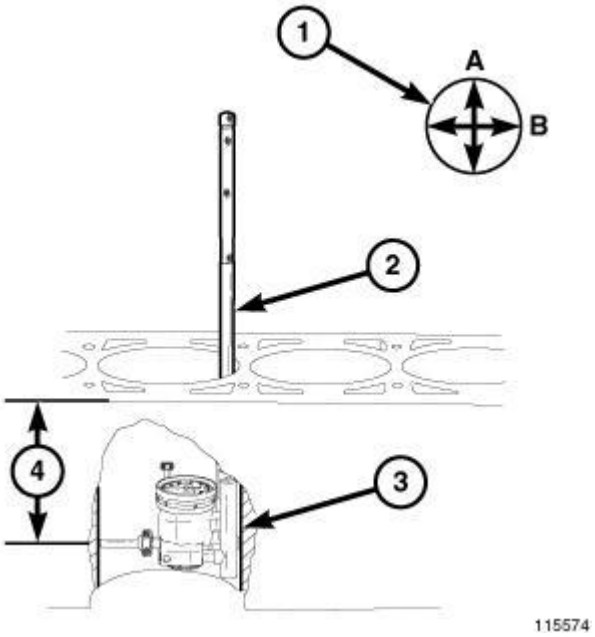


Fig. 102: Measuring Cylinder Bore Diameter
Courtesy of CHRYSLER LLC

1. It is mandatory to use a dial bore gauge (2) to measure each cylinder bore diameter. To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (0.0001 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 three levels below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft and then take two additional reading.
3. Measure the cylinder bore diameter crosswise to the cylinder block near the top of the bore. Repeat the measurement near the middle of the bore, then repeat the measurement near the bottom of the bore.
4. Determine taper by subtracting the smaller diameter from the larger diameter.
5. Rotate measuring device 90° and repeat steps above.
6. Determine out-of-roundness by comparing the difference between each measurement.
7. If cylinder bore taper does not exceed 0.025 mm (0.001 inch) and out-of-roundness does not exceed 0.025 mm (0.001 inch), the cylinder bore can be honed. If the cylinder bore taper or out- of-round condition exceeds these maximum limits, the cylinder block must be replaced. A slight amount of taper always exists in the cylinder bore after the engine has been in use for a period of time.

BEARING(S), CRANKSHAFT, MAIN

Standard Procedure

MAIN BEARING FITTING

SELECT FIT IDENTIFICATION

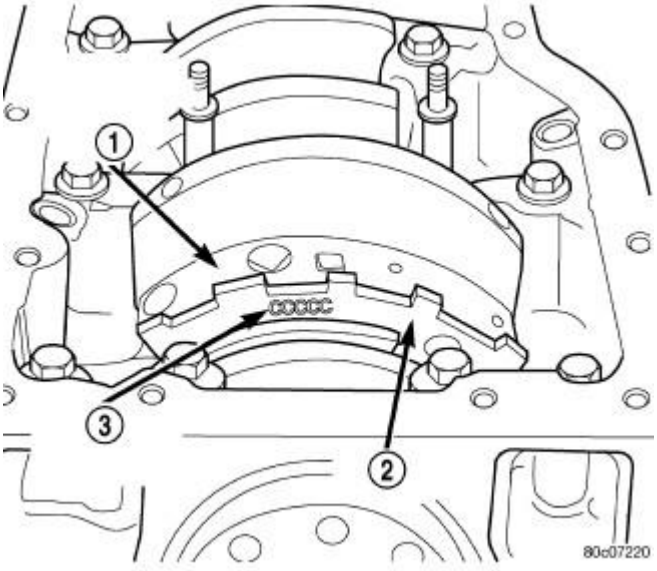


Fig. 103: Identifying Crankshaft Bearings
Courtesy of CHRYSLER LLC

The main bearings are "select fit" to achieve proper oil clearances. For main bearing selection, the crankshaft position sensor target wheel (2) has grade identification marks (3) stamped into it. These marks are read from left to right, corresponding with journal number 1, 2, 3, 4. The crankshaft position sensor target wheel (2) is mounted to the number 6 counter weight (1) on the crankshaft.

INSPECTION

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.

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

Inspect the upper insert locking tabs for damage.

Replace all damaged or worn bearing inserts.

MAIN BEARING JOURNAL DIAMETER (CRANKSHAFT REMOVED)

Remove the crankshaft from the cylinder block. See **Engine/Engine Block/CRANKSHAFT - Removal**.

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.

Install the crankshaft into the cylinder block. See **Engine/Engine Block/CRANKSHAFT - Installation**.

Check crankshaft end play.

CRANKSHAFT MAIN BEARING SELECTION

1. Service main bearings are available in four grades. The chart below identifies the four service grades available.

Crankshaft Marking	JOURNAL SIZE mm (in.)	
"R" Size	63.488 - 63.496 mm (2.4995 - 2.4998 in.)	
"S" Size	63.496 - 63.500 mm (2.4998 - 2.4999 in.)	
"T" Size	63.500 - 63.504 mm (2.4999 - 2.501 in.)	
"U" Size	63.504 - 63.512 mm (2.5001 - 2.5004 in.)	
Bearing size		
Bearing Code	Size	Application
Upper Bearing		
A	2.443 - 2.447 mm (0.0961 - 0.0963 in.)	Use with crankshaft size "R"
B	2.439 - 2.443 mm (0.960 - .0961 in.)	Use with crankshaft "S, T"
C	2.435 - 2.439 mm (0.0958 - 0.0960 in.)	Use with crankshaft "U"
Lower Bearing Main "1" and "4"		

"1"	2.441 - 2.447 mm (0.0961 - 0.0963 in.)	Use with crankshaft "R, S"
"2"	2.435 - 2.441 mm (0.0958 - 0.0962 in.)	Use with crankshaft "T, U"
Lower Main Bearing "2" and "3"		
"3"	2.429 - 2.435 mm (.0956 - .0958 in.)	Use with crankshaft "R, S"
"4"	2.423 - 2.429 mm (0.0953 - 0.0956 in.)	Use with crankshaft "T, U"
Bearing Clearances		
Main "1, 4"		
Crankshaft "R"	004 -.034 mm (.00015 -.0013 in.)	
Crankshaft "S"	004 -.030 mm (.00015 -.0011 in.)	
Crankshaft "T"	006 -.032 mm (.0002 -.0012 in.)	
Crankshaft "U"	002 -.032 mm (.00007 -. 0012 in.)	
Main "2, 3"		
Crankshaft "R"	016 -.046 mm (.0006 -.0018 in.)	
Crankshaft "S"	016 -.042 mm (.00062 -.016 in.)	
Crankshaft "T"	018 -.044 mm (.0007 -.0017 in.)	
Crankshaft "U"	014 -.044 mm (.0005 -.0017 in.)	

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 bed plate.

Operation

OPERATION

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

Removal

REMOVAL

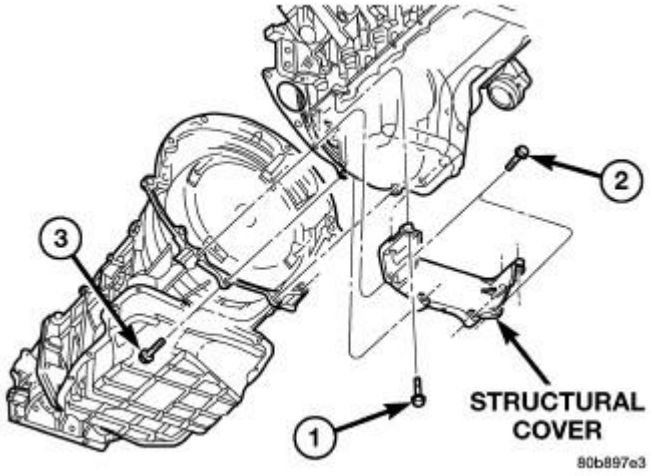


Fig. 104: Identifying Structural Cover
Courtesy of CHRYSLER LLC

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, and 3) retaining structural cover in the sequence shown in **Fig. 104**.
5. Pivot the exhaust pipe downward and remove the structural cover.

Installation

INSTALLATION

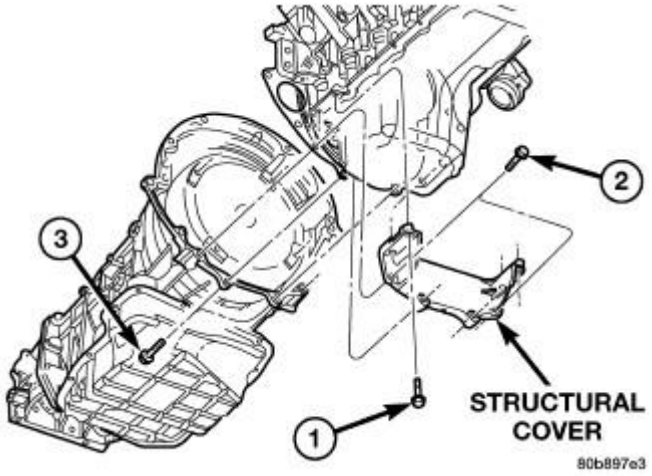


Fig. 105: Identifying Structural Cover
Courtesy of CHRYSLER LLC

1 - STRUCTURAL COVER TO ENGINE BOLTS
2 - STRUCTURAL COVER TO TRANSMISSION BOLTS

2 - TRANSMISSION TO STRUCTURAL COVER BOLTS

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 bolts (1, 2, and 3) 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 **Fig. 105**.
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

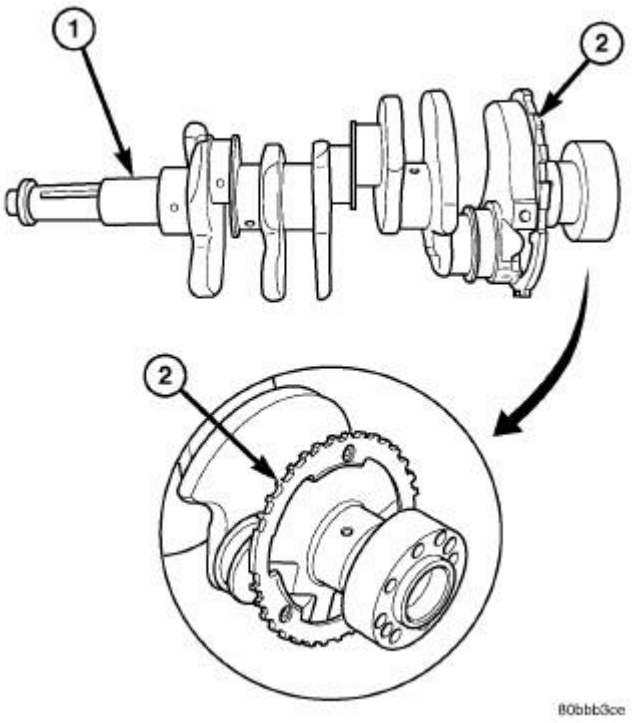


Fig. 106: Identifying Crankshaft & Target Ring
Courtesy of CHRYSLER LLC

The crankshaft (1) is constructed of nodular cast iron. The crankshaft is a three throw split pin design with six counterweights for balancing purposes. The crankshaft is supported by four select fit main bearings with the No. 2 serving as the thrust washer location. The main journals of the crankshaft are cross drilled to improve rod bearing lubrication. The No. 6 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 (2). 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 bed plate assembly.

Removal

REMOVAL

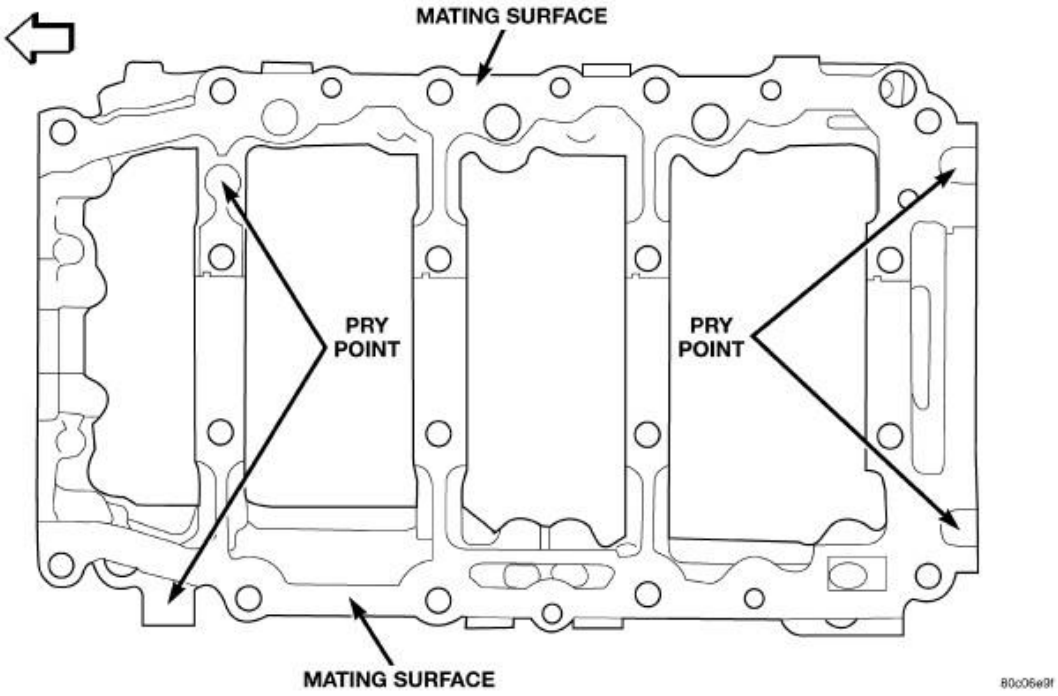


Fig. 107: Identifying Pry Points On Bed Plate
Courtesy of CHRYSLER LLC

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**.

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 the bed plate mounting bolts. Note the location of the two stud bolts for installation.
4. Remove the connecting rods from the crankshaft.

CAUTION: The bed plate to cylinder block mating surface is a critical sealing surface. Do not pry on or damage this surface in anyway.

NOTE: The bed plate contains the lower main bearing halves. Use care when handling bed plate 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 bed plate has pry points cast into it. Use these points only.

5. Carefully pry on the pry points to loosen the bed plate then remove the bed plate.

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

6. 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 bed plate 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 bed plate.
2. Thoroughly clean the bed plate to cylinder block sealing surfaces and main bearing bores. Remove all oil and sealant residue.
3. Inspect the bed plate 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 washers.
5. Inspect the oil pan gasket/windage tray for splits, tears or cracks in the gasket sealing surfaces. Replace gasket as necessary.

Installation

INSTALLATION

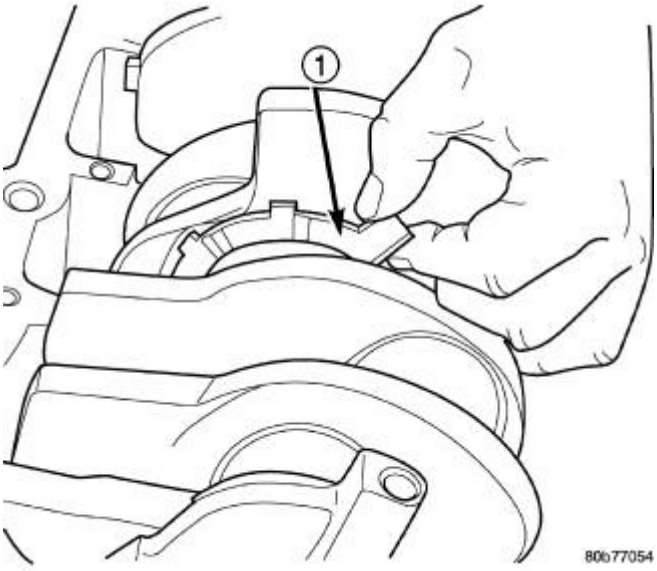


Fig. 108: Identifying Crankshaft Thrust Washer
Courtesy of CHRYSLER LLC

CAUTION: Main bearings are select fit. Refer to CRANKSHAFT MAIN BEARING SELECTION for proper bearing selections.

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

NOTE: Apply sealant to the tone wheel retaining screws prior to installation.

1. Lubricate upper main bearing halves with clean engine oil.
2. Position crankshaft in cylinder block.
3. Install the thrust washers (1).

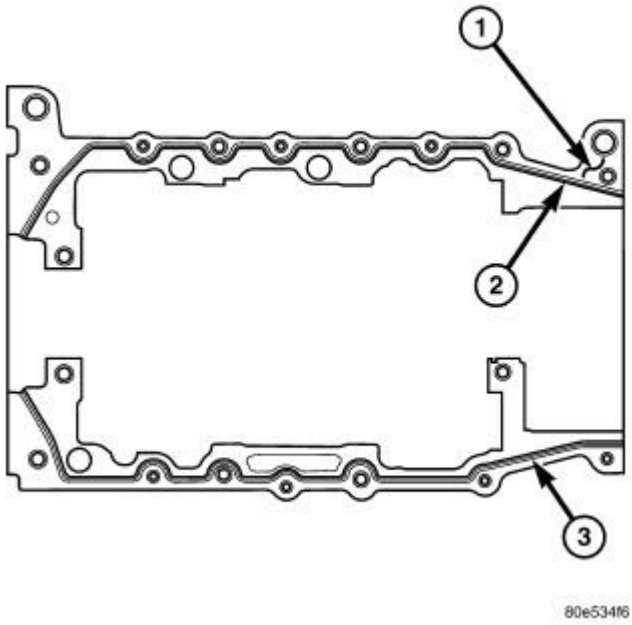


Fig. 109: BEDPLATE SEALANT
Courtesy of CHRYSLER LLC

1 - CYLINDER BLOCK
2 - SEALANT
3 - SEALANT

CAUTION: The bed plate to cylinder block mating surface must be coated with Mopar® Engine RTV sealant prior to installation. Failure to do so will cause severe oil leaks.

NOTE: Make sure that the bed plate 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 2.5mm (0.100 inch) bead of Mopar® Engine RTV sealant to the cylinder block-to-bedplate mating surface (1) and (2).
5. Coat the crankshaft main bearing journals with clean engine oil and position the bed plate onto the cylinder block.

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

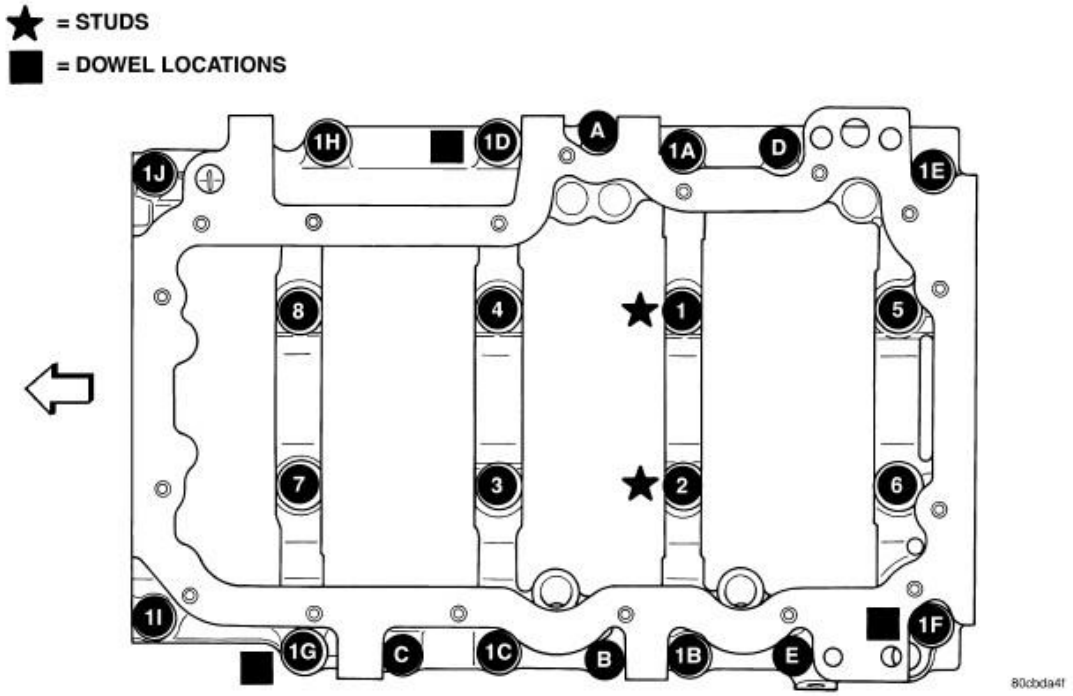


Fig. 110: Identifying Bed Plate Tightening Sequence With Stud & Dowel Location
Courtesy of CHRYSLER LLC

6. Install the bed plate retaining bolts, making sure to place the stud bolts in the correct location, Torque the bolts in the sequence shown in **Fig. 110**.
   - Hand tighten bolts **1D,1G and 1F** until the bed plate contacts the block.
   - Tighten bolts **1A - 1J** to 54 N.m (40 ft. lbs.)
   - Tighten bolts **1 - 8** to 7 N.m (62 in. lbs.)
   - Turn bolts **1 - 8** an additional 90°.
   - Tighten bolts **A - E** 27 N.m (20 ft. lbs.).
7. Measure crankshaft end play.
8. Install the connecting rods and measure side clearance. See **Engine/Engine Block/ROD, Piston and Connecting - Standard Procedure**.
9. Install the oil pump. See **Engine/Lubrication/PUMP, Engine Oil - Installation**.
10. Install the engine. See **Engine - Installation**.

DAMPER, VIBRATION

Removal

REMOVAL

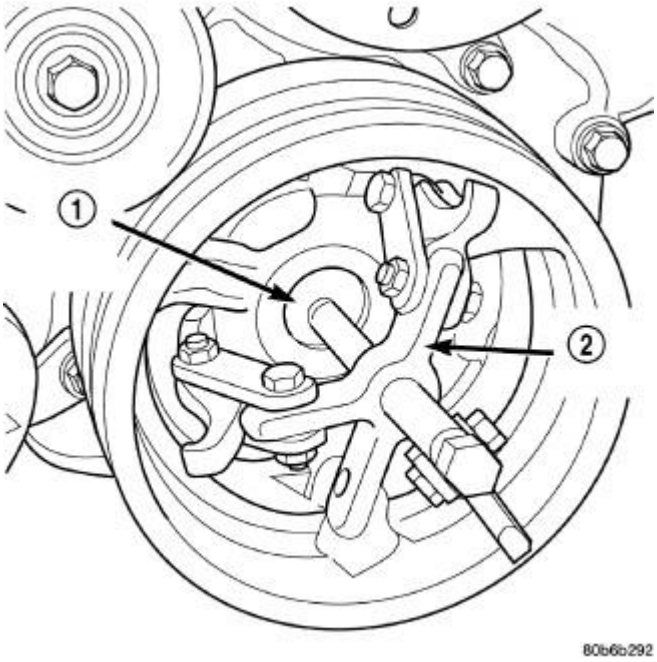


Fig. 111: Removing/Installing Damper
Courtesy of CHRYSLER LLC

1. Disconnect the negative cable from battery.
2. Remove the radiator fan. Refer to **Cooling/Engine/FAN, Cooling - Removal** .
3. Remove accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal** .
4. Remove the vibration damper bolt.
5. Remove damper using the Crankshaft Insert 8513A (1) and Three Jaw Puller 1026 (2).

Installation

INSTALLATION

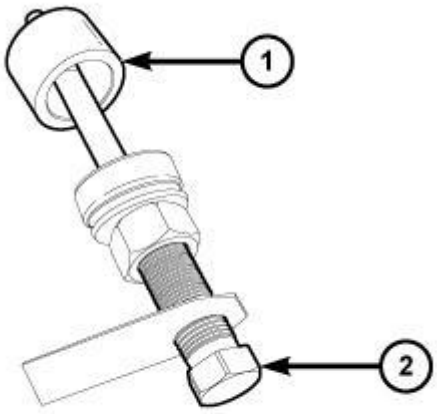


Fig. 112: Identifying Damper Installer & A/C Hub Installer Cup
Courtesy of CHRYSLER LLC

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

1. Position the damper onto crankshaft.
2. Assemble the damper installer 8512A (2) , and the pressing cup (1) from A/C hub installer 6871.
3. Coat the threads of damper installer 8512A with Mopar® Nickel Anti-Seize or equivalent.

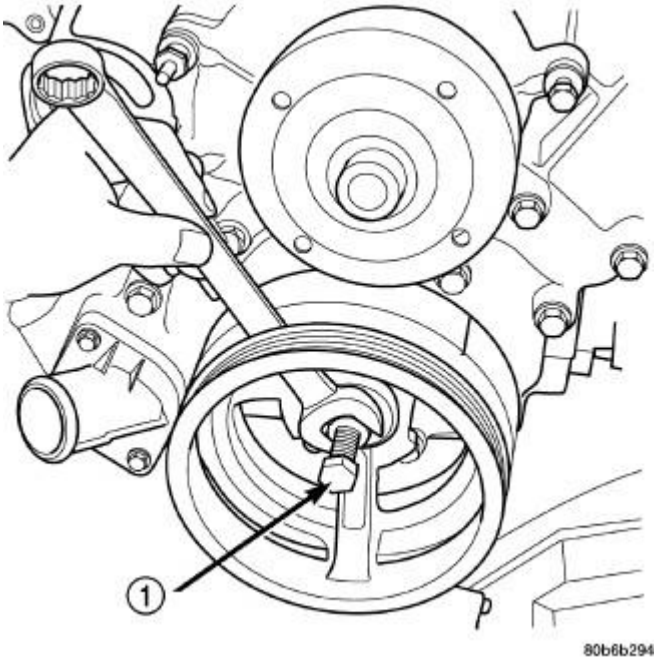


Fig. 113: Pressing Damper Onto Crankshaft Using Special Tool 8512-A

Courtesy of CHRYSLER LLC

4. Using the damper installer 8512A (1), and the pressing cup from the A/C hub installer 6871, press the damper onto crankshaft.
5. Install and tighten the vibration damper bolt to 175 N.m (130 ft. lbs.).
6. Install the cooling fan. Refer to **Cooling/Engine/FAN, Cooling - Installation** .
7. Install the accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Installation** .
8. Connect the negative cable to battery.

FLEXPLATE

Removal

REMOVAL

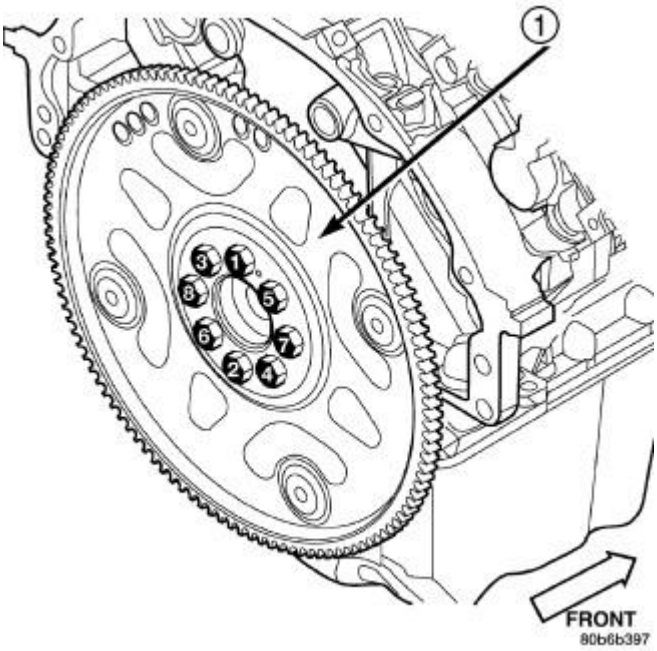


Fig. 114: Flexplate Tightening Sequence
Courtesy of CHRYSLER LLC

1 - FLEXPLATE

1. Remove the transmission. Refer to **Transmission and Transfer Case/Automatic - NAG1 - Removal** or **Transmission and Transfer Case/Automatic - 45RFE/545RFE - Removal** .
2. Remove the bolts using the sequence provided.
3. Remove the flexplate.

Installation

INSTALLATION

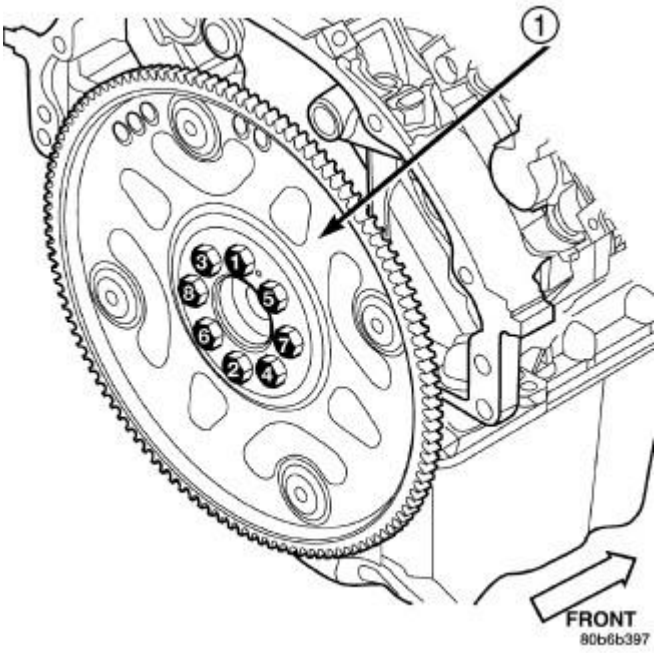


Fig. 115: Flexplate Tightening Sequence
Courtesy of CHRYSLER LLC

1 - FLEXPLATE

1. Position the flexplate onto the crankshaft and install the bolts hand tight.
2. Tighten the flexplate retaining bolts to 95 N.m (70 ft. lbs.) in the sequence shown in **Fig. 115** .
3. Install the transmission. Refer to **Transmission and Transfer Case/Automatic - NAG1 - Installation** or **Transmission and Transfer Case/Automatic - 45RFE/545RFE - Installation** .

MODULE, BALANCE SHAFT

Removal

REMOVAL

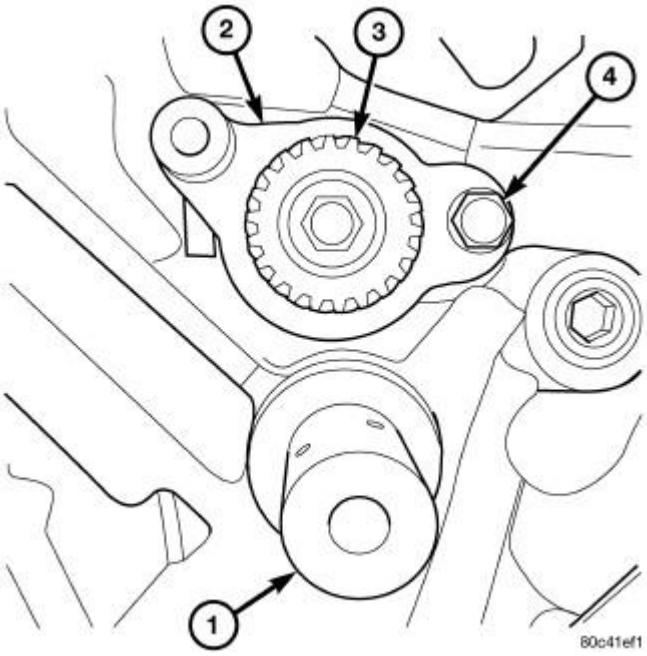


Fig. 116: BALANCE SHAFT RETAINING BOLT
Courtesy of CHRYSLER LLC

1 - IDLER SHAFT
2 - BALANCE SHAFT THRUST PLATE
3 - BALANCE SHAFT DRIVE GEAR
4 - RETAINING BOLT

1. Remove the primary and secondary timing chains. See **Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Removal**.

NOTE: The balance shaft and gear are serviced as an assembly. Do not attempt to remove the gear from the balance shaft.

Remove the retaining bolt (4) from the balance shaft thrust plate (2).

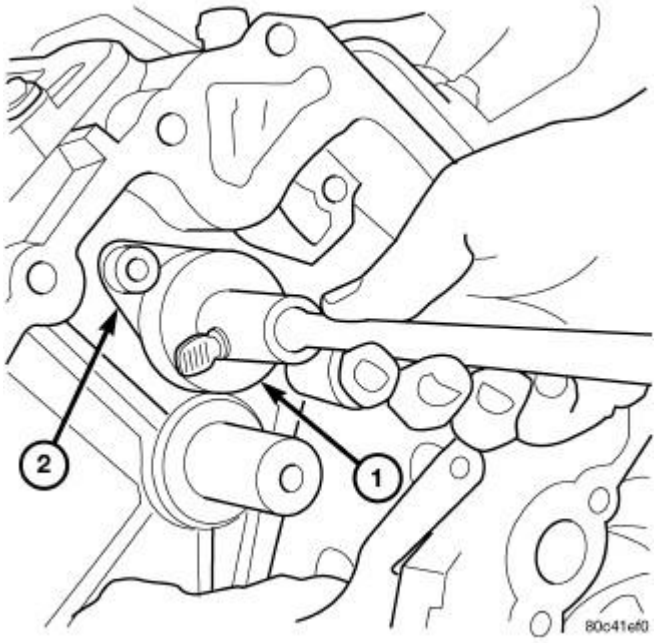


Fig. 117: BALANCE SHAFT REMOVAL/INSTALLATION TOOL
Courtesy of CHRYSLER LLC

1 - BALANCE SHAFT REMOVAL AND INSTALLATION TOOL
2 - BALANCE SHAFT THRUST PLATE

2. Using Balance Shaft Remover/Installer 8641 (1), remove the balance shaft from the engine.

Installation

INSTALLATION

NOTE: The balance shaft and gear are serviced as an assembly. Do not attempt to remove the gear from the balance shaft.

1. Coat balance shaft bearing journals with clean engine oil.

NOTE: The balance shaft is heavy, and care should be used when installing shaft, so bearings are not damaged.

2. Using Balance Shaft Remover/Installer 864, carefully install balance shaft into engine.
3. Install balance shaft thrust plate retaining bolt finger tight. **Do not** tighten bolt at this time.
4. Position the right side of the thrust plate with the right chain guide bolt, install bolt finger tight.

5. Torque the thrust plate retaining bolt to 28 N.m (250 in. lbs.).
6. Remove the chain guide bolt so that guide can be installed.

RING(S), PISTON

Standard Procedure

PISTON RING FITTING

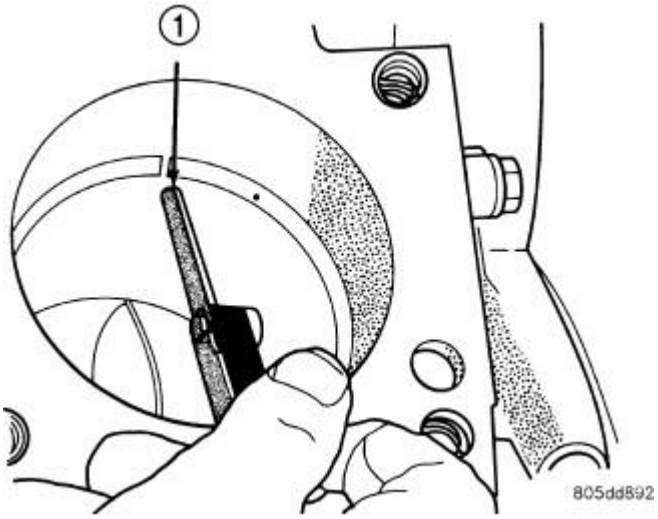


Fig. 118: Measuring Piston Ring End Gap
Courtesy of CHRYSLER LLC

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 in.) 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.

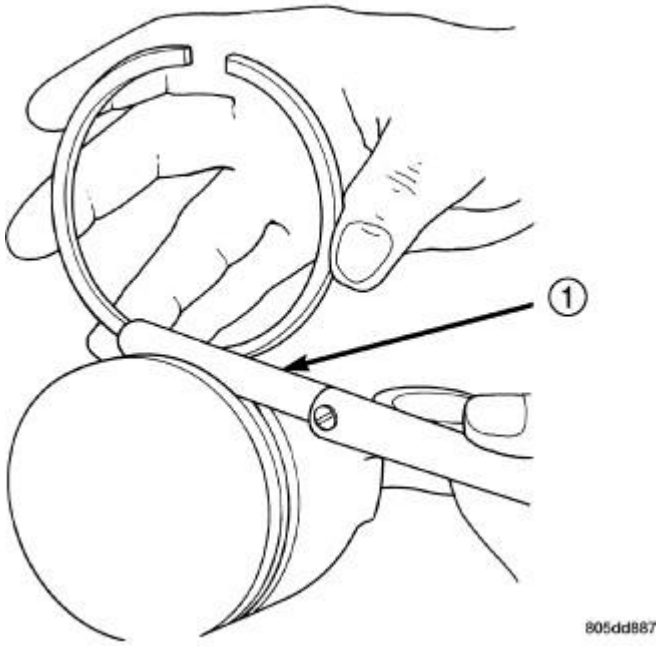


Fig. 119: Checking Piston Ring Grooves Clearances
Courtesy of CHRYSLER LLC

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

PISTON RING SIDE CLEARANCE

PISTON RING SPECIFICATION CHARTS

Ring Position	Groove Clearance	Maximum Clearance
Upper Ring	0.051-0.094 mm (0.0020-.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 (.0007-.0090 in.)	0.25 mm (0.010 in.)

Ring Position	Ring Gap	Wear Limit
Upper Ring	0.20-0.36 mm (0.0079-0.0142 in.)	0.43 mm (0.0017 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.)

5. Measure the ring side clearance as shown in **Fig. 119** make sure the feeler gauge (1) fits snugly between

the ring land and the ring. Replace any ring not within specification.

Fig. 120: Checking Ring Around Piston
Courtesy of CHRYSLER LLC

6. Rotate the ring around the piston, the ring must rotate in the groove with out binding.
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 (1).**
- **Lower oil ring side rail.**
- **No. 2 Intermediate piston ring.**
- **No. 1 Upper piston ring.**

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

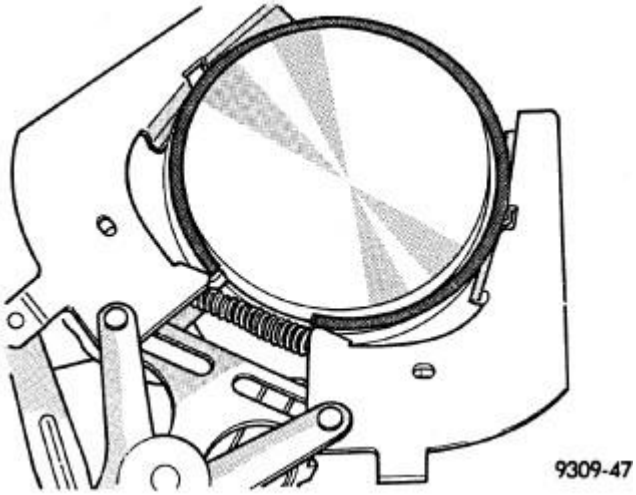


Fig. 121: Installing Piston Ring Using Ring Expander
Courtesy of CHRYSLER LLC

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

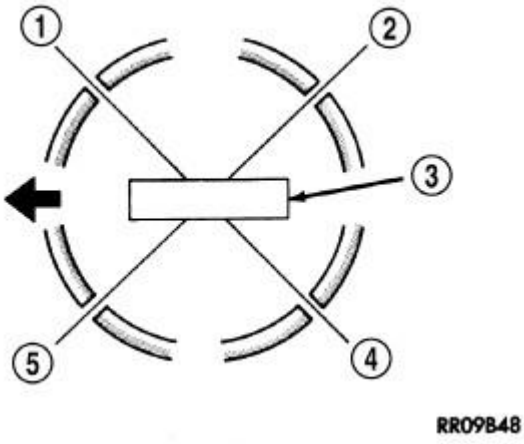


Fig. 122: Positioning Piston Ring End Gaps
Courtesy of CHRYSLER LLC

12. Position piston ring end gaps as shown in **Fig. 122**. It is important that expander ring gap 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

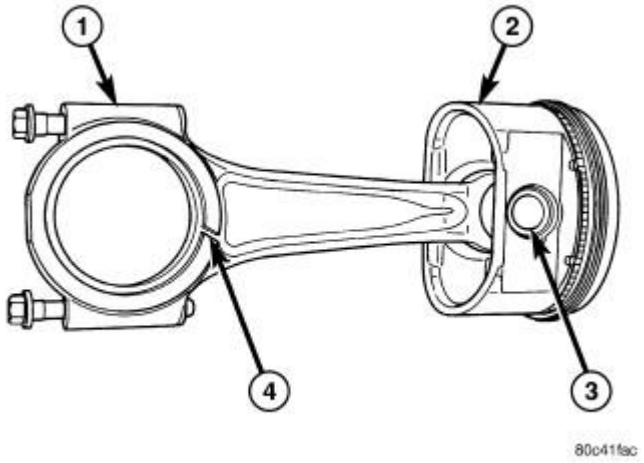


Fig. 123: Identifying Piston, Pin & Connecting Rod
Courtesy of CHRYSLER LLC

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

The pistons (2) are made of a high strength aluminum alloy. The connecting rods are made of forged powdered metal, with a "fractured cap" design (1). A full floating piston pin (3) is used to attach the piston to the connecting rod.

Standard Procedure

CONNECTING ROD BEARING FITTING

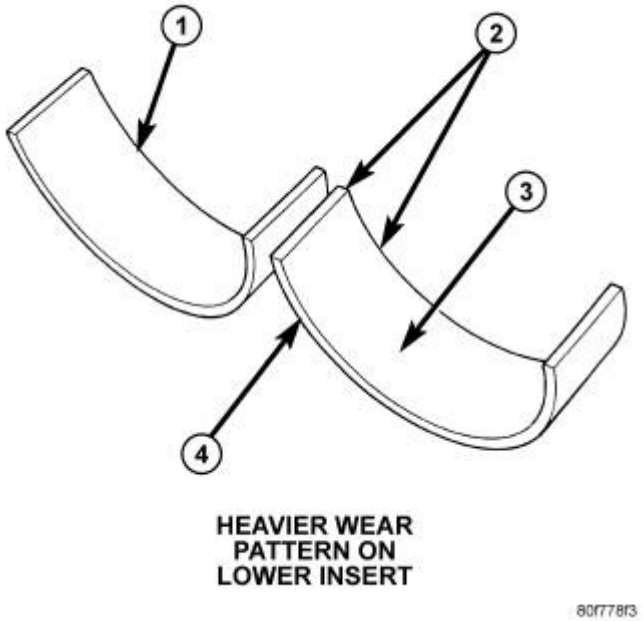


Fig. 124: Connecting Rod Bearing Inspection
Courtesy of CHRYSLER LLC

Inspect the connecting rod bearings for scoring (1) and (3). 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.

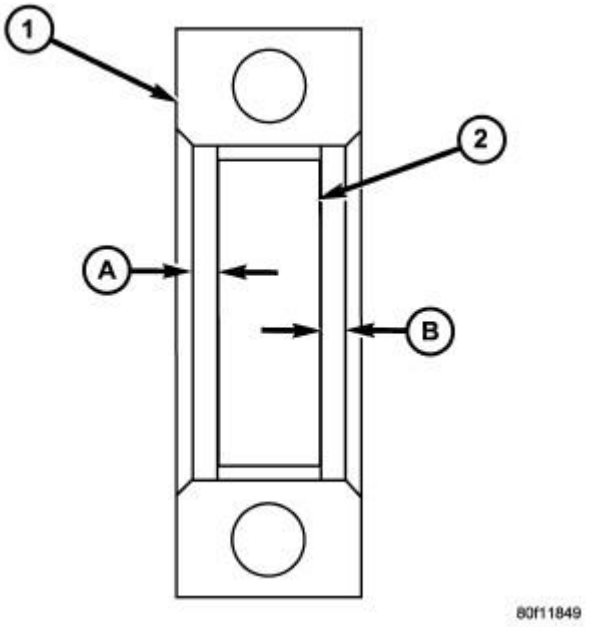


Fig. 125: Identifying Center Bearing Insert In Connecting Rod
Courtesy of CHRYSLER LLC

1. Wipe the oil from the connecting rod journal.
2. Lubricate the upper bearing insert (2) and position in connecting rod (1). Center bearing insert in connecting rod
3. Measure at point A and point B. Measurement should be less then 0.50 mm (0.0196 in.).

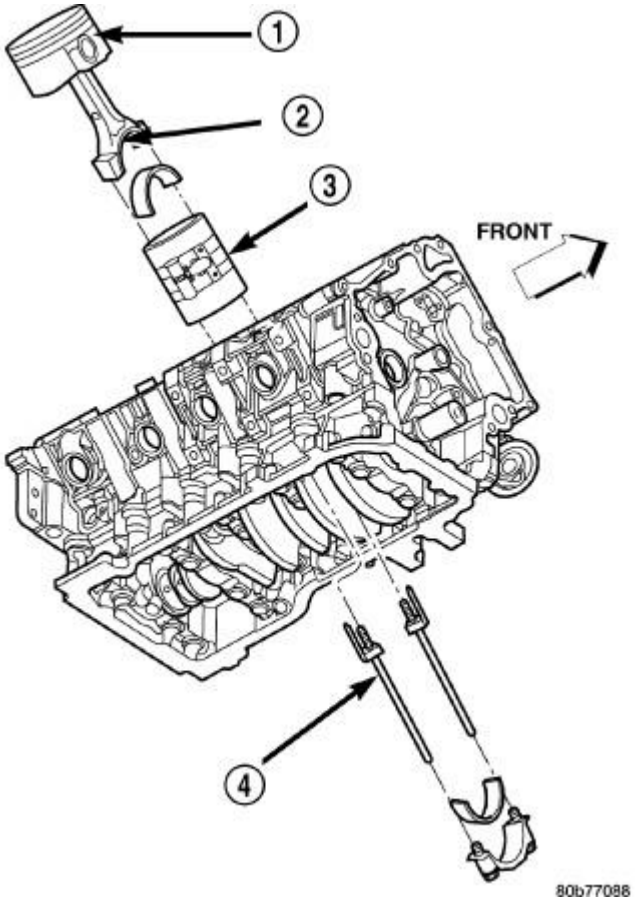


Fig. 126: Identifying Piston Ring Components
Courtesy of CHRYSLER LLC

4. 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 (1) near the piston wrist pin bore should point to the front of the engine.

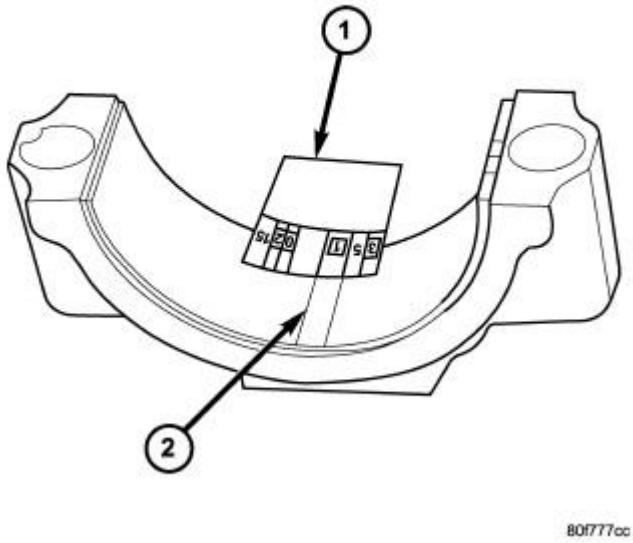


Fig. 127: Measuring Bearing Clearance with Plastigage
Courtesy of CHRYSLER LLC

5. Install the lower bearing insert in the bearing cap. Center bearing insert in connecting rod. The lower insert must be dry. Place strip of Plastigage (1) across full width of the lower insert at the center of bearing cap. Plastigage must not crumble in use. If brittle, obtain fresh stock.
6. 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.
7. Remove the bearing cap and determine amount of bearing-to-journal clearance by measuring the width of compressed Plastigage (2). Refer to **3.7L 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.**
8. If the correct clearance is indicated, replacement of the bearing inserts is not necessary. Remove the Plastigage from crankshaft journal and bearing insert. Proceed with installation.
9. If bearing-to-journal clearance exceeds the specification, determine which services bearing set to use the bearing sizes are as follows:

Bearing Mark	SIZE	USED WITH JOURNAL SIZE
0.025 US	0.025 mm (0.001 in.)	57.883-57.867 mm (2.2788-2.2783 in.)
Std.	STANDARD	57.908-57.892 mm (2.2798-2.2792 in.)
0.250 US	0.250 mm (0.010 in.)	57.658-57.646 mm (2.2700-2.2695 in.)

10. Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.
11. 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.

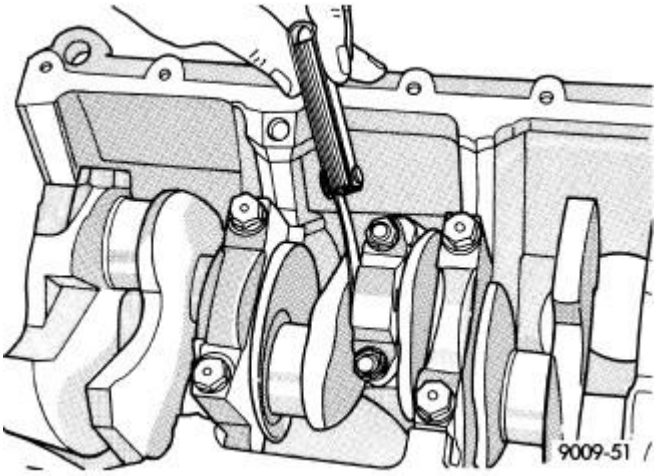


Fig. 128: Checking Connecting Rod Side Clearance-Typical
Courtesy of CHRYSLER LLC

Slide snug-fitting feeler gauge between the connecting rod and crankshaft journal flange. Refer to **3.7L ENGINE** Specifications for the proper clearance. Replace the connecting rod if the side clearance is not within specification.

PISTON FITTING

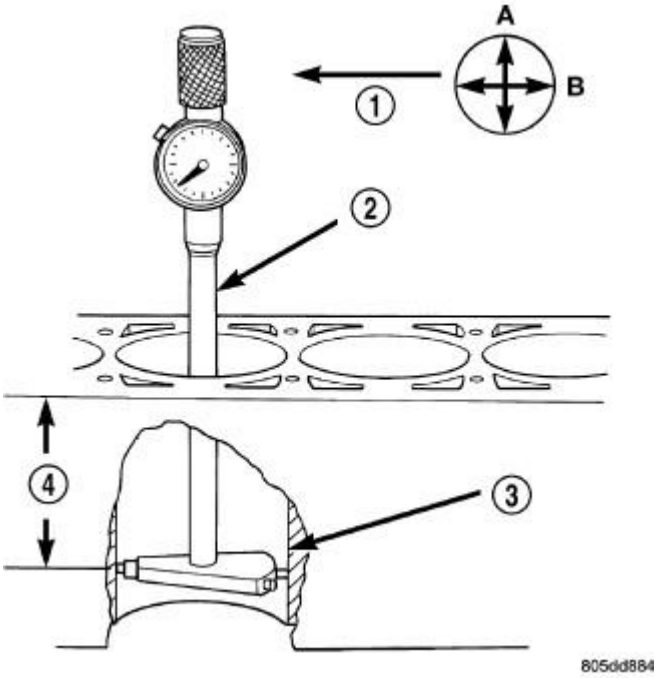


Fig. 129: Measuring Cylinder Bore Diameter

Courtesy of CHRYSLER LLC

1. To correctly select the proper size piston, a cylinder bore gauge (2), 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 (4). 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.

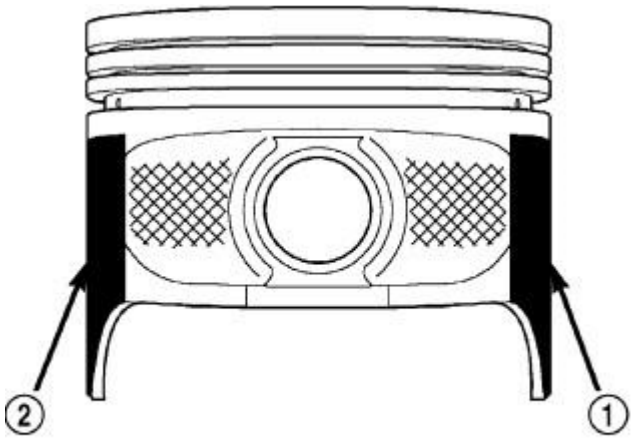


Fig. 130: Identifying Coating Material On Piston
Courtesy of CHRYSLER LLC

3. The coated pistons will be serviced with the piston pin and connecting rod pre-assembled.
4. The coating material (1) and (2) 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 the negative cable from battery.
2. Remove the following components:
   - Oil pan and gasket/windage tray. See **Engine/Lubrication/PAN, Oil - 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.

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 Connecting Rod Guides l 8507 onto 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.

Cleaning

CLEANING

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

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

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.

Inspection

INSPECTION

Check the connecting rod journal for excessive wear, taper, and scoring. See **Engine/Engine Block/ROD, Piston and Connecting - Standard Procedure**.

Check the connecting rod for signs of twist or bending.

Check the piston for taper and out of round 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

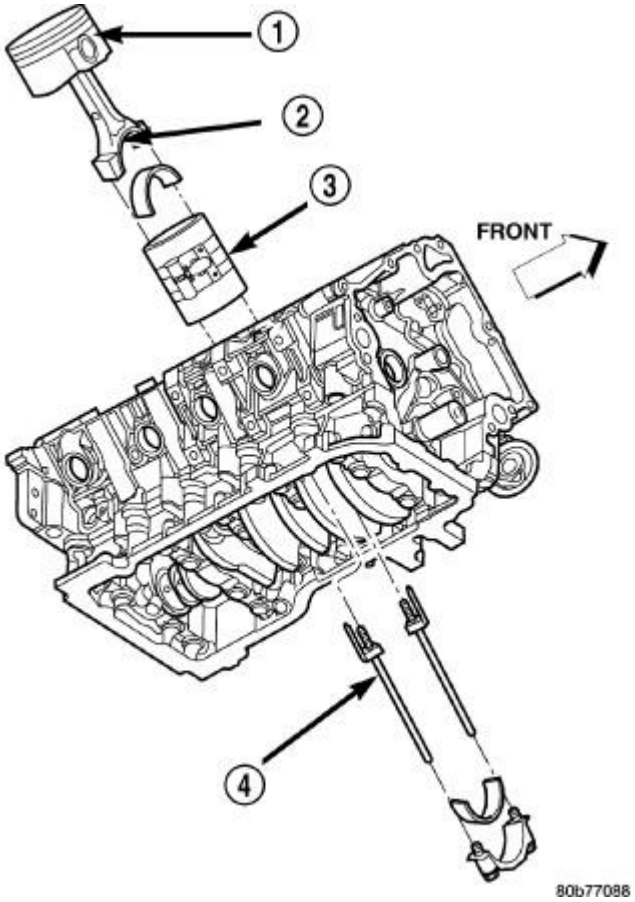


Fig. 131: Identifying Piston Components
Courtesy of CHRYSLER LLC

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 (3). **Ensure position of rings did not change during this operation.**
3. Position bearing onto connecting rod. Ensure that lubrication hole in bearing shell aligns with lubrication hole in the connecting rod. Lubricate bearing surface with clean engine oil.
4. Install Connecting Rod Guides 8507 (4) onto connecting rod bolt threads.

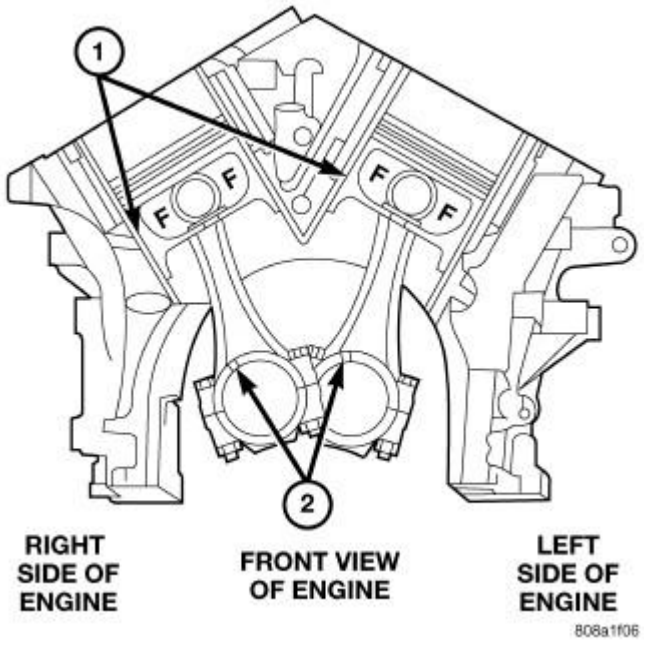


Fig. 132: Connecting Rod Guides
Courtesy of CHRYSLER LLC

5. The pistons are marked on the piston pin bore surface with a raised "F" (1) indicating installation position. 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 clean 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, guiding the connecting rod into position over the rod journal.

CAUTION: The connecting rod bolts must not be reused. Always replace the connecting rod bolts whenever they are loosened or removed.

9. Lubricate **NEW** rod bolts and bearing surfaces with engine oil. Install connecting rod cap and bearing. Tighten the **NEW** 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/CHAIN and SPROCKETS, 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

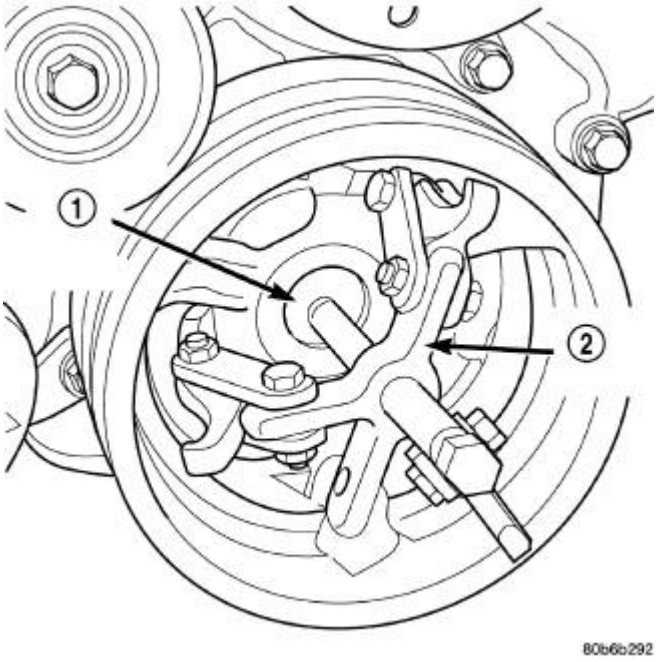


Fig. 133: Removing/Installing Damper
Courtesy of CHRYSLER LLC

1. Disconnect negative cable from battery.
2. Remove the accessory drive belt. Refer to **Cooling/Accessory Drive/BELT, Serpentine - Removal** .
3. Remove A/C compressor mounting fasteners and set the compressor aside. Refer to **Heating and Air Conditioning/Plumbing/COMPRESSOR, A/C - Removal** .
4. Drain the cooling system. Refer to **Cooling - Standard Procedure** .
5. Remove the upper radiator hose.
6. Disconnect the electrical connector for fan mounted inside radiator shroud.
7. Remove the radiator cooling fan. Refer to **Cooling/Engine/FAN, Cooling - Removal** .
8. Remove crankshaft damper bolt.
9. Remove damper using Crankshaft Insert 8513A (1) and Three Jaw Puller 1026 (2).

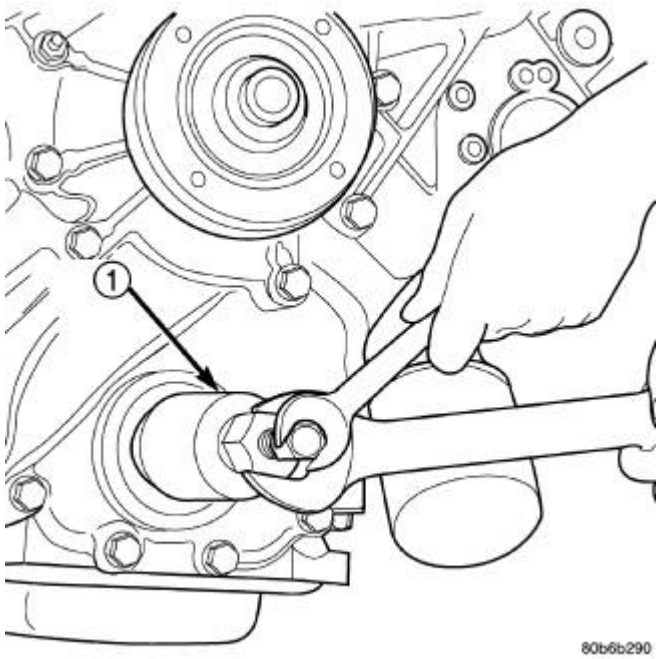


Fig. 134: Removing Crankshaft Front Seal Using Special Tool 8511
Courtesy of CHRYSLER LLC

10. Using the Seal Remover 8511 (1), remove crankshaft front seal.

Installation

INSTALLATION

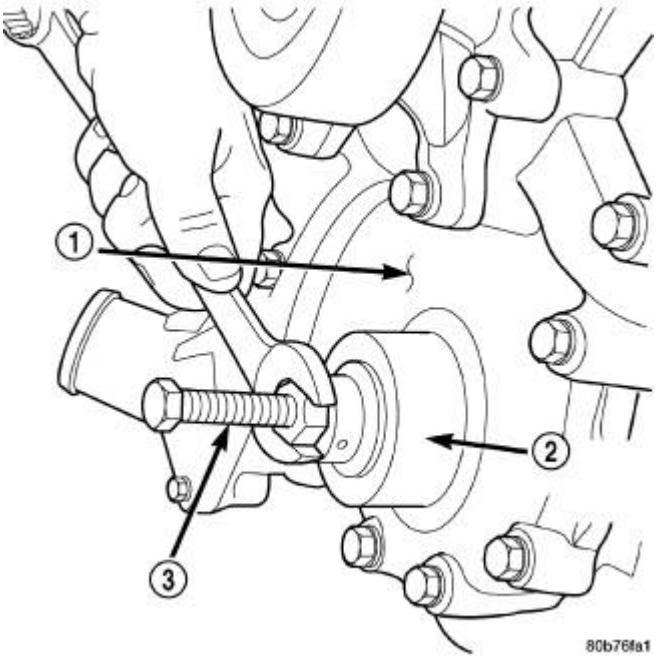


Fig. 135: Installing Crankshaft Front Seal Using Special Tool 8348 And 8512
Courtesy of CHRYSLER LLC

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

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

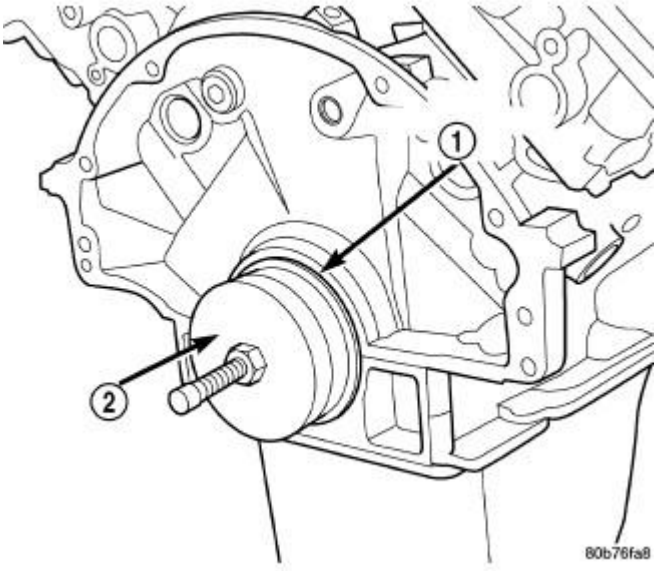


Fig. 136: Removing Crankshaft Rear Oil Seal Using Special Tool 8506
Courtesy of CHRYSLER LLC

NOTE: This procedure can be performed in vehicle.

1. If being preformed in vehicle, remove the transmission. Refer to **Transmission and Transfer Case/Automatic - 45RFE/545RFE - Removal** .
2. Remove the flexplate. See **Engine/Engine Block/FLEXPLATE - Removal**.

NOTE: The crankshaft oil seal (1) CAN NOT be reused after removal.

NOTE: The Seal Remover 8506 (2) 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

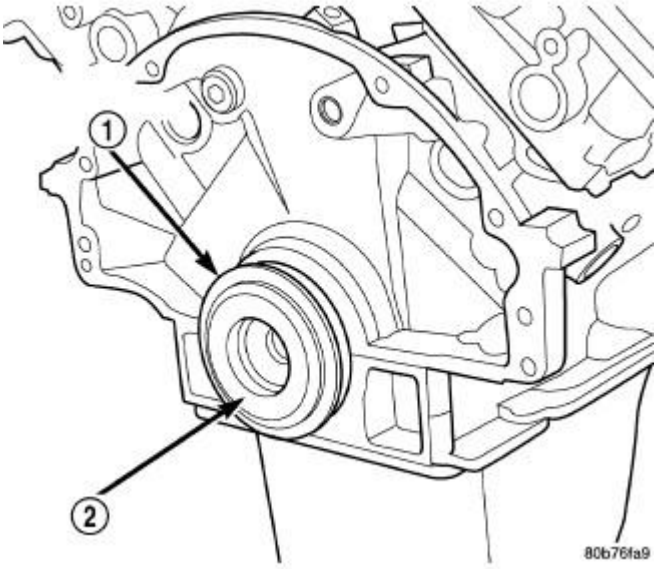


Fig. 137: Identifying Special Tool 8349-2 And Crankshaft Rear Oil Seal
Courtesy of CHRYSLER LLC

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

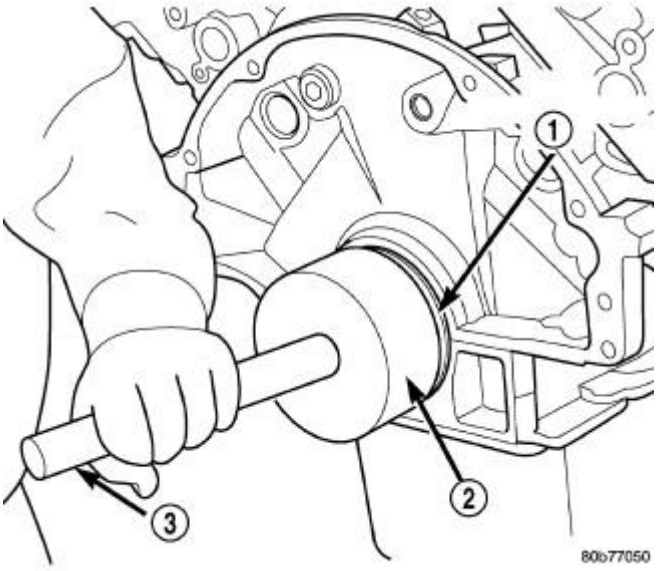


Fig. 138: Installing Crankshaft Rear Oil Seal Using Special Tool
Courtesy of CHRYSLER LLC

3. Using the Seal Installer 8349 (2) and Universal Drive 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. See **Engine/Engine Block/FLEXPLATE - Installation**.
5. Install the transmission. Refer to **Transmission and Transfer Case/Automatic - 45RFE/545RFE - Installation** .

ENGINE MOUNTING

INSULATOR, ENGINE MOUNT, FRONT

Removal

REMOVAL

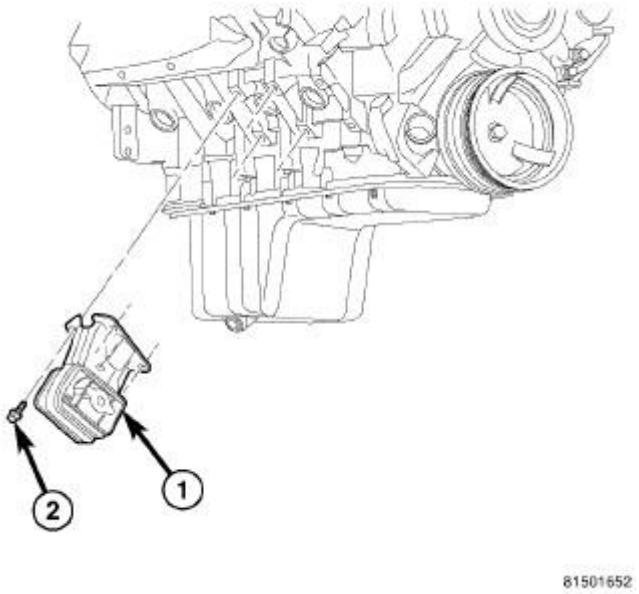


Fig. 139: Removing/Installing Engine Mount
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Raise vehicle.
3. Remove engine mount through bolts.
4. Raise engine using suitable jack.
5. Remove engine mount bolts (2).
6. Remove mount (1) from engine.

Installation

INSTALLATION

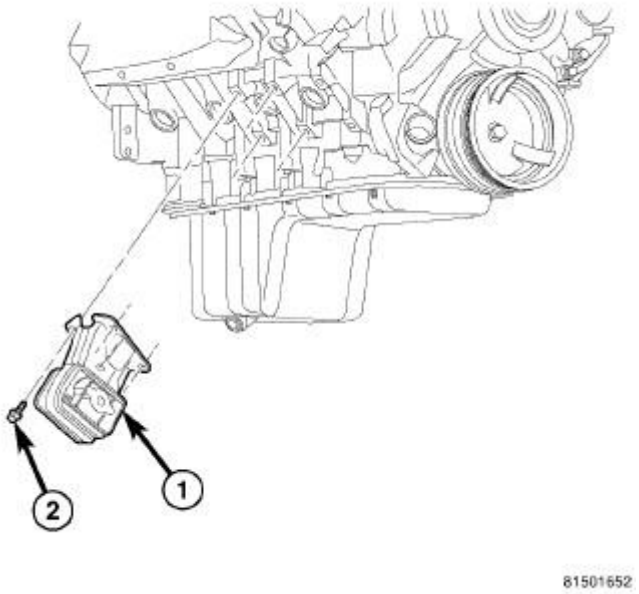


Fig. 140: Removing/Installing Engine Mount
Courtesy of CHRYSLER LLC

1. Install the engine mount (1).
2. Tighten the bolts to 30 N.m (22 ft.lbs.).
3. Lower the engine.
4. Install the through bolts and nuts.
5. Lower vehicle.
6. Connect negative battery cable.

INSULATOR, ENGINE MOUNT, REAR

Removal

REMOVAL

4X2

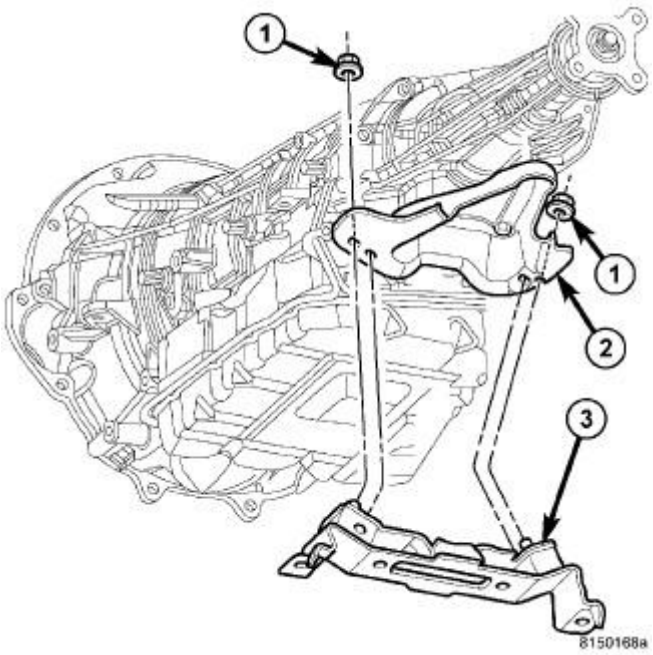


Fig. 141: 4X2 TRANSMISSION MOUNT
Courtesy of CHRYSLER LLC

1. Raise the vehicle on a hoist.
2. Using a suitable jack, support transmission.
3. Remove the crossmember.
4. Remove the fasteners (1) from the transmission mount to transmission.
5. Remove the mount (3).
6. Remove the transmission mount bracket (2), if required.

4X4

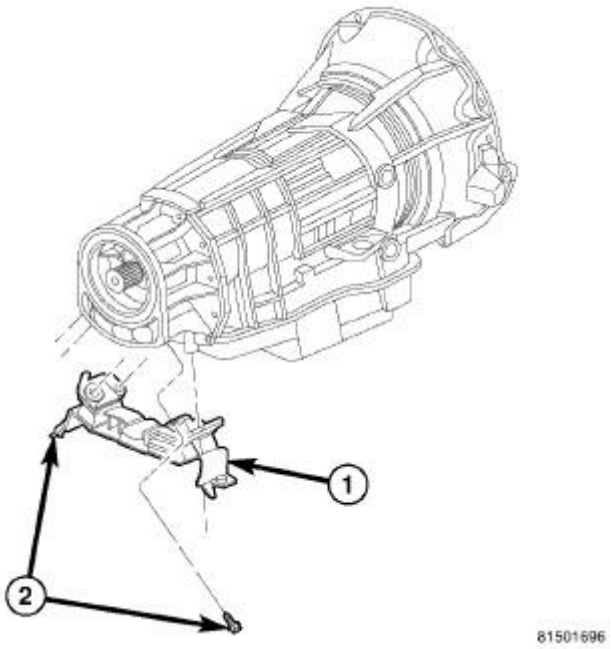


Fig. 142: 4X4 TRANSMISSION MOUNT
Courtesy of CHRYSLER LLC

1. Raise the vehicle on a hoist.
2. Using a suitable jack, support transmission.
3. Remove the crossmember.
4. Remove the fasteners (2) from the transmission mount (1) to transmission.
5. Remove the mount.

Installation

INSTALLATION

4X2

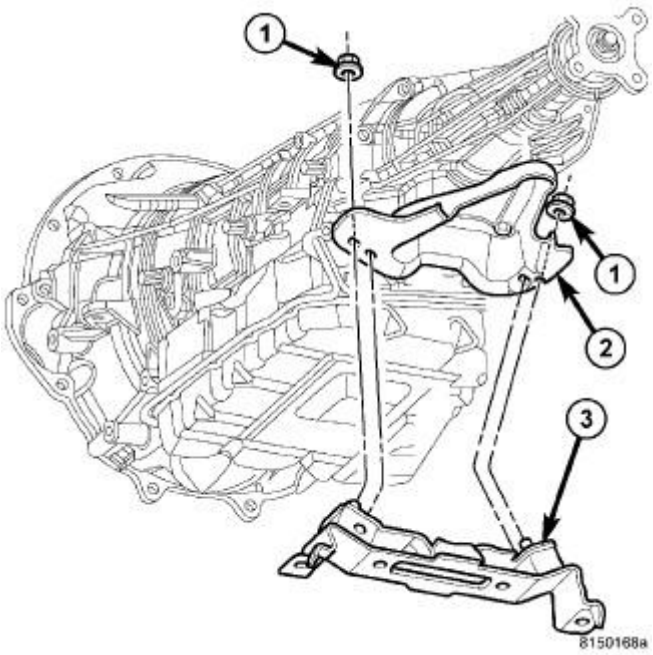


Fig. 143: 4X2 TRANSMISSION MOUNT
Courtesy of CHRYSLER LLC

1. Install the transmission mount bracket (2), if removed.
2. Position the transmission mount (3) on the transmission mount bracket (2). Install the fasteners (1) that attach the transmission mount to the bracket.
3. Tighten the bolts to 30 N.m (22 ft.lbs.).
4. Install the crossmember.

4X4

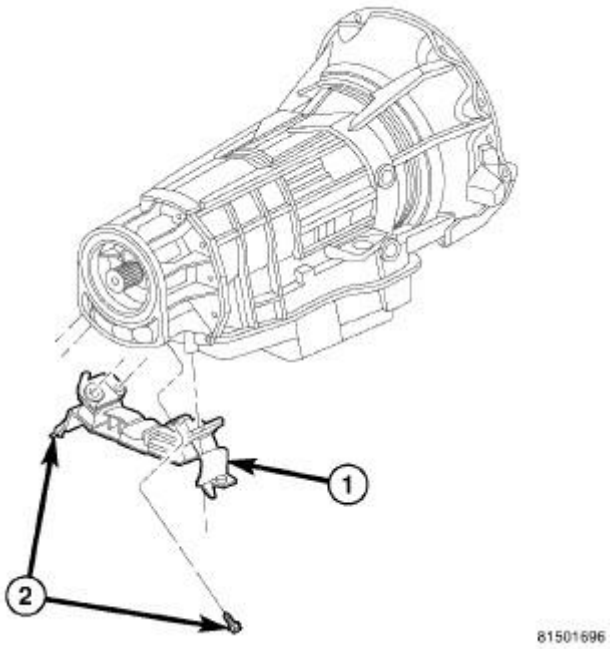


Fig. 144: 4X4 TRANSMISSION MOUNT
Courtesy of CHRYSLER LLC

1. Position the transmission mount (1) on the transmission. Install the bolts (2) that attach the transmission mount to the transmission.
2. Tighten the bolts to 30 N.m (22 ft.lbs.).
3. Install the crossmember.

LUBRICATION

DESCRIPTION

DESCRIPTION

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

OPERATION

OPERATION

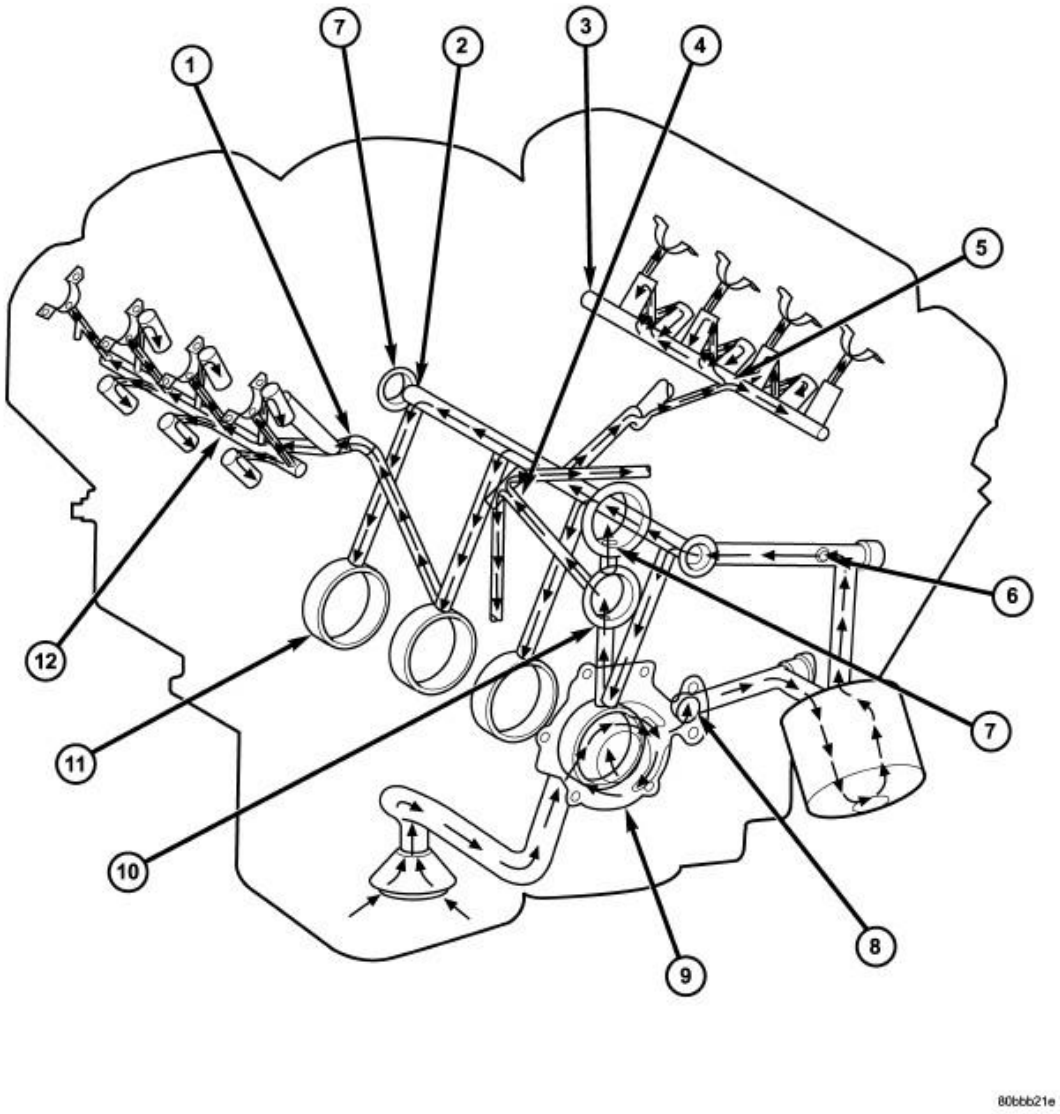


Fig. 145: LUBRICATION OIL FLOW
Courtesy of CHRYSLER LLC

1 - OIL FLOW TO RIGHT CYLINDER HEAD	7 - OIL FLOW TO COUNTER BALANCE SHAFT
2 - CYLINDER BLOCK MAIN OIL GALLERY	8 - OIL PUMP OUTLET TO CYLINDER BLOCK
3 - LEFT CYLINDER HEAD OIL GALLERY	9 - OIL PUMP
4 - OIL FLOW TO BOTH SECONDARY TENSIONERS	10 - OIL FLOW TO CRANKSHAFT MAIN JOURNALS
5 - OIL FLOW TO LEFT CYLINDER HEAD	11 - CRANKSHAFT MAIN BEARING JOURNALS
6 - OIL PRESSURE SENSOR LOCATION	12 - RIGHT CYLINDER HEAD OIL GALLERY

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 lubricated in the same manner as the exhaust lobes. The intake lobes are lubricated through internal passages in the camshaft. Oil flows through a bore in the No. 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 LUBRICATION FLOW CHART - BLOCK: 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* 4. Counterbalance Shaft Rear Journal
Crankshaft Main Journals	Crankshaft Rod Journals
Crankshaft Number One Main Journal	1. Front Timing Chain Idler Shaft 2. Counterbalance Shaft - Front Journal 3. Both Secondary Chain Tensioners
Left Cylinder Head	Refer to **ENGINE LUBRICATION FLOW CHART - CYLINDER HEADS: TABLE 2**.
Right Cylinder Head	Refer to **ENGINE LUBRICATION FLOW CHART - CYLINDER HEADS: TABLE 2**.
* The cylinder head gaskets have an oil restricted to control oil flow to the cylinder heads	

ENGINE LUBRICATION FLOW CHART - CYLINDER HEADS: 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 Drilling 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 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 de-grease 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 **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, distributor seal, camshaft bore cup plugs 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.

CHECKING ENGINE OIL PRESSURE

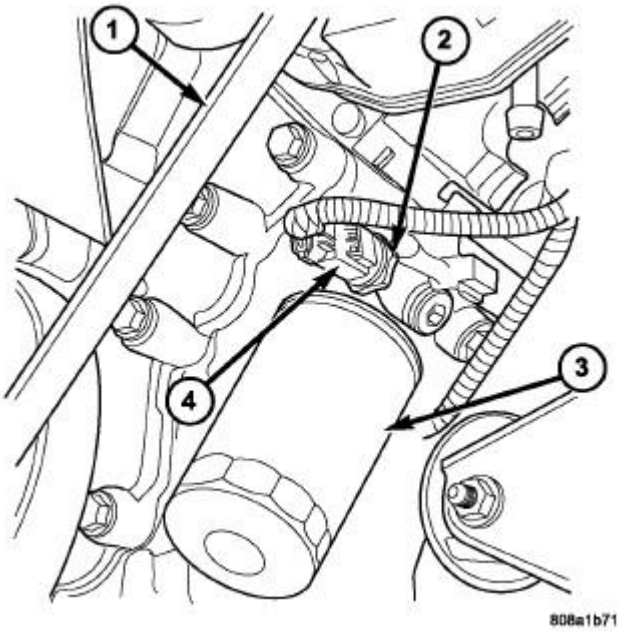


Fig. 146: Locating Belt, Oil Pressure Sending Unit, Connector & Oil Filter
Courtesy of CHRYSLER LLC

1. Remove oil pressure sending unit (2) 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 - 758 kPa (25 - 110 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.

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, camshaft bore cup plugs, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See appropriate 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 **ENGINE LUBRICATION DIAGNOSTIC TABLE** under the OIL LEAKS row, 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.

FILTER, ENGINE OIL

Removal

REMOVAL

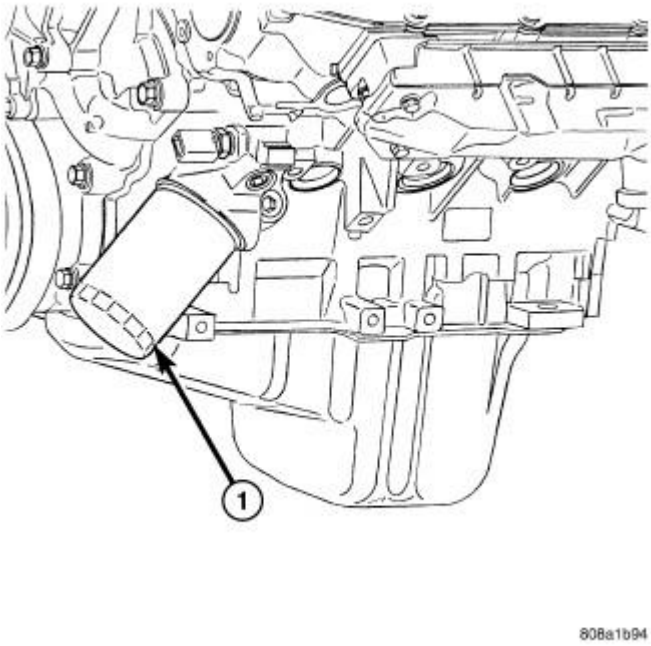


Fig. 147: Identifying Oil Filter
Courtesy of CHRYSLER LLC

All engines are equipped with a high quality full-flow, disposable type oil filter (1). 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 the filter.
3. Rotate the oil filter (1) 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

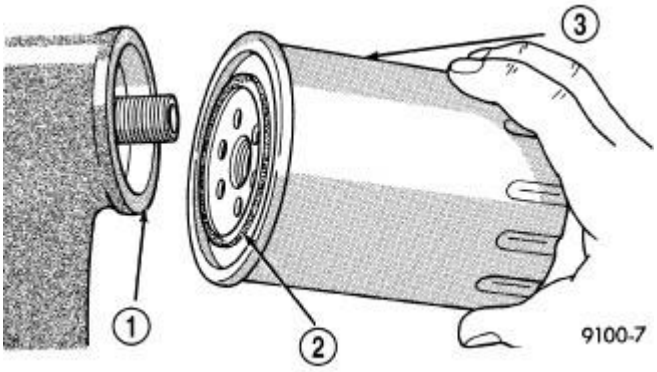


Fig. 148: Removing/Installing Oil Filter
Courtesy of CHRYSLER LLC

1. Lightly lubricate oil filter gasket (2) with clean engine oil.
2. Thread filter onto adapter nipple. When gasket makes contact with sealing surface (1), hand tighten filter (3) 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

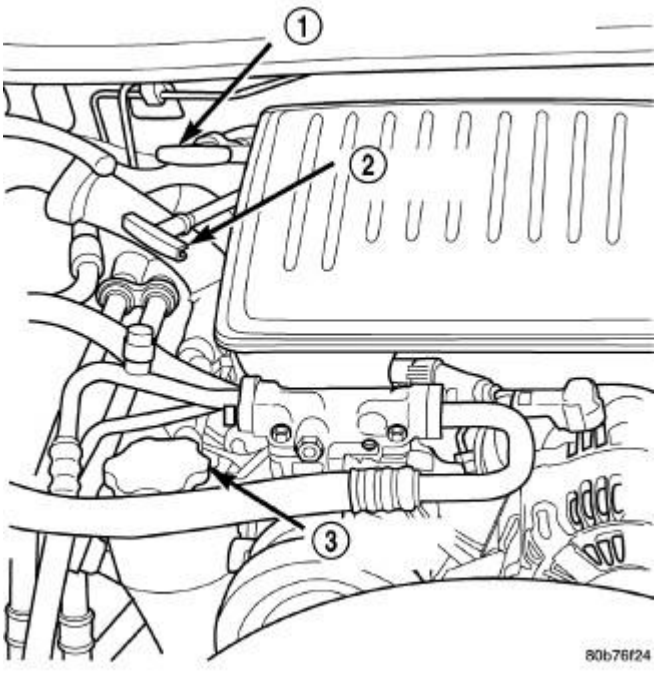


Fig. 149: Identifying Oil Dipstick, Oil Fill Cap And Transmission Dipstick
Courtesy of CHRYSLER LLC

The engine oil level indicator (2) is located at the right rear of the engine on the 3.7L 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 the 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 an oil drain pan. Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.
6. Install drain plug in crankcase. Torque to 34 N.m (25 ft. lbs.).
7. Lower vehicle and fill crankcase with specified type and amount of engine oil described in this part.
8. Install oil fill cap.
9. Start engine and inspect for leaks.
10. Stop engine and inspect oil level.

USED ENGINE OIL DISPOSAL

Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING at **COOLING SYSTEM TESTER METHOD**.

PAN, OIL

Description

DESCRIPTION

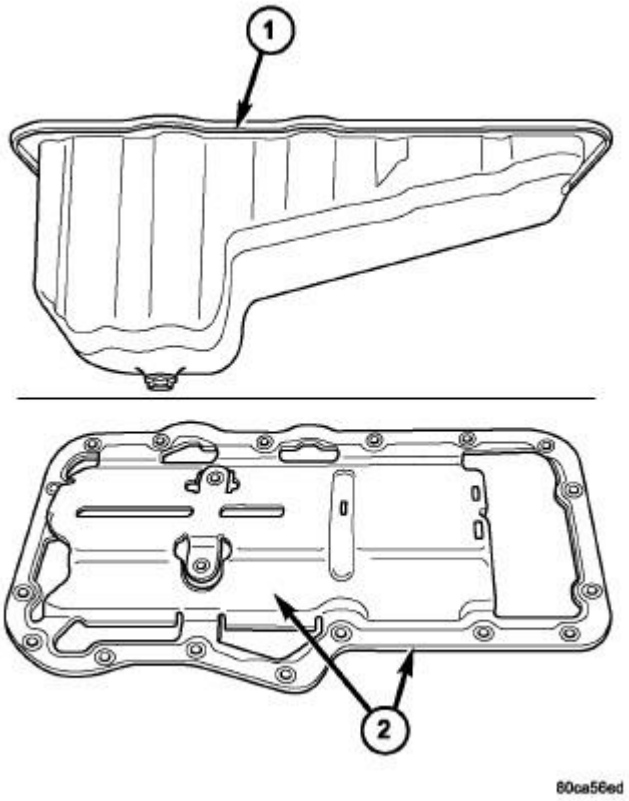


Fig. 150: Identifying Engine Oil Pan
Courtesy of CHRYSLER LLC

The engine oil pan (1) is made of laminated steel and has a single plane sealing surface. The sandwich style oil pan gasket has an integrated windage tray (2) and steel carrier. The sealing area of the gasket is molded with rubber and is designed to be reused as long as the gasket is not cut, torn or ripped.

Removal

REMOVAL

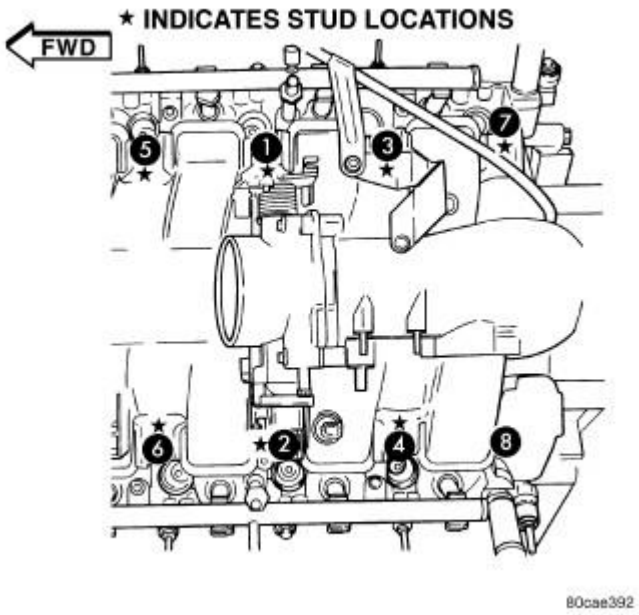


Fig. 151: Intake Manifold Tightening Sequence
Courtesy of CHRYSLER LLC

1. Disconnect negative battery cable.
2. Remove the radiator fan. Refer to **Cooling/Engine/FAN, Cooling - Removal** .
3. Remove the intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Removal**.

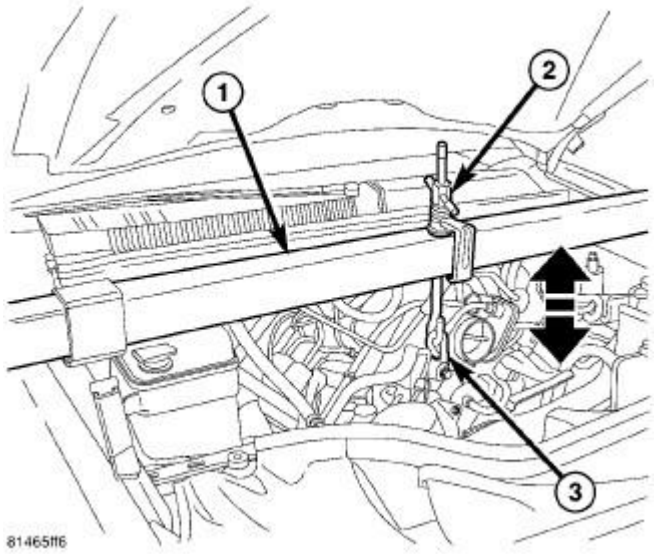


Fig. 152: ENGINE SUPPORT TOOL
Courtesy of CHRYSLER LLC

4. Install Special Tool 8534B **Do not raise engine at this time.**

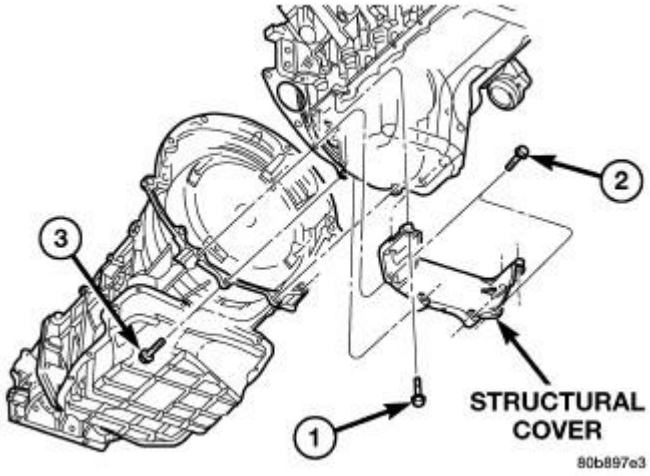


Fig. 153: Identifying Structural Cover
Courtesy of CHRYSLER LLC

5. Remove the structural cover. See **Engine/Engine Block/COVER, Structural Dust - Removal**.

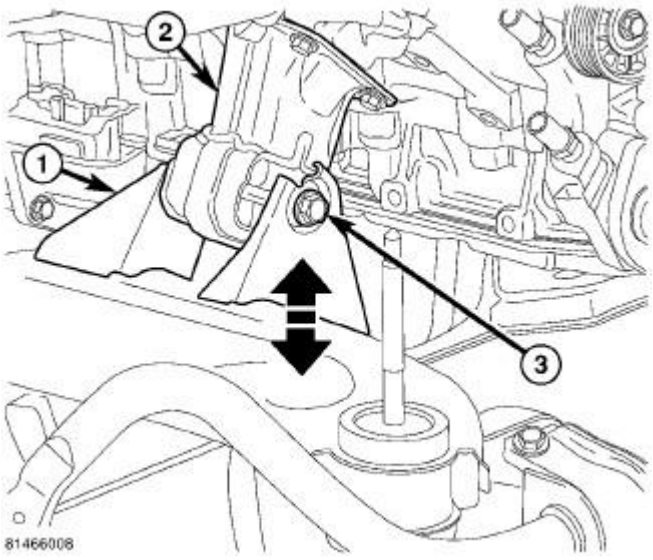


Fig. 154: ENGINE MOUNT BOLT
Courtesy of CHRYSLER LLC

6. Remove both left and right side engine mount through bolts (3).

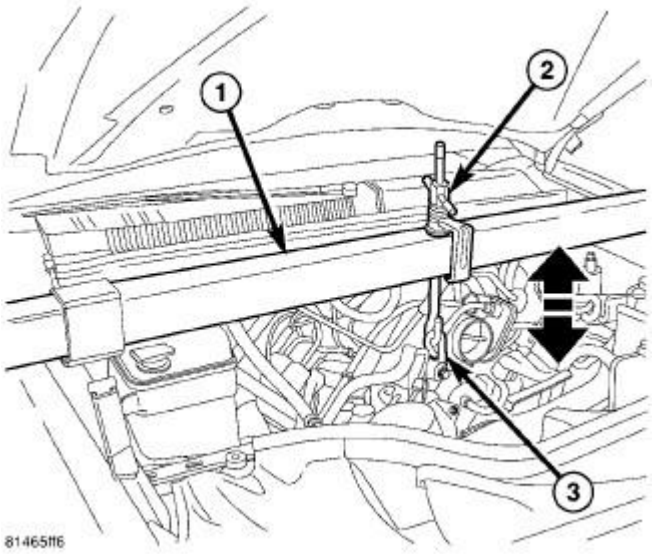


Fig. 155: ENGINE SUPPORT TOOL
Courtesy of CHRYSLER LLC

7. Raise engine using Engine Support 8534B (1), to provide clearance to remove oil pan.
8. Drain engine oil and remove oil filter.

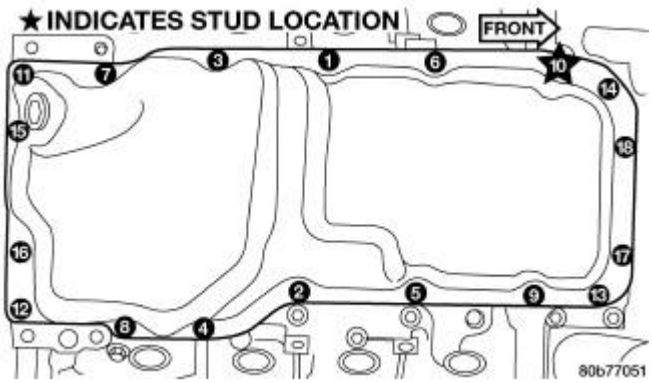


Fig. 156: Oil Pan Mounting Bolt Removal/Tightening Sequence
Courtesy of CHRYSLER LLC

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

9. Remove the oil pan mounting bolts and oil pan.
10. Unbolt oil pump pickup tube and remove tube and oil pan gasket from engine.

Cleaning

CLEANING

1. Clean oil pan in solvent and wipe dry with a clean cloth.
2. Clean the oil pan gasket surface. **DO NOT** use a grinder wheel or other abrasive tool to clean sealing surface.
3. Clean oil screen and tube thoroughly in clean solvent.

Inspection

INSPECTION

1. Inspect oil drain plug and plug hole for stripped or damaged threads. Repair as necessary.
2. Inspect the oil pan mounting flange for bends or distortion. Straighten flange, if necessary.

Installation

INSTALLATION

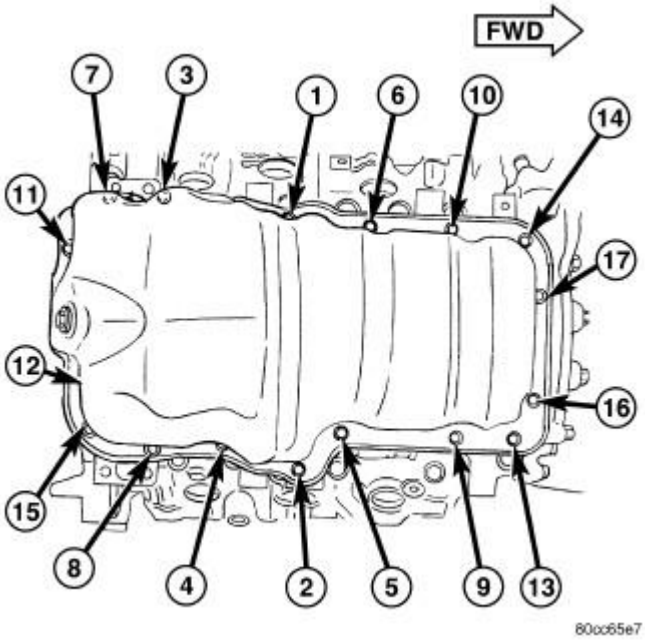


Fig. 157: Identifying Oil Pan Bolt Torque Sequence
Courtesy of CHRYSLER LLC

1. Clean the oil pan gasket mating surface of the bed plate and oil pan.
2. Inspect integrated oil pan gasket, and replace as necessary.
3. Position the integrated oil pan gasket/windage tray assembly.
4. Install the oil pickup tube
5. If removed, install stud at position No. 9.
6. Install the mounting bolt and nuts. Tighten nuts to 28 N.m (20 ft. lbs.).
7. Position the oil pan and install the mounting bolts. Tighten the mounting bolts to 16 N.m (140 in. lbs.) in

the sequence shown in **Fig. 157**.

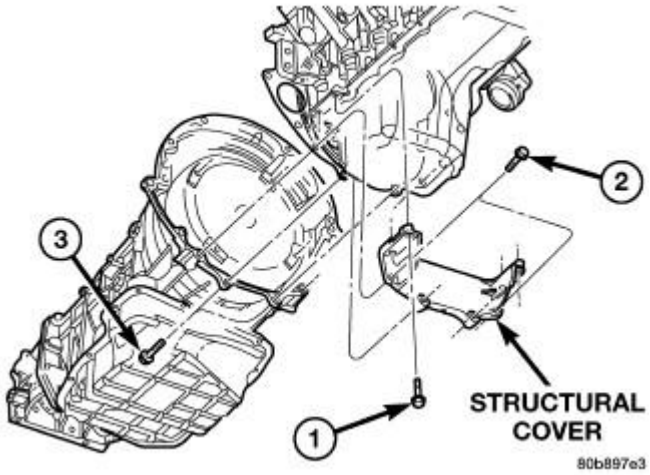


Fig. 158: Structural Cover
Courtesy of CHRYSLER LLC

8. Install structural dust cover.

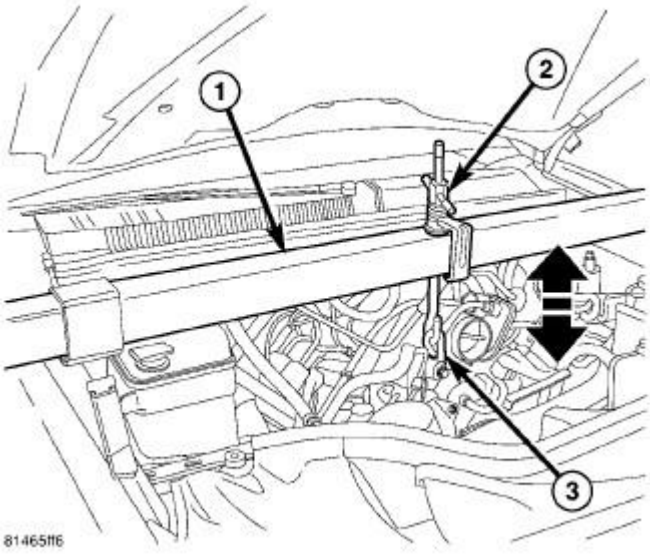


Fig. 159: ENGINE SUPPORT TOOL
Courtesy of CHRYSLER LLC

9. Lower the engine into mounts using Engine Support 8534B (1).
10. Remove Engine Support 8534B.

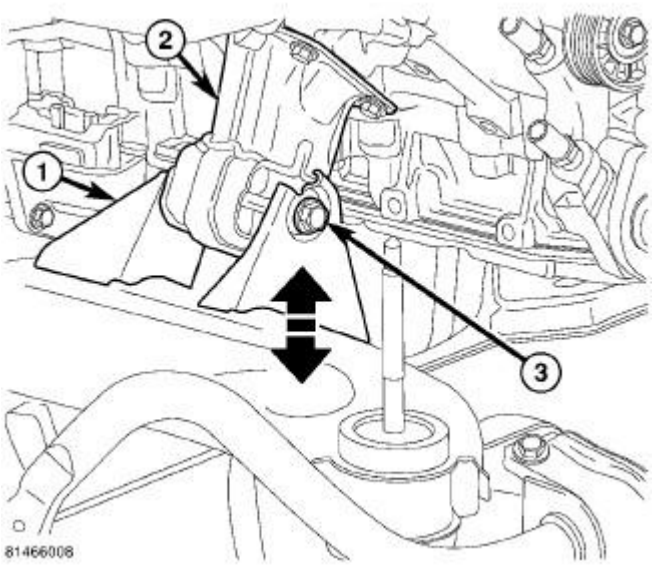


Fig. 160: ENGINE MOUNT BOLT
Courtesy of CHRYSLER LLC

11. Install both the left and right side engine mount through bolts (3). Tighten the nuts to 68 N.m (50 ft. lbs.).

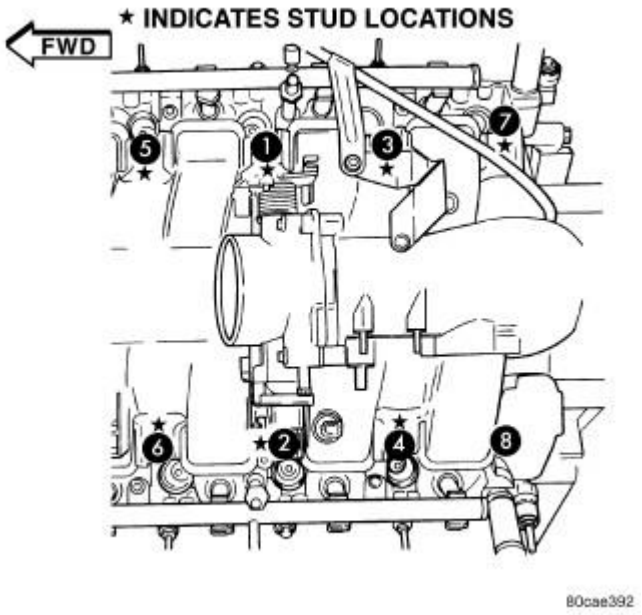


Fig. 161: Intake Manifold Tightening Sequence
Courtesy of CHRYSLER LLC

12. Install the intake manifold. See **Engine/Manifolds/MANIFOLD, Intake - Installation**.
13. Fill engine oil.
14. Reconnect the negative battery cable.

15. 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.

Inspection

INSPECTION

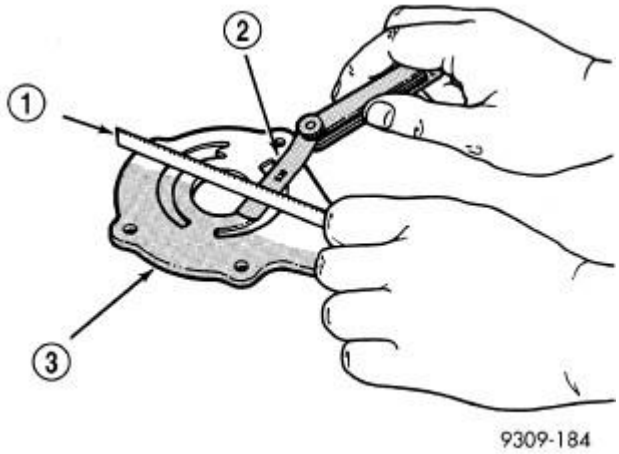


Fig. 162: Inserting Feeler Gauge Between Cover Surface & Straightedge
Courtesy of CHRYSLER LLC

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 (1) across the pump cover surface. 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.

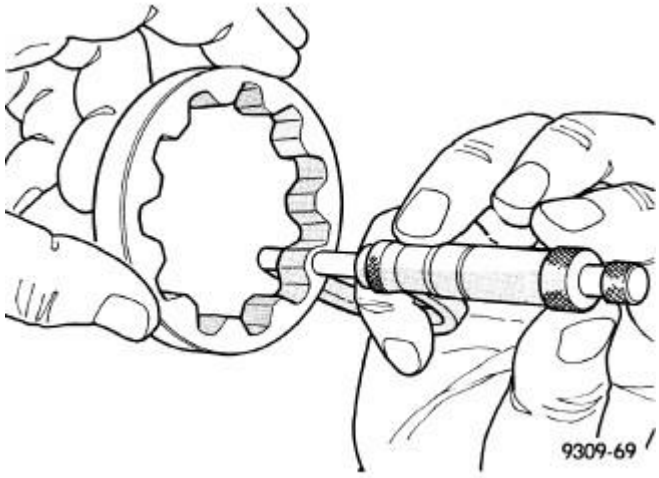


Fig. 163: Measuring Thickness Of Outer Rotor
Courtesy of CHRYSLER LLC

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.

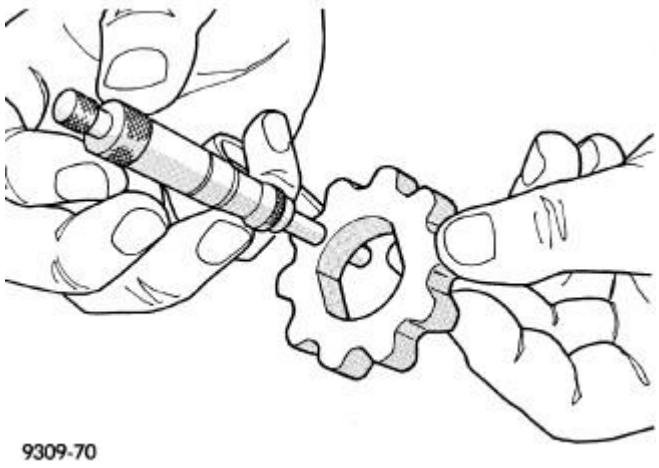


Fig. 164: Measuring Thickness Of Inner Rotor
Courtesy of CHRYSLER LLC

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.

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.

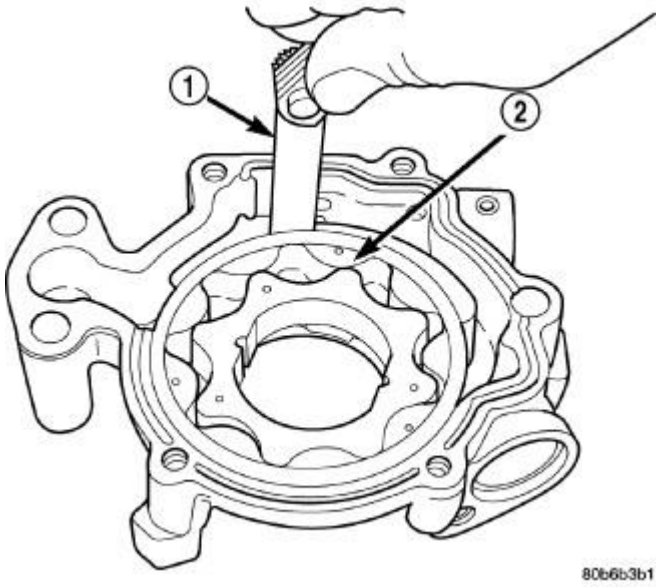


Fig. 165: Measuring Outer Rotor Clearance in Housing
Courtesy of CHRYSLER LLC

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 (1). If the measurement is 0.235 mm (0.009 in.) or more the oil pump assembly must be replaced.

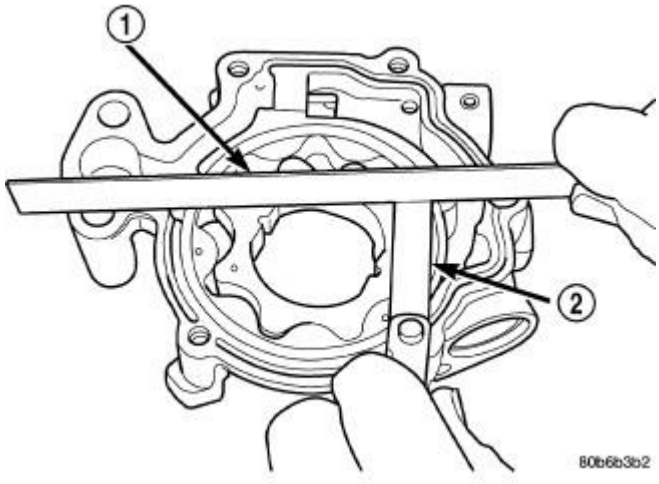


Fig. 166: Measuring Rotor & Body Height Difference
Courtesy of CHRYSLER LLC

7. Install the inner rotor in the into the oil pump body. Measure the clearance between the inner and outer rotors. If the clearance between the rotors is 0.150 mm (0.006 in.) or more the oil pump assembly must be replaced.

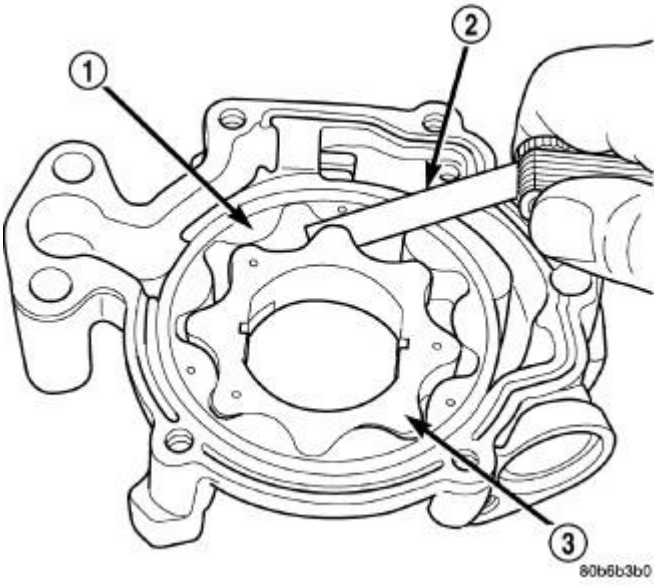


Fig. 167: Measuring Clearance Between Inner And Outer Rotors
Courtesy of CHRYSLER LLC

8. Place a straight edge across the body of the oil pump (between the bolt holes), if a feeler gauge (2) of 0.095 mm (0.0038 in.) or greater can be inserted between the straightedge and the rotors, the pump must be replaced.

NOTE: The 3.7 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

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

Installation

INSTALLATION

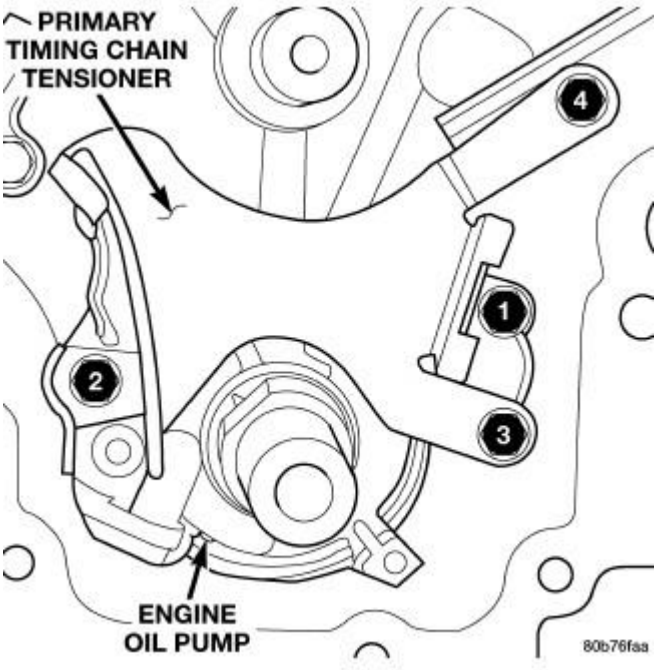


Fig. 168: Identifying Oil Pump And Primary Timing Chain Tensioner
Courtesy of CHRYSLER LLC

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 **Fig. 168**.
4. Install the secondary timing chain tensioners and timing chains. See **Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Installation**.
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

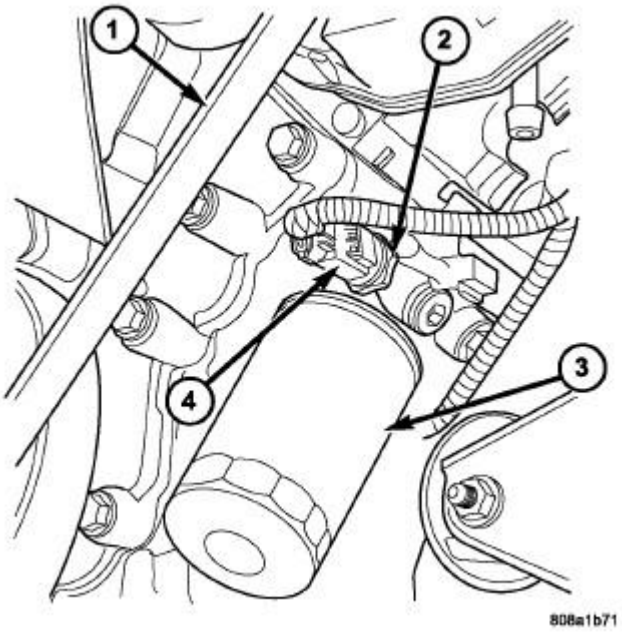


Fig. 169: Locating Belt, Oil Pressure Sending Unit, Connector & Oil Filter
Courtesy of CHRYSLER LLC

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

Installation

INSTALLATION

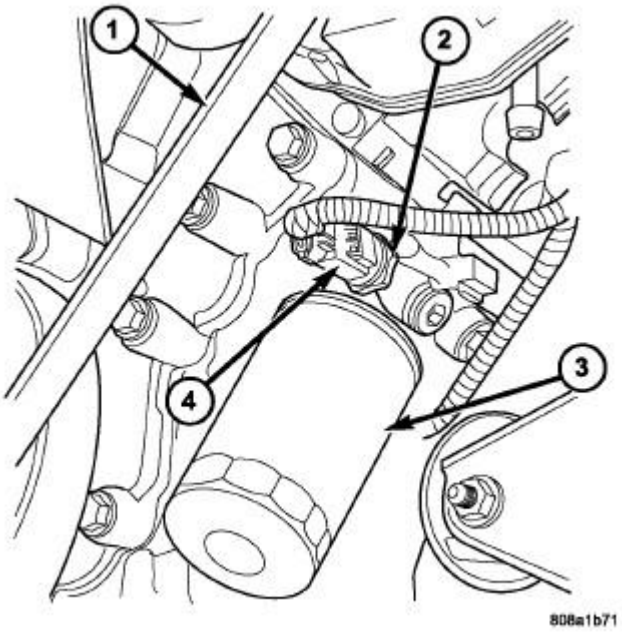


Fig. 170: OIL PRESSURE SENDING UNIT
Courtesy of CHRYSLER LLC

1. Install the oil pressure switch.
2. Connect oil pressure switch connector.
3. Install front splash shield.
4. Lower vehicle.
5. Connect the negative battery cable.
6. Start the engine and ensure there are no oil leaks from the oil pressure switch.

MANIFOLDS

MANIFOLD, EXHAUST

Description

DESCRIPTION

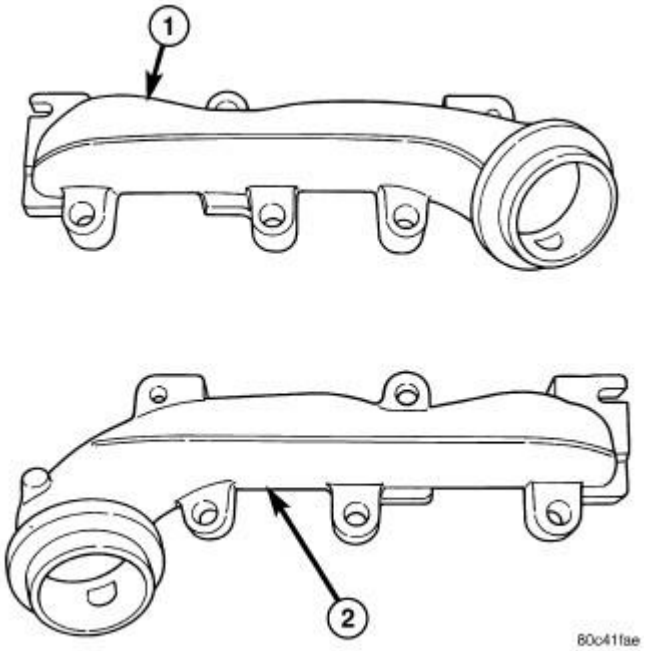


Fig. 171: Identifying Exhaust Manifolds
Courtesy of CHRYSLER LLC

The exhaust manifolds (1 and 2) 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.

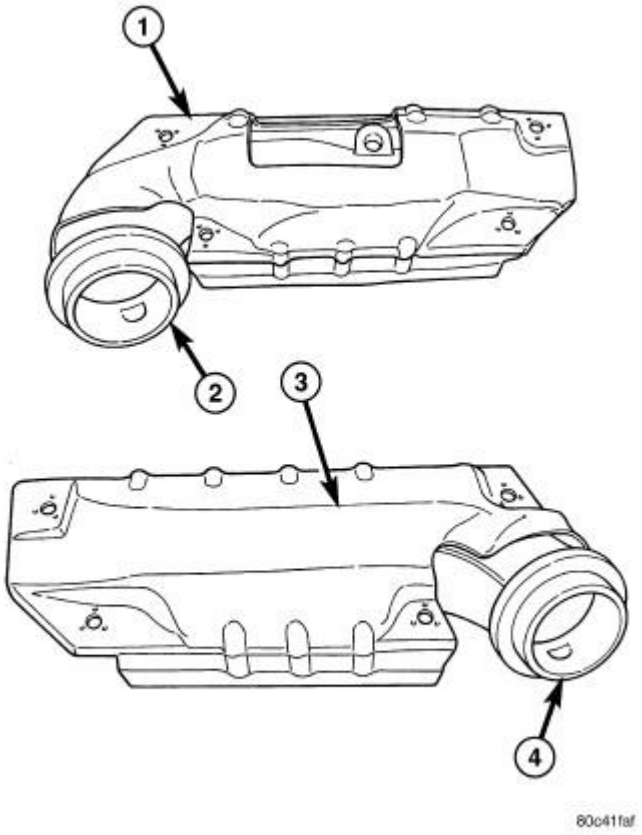


Fig. 172: Identifying Exhaust Manifold
Courtesy of CHRYSLER LLC

The exhaust manifolds are covered by a three layer laminated heat shield (1 and 3) for thermal protection and noise reduction. The heat shields (1 and 3) 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

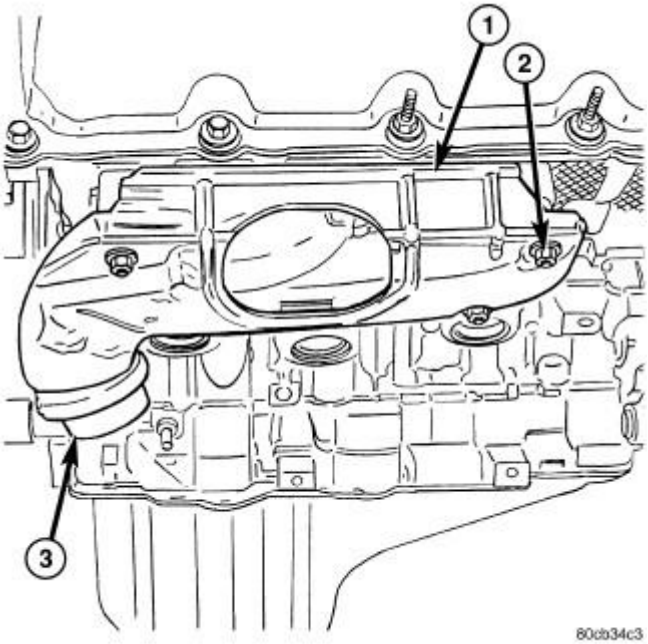


Fig. 173: Exhaust Manifold - Right
Courtesy of CHRYSLER LLC

1. Disconnect the negative cable from the battery.
2. Raise and support the vehicle.
3. Remove the bolts and nuts attaching the exhaust pipe to the engine exhaust manifold.
4. Lower the vehicle.
5. Remove the exhaust heat shield (1).
6. Remove bolts, nuts (2) and washers attaching manifold to cylinder head.
7. Remove manifold and gasket from the cylinder head.

LEFT EXHAUST MANIFOLD

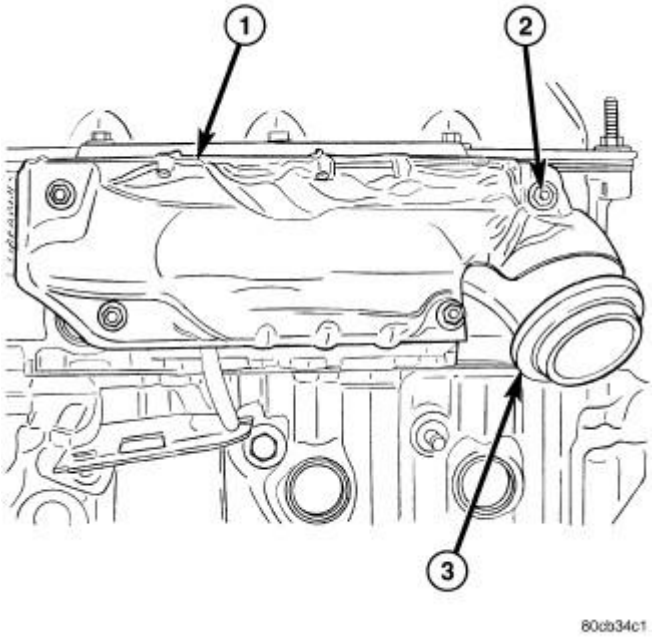


Fig. 174: Exhaust Manifold - Left
Courtesy of CHRYSLER LLC

1. Disconnect the negative cable from the battery.
2. Raise and support the vehicle.
3. Remove the bolts and nuts attaching the exhaust pipe to the engine exhaust manifold.
4. Lower the vehicle.
5. Remove the exhaust heat shields (1).
6. Remove bolts, nuts (2) and washers attaching manifold to cylinder head.
7. Remove manifold and gasket from the cylinder head.

Installation

INSTALLATION

RIGHT EXHAUST MANIFOLD

CAUTION: If the studs came out with the nuts when removing the engine exhaust manifold, install new studs. Apply sealer on the coarse thread ends. Water leaks may develop at the studs if this precaution is not taken.

1. Position the engine exhaust manifold and gasket on the two studs located on the cylinder head. Install conical washers and nuts on these studs.
2. Install remaining conical washers. Starting at the center arm and working outward, tighten the bolts and nuts to 25 N.m (18 ft. lbs.).
3. Install the exhaust heat shields.

4. Raise and support the vehicle.

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

5. Assemble exhaust pipe to manifold and secure with bolts, nuts and retainers. Tighten the bolts and nuts to 34 N.m (25 ft. lbs.).

LEFT EXHAUST MANIFOLD

CAUTION: If the studs came out with the nuts when removing the engine exhaust manifold, install new studs. Apply sealer on the coarse thread ends. Water leaks may develop at the studs if this precaution is not taken.

1. Position the engine exhaust manifold and gasket on the two studs located on the cylinder head. Install conical washers and nuts on these studs.
2. Install remaining conical washers. Starting at the center arm and working outward, tighten the bolts and nuts to 25 N.m (18 ft. lbs.).
3. Install the exhaust heat shields.
4. Raise and support the vehicle.

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

5. Assemble exhaust pipe to manifold and secure with bolts, nuts and retainers. Tighten the bolts and nuts to 34 N.m (25 ft. lbs.).

MANIFOLD, INTAKE

Description

DESCRIPTION

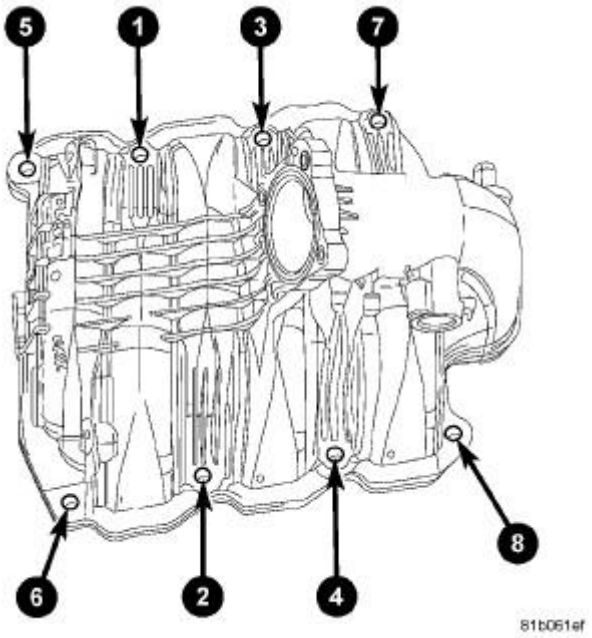


Fig. 175: 3.7L INTAKE TORQUE SEQUENCE
Courtesy of CHRYSLER LLC

The intake manifold is made of a composite material and features long runners which maximizes low end torque.

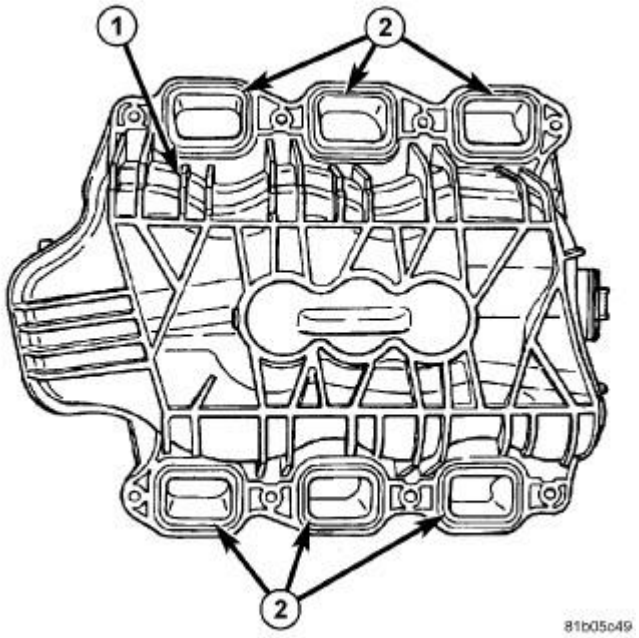


Fig. 176: INTAKE MANIFOLD SEALS
Courtesy of CHRYSLER LLC

The intake manifold (1) uses single plane sealing which consist of six individual press in place port gaskets (2) to prevent leaks. The throttle body attaches directly to the intake manifold.

Diagnosis and Testing

INTAKE MANIFOLD LEAKS

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 (spray bottle) at the suspected leak area.
3. If engine RPM'S change, the area of the suspected leak has been found.
4. Repair as required.

Removal

REMOVAL

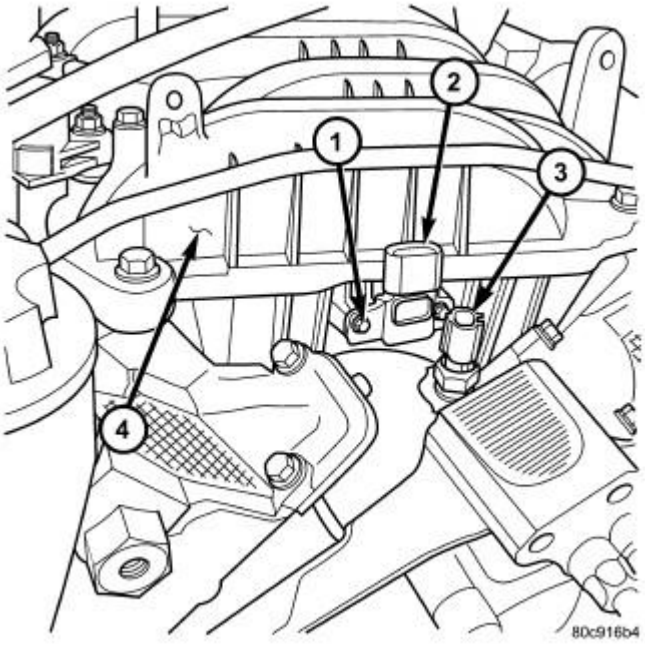


Fig. 177: MAP SENSOR - 3.7L V-6
Courtesy of CHRYSLER LLC

1 - MOUNTING SCREWS

2 - MAP SENSOR
3 - ECT SENSOR
4 - FRONT OF INTAKE MANIFOLD

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

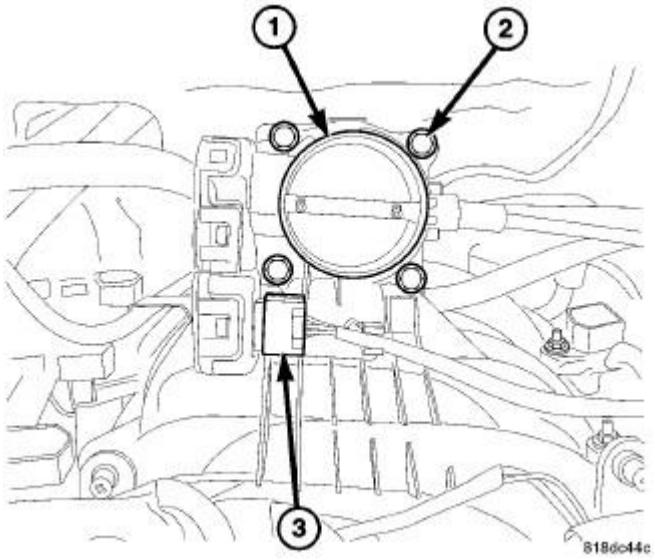


Fig. 178: THROTTLE BODY 3.7L
Courtesy of CHRYSLER LLC

1 - THROTTLE BODY
2 - MOUNTING BOLTS
3 - ELEC. CONNECTOR

- Manifold Absolute Pressure (MAP) Sensor (2)

5. Disconnect vapor purge hose, brake booster hose, positive crankcase ventilation (PCV) hose.
6. Remove the generator. Refer to **Electrical - Engine Systems/Charging/GENERATOR - Removal** .
7. Remove the air conditioning compressor. Refer to **Heating and Air Conditioning/Plumbing/COMPRESSOR, A/C - Removal** .
8. Disconnect the ETC connector from the throttle body (3).

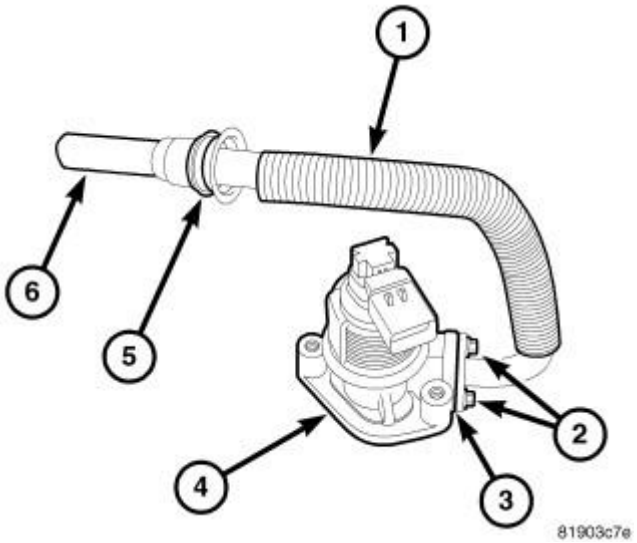


Fig. 179: EGR SOLENOID/TUBE ASSEMBLY
Courtesy of CHRYSLER LLC

9. Disconnect and remove ignition coil towers.
10. Remove top oil dipstick tube retaining bolt.
11. Remove the EGR tube (1).
12. Remove the fuel rail.

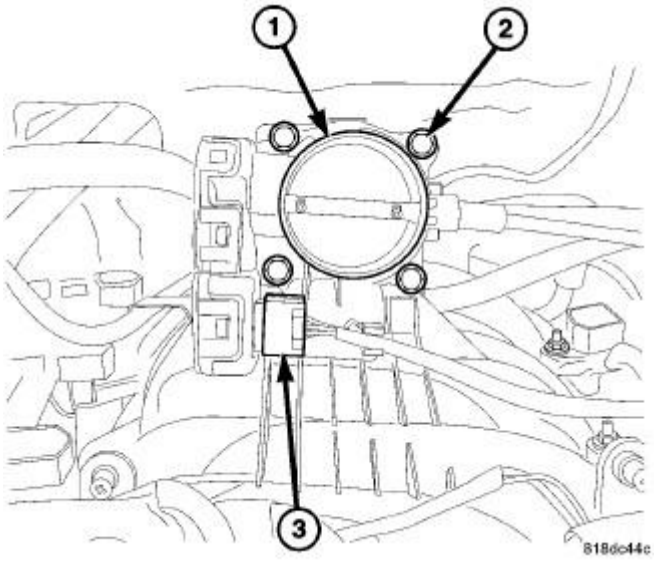


Fig. 180: THROTTLE BODY 3.7L
Courtesy of CHRYSLER LLC

1 - THROTTLE BODY
2 - MOUNTING BOLTS
3 - ELEC. CONNECTOR

13. Remove throttle body assembly (1).
14. Drain cooling system below coolant temperature level. Refer to **Cooling - Standard Procedure** .

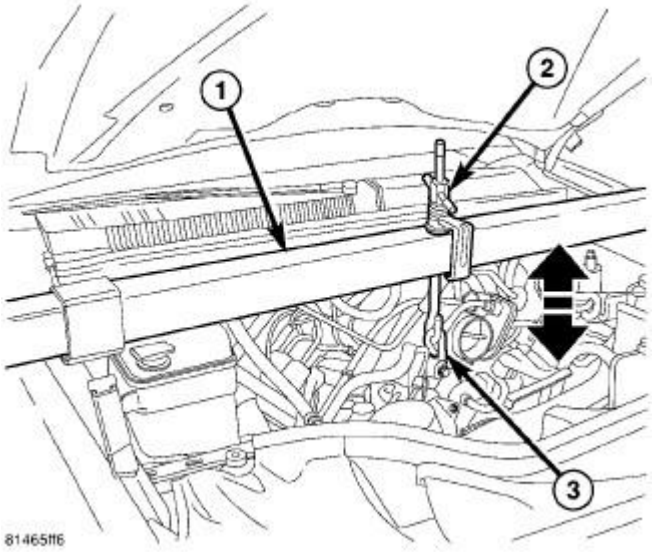


Fig. 181: ENGINE SUPPORT TOOL
Courtesy of CHRYSLER LLC

15. Support engine using engine support fixture (1), special tool 8534B.

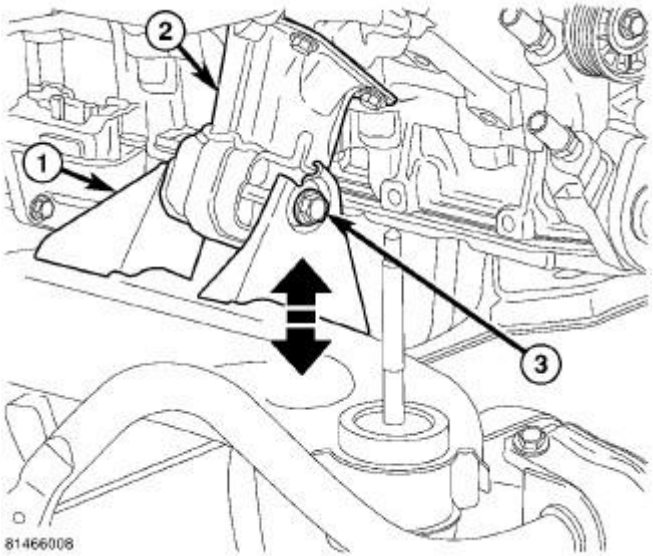


Fig. 182: ENGINE MOUNT BOLT
Courtesy of CHRYSLER LLC

16. Remove the right side engine mount to frame bolt (3).
17. With the bolt removed, lower engine until engine mount rests in frame mount.

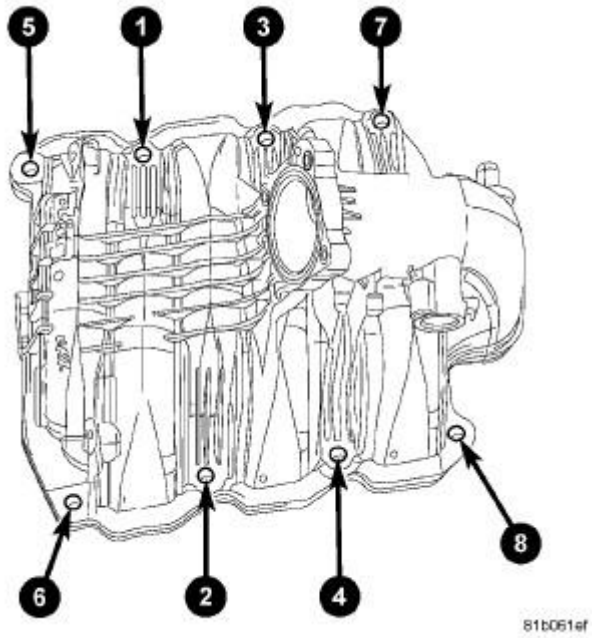


Fig. 183: 3.7L INTAKE TORQUE SEQUENCE
Courtesy of CHRYSLER LLC

18. Remove intake manifold retaining fasteners in reverse order of tightening sequence.
19. Remove intake manifold.

Installation

INSTALLATION

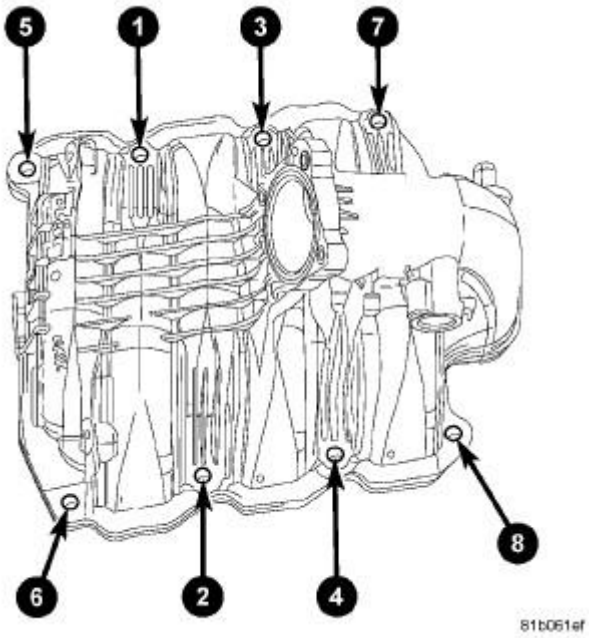


Fig. 184: 3.7L INTAKE TORQUE SEQUENCE
Courtesy of CHRYSLER LLC

1. Install intake manifold gaskets.
2. Install intake manifold.
3. Install intake manifold retaining bolts and tighten in sequence shown in **Fig. 184** to 12 N.m (105 in. lbs.).

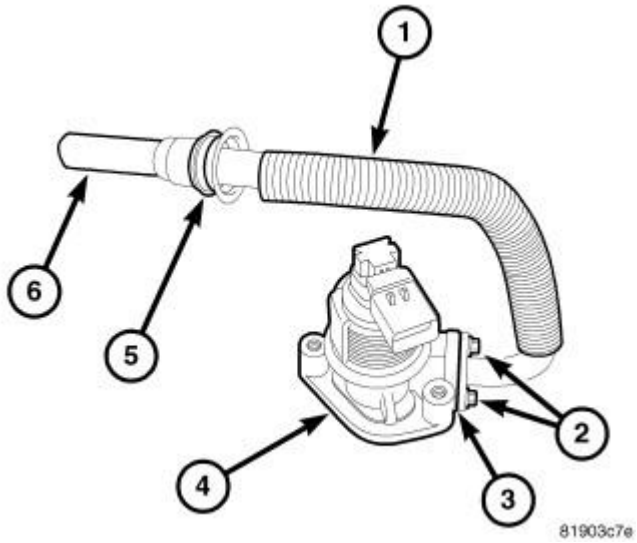


Fig. 185: EGR SOLENOID/TUBE ASSEMBLY
Courtesy of CHRYSLER LLC

4. Install fuel rail.
5. Install the EGR tube (1).

6. Install top oil dipstick tube retaining bolt.

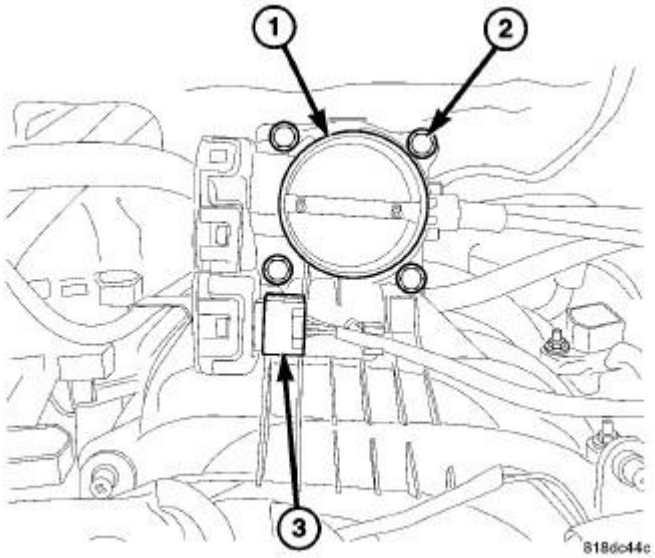


Fig. 186: THROTTLE BODY 3.7L
Courtesy of CHRYSLER LLC

1 - THROTTLE BODY
2 - MOUNTING BOLTS
3 - ELEC. CONNECTOR

CAUTION: Proper torque of the throttle body is critical to normal operation. If the throttle body is over-torqued, damage to the throttle body can occur resulting in throttle plate malfunction.

7. Install throttle body-to-intake manifold O-ring.
8. Install throttle body (1) to intake manifold.
9. Install four mounting bolts (2). Tighten bolts to 7 N.m (60 in. lbs.) torque.
10. Install ignition coil towers.

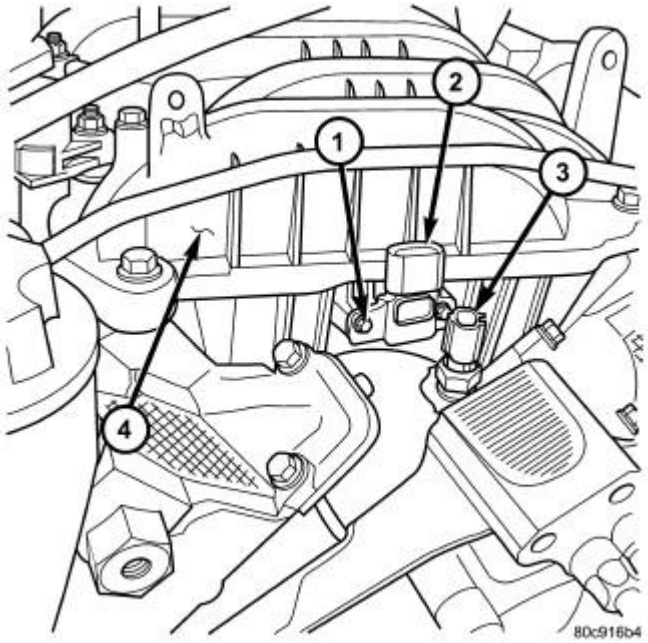


Fig. 187: MAP SENSOR - 3.7L V-6
Courtesy of CHRYSLER LLC

1 - MOUNTING SCREWS
2 - MAP SENSOR
3 - ECT SENSOR
4 - FRONT OF INTAKE MANIFOLD

11. Connect electrical connectors for the following components:

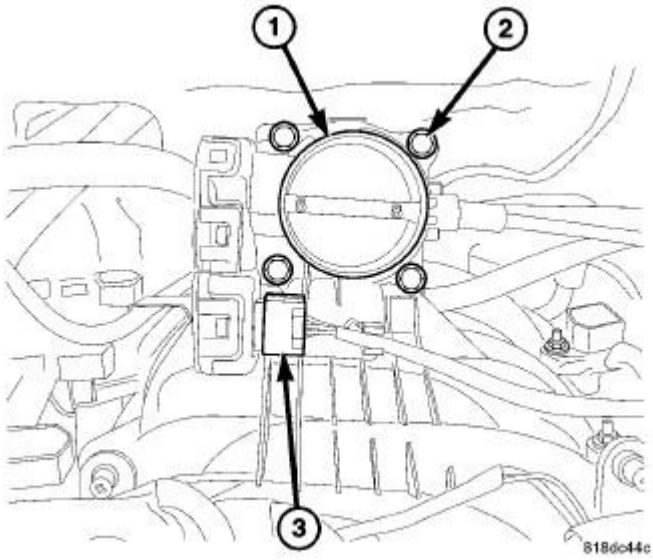


Fig. 188: THROTTLE BODY 3.7L
Courtesy of CHRYSLER LLC

1 - THROTTLE BODY
2 - MOUNTING BOLTS
3 - ELEC. CONNECTOR

- Manifold Absolute Pressure (MAP) Sensor (2)
- Coolant Temperature (CTS) Sensor
- Ignition coil towers

12. Install generator. Refer to **Electrical - Engine Systems/Charging/GENERATOR - Installation** .
13. Install the air conditioning compressor. Refer to **Heating and Air Conditioning/Plumbing/COMPRESSOR, A/C - Installation** .
14. Connect Vapor purge hose, Brake booster hose, Positive crankcase ventilation (PCV) hose.
15. Connect the ETC connector (3) to the throttle body (1).

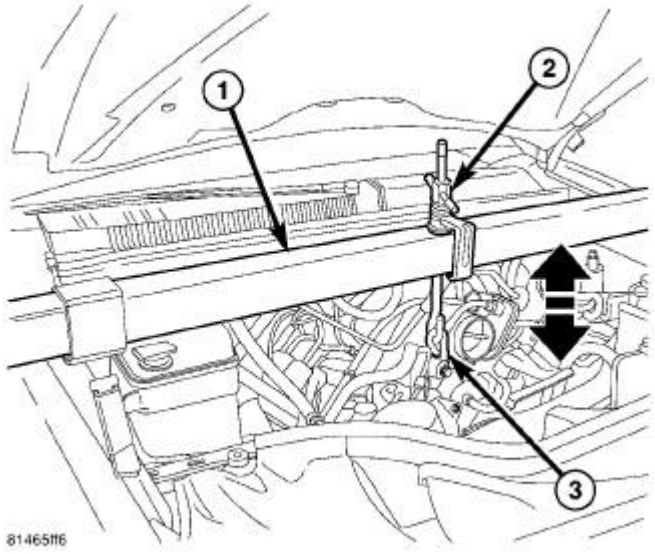


Fig. 189: ENGINE SUPPORT TOOL
Courtesy of CHRYSLER LLC

16. Fill cooling system. Refer to **Cooling - Standard Procedure** .
17. Raise engine using engine support fixture (1), special tool 8534B.

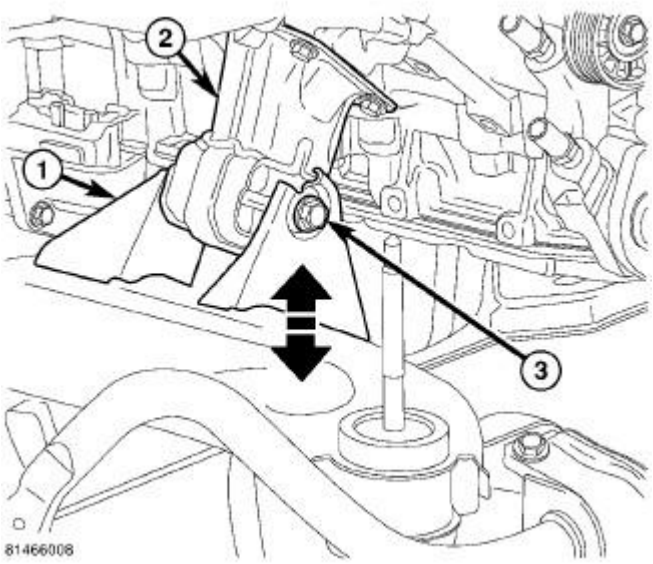


Fig. 190: ENGINE MOUNT BOLT
Courtesy of CHRYSLER LLC

18. Install the right side engine mount to frame bolt (3).
19. Remove engine support fixture, special tool 8534B.
20. Install resonator assembly and air inlet hose.
21. Connect negative cable to battery.
22. Using the scan tool, perform the ETC Relearn function.

VALVE TIMING

DESCRIPTION

DESCRIPTION

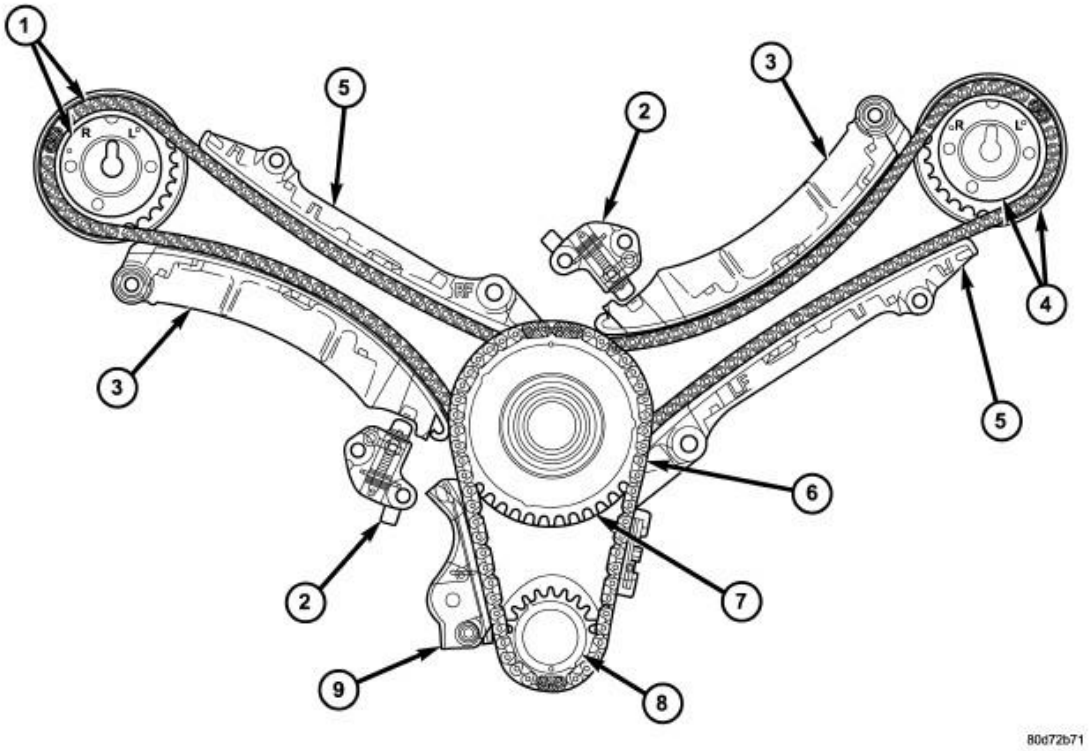


Fig. 191: Timing Drive System
Courtesy of CHRYSLER LLC

1 - RIGHT CAMSHAFT SPROCKET AND SECONDARY CHAIN	6 - PRIMARY CHAIN
2 - SECONDARY TIMING CHAIN TENSIONER (LEFT AND RIGHT SIDE NOT INTERCHANGEABLE)	7 - IDLER SPROCKET
3 - SECONDARY TENSIONER ARM	8 - CRANKSHAFT SPROCKET
4 - LEFT CAMSHAFT SPROCKET AND SECONDARY CHAIN	9 - PRIMARY CHAIN TENSIONER
5 - CHAIN GUIDE (LEFT AND RIGHT SIDE ARE NOT INTERCHANGEABLE)	

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, two secondary timing chain drives and a counterbalance shaft drive.

OPERATION

OPERATION

The primary timing chain is a single inverted tooth chain type. The primary chain drives the large 50 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 designed oil pump leakage. The idler sprocket assembly connects the primary chain drive, secondary chain drives, and the counterbalance shaft. The idler sprocket assembly consists of two integral 26 tooth sprockets a 50 tooth sprocket and a helical gear that is press-fit to the assembly. The spline joint for the 50 tooth sprocket is a non serviceable press fit anti rattle type. A spiral ring is installed on the outboard side of the 50 tooth sprocket to prevent spline disengagement. The idler sprocket assembly spins on a stationary idler shaft. The idler shaft is a light 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, both are roller type, 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 incorporates a controlled leak path through a device known as a vent disc located in the nose of the piston to manage chain loads. 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

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

1. Remove the timing chain cover. See **Engine/Valve Timing/CHAIN and SPROCKETS, Timing - Removal**.
2. To determine if the secondary timing chains are worn, rotate the engine clockwise until maximum tensioner piston 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 of an inch).
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**.

TIMING VERIFICATION

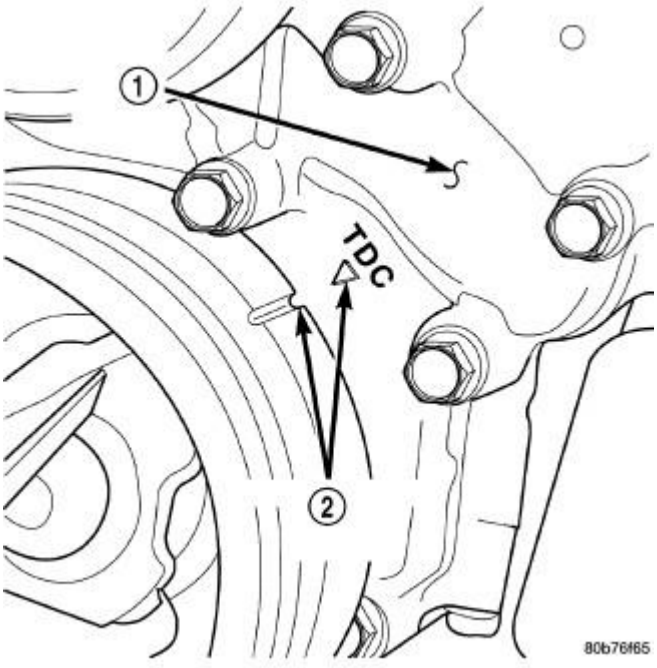


Fig. 192: Engine Top Dead Center (TDC) Indicator Mark
Courtesy of CHRYSLER LLC

CAUTION: The 3.7L 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.
2. Using a mirror, locate the TDC arrow (2) on the front cover (1). 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.

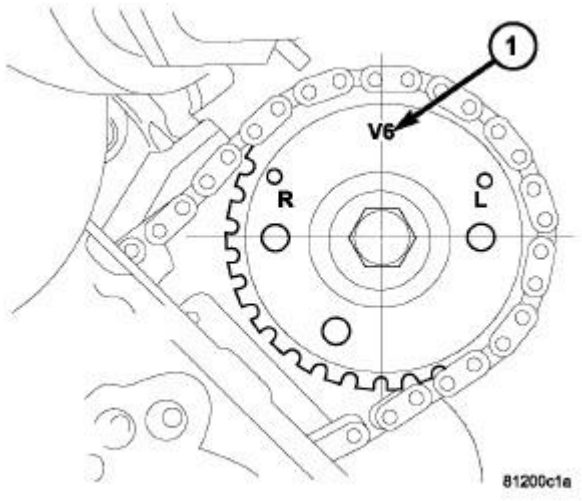


Fig. 193: CAMSHAFT SPROCKET V6 MARKS
Courtesy of CHRYSLER LLC

3. Note the location of the V6 mark (1) stamped into the camshaft drive gears. If the V6 mark on each camshaft drive gear is at the twelve o'clock position, the engine is at TDC on the exhaust stroke. If the V6 mark on each gear is at the six o'clock position, the engine is at TDC 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 **TIMING - SINGLE CAMSHAFT**.
6. If both camshaft drive gear V6 marks are at the twelve o'clock or the six o'clock position the engine base timing is correct. Reinstall the cylinder head covers.

COUNTER BALANCE SHAFT TIMING

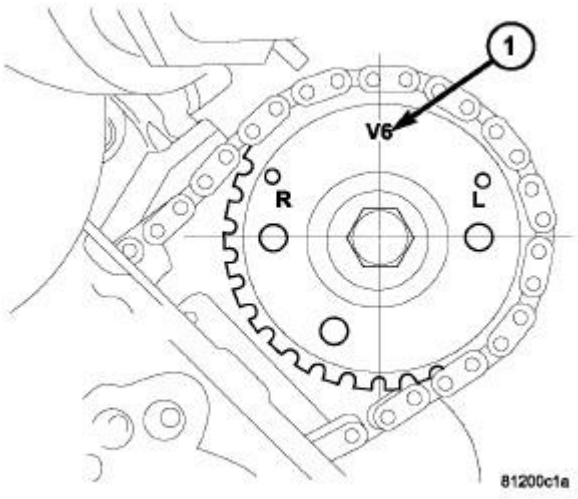


Fig. 194: CAMSHAFT SPROCKET V6 MARKS
Courtesy of CHRYSLER LLC

1. Ensure that the engine is at TDC with both camshaft sprocket V6 marks (1) in the 12 o'clock position.

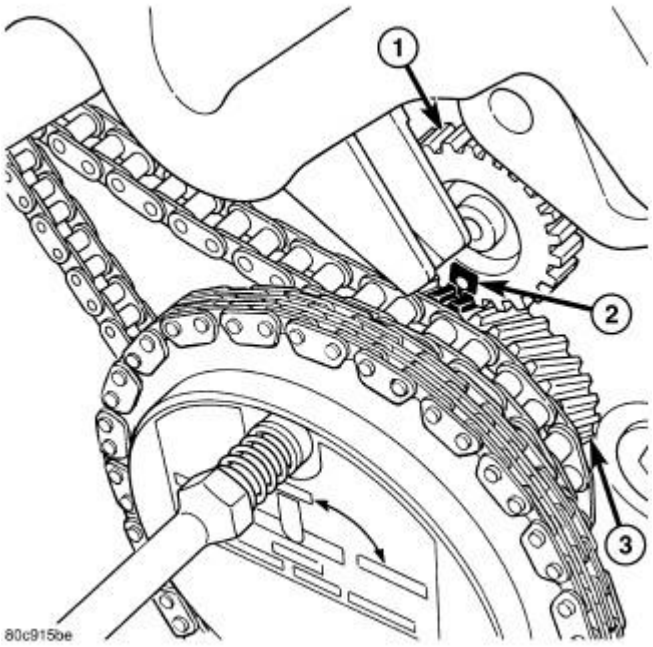


Fig. 195: COUNTERBALANCE SHAFT ALIGNMENT MARKS
Courtesy of CHRYSLER LLC

2. Look down the left cylinder head chain cavity. The timing dot on the counter balance shaft drive gear should be in the 6 o'clock position (2).

TIMING - SINGLE CAMSHAFT

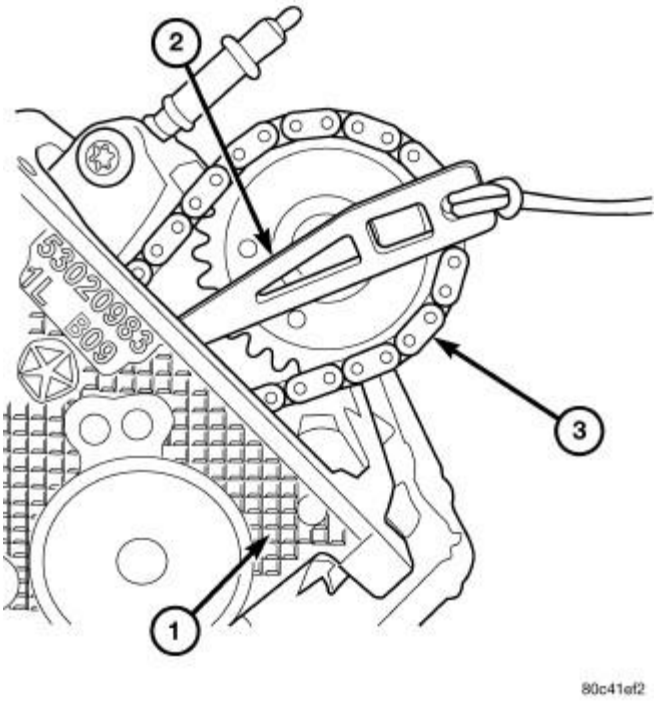


Fig. 196: SECURING TIMING CHAIN TENSIONER USING TIMING CHAIN WEDGE
Courtesy of CHRYSLER LLC

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

1. Using the Wedge Locking Tool 8379 (2), stabilize the secondary chain drive (3). For reference purposes, mark the chain-to-sprocket position.
2. Remove the camshaft drive gear retaining bolt.

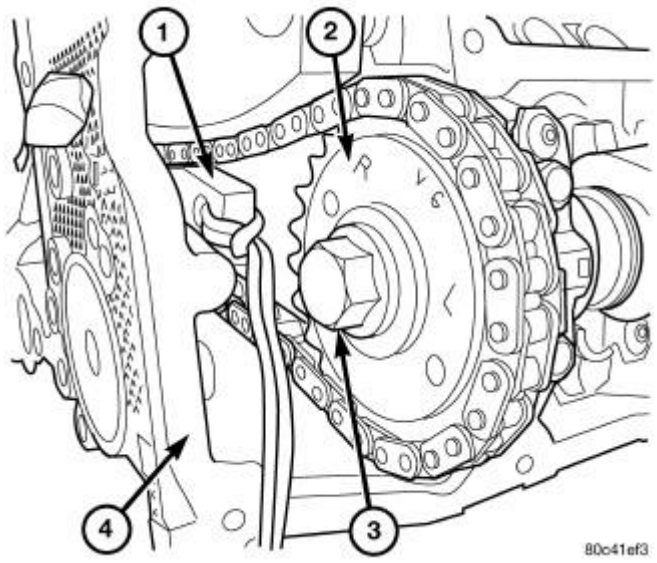


Fig. 197: CAMSHAFT DRIVE GEAR REMOVAL/INSTALLATION
Courtesy of CHRYSLER LLC

3. Carefully remove the camshaft drive gear (2) from the camshaft.
4. Re-index the camshaft drive gear in the chain until the V6 mark is at the same position as the V6 mark on the opposite camshaft drive gear.

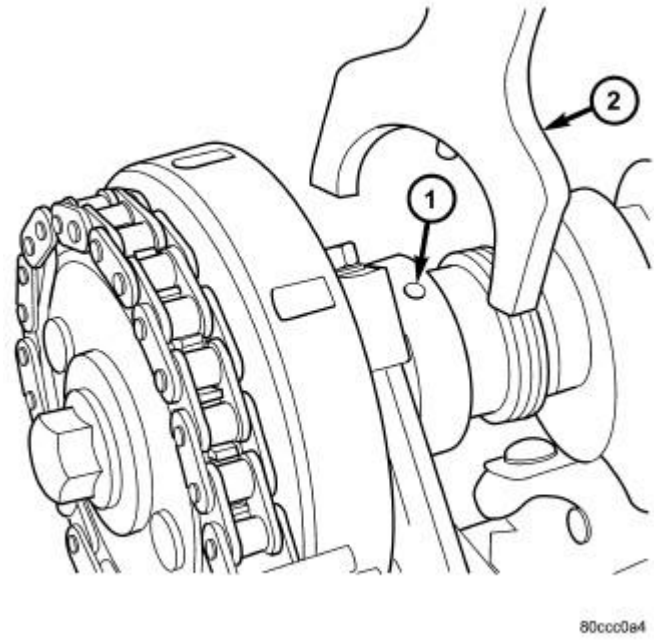


Fig. 198: Special Tool 8428
Courtesy of CHRYSLER LLC

5. Using Camshaft Holder 8428A (2), rotate the camshaft until the alignment dowel on the camshaft is

aligned with the slot in the camshaft drive gear.

CAUTION: Remove excess oil from camshaft sprocket retaining bolt before reinstalling bolt. Failure to do so may cause over tightening of the bolt, resulting in bolt failure.

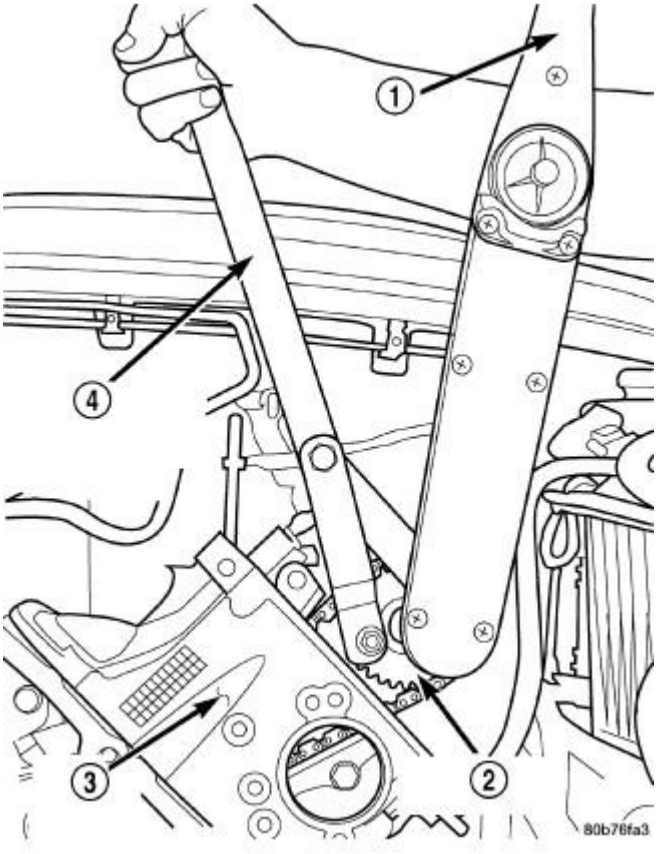


Fig. 199: Camshaft Sprocket
Courtesy of CHRYSLER LLC

6. Position the camshaft drive gear onto the camshaft, remove oil from bolt then install the retaining bolt. Using Spanner Wrench 6958 with Adapter Pins 8346 (4) and a suitable torque wrench (1), tighten retaining bolt to 122 N.m (90 ft. Lbs.).
7. Remove the Wedge Locking Tool 8379.
8. Rotate the crankshaft two full revolutions, then verify that the camshaft drive gear V6 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

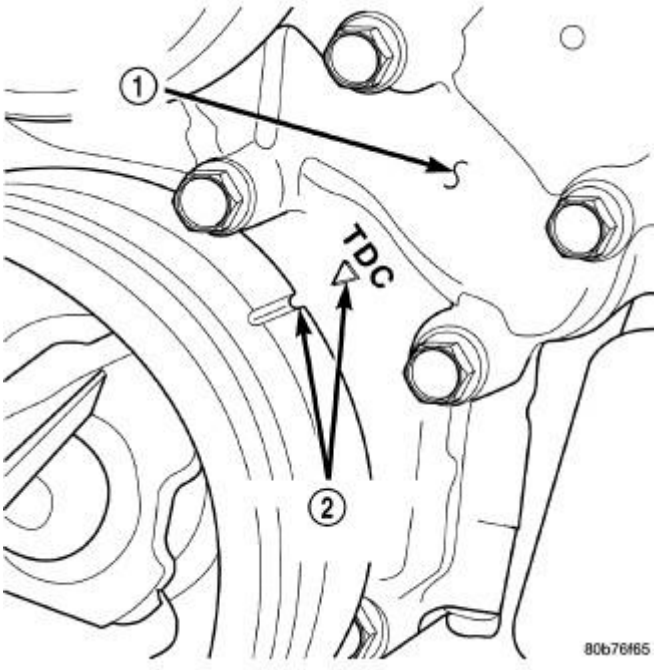


Fig. 200: Engine Top Dead Center (TDC) Indicator Mark
Courtesy of CHRYSLER LLC

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. Refer to **Cooling/Engine/FAN, Cooling - Removal** .
5. Rotate engine until timing mark (2) on crankshaft damper aligns with TDC mark on timing chain cover (1).

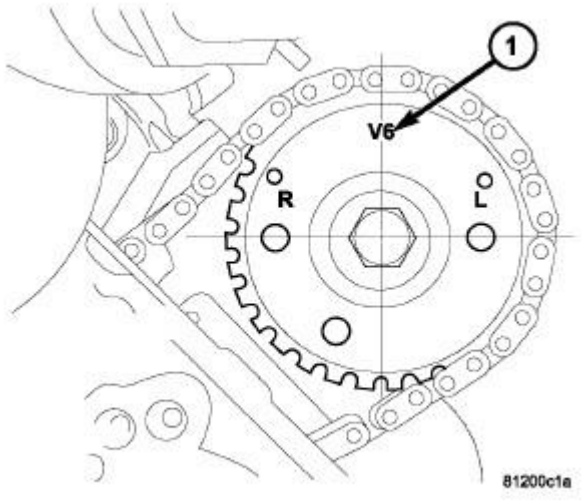


Fig. 201: CAMSHAFT SPROCKET V6 MARKS
Courtesy of CHRYSLER LLC

6. Make sure the camshaft sprocket "V6" marks (1) are at the 12 o'clock position (No. 1 TDC exhaust stroke).
7. Remove power steering pump. Refer to **Steering/Pump - Removal** .

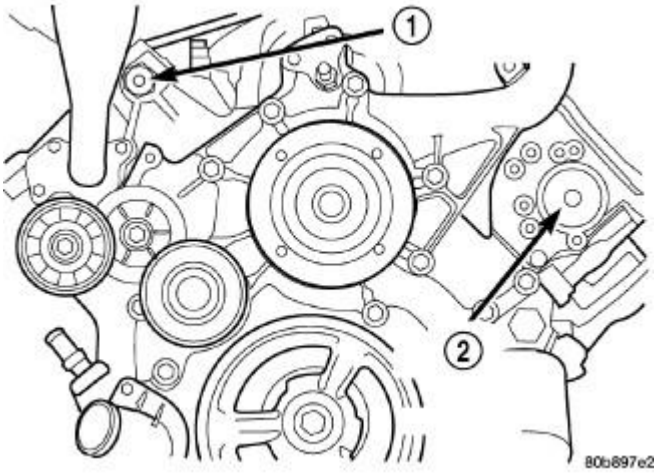


Fig. 202: Cylinder Head Access Plugs
Courtesy of CHRYSLER LLC

8. Remove access plugs (1 and 2) from left and right cylinder heads for access to chain guide fasteners.
9. Remove the oil fill housing to gain access to the right side tensioner arm fastener.
10. Remove crankshaft damper and timing chain cover. See **Engine/Engine Block/DAMPER, Vibration - Removal**. See **Engine/Valve Timing/COVER(S), Engine Timing - Removal**.
11. Collapse and pin primary chain tensioner.

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

12. Remove secondary chain tensioners.

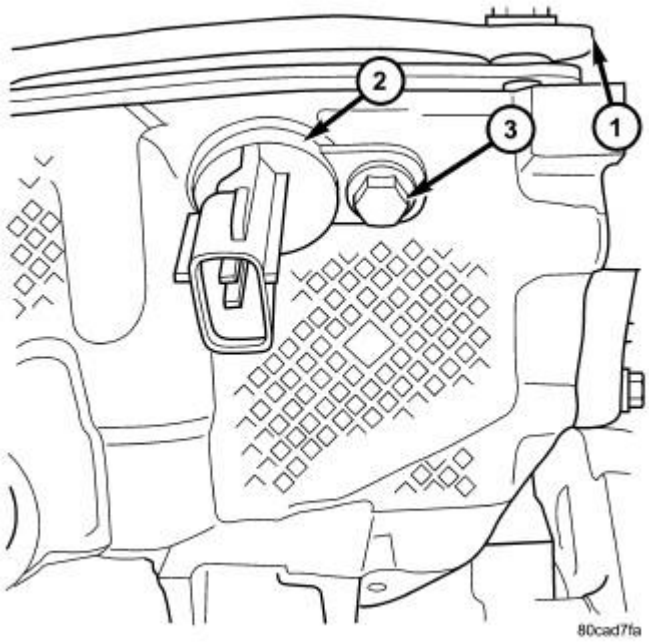


Fig. 203: CAMSHAFT POSITION SENSOR
Courtesy of CHRYSLER LLC

13. Remove camshaft position sensor (2).

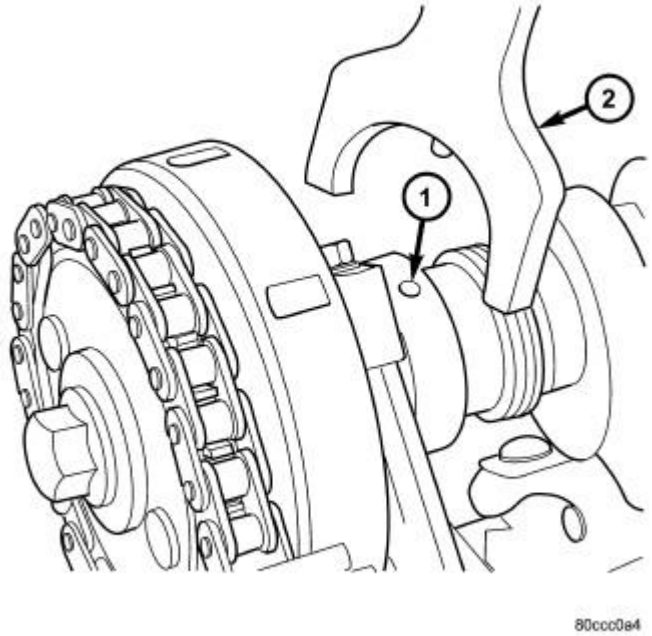


Fig. 204: Special Tool 8428
Courtesy of CHRYSLER LLC

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.

14. Remove left and right camshaft sprocket bolts.
15. While holding the left camshaft steel tube Camshaft Holder 8428A (2), remove the left camshaft sprocket. Slowly rotate the camshaft approximately 5 degrees clockwise to a neutral position.
16. While holding the right camshaft steel tube with Camshaft Holder 8428A (2), remove the right camshaft sprocket.
17. Remove idler sprocket assembly bolt.
18. Slide the idler sprocket assembly and crank sprocket forward simultaneously to remove the primary and secondary chains.
19. Remove both pivoting tensioner arms and chain guides.
20. Remove primary chain tensioner.

Inspection

INSPECTION

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 arm and chain should be replaced.
- Primary chain tensioner plastic faces. Replace as required.

Installation

INSTALLATION

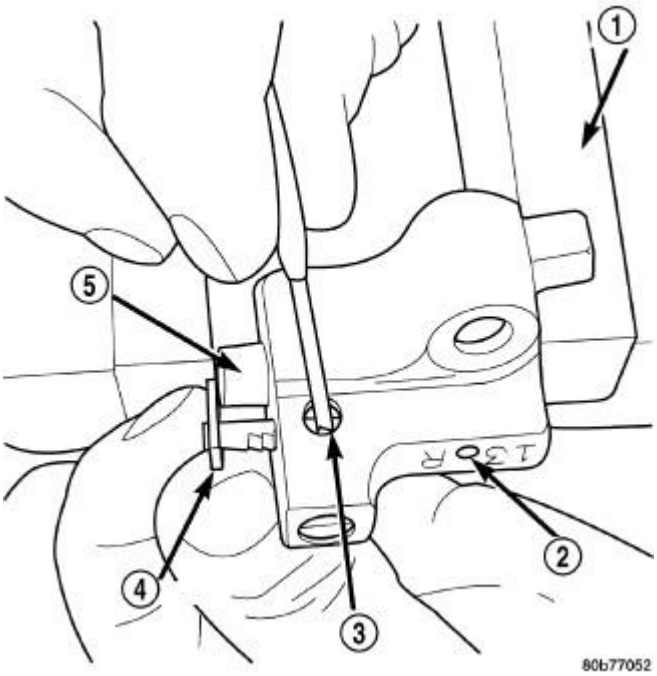


Fig. 205: Resetting Secondary Chain Tensioners
Courtesy of CHRYSLER LLC

1. Using a vise, lightly compress the secondary chain tensioner piston until the piston step (5) is flush with the tensioner body. Using a pin or suitable tool, release ratchet pawl (4) 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 Tensioner Pins 8514 (2) into hole on front of tensioner. 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. Install Torx® bolt. Tighten Torx® bolt to 28 N.m (250 in. lbs.).

CAUTION: 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.).
5. Install left side chain tensioner arm, and Torx® bolt. Tighten Torx® 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.).

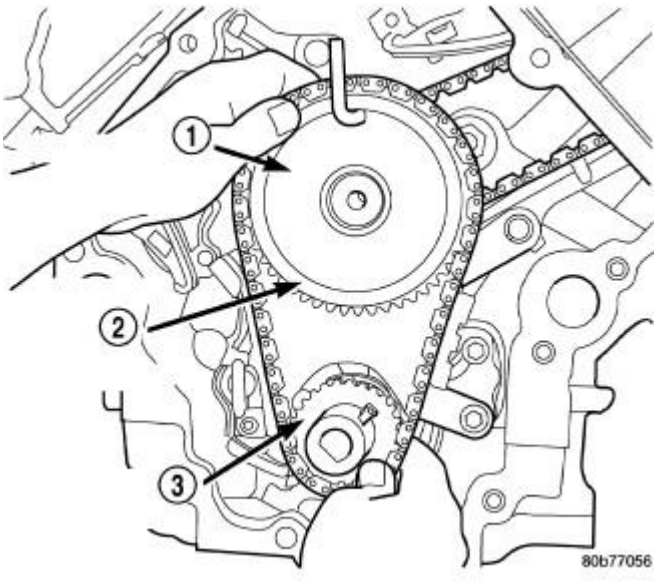


Fig. 206: Installing Idler Gear, Primary and Secondary Timing Chains
Courtesy of CHRYSLER LLC

7. Install both secondary chains onto the idler sprocket (2). 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, Secondary Camshaft Chain Holder 8429 (1) to hold chains in place for installation.
8. Align primary chain double plated links with the timing mark at 12 o'clock on the idler sprocket. Align the primary chain single plated link with the timing mark at 6 o'clock on the crankshaft sprocket.
9. Lubricate idler shaft and bushings with clean engine oil.

NOTE: The idler sprocket must be timed to the counterbalance shaft drive gear before the idler sprocket is fully seated.

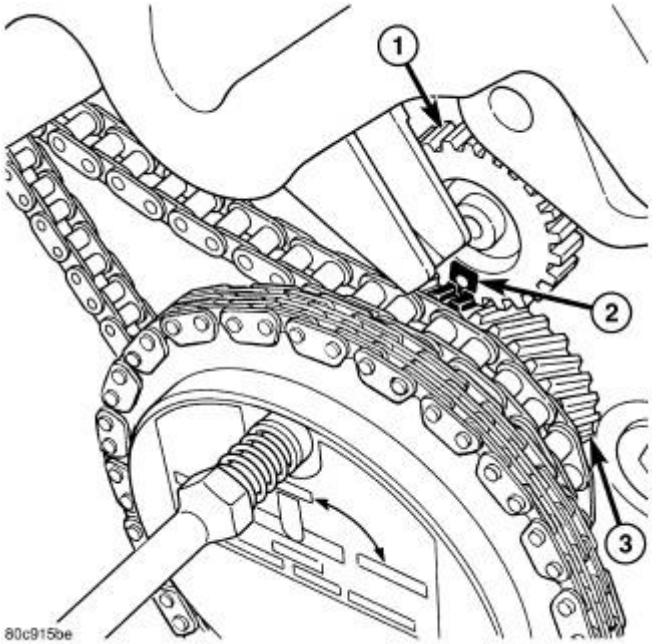


Fig. 207: COUNTERBALANCE SHAFT ALIGNMENT MARKS
Courtesy of CHRYSLER LLC

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 equivalent. This will maintain tension on chains to aid in installation. Align the timing mark (2) on the idler sprocket gear (3) to the timing mark on the counterbalance shaft drive gear (1), then seat idler sprocket fully. Before installing idler sprocket bolt, lubricate washer with oil, and tighten idler sprocket assembly retaining bolt to 34 N.m (25 ft.lbs.).

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 Secondary Camshaft Chain Holder 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 "V6" 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.

15. Install both secondary chain tensioners. Tighten bolts to 28 N.m (250 in.lbs.).

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

16. Remove all locking pins from tensioners.

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.

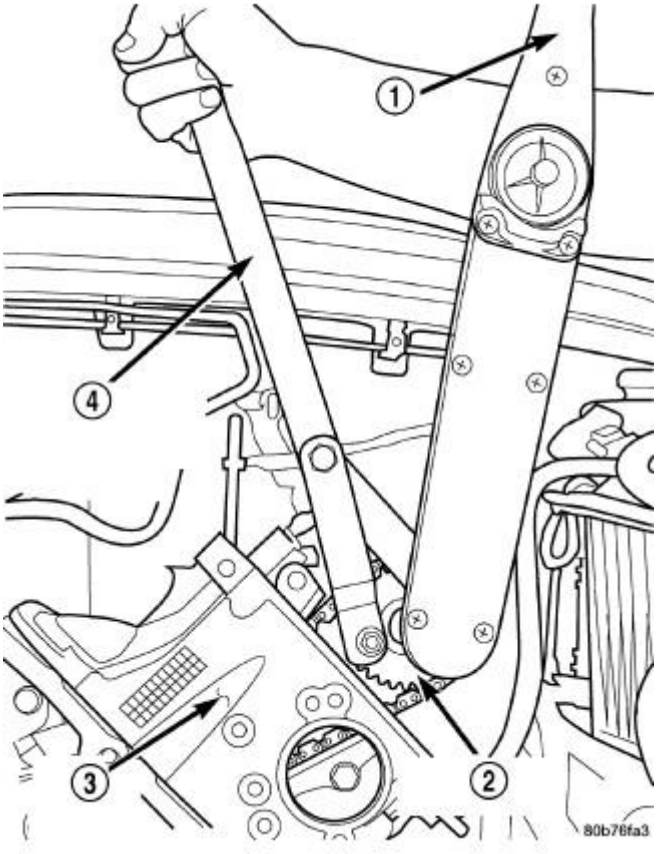


Fig. 208: Camshaft Sprocket
Courtesy of CHRYSLER LLC

1 - TORQUE WRENCH
2 - CAMSHAFT SPROCKET
3 - LEFT CYLINDER HEAD
4 - SPECIAL TOOL 6958 SPANNER WITH ADAPTER PINS 8346

17. Using Spanner Wrench 6958, with Adaptor Pins 8346 (4), tighten left camshaft sprocket bolts to 122 N.m (90 ft.lbs.).

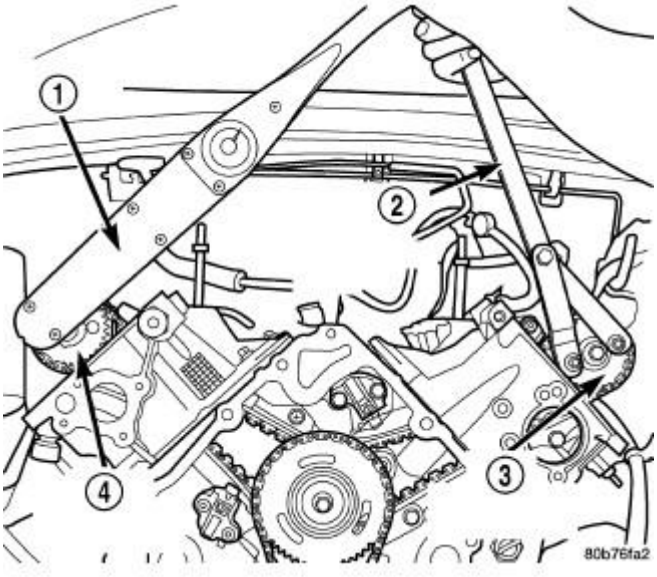


Fig. 209: Camshaft Sprocket Installation-Right Cylinder Head
Courtesy of CHRYSLER LLC

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

18. Using Spanner Wrench 6958, with Adaptor Pins 8346 (2) , tighten right 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 "V6" marks are at 12 o'clock
    - balance shaft drive gear dot is aligned to the idler sprocket gear dot
20. Lubricate all three chains with engine oil.

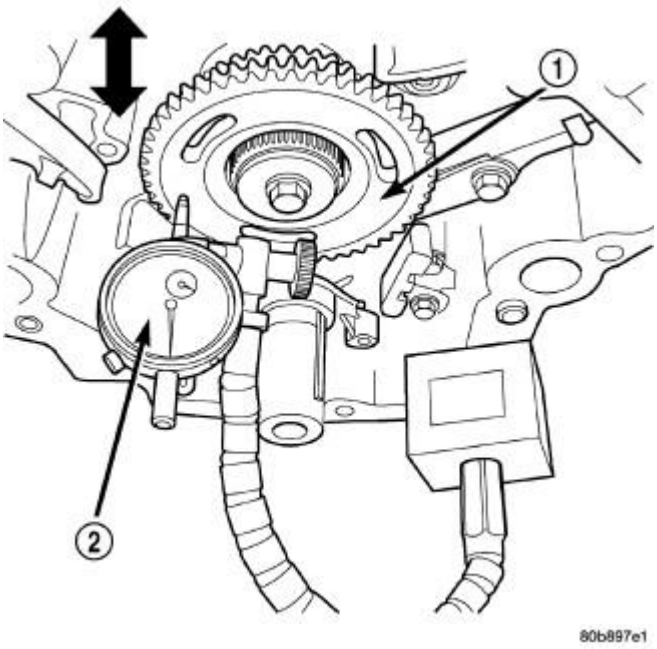


Fig. 210: Measuring Idler Gear End Play
Courtesy of CHRYSLER LLC

1 - IDLER SPROCKET ASSEMBLY 2 - DIAL INDICATOR

21. After installing all chains, it is recommended that the idler gear 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 (1) 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**.

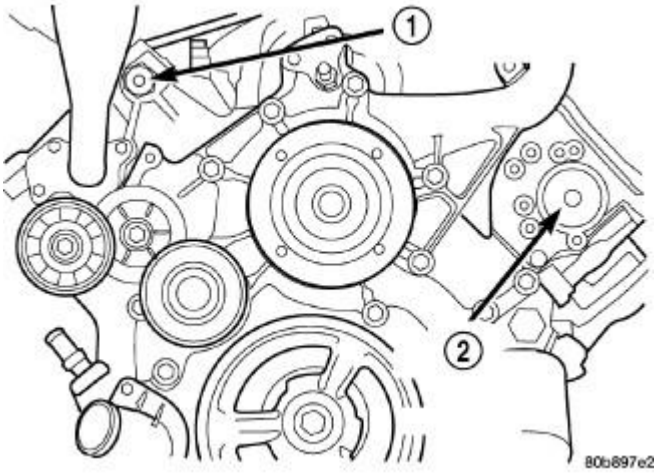


Fig. 211: Cylinder Head Access Plugs

Courtesy of CHRYSLER LLC

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

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 (2) 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 (1) in left cylinder head.
27. Install power steering pump. Refer to **Steering/Pump - Installation** .
28. Fill cooling system. Refer to **Cooling - Standard Procedure** .
29. Connect negative cable to battery.

COVER(S), ENGINE TIMING

Removal

REMOVAL

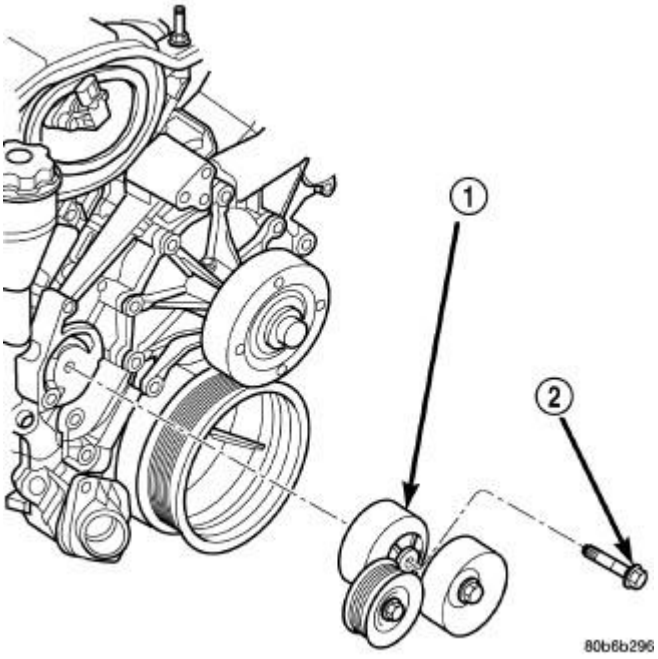


Fig. 212: ACCESSORY DRIVE BELT TENSIONER
Courtesy of CHRYSLER LLC

1 - TENSIONER ASSEMBLY

2 - FASTENER TENSIONER TO FRONT COVER

1. Disconnect the battery negative cable.
2. Drain the cooling system. Refer to **Cooling - Standard Procedure** .
3. Remove electric cooling fan and fan shroud assembly.
4. Remove the radiator fan. Refer to **Cooling/Engine/FAN, Cooling - Removal** .
5. Disconnect both heater hoses at timing cover.
6. Disconnect lower radiator hose at engine.
7. Remove accessory drive belt tensioner assembly (1).
8. Remove crankshaft damper. See **Engine/Engine Block/DAMPER, Vibration - Removal**.
9. Remove the generator. Refer to **Electrical - Engine Systems/Charging/GENERATOR - Removal** .
10. Remove the A/C compressor. Refer to **Heating and Air Conditioning/Plumbing/COMPRESSOR, A/C - Removal** .

CAUTION: The 3.7L engine uses an anaerobic 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.

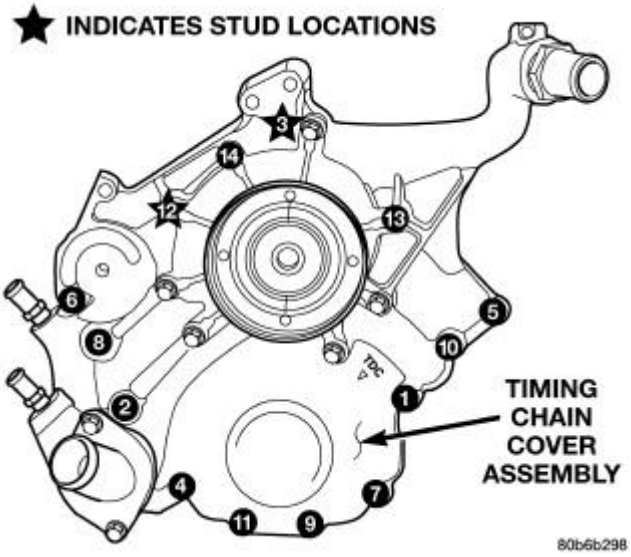


Fig. 213: TIMING CHAIN COVER FASTENERS
Courtesy of CHRYSLER LLC

11. Remove the bolts holding the timing cover to engine block.
12. Remove the timing cover.

Installation

INSTALLATION

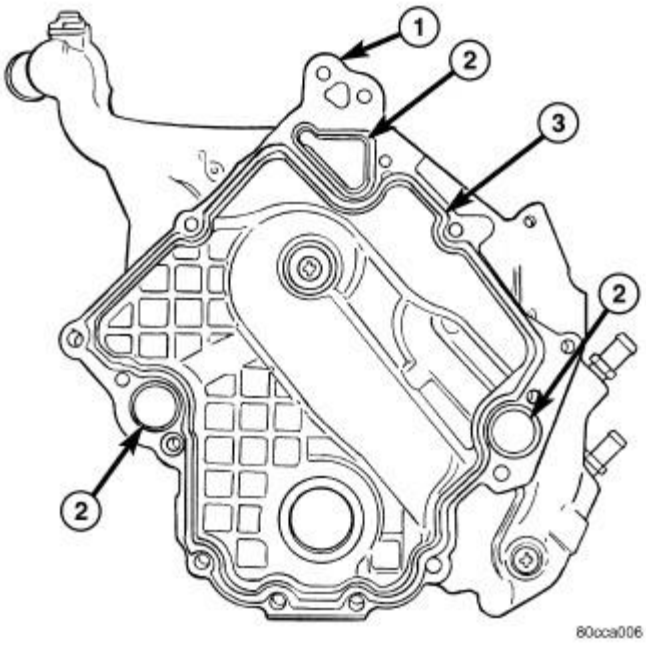


Fig. 214: TIMING COVER SEALANT
Courtesy of CHRYSLER LLC

1 - TIMING CHAIN COVER
2 - WATER PASSAGE O-RING
3 - MOPAR® 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 3.7L uses a special anaerobic sealer instead of a gasket to seal the timing cover to the engine block, from the factory. For service repairs, Mopar® Engine RTV must be used as a substitute.

2. Inspect the water passage o-rings (2) for any damage, and replace as necessary.
3. Apply Mopar® Engine RTV sealer to front cover as shown in **Fig. 214** (3) using a 3 to 4 mm thick bead.

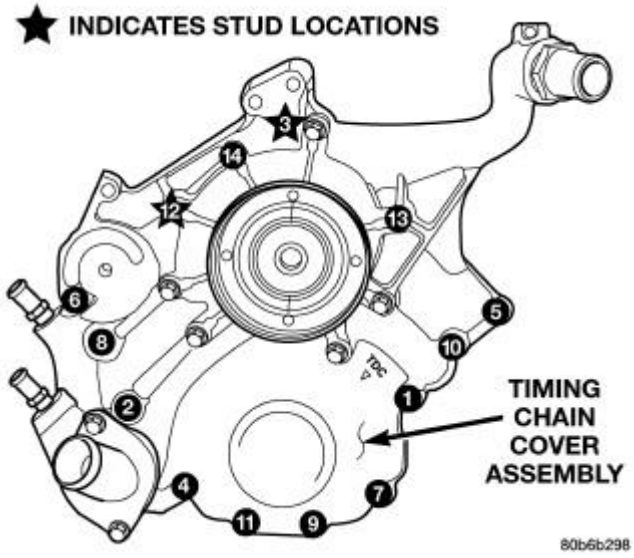


Fig. 215: TIMING CHAIN COVER FASTENERS
Courtesy of CHRYSLER LLC

4. Install cover. Tighten fasteners in sequence as shown in **Fig. 215** to 58 N.m (43 ft. lbs.).
5. Install crankshaft damper. See **Engine/Engine Block/DAMPER, Vibration - Installation**.
6. Install the A/C compressor. Refer to **Heating and Air Conditioning/Plumbing/COMPRESSOR, A/C - Installation** .
7. Install the generator. Refer to **Electrical - Engine Systems/Charging/GENERATOR - Installation** .
8. Install accessory drive belt tensioner. Refer to **Cooling/Accessory Drive/TENSIONER, Belt - Installation** .
9. Install radiator upper and lower hoses.
10. Install both heater hoses.
11. Install the radiator fan. Refer to **Cooling/Engine/FAN, Cooling - Installation** .
12. Fill the cooling system. Refer to **Cooling - Standard Procedure** .
13. Connect the battery negative cable.

SHAFT, IDLER

Removal

REMOVAL

1. Remove the primary and secondary timing chains and sprockets. Refer to **CHAIN and SPROCKETS, Timing**.

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 Slide Hammer 8517, 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. Refer to **CHAIN and SPROCKETS, Timing**.

